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A framework for implementing sustainable oral health promotion interventions

D. Dwayne Simpson, PhD

Institute of Behavioral Research (IBR), Texas Christian University, Fort Worth, TX

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Correspondence
Dr. D. Dwayne Simpson, Institute of Behavioral Research (IBR), Texas Christian University, TCU Box 298740, Fort Worth, TX 76129. Tel.: 817-257-7226; Fax: 817-257-7290; e-mail: ibr@tcu.edu. D. Dwayne Simpson is with the Institute of Behavioral Research (IBR), Texas Christian University.

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Abstract

The present paper addresses basic evaluation and procedural concepts that are involved in the process of implementing sustainable oral health behavioral and social interventions. It is part of a series of thematic articles describing cutting-edge methods for conducting oral health interventions research. Core components for effective intervention implementation are presented as part of a comprehensive model composed of four stages (training, adoption, implementation, and practice), along with sustaining influences involving preparation and maintenance. This model systematically addresses common barriers that can reduce innovation success and permanence. Special attention is given to the measurement and impact of organizational and related contextual influences across stages of the implementation process. Assessment tools and research strategies are recommended and illustrated based on evaluations of interventions implemented in addiction and mental health treatment systems. These tools and research strategies also hold promise for use within the National Institute of Dental and Craniofacial Research Practice-Based Research Networks, as well as other systems of oral health care delivery.

Introduction

Effective oral health promotion requires attention to multiple factors involved in prevention, corrective interventions, and recovery. The challenges are diverse, including establishing and maintaining healthy nutrition and oral hygiene, accessing quality preventive and restorative dental treatment, navigating complex treatment and psychosocial issues associated with craniofacial anomalies, coping with chronic orofacial pain such as temporomandibular joint disorder, reducing tobacco use and problematic alcohol use, and many others. Along with other medical and public health delivery systems, oral health providers have come under growing pressures during the past two decades to deliver "evidence-based" care (1). For example, the US Public Health Service established clinical practice guidelines that recommend that clinicians screen adult patients for tobacco use and provide tobacco cessation interventions for tobacco users (2). Recognizing the importance of tobacco cessation in oral health, the American Dental Association also endorsed this recommendation (3). In 2009, the US Preventive Services Task Force renewed this recommendation, characterizing the evidence for screening and brief intervention as consistent, of high quality, and compelling (4).

Despite the evidence for efficacy, and the endorsement of national organizations, tobacco screening and brief counseling still appears to be delivered inconsistently in dental settings (5,6). This discrepancy between the existence of evidence-based health promotion interventions and their use in practice is not unique to dentistry but has been widely recognized as a challenge for all clinical practice (7). Clearly, the typical modes of information sharing through scientific publication channels and passive instruction have not been sufficient to reliably initiate and sustain new practices. In order to move evidence-based approaches into practice, more careful examinations of methods to introduce and sustain effective oral health practices are needed.

This paper describes one systematic model for purposively disseminating innovations in health-care practice through careful attention to stages of effective implementation. The model is built around a multilevel process that a) first considers preparedness of the providers and the organizations in which they function for specific practice changes; b) follows four intervention implementation stages, and c) attends to factors that further influence the long-term sustainability of behavioral and social interventions. It is founded on large-scale treatment effectiveness outcome and therapeutic

process studies conducted at the Institute of Behavioral Research, Texas Christian University (TCU) beginning in the 1970s (8), along with those of many other scientists in public health, education, and business research discipline. The body of accumulated work at TCU includes evidence-based interventions, synchronized assessment tools, conceptual formulations of treatment process dynamics, and peer-reviewed publications examining these tools for improving behavioral and social interventions (8).

Implementing evidence-based innovations into healthcare practice depends on how the care is provided, structured, and supported. Oral health services in the United States are delivered primarily through private and independently operated dental clinics. Most dentists belong to the American Dental Association, a traditional resource for information on approved practices and procedures for care. In addition, services are provided through the armed forces, other federal systems, universities, hospitals, and health centers (such as for special needs groups and rural settings). Understanding more fully how practice changes are made in these systems can inform how best to create sustainable changes as new innovations are developed.

