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# The Sustainability of Evidence-Based Interventions and Practices in Public Health and Health Care

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## Keywords

adaptation, evidence-based interventions, implementation science, maintenance, sustainability

## Abstract

There is strong interest in implementation science to address the gap between research and practice in public health. Research on the sustainability of evidence-based interventions has been growing rapidly. Sustainability has been defined as the continued use of program components at sufficient intensity for the sustained achievement of desirable program goals and population outcomes. This understudied area has been identified as one of the most significant translational research problems. Adding to this challenge is uncertainty regarding the extent to which intervention adaptation and evolution are necessary to address the needs of populations that differ from those in which interventions were originally tested or implemented. This review critically examines and discusses conceptual and methodological issues in studying sustainability, summarizes the multilevel factors that have been found to influence the sustainability of interventions in a range of public health and health care settings, and highlights key areas for future research.

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**Evidence-based interventions (EBIs):** programs, practices, policies, and guidelines with proven efficacy

**Sustainability:** the continued use of program components at sufficient intensity for the sustained achievement of desirable program goals and population outcomes

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## THE VALUE OF UNDERSTANDING SUSTAINABILITY

Dissemination and implementation (D&I) science is an emerging priority in public health and medicine in the United States and globally. There is strong interest from the National Academy of Medicine, National Institutes of Health, and the World Health Organization in narrowing the gap between research (what we know) and practice (what we do) (17, 97, 109). Although numerous evidence-based public health interventions and clinical preventive strategies and treatments are available, it can be challenging to implement and sustain them outside of controlled settings, particularly if they were originally tested in narrow populations or unrepresentative circumstances (49).

As a rapidly growing field, implementation science has focused on understanding factors and strategies that influence the initial adoption and integration of evidence-based interventions (EBIs) in real-world settings (103). Whereas significant advancements have been made in understanding the adoption and implementation of EBIs across a range of community and health care settings, less is known about their sustainability. Recently, experts have prioritized sustainability as an understudied area (45), identifying it as “one of the most significant translational research problems of our time” (103, p. 2) and as a persistent challenge across a range of settings and service delivery sectors, and across health behaviors and outcomes.

Maximizing the public health impact of EBIs will require investing in sustainability research. This research will enable us to better understand what factors and processes influence the sustainability of interventions and how to plan proactively for the continuation of EBIs. Moreover, there has been growing consideration of the policy and ethical implications of developing effective health programs without investing in sustainability (118). Researchers, health leaders, advocates, policy makers, practitioners, and funders alike have concerns about the long-term impact and value of their investment in discontinued interventions. In addition to lost investments, time, and resources, there are other reasons for which advancing our understanding of the sustainability of EBIs has value (99, 122). Maintaining effective programs and practices is critical for achieving health benefits, particularly if there is a latency period between implementation and the palpable or full impact of the intervention (118). Furthermore, discontinuing or abandoning programs in community settings may result in low levels of community support and trust in research and public health/medical institutions (122).

## FUNDAMENTAL CHALLENGES

A fundamental challenge to achieving and studying both implementation and sustainability (including for much of the literature reviewed here) has been the nature of the evidence upon which the field has relied in determining which interventions and practices are evidence based and should be implemented and sustained in the first place. Often, this evidence comes from systematic reviews of controlled trials that prioritize internal validity (e.g., does the intervention work?) over external validity (e.g., can the findings be generalized, and among what populations and settings?) (48, 54). These studies also tend to be conducted in well-resourced settings and unrepresentative populations, making the conditions of implementation also unrepresentative (48). Systematic reviews have only recently begun to be held to a standard of external validity (e.g., by the Community Preventive Services Task Force), and it is critical for implementation science to recognize and continue to address these issues to make progress. Additionally, the metrics of effectiveness that are reported in these contexts are typically short-term. The discrepancies between research settings and the context in which the interventions are implemented may further increase over time after initial implementation has been achieved and populations, policies, and available resources change (23). Additional challenges and considerations for studying sustainability are considered below.

## THE EXTENT TO WHICH PROGRAMS ARE SUSTAINED

Conceptualizations of intervention sustainability have evolved in the past two decades. Initial research considered deviations from the intervention as originally specified in a protocol or manual to be an implementation failure, even when the setting, population, or circumstances differed substantially from those of the initial experimental research that had proved the intervention's effectiveness (3, 9). Fidelity can be a challenge when interventions are implemented in different populations, contexts, and circumstances (7, 22). It is difficult to implement and sustain something that may be a poor fit in the first place or may no longer fit in the ways that it did when originally implemented. Thus, as detailed below, conceptualizations of sustainability have shifted away from concepts that imply that long-term implementation is static in nature [e.g., routinization or institutionalization (105)] and toward frameworks, such as the Dynamic Sustainability Framework (DSF), which highlight the constantly evolving context into which interventions are implemented (23).

In light of these conceptual challenges as well as the relative infancy of the literature on sustainability, little is known about the extent to which EBIs in health care and public health settings are sustained or about whether their impact on health is maintained after the initial implementation. Rates of sustainability have been variable and variably reported. In one of the first articles to examine systematically the sustainability of public health programs, Scheirer reviewed 19 health-related programs and found that one to six years after program adoption, 40–60% of the programs reported continuing in the community to some extent (116). This finding is consistent with a recent review of sustained EBIs in under-resourced settings (60). However, a challenge in capturing these data and comparing rates has been the variability in how sustainability has been conceptualized, defined, and measured across studies.

