You have an Effective Brief Intervention (BI) for Young Adults, Now What?: Concrete Strategies to Advance BI Implementation in Usual Care Settings

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Abstract

Objective: Risky drinking remains high among young adults and is associated with negative health-related consequences. Brief interventions (BIs) are an evidence-based practice for risky drinking that are particularly well-suited for young adults. However, widespread implementation of BIs remains challenging. This manuscript highlights guiding principles for researchers and clinicians seeking to implement BI for young adults.

Method: Five guiding principles for the implementation of BIs for young adults with risky drinking are introduced: 1) selecting an implementation model; 2) considering contextual factors; 3) specifying an implementation strategy; 4) assessing implementation outcomes; and 5) embracing hybrid effectiveness-implementation designs. Advancing health equity is considered a key cross-cutting theme.

Results: Multiple implementation models are discussed including process models, determinant frameworks, classic theories, implementation theories, and evaluation frameworks. Contextual factors impacting BI implementation are then considered across multiple levels within an organization. Next, we present methods for selecting implementation strategies and discuss implementation outcomes that can be measured during pre-implementation, implementation, and sustainability phases. Finally, we encourage employing hybrid effectiveness-implementation designs to reduce the BI science-practice gap. Guiding principles are illustrated with examples from two National Institute on Alcohol Abuse and Alcoholism-funded studies exploring BI implementation domestically and internationally.

Conclusions: This manuscript introduces foundational principles and emerging strategies to non-specialist researchers, clinicians, and policymakers seeking to enhance the dissemination and implementation of BIs. Advancing the dissemination and implementation of BIs is essential to ensure that investments in BI research are fully realized in order to equitably improve public health.

Keywords

brief intervention; implementation; young adults; alcohol

Introduction:

Rates of risky drinking in young adults remain perniciously high and are associated with far-reaching negative consequences including college dropout, lethal unintentional accidents, violence, unintended pregnancy, and sexually transmitted disease (Centers for Disease Control and Prevention [CDC], 2019; National Institute on Alcohol Abuse and Alcoholism [NIAAA], 2020). It has been estimated that approximately 1,800 college students between the ages of 18 to 24 die each year due to excessive alcohol consumption (NIAAA, 2020). Problems associated with risky drinking in this age cohort increase the risk of alcohol use disorders as well as multiple medical and behavioral health diagnoses (Richter et al., 2016). The sequalae of risky drinking during this vulnerable period underscores the importance of advancing the utilization of evidence-based interventions for young adult drinking.

As has been conveyed in other articles in this Special Issue, brief interventions (BIs) targeting young adult risky drinking are supported by a robust evidence base from well-controlled clinical trials. In addition to extensive meta-analytic support (Carey et al., 2007; Fachini et al., 2012; Tanner-Smith & Lipsey, 2015), BIs are particularly well suited for the developmental needs of this age cohort. BIs are consistent with a harm-reduction paradigm, whereby young adults are not required to refrain from drinking altogether, but rather are encouraged to set personalized goals to reduce their drinking to safer levels (Toumbourou et al., 2007). The brief format, typically consisting of one to four sessions, also makes such interventions highly scalable (World Health Organization, 2019), with the potential for delivery across multiple settings serving young adults, such as primary health care clinics, emergency departments, college counseling centers, and outpatient behavioral health centers (see Monti, Colby, & Tevyaw, 2018). Multiple national organizations (CDC, 2020; NIAAA, 2019) have recommended using BIs as part of an integrated public health framework approach that promotes early detection and intervention of those at risk of substance-related consequences, as opposed to a disease-oriented approach focused only on those meeting full criteria for an alcohol use disorder. In particular, pairing BIs with universal screening has been touted as a pragmatic approach for advancing population-level reductions in alcohol use among this high-risk cohort (Babor et al., 2007; Substance Abuse and Mental Health Services Administration, 2011). Thus, BIs are ideally suited to be widely promoted across a wide range of clinical and allied health settings serving young adults.

Implementation Science as a Guide for Advancing BI Uptake

Efforts to advance the uptake of BIs for risky drinking in young adults can be guided by the field of implementation science. Implementation science is a relatively new area of scientific inquiry that aims to bridge the gap between public health knowledge (e.g., "what we know") and public health practice (e.g., "what we do"; Wallace, 2008). More specifically, the field has been defined as "the scientific study of methods to promote the systematic uptake of research findings and other evidence-based practices into routine practice, and, hence, to improve the quality and effectiveness of health services" (Eccles & Mittman, 2006). The need for implementation science is supported by an oft-cited statistic, which estimates that it takes about 17 years to translate 14% of research into

clinical usage (Balas & Boren, 2000). In a primer about implementation science, Bauer and colleagues (2015) explain that this slow journey reflects the speed of the biomedical research process, which can be conceptualized as a "pipeline" whereby an intervention moves from efficacy through effectiveness trials to sustained application in clinical practice. A myriad of blockages throughout the pipeline impede the uptake of evidence-based interventions, including (but not limited to) provider knowledge, skill, and self-efficacy; misalignment of research evidence with clinical priorities; and lack of organizational will to support the time and resources needed for provider training (Bauer et al., 2015). Implementation science aims to address gaps in this "leaky pipeline" through the development of replicable, specific strategies to promote the equitable uptake of evidence-based interventions (e.g., BIs targeting risky drinking in young adults) in routine clinical care settings (Green et al., 2009).

In contrast to clinical research, which typically focuses on change at the patient-level, implementation science research is inherently multi-level and broad in scope. Implementation science studies address a range of contextual factors and consider change at the patient-, provider-, organization-, and system-levels (Chaudoir et al., 2013). As such, traditional clinical science frameworks, measures, strategies, and designs are often insufficient to test implementation science hypotheses. According to the National Institutes of Health (2019), "studies in this field typically involve both interdisciplinary cooperation and trans-disciplinary collaboration, utilizing theories, empirical findings, and methods from a variety of fields."