Implementation as a multistaged process

Efforts to upgrade public health care through prescribed use of evidence-based practices show that this can be a long, challenging, and multistaged endeavor. As described by Crosby and Noar in this issue (9) and as detailed in the PRECEDE-PROCEED planning model (10), the process of implementing these practices involves consideration of all aspects of a provider's environment, as well as the provider's own individual characteristics. This ecological approach recognizes that effective research-to-practice pipelines involve a broad list of factors that influence intervention implementation, including the acceptability of an intervention for its intended users (11), the context in which it will be implemented, and the evaluation mechanisms for maintaining and updating the intervention and demonstrating its cost-effectiveness over time (12). As an analogy, consider the agricultural chances of success in planting a valuable seed in an open field and leaving it alone to flourish versus following an intentional cultivation plan that attends to soil, weather, and maintenance requirements of the seedling. Important interventions likewise require planning, nurturing, and adjustment.

Diffusion of innovation theory also underscores the multistage process of implementing evidence-based practices. While informed by scholars from many disciplines and fields of study (13), the work of Rogers (14) is illustrative of this framework. In brief, Rogers contends that one must first consider how providers perceive the characteristics of the new practice. If they view the practice as significantly better than what they currently use (relative advantage), well suited to their experiences, values, and goals (compatibility), easy to use and understand (simplicity), able to be tried out first (trialability), and demonstrably beneficial (observability), providers are more likely to adopt the practice. Rogers notes that for practices found to be attractive, providers next proceed through five steps for the new practice to be implemented and sustained: a) learning about the new practice (knowledge); b) developing a positive attitude toward it (persuasion); c) developing an intention to try the new method (decision); d) learning how to use it (implementation); and e) integrating the approach into routine practice after experiencing success with it (confirmation).

In general, diffusion of innovations typically has referred to natural and passive processes by which providers adopt practices. By comparison, the terms "dissemination" (defined as methods for transmitting information about health practice to providers) and "implementation" (defined as methods to fit new health practices within real-world public health, clinical, and community service systems) are seen as involving the purposeful use of strategies in specific settings to promote the effective uptake of evidence-based practices that build upon concepts noted in the earlier diffusion of innovations literature (15-18). The US National Institute of Health is putting more emphasis on dissemination and implementation research as a core component of its translational research agenda, which aims to promote the development and conversion of new basic science findings into practical applications that are sustainable in the field (19). Of particular importance are clinical context and organizational factors that emerge across distinctive information processing and action stages that must be considered when promoting sustainable practice improvement (20-22).

To help translate these general principles into a heuristic action plan, an implementation process model has been developed and tested by Simpson and associates (20,23,24). As summarized graphically in Figure 1, it is centered by four "stages of implementation" labeled as training-dissemination, adoption (a planning and trial stage), implementation, and practice improvement. These stages capture the individual concepts listed above and show how they contribute as parts of an integrated chain of events. A unique feature of this model, however, is the designation of key factors that sequentially influence sustainability of an innovation. More specifically, it highlights readiness of the organization and its services infrastructure to embrace a specific intervention (i.e., preparation). Furthermore, the model denotes that the sustainability of innovations over time will be dictated in large part by resource allocations and organizational climate factors (i.e., maintenance).

Each section of this model is explained below, followed by the description of a battery of empirical measurement instruments associated with elements of the model. Research also is

