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Increasing the Translation of Evidence Into Practice, Policy, and Public Health Improvements: A Framework for Training Health Professionals in Implementation and Dissemination Science

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Abstract

The authors describe a conceptual framework for implementation and dissemination science (IDS) and propose competencies for IDS training. Their framework is designed to facilitate the application of theories and methods from the distinct domains of clinical disciplines (e.g., medicine, public health), population sciences (e.g., biostatistics, epidemiology) and translational disciplines (e.g., social and behavioral sciences, business administration education). They explore three principles that guided the development of their conceptual framework: Behavior change among organizations and/or individuals (providers, patients) is inherent in the translation process; engagement of stakeholder organizations, health care delivery systems, and individuals is imperative to achieve effective translation and sustained improvements; and IDS research is iterative, benefiting from cycles and collaborative, bidirectional relationships. The authors propose seven domains for IDS training--team science, context identification, literature identification and assessment, community engagement, intervention design and research implementation, evaluation of effect of translational activity, behavioral change communication strategies--and define twelve IDS training competencies within these domains. As a model, they describe specific courses introduced at the University of California, San Francisco, which they designed to develop these competencies. The authors encourage other training programs and institutions to use (or adapt) the design principles, conceptual framework, And proposed competencies to evaluate their current IDS training needs and to support new program development.

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Translation of medical evidence into practice, policy, and public health improvements refers to the widespread dissemination and adoption of interventions that can have a significant effect on health. Although most interventions designed to improve population health target individuals, access to and delivery of these interventions depends on communities, health care delivery systems (HCDS), health care professionals, and government agencies. Effective translation has been slow and inconsistent across the spectrum of HCDS and communities in the United States,[1–4] and such inconsistencies contribute to the current state of variable and suboptimal population health.[5–7] Within U.S. HCDS, challenges with translation are perhaps best exemplified by the finding that dissemination of practice guidelines rarely changes practice.[7]

Researchers trained in implementation and dissemination science (IDS) are needed to facilitate the translation of evidence into practice. The National Institutes of Health (NIH) defines *implementation* as "the use of strategies to adopt and integrate evidence-based health interventions and change practice patterns within specific settings" and *dissemination* as "the targeted distribution of information and intervention materials to a specific public health or clinical practice audience."[8] IDS research aims to examine and promote changes at the intersection of *health services* (interventions intended to improve health, such as specific treatments, tests, or behavioral strategies), *delivery systems* (systems that facilitate the delivery of health services, such as hospitals, clinics, or community-or policy-based organizations), and *communities* (groups of individuals, such as physicians, patients with diabetes, hospital administrators, or policy makers). These sets of actors collaboratively shape the reach, relevance, uptake, and diffusion of interventions.

During the past 30 years, clinical research has been redefined by the application of epidemiology and biostatistics theory and methods to biological, clinical, and population health sciences. This transformation has led to new approaches, methods, and training programs, which have yielded a generation of investigators specializing in relatively new fields such as clinical trials, clinical and social epidemiology, and evidence-based medicine. Recent mandates from stakeholder organizations (e.g., government agencies, payers) that direct researchers to translate knowledge gained from the publicly funded investment in biomedical sciences research into improved population health are similarly transforming IDS research.[9]

Further, there is a large and growing body of evidence that supports the effectiveness of intervention implementation strategies based on IDS principles[10,11] (For example, the Cochrane Collaboration's Effective Practice and Organisation of Care Group conducts systematic reviews on a wide variety of implementation strategies and tools.[12]) However, even though IDS researchers require specific skills to help translate evidence into practice, there is a dearth of IDS training programs in the United States—in part because the skill set has not been adequately defined and continues to evolve. A directory of implementation science training programs provided by the March 2011 NIH Conference on Dissemination and Implementation Science identified only six "specialized programs" And 14 "general training programs with implementation science as [a] secondary or optional concentration" in this country.[13]

To help inform institutional efforts to develop and expand IDS research skills training for health care professionals, we propose in this article a conceptual framework that defines, organizes, and guides specific translational activities. Using this framework, we propose seven domains comprising twelve core competencies for IDS researchers. Finally, we describe the series of IDS-specific courses at the University of California, San Francisco (UCSF) that has evolved from this conceptual framework and supports the attainment of these core competencies.

