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ORIGINAL PAPER

Implementation Matters: A Review of Research on the Influence of Implementation on Program Outcomes and the Factors Affecting Implementation

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Abstract The first purpose of this review was to assess the impact of implementation on program outcomes, and the second purpose was to identify factors affecting the implementation process. Results from over quantitative 500 studies offered strong empirical support to the conclusion that the level of implementation affects the outcomes obtained in promotion and prevention programs. Findings from 81 additional reports indicate there are at least 23 contextual factors that influence implementation. The implementation process is affected by variables related to communities, providers and innovations, and aspects of the prevention delivery system (i.e., organizational functioning) and the prevention support system (i.e., training and technical assistance). The collection of implementation data is an essential feature of program evaluations, and more information is needed on which and how various factors influence implementation in different community settings.

Keywords Implementation · Youth programs · Prevention · Health promotion

Introduction

"Build a better mousetrap and the world will beat a path to your door." While this dictum from the business world sounds challenging enough, the ultimate extent to which a better product will maximize its market share is dependent on a host of related developments. New consumers must learn about the product's existence and potential benefit, decide to buy the product, use it effectively, and continue its use if it works as intended and the need persists. This total process is known as diffusion or technology transfer and can refer to the spread of new ideas, technologies, manufactured products such as mousetraps, and evidence-based promotion, prevention or treatment programs (Rogers 2003).

For example, social scientists recognize that developing effective interventions is only the first step toward improving the health and well-being of populations. Transferring effective programs into real world settings and maintaining them there is a complicated, long-term process that requires dealing effectively with the successive, complex phases of program diffusion. These phases include how well information about a program's existence and value is supplied to communities (dissemination[1]), whether a local organization or group decides to try the new program (adoption), how well the program is conducted during a trial period (implementation), and whether the program is maintained over time (sustainability). Moreover, if many people are to benefit, diffusion must be successful in multiple communities, and at each stage of the process, from dissemination through sustainability.

Unfortunately, research indicates that the diffusion of effective interventions typically yields diminishing returns as the process enfolds. For many reasons, information about effective interventions does not adequately reach many communities. When it does, only some in the community become motivated to try something new. Many innovations encounter implementation problems that

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[1] We use the term dissemination to refer to the first of Roger's stages of diffusion although some apply the term to multiple stages of the diffusion process.

diminish a program's impact. Finally, only a relatively few interventions are sustained over time, regardless of their success achieved during a demonstration period (Rogers 2003).

The Need to Understand Implementation

The current paper focuses on the implementation stage of the diffusion process. It is important that the potential value of new interventions is adequately tested, and this is impossible without attending carefully to the process of implementation. Assessment of implementation is essential for assessing the internal and external validity of interventions. For example, accurate interpretation of outcomes depends on knowing what aspects of the intervention were delivered and how well they were conducted. Negative results can occur if the program is not implemented sufficiently, or positive impact can be achieved through an innovation that, in practice, was very different from what was intended. Valid judgments about the value of the original program would not be possible in either situation. Implementation data are also important in testing the theory behind an innovation. Theories about the crucial importance of different intervention components cannot be assessed without ascertaining that these components were effectively administered. Furthermore, early monitoring of implementation can identify problems in program application that can be corrected quickly to ensure better outcomes.

Although many authors would agree that implementation influences the outcomes of promotion and prevention programs, the relevant literature has not been completely examined. For example, Dane and Schneider (1998) found that only 39 of 162 (24%) of published mental health prevention studies appearing between 1980 and 1994 described any steps that were taken to document implementation, and of these 39, only 13 assessed if implementation affected outcomes. Durlak (1997) reported that less than 5% of the 1,200 prevention studies appearing by the end of 1995 in mental and physical health and education provided any data on program implementation. Later, Durlak (1998) described the results of 11 representative investigations that related implementation to outcomes. Dusenbury et al. (2003a) examined several hundred outcome studies covering a 25-year period of drug prevention research but briefly summarized data from only nine reports providing information on the relationship between implementation and outcomes. Finally, in their review of 32 evidence-based mental health prevention programs, Domitrovich and Greenberg (2000) noted that only 13 studies conducted analyses relating implementation to outcomes.

Fortunately, there is now an extensive database that permits a systematic and comprehensive assessment of the literature. The primary purpose of this paper is to examine implementation studies in the field of prevention and promotion targeting children and adolescents to answer two research questions: (1) does implementation affect outcomes, and (2) what factors affect implementation? In addition to addressing these two questions, we also sought to identify gaps that exist in the literature and discuss the major implications of current research findings.

We hypothesized there would be credible and consistent evidence across programs that implementation was a significant influence on outcomes. Assuming this hypothesis would be confirmed, we developed an ecological framework adapted from previous authors, and hypothesized that a literature review would confirm that factors affecting implementation would reside in four major categories. The ecological framework is explained in a later section when the relevant data are evaluated.

Because answering the second research question is dependent on a positive answer to the first question, this article is organized as followed. First, we define different aspects of implementation and then describe the methods used in searching for studies relevant to both research questions. Then we review the findings on the relationship between implementation and outcomes before discussing the findings regarding which factors affect implementation. In the latter section, we indicate how our model of implementation fits with the Interactive Systems Framework for Dissemination and Implementation (ISF) (Wandersman et al. 2008) guiding this special issue. Lastly, a research agenda for future work on implementation is presented.

Defining Key Terms

Our primary interest was interventions conducted in real world settings by non-researchers. We use the term *provider* to designate the non-research staff of community-based organizations who implement the new intervention (e.g., the staff in schools, health clinics, or community coalitions). We use the terms *program*, *innovation*, and *intervention* interchangeably in reference to newly introduced promotion and preventive approaches. Evaluating the implementation literature presents a challenge due to the lack of consensus regarding a standardized vocabulary and set of operational definitions of relevant terms. Therefore, as we define major variables, some alternate terms used by others are presented in parentheses. Although these alternate terms can have other meanings depending on a specific context, they are often consistent with our definitions.

What is Implementation?

In general, implementation refers to what a program consists of when it is delivered in a particular setting. There are eight different aspects to implementation, and Dane and Schneider (1998) described five of these. (1) There is fidelity, which is the extent to which the innovation corresponds to the originally intended program (a k a adherence, compliance, integrity, faithful replication). (2) There is dosage, which refers to how much of the original program has been delivered (quantity, intervention strength). (3) Quality refers to how well different program components have been conducted (e.g., are the main program elements delivered clearly and correctly?). (4) Participant responsiveness refers to the degree to which the program stimulates the interest or holds the attention of participants (e.g., are students attentive during program lessons?). (5) Program differentiation involves the extent to which a program's theory and practices can be distinguished from other programs (program uniqueness). The latter two aspects of implementation have not received much research attention, and are not evaluated here, but see Hogue et al. (2005), and Hansen and McNeal (1999) for examples.