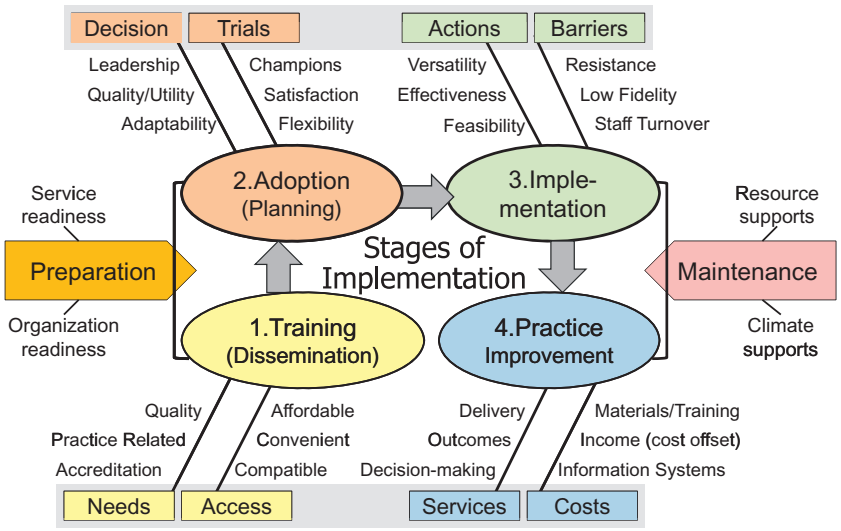

Figure 1 Stages of innovation implementation and factors affecting sustainability.

summarized, showing how these assessments have been used to evaluate the process represented.

Stages of implementation process

At the core of this multilevel model is a stage-based process that determines implementation success (23,24). Each stage is under the influence of several factors which can determine whether or not it is completed. This sequence of activities for implementing technical or complex procedural innovations commonly begins with dissemination strategies such as workshop-based training sessions. Decisions about whether or not to attend such training are influenced by perceived needs of providers and accessibility of the training venue. Depending on the intervention or procedural innovation being considered, optimal settings and methods used for training can vary.

Christensen (25) illustrates decision points involved in training dental office staff to deliver a patient-education intervention. Based on the assumption that better behavioral and decisional information frequently is needed by patients about oral preventive and treatment procedures, a dental office might decide to develop patient educational teams, utilizing the specialized skills of each member of the dental office. Christensen advocates staff training strategies (including administrative staff, dental assistants, and hygienists), initiated typically by motivational incentives from the dentist for providing pertinent and coordinated information about clinical issues (i.e., schedules and costs, patient needs and wants, and oral health procedures). Notably, his procedural advice concerning training topics, scheduling of in-service training sessions, preparing staff for the innovation, and selecting educational tools parallels many of the implementation principles presented more formally in the present paper.

As summarized in Figure 1, training for interventions must be relevant to the practice needs of a setting and meet acceptable standards of quality, preferably including accreditation or credentialing benefits as well. Moreover, training must be readily accessible, meaning it is affordable, convenient, and compatible with the providers' skills and attitudes. Leadership pressures and expectations can influence training attendance, especially when complex interventions require that training be extensive and multistaged over time.

Evidence shows that casual decisions to adopt behavioral or social interventions are seldom effective in changing long-term practice. It is analogous to "animal pet adoptions" that too often lack owner commitment and sustained care. As the next crucial step in the process, therefore, adoption is best viewed as a two-step *planning* activity comprised of reasoned decision-making and trial applications of intervention components. For an institution to "decide" to implement an intervention, its leadership must affirmatively support the practice in words and deeds, and users must view it as possessing the quality and utility necessary for addressing real-world circumstances. It also must be seen as being sufficiently adaptable to the wide-ranging applications and existing values or culture of the service program and patients. Piloting the interventions comes next, including test or practice runs to fine-tune and flexibly adjust how the intervention will be conducted. This process creates a mechanism for team feedback on how well the intervention meets preliminary expectations. A strong staff advocate (i.e., a champion) can effectively promote and facilitate adoption commitments.

Contingent on results of these training and adoption planning activities, implementation follows as the next stage. It represents the apex of the process, building directly on trial experiences from the adoption stage. Progress rests largely on the degree to which staff members take actions to use the

intervention and the severity of barriers encountered. As listed in the figure, an innovation must be regarded by the staff as being sufficiently versatile, effective, and feasible for them to use. At the same time, related active and passive barriers (e.g., resistance related to costs of resources, time needed to use the innovation, and lack of leadership encouragement) must be manageable. Some barriers may be specific to the innovation, setting, training, and staff members involved, but more generic complications also can result from the staff not using the intervention with sufficient fidelity (26), sometimes compounded by high staff turnover.