A Conceptual Framework for Training in IDS Research

The goals and methods of IDS research are distinct from those of conventional clinical research. The IDS approach to improving health care safety, efficiency, equitability, and patient-centeredness focuses on care structures and processes, and it requires sustained engagement with the individuals, communities, and organizations targeted by health interventions.[14] To prepare investigators and health professionals for this approach, we believe a new fusion must take place among the clinical and public health disciplines, which provide content and context expertise in specific health-related areas; the population sciences (e.g., epidemiology, biostatistics, health policy), which generate human subjects-based medical evidence; and the translational disciplines, which we define as the diverse array of IDS-relevant disciplines that provide a theoretical and methodological basis for understanding and changing behaviors (Figure 1).

Given that IDS goals for translating research findings into practice lie at the intersection of a variety of disciplines, it is not feasible for implementation scientists to be expert in all of the relevant theories and methods. This is why successful IDS research draws upon multidisciplinary teams—team science is critical for effective implementation of health care improvement strategies. As a result, IDS training programs--which should include trainees from a wide variety of educational and professional backgrounds--will benefit from an interdisciplinary model for teaching and curriculum development. There is a growing body of research demonstrating the advantages of incorporating interdisciplinary approaches such as team science into training programs. For example, Nair and Finucane[15] found that seasoned and early-career researchers who have been trained in interdisciplinary graduate programs are capable of consistently bridging the knowledge and methods of different disciplines and of more effectively tailoring their investigations to local circumstances.

To guide the development and/or expansion of IDS research training curricula for investigators and health professionals, we developed a series of design principles and a conceptual framework. Our iterative, collaborative development process involved reviews of literature on IDS-related research goals and discussions of those goals' implications for training. Below, we describe each of the three design principles and related aspects of the conceptual framework.

Design principle 1: Behavior change among individuals and health care delivery systems is inherent in the translation of evidence into practice, policy, and public health improvements

As depicted in our conceptual framework (Figure 2), behavior change targets can represent *stakeholder organizations*, which include government agencies, employers, insurers/payers, and academic institutions; *HCDS*, which are organizations that provide health care services or the settings in which such services are delivered (e.g., hospitals, private practices, pharmacy-based clinics); and *individuals*, who include patients and clinicians practicing within or outside HCDS. Defining a given translational activity's behavior change target can direct the IDS research team to the relevant theory and current evidence for program planning and development. For example, Shortell and Kaluzney[16] have defined some of the theoretical constructs and translational tools that pertain to organizational behavior change among HCDS. Glanz and colleagues[17] have compiled a similar body of knowledge related to behavior change among individuals and social groups (including patients and clinicians).

A key learning objective for IDS trainees involves identifying the range of factors (behavioral, social, ethical, institutional, political, and economic) that shape a particular behavior or organizational process, and then choosing appropriate theoretical constructs to describe and predict a desired change. For example, one of the major lessons that emerged

from the application of Prochaska's "stages of change" theory to smoking cessation trials was that smokers at different stages of change require different interventions.[18] For example, smokers who express motivation and a "readiness to quit" are much more successful with interventions focusing on therapeutic support (e.g., nicotine replacement therapy) than are smokers who have not expressed interest in quitting. By contrast, effective strategies for smokers who have not considered quitting are those that increase their readiness to quit, such as social marketing and motivational interviewing techniques. This theory-driven approach has been successfully employed in behavior change interventions targeting diverse settings, communities, and individuals, including clinicians in quality improvement programs and young adults in social settings.[19]

Implicit in the concept of behavior change related to the translation of evidence into practice is an *operator* who sponsors, directs, and/or promotes the proposed behavior change. Depending on the nature of the intervention or research activity, an operator can also serve as the *target* for behavior change. IDS researchers should be adept at identifying the key players in a translational project because doing so allows them to establish the nature of relationships and the direction of information flow. For example, a stakeholder organization such as Medicare (acting as the operator) can implement a new policy that requires hospitals (the behavior change target) to report the number of their emergency department patients who "left without treatment." Although the ultimate desired outcome is to reduce the number of patients who leave emergency departments without treatment, from an implementation design perspective, the key behavior of this intervention is hospital compliance with public reporting (and relevant theory might center on organizational behavior change). In another example, a community advocacy group (acting as the operator) could create a media campaign and lobbying effort to convince Medicare (the behavior change target) to monitor and then develop and enact policies (the behavior) that would help decrease crowding in emergency departments. As these examples illustrate, in IDS research there are often multiple and changing actors at different stages of the investigation, intervention development, and implementation; there are no "fixed" assignments of "operator" and "target."