In a systematic review of 125 empirical studies focused on the sustainability of public health and clinical interventions (135), researchers found that even when full implementation was originally achieved, partial sustainability was much more common than the continued implementation of the entire intervention. Overall, fewer than half of the programs continued at high levels of fidelity. Due to the highly variable and conceptually underdeveloped research conducted at the time, Stirman and colleagues (135) found it challenging to generalize the extent to which sustainability was achieved, because many studies did not detail which components were continued or discontinued, why and what adaptations were made, or what the health impact of partially sustained programs was.

## CONCEPTUALIZING SUSTAINABILITY

Despite a growing interest in research on sustainability, the literature has been highly fragmented across topical areas and disciplines. Most notably, until recently, the field has lacked a common set of definitions, research questions, measures, and conceptual frameworks (39, 42, 118). It is only in the past five to eight years that scholars have introduced conceptual and methodological guidance and agendas for conducting sustainability research (116, 118, 135). With a clearer agenda, this guidance will hopefully allow the field to coalesce into the next generation of studies.

### Defining Sustainability

Scholars have used numerous definitions and terms, often related but not necessarily equivalent, to refer to sustainability. In Stirman and colleagues' (135) review, 65% of studies did not define sustainability, and many definitions were developed anew by the study's authors. Among those studies that did provide definitions, sustainability was the most commonly used term (116, 122,

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**Fidelity:** the extent to which the intervention was delivered as planned, representing the quality and integrity of the intervention as conceived by the developers

**Adaptation:** the degree to which an evidence-based intervention is changed to fit the setting or to improve fit to local conditions

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135). Other common terms included routinization, institutionalization, sustainment, durability, maintenance, and long-term follow-up/implementation, as well as terms related to discontinuing programs (e.g., discontinuation, deadoption) (103, 135). Stirman and colleagues suggested that an intervention could be considered sustained at a given point in time if, after the initial start-up implementation support had been withdrawn, core elements were maintained (e.g., remained recognizable or delivered at a sufficient level of fidelity or intensity to yield the desired health outcomes) and adequate capacity for the continuity of these elements was maintained. An increasingly used definition of sustainability is Scheirer & Dearing's (118, p. 2060) conceptualization as the "continued use of program components and activities for the continued achievement of desirable program and population outcomes." To advance research and increase clarity, researchers should specify conceptually and operationally, in alignment with recommended definitions and conceptualizations from the published literature (88, 103, 118, 135), the dimensions of sustainability that they will address, as well as the aspects of the intervention that are considered effective or necessary to produce the desired health outcomes.

### **Conceptualizing Sustainability as Process Versus Outcome**

Researchers have often conceptualized sustainability as the final stage in the overall life cycle of an intervention, including development, adoption, implementation (with potential adaptations), and sustainability (14, 31, 52, 110, 115, 118). For example, the EPIS (Exploration, Preparation, Implementation, and Sustainment) model frames implementation as a process influenced by multilevel factors over time, starting with exploration and concluding with sustainment (2). The RE-AIM model also includes the maintenance phase of implementation (50), but its authors later noted the inherent limitation of the evidence base in terms of external validity (i.e., the applicability of the evidence used to deem the program effective), which might warrant changes to the intervention over time (54). Sustainability has also been included as an outcome or subconcept under the broader concept of implementation (104). A few researchers have focused on sustainability as a set of processes that occur in the earlier stages of the life cycle of a project and have emphasized the importance of planning for sustainability (66, 99). Other researchers agree that sustainability is likely influenced by earlier implementation processes, but they argue that conceptualizing sustainability as a process does not emphasize the longitudinal perspective needed for sustainability research and does not account for the potential recursive nature of sustainability (99, 118). It is important for researchers to consider that sustainability may very well differ across settings and by type of intervention. For example, as public health programs evolve over time in response to changes in (and input from) the community, the maturation of program staff, and increased skills and refinement in delivery, the sustainability of public health interventions may look different from that of medical interventions, which are highly standardized and may require closer adherence to protocols. It is also worth noting that sustainability, as defined above, is not the only endpoint to consider in the implementation process. As the eligible population changes and the needs of the community change, or more effective or appropriate interventions are identified, the evolution or even replacement of an intervention might be more warranted than sustainment. In fact, discussions of sustainability have warned against the ossification of a set of procedures at the expense of fit and effectiveness (23, 135).

### **Conceptualizing the Dynamic Nature of Sustainability**

Whereas the early literature on sustainability focused largely on institutionalization and routinization (e.g., integrating a new set of practices into the routine operations of an organization)

(129, 149), there has been recognition over the past 20 years that institutionalization may impede organizations or communities from adopting more effective practices when new evidence emerges (135). Sustainability has been increasingly conceptualized as a more dynamic construct that allows for adaptation and capacity building in response to new evidence, policies, or other influences (23, 58, 66, 72).