The objective of this manuscript is to highlight a set of guiding principles for researchers and clinicians seeking to advance the implementation of BIs targeting risky drinking in young adults. Principles are drawn from seminal dissemination and implementation science publications, as well as our extensive international experience as BI researchers and reviewers of both BI and implementation science grants. Throughout this manuscript, we rely upon several key terms to describe phases of the implementation process, which have been discussed extensively in prior work (Gilmartin & Hessels, 2019; Rabin & Brownson, 2018) and modified here to focus on BI in risky drinking in young adults. *Adoption* pertains to the decision of an organization, system, or community to commit to and initiate the use of an evidence-based BI. *Implementation* is a process that moves beyond adoption and refers to the integration of an evidence-based BI within a specific clinical or allied setting. *Sustainability* refers to the extent to which an organization, system, or community can continue to deliver an evidence-based BI over an extended period, following the removal of external implementation support.

The strategic advice provided in this manuscript centers around five key implementation science research dimensions: models/theories/frameworks; contextual determinants; implementation strategies; outcomes; and designs. First, we provide guidance as to how to select an appropriate model, theory, or framework to guide BI implementation efforts in a specific setting serving young adults. Second, we present contextual factors likely to influence the adoption, implementation, and/or sustainment potential of a BI. We argue that these factors should be actively anticipated, considered, and to the extent possible, measured in implementation science studies. Third, we discuss how to select and specify a replicable, well-defined implementation strategy or set of strategies to transfer a BI from

research to routine practice. Fourth, we highlight an array of implementation outcomes, distinct from typical clinical outcomes, that could be used as study endpoints. Finally, we advocate for the use of hybrid effectiveness-implementation designs to accelerate the research to practice pipeline. For each guiding principle, we review seminal articles and best practices identified in the implementation science literature. Case examples of studies funded by NIAAA illustrate how to promote the implementation of BIs for young adults in routine service settings.

Throughout the manuscript, advancing health equity to ensure that BIs are implemented and accessible for all young adults is discussed as a cross-cutting theme. Health equity refers to providing a fair and just opportunity to be healthy, by "reducing and ultimately eliminating disparities in health and its determinants that adversely affect excluded or marginalized groups" (Braveman, 2017). As noted by Nápoles and Stewart (2018), translational methods to reduce health disparities have only recently begun to receive attention in the implementation science literature, and prior work should be leveraged as a "starting point for systematic efforts to advance translation of evidence-based interventions to reduce health disparities."

Guiding Principle #1: Select a Conceptual Model, Theory, or Framework

A critical first step in studying how to best implement a BI is selecting a guiding model, theory, or framework (hereafter called "model" for brevity). In 2015, Nielsen conducted a narrative review of the implementation science literature and developed a taxonomy to facilitate selection and application of appropriate models. This seminal work describes three overarching aims that can be used to guide the selection of models in BI implementation studies: (1) describing the process of translating research into practice; (2) understanding what influences implementation outcomes; and (3) evaluating implementation. Table 1 maps these overarching aims onto five distinct goals with definitions and illustrative examples.

The first goal (e.g., to describe the BI implementation process) maps onto one category called "process models." Such models specify the stages or phases of taking an evidence-based BI from research to practice in an equitable manner. The aim of process models is to delineate and/or guide the specific steps needed to translate research into practice. Two popular process models are the Quality Improvement Framework (Meyers et al., 2012) and the Exploration, Preparation, Implementation, Sustainment (EPIS) model (Moullin et al., 2019). The Quality Improvement Framework outlines four implementation phases and 14 critical implementation steps that should be taken to ensure quality BI implementation. Similarly, the EPIS model delineates four sequential implementation phases – Exploration, Preparation, Implementation, and Sustainment. The specific stages outlined in process models can be used to articulate research questions, determine the optimal timing of specific implementation strategies, and guide the selection, content, and timing of measurement protocols.

With regard to the second goal of understanding the implementation process, there are three types of frameworks: determinant frameworks, classic theories, and implementation theories. First, determinant frameworks specify different classes or domains of determinants (independent variables) that act as barriers and facilitators of implementation (dependent

variables; Nilsen, 2015). Such models are designed to understand and/or describe influences on implementation outcomes. One of the most popular determinant frameworks is the Consolidated Framework for Implementation Research (CFIR; Damschroder et al., 2009), which identifies five domains of determinants: outer setting factors; inner setting factors; provider characteristics; characteristics of the intervention; and implementation process factors. Second, classic theories are theoretical arguments that originated from fields outside of implementation science, such as engineering, marketing, psychology, and organizational theory, which can be applied to help explain the implementation process. A commonly used classic theory is Rogers' (2003) Theory of Diffusion of Innovations, which argues that the extent to which an innovation will diffuse is a function of its relative advantage, complexity, observability, compatibility, and trialability. Third, implementation theories have been developed by implementation scientists to describe the implementation process. An example theory is Organizational Readiness (Weiner, 2009), which speculates that the ability of an implementation strategy to exert meaningful change is a function of its ability to increase an organization's readiness to change.

The final goal of models is to evaluate implementation. This goal is addressed by using evaluative frameworks, which specify potential trial endpoints. Perhaps the most well-known evaluative framework is RE-AIM (Glasgow et al., 1999), prominently featured in the implementation science literature for over 20 years (Glasgow et al, 2019). Each letter stands for a distinct outcome: Reach (proportion of young adults reached by the BI); Effectiveness (the effects of the BI on young adults under real-world conditions); Adoption (proportion of providers delivering the BI); Implementation (extent to which the BI is delivered as intended); and Maintenance (extent to which the BI is sustained after removal of active support). Letters to the left of the hyphen (R-E) refer to outcomes measured at the patient-level, while letters to the right (A-I-M) refer to outcomes measured at the provider-, organization-, or system-level.