Defining the operator and the behavior change target for a particular problem can be complex. The IDS research team may need to use qualitative methods to tease out relevant behaviors based on interviews and direct observation of key individuals. Once the key behavior change pathways are delineated, IDS researchers can then begin testing theoretically based constructs or develop them *de novo*. (For examples of f operator and behavior change target relationships, see Appendix 1.)

Using our conceptual framework to define these relationships can also help classify a wide variety of implementation tools and strategies employed in the translation of evidence into practice, policy, and public health (Appendix 1). Examples of tools that are commonly used to directly influence individual behaviors include clinical practice guidelines, decision aids, mass media campaigns, and conditional cash payments. Individual behaviors can also be influenced indirectly. Indirect strategies assume that changing HCDS and stakeholder organizational structures and policies will result in changes in individual (provider or patient) behaviors. These include engineered wellness programs and built-environment enhancements that encourage increased physical activity in work and community settings; measurement and public reporting of quality indicators at the hospital, clinic, health department, or health plan level; financial incentives for HCDS to achieve certain benchmarks of quality performance (pay for performance); and accreditation policies.

Design principle 2: Engagement with a range of individuals and stakeholder organizations is imperative to achieve effective translation and sustained improvement

Historically, many initiatives to promote healthy behaviors and improve the quality of health care delivery have been implemented without direct input from and engagement with the targeted individuals/communities, or have limited their engagement to individuals/communities who are convenient to access, such as those represented by specific organizations (e.g., professional societies or churches). In this context, we Endorse a broad definition of *community* to include ambulatory care and hospital providers and staff, clinical microsystems (e.g., intensive care units, dialysis centers), public health departments, regulatory agencies, government agencies, employers, insurers, and community-based organizations outside the health arena. The omission of targets' direct input is commonly cited[20] as one reason why health care interventions and implementation strategies that succeed in one community setting may be difficult to sustain and disseminate more broadly across other community settings.

To be most effective, IDS researchers must be skilled in building successful and sustainable relationships with community members and organizations. They should integrate a thorough understanding of local context and culture into the design of the research question and intervention. Competencies in community engagement can be initiated in the classroom, but ultimately IDS researchers require hands-on experience with relevant community-based organizations and stakeholders.

Design principle 3: IDS research is iterative and benefits from cycles and collaborative/bidirectional relationships

A "one-size-fits-all" approach to spreading successful health care interventions from one setting to another rarely succeeds. A cyclical, rather than linear, approach is necessary because translating evidence into practice requires attention to real-world settings in which many contextual variables will influence the implementation process. With each cycle, the IDS project team identifies barriers to improving outcomes and develops strategies to minimize or work around these barriers. The ongoing evaluation of the implementation process enables the team to assess the effect of specific translational activities. The utility of this approach is exemplified by the iterative, continuous-quality-improvement-inspired plan-do-study-act cycle applied to health care by the Institute for Healthcare Improvement and other organizations[21], the community-engagement practices in community clinic settings such as those described in community-oriented primary care models[22], and the community-based participatory research models adapted from public health.[23]

The iterative, bidirectional approach we describe applies to implementation of a single translational activity (e.g., represented by a single dyad, such as those shown in Appendix 1), as well to larger-scale programs that employ multiple dyads across multiple dimensions over time. To illustrate how all three design principles could be applied in a targeted intervention, we provide a case study focusing on an effort to improve chlamydia screening rates (see Supplemental Digital Appendix 1, [LWW INSERT LINK]).