Most conceptual frameworks have not fully addressed sustainability in the context of change over time or the potential need for adaptation to improve the fit and impact of EBIs in new and/or changing contexts and populations. However, as noted above, Chambers and colleagues (23) introduced the Dynamic Sustainability Framework (DSF) to address this gap, consistent with recent conceptualizations that move away from thinking about sustainability as the endgame to see it as an ongoing dynamic process (118). These authors reject the assumptions of “voltage drop” (i.e., interventions are expected to yield lower benefits as they move towards sustainability) and program drift (i.e., benefits are expected to decrease when deviating from strict protocols). The DSF suggests instead that interventions should not be considered optimized until they have been implemented, tested, and refined in the settings in which they will be ultimately delivered. This framework challenges scholars in the field to scrutinize their assumptions about which elements are indeed core elements of the intervention and to consider data-driven adaptation and evolution as essential aspects of sustainability (23). Thus, DSF focuses on continued learning and evaluation, problem-solving, and ongoing adaptation of the interventions to enhance their fit with contexts and populations that differ from those in which the interventions were originally tested. Such measures, rather than diluting the interventions, may ultimately improve them and increase the likelihood of sustainability. Some researchers have begun to integrate this framework into their research to examine whether strategies to address the dynamic contexts into which interventions are implemented can lead to successful implementation and sustainment (73, 133).

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**Capacity building:** activities that build durable resources and enable the recipient community to continue the delivery of an evidence-based intervention

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### **Conceptual Frameworks of Factors Influencing Sustainability**

A number of sustainability frameworks have been developed in recent years (132), with some focusing on intervention characteristics that influence sustainability (107) and others focusing more on contextual influences (2, 58). Rather than testing comprehensive frameworks, many studies have examined individual factors or have used qualitative research to identify stakeholder perspectives on sustainability (38, 70, 95). Therefore, most of those frameworks have not been empirically tested to determine their validity for different types of interventions and to identify core factors that may predict sustainability across diverse contexts and intervention types. A priority area for the field is empirically testing conceptual frameworks in this area (103).

Some researchers posit that sustainability must be studied distinctly from other phases of D&I. They assert that the factors that influence the initial adoption of EBIs may differ from those that influence sustainability (115, 122), and that different factors might be more influential at different time points (2). Whether various phases of the implementation process have different predictors that necessitate distinct conceptual frameworks is unknown (135). It will be helpful for the field to distinguish sustainability from implementation in terms of what is uniquely important to each and which factors influence both (135).

In recent years, scholars have developed an overarching multilevel framework of recognized influences on sustainability (118, 122), which includes the categories of intervention characteristics, organizational setting factors, and the broader context/community environment. These categories are similar to those identified in existing implementation frameworks (2, 30) and are fairly consistent with Stirman’s classifications (innovation characteristics, context, capacity, processes), as well as with factors hypothesized to influence sustainment in the EPIS model (135).

There are gaps in our understanding regarding these categories and varying levels of evidence for each. For example, very little is known about the nature and influence of processes (training, planning, partnerships, evaluation, engagement) on sustainability. Finally, some researchers have adapted existing sustainability frameworks to apply them to specific intervention types (e.g., the Lay Health Advisor Sustainability Framework) (123). In future research, it will be important to be explicit about the conceptual or theoretical framework used and to differentiate sustainability determinants from sustainability outcomes.

### Capacity for Sustainability

Schell and colleagues (121) recently developed a framework to identify the core domains of a public health program's capacity for sustainability. They define sustainability capacity as the presence of structures and processes that allow a program to maximize resources to successfully implement and maintain evidence-based policies and activities. The core domains they identified include environmental support, funding stability, partnerships, organizational capacity, program evaluation, program adaptation, communications, and strategic planning. The framework and associated measure that came from it, the 40-item Program Sustainability Assessment Tool (PSAT) (76), can be used by D&I researchers and stakeholders when planning and making decisions about public health programs to implement. Although several studies have applied the PSAT measure or framework (62, 76, 138, 141), it is not evident whether the tool captures all relevant domains, and research is needed to validate the tool across diverse contexts. Other useful sustainability planning frameworks are also available, including Getting to Outcomes (65) and the NHS Sustainability Model and Guide (developed to plan and build capacity for clinical interventions by the National Health Service) (33, 79). In fact, established program planning models and frameworks are intended to enhance sustainability, and those that emphasize community-based participatory research (CBPR) (e.g., PRECEDE-PROCEED) are particularly useful for planning for sustainability by addressing stakeholder needs and identifying adaptations that may be necessary to improve fit (55, 85).

### RELATIONSHIP BETWEEN ADAPTATION AND SUSTAINABILITY

There is increasing recognition, particularly in public health, that adaptation is common and necessary in light of the dynamic contexts in which interventions are implemented (23). Therefore, one challenge inherent in studying sustainability is the tension between the continuation of interventions as originally developed and the need to adapt them for use in contexts and populations that may differ from those originally tested and that change over time (7, 14, 23, 118, 122). Some research suggests that adaptation is likely necessary to promote sustainability (7, 8, 23), although other studies suggest that certain types of adaptation decrease the benefits associated with the intervention (68, 128). What is currently known, though, is that although high fidelity has been associated with positive program outcomes (34), adaptation is fairly common (3, 86, 125, 150) and often necessary.

