

This paper was commissioned for the Committee on the Well-being of Military Families. Opinions and statements included in the paper are solely those of the individual author, and are not necessarily adopted, endorsed, or verified as accurate by the Committee on the Well-being of Military Families or the National Academy of Sciences, Engineering, and Medicine.

**Application of Implementation Science to Population-based, Behavioral Health Prevention**

**Continuum of Care for Military Families**

David A. Chambers, D.Phil. & Wynne E. Norton, PhD.

Implementation Science Team

Division of Cancer Control and Population Sciences

National Cancer Institute

Background Paper

Committee on the Well-being of Military Families

National Academies of Sciences, Engineering, and Medicine

July 18, 2018

**1. How can advancements in implementation science and health system frameworks inform an approach to the challenges faced by the U.S. Department of Defense (DoD) and researchers in developing, adapting and implementing prevention programs and practices to support military family (child, parent, couples, caregivers, family, etc.) resilience and well-being?**

*A Brief Overview of Implementation Science*

Private and public funding agencies, researchers, and health-focused organizations have invested billions of dollars and decades of research into the development of practices, programs, guidelines, and interventions (collectively referred to as interventions throughout this paper) demonstrated through rigorous research studies to affect individual-level health-related behavior and outcomes. Evidence-based interventions have been developed for a range of target health behaviors and outcomes. Many of these interventions have been compiled and centralized into compendiums with associated materials, delivery protocols, guidance documents, and intervention-related components (e.g., videos, downloadable flyers, intervention manuals, implementation toolkits). Some interventions have been developed specifically for military populations and shown to affect a range of health behaviors and outcomes; other interventions may be ripe for adaptation from non-military to military populations and settings using structured, planned processes to inform intervention adaptation and delivery to maximize impact on health-related behaviors and outcomes.

For example, the National Cancer Institute hosts *Research-Tested Intervention Programs* (RTIPs([Institute](#))), a compendium of evidence-based interventions across the cancer prevention and control continuum (e.g., breast cancer screening, diet/nutrition, obesity, survivorship/supportive care, sun safety, tobacco control) delivered in a variety of public health and health care settings (e.g., community-based organizations, school-based settings, workplace settings, and clinical care) and for a range of target populations (e.g., adolescents, adults, Whites [not of Hispanic or Latino origin], Hispanics or Latinos, African-Americans, and men and women). Although the RTIPs compendium does not currently include evidence-based interventions developed and testing among military populations, it nonetheless includes interventions that can be readily adapted to military populations and settings using structured, planned adaptation processes and evaluation.

The Substance Abuse and Mental Health Services Administration (SAMHSA) hosts a searchable, online compendium—the *National Registry of Evidence-based Programs and Practices* (NREPP([Administration](#)))—of mental health and substance use interventions. Example topic areas (and respective evidence-based interventions) include alcohol, tobacco, and other drugs, behavioral health treatments and services, and trauma and violence. NREPP includes interventions that have been developed specifically for or are applicable to veteran and military family populations; these interventions have shown to change outcomes such as depression and trauma- and stress-related disorders and symptoms (i.e., Accelerated Resolution Therapy); coping, general functioning and well-being (i.e., Trauma Affect Regulations: Guide for Education and Treatment [TARGET]); relationship skills including communication, conflict resolution, emotional awareness, and relationship satisfaction (i.e., Creating Lasting Family Connections Marriage Enhancement Program [CLFCMEP]); and awareness of signs of post-deployment stress

and motivation to access mental health services as needed (i.e., Kognito Family of Heroes). Although these interventions have been developed and tested specifically for military populations and settings, they may nonetheless necessitate local adaptations to increase the likelihood of adoption and implementation as well as impact on health-related behaviors and outcomes.

Despite the availability of hundreds of evidence-based interventions through these and other compendiums (e.g., Center for Disease Control and Prevention [CDC] *Community Guide*[\(Prevention\)](#), CDC's *Effective Interventions: HIV Prevention That Works*[\(Prevention\)](#), *Guidelines International Network*), few are implemented and sustained in everyday public health and health care settings. Indeed, empirical evidence indicates that Americans receive approximately 50% of recommended care[\(McGlynn et al. 2003\)](#), and that it takes approximately 17-years for 14% of original research to benefit patient care[\(Balas and Boren 2000\)](#). Although these studies did not include military populations and settings, it is likely that a gap exists between what has been demonstrated to affect health-related behaviors and outcomes and what is typically practiced in public health and health care delivery settings that serve military populations.

In recognition of the relatively poor adoption, implementation, and sustained use of evidence-based practices across populations and delivery settings, the field of implementation science is focused on understanding and remediating the evidence-to-practice gap. Implementation science (also referred to as implementation research) can be defined as, “the scientific study of the use of strategies to adopt and integrate evidence-based health interventions into clinical and community settings in order to improve patient outcomes and benefit population health.[\(Health\)](#)” In essence, the field of implementation science is designed to rigorously study the research-to-practice gap, in an overall effort to identify effective ways to improve the adaptation, adoption, implementation, and sustainment of evidence-based practices in routine delivery settings, and

foster partnerships with practice organizations to accelerate the transition of interventions from research- to practice-focused settings.

As with many relatively new scientific fields, implementation science is just one of many terms used to generally convey research focused on bridging the research-to-practice gap. Related terms and processes include dissemination, knowledge translation, diffusion, research-to-practice, discovery-to-delivery, quality improvement research, and improvement science, among others([McKibbon et al. 2010](#)). Broadly speaking, this field is focused on conducting research to understand barriers toward adoption and develop and test strategies to support the effective implementation and sustainment of evidence-based interventions. Consistent with the tenets of research, implementation science is focused on creating generalizable knowledge that can provide empirical guidance on how best to integrate evidence-based interventions into routine public health and health care delivery settings to improve patient and population health behaviors and outcomes.

#### *Foundational Elements of Implementation Science*

The following section offer an overview of some of the key aspects within the field of implementation science, including theories, models, and frameworks; research designs; measures and measurement; and implementation strategies. The brief descriptions that follow are meant to provide additional context in which adaptation of evidence-based interventions occur, and how it is relative to other processes and elements in the field.

Theories, Models, and Frameworks in Implementation Science. As with many research fields, particularly in the social and behavioral sciences, implementation research leverages theories, frameworks, and models (hereafter collectively referred to as models) to understand, test, and ultimately improve the integration of evidence-based interventions into routine practice settings. A review by Tabak and colleagues([Tabak et al. 2012](#)) (2012) identified 60 models that

had been used in implementation studies. However, it is important to note that most of these models were originally developed in other disciplines (e.g., public health, psychology, sociology), and have since been adapted and applied to implementation research. In implementation science, models can be woven throughout the proposed research study (or practice activity) to help inform adaptations to evidence-based interventions, selection of implementation strategies, identification of measures, and data analyses.

An article by Nilsen([Nilsen 2015](#)) (2015) provides a nice overview of the three types of models used in implementation science, including (1) process models, (2) determinant frameworks or theories, and (3) evaluation frameworks. The *Consolidated Framework for Implementation Research*([Damschroder et al. 2009](#)) (CFIR), one of the most frequently used frameworks in implementation science, is a determinants framework. CFIR is a comprehensive framework that outlines multi-level constructs associated with the implementation process. CFIR includes five key constructs (i.e., intervention characteristics, outer setting, inner setting, and characteristics of individuals, and process) and associated sub-constructs that are hypothesized to influence the implementation of evidence-based interventions. Additional information about CFIR, including guidelines for using CFIR to design a study or select an implementation strategy, as well as tools and templates (e.g., interview guide tools), can be found on the CFIR technical assistance website (<http://www.cfirguide.org/index.html>).