Ultimately, interventions that successfully advance through these training, adoption, and implementation stages tend to become accepted and routinely used for practice improvement. Functionally, this step reflects a consensus view of staff and leadership that their services are being enhanced by the new practice. This might be based on patient satisfaction indicators, treatment adherence and outcomes, or clearer decision-making about clinical procedures. In public health practice, of course, costs are always relevant. In that regard, an innovation must be able to "pay for itself" from reimbursable fees, and costs for materials and training must be acceptable. Structured evaluations of the delivery process and outcomes are critical assets for this concluding stage of implementation, especially if evidence can show that decision-making about clinical services is linked to efficiency. To the extent that objective assessments can document the effectiveness of an innovation, decisions about its quality and sustainability are based on firm empirical evidence.

Additional influences on sustainability

In private dental settings, dentists make most decisions about practice changes, but they rely frequently on peer opinions or trusted professional leaders as a basis for their intervention adoption decisions. A national annual survey conducted by the American Dental Association consistently reports that dentists' main source of information for making improvements in their practices are their respected peers (27). Other studies of information seeking among oral health-care providers confirm these results, with the most common venues for information exchange being online discussion groups and continuing education courses (28,29).

Sometimes, decisions to implement interventions are made prematurely. Long-range sustainability of behavioral and social interventions depends on service and organizational readiness, sufficient resource allocations, and a supportive team climate which includes proper coordination of staff roles to maintain successful intervention implementation. As interventions become more complex, maximizing the positive contribution of each of these areas becomes increasingly important. That is why planning and preparation for intervention implementation at the outset ought to identify and address organizational strengths and deficiencies that might be harnessed or remedied to improve sustainability (30).

In the model presented in Figure 1, these factors are divided into two parts – those with particular relevance to the early training and adoption stages of the implementation process (labeled as "preparation") and those that impact ongoing innovations (labeled "maintenance").

Preparation

Service delivery settings can be judged on the basis of indicators for "services readiness" (referring to a conceptual and procedural understanding by the staff about the types of services being provided), along with "organizational readiness" (referring to staff perceptions of service-specific needs, resources, and workgroup infrastructure). Information gathered about the types of services being provided and procedures followed can help plan for how an innovation might enhance quality or efficiency of care. Sufficient staff consensus about the potential value of particular interventions, along with resources required to follow through on these interests, are necessary. Leadership assumptions about these matters can sometimes be inaccurate, especially in larger organizational settings; so, staff survey procedures are sometimes needed to assess these issues more objectively.

Services tend to become more complicated when new behavioral or social interventions are introduced. Service providers therefore need sufficient information to determine if the risk–benefit ratio is justifiable for initiating an innovation. As discussed in more detail elsewhere (31,32), evidence shows that having a firm foundation of clinical knowledge about therapeutic process can improve the odds that implementation of new practices will be more intentional, rational, and permanent.

Organizational dysfunction likewise threatens innovation planning. Staff assessments focused on personal and professional dynamics can be administered, and results are compared to normative profiles to help diagnose preparedness. If needed, structured guides are available (30) for identifying organizational functioning problems and addressing these issues constructively with staff participation. Retesting with these same assessments later can show how well organizational intervention efforts worked to foster better preparedness for intervention implementation. Unless resolved, of course, serious personnel problems, staff dissensions, and lack of common goals can become major barriers.

Maintenance

Just as preparation is important for the initial stages of training and adoption of interventions, *maintenance* strategies

must be in place to sustain the crucial implementation and practice stages that follow. Resource allocations (for materials, training, equipment, staffing, offices, etc.) are often necessary to fully support new implementation protocols over time. Costs associated with new interventions (for training, deployment, and maintenance) are particularly important. In addition to these obvious financial obligations, there are "organizational climate" factors to consider (involving staff commitments and social interrelations) within a healthy work atmosphere. Staff perceptions about mission clarity, cohesion, communication, and stress affect their collective use of the intervention and patient responses to services (33,34). As explained below, these theoretical constructs are linked to empirical assessments.