It is important to consider that some adaptations are not deviations from the original effective components of the program and may be beneficial (11, 21, 22, 148). For example, there is evidence that family-based interventions to reduce substance use reach more minority participants if they are adapted to fit local culture and context (e.g., to reflect sociocultural values of Hispanic populations and rural settings) (59, 69, 82). However, in some cases, major adaptations may be made to the core program components due to preference or limited time and resources, despite evidence that those core components are effective and/or necessary to address the needs of different populations (43). Concepts such as flexible fidelity have been introduced to acknowledge the importance of

tailoring interventions to meet the needs of differing populations while preserving the effective components (41).

The program planning literature offers some guidance on adapting interventions to fit certain populations and circumstances (55). However, much work remains to be done to make empirical determinations about the appropriate balance between adaptation and fidelity. An important step is to examine which components are necessary for effectiveness. Fidelity to core components could be conceptualized as the continuation of the elements found to be necessary for intervention effectiveness. Thus, considerations of adaptation and fidelity should be informed by evaluation data, as suggested in the DSF (23). More work is needed to determine what types of adaptation may specifically enhance sustainability and what types may erode the benefits or delivery of the intervention over time (135, 137). It is likely that the amount and type of adaptation that may be required will vary depending on the intervention and the context (8, 23). For example, some elements may be necessary for some populations but not others. Thus, some have begun to call for a better characterization of the types of adaptations, to allow for the investigation of the impact of different forms of adaptations on outcomes of interest for different types of interventions (24, 134, 137). This can provide better guidance regarding whether, when, and how to adapt interventions to promote sustainability. Furthermore, it is worth considering the threshold after which an intervention has been changed so much that, rather than being considered sustained, it should be considered to have been replaced or reinvented. Some have suggested that an intervention should remain recognizable to be considered sustained (135).

## **METHODOLOGICAL CONSIDERATIONS IN STUDYING SUSTAINABILITY**

Several methodological issues have hampered the sustainability literature and the broader development of the field (16, 116, 118, 135). Much of this work has been naturalistic, descriptive, exploratory, retrospective, and often influenced by short-term budgets and funding cycles for intervention research. Few studies have been guided by conceptual frameworks with clear operational definitions or have used rigorous outcome measures of sustainability. In Stirman and colleagues' (135) review, only 45% of the 125 studies measured continued delivery of program components among sites or providers, and only 22% of the studies reported information about health behaviors or outcomes. Often, sustainability outcomes have been measured dichotomously, making it difficult to determine the extent to which various components of the program were sustained, added, changed, or found to be associated with desired health outcomes over time. Time periods for follow-up have been variable (due in part to funding constraints, and because the health issues/behaviors studied are variable), and most studies have used self-report, with very few studies using independent observation and/or fidelity assessments.

In studying sustainability, several design and measurement recommendations have been made. For example, a timeframe should be selected for the health issue being studied that allows changes over time to be examined; typically, scholars have recommended that this be at least a year after implementation, and ideally two or more years later (135). The appropriate time frame depends on the nature of the intervention (e.g., scale of expenditure) and on what is relevant for the health issue/behavior studied. However, the dynamic nature of the sociopolitical context into which interventions are implemented often results in changes in funding, policy maker attention, populations, and public interest in the intervention, which can all affect sustainability. It is therefore useful to assess sustainability over multiple time points to capture its possible dynamic and nonlinear nature (84, 135). Also, determinations should be made regarding how much adaptation of intervention components is acceptable or expected, and whether there is, or should be, a recommended

threshold that needs to be reached for the intervention to be considered sustained (118). This may be increasingly important in the constantly changing context of digital health, as new technologies are implemented and supplanted (93). It is also important that researchers specify the unit of data collection and analysis for both sustainability determinants and outcomes.

Prospective, multilevel, and mixed-methods study designs are ideal for studying sustainability (94, 98). For example, quantitative surveys could be used to examine predictors of sustainability in multiple waves over time in conjunction with measures of sustainability outcomes, whereas qualitative surveys (e.g., in-depth case studies, interviews, ethnographic research) could be conducted among stakeholders at multiple levels to contextualize the findings within specific organizational settings, to provide insight into why programs were or were not sustained, and to understand differential processes that occurred across organizations (13, 98, 131, 147). Comparative case studies provide another promising approach that has been used successfully in sustainability research (114).

It is ideal to measure multiple indicators of sustainability outcomes (e.g., sustained changes in health outcomes and continued program implementation), and when possible, to validate self-reported sustainability outcomes with administrative data (e.g., staff retention, costs). One limitation of using multivariable analyses to model predictors of sustainability can be the large number of organizations needed to have sufficient power to examine multiple predictor variables, especially when sustainability is measured at the organizational level (92). Hybrid trials to assess both program effectiveness and aspects of implementation and sustainability are becoming more common (28, 71). Systems science approaches, network analysis, time series analysis, survival analysis, and other nonlinear methods may also be useful for capturing the complexity of the continuation, discontinuation, and replacement of interventions within complex service settings (12, 81, 103, 111). Experimental designs are not common in sustainability research, and they may be most useful for testing out which strategies are effective in increasing the sustainability of EBIs.

## MEASUREMENT

As with implementation science more generally (74), research on EBIs has been hampered by the lack of valid and reliable measures. Therefore, developing and evaluating robust measures that can be widely disseminated is critical. To date, there is no consensus on measures, and psychometric properties have not been reported for most measures, although efforts are underway to increase measurement rigor and identify psychometrically sound measures (75).