The *Diffusion of Innovations*([Rogers 2010](#)) (DoI) model is another commonly-used model to help understand the implementation process. Developed by Everett Rogers' work in agriculture for understanding the diffusion of corn seeds in Iowa, it has been used to understand the diffusion of many different types of interventions across a range of settings. The DoI model consists of four main elements hypothesized to affect and explain diffusion: the process by which (1) an innovation

(2) is communicated through certain channels (3) over time (4) among members of a social system. More specifically, aspects of the *innovation* that can facilitate or limit diffusion include (1) *relative advantage* (to what extent is the innovation perceived as better than what is currently in place?), (2) *compatibility* (to what extent is the innovation perceived as being consistent with the existing values, experiences, and needs of potential users?), (3) *complexity* (to what extent is the innovation perceived as difficult to understand or use?), (4) *trialability* (to what degree can the innovation be experimented with on a limited basis before full implementation?), and (5) *observability* (to what extent are the results of an innovation visible to others?). These five characteristics of innovations (or evidence-based interventions, for purposes of this paper) affect whether the innovation is adopted and the rate of diffusion pending initial adoption. *Communication channels* refers to how information about the innovation is shared with others, and may include mass media campaigns and interpersonal channels. *Time* refers to the speed with which an innovation diffuses across communication channels, conceptualized as occurring through a decisional process of knowledge, persuasion, decision, implementation, and confirmation. Finally, the *social system* is defined as a set of interrelated units that are engaged in joint problem solving to accomplish a common goal. Examples of social systems include the individuals who collectively form informal groups, communities, professional societies, and organizations.

The *Exploration—Preparation—Implementation—Sustainment* model ([Aarons, Hurlburt, and Horwitz 2011](#)) (EPIS) is a nice example of a phased approach to implementation that articulates the process through which an evidence-based intervention may be implemented. As implementation is oftentimes conceptualized as a process (typically consisting of four or five phases), EPIS outlines multi-level factors likely to facilitate or impede the integration of an evidence-based intervention into routine delivery settings, and how these particular factors change

may be more or less important depending on the phase. For example, *funding* (e.g., service grants, workforce stability, sustained fiscal support, continuity of funding), one of several factors in the *outer context* domain, plays a critical role in whether the intervention progresses through the four phases of exploration, preparation, implementation and sustainment. *Organizational characteristics* (e.g., absorptive capacity, role specialization, readiness for change, and leadership) is one of several factors in the *inner context* domain, also play a role in progression (or lack thereof) of an evidence-based intervention through the phases of implementation. Importantly, this phased approach to conceptualizing implementation provides insight into what elements are most applicable and important for completion of each phase, and subsequently provides guidance on what strategies may be needed to facilitate implementation through all four phases.

Implementation theories, frameworks, and models can help facilitate integration of evidence-based interventions targeting military populations and delivery settings by identifying likely barriers toward implementation, and providing guidance for how best to overcome such barriers. Most models are multi-level, reflecting the complex nature of implementation, and most include a phased-approach to implementation, recognizing that factors influencing implementation change over time, and may need different strategies to move from one phase to the next.

Research Designs and Methods in Implementation Science. Implementation science leverages many study designs and research methods to answer implementation questions, briefly described below.

*Qualitative methods* (e.g., focus groups, semi-structure interviews) are particularly well-suited for understanding and describing how context plays a role in the implementation process over time. For example, one may conduct semi-structured interviews with a purposeful sample of physicians to identify barriers and facilitators toward adoption of an evidence-based guideline for

screening for depression, anxiety, and post-traumatic stress disorder commonly experienced post-deployment. Through thematic content analysis, one may be able to identify factors that impede the implementation of an evidence-based screening questionnaire, thereby identifying potential strategies that are needed to facilitate the adoption and implementation process.

*Quantitative methods* are well-suited to help answer questions about the effectiveness of implementation strategies designed to integrate evidence-based practices into delivery settings. For example, to measure whether an implementation strategy was effective at increasing the use of an evidence-based screener for suicidal ideation, surveys could be administered to mental health providers, asking them to indicate whether they used the screener with their patients. One could also ask patients to complete surveys, asking them to indicate if their provider administered the screener (yes/no), to validate providers' responses, which may be subject to recall bias or self-presentation bias. Electronic health records (EHRs) could also be leveraged to assess implementation outcomes. For example, billing codes, physician notes, referrals, or International Classification of Diseases (ICD) codes could be collected and analyzed as proxies for the adoption of evidence-based clinical care guidelines, such as referral to mental health professional, diagnosis of depression, and/or prescription for anti-depressants.

*Mixed methods designs* are designs that include the collection and integration of both qualitative and quantitative data. Mixed methods designs ([Creswell and Clark 2017](#)), such as convergent parallel designs and explanatory sequential designs, are particularly well-suited for studying implementation, as they guide the collection of complementary data that provide both depth and breadth of the implementation process. For example, one may collect semi-structured interviews from staff at community-based organizations to understand barriers toward delivery of evidence-based relationship and communication skills programs (e.g., CLFCMEP) for military

families. Thematic content analysis may identify lack of training as a significant barrier toward adoption of the intervention, as well as identifying areas in which the intervention would need to be adapted to fit within the context of the organization and target population of military families. Quantitative data, in the form of surveys, could help identify what specific adaptations are needed to improve the fit between the intervention and the delivery setting, and assess intentions to adopt the intervention based on proposed types of adaptations. Collectively, both the qualitative and quantitative data could be used to identify appropriate intervention adaptations and training needs to support implementation, which could inform a follow-up study to assess the effectiveness of specific intervention adaptations and training modules on adoption and use as well as health- and well-being outcomes among military families.

*Experimental and quasi-experimental designs.* Experimental (e.g., randomized controlled trials, cluster randomized controlled trials, stepped-wedge designs) and quasi-experimental designs (e.g., interrupted time series, regression discontinuity, non-equivalent control group) are commonly used in implementation research to test strategies for effectively integrating evidence-based interventions into routine delivery settings ([Brown et al. 2017](#), [Cook, Campbell, and Shadish 2002](#), [Handley et al. 2018](#)). Preference for the use of one design over another is largely dependent on the type of study questions, availability and willingness of sites to participate, and resources available to execute the study. For these reasons, many implementation trials rely on the use of quasi-experimental designs ([Handley et al. 2018](#)). For example, one might collect EMR data at one-month intervals for 12-months before and after the introduction of implementation strategies (e.g., audit and feedback, order set changes, clinical decision support systems, reminders) to increase referrals to mental health specialty care for military service members with anxiety and depression post-deployment. However, given the number of clinical care sites, community-based

organizations, and other health care and public health delivery settings, randomized designs to answer important priority research questions might be particularly feasible within the military infrastructure. One type of design—the stepped-wedge randomized design—may be particularly appropriate. In this context, the stepped-wedge design would randomize the order in which sites (e.g., clinics, communities) receive implementation strategies to increase adoption and appropriate use of an evidence-based intervention. In doing so, all sites are eventually exposed to the experimental condition, as opposed to parallel randomized designs where one set of sites serve as the no-treatment control condition. Moreover, the sequential roll-out of the implementation strategies allows for efficient use of resources, and is often easier to manage logistically compared to trying to administer implementation strategies to all experimental sites simultaneously.