Measurement tools for evaluating and monitoring implementation

Evaluation of efforts to implement and sustain behavioral and social oral health interventions should use theories (35) and models (9) to schematically plan and apply appropriate assessment tools. A battery of measures has been developed (36,37) for key domains and scales designated in the implementation process model, listed in Table 1. Because they have been applied and evaluated across a variety of settings, several adaptations are available on the TCU Institute of Behavioral Research Web site along with administration guideline and scoring procedures (38). Scale score norms defined on the basis of large samples in TCU data files presented on the Web

Table 1 Summary of TCU Assessment Instrument Domains and Scales

A. Needs/Pressures for Change*
   1. Clinical needs: staff valuations about needs to improve clinical care (patient assessments, engagement, decision-making)
   2. Program needs: staff valuations about program strengths/weaknesses and issues that need attention such as goals, performance, staff relations, and information systems
   3. Treatment needs: staff perceptions of specialized clinical and operational training needs
   4. Pressure for changes: staff perceptions about internal/external pressure for innovation

B. Staff Attributes*
   1. Growth: emphasis on developing personal skills and professional growth
   2. Efficacy: confidence in personal skills and effectiveness
   3. Influences: perceived influence and professional respect from peers
   4. Adaptability: ability to adapt effectively to new ideas and change
   5. Satisfaction: general satisfaction with job and work environment

C. Institutional Resources*
   1. Offices: adequacy of office equipment and physical space available
   2. Staffing: overall adequacy of staff size and skills available
   3. Training: priority given to staff training and education
   4. Equipment: adequacy of computerized systems and services
   5. Internet: access to e-mail and internet for professional communications
   6. Supervision: confidence in leadership and team-based management

D. Organizational Climate*
   1. Mission: staff understanding of service mission and clarity of goals
   2. Cohesion: mutual trust and cooperation within workgroup
   3. Autonomy: sufficient authority and latitude allowed to perform job
   4. Communication: adequacy of information network and interactions with leadership
   5. Stress: perceived strain, stress, and role overload
   6. Change: staff openness and acceptance of changes needed in services

E. Workshop Evaluation (Post-Training)
   1. Innovation quality and utility
   2. Resources and staff skills available
   3. Adequacy of training
   4. Support and commitment expected
   5. Major barriers expected

F. Workshop Assessment at Follow-up
   1. Innovation quality and utility
   2. Resources and staff skills available
   3. Adequacy of training
   4. Support and commitment experienced
   5. Major barriers encountered

* These scales are from the Organizational Readiness for Change (ORC) Form.

Note. All TCU assessments are available without charge from http://www.ibr.tcu.edu.

site are also available to help guide interpretations and applications.

Administration of these assessments is usually conducted in small group settings, and at least 3-5 individuals from any given work unit should be included in order to establish representative score profiles (based on averaged scores across respondents for each scale). Group score profiles are recommended for use in most organizational assessment applications (with confidentiality assurances to individual respondents, which help reduce response bias and protect against potential prejudicial reactions), although under some circumstances, individual-level scores might be useful as exemplified later in this paper.

The first four domains of scales presented in Table 1 – Needs/Pressures for Change, Staff Attributes, Institutional Resources, and Organizational Climate – are taken from the TCU Organizational Readiness for Change (ORC) assessment (37). Over 5,000 ORC surveys administered in over 650 organizations (including work in Italy and England, and representing a variety of social, medical, and mental health settings in the United States) demonstrate its broad applicability (33,34,39,40). The first two domains of the ORC scales are particularly relevant for gauging service needs and organizational readiness for implementation (preparation), and the third and fourth domains (involving resources and climate) represent dominant influences on maintenance of innovations.