There are three additional aspects of implementation worthy of attention. These include (6) the monitoring of control/comparison conditions, which involves describing the nature and amount of services received by members of these groups (treatment contamination, usual care, alternative services). (7) Program reach (participation rates, program scope) refers to the rate of involvement and representativeness of program participants. Finally, there is adaptation, (8) which refers to changes made in the original program during implementation (program modification, reinvention).

Monitoring of comparison groups is important. It is often assumed incorrectly that controls do not receive any services, but this is almost never the case in school-based studies (Durlak 1985). For example, several authors who have examined the issue have found that many individuals in their no-intervention control condition received some alternative services (Abbott et al. 1998; Ary et al. 1990; Basch et al. 1985; Elder et al. 1996; Kendrick et al. 1995; Kerr et al. 1985). Child psychotherapy studies in which alternate conditions have received treatment have yielded mean effect sizes half as large in magnitude as those produced in true treatment versus control designs (Kazdin et al. 1990). Similar findings are likely in promotion and prevention studies. As a result, the monitoring of comparison groups would provide a more accurate view of the value of a new intervention.

Reach is different from participant responsiveness because the former is concerned with questions relating to the percentage of the eligible population who took part in the intervention, and their characteristics. A new program may not attract as many or the same types of participants as the original program. For example, a prevention program potentially suitable for all parents in a diverse community may only attract and retain less than 5% of eligible parents, almost all of whom are Caucasian and members of the upper socioeconomic classes. Finally, the inclusion of adaptation as an aspect of implementation might surprise some readers, but data presented later indicate why adaptation deserves study as a part of implementation. The different aspects of implementation are related, but can be separated for study, and we were interested in the extent to which this occurred in the studies reviewed here.

Method

Literature Search Procedures

The same three search strategies were used to locate published and unpublished studies relevant to both research questions. First, computer searches were conducted of PyscInfo, MEDLINE, and *Dissertation Abstracts* using a variety of search terms. Second, the references from several reviews were examined (e.g., Dane and Schneider 1998; Domitrivich and Greenberg 2000; Durlak 1998; Dusenbury et al. 2003a), and the citations from each included individual report were also inspected. Third, we conducted manual searches of the past 5 years of several journals that had published relevant articles.[2]

The primary focus was on prevention and health promotion programs for children and adolescents related to the following topics: physical health and development, academic performance, drug use, and various social and mental health issues such as violence, bullying, and positive youth development. The literature review began in 1976 when research on implementation first began appearing with any frequency, and ended on December 31, 2006. Only reports in English were included.

We included quantitative and qualitative investigations, but used them for different purposes.[3] Because there were a sufficient number of reports, only quantitative investigations were used to examine the first research question pertaining to the influence of implementation on outcomes. Studies with control groups and one-group pre-post designs

[2] These journals included *American Journal of Community Psychology, Health Education and Behavior, Health Education Research, Journal of Community Psychology, Journal of Primary Prevention*, and *Prevention Science.*

[3] We refer here to traditional distinctions regarding what type of data were collected and how the data were analyzed. Several studies combined qualitative and quantitative methods.

were included. Both quantitative and qualitative studies were used to identify factors affecting implementation, and for this area we also included the commentaries of several authors based on their extensive research or field experiences (e.g., Elias et al. 2003; Hogan et al. 2003; Kealey et al. 2000; Mihalic et al. 2004; Scheirer, 2005; Wolff, 2001).

Results

Research Question # 1: Does Implementation Influence Program Outcomes?

Overall, we located reports on 542 relevant interventions. There were 483 studies summarized in five meta-analyses and 59 additional studies assessing the impact of implementation on outcomes. The meta-analytic findings are discussed first followed by the data from the additional quantitative reports

Findings from Meta-analyses

There are five meta-analyses containing information on the impact of implementation on outcomes. The primary studies in these reviews vary in terms of how they report on implementation. For example, in a review of 59 mentoring studies, DuBois et al. (2002) found programs that monitored implementation obtained effect sizes three times larger than programs that reported no monitoring (mean effects of 0.18 vs. 0.06, respectively). Similarly, Smith et al. (2004) reported that although 14 whole-school anti-bullying programs obtained modest effects overall, those that monitored implementation obtained twice the mean effects on self-reported rates of bullying and victimization than those that did not monitor implementation.

Tobler (1986) reported that 29% of the outcomes derived from 143 drug prevention studies were drawn from interventions that were improperly implemented, and comparisons suggested that well-implemented programs achieved effect sizes 0.34 greater than poorly implemented programs. In the largest relevant meta-analysis, Wilson et al. (2003) reviewed 221 school-based prevention programs targeting aggressive behaviors. A regression analysis indicated that implementation was the second most important variable overall, and the most important program feature that influenced outcomes.[4]

A fifth meta-analysis took an innovative approach in evaluating the impact of implementation. Derzon et al. (2005) assessed findings from 46 unpublished drug prevention programs funded by SAMHSA. The initial outcome data were discouraging: the mean effect size on drug use from the 46 sites was only 0.02, and not statistically significant. Furthermore, 21 of the 46 sites produced negative effect sizes, indicating that comparison youth had less drug use at post than program participants. However, Derzon and colleagues (2005) found that three factors with the strongest effects on outcomes were related to implementation. Two of these involved the implementation of the intervention (i.e., the degree to which program objectives and procedures were put into everyday practice, and the intensity of program delivery) and the third factor related to the control groups (i.e., the, exposure of the control students to alternative drug prevention services).[5]

Derzon and colleagues (2005) were then interested in how effective programs could be if data were adjusted to optimize the influence of these three factors, and they used regression procedures to re-estimate study outcomes. In other words, what would the results be if controls received no alternative services and if programs were implemented consistently and with sufficient intensity? The results of their synthetic projections were dramatic. Mean effects for the 46 programs rose from 0.02 to 0.24, reached statistical significance, and only one program now had a negative effect size. In other words, if issues related to implementation of the intervention and the receipt of services by control groups could be controlled, the programs would have been 12 times more effective!

On the one hand, the results of the above meta-analyses are consistent in indicating the influence of implementation on outcomes. The overall magnitude of the difference favoring programs with apparently better as opposed to poorer implementation is profound, and has resulted in mean effect sizes that are two to three times higher, and, under ideal circumstances, may be up to 12 times higher (Derzon et al. 2005). Such findings offer strong support to the conclusion that implementation influences outcomes.