Competencies for IDS Trainees

Our design principles and conceptual framework provide a foundation for identifying key knowledge, skills, and abilities for IDS researchers. IDS requirements inherently overlap with those identified by Gebbie and colleagues[24] for the field of interdisciplinary research. Their proposed interdisciplinary research competencies, developed using a Delphi process, include the following:

- Use theories and methods of multiple disciplines in developing integrated theoretical and research frameworks
- Integrate concepts and methods from multiple disciplines in designing interdisciplinary research protocols
- Investigate hypotheses through interdisciplinary research
- Draft funding proposals for interdisciplinary research programs
- Disseminate interdisciplinary research results within and outside the discipline
- Author publications with scholars from other disciplines
- Present interdisciplinary research at venues representing more than one discipline.[24]

We integrated these IDS-relevant competencies with our IDS design principles to generate a set of seven IDS domains: team science, context identification, literature identification and assessment, community engagement, intervention design and research implementation, evaluation of effect of translational activity, and behavioral change communication strategies. For each domain, we propose associated IDS competencies that are distinct from those in traditional disciplines (Table 1). Once one of these competencies is identified as a goal in a particular IDS curriculum, course developers can suggest learning activities that are appropriate for that competency. Table 1 provides examples of specific learning activities included in UCSF's IDS courses, which we described below.

UCSF's IDS Curriculum

During 2008–2011, we used our conceptual framework and the competencies outlined above to create an IDS curriculum within UCSF's Training in Clinical Research (TICR) program. In 2010–2011, approximately twenty scholars participated substantively in the IDS curriculum (completing multiple IDS-specific courses and initiating IDS research projects). TICR is based on a foundation of applied epidemiology and biostatistics, and it offers some elective, IDS-oriented courses that predate the IDS curriculum: Clinical Performance and Health Outcome Measurement, Measurement in Clinical Research, Qualitative Research Methods, Decision and Cost-Effectiveness Analysis, Health Disparities Research Methods, and Biomedical Informatics. To this program, we have added five courses specifically geared to IDS training. These courses are summarized below; greater detail and learning objectives are provided in Table 2.

- Introduction to Translating Evidence Into Practice--Theory and Design: Introduces the translation of evidence into practice and policy and includes synopses from the other four courses
- Translating Evidence Into Practice--Individual-Centered Implementation Strategies: Focuses on integrating the components of individual behavior change theories and effective implementation strategies into the design of health care interventions
- Translating Evidence into Practice--System-Centered Implementation Strategies: Introduces theories of organizational behavior and culture in the context of program and policy implementation
- Translating Evidence Into Practice—Community-Engaged Research: Focuses on establishing partnerships with individuals and organizations in specific communities that are targeted for health care interventions

- Translating Evidence Into Policy--Framing Research to Influence Policy: Describes effective strategies for collecting and disseminating research findings to inform and influence the policy-making process

The IDS courses have been integrated into TICR's programs of study, including the two-year master's degree program in clinical research that is intended for advanced pre-doctoral students, post-doctoral fellows, and faculty members who wish to master clinical research methods and pursue independent research careers. These scholars may enroll in the IDS track, which combines epidemiology and biostatistics courses with a minimum of five courses in IDS theory and methods. (Three of the five must be selected from the IDS-specific courses, and two may be chosen from the IDS-specific courses or the IDS-oriented courses.) Concurrent with their didactic coursework, IDS research trainees may opt to be placed with HCDS (e.g., hospitals, clinics, public health departments) to learn how these community-based organizations prioritize and make decisions about which health care and/or public health interventions to implement. Scholars in the IDS track complete all of the capstone assignments required for the master's in clinical research, including a comprehensive review of the literature on a specific topic, a first-authored oral or poster presentation at a national or international meeting, and a first-authored manuscript submission to a peer-reviewed journal.

We are developing a brief (3–6 month), intensive IDS training experience that is independent of the master's program, in which trainees will learn and apply the principles and skills of IDS through participation in a quality improvement, delivery system innovation, or community health promotion project. These projects will be directed by members of an experienced, multidisciplinary team, and trainees will participate in the project's design, implementation and evaluation aspects. Through discussions with leaders of HCDS and public health officers, potential projects will be identified that are high priority to the HCDS or public health stakeholders and that have high organizational/community commitment and investment.