### Measuring Sustainability as an Outcome

In measuring sustainability as an outcome, having a gold standard can be challenging, given the wide variability in the program components of individual interventions (122) as well as the variability across health outcomes, settings, and behaviors studied. In recent years, sustainability outcomes have been conceptualized as (118, 119, 135) (*a*) continuing or improving health benefits or outcomes for patients/consumers at the individual level; (*b*) maintaining community-level partnerships or coalitions and community capacity for collaboration; (*c*) maintaining organizational practices, procedures, and policies started during implementation (institutionalization) (100, 126, 130); and (*d*) continuing the program activities or core elements of the original intervention. Additional proposed sustainability outcomes include documentation of the extent to which the interventions continue to be implemented (135), adaptation of intervention components (135), sustained attention to an issue or problem (media, public, policy agendas) (118), and program diffusion and replication in other sites (118). Researchers may also want to examine any negative unintended consequences that arise. Recent research suggests that multiple aspects of sustainability may



require different data sources and levels of analysis, and sustainability outcome indicators may vary (120). Ideally, multiple sustainability outcomes should be measured (113), and researchers should work with stakeholders in determining and prioritizing indicators.

As the discussion of fidelity and adaptation above suggests, there has also been debate about how to measure the core components of a program, particularly when applied to varied contexts and populations (22). For many interventions, such core components are based on theory but are not examined empirically with diverse populations before they are implemented. When assessing which components are sustained, we suggest a distinction between the core components identified through theory and those determined empirically. It is possible that further assessment evaluation will determine that some intervention components that are identified as “core” may not be needed in some populations, and that other effective elements may be identified and added during the implementation process. These considerations should be kept in mind when studying continuation or fidelity of the original program components as a dimension of sustainability. Furthermore, a thorough study of the sustainability of an intervention will include documentation of adaptations and of the reasons for those adaptations (8).

### **Measuring Factors That Influence Sustainability**

In terms of measuring multilevel factors related to the sustainability of community-based health interventions, Mancini & Marek (80) introduced the Program Sustainability Index; although this framework is promising, more work is needed in establishing its validity. Other examples include the British National Health Service Sustainability Index, a 10-item measure of an organization’s likelihood to sustain practices (78), the Program Sustainability Assessment Tool (76, 138), and the Sustained Implementation Support Scale, a scale that measures factors that affect the implementation process among practitioners (61).

In general, further work is needed to advance the psychometrics of measures in this area and to validate findings across diverse samples. Increasing availability of measurement resources for D&I research will produce more opportunities for improving measurement in this area (74, 106).

### **EMPIRICAL RESEARCH ON INTERVENTION SUSTAINABILITY ACROSS DIVERSE SETTINGS**

Sustainability research has been growing rapidly in recent years. One review found that most of the empirical research on sustainability has focused on multicomponent interventions across diverse fields and topics, with about one-third of the programs focused on health care interventions, one-third on behavioral and mental health interventions, and one-third on health promotion interventions (135). Despite this breadth, there are still gaps, including a dearth of studies focused on understanding the sustainability of interventions for people living with chronic diseases (142).

To date, the empirical literature suggests the existence of important categories of factors that influence sustainability across settings and are dynamically related. They are outer contextual factors (e.g., sociopolitical context, funding environment), inner contextual or organizational factors (e.g., financial resources, leadership, program champions, organizational support, staff stability, policy alignment), processes (e.g., training, strategic planning, stakeholder engagement, partnerships), intervention characteristics (e.g., adaptability, fit with context and population, benefits/effectiveness), and implementer characteristics (e.g., skills, attitude, motivations) (15, 115, 118, 135, 139).

However, there are many gaps in our understanding of the factors that influence sustainability and the interrelationships among these factors (118, 135). For example, do all factors need to be

in place or are some more critical than others? What combination is most important? Can the presence of some factors compensate for the absence of others? Are some determinants important in relation to certain sustainability outcomes but not others? Does the importance of factors differ across populations, health care, and community contexts, or by topic?

Another area for further investigation is whether sustainability differs based on the inherent structures or level of the intervention (140). Scheirer (117) proposed that one size does not fit all with interventions, and that sustainability research and planning might differ based on intervention structure (e.g., what the interventions are and how they are implemented). Scheirer proposed six types of interventions or programs distinguished by their structure, namely (a) interventions implemented by individual providers; (b) interventions requiring coordination among multiple staff; (c) new policies, procedures, and technologies; (d) capacity or infrastructure building; (e) collaborative partnerships or coalitions; and (f) broad-scale system change. An important next step is for researchers to formulate and test research questions reflecting these structural intervention categories; for example, for interventions requiring coordination among multiple staff, are organizational factors such as administrative and financial support, program champions, and ongoing training and technical assistance most important?

Below we highlight emerging research in the area of sustainability and identify factors that may be particularly important within certain types of contexts or interventions (see **Table 1**). The Integrated Sustainability Framework is presented in **Figure 1**. Informed by the emerging evidence base reviewed below and in **Table 1**, this framework highlights key multilevel factors that may be important in facilitating sustainability across multiple settings and contexts.