Decisions about administration time lines for these assessments depend on particular evaluation designs and research objectives, but as illustrated below, these scales are well suited to group-level, pre-to-post intervention implementation testing. The Needs/Pressures for Change scales (requiring 5-10 minutes) can be briefly administered before training begins as a way to better gauge training needs and circumstances of the programs in which training will occur, and they can be customized according to intervention type and setting.

The TCU Workshop Evaluation (WEVAL) form targets information listed under section E of the table, designed to be administered at the end of a training session, while the TCU Workshop Assessment Follow-Up (WAFU) form is represented in section F. The contents of these assessments are parallel in order to examine factors that influence progress throughout the implementation stages. More specifically, the WAFU is intended to be completed by trainees several weeks or months after a workshop to address subsequent intervention utilization, and items can be edited or added to examine specialized issues.

Summary of research evidence for the implementation model

A series of studies assembled by Simpson and Flynn (36) illustrate recent research methods applied to several large-scale intervention implementation evaluations. Approximately 800 addiction treatment programs located across the United States participated in the studies and data analyses relied on the set of TCU assessments listed above. The central research theme focused on answering practical questions about program needs and functioning in relation to intervention training and implementation in various networks of addiction treatment services. The most comprehensive study (41) relied on multimethod analytic strategies with 2-year longitudinal process data that focused on relationships between staff ratings of innovation needs, training, adoption, and implementation across time using a long-range, cross-linked subset of service provider records. The findings fit the model shown in Figure 1 in that staff perceptions about program training needs (measured using a program needs survey a year before training) were related to subsequent staff responsiveness to workshop training. Next, it was found that indicators of favorable organizational functioning (collected 4 months before training) were related to more positive staff responses to training activities. Finally, and importantly, positive staff-level responses to workshop training as well as perceived progress in implementation related positively to independent patient-level reports regarding their own counseling participation, rapport, and satisfaction completed 9 months after the counselor training.

Because quality of innovation training is fundamental in preparing counselors for change, one of the studies (42) focused in more detail on workshop evaluation and follow-up assessments for examining staff views on relevance and quality of training for specific interventions in relation to subsequent "trial use." As expected from the model, higher ratings about intervention relevance to patient needs and adequacy of program resource allocations predicted staff endorsement and actual use of materials following training. Principal implementation barriers faced by the staff included lack of time and perceived redundancy with previously existing practices, indicative of the failures by some participating programs to fully review the purpose and procedures of the new interventions during their preparation phase.

An example for studying readiness and sustainability of interventions using TCU assessments

The studies just summarized addressed organizational needs and functioning indicators using aggregated staff ratings to represent each service delivery unit included. Because representative samples of "staff units" might sometimes be unavailable for such a survey, especially when using a train-the-trainer implementation strategy, whereby a single "intervention champion" is selected to attend a training workshop, a modified approach can be appropriate.

An example of this application comes from a training course provided on the innovative approach called TCU

Mapping-Enhanced Counseling (43), based on an effective visual communication and personal decision-making tool. This counseling method uses a structured type of flowcharting called node-link mapping – namely boxes (nodes) and lines (links) – to graphically illustrate thoughts, feelings, and actions, and how they relate to each other. It is embedded in a series of TCU motivational readiness and engagement interventions to improve patients' ability to process information and make decisions, as well as help overcome educational, cognitive, or related attention deficits. Mapping has been shown to be effective in increasing patient motivation, engagement, participation, and retention in treatment (44,45). It also promotes more positive interactions among patients and with treatment staff, both in community-based as well as correctional settings (46,47). Further information, including self-training manuals for using mapping tools, are available without cost on the TCU Web site (38).