On the other hand, the meta-analytic findings are limited by the data contained in the original reports. Meta-analysts have had to depend on original authors' general comments relating to the monitoring of implementation, or if implementation problems occurred. Furthermore, the nature and extent of these problems, and the actual level of imple-

[4] The risk status of students was the most important factor; i.e., students selected for intervention because of their early aggressive behavior improved the most.

[5] A fourth factor, gender of the participants, was also related to program outcomes but was not included in their subsequent analyses.

mentation achieved in studies were not reported frequently enough to be examined. Fortunately, data are available from additional studies that provide more specific information on implementation and its effect on outcomes. These studies are evaluated next.

Additional Studies Linking Implementation to Outcomes

Researchers have analyzed implementation data in two major ways: (1) categorically, by creating groups of providers who differ in their level of implementation (e.g., low versus high implementation groups); or (2) by assessing implementation in a continuous fashion (e.g., by using percentages to assess the level of dosage or fidelity achieved). In the former case, investigators usually report if statistically significant or different outcomes were achieved for different implementation groups, or they compare outcomes for implementation groups and controls (e.g., Botvin et al. 1989; Gottfredson et al. 1993). In the second situation, the level of implementation is correlated with outcomes (e.g., Abbott et al. 1998). Both strategies have tended to find a relationship between implementation and outcomes, but the second approach has more statistical power. In either case, the full range of implementation data should always be reported. Designations of "low," or "high," implementation are arbitrary, and have reference only to locally obtained data; what is "high" in one study may not be "high" in another.

Table 1 summarizes the findings from 59 additional studies and identifies what aspect of implementation was assessed in each study, how it was assessed, and with what results. In 76% of the studies (45 of 59), there was a significant positive relationship between the level of implementation and at least half of all program outcomes. Moreover, minimal variability in implementation levels could be an explanation for the weak or null results obtained in 8 of the remaining 14 studies (e.g., Basch et al. 1985; Cho et al. 2005; Elias et al. 1986; Hopkins et al. 1988; Komro et al. 2006; Resnicow et al. 1998a, b; Spoth et al. 2002, both studies). If levels of implementation are all very high or very low across groups or sites, the lack of variability does not provide much power in detecting any between-group differences. In the former case, all participants might have received an effective level of implementation so that their outcomes should be similar; in the latter case, implementation might be too low to yield expected benefits for any group. Overall, findings from the studies in Table 1 provide additional support for the relationship between implementation and outcomes. A majority of studies have found that higher levels of implementation lead to better outcomes.

The largest group of studies in Table 1 evaluated fidelity ($n = 37$), while 29 assessed dosage; fewer monitored any of the other aspects of implementation such as quality or program reach. It is noteworthy that the three studies that assessed adaptation all found a positive effect for adaptation on program outcomes (Blakely et al. 1987; Kerr et al. 1985; McGraw et al. 1996). The majority of studies ($n = 41$, or 69%) assessed only one aspect of implementation, but 18 (31%) evaluated at least two aspects such as fidelity and dosage (e.g., McGraw et al. 1996), or dosage and quality (Bush et al. 1989).

Assessment of Implementation

The two primary methods of assessing implementation have been provider self-reports and independent behavioral observations. Most of the latter studies have documented the reliability of their observational procedures, but studies relying on self-reports typically have not. There are some indications, however, that observational data are more likely to be linked to outcomes than self-report data (e.g., Hansen et al. 1991; Lillehoj et al. 2004; Resnicow et al. 1998a, b), but few studies have directly compared these two strategies. Because observational data are more objective, it seems preferable to use such information for implementation analyses, if it is realistic to do so. Regardless of the methodology, periodic spot checks of implementation can help identify providers who might be struggling with executing parts of the intervention. Several authors have indicated this might occur with the more difficult sections of interventions (Botvin et al. 1990; Hahn et al. 2002; Kallestad and Olweus 2003).

Other Notable Findings

There are two other notable findings from implementation studies that are not apparent in Table 1.

1. Expecting perfect or near-perfect implementation is unrealistic. Positive results have often been obtained with levels around 60%; few studies have attained levels greater than 80%. No study has documented 100% implementation for all providers. This point is important in light of program adaptation, which is discussed later.
2. There is marked variability in implementation achieved across providers within the same study. The range of implementation data has been as high as 87% when comparing the lowest and highest

Table 1 Characteristics and findings for studies assessing the impact of implementation on program outcome

Study	General area	Implementation features		Method of assessing implementation	Data treated categorically or continuously	Proportion of outcomes affected by implementation
		# Of Measures	Aspect of Implementation			
Abbott et al. (1998)	Academic & mental health	1	Fidelity	Observation	Continuous	3 of 4
Aber et al. (1998)	Mental Health	1	Dosage	Self-report	Categorical	3 of 5
August et al. (2006)	Academic & mental health	3	Fidelity, quality, & program reach	Self-report & observation	Categorical	Child component: 4 of 6 Parent component: 3 of 6
August et al. (2003a)	Academic & mental health	1	Dosage	Attendance figures	Continuous	Child component: 2 of 3 Parent component: 1 of 3
August et al. (2003b)	Academic & mental health	2	Dosage & program reach	Attendance figures	Continuous	2 of 8
Basch et al. (1985)	Physical health promotion	3	Dosage	Self-report	Categorical	0 of 1
Battistisch et al. (2000)	Academic & mental health	1	Fidelity	Self-report & Observation	Categorical	4 of 8
Battistisch et al. (2004)	Academic & mental health	1	Fidelity	Self-report	Categorical	20 of 40
Bell et al. (2005)	Alcohol use prevention	1	Dosage	Objective records	Continuous	6 of 8
Blakely et al. (1987)	Academic achievement & criminal justice	2	Fidelity & adaptation	Interviews & observation	Continuous	1 of 1
Botvin et al. (1995)	Substance abuse prevention	1	Dosage	Observation	Categorical	1 of 2
Botvin et al. (1990)	Substance abuse prevention	1	Dosage	Observation	Categorical	5 of 5
Botvin et al. (1990)	Substance abuse prevention	1	Fidelity	Observation	Categorical	6 of 7 for females
Botvin et al. (1992)	Substance abuse prevention	1	Dosage	Observation	Categorical	1 of 1
Botvin et al. (1989)	Tobacco use prevention	2	Dosage & quality	Observation	Categorical	8 of 16
Bush et al. (1989)	Physical health promotion	2	Dosage & quality	Observation	Continuous	3 of 10
Cho et al. (2005)	Social skills	1	Fidelity	Self-report, observation & student feedback	Continuous	0 of 5
Conduct Problems Prevention Research Group (1999)	Mental health	2	Dosage & fidelity	Self-report & observation	Continuous	Dosage: 1 of 3 Fidelity: 2 of 3
Cook et al. (1999)	Mental health	2	Fidelity & dosage	Self-report	Categorical	Fidelity: 10 of 22 Quantity: 1 of 22
Cook et al. (2000)	Mental health	1	Fidelity	Self-report	Categorical	7 of 18