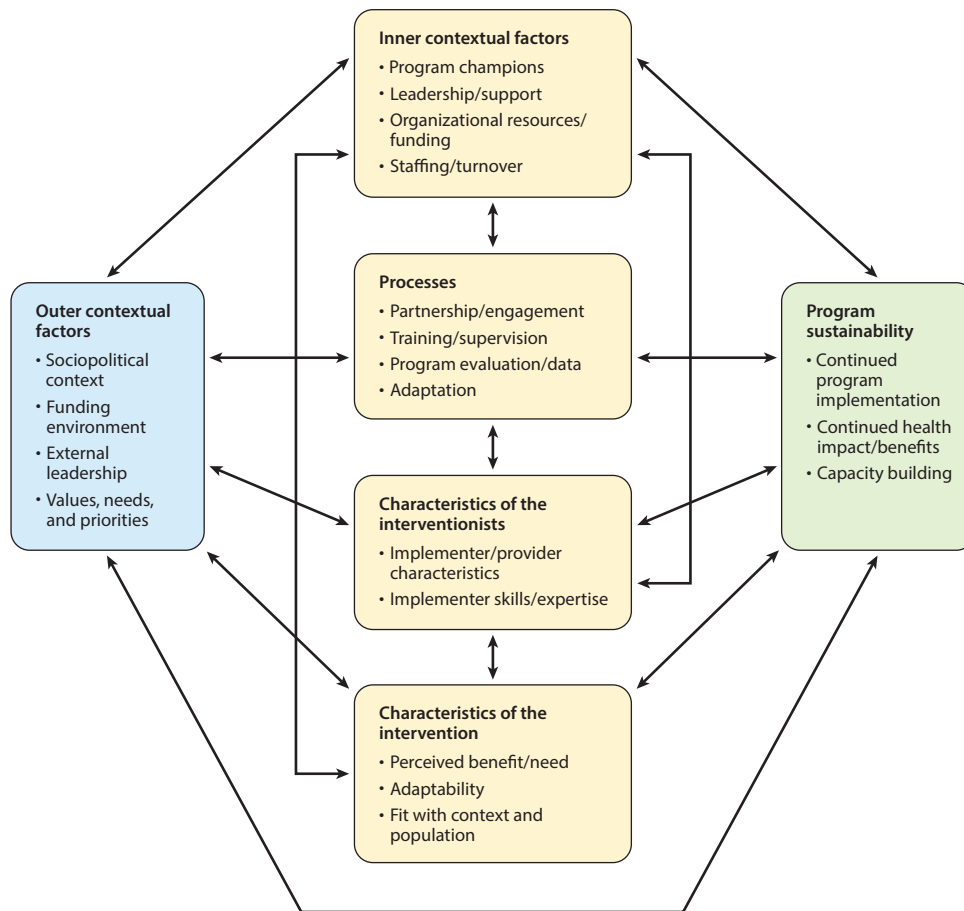
## Community Settings

There has been a growing literature on the sustainability of interventions implemented in a wide range of public health and community settings (e.g., schools, worksites, community organizations, health departments, churches) (18, 29, 44, 120, 124, 127, 141). Whereas many studies have investigated stakeholder perspectives on barriers and facilitators, several studies have begun empirically testing multilevel predictors of sustainability (27, 108). For example, one study (27) examined 77 EBIs in a statewide initiative aimed at reducing youth substance use and delinquency. Compared with their nonsustained counterparts, sustained programs were more likely to report connection and communication with stakeholders, fit between program characteristics and organizational capacity, knowledge of the program, communication with the program trainer/developer, and sustainability planning. Consistent with Scheirer's (117) assertion to consider differences by intervention type, Cooper and colleagues (27) found that for family-focused programs, a lack of connection to a high-functioning community coalition and recruitment challenges were negatively related to sustainment. For school-based programs, inadequate staffing and administrative support hindered sustainment. This finding is consistent with recent studies that suggest that administrative support, consistent resources, and staff stability and buy-in are particularly important in the school context (70, 84, 90, 146).

Several studies have focused on the sustainability of coalitions aimed at implementing EBIs, including the Communities That Care (CTC) coalition-based prevention system (51) and the PROSPER community-university partnership model (56). A study of 110 CTC sites in Pennsylvania found that 90% of coalitions continued after the three-year initial funding period, with 3–8% of sites terminating each year after (36). Studies suggest that some factors may be uniquely important for sustaining coalitions, including board/team functioning, data/evaluation resources, and planning for sustainability (56, 64, 96, 127, 145). What may be particularly important and should be explored is the degree of collaboration, planning, and ability needed to respond to changes in policy, funding, populations, and personnel in this context.