An important element to consider when designing an experimental or quasi-experimental study is the extent to which the results will be applicable in the ‘real-world’ or outside of the context of the study. Originally conceptualized by Schwartz and Lellouch (1967) ([Schwartz and Lellouch 1967](#)), the explanatory—pragmatic continuum is one way to think about the extent to which the study results will be applicable to everyday practice settings, and have the potential to inform and influence the delivery of interventions following study results. On one end of the continuum, explanatory studies (otherwise termed efficacy trials) lend themselves to questions of *understanding* and seek to maximize internal validity with less focus on external validity. On the other end of the continuum, pragmatic trials (otherwise termed effectiveness trials) lend themselves to questions that will inform future decision-making and seek to balance both internal and external validity such that trial results are more applicable to everyday ‘normal’ conditions rather than ideal laboratory conditions present in explanatory studies.

Developed by Loudon and colleagues (2015)([Loudon et al. 2015](#)), the *PRagmatic Explanatory Continuum Indicator Summary* (PRECIS-2) tool is designed to help conceptualize trials along the explanatory-continuum based on 9 domains. The PRECIS-2 tool, including the interactive website([Stirling](#)), provides structured guidance for what elements to consider when planning a trial, and how decisions regarding those elements make the trial more pragmatic. The PRECIS-2 tool is well-suited to provide guidance to researchers during the trial planning phase, with the end goal of developing evidence and answering questions that are important, relevant, and applicable to everyday practitioners, policymakers, and decision-makers involved in the creation, adaptation, and delivery of evidence-based interventions and services to improve health and well-being among military service members and their families.

Measurement in Implementation Science. Consistent with many emerging disciplines, the field of implementation science lacks established, validated measures of major implementation constructs, processes, and outcomes. To date, most measures have been “home-grown,” developed specifically for one study, and intended for broader use or validated for psychometric properties. Efforts are underway to develop psychometrically-validated measures to assess implementation constructs, processes, and outcomes, and to develop measures that practical in that they are useful for research and practice efforts([Martinez, Lewis, and Weiner 2014](#)). Lewis and colleagues have reviewed the current literature of implementation measures and measurement issues in the field([Lewis et al. 2015](#), [Rabin et al. 2016](#)), and Chaudoir and colleagues([Chaudoir, Dugan, and Barr 2013](#)) provide a nice systematic review of implementation measures at multiple levels. To advance the field, robust, validated measures are needed to ultimately better understand multi-level and contextual factors influencing the implementation process, and compare the effectiveness of implementation strategies in accelerating the research-to-practice transition.

*Examples of measures.* One example of a psychometrically-validated measure is the Evidence-Based Practice Attitude Scale (EBPAS) developed and refined over the years by Aarons and colleagues ([Aarons et al. 2012](#), [Aarons 2004](#), [Aarons et al. 2010](#)). The EBPAS has good construct validity, face validity, reliability, and predictive validity for an array of evidence-based practices and practitioner-types (e.g., mental health treatments, workers supporting people with disabilities ([Rye et al. 2017](#), [Vassos and Carroll 2016](#))). The EBPAS can be used to get a sense of practitioners' readiness and willingness to implement a new evidence-based practice, and structure the selection and use of implementation strategies to address identified barriers.

Another commonly-used measure in implementation science is the Organizational Readiness to Change (ORCA). Developed by Helfrich and colleagues ([Helfrich et al. 2009](#)), the ORCA is designed to assess the extent to which an organization (e.g., clinic, hospital, community-based organization, health department) is ready and willing to implement a new evidence-based practice or program. Like the EBPAS, it is designed to help identify strategies to overcome barriers toward adoption of evidence-based interventions. Additional measures are available that assess organizational culture and climate, and their association with an organization's capacity, willingness, interest, and readiness to adopt a new practice or program ([Allen et al. 2017](#), [Hannon et al. 2017](#)).

Implementation Outcomes. Implementation outcomes include acceptability, adoption, appropriateness, costs, feasibility, fidelity, penetration, and sustainability, as defined by Proctor and colleagues ([Proctor et al. 2011](#)). Implementation outcomes can be assessed across the phases of implementation; for example, acceptability, feasibility, and appropriateness may be best assessed at the planning phase for implementation, whereas fidelity and penetration may be best suited for assessment during the implementation and maintenance phase. Sustainability is often

assessed approximately 6-months to two-years after funding to support the initial implementation of an evidence-based intervention has ceased ([Scheirer and Dearing 2011](#)), essentially assessing the extent to which it can be integrated into routine delivery settings. Implementation outcomes are initial outcomes along the continuum from implementation of evidence-based interventions. These outcomes are hypothesized to impact service outcomes, as defined by IOM Standards of Care (e.g., efficiency, safety, effectiveness, equity, patient-centeredness, and timeliness ([Health and Disorders 2006](#))), which are in turn hypothesized to affect client or patient outcomes (e.g., satisfaction, function, symptomatology). Implementation outcomes serve as proxies for their impact on patient-outcomes, with the long-term goal of improving population health. As outlined in the measurement section, qualitative and quantitative approaches can be used to assess implementation outcomes.

Implementation Strategies. Implementation strategies can be defined as “a systematic intervention process to adopt and integrate evidence-based health innovations into usual care. ([Powell et al. 2012](#))” Further, discrete implementation strategies are those that involve one process or action (e.g., reminders, educational meetings), whereas multifaceted implementation strategies include those that use two or more discrete strategies (e.g., training and technical assistance, organizational change and external facilitation) to facilitate the adoption and integration of an evidence-based intervention into routine public health and health care settings ([Powell et al. 2012](#)). To date, over 70 implementation strategies have been identified from literature reviews and expert input. These strategies can largely be segmented into 7 categories, including planning strategies, educational strategies, financial strategies, restructuring strategies, quality management strategies, and policy context strategies ([Powell et al. 2012](#)). Generally, a combination of strategies (vs. single strategy) is needed to effectively move an evidence-based intervention into routine

practice. Implementation strategies are the target of implementation trials (either experimental or quasi-experimental designs), as they seek to test the extent to which strategies can facilitate the implementation of interventions into practice, usually compared to an ‘implementation-as-usual’ condition or relevant comparison or control condition. The field is currently working toward improving our understanding of what combination of strategies are most effective for specific contexts, evidence-based interventions, and implementation phases. Methods to improve the selection and tailoring of implementation strategies, as well as understanding mechanisms of change of implementation strategies, are the next frontier in this area.

**2. How could the “Adaptome” framework provide guidance to the DoD in implementing evidence-based practices (often developed/tested in non-military populations) to support a population level approach to prevention?**

*Brief Overview of Intervention Adaptation*

The systematic and planned adaptation of evidence-based interventions is an important process throughout the lifecycle of implementation. Intervention adaptation can be defined as the degree to which an evidence-based intervention is changed or modified by a user during adoption and implementation to suit the needs of the setting or to improve the fit to local conditions ([Rabin et al. 2008](#), [Rogers 2010](#)). Adaptations are often considered necessary to support the effective implementation of evidence-based interventions, and can occur at multiple phases during the lifecycle of the implementation process. Indeed, the Dynamic Sustainability Framework outlines how adaptation of interventions may occur over time and their role in facilitating the integration and sustainability of interventions to adapt to the every-changing context in which they are delivered, including changes to the delivery setting, target population, evidence base, political

context, and other key variables that are known to occur over time ([Chambers, Glasgow, and Stange 2013](#)). To this end, adaptation should be supported—and even encouraged—during the implementation process, rather than conceptualized as something that should not occur because it leads to suboptimal levels of fidelity to intervention components, and subsequently reduces the impact of the intervention on changing health behaviors or outcomes among the target population as compared to the initial or original trial testing the intervention (i.e., “voltage drop”).