A workshop to "train the trainers" for this intervention was conducted by the TCU team during 2009 for 36 registered participants from across the United States, Canada, and England. Assessment tools described above (ORC and WEVAL) were used to survey pretraining needs and implementation plans of attendees from an array of educational and public health service provider programs represented. Participant surveys completed immediately before training focused on the perceptions of staff needs and organizational functioning of the treatment program settings they represented. Two key sections of the ORC scales were included, reflecting staff perceptions of "program needs and readiness for change" and "organizational climate." The large majority of participants reported that their respective programs needed *better patient assessments* to document care improvements (86 percent), guide clinical care decisions (81 percent), and match patients to appropriate services (78 percent). Trainees also emphasized the need for clinical tools to improve their patients' treatment engagement and clinical progress through better thinking, cognitive focus, problem solving, rapport building, and behavioral management (i.e., 67 percent to 81 percent agreements). "Organization-level needs" given the highest ratings by training participants included improving staff communications (67 percent), staff interrelations (61 percent), evaluations of staff performance (58 percent), and record-keeping systems (58 percent). Finally, questions on "pressures for program changes" showed that their supervisors or managers (67 percent) and funding agencies (53 percent) were principal agents for influencing change.

The second section of the pretraining survey focused on "organizational climate." It included ORC scales for *clarity of program mission*, *staff cohesion*, *autonomy*, *communication*, *stress*, and *openness to change*. Mean scores were calculated across all workshop participants, and when compared to normative scores defined from collectively other TCU studies, they suggested favorable organizational infrastructures were in place at most of the programs represented. Because some participants scored higher and some scored lower than this "mean score," however, the ORC scales were examined in relation to the ratings of specific needs summarized above.

As expected, organizational climate scales were found to have predictable relationships with other participant perceptions about program needs and pressures. Correlational analysis ($P < 0.05$), for instance, showed that ORC scores indicative of higher staff stress levels were associated with greater needs for better patient problem-solving and behavioral management strategies. In short, working with more hard-to-manage patients has the effect of increasing staff stress levels. Even more significant (with some correlations as high as 0.65) were the relations found between ORC scale scores and participant concerns about program structure and operations. They showed that higher ratings of staff stress were accompanied by greater needs for program guidance in dealing with service delivery and staffing dysfunctions. Likewise, poorer staff clarity about the mission of their services (defined by lower ORC scores on this scale) was associated with greater needs for improving service goals, staff role definitions, job descriptions, performance evaluations, and staff relations and communications in their respective programs.

Because previous research found that poor organizational focus and functional dynamics predict poorer quality of services to patients (37,48), it is likely that proactive preparatory efforts to improve "internal functionality" help make the implementation of an intervention more sustainable within programs that lack key organizational strengths (30). In practice, this type of information can identify and help preempt implementation problems peculiar to any given service setting.

Post-training evaluations of the intervention training event (using the WEVAL) showed that table discussions, role-playing exercises, case study reports, and clinical tip-sharing were viewed very favorably by workshop participants. *General quality*, *satisfaction*, and *utilization* of TCU mapping were strongly endorsed, with 94-100 percent agreement. Participants also generally believed that *program resources and staff skills* in their respective programs were adequate for mapping implementation (72 percent to 89 percent); only 14 percent doubted that any of their fellow counselors could use the technique effectively. *Training* activities were judged to have included effective practice sessions, adaptation strategies, and training preparation exercises (89 percent to 94 percent agreement). Only 22 percent thought that more follow-up training would be necessary before they could effectively use the new intervention with their patients. These indicators suggest that efforts in this workshop to train new "mappers" were successful.

Finally, ratings of the level of *support and commitment* that participants anticipated from their respective programs

leaders, fellow staff members, and patients were generally high (i.e., 75 percent to 94 percent agreed). Their overall ratings on *common barriers* facing clinical innovations reflected high optimism about the practical and sustained implementation of mapping-based counseling materials. Only 11 percent worried about a lack of time for preparation and applications, possibly related to the indicators of organizational dysfunction discussed earlier. Other types of implementation barriers – such as having better options to use, adaptability to patients, or training inadequacies – seemed to be of virtually no concern (0 percent to 3 percent). Further information on follow-up practices could serve the need for formal evaluations focused on planning and sustaining implementation protocols across settings.