**Table 1 Emerging factors associated with sustainability across multiple settings and contexts**

|   | Community | School | Clinical/social service | Global | Whole systems | Coalitions |
|---|-----------|--------|-------------------------|--------|---------------|------------|
| <b>Outer context</b>                              |           |        |                         |        |               |            |
| Policy and legislation                            | X         |        | X                       |        |               |            |
| Sociopolitical context                            | X         |        | X                       | X      | X             |            |
| Funding environment                               | X         | X      | X                       | X      | X             | X          |
| Leadership  |           |        | X                       |        | X             | X          |
| Values, priorities, needs                         |           |        | X                       | X      | X             |            |
| Community ownership                               |           |        |                         | X      |               |            |
| <b>Inner context</b>                              |           |        |                         |        |               |            |
| Funding/resources                                 | X         | X      | X                       | X      |               |            |
| Leadership/support                                | X         | X      | X                       |        |               |            |
| Climate/culture                                   |           |        | X                       |        |               |            |
| Staffing/turnover                                 | X         | X      | X                       |        | X             |            |
| Structural characteristics                        |           | X      |                         |        | X             |            |
| Capacity  | X         |        |                         | X      |               |            |
| Champion  | X         |        | X                       |        | X             |            |
| Policies (alignment)                              |           | X      |                         |        | X             |            |
| Mission   |           |        |                         | X      |               |            |
| <b>Intervention characteristics</b>               |           |        |                         |        |               |            |
| Adaptability                                      | X         |        | X                       | X      | X             |            |
| Fit with population and context                   | X         | X      | X                       |        | X             |            |
| Benefits/need                                     | X         |        | X                       | X      |               | X          |
| Burden/complexity                                 | X         |        |                         |        |               |            |
| Trialability                                      |           |        |                         |        |               | X          |
| Cost  |           |        |                         | X      |               |            |
| <b>Processes</b>                                  |           |        |                         |        |               |            |
| Partnership/engagement                            | X         |        | X                       | X      |               | X          |
| Training/support/supervision                      | X         | X      | X                       |        |               |            |
| Fidelity  |           | X      | X                       |        |               |            |
| Adaptation  |           |        | X                       |        |               |            |
| Planning  | X         |        |                         |        |               | X          |
| Team/board functioning                            |           |        |                         |        |               | X          |
| Program evaluation/data                           | X         | X      | X                       |        | X             | X          |
| Communication                                     | X         |        | X                       |        |               |            |
| Technical assistance                              |           |        |                         | X      |               |            |
| Capacity building                                 | X         |        |                         | X      |               |            |
| <b>Implementer and population characteristics</b> |           |        |                         |        |               |            |
| Provider/implementer characteristics              | X         |        | X                       | X      |               |            |
| Implementation skills/expertise                   | X         |        |                         | X      |               | X          |
| Implementer attitudes                             | X         |        |                         |        |               |            |
| Implementer motivation                            | X         |        |                         |        |               |            |
| Population characteristics                        |           |        |                         | X      |               |            |



**Figure 1**

Integrated sustainability framework. This framework highlights key multilevel factors that the emerging evidence suggests are important for facilitating sustainability across multiple contexts and settings. As illustrated in the framework, dynamic interactions between outer contextual factors, inner contextual or organizational factors, processes, intervention characteristics, and implementer characteristics influence sustainability across community, health care, and social service settings. Please note that factors in each box are not an exhaustive list. **Table 1** and the text provide a comprehensive list of factors, as well as findings specific to particular settings and intervention types.

## Health Care and Social Service Settings

Scholars have conducted a growing number of sustainability studies in clinical or health care settings (20, 67) and mental health systems (1, 26, 136). Many studies have used a qualitative or mixed-methods approach to understand barriers and facilitators to sustainability (5, 10, 37). Consistent with organizational contexts in community settings (e.g., schools), many of these studies, particularly those in clinics or hospitals, suggest that funding, organizational factors and support (e.g., champions, supervision), and practitioner/workforce characteristics (e.g., turnover) are particularly influential (13, 98, 125).

## Low- and Middle-Income Countries

Many studies have been conducted in low- and middle-income countries, most commonly in Africa (4, 15, 63, 143). Such studies indicate the importance of strategic partnerships (89, 112) and the impact of the broader social context and of health system weaknesses (15, 63) as important influences on sustainability. A recent review of 41 studies across 26 countries in sub-Saharan Africa suggests that community engagement, community resources, and mobilization may be unique influences on sustainability in such contexts (63). The importance of understanding local context and adapting the intervention to reflect traditional and cultural norms and values was also found to be critical, consistent with other research on the sustainability of EBIs in Mexico (95).

## Whole Systems Change

Only recently have researchers begun to examine sustainability across whole systems, communities, cities, or countries (40, 87, 144). Although more research is needed, research to date suggests that additional factors to consider include synchronization between local, regional, and state policies; potential conflicting stakeholder interests; and the potential need for adaptation, given that homogenous implementation is difficult across systems. A study of the sustainability of whole-system change in London used a mixed-method organizational case study design across primary and secondary care (57). This study provides a transferable methodological guide for approaching sustainability research in the context of large and complex whole systems that are continuously changing, and it urges researchers not only to ask what persists from the original program, but also to advance understanding about what has been adapted and why these adaptations were made.

## PLANNING FOR AND STRATEGIES TO ENHANCE SUSTAINABILITY

A logical next step is to use sustainability theory and evidence linking specific factors to sustainability outcomes to inform the development of sustainment strategies. Similar to other areas of implementation research, this endeavor presents methodological challenges, many of which hinge on the valid and reliable assessment of sustainability predictors, the outcomes, and the sustainment strategies being implemented (25, 83, 106). There is emerging evidence for the reliability and validity of a small number of sustainability-specific assessments and tools, which are designed to determine an organization's capacity in key factors (e.g., partnerships, strategic planning) that have been shown to be linked to sustainment success (61, 76) and to develop a strategic action plan for building capacity in areas of weakness (19, 35, 65, 113). Theoretically, this assessment and planning process should lead to a greater likelihood of intervention sustainability. However, these strategies have only begun to be evaluated in small pilot studies (19, 65).