Table 1 continued

Study	General area	Implementation features		Method of assessing implementation	Data treated categorically or continuously	Proportion of outcomes affected by implementation
		# Of Measures	Aspect of Implementation			
Dubas et al. (1998)	Substance abuse prevention	1	Fidelity	Observation	Continuous	1 of 1
Elias et al. (1986)	Mental health	1	Fidelity	Self-report	Categorical	0 of 5
Felner et al. (1997)	Academic & mental health	1	Fidelity	Self-report	Categorical	3 of 3
Forgatch et al. (2005)	Mental health	1	Fidelity	Observation	Continuous	2 of 2
Fors and Doster (1985)	Physical health promotion	1	Dosage & fidelity	Self-report	Categorical	4 of 4
Gottfredson, Gottfredson, and Hybl (1993)	Mental health	1	Fidelity	Self-report & Observation	Categorical	12 of 13
Greenwood et al. (2003)	Academic achievement	1	Fidelity	Observation	Continuous	2 of 2
Greenwood et al. (1992)	Academic achievement	1	Fidelity	Self-report	Continuous	1 of 1
Hansen et al. (1991)	Alcohol use prevention	2	Fidelity	Self-report	Categorical	2 of 7, 3 of 7
Harachi et al. (1999)	Mental health	1	Fidelity	Observation	Continuous	3 of 4
Hopkins et al. (1988)	Substance abuse prevention	1	Dosage	Self-report	Categorical	9 of 91
Hopper et al. (1996)	Physical health promotion	1	Program reach	Attendance logs	Continuous	2 of 8
Ialongo et al. (1999)	Family School Innovation	1	Program reach	Self-report	Categorical	3 of 6
Ialongo et al. (1999)	Mental health	1	Fidelity	Self-report & Observation	Categorical	4 of 6
James et al. (2006)	HIV/AIDS prevention	1	Dosage	Self-report	Categorical	4 of 6
Kam et al. (2003)	Mental health	1	Fidelity	Observation	Categorical	4 of 4
Kerr et al. (1985)	Academic achievement & mental health	2	Fidelity & adaptation	Observation	Continuous	2 of 2
Komro et al. (2006)	Alcohol use prevention	1	Dosage	Self-report	Categorical	2 of 7
Lapan et al. (2001)	Mental health	1	Fidelity	Self-report	Continuous	5 of 5
Lillehoj et al. (2004)	Substance abuse prevention	2	Dosage	Self-report & observation	Continuous	Self-report: 0 of 3 Observers: 3 of 3
McGraw et al. (1996)	Physical health promotion	3	Fidelity, dosage, & adaptation	Self-report & Observation	Continuous	2 of 3
Moskowitz et al. (1982)	Mental health	1	Dosage	Self-report	Categorical	1 of 14
Noell et al. (1997)	Academic achievement	1	Fidelity	Observation	Continuous	1 of 1
Pentz et al. (1990)	Substance Abuse Prevention	2	Dosage & fidelity	Self- report & observation	Categorical	3 of 3
Resnicow et al. (1992)	Physical health promotion	2	Dosage & quality	Self-report & observation	Categorical	4 of 7
Resnicow et al. (1998a, b)	Physical health promotion	4	Dosage & fidelity	Self-report & observation	Continuous	Self-report 0 of 3 Observations 2 of 3

Table 1 continued

Study	General area	Implementation features		Method of assessing implementation	Data treated categorically or continuously	Proportion of outcomes affected by implementation
		# Of Measures	Aspect of Implementation			
Rohrbach et al. (1993)	Substance abuse prevention	1	Fidelity	Self-report & observation	Categorical	3 of 6
Saunders et al. (2006)	Physical health promotion	2	Fidelity & dosage	Observations, interviews & record review	Categorical	1 of 1
Solomon et al. (2000)	Mental health & academics	1	Fidelity	Observations & self-report	Categorical	14 of 28
Spoth et al. (2002)	Substance abuse prevention	1	Dosage	Observation	Categorical	0 of 1
Spoth et al. (2002)	Substance abuse prevention	1	Dosage	Observation	Categorical	1 of 3
Sterling-Turner et al. (2002)	Mental health	1	Fidelity	Observation	Continuous	1 of 1
Stevens et al. (2001)	Mental health	1	Fidelity	Self-report & interviews	Continuous	1 of 1
Story et al. (2000)	Physical health promotion	3	Dosage, fidelity, & program reach	Parent & teacher self-report & observation,	Categorical	1 of 3
Stotts et al. (2002)	Tobacco use prevention	1	Dosage	Self-report	Categorical	1 of 1
Taggart et al. (1990)	Physical health promotion	2	Dosage & quality	Observation	Continuous	5 of 9
Telzrow et al. (2000)	Mental health	1	Fidelity	Self-report	Continuous	6 of 8
Weisman et al. (2003)	After school	2	Fidelity & quality	Self-report, observation, interviews	Categorical	7 of 7
Gerstenblith et al. (2005)	Deliquency & substance abuse prevention	5	Fidelity & dosage	Interviews, self-report, observation	Continuous	Fidelity: 4 of 5 Dosage: 3 of 5

implementation levels, and 20 to 40% differences between providers or sites are common. Reporting only mean implementation data can easily obscure the fact that some providers are much better at implementation than others.

In sum, the results of 483 studies included in five meta-analyses that look broadly at implementation combined with the results of 59 additional studies with more specific findings clearly indicate that implementation matters. The level of implementation achieved is an important determinant of program outcomes. Achieving good implementation not only increases the chances of program success in statistical terms, but also can lead to much stronger benefits for participants.

Moreover, current research has been conducted across a diverse set of programs, providers, and settings. The literature includes studies of mentoring, after-school programs, drug prevention, and mental and physical health promotion and prevention programs of various types offered in schools, health clinics, and other community agencies. Implementation has been important in all these situations. Therefore, our hypothesis regarding the first research question was confirmed. There is credible and extensive empirical evidence that the level of implementation affects program outcomes.

This conclusion indicates the importance of identifying the factors that affect the implementation process. This research is reviewed next.

Research Question #2: What Factors Affect Implementation?

Before discussing the findings for the second research question, the hypothetical framework tested in this aspect of the literature review is described.

A Framework for Successful Implementation

Wandersman et al. (2008) note that "understanding capacity is central to addressing the gap between research and practice." (p. X, this issue). Capacity is often used in reference to the entire process of diffusion and can be defined as the necessary motivation and ability to identify, select, plan, implement, evaluate, and sustain effective interventions. Our focus was on capacity relative to successful implementation, and we hypothesized that a multilevel ecological perspective was necessary for understanding successful implementation, a view shared by several other authors (Altschuld et al. 1999; Riley et al. 2001; Shediac-Rizkallah and Bone 1998; Wandersman 2003).