Well-designed planning and longitudinal evaluation based on this model can and should be applied to future oral health interventions. These efforts would require adapting, translating, and validating the TCU assessment instruments for use within the oral health community. For example, the ORC would need modification in several ways, including a) replacing the assessment of psychotherapeutic counseling approaches to behavior change strategies likely to be used in dentistry (e.g., education, motivational incentives), b) de-emphasizing evaluation of workshop training opportunities in favor of understanding current professional peer influences and online distance learning opportunities, and c) assessing the business realities (e.g., reimbursable services) of the predominantly private-for-profit-operated dental clinics that might influence practice adoption, implementation, and maintenance decisions. This kind of effort to establish tools for conducting dissemination and implementation research in the oral health field would require access to a large number of dental practices as was done originally for the TCU assessments in addiction treatment settings (36). Opportunities may exist within the dental practice-based research networks (dental PBRNs) described below.

Opportunities for research with the dental PBRN

Unique opportunities to study the sustainability of interventions in real-world oral health practice settings exist through the dental PBRNs, funded since 2005 by the National Institute of Dental and Craniofacial Research (NIDCR). The PBRNs are organized as three separate networks of over 700 private and community dental clinics across the Unites States, along with a few international partners, with the common goal of conducting research in dental practice settings (49). To date, these networks have conducted studies on a wide range of issues relevant to dental practice, including prevention and treatment of caries and periodontal diseases (50), orofacial pain (51), tobacco cessation (52), and more. Although the PBRNs were not established initially to conduct implementation science, these research networks have begun to gather data that might advance implementation of oral health innovations. For example, each network has conducted surveys to understand the nature of participating practices and clinics, and their perspectives on data collected via clinical research (e.g., PRECEDENT Network) (53,54). The networks also have tested approaches to improve delivery of innovations by sending email reminders (55) and by conducting interim data analysis (PEARL Network) (56). Similarly, they are tackling the issue of innovations in cost reimbursement, and identifying barriers and facilitators to one system for reimbursement (57,58).

In private practice, cost reimbursements usually determine which services are delivered. In dentistry, for instance, diagnostic and billing codes exist for brief tobacco counseling for prevention of oral diseases. Because major dental insurance providers do not reimburse for these costs, however, tobacco cessation interventions tend not to be used in private practices. Without clear and convincing cost-effectiveness data for service providers and insurance companies, sustainability of effective interventions such as this one can be thwarted (12). The TCU team developed new costing tools (59) for use as part of an addiction treatment process data system to collect, allocate, analyze, and report program accounting and economic costs. Of particular relevance for potential users of new interventions are cost calculations associated with purchases of materials, training, and sustaining service innovations. An emphasis on augmenting the implementation process model presented in this paper with such data on system costs and benefits could be extremely important for future practitioner applications in the oral health field.

On November 12, 2010, the NIDCR issued a Funding Opportunity Announcement to solicit applications for the next iteration of the PBRN program wherein they could become working laboratories for studying implementation and practice changes. Following an implementation model such as the one presented in this paper, this research could study different methods for assessing oral health settings' readiness for change, training providers in oral health innovations; research could examine factors affecting decision-making to adopt interventions; PBRN researchers could develop and compare different ways to overcome barriers to using innovations; and researchers could track influences to long-term sustainability of innovations in practice, including cost-effectiveness analyses.

Concluding comments

Evidence-based social and behavioral interventions have limited use if they cannot be accurately established and sustained in practice. The National Institutes of Health, in general, have heightened attention to the need for dissemination and implementation research. This paper presents an

established, systematic multistage model and related measures to help formulate and guide work in this area. Research about the sustainability of interventions requires thorough examination of a complex array of systems-level factors (e.g., clinical, administrative, organizational, and policy). This includes public health system and related organizational factors. Better staff knowledge about the rationale and delivery of services, along with up-to-date feedback about effectiveness of current services, provide a foundation for more educated and rational choices about innovations that can work. With these elements in place, a comprehensive implementation process for behavioral and social interventions can be more securely planned, carried out, and sustained.

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Conflict of interest

The author has received payment from NIDCR for writing this manuscript.

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