While Nilsen's categorization of models provides a helpful taxonomy, BI researchers may require guidance as to how to select a model for a specific project and how to use the model to ensure equitable implementation. Moullin and colleagues (2020) recently outlined a set of recommendations for incorporating models in implementation research, and suggested that model selection should consider: a) the purpose of the framework (e.g., the three aims outlined by Nilsen); b) the level(s) included within the framework (e.g., patient, provider, organization, system); c) the degree to which the model includes various implementation concepts; and d) the framework's orientation (e.g., both the setting and type of intervention for which the framework was initially designed). Other key recommendations were to explicate specific research questions or hypotheses and to develop a logic model (i.e., a pictorial representation of each stage of the research process) that outlined the hypothesized mechanisms of implementation. Of note, neither Nilsen's taxonomy nor Moullin et al's recommendations explicitly discuss health equity. Table 1 considers how different types of frameworks can be used to advance equitable implementation.

Fortunately for BI researchers new to the field of implementation science, there are a number of websites and interactive tools available to help follow these recommendations and choose appropriate models. Damschroder (2020) describes several of these tools in

a recent commentary about the use of models in implementation research. For instance, the website Dissemination and Implementation Models in Health (https://dissemination-implementation.org) is a tool based on a seminal review by Tabak and colleagues (2012) that guides researchers in thinking through whether their research questions are implementation or dissemination focused (or if they apply equally to these areas) and at what socioecological level their questions operate (system, community, organization, individual or policy levels). This website tool integrates this information to allow researchers to develop a visual logic model of their implementation research questions and select the model(s) that best fit(s) their hypotheses. Similarly, the Theory Comparison and Selection Tool (T-CaST; Birken et al., 2018) is an interactive tool that BI researchers can apply to consider the characteristics of implementation models most essential for their project and evaluate the ways in which specific models meet the needs of the intended work. Both the Veteran's Administration Quality Enhancement Research Initiative (https://www.queri.research.va.gov/implementation/) and Colorado University (http://crispebooks.org/) also have online guides that can help BI researchers to choose from among the plethora of models available to guide implementation efforts.

Case Study.—Members of our team are currently conducting an NIAAA-funded study called IAMSBIRT (Implementing Alcohol Misuse Screening, Brief Intervention, and Referral to Treatment [SBIRT]; Mello et al., 2018), which aims to implement SBIRT across pediatric trauma centers serving older adolescents. In this study, we opted to include more than one model to address the study aims. IAMSBIRT uses a process model (EPIS) to delineate the stages of implementation, a determinant framework (CFIR) to guide the contextual variables measured throughout implementation, and an implementation theory (Organizational Readiness to Change) to inform testing of mediators. In accordance with the EPIS model, the implementation strategy proceeds across three phases: Preparation, Implementation, Sustainment. Specific activities occur in each phase, and a phase is not considered complete until milestones are completed. In the Preparation phase, each pediatric trauma center must integrate SBIRT into the electronic medical record, distribute SBIRT training materials to pediatric trauma center staff, and have staff complete at least one role play of SBIRT delivery. In the Implementation phase, pediatric trauma centers commence SBIRT delivery as well as the tracking of outcomes, while receiving active implementation support. In the final Sustainment phase, centers must follow their own ongoing quality improvement / sustainment plan to continue delivering SBIRT without external support.

The CFIR model was used to identify a range of potential contextual determinants that are measured at baseline as potential predictors of implementation success. Focal determinants were predominantly in the inner context (e.g., measures of organizational census, types of injuries most often treated, number and types of medical experts [nurses vs. social workers vs. surgeons]) and the characteristics of the individuals involved (e.g., measures of provider attitudes towards SBIRT, provider education level, and socio-demographics). Finally, the organizational readiness to change theory is used to guide an exploratory hypothesis that change in organizational readiness will partially mediate the effects of the implementation strategy on specific outcomes. This theory was selected because the implementation strategy

(described further in Guiding Principle #3) specifically targets organizational readiness to change through external facilitation provided to center leadership.

Guiding Principle #2: Consider Contextual Factors

A second guiding principle for BI research is to consider contextual determinants of implementation across service settings. Even if a study does not use a determinant framework, evaluation of contextual determinants can identify key variables that influence implementation effectiveness. In a recent a scoping review (2019), Nilsen and Bernhardsson identified 17 determinant frameworks, as well as a number of definitions of contextual determinants in the implementation science research. According to one of the most comprehensive definitions by Damschroder et al (2009), "context consists of a constellation of active intervening variables and is not just a backdrop for implementation…. For implementation research, 'context' is the set of circumstances or unique factors that surround a particular implementation effort." The scoping review characterized 12 common types of contextual factors, which spanned four major categories that the investigators labelled micro-level, meso-level, macro-level, and multi-level, derived from the socio-ecological framework (Bronfenbrenner, 1979).

Each of the levels defined by Nilsen and Bernhardsson (2019) pertains to a set of contextual variables that can potentially influence the success of BI implementation. The micro-level includes young adult characteristics such as attitudes, socio-demographics, and clinical variables. In a BI implementation, potential patient-level variables to consider include young adults' needs, preferences, and attitudes toward BIs, as well as their level of risky drinking, to anticipate potential intervention "fit" with the target population (Chaudoir et al., 2013). Though not explicitly mentioned in the scoping review, provider-level variables are also vital micro-level factors. Providers' self-efficacy, attitudes, confidence, and knowledge have all been associated with BI delivery (e.g., Tenkku Lepper et al., 2019) and are likely to be important determinants of the effectiveness of BI implementation efforts.

The meso-level includes an array of organizational attributes, such as the culture and climate, readiness to change, institutional support, and organizational structure (Nilsen & Bernhardsson, 2019). Potential issues for BI researchers to anticipate include institutional support for delivering the novel intervention, the extent to which organizational culture and climate encourages use of evidence-based practices in general and reflects positive attitudes towards the use of BI in particular, and organizational readiness to change and adopt new practices. BI uptake may also be influenced by organizational structures such as the size of the organization, the types of services provided, the level of staff training, and the degree to which staff are centralized (e.g. involved in the same teams or attend the same meetings).