Figure 1 depicts how our ecological framework is connected to the Interactive Systems Framework (ISF) presented in this special issue (Wandersman et al. 2008). Our view is that key elements of the Prevention Delivery System related to organizational capacity and two key elements of the Prevention Support System in the form of training and technical assistance lie at the center of effective implementation. Some type of organizational structure is necessary and responsible for guiding the implementation of a new program. This can be a newly created structure in the community (e.g., a community coalition) or an existing community-based agency (e.g., health clinic, hospital, school, or community service center). Therefore, organization capacity is important for successful implementation. However, we do not separate general and innovation-specific capacity, as does the ISF model. Although general and innovation-specific capacity may be distinct theoretically, there were no studies in our review that distinguished between these two elements of organizational functioning. While organizational capacity is important, organizations need support in conducting new interventions successfully, and this support comes primarily through training and technical assistance that is provided by outside parties (i.e., the prevention support system noted in the ISF model).

Most important, an organization's success at implementation will also be dependent on factors present in three other categories that provide an extended ecological context for implementation (i.e., by innovation characteristics, provider characteristics and community factors). Community factors are also noted in the ISF model as contributing to effective dissemination and implementation. The bidirectional arrows in the outer circles of Fig. 1 in our model indicate that variables in these categories can interact with each other and with the prevention delivery and support systems to affect implementation.

In sum, we hypothesized that implementation is influenced by variables present in five categories: innovations, providers, communities, the prevention delivery system (i.e., features related to organizational capacity) and the prevention support system (i.e., training and technical assistance). Under favorable circumstances, variables in all five categories interact and lead to effective implementation, that is, a process for conducting the intervention as planned. What is specifically required for effective

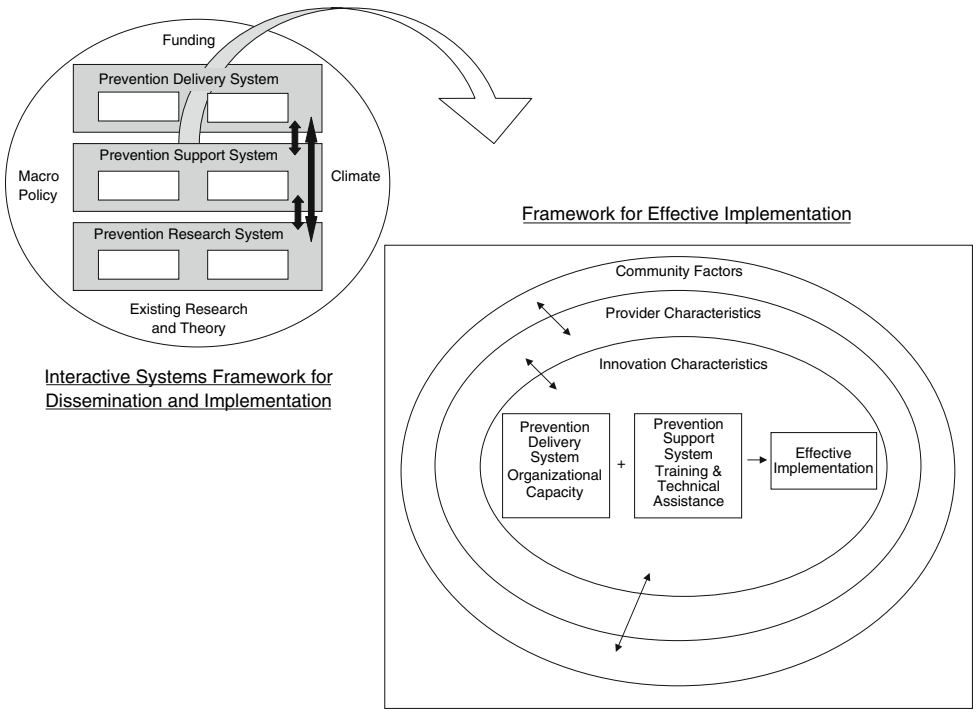

Fig. 1 Ecological framework for understanding effective implementation

implementation, however, depends on a constellation of factors because local contexts differ. Developing sufficient capacity for implementation is essential for helping local providers conduct new programs effectively, and the extent of their success will depend on the interaction of multiple ecological factors that contribute to capacity.

Research has supported the general relationship between capacity and implementation. One research group found that capacity (community readiness) was a significant predictor of the implementation of youth tobacco control programs during a 3-year intervention (Engstrom et al. 2002), and at a 3-year follow-up point (Jason et al. 2004). Similarly, Kegler et al. (1998a) found that the level of capacity achieved through the actions of community coalitions was significantly related to more effective implementation, and others have also reported significant relationships between organizational capacity and more effective implementation (Gingiss et al. 2006; Riley et al. 2001). The following sections attempt to explicate if research supports the conceptual framework depicted in Fig. 1 regarding the major influences that contribute to capacity and thus effective implementation.

Research Findings

We located 81 studies containing quantitative or qualitative data on factors affecting the implementation process. Several studies contained data on more than one factor. Data from these reports offered strong support for our ecological framework for successful implementation. Although we did not predict which factors would be present within each category, the literature review identified 23 factors associated with one of the five categories in our model (Fig. 1).

Table 2 lists the specific factors affecting implementation in these five categories. A factor is listed in Table 2 only if it was related to implementation in at least five articles and if findings were consistent in the more rigorously conducted investigations. For quantitative studies this typically meant the use of larger samples and psychometrically sound assessment procedures; in qualitative reports this generally meant the use of multiple as opposed to single case studies, prospective rather than retrospective designs, and multiple versus single methods of data collection. Once again, we indicate alternate terminology that occurs across reports for similar constructs. Table 2 is not a comprehensive listing of all potentially relevant factors, because results based on less than five studies were not included.

Space does not permit an extended discussion of all the factors in Table 2. We selectively discuss a few factors below and instead emphasize the likely interactions that occur among factors, particularly across categories, which illustrate how an ecological perspective is essential for understanding successful implementation.

Community Level Factors

The community context in which a program will be conducted must be considered and the important community factors identified in the literature are the prevention research system, politics, funding, and policy. Findings from prevention science should provide the basic information for dissemination to communities, and new findings appear all the time. Several groups and federal agencies have developed web sites and other means of disseminating information about prevention to the general public (see Chinman et al. 2005). Politics can help or hurt implementation. For example, school staff pressured by the superintendent's office to offer new programs often do not implement them very effectively, probably because they do not become committed to the intervention (Berman and McLaughlin 1976). Policies such as No Child Left Behind might enhance or impede implementation depending on the extent to which a new program is perceived as impacting students' academic performance. Funding is a necessary but insufficient condition for effective implementation, although many funders do not provide sufficient time or money for implementation. Finally, social policy is important for institutionalizing new procedures and practices, and supporting an administrative and financial infrastructure.