Our future research will evaluate the impact of these two IDS training programs. We plan to assess the impact of this curriculum on trainee's IDS competencies, as well as the number and type of resulting multi-disciplinary collaborations and community partnerships, the number of IDS-related research publications and grant submissions by trainees, and the effectiveness of implementation programs designed and/or coordinated by trainees.

Conclusions

When developing a curriculum, it is essential to identify learners' needs and devise learning objectives and teaching strategies designed to meet these needs. Our conceptual framework for IDS, our design principles for IDS research training and our interdisciplinary model curriculum represent a break with the dominant educational paradigm in which most courses reside in separate disciplines. Moreover, the competencies we propose here and teach in our IDS courses at UCSF are grounded in interdisciplinary research and team sciences--a departure from the emphasis of standard scientific research training programs. We believe these competencies, along with the conceptual framework that guides them, can serve as the foundation for the development of robust IDS curricula. We encourage other training programs and institutions to use or adapt our design principles, framework, and competencies to examine their existing IDS-related curricula and identify opportunities for growth.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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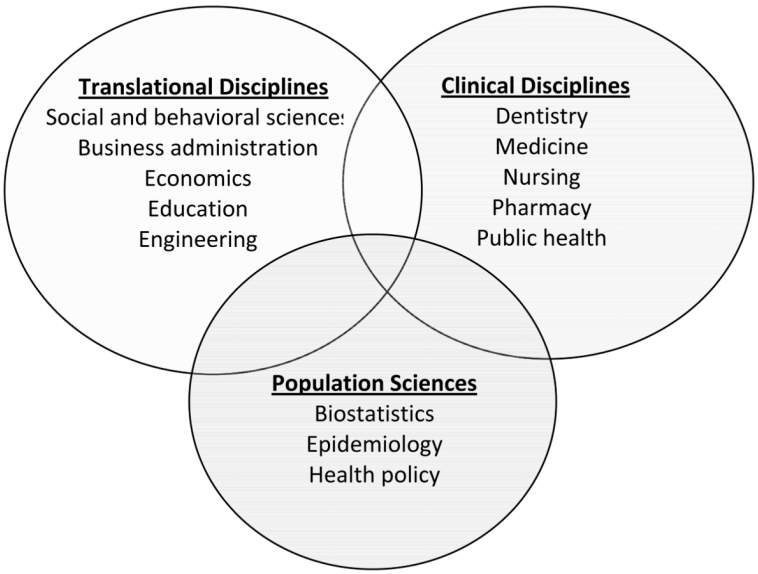

Figure 1.

Interdisciplinary nature of implementation and dissemination science (IDS). This Venn diagram emphasizes the need for training in IDS research to integrate translational disciplines (as represented by social and behavioral sciences, business administration, economics, education and engineering) with clinical disciplines and population sciences. This integration distinguishes IDS research training programs from traditional clinical research training programs.