Planned and purposeful intervention adaptation is encouraged, and can occur during all phases of the implementation process. Intervention adaptation can be informed by feasibility and acceptability testing from potential end-users being asked to deliver the intervention, as well as those to whom the intervention is targeted to change health behaviors or health outcomes. Both qualitative (e.g., focus groups, interviews) and quantitative (e.g., surveys) can be used to guide the planned adaptation of interventions, recognizing that too many significant or substantive changes to the intervention may be less desirable—and to some extent resemble a new intervention that should undergo testing before it is considered evidence based. How much adaptation occurs before an existing evidence-based intervention resembles a different intervention and should undergo evaluation is an important yet unanswered question in the field.

There are many types of adaptations that can (or should) occur to an evidence-based intervention. Stirman and colleagues ([Stirman et al. 2013](#)) proposed a framework and coding system for modifications and adaptations to evidence-based interventions based on a systematic review of the literature. Intervention adaptations were classified into five broad categories and associated sub-categories (see Figure 2, p.6, Stirman et al. ([Stirman et al. 2013](#))). The five main categories reflected five key questions about the adaptation process:

1. By whom are modifications made? (e.g., individual, team, researcher, etc.)

2. What is modified? (e.g., content, context, training and evaluation, etc.)
3. At what level of delivery (for whom/what are modifications made)? (e.g., group level, hospital level, network level, etc.)
4. Context modifications are made to which of the following? (e.g., format, setting, population)
5. What is the nature of the content modification? (e.g., tailoring, substituting, reordering, etc.)

Building on this taxonomy, Chambers and Norton ([Chambers and Norton 2016](#)) expanded the types of intervention adaptations as part of the *Adaptome*, a proposed set of approaches, processes, and infrastructure needed to advance the science of intervention adaptation. Sources of intervention adaptations (and example questions) include *service setting* (e.g., who delivers the intervention? How does the proposed intervention fit with other interventions?), *target audience* (e.g., health literacy, comorbid conditions, age-appropriateness), *mode of delivery* (e.g., number of sessions, dose, session length), *cultural* (e.g., cultural sensitivity, use of imagery), and *core components* (e.g., mechanisms of action, core components identified through testing; see Figure 2, p.4, Chambers and Norton ([Chambers and Norton 2016](#))).

Using the *Adaptome* concept, and supplemented with existing literature on the science of intervention adaptation, we present several examples of ways in which existing, evidence-based prevention programs and practices can be adapted, monitored, and refined over time to meet the needs of military family resilience and well-being and the military health care and community settings in which they may be delivered.

Service Setting Adaptations. Service settings adaptations seek to better align the original evidence-based intervention with the original setting in which it is delivered. This may include

changes to who delivers the intervention to military families (including active service members, children, parents, couples, caregivers, other family member), assessment of the fit between the proposed evidence-based intervention and interventions that are already being delivered in the setting that are consistent with the organizational mission but complement other available interventions, and resources and capacity to deliver the intervention (e.g., personnel, funding, organizational culture, absorptive capacity, time constraints, competing demands).

For example, consider the case where the original prevention intervention relied on graduate-level practitioners to deliver the evidence-based prevention intervention. In planning for implementation of the intervention into other settings, initial interviews to assess intervention feasibility and acceptability with service setting staff indicate few graduate-level staff available to deliver the program, and those who are part of the organization have competing demands that are of higher priority than the proposed intervention. As part of the adaptation process, one may identify viable others—through suggestions from the service setting staff, consultation with the original intervention developers, and review of existing empirical literature—who could be trained to deliver the prevention program with reasonable effectiveness. Task-shifting is one approach commonly leveraged in low-resource settings, whereby systems rely on community health workers, lay personnel, peers, and/or volunteers to deliver prevention programs given the dearth of professional-trained providers. In this situation, perhaps the alternative implementers of the prevention program need additional training and ongoing coaching or supervision to deliver the intervention, but are nonetheless able to do so while maintaining or even improving patient-level outcomes. Regular program monitoring (e.g., patient outcomes, feedback from staff, input from implementers, practical measures of ongoing intervention adaptation) can help identify additional needs of the implementers to support effective implementation, and how those needs may change

over time, with implications for training new implementers as others may transition to other responsibilities.

Target Audience Adaptations. Target audience adaptations include those that are designed to create a better fit between the intervention and proposed target population to whom the intervention will be delivered. These adaptations may include changing the content of the intervention (e.g., materials, workbooks, flyers) to better match the health literacy levels of the target population, or include examples that are more relevant and important to the target population (e.g., pictures included in intervention materials, names and locations of delivery sites, resources available). To better match the fit of the intervention with the proposed target population, rapid-cycle usability testing can be done on an individual basis or in a group setting. Interview or focus group guides can frame the conversation to identify adaptations that are needed to make the intervention more applicable to the target population. For example, one could ask members of the target population to review intervention materials, and identify aspects that they feel are relevant to them, aspects that are irrelevant, and aspects that should be modified to fit their needs. This approach could be leveraged over time to make improvement to intervention materials delivered within the same setting, or subsequent iterations of the intervention as it is delivered to members of the target population in different geographic regions, health literacy rates, and age range.

Mode of Delivery Adaptations. This source of intervention adaptation focuses on changes that may need to occur to how the intervention is delivered in terms of number of sessions (e.g., 3 vs. 10 sessions), length of sessions (e.g., 20-minutes vs. 3-hours), frequency of sessions (e.g., 4-weeks vs. 10-weeks), and mode of delivery (e.g., online vs. in-person; individual vs. group-based; clinic vs. telehealth; text messages vs. phone; active vs. passive telephone outreach). For example, consider an evidence-based intervention that was originally developed in a group-based setting for

2-hours a week for 12-weeks. Although retention rates were high in the original study, perhaps military service members and their families are unlikely to have time to attend all sessions given other responsibilities, interests, and demands. This is a common barrier toward implementation and receptivity among target populations: Interventions are often designed with lack of attention toward viability outside the context of a trial, and subsequently are not of interest to the target population, particularly interventions that require a lot of time, frequent off-site visits, or rely on participation of other groups members to be effective. As an alternative, one might explore the possibility of delivering part of intervention through private, group-based portals and reducing the number and frequency of sessions. If child-care duties are barriers toward in-person participation, one may consider delivering the intervention in a school-based or daycare setting, to reduce impediments toward participation.

Suggestions for ways to increase participation and interest while maintaining sufficient delivery and dosage of the intervention should be informed by input from the target population in advance of intervention adaptations. Again, rapid-cycle evaluations can be used to inform iterations to the intervention over time as well as across geographic regions or other characteristics that may suggest the need for altered adaptations to the delivery (i.e., dose, frequency, format, length) as it is scaled-up to other areas.

Cultural Adaptations. Cultural adaptations are essential to consider during the implementation planning process. Often, cultural adaptations require important yet relatively subtle changes to the content of the intervention that are critical for perceived acceptability, relevance, and credibility of the intervention for the target population. Importantly, cultural adaptations go beyond minor changes to the names, locations, and lists of relevant resources and services—they include changes to culture-specific nomenclature of intervention materials that may vary by geographic region or

sub-populations (e.g., urban vs. rural; use of ‘y’all’ vs. ‘you all’ for Southern vs. non-Southern target populations; African-American young adults vs. African-American middle-aged adults), pictures (including age, gender, race/ethnicity, appearance), examples or scenarios used in intervention materials or content, and changes that may need to occur such that the adapted intervention is consistent with the general beliefs of the target population (e.g., religiosity, stigma, social and personal attitudes, medical mistrust). Additional guidance for what types of cultural adaptations should be considered during the adaptation process are available in the literature([Bernal and Domenech Rodríguez 2012](#), [Cabassa and Baumann 2013](#)).