Provider Characteristics

The four provider characteristics most consistently related to implementation involve perceptions related to the need for, and potential benefits of the innovation, self-efficacy, and skill proficiency. Providers who recognize a specific need for the innovation, believe the innovation will produce desired benefits, feel more confident in their ability to do what is expected (self-efficacy), and have the requisite skills are more likely to implement a program at higher levels of dosage or fidelity (e.g., Barr et al. 2002; Cooke 2000; Kallestad and Olweus 2003; Ringwalt et al. 2003).

Innovation Characteristics

Two innovation characteristics consistently related to implementation are adaptability (flexibility) and compatibility (contextual appropriateness, fit, match, congruence; Berman and McLaughlin 1976; Gottfredson and Gottfredson 2002; Mihalic et al. 2004; Richard et al. 2004; Riley et al. 2001; Rogers 2003). The former indicates that programs that can be modified to fit the needs of providers,

Table 2 Factors affecting the implementation process

I. Community Level Factors

A. Prevention Theory and Research[c]

B. Politics[a,b]

C. Funding[a,b,c]

D. Policy[a,b]

II. Provider Characteristics

A. Perceived Need for Innovation[b,c]

Extent to which the proposed innovation is relevant to local needs

B. Perceived Benefits of Innovation[b]

Extent to which the innovation will achieve benefits desired at the local level

C. Self-efficacy

Extent to which providers feel they are will be able to do what is expected

D. Skill Proficiency[a,b,c]

Possession of the skills necessary for implementation

III. Characteristics of the Innovation

A. Compatibility (contextual appropriateness, fit, congruence, match)[b,c]

Extent to which the intervention fits with an organization's mission, priorities, and values.

B. Adaptability (program modification, reinvention)[b]

The extent to which the proposed program can be modified to fit provider preferences, organizational practices, and community needs, values, and cultural norms

IV. Factors Relevant to the Prevention Delivery System: Organizational Capacity

A. General Organizational Factors

1. Positive Work Climate[a,b,c]

Climate may be assessed by sampling employees' views about morale, trust, collegiality, and methods of resolving disagreements

2. Organizational norms regarding change (a k a, openness to change, innovativeness, risk-taking)[b]

This refers to the collective reputation and norms held by an organization in relation to its willingness to try new approaches as opposed to maintaining the status quo

3. Integration of new programming[b,c]

This refers to the extent to which an organization can incorporate an innovation into its existing practices and routines

4. Shared vision (shared mission, consensus, commitment, staff buy-in)[b]

This refers to the extent to which organizational members are united regarding the value and purpose of the innovation

B. Specific Practices and Processes

1. Shared decision-making (local input, community participation or involvement, local ownership, collaboration)[a,b,c]

The extent to which relevant parties (e.g., providers, administrators, researchers, and community members) collaborate in determining what will be implemented and how

2. Coordination with other agencies (partnerships, networking, intersector alliances, multidisciplinary linkages)[a,b,c]

The extent to which there is cooperation and collaboration among local agencies that can bring different perspectives, skills, and resources to bear on program implementation

3. Communication[b]

Effective mechanisms encouraging frequent and open communication

4. Formulation of tasks (workgroups, teams, formalization, internal functioning, effective human resource management)[a,b,c]

Procedures that enhance strategic planning and contain clear roles and responsibilities relative to task accomplishments

C. Specific Staffing Considerations

1. Leadership[a,b,c]

Leadership is important in many respects, for example, in terms of setting priorities, establishing consensus, offering incentives, and managing the overall process of implementation

2. Program champion (internal advocate)[a,b,c]

An individual who is trusted and respected by staff and administrators, and who can rally and maintain support for the innovation, and negotiate solutions to problems that develop

3. Managerial/supervisory/administrative support[a,b,c]

Extent to which top management and immediate supervisors clearly support and encourage providers during implementation

Table 2 continued

V. Factors Related to the Prevention Support System
A. Training[a,b,c]
Approaches to insure provider proficiencies in the skills necessary to conduct the intervention and to enhance providers' sense of self-efficacy
B. Technical Assistance[a, b, c]
This refers to the combination of resources offered to providers once implementation begins, and may include retraining in certain skills, training of new staff, emotional support, and mechanisms to promote local problem solving efforts

[a] Factors also identified by Fixsen et al. (2005)

[b] Factors also identified by Greenhalgh et al. (2005)

[c] Factors also identified by Stith et al. (2006)

Note. A detailed listing of the studies supporting the importance of each factor is available from the first author on request

organizations and communities have a better chance of stronger implementation than those that must be conducted "as is." The latter characteristic suggests that providers and organizations implement new programs more effectively to the extent they fit with the organization's current mission, priorities, and existing practices.

The Prevention Delivery System: Factors Related to Organizational Capacity

There are several ways to describe factors related to organizational capacity. The variables identified in our literature review fit best into three categories: general organizational features, specific organizational practices and processes, and specific staffing considerations. Early diffusion research characterized individuals who were among the first to adopt innovations as adventuresome, open to change, and innovative (Rogers 2003), and these descriptions apply as well to organizations. Innovative organizations cultivate an atmosphere conducive to trying new approaches. Effective leadership is crucial to implementation, and the existence of at least one program champion has long been recognized as a valuable resource to encourage innovation. Program champions, particularly those who are highly placed in an organization and have the respect of other staff, can do much to help orchestrate an innovation through the entire diffusion process from adoption to sustainability.

An important organizational practice supporting implementation in several studies is shared decision-making (i.e., collaboration, community involvement or participation, local input, local ownership). Situations in which shared decision-making occurs among providers, researchers, administrators, and community members has consistently led to better implementation (e.g., Berman and McLaughlin 1976; Cooke 2000; Kegler and Wyatt 2003; McCormick et al. 1994; Mihalic et al. 2004; Riley et al. 2003). Ideally, this collaborative process is characterized by nonhierarchical relationships among participants, mutual trust and open communication, shared responsibilities for completing important tasks, and efforts to reach consensus when disagreements or stalemates arise. Moreover, other data indicate that shared decision-making also predicts program sustainability (Hahn et al. 2005). "The literature overwhelmingly shows a positive relationship between community participation and sustainability" (Shediac-Rizkallah and Bone 1998; p. 103). In other words, an effective program is more likely to be better implemented and then remain in a setting when collaborative methods have been used to determine what type of program should be conducted in the first place. As a result, the importance of encouraging local input into new programming cannot be underestimated.