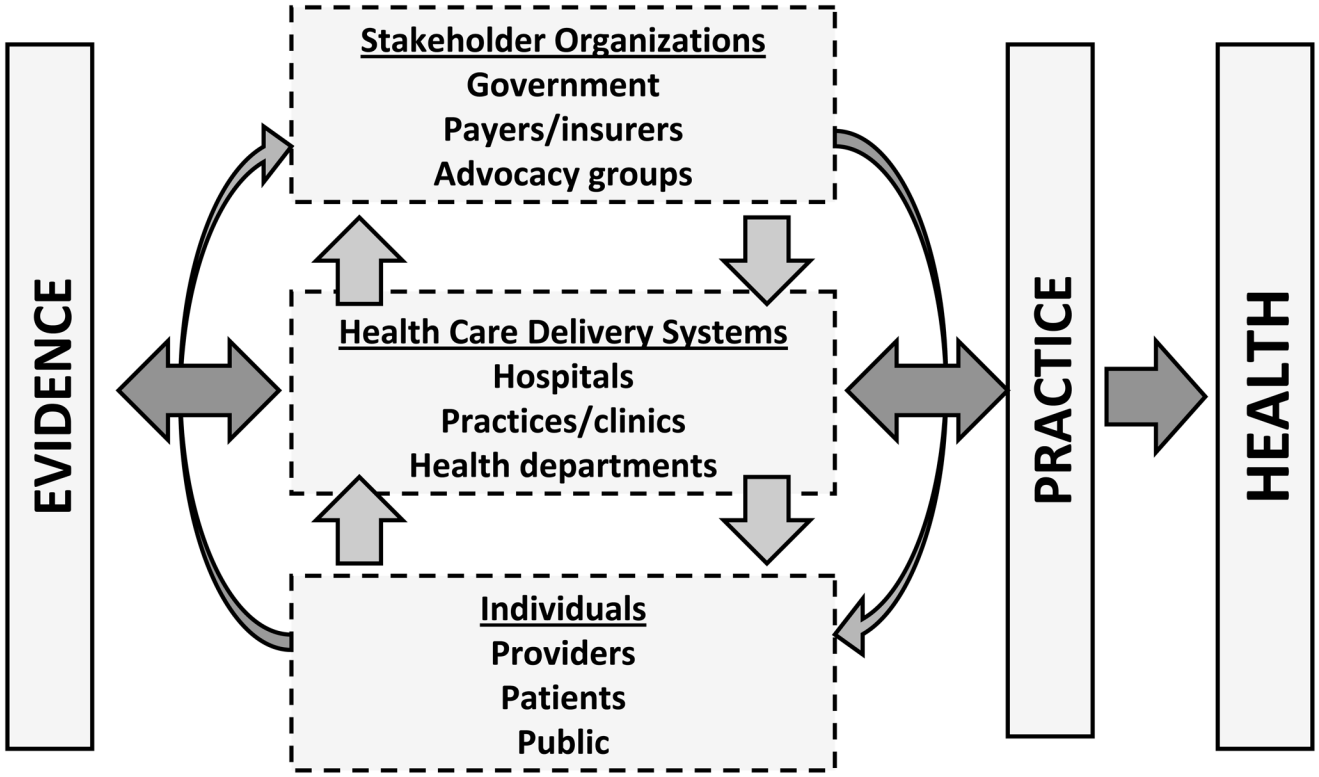

Figure 2.

A conceptual framework for translating evidence into practice, policy and public health improvements. The translation of evidence into practice, policy, and population health is made operational through activities that occur and relationships that exist among stakeholder organizations, health care delivery systems, and individuals. For a given translational activity, vertical arrows link the *operator* (the entity that is initiating/sponsoring the activity) and the *target* for the desired behavior change. The vertical arrows on the right side of the figure represent *intervention* activities, which are primarily activities designed to induce change. The vertical arrows on the left side represent *engagement* activities, which are primarily activities designed to gather information to inform stakeholder organizations about or to advocate intervention activities. The bidirectional nature of the vertical and horizontal arrows is intended to represent the iterative, cyclical nature of implementation and dissemination science research.

Table 1

Proposed Domains and Competencies for Implementation and Dissemination Science (IDS) Training Programs With Examples of Relevant Activities and IDS Courses Offered by the Training in Clinical Research Program (TICR) at the University of California, San Francisco, 2011–2012