The macro-level includes broader attributes of the wider healthcare environment such as policies, legislation, and regulations (Nilsen & Bernhardsson, 2019). The ability for providers to obtain reimbursement for BI as a billable service is a key consideration in this level. Finally, multi-level contextual factors are those that arguably could span multiple levels including social relations and support, financial resources, leadership, time availability, and characteristics of the physical environment. Example considerations for BI researchers include the extent to which the physical environment is conducive to delivering

BIs (either with or without universal screening), the extent to which leaders are committed to BI implementation, and the extent to which the institution has the financial resources to release staff for training in BI delivery and/or to provide provider incentives for effective BI delivery.

As noted previously, the CFIR is one of the most popular determinant frameworks (Damschroder et al., 2009). The CFIR examines factors spanning all of the dimensions identified in the scoping review, including the macro-level environment (i.e., the outer setting in CFIR), the meso-level (i.e., the inner setting), the micro-level (i.e., characteristics of individuals involved, and multi-level factors (i.e., inner and outer setting factors). CFIR also includes characteristics of the focal intervention and the implementation process. Recognizing the central importance of health equity in implementation efforts, Woodward and colleagues (2019; 2020) have published a series of manuscripts containing concrete guidance as to how to integrate health equity domains into the CFIR and other determinant models. This program of work recommends explicitly including contextual determinants that have strong, clear associations with inequities in health status, or access to, quality of, or outcomes of healthcare. As an example, in a test of BIs among mandated college students, it might be important to consider whether Black students experience reticence to engage due to a history of anti-Black racism and punishment in schools (e.g., Wun, 2016): instruments measuring perceived racism and/or a history of racism would represent salient determinants in the micro-level of Nilsen and Bernhardsson's model.

BI researchers interested in using the CFIR with young adults can benefit from various user-friendly reviews, guides, and interactive tools that provide guidance as to how to apply the framework to both qualitative and quantitative work. One of the most robust examples is cfirguide.org. This highly intuitive website, created by the CFIR developers, has both a qualitative interview guide generator and a quantitative survey generator for investigators who know which types of determinants they would like to measure but require support developing an assessment strategy. The site also includes qualitative data analysis techniques derived from specific studies using the CFIR, as well as examples of quantitative measures from other studies which map onto CFIR constructs.

Case study.—In the IAMSBIRT study (see Guiding Principle #1), our team is employing the CFIR to inform a quantitative assessment of contextual variables, spanning the inner setting and characteristics of the individuals involved dimensions. The CFIR is also used to guide collection of contextual variables in an ongoing NIAAA-funded study implementing a train-the-trainer model to scale up screening and BI (SBI) delivery to HIV service organizations in South Africa. Within the inner setting (i.e., meso-level) dimension, we assess a range of organization-level variables at baseline including size, years in operation, census, and organizational readiness to change, as measured using the Organizational Readiness for Implementing Change scale (Shea et al., 2014). In addition, we assess where the participating organizations fall along the HIV service continuum, by recording special populations served (e.g., female sex workers, adolescent girls and young women, men who have sex with men), specific HIV services provided (e.g., HIV testing, treatment, and/or adherence support), and geographic provinces served (as a proxy for HIV rates in the surrounding community). Regarding characteristics of the individuals involved (i.e., micro-

level factors), we collect data from both master trainers and providers trained. Specific trainer-level contextual variables include years of experience delivering training, skill in training delivery, and socio-demographic variables including age, race, and gender. At the provider-level, contextual variables include experience working with persons with HIV, familiarity with SBI for risky drinking, average case load, and socio-demographic variables.

Guiding Principle #3: Specifying an Implementation Strategy

Selection of an implementation model, theory, or framework can help to elucidate the contextual determinants that need to be addressed, which in turn, can help guide the selection and specification of implementation strategies. Proctor and colleagues (2013) defined implementation strategies as "methods or techniques used to enhance the adoption, implementation, and sustainability of a clinical program or practice." The term "clinical program or practice" was intentionally defined broadly in order to encompass an array of evidence-based interventions, clinical practice guidelines, and policies. Implementation strategies are arguably the bedrock of successful implementation efforts, and are extremely heterogeneous in terms of their complexity and purpose (Moullin et al., 2020).

Replicable taxonomies of strategies are needed to facilitate the sharing of knowledge. In a landmark paper, Powell and colleagues (2012) synthesized 41 reviews and developed a consolidated compilation of 68 discrete implementation strategies. Subsequent work further refined this list by systematically gathering input from a panel of expert implementation scientists and clinical practitioners (Powell et al., 2015). This process led to a refined list of 73 discrete strategies, referred to as the Expert Recommendations for Implementing Change (ERIC) list, which provides a valuable starting point for BI researchers seeking to build, refine, or customize a comprehensive implementation strategy. Other compilations, including the Behavior Change Technique (BCT; Abraham & Michie, 2008) and the Effective Practice and Organization of Care (EPOC) taxonomies (Cochrane Effective Practice and Organisation of Care Group, 2015), provide additional resources for BI researchers seeking to promote uniform communication and facilitate the synthesis of results across studies (Moullin et al., 2020). As noted by Baumann and Cabassa (2020), implementation strategies in vulnerable communities will likely require multi-level approaches to address the range of determinants associated with health inequities and may require components beyond those listed in standard taxonomies (e.g., cultural competence, advocacy).

Once BI researchers are familiar with the range of discrete implementation strategies available, the next challenge is matching implementation strategies to specific barriers identified in the focal organization, setting, or system of care. Barriers and facilitators are often elucidated during the assessment of contextual determinants (Nilsen & Bernhardsson, 2019). Building upon their work identifying discrete strategies, Powell, Proctor, and colleagues (2017) have outlined four primary methods for matching implementation strategies to barriers: a) conjoint analysis, b) intervention mapping, c) concept mapping, and d) group model building. Key strengths underlying these four methods are that they are all inherently participatory, they all actively engage stakeholders in the matching process, and they all outline concrete, replicable steps for tailoring implementation strategies.

Conversely, the methods share key weaknesses including the need for specialized training and support, the use of labor-intensive processes, and limited data on their effectiveness and cost-effectiveness.