The Prevention Delivery System: Training and Technical Assistance

The two features of the prevention delivery system that have received the most attention and empirical support (from over 20 studies) are training and technical assistance (TA) (e.g., Allison et al. 1990; Barr et al. 2002; Basen-Engquist et al. 1994; McCormick et al. 1994; Perry et al. 1990). Ideally, training and TA occur after necessary resources related to time, staff, administrative, and financial support have been secured, and other factors are positively disposed toward implementation (shared vision, shared decision-making, effective leadership and support, and so on).

In general, the goals of training are to prepare providers effectively for their new tasks, but this means training should not only help providers develop mastery in specific intervention skills, but also attend to their expectations, motivation, and sense of self-efficacy, because the latter can affect their future performance in and support of the new innovation. Research indicates that active forms of learning promote skill acquisition. Training that includes modeling followed by role playing and performance feedback offered in a supportive emotional atmosphere has

been successful in many studies (e.g., Dufrene et al. 2005; Sterling-Turner et al. 2002).

In general, TA refers to the resources offered to providers once the intervention begins. The goals of TA are to maintain providers' motivation and commitment, improve their skills levels where needed, and support local problem solving efforts. Depending on the situation, TA may include some combination of re-training of initial providers, training of new staff, and providing emotional support. Early monitoring of implementation followed promptly by retraining has doubled the fidelity of implementation to over 85% for providers who were having initial difficulties (DuFrene et al. 2005; Greenwood et al. 2003). Staff turnover can jeopardize implementation so contingencies for training new staff should be made. If collaboration and shared decision-making have characterized the diffusion process from the beginning, then providers should have fewer doubts about their competence, and will be able to find solutions to implementation roadblocks.

Relationships Among Factors

Most investigators have assessed factors affecting implementation in an isolated fashion by focusing on only a few variables at a time. This is understandable because researchers cannot study everything at once. Table 2 thus presents a complicated array of at least 23 contextual factors that merit attention in future research. However, this list will likely be reduced over time through further research because there appears to be considerable overlap among these factors.

The two innovation characteristics listed in Table 2 (i.e., adaptability and compatibility) are related to each other, and to the integration of new programming into an organization. The more compatible and adaptable a program is, the more it can be incorporated into an organization's procedures.[6] Shared decision-making regarding program implementation also relates to the above three factors because mutual input into programming decisions often involves issues related to compatibility, adaptability, and integration into existing practices. Similarly, among the staff variables in Table 2, in some cases, the functions related to leadership, a program champion, and a supportive supervisor could be supplied by the same person, so these variables may or may not be separate depending on the circumstances.

[6] Based on their pioneering survey of school-based implementation, Berman and McLaughlin (1976) were the first to stress the importance of mutual adaptation, that is, the organization should adapt to the innovation at the same time as the innovation is adapted to fit the organization. To our knowledge, the extent to which this has occurred during the diffusion of prevention or promotion programs has not been assessed.

A few studies have begun to assess the relative influence of different factors on implementation, or the possible interactions that occur among contextual factors. Such studies offer useful directions for future research. For example, a regression analysis indicated that training and providers' sense of self-efficacy emerged as significant predictors of the implementation of an arson prevention program for children, whereas technical assistance and intervention complexity did not (Henderson et al. 2006). Kallestad and Olweus (2003) studied the implementation of school-wide anti-bulling programs in Norway. Using multilevel modeling techniques, these authors reported that both individual and school level variables predicted implementation (e.g., teachers' perception of the problem and their sense of self efficacy, school climate, and leadership in the school regarding anti-bullying). Kam et al. (2003) found a significant main effect for principal support and a significant interaction between principal support and the fidelity of teacher's implementation on student outcomes in a school based mental health program. When both of these factors were high, students improved significantly on all outcomes; when principal support was low, however, several negative changes were observed in students.

Finally, Riley et al. (2001) successfully used a path analytic model to predict nearly half the variance in implementation of Canadian health promotion programs. The findings highlighted the importance of variables such as a shared vision, integration of programming, and partnerships with other agencies. In this study, variables related to funding, staff experience, and managerial support were not part of the final path model predicting implementation. Although it is premature at this point to reach conclusions about which variables are more important in which situation, studies that compare the influence of different variables, particularly those from multiple categories (i.e., at individual, organizational and community levels) are encouraged.

Convergent Evidence from Other Reviews

Three other systematic narrative reviews identifying factors affecting implementation have recently appeared (Greenhalgh et al. 2005; Fixsen et al. 2005; Stith et al. 2006). We did not examine these other sources until our review was completed in order to assess how much correspondence existed between the results of these other reviews and our findings. There are important differences in the types of programs and target populations examined across reviews. Greenhalgh et al. (2005) identified implementation efforts in multiple disciplines (e.g., sociology, communications, marketing, medicine, health promotion, organizational and management development, and manufacturing) that had relevance for the conduct of health care

treatment and prevention programs for all ages. Fixsen et al. (2005) also reviewed various types of innovations for children and adults from multiple research areas (e.g., education, agriculture, business, medicine, and mental health). Finally, Stith et al. (2006) reviewed factors affecting the implementation of prevention programs initiated by community coalitions to combat child abuse and neglect and domestic violence against adults.

Despite the diversity in scope and purpose of these other reviews, the findings are consistent with ours in both general and specific ways. At the general level, each of the other reviews confirms the necessity of a multi level ecological framework for understanding implementation and that such a framework should consider variables related to the characteristics of innovations, communities, and individuals, as well as those associated with the prevention delivery and support systems. Each of these reviews also concludes that factors interact to influence implementation.

Moreover, there is substantial overlap regarding specific factors that affect implementation. For example, 21 of the 23 factors identified in our review were also identified in some fashion by Greenhalgh et al. (2005), 13 were noted by Fixsen et al. (2005), and 15 were noted by Stith et al. (2006). The correspondence between the results of our review and the others is identified by superscripts next to each factor in Table 2.

Furthermore, all four reviews (including ours) agreed on the importance of 11 factors. These consisted of funding, a positive work climate, shared decision-making, co-ordination with other agencies, formulation of tasks, leadership, program champions, administrative support, providers' skill proficiency, training, and technical assistance.

At the same time, some reviews mentioned additional factors such as the importance of having: (a) an accurate monitoring and feedback system in place as implementation enfolds (Greenhalgh et al. 2005; Fixsen et al. 2005), and, (b) an infrastructure that provides incentives supporting the work of individuals whose specific job and responsibilities relate to program implementation (Fixsen et al. 2005). The latter observation suggests that new career paths might become established and be appealing to those who are particularly interested in bridging the research to practice gap by devoting their attention to the effective diffusion of evidence-based programs. A coordinated infrastructure to support evidence-based prevention and promotion efforts is emphasized in the ISF model (Wandersman et al. 2007).