Core Components. Finally, core components play a role in the adaptation process, and are conceptualized as the ‘active ingredients’ of an evidence-based intervention, without which one would not see the intended impact on changes in health behaviors and health outcomes among the target population. As factorial study designs to identify the exact core components (vs. peripheral components that can be significantly changed or deleted without affecting outcomes) of an intervention are logistically challenging, costly, and impractical, alternative modes are recommended for identifying core intervention components that should neither be removed nor significantly altered during the adaptation and implementation process. Identification of core components is difficult, but can be informed by conversations with the original intervention developers and reliance on theoretical constructs that have been demonstrated to be required for effective behavior change (i.e., skills-training and education vs. education-only). Core components not recommended for adaptation include the target behavior and associated health topic (e.g., communication skills, depression, anxiety, physical activity); peripheral components vary widely, and are best distinguished from core components through processes noted above.

*Data to Inform Intervention Adaptations.* As articulated by the *Adaptome*, multiple data sources and types of data are needed to inform and guide intervention adaptations to increase population-level impact and advance the science. Within the military service context, there are several existing datasets that could be leveraged to guide intervention adaptations, and others that could be developed to further refine the adaptation process. For example, the Survey of Reserve Component Members and others administered by the Defense Research, Surveys, and Statistics Center could be used to systematically identify the needs of local communities and the context in which those needs can be met. Responses could help prioritize what evidence-based interventions are most needed by the community (e.g., alcohol prevention, spousal communication, reintegration) and preferred delivery format of such interventions (e.g., individual, group, phone, text, online). This information could be used to help identify existing interventions developed for civilian populations and hosted in online intervention compendiums, and guide the selection of interventions for that local setting and target population. Further, perhaps a few additional items could be added to the Survey of Reserve Component Members to help assess beliefs, attitudes, health literacy, and other characteristics that can help guide the selection of and inform initial adaptations to evidence-based interventions across various sources of intervention adaptation. This may be an efficient way to help select and initially adapt an intervention, and could be bolstered by select follow-up surveys or group-based feedback on specific adaptations that may be needed to further enhance the fit between the intervention and the overall setting. Additional surveys and studies, such as the Millennium Cohort Study, Military Family Life Project, and Deployment Life Study, can help track trends over time, and suggest what additional adaptations may be needed over time as well as highlight what interventions may be discontinued or replaced as priorities, health conditions, and context changes over time.

Administrative and reporting databases can help inform needs of target populations, adoption and use of evidence-based interventions (e.g., guidelines delivered in clinical care), suggested adaptations, and monitoring of adaptations over time. For example, datasets in the Defense Manpower Data Center could be triangulated to identify target populations in greatest need of additional, more intense mental health treatments based on prevalence rates of post-traumatic stress disorder, suicidality, or depression. The Immunization Compliance Reporting System may capture (or add the ability to capture) HPV vaccination rates among children of active military service members; descriptive statistics on geographic region and sub-populations could help inform the selection of evidence-based interventions to increase HPV vaccination rates, and identify what specific types of intervention adaptations may be needed to initially increase fit based on care and support service utilization (e.g., delivery by pharmacists vs. pediatricians; school-based educational and awareness campaigns vs. brochures at primary care clinics; cultural adaptations based on characteristics of the target population).

### **3. How can lessons from implementation science inform the committee’s recommendations for the field, including a systematic way to consider contexts for prevention?**

As the knowledge base for implementation science has matured over the past twenty years, our overall understanding of the pathways from scientific discovery to health service delivery has significantly increased. What was once considered a linear pathway from research to practice ([Westfall, Mold, and Fagnan 2007](#)) has now been reframed as a cyclical process for which knowledge acquisition is never complete and our interventions are dynamically integrated within an ever-changing set of service systems ([Chambers, Glasgow, and Stange 2013](#)). This newer perspective on implementation carries with it some key insights that can be particularly useful in charting the future course of efforts to strengthen the health and wellbeing of military families.

*EBPs are constantly changing.* Traditionally, the research community has described an intervention development pathway that starts with contributions of basic science leading to the identification of a specific signal that an intervention might lead to improvement in a targeted health outcome. This intervention, following pilot testing, is rigorously evaluated in an efficacy trial, and assuming benefit, is further tested through a larger effectiveness trial. Key to determining the integrity of the intervention is the strict manualization of each component, with a fidelity checklist assessing the consistency through which that intervention must be delivered. If effectiveness of the intervention is demonstrated, the manualized intervention is ready to be implemented. The evidence-based practice is disseminated, largely through various repositories, training courses or publications with an expectation that the manual be followed. Our experience in implementation science has shown that in contrast to the research-driven view, evidence-based practices are constantly being adapted when implemented in service systems. In some cases, community and clinical settings are unable to deliver the intervention as designed, see incompatibilities with the patient population needs or the resources required for strict delivery, and make modifications. Future efforts to improve the uptake of evidence-based interventions for military families should expect that the interventions will need to be modified over time to improve fit with family needs, as well as need to at some point be replaced by alternate interventions.

*Evidence on effectiveness accrues over time—build into ongoing evaluation process and use as indicators for further scale-up, adaptation, or de-escalation.* Once an intervention achieves positive effects when tested in efficacy and effectiveness trials, the expectation is that the evidence generation stage is complete—dissemination and implementation efforts target the ability to replicate the performance of the intervention as it is spread to various service systems. Implementation scientists have indeed recognized that in most cases, exposure of the intervention

to populations different from the original sample in previous trials means the ability to gather further evidence on the effectiveness of that intervention. Researchers within the Veterans Health Administration (VHA) have led efforts to build in additional evidence gathering during the implementation phase, considered as a hybrid type 3 effectiveness—implementation trial ([Curran et al. 2012](#)). This suggests that efforts to improve implementation of evidence-based interventions for military family wellness should include opportunities to study the interventions and how they perform within various populations. This will not only be instructive to ensure the best fit between the intervention and family needs, but it will also permit the ongoing assessment of that intervention as to whether it should be scaled up to additional settings, adapted to improve its utility toward improving family outcomes, or possibly de-implemented if it is not beneficial to the population.

*Local and national context impacts implementation which impacts value.* One of the common themes across implementation science is the inescapable influence of context on the delivery of evidence-based interventions. This is described in virtually all of the conceptual models ([Tabak et al. 2012](#)) in the field, both at a local (or “inner”) level and at an ecological (or “outer”) level. To achieve significant improvement at a population level for military families through the implementation of evidence-based health promotion interventions, efforts must understand local, regional and national context and seek to optimize the fit of interventions within the specific context ([Chambers, Glasgow, and Stange 2013](#)). This suggests significant attention placed on building capacity to monitor contexts, repeated measurement of contextual variables to identify change over time, and expectations that fit between the interventions and the contexts will vary across space and over a longer timeframe. Recommendations to improve implementation of evidence-based practices for military families can consider the degree to which contextual

assessment is already reflected in exist data, as well as information that allows assessment of the quality with which interventions are delivered, and the relevant family outcomes that result from the delivery of needed services.