For BI researchers seeking a less time-intensive approach to matching barriers to strategies, the developers of the CFIR and the ERIC strategy compilation have partnered to create the CFIR-ERIC matching tool. The tool is described in Waltz et al. (2019) and is available for download at cfirguide.org. To use this tool, a BI researcher must first understand potential barriers to BI uptake in a specific organization or system of care serving young adults, using the same general nomenclature as in the CFIR. These barriers can then be entered into the CFIR-ERIC matching tool to identify a range of discrete strategies that could be used to address them. Of note, the matching of strategies to barriers in this tool was based on expert consensus (Waltz et al., 2019), and there was substantial heterogeneity in endorsements, suggesting that there is no single "correct" strategy to address a given barrier to BI uptake. Instead, there is likely a range of potential strategies that can be used to address each specific barrier. The authors encourage researchers to use the tool to help generate a list of potential implementation strategies, and discourage using the tool to dictate a particular approach.

A final consideration related to this guiding principle is that it is not sufficient for BI researchers to simply select an implementation strategy. It is also essential to report the use of the implementation strategy in a transparent and rigorous manner. Just as evidence-based interventions require specification of mechanisms of action and fidelity monitoring, so do implementation strategies (Kirchner et al., 2018). Yet such specification, operationalization, and monitoring of strategies is rare in the implementation literature. Proctor and colleagues (2013) advocate for the use of a simple three-step approach to describing implementation strategies: a) define it; b) name it; and c) specify it. The specify step is the most critical and should specify *who* delivers the strategy, *when* the strategy is delivered, *what* specific actions are taken, *what* the dosage and unit of analysis are, *which* implementation outcomes are likely to be most affected, and *why* the strategy was selected.

Case study.—In our IAMSBIRT study, pediatric trauma centers receive a multi-faceted implementation strategy that consists of three core elements: a) didactic training, b) performance feedback, and c) external facilitation. Each of these elements is tailored for a specific type of provider, with separate training tracks for nurses, social workers, and center leaders/ administrators. Didactic training consists of asynchronous webinars led by Master's-level counselors for all three tracks: nurses view a 20-minute webinar on screening, whereas social workers and leaders view a 1-hour webinar on BI delivery. Social workers delivering the BI also participate in a 2-hour synchronous workshop and receive performance feedback on two BI role plays from a clinical psychologist with expertise in motivational interviewing. In addition, center leaders (typically trauma surgeons) provide performance feedback to nurses and social workers on their delivery of screening and BI, respectively, at least monthly using electronic medical record data. External facilitation is provided jointly by an emergency medicine doctor and the clinical psychologist, via monthly calls throughout the active implementation phase. The published study protocol (Mello et al., 2018) contains a visual diagram depicting each element of the implementation strategy

and when it is delivered, accompanied by an in-depth rationale for the multi-faceted strategy, following Proctor et al's (2013) guidelines.

Guiding Principle #4: Assessing Implementation Outcomes

Following implementation strategy deployment, the next guiding principle is to select and evaluate specific indicators of adoption, implementation, and sustainment, also known as implementation outcomes. Implementation outcomes are commonly measured at the pre-implementation needs assessment as well as during and following implementation strategy deployment. A seminal review by Proctor and colleagues (2011) highlights eight different implementation outcome domains that can be measured across patient-, provider-, and organization-levels via quantitative and/or qualitative methods (i.e. qualitative interviews or focus groups, surveys or questionnaires): acceptability, adoption, appropriateness, costs, feasibility, fidelity, penetration, and sustainability.

About half of these measures assess the intervention's perceived utility and likelihood of success in a specific organization or system of care. Adoption outcomes relate to the degree to which providers develop the intention to try BI with their young adult clients, as well as the degree to which they initially implement BI (e.g. use BI at least once). Adoption measurement is important in the early phases of a BI implementation effort, to capture providers' first effort to use BI with young adults (Proctor et al., 2011). Acceptability refers to the degree to which providers (and in some cases young adults) are satisfied with the BI intervention and approve of its use in their specific setting. Similarly, appropriateness measures provider or organizational perceptions about whether BI feels compatible or fits well with current provider/organizational practice. Feasibility is an assessment of the actual utility or ease of use of the BI intervention, assessed at either the provider or organizational-level. Measures of acceptability, appropriateness, and feasibility are valuable to assess prior to the start of an implementation effort as "leading indicators" in order to determine whether stakeholders broadly perceive the BI intervention as useful, relevant, and compatible with their current treatment approach (see Weiner et al., 2017). Such measures can also be administered throughout an implementation effort to assess whether the implementation process has an effect on stakeholder impressions.

Remaining measures evaluate the effect of an implementation process on the organizations and systems in which they are delivered. Cost can be measured in a number of ways, but can involve anything from tracking money spent to engaging in a formal economic evaluation via cost-effectiveness or cost benefit analysis of BI compared to usual care (Eisman et al., 2020). Costs should be monitored throughout an implementation effort, including prior to implementation, during implementation, and throughout the sustainability phase in order to monitor change in costs or cost-benefits that might impact sustained BI use (see Saldana et al., 2014). Fidelity assesses the degree to which the BI was delivered as intended, and captures both adherence and skill (Carroll et al., 2007): it is beneficial to assess throughout active BI implementation as it allows for a determination of the degree to which providers may be "drifting" away from BI over time. Penetration is a measure of intervention reach and refers to the extent to which evidence-based practice or program becomes integrated within a specific organization or system. It should be measured during the implementation

and sustainability phases of a project in order to assess the spread of the BI intervention following a period of initial adoption (Proctor et al., 2011). Finally, sustainability assessment involves evaluating whether the BI intervention continues to be used with fidelity over time and thus becomes an established part of clinical practice (Shelton et al., 2018). Sustainability is typically measured late in a BI implementation effort given the focus on assessing whether the BI continues to be implemented after removal of external support.