Domain	Competency		Relevant activities	Relevant IDS courses*
Team science	**1**	Develop a collaborative, multidisciplinary team that shares a common language, and promotes a transdisciplinary blending of disciplines.	• Small-group, multidisciplinary works-in-progress seminars • Grant applications and manuscript submissions • Mock study sections	• Introduction to Translating Evidence into Practice—Theory and Design • Translating Evidence Into Practice—Individual-Centered Implementation Strategies • Translating Evidence Into Practice—System-Centered Implementation Strategies • Translating Evidence Into Practice—Community-Engaged Research • Translating Evidence Into Policy—Framing Research to Influence Policy • IDS Grant Writing Course
	2	Engage in collaborative writing, including the production of grants and manuscripts that meet the unique needs of sponsors of implementation and dissemination sciences.		
Context identification	**3**	Determine the range of factors—behavioral, social, ethical, institutional, political, economic, historical—that inform the research question and design structure	• Small-group, multidisciplinary works-in-progress seminars. • Field internship program • Multidisciplinary faculty mentorship	• Translating Evidence Into Practice—Community-Engaged Research • Translating Evidence Into Practice—Individual-Centered Implementation Strategies • Translating Evidence Into Practice—System-Centered Implementation Strategies
Literature identification and assessment	**4**	Identify relevant theory, evidence, methods, and perspectives outside the clinical domain of the research program.	• Literature search and retrieval skills	• TICR courses teach literature search skills • All IDS courses teach relevant content and search strategies
Community engagement	**5**	Build relationships with community members and community-based organizations, in order to engage multiple perspectives on the problem.	• Field internship program • Individual research and implementation projects	• Translating Evidence Into Practice—Community-Engaged Research • Translating Evidence Into Policy—Framing Research to Influence Policy
Intervention design and research implementation	**6**	Integrate diverse disciplinary, stakeholder and community perspectives into a cogent intervention design and/or implementation and dissemination strategy.	• Small-group, multidisciplinary works-in-progress seminars. • Biostatistical consultations	• Introduction to Translating Evidence Into Practice—Theory and Design • Translating Evidence Into Practice—Individual-Centered Implementation Strategies • Translating Evidence Into Practice—Systems-Centered Implementation Strategies
	7	Utilize a comprehensive implementation framework to guide the integration of theory		

Domain	Competency		Relevant activities	Relevant IDS courses*
		with specific intervention, evaluation, and dissemination activities		• Translating Evidence Into Practice—Community-Engaged Research • Translating Evidence Into Policy—Framing Research to Influence Policy
Evaluation of effect of translational activity	**8**	Employ epidemiological methods in study designs, program evaluations and causal inference.	• Epidemiology courses • Biostatistics courses (including quasi-experimental designs)	• Clinical Performance and Health Outcome Measurement† • Qualitative Research • Methods† • Translating Evidence Into Policy—Framing Research to Influence Policy • Program Evaluation (in development) • Health Policy (in development)
	9	Gain facility with qualitative and quasi-experimental designs to plan, implement, and evaluate interventions and policy impact.		
	10	Determine and measure processes and outcomes that support iterative cycles of implementation and bidirectional flow of information.		
Behavioral change communication strategies	**11**	Disseminate research/program results to relevant stakeholders and communities in a manner that maximizes their influence and sustainability outside of the research paradigm.	• Field internship program	• Translating Evidence Into Practice—Individual-Centered Implementation Strategies • Translating Evidence Into Policy—Framing Research to Influence Policy • Health Policy (in development)
	12	Ability to articulate IDS as an innovative approach to clinical and community-based research.		

*See Table 2 for a full description of each IDS-specific course.

†This course was offered by the UCSF clinical research training program before the development of the IDS-specific courses and curriculum described in this article and in Table 2.

Table 2

Implementation and Dissemination Science (IDS) Courses in the Training in Clinical Research Program, University of California, San Francisco, 2011–2012

IDS course title	Course description	Course learning objectives: The trainee will be able to
Introduction to Translating Evidence Into Practice—Theory and Design	• Provides a foundation in the development and implementation of evidence-informed health interventions, and guides trainees in developing a research protocol for their intervention of interest • Includes an overview of needs assessment, translational tools, organizational and individual behavior change theories, community engagement, program evaluation, and multi-level analytical techniques	• Justify the trainee's health care interventions based on an analysis of the relevant quality and outcome gaps • Apply theory and evidence for designing effective health care interventions • Evaluate and analyze health care interventions using a combination of techniques • Develop a health care research protocol aimed at translating an established intervention into practice
Translating Evidence Into Practice—Individual-Centered Implementation Strategies	• Integrates individual behavior change theories in the design of interventions targeting the public, patients, and clinicians • Enable trainees to integrate principles of behavior change theory, relevant formative research strategies, evidence for effective tools, and practical implementation strategies into the design of health care interventions	• Incorporate behavior change theories into a theoretical framework that applies to the trainee's area of interest • Describe how to adapt principle health promotion and evaluation frameworks to the planning of an intervention • Design a strategy to apply specific practical tools for behavior change to one or more components of an intervention project the trainee is considering • Integrate a reach and/or tailoring strategy into the trainee's intended intervention • Incorporate an evaluation plan into the trainee's implementation strategy
Translating Evidence Into Practice—System-Centered Implementation Strategies	• Introduces theories of organizational behavior and culture • Presents strategies for change in the context of sociological theories of organizational behavior and policy implementation • Focuses on translational tools used by stakeholders outside health care delivery organizations to promote adoption of innovations within organizations	• Better understand the nature and scope of system-level tools for promoting the widespread adoption of new clinical and public health interventions • Consider how each tool can be applied to address implementation barriers in the trainee's substantive field of expertise • Complete a case study that applies selected tools to the trainee's area of expertise
Translating Practice Into Evidence—Community-Engaged Research	• Provides training and skills in how to approach, communicate, and engage with a community of interest* • Teaches how community input can be incorporated in the development of the research question, implementation of the project/intervention, analysis of the results, and/or dissemination of the findings	• Define the key principles of community-engaged research • Describe the benefits of community-engaged research for the scientific validity, impact, and ethical conduct of research • Identify challenges to community engagement in research and strategies to overcome these challenges • Apply the principles and methods of community-engaged research to the trainee's own research program and integrate the methods in a practical manner into the protocol for a specific research project