*Multiple practices are likely needed to address complex needs—multi-level, multi-determinant problem.* Historically, the scientific community has focused on the development, testing and implementation of individual health interventions without regard for how they can be integrated to form an evidence-based system of care. Implementation science has long recognized the importance of instead matching supply of a set of interventions to meet the demand for those interventions, reflected by the needs of the population. From literature on factors affecting the health and well-being of the population, individual interventions are likely insufficient to cover the range of military family needs. Therefore, a concentration on a collective effort to create a delivery system that provides access to the range of evidence-based interventions would be beneficial to future efforts. Existing interventions target needs of heterogeneous families, communities and systems, and their successful use requires the understanding of multi-level determinants of access, quality of care, and outcomes. Recommendations for improving health and well-being among military families should recognizes the multi-level and multi-determinant nature of family challenges, interventions to address them, and the range of outcomes that can be improved.

*Sustainment/de-implementation/adaptation should be part of the ongoing planning.* The biomedical research community has typically followed a linear path from intervention development and testing to adoption, implementation and sustainment of the intervention within clinical and community settings. Initial implementation has long been the final step for researchers in this movement from research to practice. Implementation science has recently recognized the

importance of longer implementation life-cycle, including later decisions about whether interventions should be sustained within delivery systems, adapted to improve the fit with local contexts, or de-implemented if they are not providing value and improved health for those who receive them([Norton, Kennedy, and Chambers 2017](#), [Wiltsey Stirman et al. 2012](#), [Aarons, Hurlburt, and Horwitz 2011](#)). The concept of “designing for dissemination”([Klesges et al. 2005](#), [Brownson et al. 2013](#)) suggests that our interventions will better meet the need of end users if the longer-term viability of intervention delivery is baked into the developmental process and continues throughout implementation([Luke et al. 2014](#)). A recommendation to encourage planning for sustainment, adaptation or de-implementation earlier in the development process would be beneficial to military family health and well-being.

*Developing new interventions with dissemination and implementation in mind.* Related to the prior section, too many interventions have been designed without understanding of the populations and settings that will host the interventions as they move into widespread use. Investigators using an implementation science lens have adopted both the concepts of “designing for dissemination”([Klesges et al. 2005](#), [Brownson et al. 2013](#)) and of “user-centered design”([Abrams, Maloney-Krichmar, and Preece 2004](#)), in which information is gathered from the target audience for the intervention (i.e., military families, providers, communities) to determine the needs that the intervention should address. The NCI has instituted a training program for investigators to incorporate these design principles, along with content around entrepreneurship, based on the National Science Foundation’s *Innovation Corps* (I-Corps) model([Foundation](#)). The *SPeeding Research-tested INTerventions* (SPRINT([Institute](#))) program provides support for intervention developers to re-think the design of existing interventions and consider new strategies

for intervention development. Such an opportunity could be beneficial for improving the feasibility and acceptability of interventions targeted to improve health and well-being of military families.

#### **4. What are the potential contribution of these lessons from implementation science beyond the military context?**

The opportunity to learn from a set of initiatives to improve the implementation of evidence-based interventions for military family health and well-being extends well beyond the specific population and service systems where military families receive care. Indeed, this effort could serve as a model for implementation science going forward, in the creation of a “natural laboratory” for implementation that enables ongoing study of evidence-based practice implementation, monitoring of the impact of implementation on families, providers and service systems, and the development of methods and measures that can serve to build tools for the field of implementation science. In this section, we briefly describe several of the contributions that a functional implementation laboratory for military family health and well-being can make for the field at large.

First, the military context provides a rich, multi-level, multi-sectoral, and multi-organizational environment that is a microcosm of the ecology within which implementation science findings are applied. As a natural laboratory for implementation, its constituent families must be reached across substantial geography and with a recognition of diversities in culture, socioeconomic status, access to resources and family needs. Unlike many settings, however, it has strengths that could be replicated in the future. It has the benefits of an integrated care system, with multiple data sources that together informs service needs, services received, and outcomes. Military families, given their diversity, have health care and public health needs that generalize to the larger population and thus, insights on effective implementation could generalize as well.

Second, some of the same interventions are delivered within and outside of the military context, and as such, the implementation strategies to bring evidence-based interventions to military families can be simultaneously tested in external settings as well. The cross-context comparison can help to isolate what characteristics of health care and community settings improve adoption, implementation and sustainability of interventions, and can add to the field's understanding of how and why implementation strategies improve successful integration of interventions into practice.

Third, data resources within the military context are more advanced, and the availability, volume and scope of data can be leveraged to identify areas where interventions are needed for families, inform how a package of evidence-based interventions can be assembled to meet those needs, guide strategies selected to implement the set of interventions, monitor implementation progress over time, and adjust what is implemented, how it is implemented and where it is implemented over time. This ability to study and improve understanding of intervention adaptation, intervention sustainment, and (where needed) de-implementation is generally lacking in the field. Such an effort could form the basis of a learning implementation system([Stein, Adams, and Chambers 2016](#), [Smith et al. 2013](#), [Medicine 2013](#)) whose benefits to our knowledge base could be immense.

Fourth, the durable, strong support of the country for its service members and their families gives an opportunity for sustained study of implementation over a longer time horizon than is typically possible in a research study. In addition, ongoing study of implementation, adaptation, sustainment and de-implementation that does justice to the inherent dynamism in real-world settings requires a commitment to apply the lessons learned over time, toward ongoing service system improvement. The military context may provide one of the few examples where this

commitment will persist in the coming years. It is therefore a natural setting in which to test innovative strategies to more effectively support implementation, adaptation, improvement and discontinuation of a variety of evidence-based practices. A significant investment in research that identifies core mechanisms affecting implementation processes will produce value for the military families directly, as well as the larger implementation science community.

Finally, the implementation laboratory within the collective service systems that provide support to service members and their families allows for the investigation of a range of different research questions, a small sample of which are listed below:

- a. How and why implementation strategies and approaches to adaptation work?
- b. How should systems optimally select and scale a combination of complementary evidence-based programs?
- c. Can we identify the rate at which different evidence-based programs and implementation strategies can scale-up across systems and communities?
- d. What is the comparative effectiveness and cost effectiveness of variable strategies to adopt, implement, adapt, sustain or de-implement interventions to promote health and well-being?

These and other questions (see PAR-18-007([Health](#)) for a broad set of priority dissemination and implementation research questions in health) can directly benefit military family health and well-being and, in addition, greatly contribute to the larger implementation science knowledge base.

In concert with other research activities, the field can substantially improve the integration of research and practice and improve population health.

In closing, we have sought to summarize the evidence base on intervention adaptation and highlight opportunities for how the military infrastructure is uniquely positioned to both

learn from and contribute to the science intervention adaptation specifically and the field of implementation science more broadly. We have highlighted ways in which the military may seek to adapt evidence-based interventions from largely civilian populations to active military populations, leverage existing platforms to inform the selection, adaptation, and ongoing monitoring and subsequent adaptations to interventions, a broad set of recommendations for the committee to consider moving forward, and opportunities for the field to benefit and learn from practice-based research on adapting and delivering effective prevention programs and practices to enhance military family resilience and well-being.

## References

"Guidelines International Network ".

Aarons, G. A. 2004. "Mental health provider attitudes toward adoption of evidence-based practice: the Evidence-Based Practice Attitude Scale (EBPAS)." *Ment Health Serv Res* 6 (2):61-74.