In addition to these "implementation outcomes," Proctor and colleagues (2011) identify a number of "service outcomes" including equity, efficiency, and patient-centeredness. Equity, in particular, is a critical outcome to assess both as a stand-alone endpoint and a cross-cutting theme underlying the aforementioned implementation outcomes. BI researchers seeking to center health equity in their implementation studies with young adults can look to the work of Eslava-Schmalbach and colleagues (2019), which provides modified equity-focused definitions of the aforementioned classic implementation outcomes. As an example of their refined definitions, the term "penetration" is modified to "coverage" and reflects the "degree of reach, access, service spread or effective coverage… on the disadvantaged population eligible to benefit from the program or the intervention." Shelton and colleagues (2020) have similarly proposed ways in which the RE-AIM evaluation framework can be adapted to consider health equity in each of the five key elements (e.g., Reach, Effectiveness, Adoption, Implementation, Maintenance). Table 2 presents the eight classic implementation outcomes and the five RE-AIM outcomes, along with their modified health equity definitions and example measurement approaches/tools.

Similar to the processes of selecting an implementation model or strategy, BI researchers need to carefully select those outcomes that will be optimal for a particular BI implementation study. In a specific implementation outcomes toolkit, Gerke, Proctor, and colleagues (2017) provide recommendations for effective selection of implementation outcomes, including: a) consideration of the barriers or contextual determinants of practice that emerged during an initial organizational needs assessment or environmental scan; b) the degree to which the BI to be implemented differs from current practice in the organization (i.e. intervention novelty); c) the specific setting where the BI is to be implemented; and d) current organizational resources for training and ongoing supervision (i.e. existing capacity for BI implementation). Decisions must also be made about the unit of analysis for outcomes measurement (i.e. whether measurement will happen at the provider or organization level) and the timeline for assessment (i.e. pre-implementation, during implementation, and/or during sustainability). Once BI researchers have made these decisions, a final step is selecting among available measures. The Society for Implementation Research Collaboration's Instrument Review Project (IRP) has produced both a systematic review (Lewis et al., 2016) and an online repository of measures (https://societyforimplementationresearchcollaboration.org/sirc-instrument-project/) to support this effort. The IRP repository graphically compares implementation outcome measures assessing a core set of constructs on nine psychometric and five pragmatic qualities.

Case study.—In our SBI implementation effort in South Africa, our implementation strategy is a train-the-trainer approach (containing didactic training and external facilitation) in which organizations nominate master trainers who train providers, who in turn treat

patients in HIV service settings. To capture these distinct levels, we measure implementation outcomes at four levels: organization-, trainer-, provider-, and patient-encounter-level. Our selection of measures was guided by a needs assessment completed by 30 members of a National Advisory Board, who raised concerns about multi-level barriers including organizational resources, trainer knowledge and skill, and provider attitudes and self-efficacy.

To address concerns about limited resources, we track organization-level costs in the form of staff time and effort throughout the project to justify the investment required, using a pragmatic approach to estimating time-driven activity-based costs described by Cidav et al (2020). In response to anticipated trainer-level barriers, trainer fidelity and knowledge are both measured before and after training. The fidelity measure was developed specifically for the project and tracks both adherence and skills, following the guidance of Carroll et al (2007). A 20-item SBIRT knowledge scale was developed specifically for this project, modeled after a scale used as part of a Substance Abuse and Mental Health Services Administration SBIRT implementation effort (Knopf-Amelung et al., 2018). Provider-level outcomes include dimensions raised as potential concerns - attitudes and confidence towards SBI delivery – using scales recommended in the Emergency Nurses Association SBIRT Alcohol Screening Toolkit (2008). Provider outcomes are measured prior to training, post-training, and at 3- and 6-month follow-ups to document responsiveness to the implementation strategy. Finally, patient-encounter data are examined to determine whether the train-the-trainer model impacts service delivery. Specifically, reach is measured over the 3-months prior and the 6-months following training as the proportion of HIV patients admitted who received SBI, tracked in real time via patient encounter data recorded on tablets and scannable paper forms. Reach is examined by South African population group to monitor and ensure equitable SBI implementation.

Guiding Principle #5: Embracing Hybrid Effectiveness-Implementation Trials

A final guiding principle for BI researchers seeking to venture into implementation science is to embrace hybrid effectiveness-implementation trials. It has been well-documented that the "leaky pipeline" is an artifact of the predominant clinical research approach, which encourages sequential, step-wise progressions from clinical efficacy research to clinical effectiveness research and finally to implementation research (Curran et al., 2012; Landes et al., 2019). Recognition of the inefficiencies of this approach has led investigators to advocate for the blending of design elements in effectiveness and implementation trials.

In a seminal paper, Curran and colleagues (2012) introduced the concept of "effectiveness-implementation hybrid trials," which they defined as trials with a dual focus *a priori* in assessing both effectiveness and implementation outcomes. The investigators specifically explicated three types of hybrid trials. Type 1 trials prioritize testing of a BI's effectiveness, while simultaneously gathering data on the implementation context " of the BI. These trials help elucidate barriers and facilitators to BI implementation, while identifying what is needed to support implementation under real-world conditions. Type 2 trials place equal weight on the testing of the effectiveness of the BI and the outcomes of the implementation strategy, simultaneously examining whether the BI is effective in real-world settings and

whether the implementation strategies are effective in increasing BI implementation. Finally, type 3 trials prioritize testing of implementation strategies, while secondarily gathering data on the BI's effectiveness: such designs are ideal when BI effectiveness has been established in prior trials, yet still needs attention given its implementation in a new setting or with a new population.

To enhance our guidance for BI researchers, we searched the National Institute of Health database (NIH Reporter) in November 2020 to assess how many projects funded by NIAAA identify as using a hybrid design, which types of hybrid designs are most commonly used, and whether these designs are being used by BI researchers. The search identified a total of 19 projects funded by NIAAA that had "hybrid" in the title, project description, or keywords.