There is a growing body of literature documenting the efficacy of implementation strategies through randomized controlled trials, which have shown impacts on implementation outcomes like adoption and fidelity; however, few studies have examined their effects on sustainability (101, 102). One exception is a 2017 trial examining the comparative effectiveness of two learning collaborative components (fidelity-oriented versus continuous quality improvement-oriented) on the sustainability of cognitive processing therapy for post-traumatic stress disorder (133). This is a quickly evolving area, and it will be important that terminology and measures be based on established implementation and sustainability frameworks in order to systematically evaluate their validity and improve upon them as new findings emerge.

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**Implementation research:** research seeking to understand the processes and factors associated with the successful integration of evidence-based interventions within a particular setting

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## FUTURE DIRECTIONS TO ADVANCE SUSTAINABILITY RESEARCH AND PRACTICE

Sustainability research is a rapidly evolving area within implementation science. We are seeing increased rigor and methodological advances in the field, as well as a growing emphasis on understanding strategies to support sustainability. In line with Proctor and colleagues, we agree that key areas to be addressed include (a) advancing substantive research on sustainability, (b) advancing methods for sustainability research, and (c) advancing the capacity for conducting sustainability research. We have highlighted many of the most critical areas for future research, including improving the clarity of operational definitions and terms and rigorously testing conceptual frameworks in this area.

A particularly important issue to address is the tension between the long-term sustainability of the program (and associated expectations of fidelity to its original form) and adaptation. It will be critical for researchers to more explicitly recognize and evaluate adaptation as being central to studying sustainability and to better understand the impact that measured adaptations have on intervention effectiveness and sustainability. Researchers have called for more reporting and transparency of external validity to help us understand not only whether the intervention works, but among what populations and settings it is effective and appropriate (46, 47, 54). Furthermore, there has been greater recognition of the need to produce more practice-based evidence (6, 53), to use evaluation data to guide and inform adaptation (23), to develop interventions that have been designed with implementation in mind from the start (32, 77), and to integrate program planning models and CBPR to guide adaptation (8, 55, 85). All of these efforts, if seized, will benefit sustainability research.

Advancing the measurement of the determinants and outcomes of sustainability through robust prospective designs will also be critical. Mixed methods are often recommended for studying sustainability, and this approach has many strengths, but it will be important that researchers begin to coalesce around language. Different terms are used that mean similar concepts, and there are discrepancies in terms of which factor fits under which category within different conceptual frameworks. It may be time to work from established sustainability frameworks while also allowing for emergent themes to be identified, particularly if differences emerge across settings or intervention types. Furthermore, clear definitions and conceptual and operational specificity are needed with respect to terms like “capacity” and “organizational support” to refine frameworks in this area.

There are many opportunities for implementation scientists and practitioners to advance research and practice in this area. We focused on the sustainability of EBIs, but more work is needed in examining the sustainability of policies as well. Another related area for future study is deimplementation or deadoption (removing or replacing practices or programs that are no longer recommended or lack scientific evidence) in the context of long-term sustainability (91). Furthermore, it will be important to consider whether it is necessary to make distinctions between sustainability and concepts such as reinvention and evolution. Finally, it is critical that there be more focus on understanding, measuring, and communicating the value of sustainability and why sustainability is a good return on investment for the multiple stakeholders involved.

### SUMMARY POINTS

1. Sustainability is critical to address, as it is a persistent challenge across a range of public health and health care settings, service delivery sectors, and health behaviors and outcomes.

2. There have been methodological and conceptual limitations in measuring sustainability and determining both how much of the original intervention must be in place for it to be considered sustained, and what types and how much adaptation is necessary and appropriate in real-world settings that may include new populations and contexts.
3. Sustainability is increasingly conceptualized as a dynamic construct that allows for adaptation in response to new or changing populations, evidence, policies, or other contextual influences.
4. Contextual factors such as differences in population, service structures, and sociopolitical context can influence the ways in which interventions evolve after implementation and are sustained across time in real-world settings, particularly if interventions were originally tested among narrow populations or under unrepresentative circumstances.
5. Recommended sustainability outcomes include continuation of program components, capacity building, and continued health benefits or outcomes.
6. Prospective, multilevel, mixed-methods study designs are ideal for studying sustainability and empirically testing conceptual frameworks to advance the field.
7. As illustrated in the Integrated Sustainability Framework, empirical literature suggests the existence of dynamic interactions among outer contextual factors, inner contextual or organizational factors, processes, intervention characteristics, and implementer characteristics; these appear to be important categories of factors influencing sustainability across settings.
8. In coming years, more research is needed to identify and evaluate planned strategies to support the sustainability of evidence-based interventions in real-world settings.
9. Conceptual and methodological guidance and agendas for conducting sustainability research have been introduced in recent years, providing an opportunity for this rapidly evolving field to coalesce with the next generation of research.

## DISCLOSURE STATEMENT

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## Errata

An online log of corrections to *Annual Review of Public Health* articles may be found at <http://www.annualreviews.org/errata/publhealth>