IDS course title	Course description	Course learning objectives: The trainee will be able to
Translating Evidence Into Policy—Framing Research to Influence Policy	• Focuses on effective strategies for collecting and disseminating research findings to inform and influence the policy-making process • Provides an opportunity for trainees to apply the strategies to their own work and to test them with an audience of experienced policy makers	• Identify key components of the policy process as well as when and how is it activated • Recognize how research can be applied to the policy process • Define principles of research design methods such as natural experiments to inform the policy process • Develop strategies to be in a position to influence the policy process • Describe effective communication strategies with policy makers to influence decision making • Define potential conflicts of interest in using research to advocate policy change

* We define *community* broadly to include key groups of individuals that are being targeted by health care interventions and policies, including institutions and self-identified communities based on ethnic identity, geographical proximity, age, disability status, etc. At its core, community-engaged research is about forging partnerships and relationships with individuals and organizations in specific populations targeted by health interventions.

Appendix 1

Operator-Behavior Change Target Dyads and Common Translational Tools Used to Promote Behavior Change*

Operator → Behavior Change Target Dyads	Potential translational tools	Examples of translational activities
Stakeholder organization → Health care delivery system (HCDS)	• CQI; PDSA; Six Sigma • Pay for performance • Public reporting of performance and outcomes • Accreditation policies	• The National Committee on Quality Assurance publically reports health plans' performance on certain quality indicators. • Medicare provides additional incentive payments to hospitals that meet certain performance standards. • A breast cancer advocacy group releases position statement on mammography for women under 50 years of age.
Stakeholder organization → Individuals	• Pay for performance • Conditional cash payments • Mass media campaigns • Clinical practice guidelines • Wellness programs • Built environment enhancements	• A professional society disseminates a clinical practice guideline. • Medicare provides cash payments to patients to encourage weight loss. • A community environmental coalition releases a report encouraging community members to get screened for exposure to environmental chemicals.
HCDS → Individuals	• Pay for performance • Decision aids • Educational conferences • Audit and feedback	• A hospital provides its physicians with individual performance measures on appropriate antibiotic use. • Clinics provide free vaccines to the community on weekend days. • An AMC primary care clinic conducts outreach telephone calls to promote colon cancer screening.
HCDS → Stakeholder organization	• Mass media campaigns • Advocacy/lobbying	• A community health center's representatives lobby government officials to provide better medication coverage
Individuals → HCDS	• CBPR • COPC	• Anesthesiologists request that hospitals to provide greater access to nurse anesthesthetists. • Community members ask an HCDS to provide mobile mammography.
Individuals → Stakeholder organization	• CBPR • COPC • Mass media campaigns • Advocacy/lobbying	• Physicians lobby members of Congress to increase appropriations for uninsured health care. • Community members ask the city council to invest in safe walking and exercise trails.

* AMC indicates academic medical center; CBPR, community-based participatory research[21]; COPC, community-oriented primary care[20]; CQI, continuous quality improvement; PDSA, plan-do-study-act cycle.[19]