Of these, 12 active projects are currently using hybrid effectiveness-implementation designs based on the title, project description, and keyword search. Notably, eight of these studies evaluated BIs rooted in motivational interviewing as the focal clinical intervention. The four studies that did not evaluate BIs evaluated contingency management (R21AA027045), a peer-moderated smartphone app (U01AA026104), a continuing care smartphone app (R01AA024150), and a trans-diagnostic cognitive behavioral therapy (R34AA027200). Two of the eight BI projects identified as hybrid trials (R01AA018673, K01AA028199) did not specify the type of hybrid design or explicate whether effectiveness or implementation outcomes were prioritized. Of the remaining six BI projects, four identified explicitly as hybrid type 1 trials. Two of the hybrid type 1 trials evaluated technology-based BI delivery; both of these trials were embed within the same research center as the South Africa SBI implementation trial (P01AA019072), which has an implementation science focus. The third hybrid type 1 trial evaluated a four-session BI in India (R01AA027974) and the fourth evaluated a culturally adapted BI for Latinx youth (R01AA028507). We identified only hybrid type 2 trial (R01AA025947), which tested SBI implementation in Mozambique. Likewise, we identified only one hybrid type 3 trial (the IAMSBIRT study, R01AA025914), which tested SBIRT implementation in a cohort of pediatric trauma centers. This cursory review revealed very few NIAAA-funded hybrid trials evaluating BI interventions, with type 2 and type 3 trials being especially rare. None of the studies explicitly targeted young adults. Our search also highlighted areas for improvement in the reporting of hybrid trials, since about a third of NIAAA-funded hybrid BI trials did not specify the hybrid type or clarify the relative importance of the effectiveness and implementation research objectives.

Case study.—The IAMSBIRT trial is currently the only NIAAA-funded hybrid type 3 trial that uses the nomenclature "hybrid" in the title, project description, or keywords. Consistent with the guidance for type 3 trials, the primary aim of IAMSBIRT is to test the effects of the multi-level implementation strategy on implementation outcomes. Specifically, the primary outcomes include the reach of SBI delivery (i.e., the proportion of patients admitted to the pediatric trauma centers who receive screening, and the proportion of patients screening positive who receive BI) and the fidelity of SBI delivery (i.e., provider skill in SBI based on role plays, and provider adherence to SBI based on electronic medical record data). Reach is examined by age, race/ethnicity, and biological sex to assess equitable implementation. The secondary aim of IAMSBIRT is to test the effects of the multi-level implementation

strategy on patient outcomes. The patient outcome of interest is patient linkage to their primary care doctor within 30 days of discharge from the trauma center. An exploratory aim is testing the hypothesis that the effects of the multi-level implementation strategy (on both implementation and patient outcomes) will be partially mediated by change in organizational readiness to implement SBI. As noted in Guiding Principle #1, this exploratory aim is guided by the organizational readiness to change theory.

Conclusions

Our review of the implementation science literature provides essential information for helping researchers advance the uptake of BIs to reduce risky drinking in young adults. The fundamentals of implementation science provide five guiding principles for moving evidence-based interventions into usual care settings: choosing theories, models and frameworks; assessing the implementation context; specifying implementation strategies; identifying implementation outcomes; and embracing hybrid effectiveness-implementation designs. Advancing health equity is a cross-cutting theme underlying each of these principles. In recent years, several websites and tools based on empirical studies have emerged to help BI researchers with these fundamentals: links to these tools have been included throughout this review. Moreover, recent efforts highlight the ways existing implementation models assessing contextual determinants (Woodward et al., 2019, 2020) and implementation outcomes (Eslava-Schmalbach et al., 2019; Shelton et al., 2020) can be modified to proactively include the examination of health equity. Such efforts are necessary for ensuring broad, equitable reach, adoption and sustainment of BI for risky alcohol use over time.

Four of our focal areas – models, determinants, strategies, and outcomes – are key ingredients needed to determine why an implementation succeeds or fails. As Proctor et al (2011) state, "when [interventions] fail, as they often do, it is important to know if the failure occurred because the intervention was ineffective in a new setting (intervention failure) or if a good intervention was deployed incorrectly (implementation failure)." Careful specification of the fundamentals outlined here can help BI researchers to evaluate implementation success (or failure), and make evidence-informed decisions about intervention and implementation delivery.

The fifth principle - embracing hybrid effectiveness-implementation trial designs – is critical for reducing the time lag between determining that a BI is effective and implementing it into usual care settings (Curran et al., 2011). Hybrid designs, allowing for the simultaneous examination of BI effectiveness and the implementation context, are one of implementation science's most seminal contributions to translational science. Given that only eight hybrid effectiveness-implementation BI trials are currently funded by NIAAA, we encourage aspiring BI implementation scientists to, at the very least, consider creating hybrid type 1 designs out of any randomized controlled trial they may be intending to launch. Assessing the implementation context, while determining real-world effectiveness of a BI, is an important, and necessary, first step on the path to evidence adoption and the acceleration of the translational science pathway.

Emerging Areas of Implementation Science

There are several newer areas of implementation science that represent potential future directions for BI researchers once the five fundamental principles reviewed here have been met. First, BI researchers might choose to develop novel delivery models (e.g., technology-delivered BIs, peer-delivered BIs), and should consider principles of how to effectively "design for dissemination" by engaging stakeholders at the start of the project. Designing for dissemination is a process of ensuring that research products (e.g., BI manuals, materials, results) fit the needs, resources, workflow, and contextual characteristics of the target audience and setting (Brownson et al., 2013). Second, budding BI implementation scientists should look beyond active implementation, and should proactively follow best practices for sustaining BI delivery following removal of external support (Shelton et al., 2018). Third, BI researchers should consider that novel populations and settings might require adaptations to evidence-based BI models: the implementation science literature has several foundational works advising researchers as to how to balance adaptations with fidelity to core elements (e.g., Stirman et al., 2019). Fourth, though we considered health equity as a cross-cutting theme here, only a small handful of papers have discussed how to use implementation science to address inequities in healthcare delivery (see Baumann & Cabassa, 2020; Nápoles & Stewart, 2018; Shelton et al., 2020; Woodward et al., 2019, 2020). This represents a high priority area in need of further research. Finally, BI researchers should get comfortable with the concept of de-implementation, defined as reducing or stopping the use of a health service or practice provided to patients by healthcare practitioners and systems (Norton et al 2017). It is possible that widely available, yet ineffective interventions for young adults (e.g., confrontation, mandated self-help groups) will need to be proactively replaced with effective BIs, suggesting that both de-implementation and implementation strategies will be needed.