Aarons, G. A., G. Cafri, L. Lugo, and A. Sawitzky. 2012. "Expanding the domains of attitudes towards evidence-based practice: the evidence based practice attitude scale-50." *Adm Policy Ment Health* 39 (5):331-40. doi: 10.1007/s10488-010-0302-3.

Aarons, G. A., C. Glisson, K. Hoagwood, K. Kelleher, J. Landsverk, and G. Cafri. 2010. "Psychometric properties and U.S. National norms of the Evidence-Based Practice Attitude Scale (EBPAS)." *Psychol Assess* 22 (2):356-65. doi: 10.1037/a0019188.

- Aarons, G. A., M. Hurlburt, and S. M. Horwitz. 2011. "Advancing a conceptual model of evidence-based practice implementation in public service sectors." *Adm Policy Ment Health* 38 (1):4-23. doi: 10.1007/s10488-010-0327-7.
- Abras, Chadia, Diane Maloney-Krichmar, and Jenny Preece. 2004. "User-centered design." *Bainbridge, W. Encyclopedia of Human-Computer Interaction. Thousand Oaks: Sage Publications* 37 (4):445-456.
- Administration, Substance Abuse and Mental Health Services. "National Registry of Evidence-based Programs and Practices."
- Allen, J. D., S. D. Towne, Jr., A. E. Maxwell, L. DiMartino, B. Leyva, D. J. Bowen, L. Linnan, and B. J. Weiner. 2017. "Measures of organizational characteristics associated with adoption and/or implementation of innovations: A systematic review." *BMC Health Serv Res* 17 (1):591. doi: 10.1186/s12913-017-2459-x.
- Balas, E Andrew, and Suzanne A Boren. 2000. "Managing clinical knowledge for health care improvement." *Yearbook of medical informatics 2000: Patient-centered systems*.
- Bernal, Guillermo Ed, and Melanie M Domenech Rodríguez. 2012. *Cultural adaptations: Tools for evidence-based practice with diverse populations*: American Psychological Association.
- Brown, C. H., G. Curran, L. A. Palinkas, G. A. Aarons, K. B. Wells, L. Jones, L. M. Collins, N. Duan, B. S. Mittman, A. Wallace, R. G. Tabak, L. Ducharme, D. A. Chambers, G. Neta, T. Wiley, J. Landsverk, K. Cheung, and G. Cruden. 2017. "An Overview of Research and Evaluation Designs for Dissemination and Implementation." *Annu Rev Public Health* 38:1-22. doi: 10.1146/annurev-publhealth-031816-044215.
- Brownson, Ross C, Julie A Jacobs, Rachel G Tabak, Christine M Hoehner, and Katherine A Stamatakis. 2013. "Designing for dissemination among public health researchers: findings from a national survey in the United States." *American journal of public health* 103 (9):1693-1699.
- Cabassa, Leopoldo J, and Ana A Baumann. 2013. "A two-way street: bridging implementation science and cultural adaptations of mental health treatments." *Implementation Science* 8 (1):90.
- Chambers, D. A., R. E. Glasgow, and K. C. Stange. 2013. "The dynamic sustainability framework: addressing the paradox of sustainment amid ongoing change." *Implement Sci* 8:117. doi: 10.1186/1748-5908-8-117.
- Chambers, D. A., and W. E. Norton. 2016. "The Adaptome: Advancing the Science of Intervention Adaptation." *Am J Prev Med* 51 (4 Suppl 2):S124-31. doi: 10.1016/j.amepre.2016.05.011.
- Chaudoir, S. R., A. G. Dugan, and C. H. Barr. 2013. "Measuring factors affecting implementation of health innovations: a systematic review of structural, organizational, provider, patient, and innovation level measures." *Implement Sci* 8:22. doi: 10.1186/1748-5908-8-22.
- Cook, Thomas D, Donald Thomas Campbell, and William Shadish. 2002. *Experimental and quasi-experimental designs for generalized causal inference*: Houghton Mifflin Boston.
- Creswell, John W, and Vicki L Plano Clark. 2017. *Designing and conducting mixed methods research*: Sage publications.
- Curran, G. M., M. Bauer, B. Mittman, J. M. Pyne, and C. Stetler. 2012. "Effectiveness-implementation hybrid designs: combining elements of clinical effectiveness and implementation research to enhance public health impact." *Med Care* 50 (3):217-26. doi: 10.1097/MLR.0b013e3182408812.

- Damschroder, L. J., D. C. Aron, R. E. Keith, S. R. Kirsh, J. A. Alexander, and J. C. Lowery. 2009. "Fostering implementation of health services research findings into practice: a consolidated framework for advancing implementation science." *Implement Sci* 4:50. doi: 10.1186/1748-5908-4-50.
- Foundation, National Science. "Innovation Corps." [https://www.nsf.gov/news/special\\_reports/i-corps/](https://www.nsf.gov/news/special_reports/i-corps/).
- Handley, M. A., C. R. Lyles, C. McCulloch, and A. Cattamanchi. 2018. "Selecting and Improving Quasi-Experimental Designs in Effectiveness and Implementation Research." *Annu Rev Public Health* 39:5-25. doi: 10.1146/annurev-publhealth-040617-014128.
- Hannon, P. A., C. D. Helfrich, K. G. Chan, C. L. Allen, K. Hammerback, M. J. Kohn, A. T. Parrish, B. J. Weiner, and J. R. Harris. 2017. "Development and Pilot Test of the Workplace Readiness Questionnaire, a Theory-Based Instrument to Measure Small Workplaces' Readiness to Implement Wellness Programs." *Am J Health Promot* 31 (1):67-75. doi: 10.4278/ajhp.141204-QUAN-604.
- Health, Institute of Medicine . Committee on Crossing the Quality Chasm: Adaptation to Mental, and Addictive Disorders. 2006. *Improving the quality of health care for mental and substance-use conditions*: National Academy Press.
- Health, National Institutes of. "Dissemination and Implementation Research in Health (PAR-18-007)." <https://grants.nih.gov/grants/guide/pa-files/PAR-18-007.html>.
- Helfrich, C. D., Y. F. Li, N. D. Sharp, and A. E. Sales. 2009. "Organizational readiness to change assessment (ORCA): development of an instrument based on the Promoting Action on Research in Health Services (PARIHS) framework." *Implement Sci* 4:38. doi: 10.1186/1748-5908-4-38.
- Institute, National Cancer. "Research-Tested Intervention Programs." accessed June 1, 2018. <https://rtips.cancer.gov/rtips/index.do>.
- Institute, National Cancer. "SPeeding Research-tested INTerventions (SPRINT)." <http://www.nci-sprint.com/>.
- Klesges, Lisa M, Paul A Estabrooks, David A Dzewaltowski, Sheana S Bull, and Russell E Glasgow. 2005. "Beginning with the application in mind: designing and planning health behavior change interventions to enhance dissemination." *Annals of Behavioral Medicine* 29 (2):66-75.
- Lewis, C. C., S. Fischer, B. J. Weiner, C. Stanick, M. Kim, and R. G. Martinez. 2015. "Outcomes for implementation science: an enhanced systematic review of instruments using evidence-based rating criteria." *Implement Sci* 10:155. doi: 10.1186/s13012-015-0342-x.
- Loudon, K., S. Treweek, F. Sullivan, P. Donnan, K. E. Thorpe, and M. Zwarenstein. 2015. "The PRECIS-2 tool: designing trials that are fit for purpose." *Bmj* 350:h2147. doi: 10.1136/bmj.h2147.
- Luke, Douglas A, Annaliese Calhoun, Christopher B Robichaux, Michael B Elliott, and Sarah Moreland-Russell. 2014. "Peer Reviewed: The Program Sustainability Assessment Tool: A New Instrument for Public Health Programs." *Preventing Chronic Disease* 11.
- Martinez, R. G., C. C. Lewis, and B. J. Weiner. 2014. "Instrumentation issues in implementation science." *Implement Sci* 9:118. doi: 10.1186/s13012-014-0118-8.