The collection of articles in this Special Issue present a compelling case that BIs for risky drinking are ideally suited to be promoted across clinical and allied health settings serving young adults. Following the five guiding scientific principles and the cross-cutting theme outlined here, while considering emergent areas of inquiry, will help advance the widespread adoption, implementation and sustainment of BIs. Such efforts, in turn, have the potential to reduce risky drinking and contribute to a healthier young adult population.

Acknowledgments

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Public Significance Statement:

Brief interventions are effective for risky drinking in young adults, but rarely available in the community. This article presents guiding principles for non-specialists seeking to implement brief interventions in community settings.

Table 1

Implementation Model Aims, Definitions, Equity Considerations and Examples to Guide Brief Intervention (BI) Implementation (Adapted from Nilsen, 2015)

Overarching Aim	Type of Model	Definition	Equity Considerations	Examples
Describing/Guiding the process of translating research to practice	Process models	Models specify the phases of taking a BI from research to practice. They can identify and guide the specific steps needed to translate a BI into practice	Models can specify the key phases or steps needed to translate a BI into practice with health disparity populations	• Exploration, Preparation, Implementation, Sustainment (EPIS; Moullin et al., 2019) • Transcreation Framework for Community-Engaged Behavioral Interventions to Reduce Health Disparities (Nápoles & Stewart, 2018)
Understanding what influences implementation outcomes	Determinant frameworks	Frameworks describe influences (e.g., barriers and facilitators) on BI implementation and relationship among these influential factors	Social determinants of health and health inequities can be considered key influences on implementation	• Consolidated Framework for Implementation Research (CFIR; Damschroder et al., 2009) • Health Equity Implementation Framework (Woodward et al., 2019)
	Classic theories	Theories derived from fields outside of implementation science (e.g., psychology, organizational theory) to explain the process of BI implementation	Theories from other disciplines can explain the process of BI implementation with health disparity populations	• Theory of Diffusion of Innovations (Rogers, 2003)
	Implementation theories	Theories derived specifically by implementation scientists to explain the process of BI implementation	Theories can be derived specifically to explain the process of equitable BI implementation	• Organizational Readiness (Weiner, 2009)
Evaluating implementation	Evaluation frameworks	Frameworks specify elements of the BI implementation effort that can be measured to determine implementation success	Evaluation frameworks can measure the effects of implementation on indicators of health equity	• Reach, Effectiveness, Adoption Implementation, & Maintenance (RE-AIM; Glasgow et al., 1999) • Extension of RE-AIM to Advance Equitable Sustainment (Shelton et al., 2020)

Table 2

Implementation Outcome Traditional Definitions, Health Equity Focused Definitions, and Example Assessment Tools or Methods

Implementation Outcome	Traditional Definition (Glasgow et al., 1999; Proctor et al., 2011)	Health Equity Focused Definition (Eslava-Schmalbach et al., 2019; Shelton et al., 2020)	Example Assessment Tool or Method
RE-AIM (Glasgow et al., 1999)			
Reach	Proportion of eligible young adult patients or clients who receive a BI	Proportion of eligible young adults who receive a BI, as well as evaluation of the degree to which young adults are being equitably reached by the BI	Number of young adults who receive BI divided by total number of eligible young adults
Effectiveness	Success rate of the implemented BI with respect to decreased alcohol use and alcohol-related problems among young adults	Evaluation of potential differences in success rate of the implemented BI across young adults as a function of social determinants of health	Pre-post implementation assessment with an alcohol use scale or clinical interview
Adoption	Degree to which providers initiate BI at least once with young adults	Degree to which providers initiate BI with at least one young adult, and whether BI uptake is equitable across treatment settings (e.g. organizations with different resources) and disadvantaged populations	Number of providers who initiate BI with at least one young adult divided by the total number of eligible providers
Implementation/ Fidelity	Degree to which providers are delivering BI as intended with respect to both adherence and skill	Degree to which providers are delivering BI as intended equitably across settings and populations (e.g. as potentially influenced by resources or social determinants of health)	Fidelity checklists assessing BI core components
Sustainability/ Maintenance	Degree to which BI becomes an established part of clinical practice and continues to be used once implementation supports are removed	Degree to which BI becomes an established part of clinical practice equitably across settings, with attention to whether resources are equitably maintained among disadvantaged populations	Measure of reach 6 or more months after removal of active implementation support
Classic Implementation Outcomes (Proctor et al., 2011)			
Acceptability	Degree to which treatment providers and/or patients/ clients are satisfied with the BI intervention and approve of BI implementation in the treatment setting	Degree to which treatment providers, patients/clients from disadvantaged populations, members of the broader community, and other key stakeholders are satisfied with the BI intervention and approve of BI implementation in the treatment setting	Acceptability of Intervention Measure (Weiner et al., 2017)
Appropriateness	Provider or organizational perceptions about whether BI is compatible or fits well with current provider/ organizational practice.	Provider or organizational perceptions about whether BI is compatible or fits well with disadvantaged populations that they serve	Intervention Appropriateness Measure (Weiner et al., 2017)
Costs	Total costs and resources needed to scale up BI in a specific organization or system	Total costs and resources needed to scale up BI in an organization/ system for both disadvantaged and non-disadvantaged populations	Calculation of total dollars and resources mapped to observerable activities required to implement BI (Saldana et al., 2014)
Feasibility	Utility or ease with which providers can use the BI intervention with patients or clients	Utility or ease with which providers can use BI to reduce barriers to treatment and the degree to which BI can be used across settings for disadvantaged populations	Feasibility of Intervention Measure (Weiner et al., 2017)
Penetration/Coverage	Extent to which a BI becomes integrated within a specific organization or system	Extent to which BI can be accessed by disadvantaged populations who may benefit from BI receipt	Number of providers who routinely deliver BI divided by the total number of providers trained in BI

Note: Three of the classic implementation outcomes - adoption, sustainability, and fidelity - overlap with the RE-AIM outcomes and are listed in the RE-AIM section of the table.