- McGlynn, Elizabeth A, Steven M Asch, John Adams, Joan Keeseey, Jennifer Hicks, Alison DeCristofaro, and Eve A Kerr. 2003. "The quality of health care delivered to adults in the United States." *New England journal of medicine* 348 (26):2635-2645.
- McKibbin, K. A., C. Lokker, N. L. Wilczynski, D. Ciliska, M. Dobbins, D. A. Davis, R. B. Haynes, and S. E. Straus. 2010. "A cross-sectional study of the number and frequency of terms used to refer to knowledge translation in a body of health literature in 2006: a Tower of Babel?" *Implement Sci* 5:16. doi: 10.1186/1748-5908-5-16.
- Medicine, Institute of. 2013. *Best Care at Lower Cost: The Path to Continuous Learning Health Care in America*. edited by National Academies Press. Washington, D.C.
- Nilsen, P. 2015. "Making sense of implementation theories, models and frameworks." *Implement Sci* 10:53. doi: 10.1186/s13012-015-0242-0.
- Norton, W. E., A. E. Kennedy, and D. A. Chambers. 2017. "Studying de-implementation in health: an analysis of funded research grants." *Implement Sci* 12 (1):144. doi: 10.1186/s13012-017-0655-z.
- Powell, B. J., J. C. McMillen, E. K. Proctor, C. R. Carpenter, R. T. Griffey, A. C. Bunger, J. E. Glass, and J. L. York. 2012. "A compilation of strategies for implementing clinical innovations in health and mental health." *Med Care Res Rev* 69 (2):123-57. doi: 10.1177/1077558711430690.
- Prevention, Centers for Disease Control and. "Community Guide."
- Prevention, Centers for Disease Control and. "Effective Interventions: HIV Prevention That Works."
- Proctor, E., H. Silmere, R. Raghavan, P. Hovmand, G. Aarons, A. Bunger, R. Griffey, and M. Hensley. 2011. "Outcomes for implementation research: conceptual distinctions, measurement challenges, and research agenda." *Adm Policy Ment Health* 38 (2):65-76. doi: 10.1007/s10488-010-0319-7.
- Rabin, B. A., R. C. Brownson, D. Haire-Joshu, M. W. Kreuter, and N. L. Weaver. 2008. "A glossary for dissemination and implementation research in health." *J Public Health Manag Pract* 14 (2):117-23. doi: 10.1097/01.PHH.0000311888.06252.bb.
- Rabin, B. A., C. C. Lewis, W. E. Norton, G. Neta, D. Chambers, J. N. Tobin, R. C. Brownson, and R. E. Glasgow. 2016. "Measurement resources for dissemination and implementation research in health." *Implement Sci* 11:42. doi: 10.1186/s13012-016-0401-y.
- Rogers, Everett M. 2010. *Diffusion of innovations*: Simon and Schuster.
- Rye, M., E. M. Torres, O. Friberg, I. Skre, and G. A. Aarons. 2017. "The Evidence-based Practice Attitude Scale-36 (EBPAS-36): a brief and pragmatic measure of attitudes to evidence-based practice validated in US and Norwegian samples." *Implement Sci* 12 (1):44. doi: 10.1186/s13012-017-0573-0.
- Scheirer, M. A., and J. W. Dearing. 2011. "An agenda for research on the sustainability of public health programs." *Am J Public Health* 101 (11):2059-67. doi: 10.2105/ajph.2011.300193.
- Schwartz, Daniel, and Joseph Lellouch. 1967. "Explanatory and pragmatic attitudes in therapeutical trials." *Journal of Clinical Epidemiology* 20 (8):637-648.
- Smith, Mark, Robert Saunders, Leigh Stuckhardt, and J Michael McGinnis. 2013. *Best care at lower cost: the path to continuously learning health care in America*: National Academies Press.

- Stein, B. D., A. S. Adams, and D. A. Chambers. 2016. "A Learning Behavioral Health Care System: Opportunities to Enhance Research." *Psychiatr Serv* 67 (9):1019-22. doi: 10.1176/appi.ps.201500180.
- Stirling, University of. "PRECIS-2 Tool." <https://www.precis-2.org/>.
- Stirman, S. W., C. J. Miller, K. Toder, and A. Calloway. 2013. "Development of a framework and coding system for modifications and adaptations of evidence-based interventions." *Implement Sci* 8:65. doi: 10.1186/1748-5908-8-65.
- Tabak, R. G., E. C. Khoong, D. A. Chambers, and R. C. Brownson. 2012. "Bridging research and practice: models for dissemination and implementation research." *Am J Prev Med* 43 (3):337-50. doi: 10.1016/j.amepre.2012.05.024.
- Vassos, M. V., and M. F. Carroll. 2016. "Assessing Attitudes Toward Evidence-Based Practices of Workers Supporting People With Disabilities: A Validation of the Evidence-Based Practice Attitudes Scale." *Am J Intellect Dev Disabil* 121 (4):364-78. doi: 10.1352/1944-7558-121.4.364.
- Westfall, J. M., J. Mold, and L. Fagnan. 2007. "Practice-based research--"Blue Highways" on the NIH roadmap." *Jama* 297 (4):403-6. doi: 10.1001/jama.297.4.403.
- Wiltsey Stirman, S., J. Kimberly, N. Cook, A. Calloway, F. Castro, and M. Charns. 2012. "The sustainability of new programs and innovations: a review of the empirical literature and recommendations for future research." *Implement Sci* 7:17. doi: 10.1186/1748-5908-7-17.
- e.

### Select Resources

- CDC's Community Guide: <https://www.thecommunityguide.org/>
- CDC Effective Interventions: HIV Prevention That Works:  
<https://effectiveinterventions.cdc.gov/>
- Consolidated Framework for Implementation Research (CFIR): <http://cfirguide.org/>
- Consortium for Implementation Science (CIS): <http://consortiumforis.org/>
- Dissemination and Implementation Models in Health Research and Practice:  
<http://www.dissemination-implementation.org/>
- Effective Practice and Organization of Care (EPOC), Cochrane Review Group, Cochrane Collaboration: <http://epoc.cochrane.org/>
- Guidelines International Network (GIN): <https://www.g-i-n.net/home>
- Implementation Science (open-access journal):  
<https://implementationscience.biomedcentral.com/>
- Implementation Science Exchange: <https://impsci.tracs.unc.edu/>
- Leadership and Organizational Change for Implementation (LOCI):  
<https://www.implementationleadership.com/>

- National Collaborating Center for Methods and Tools: <https://www.nccmt.ca/>
- NCI Implementation Science: <https://cancercontrol.cancer.gov/IS/>
- NCI Research-tested Intervention Programs (RTIPs): <https://rtips.cancer.gov/rtips/index.do>
- Reach, Effectiveness, Adoption, Implementation, Maintenance (RE-AIM): <http://www.re-aim.org/>
- Society for Implementation Research Collaboration:  
<https://societyforimplementationresearchcollaboration.org/>
- SAMHSA NREPP: <https://nrepp.samhsa.gov/landing.aspx>
- Top Tier Evidence Initiative, Coalition for Evidence Based Policy: <http://toptierevidence.org/>