When independent researchers use different methods to examine different literatures, but nevertheless reach similar conclusions, there is good convergent validity to the common findings. In sum, convergent evidence obtained from several fields confirms that implementation is a complex developmental process that can be affected by a multiple array of interacting ecological factors present at the individual, organizational and community level. The specific factors as noted above that have been identified as important to implementation across research areas and disciplines bear particular scrutiny.

Discussion

The first major purpose of this review was to evaluate research on the hypothesized relationship between implementation and program outcomes. Findings offered strong support for the premise that effective implementation is associated with better outcomes. Data from nearly 500 studies evaluated in five meta-analyses indicates that the magnitude of mean effect sizes are at least two to three times higher when programs are carefully implemented and free from serious implementation problems than when these circumstances are not present. Data from 59 additional quantitative studies confirms that higher levels of implementation are often associated with better outcomes, particularly when fidelity or dosage is assessed. Implementation has been important in research conducted on a wide variety of programs, providers, community settings, and outcomes. In sum, there is extensive and persuasive evidence that confirms the powerful impact of implementation on outcomes. A major implication emanating from these findings is that the assessment of implementation is an absolute necessity in program evaluations. Evaluations that lack carefully collected information on implementation are flawed and incomplete. Without data on implementation, research cannot document precisely what program was conducted, or how outcome data should be interpreted.

The second purpose of this review was to identify factors that influence the implementation process. Guided by an ecological framework, the hypothesis was supported that factors affecting implementation are present in five categories. These categories consist of characteristics of innovations, individuals and communities, and features associated with the prevention delivery and support systems. The latter three categories are explicit parts of the ISF model. Overall, 23 relevant factors were identified and support the conclusion that contextual factors must be considered when innovations are implemented in real world settings. Reviews conducted on other literatures confirm the importance of many of the specific factors that we identified.

The finding that shared decision-making (community participation, collaboration) enhances implementation is consistent with a prominent principle in community psychology: empowering community members can be an effective way to solve local problems. Shared decision-making empowers individuals to exercise some control

over local services and recognizes the importance of matching program delivery to local needs, preferences, and cultural norms. As a result, community ownership of a program should be promoted. Moreover, as previously noted, community participation increases the likelihood that effective programs will be sustained (Shediac-Rizollah and Bone 1998).

Finding the Right Mix of Fidelity and Adaptation

The important role that adaptation can play in program implementation might be the most provocative finding of this review, and deserves extended discussion. There has been substantial debate about whether new interventions should be implemented with maximum fidelity or whether adaptation (reinvention) should be permitted or encouraged to suit local needs and preferences (see Backer 2002; Blakely et al. 1987). A high level of fidelity is possible under favorable circumstances (Fagan and Milhalic 2003). Some interventions are more conducive to fidelity because they are highly structured and have accompanying detailed manuals or lesson plans, but many interventions do not have these features.

Current research suggests that fidelity and adaptation frequently co-occur and each can be important to outcomes. That is, providers often replicate some parts of programs but modify others. Several studies in Table 1 indicate that higher levels of fidelity are significantly related to program outcomes. However, fidelity levels do not reach 100%, leaving room for adaptation to have an effect. Several surveys and larger studies of diffusion indicate that providers frequently modify programs during implementation (Berman and McLaughlin 1976; Rogers 2003; Ringwalt et al. 2003). Ringwalt et al. (2003) offered the following observation based on their survey of school-based programs: We can thus say now with confidence that some measure of adaptation is inevitable and that for curriculum developers to oppose it categorically, even for the best of conceptual or empirical reasons, would appear to be futile (p. 387). Unfortunately, most researchers have considered program adaptation as an implementation failure (i.e., a failure to achieve fidelity) and have not assessed its possible contribution to outcomes.

Nevertheless, three quantitative studies have found that adaptations made by providers improved program outcomes (Blakely et al. 1987; McGraw et al. 1996; Kerr et al. 1985). Furthermore, data from several qualitative studies on factors such as program adaptability and shared decision-making suggest that better implementation occurs when providers can make some program adjustments. Actually, this should not come as much of surprise. If providers are knowledgeable about their communities, they should be able to modify a program to make it more effective in a specific context. Researchers can thus learn from local practitioners how to improve interventions, if they carefully measure what is happening during implementation.

A few research groups are beginning to examine how the implementation of theoretically important program components (i.e., active ingredients, core elements, mechanisms of change) relates to outcomes, sometimes with surprisingly results. Mitchell (1983) found that the types of activities performed during a mentoring program were unrelated to outcomes, perhaps because the quality of the relationship formed between mentor and youth was more important. In mentoring, it may be not what you do, but how you do it that counts. A large multi site study found that the implementation of two components of welfare-to-work programs was positively related to outcomes (i.e., quick entry into the workforce, and tailoring intervention procedures to client needs), but a third (close monitoring of clients) was negatively related (Bloom et al. 2003). It is noteworthy that one of the former factors involved program adaptation (i.e., modifying procedures to match each client's needs).

Stevens et al. (2001) reported that the implementation of only two of six components of school-wide anti-bullying programs were significantly related to outcomes, and Telzrow et al. (2000) found significant but modest correlations between the delivery of six of eight presumed core components and outcomes in a school-based program. More research identifying the core components of programs that are related to positive outcomes will help determine which program features should be executed with fidelity and which can be modified to suit local conditions.

In our opinion, the fidelity-adaptation debate is framed inappropriately in either-or terms, and suffers from imprecision in the measurement of important constructs. The prime focus should be on finding the right mix of fidelity and adaptation (*cf.* Backer 2002), and this cannot be determined without measuring each of these dimensions during implementation. Unfortunately, it is unclear in most studies of implementation exactly which components are reproduced faithfully, or exactly how the intervention is being altered in its new context.

It is particularly important to specify the theoretically important components of interventions, and to determine how well these specific components are delivered or altered during implementation. This is because core program components should receive emphasis in terms of fidelity. Other less central program features can be altered to achieve a good ecological fit. Although several authors have stressed the need to identify the core components of interventions and monitor their delivery during implementation (e.g., Backer 2002; Durlak 1998; Dusenbury et al. 2003a; Mowbray et al. 2003), researchers have been

slow to respond, so the active ingredients of most programs are currently unknown.

By the same token, whenever programs are adapted, it is crucial to determine how and to what extent original core program components are changed, whether new things are added and what they are, or whether parts of intended programs are entirely omitted. In some cases, adaptations might improve outcomes, whereas in other cases, changes might undermine program success. Therefore, it is essential to monitor the types of adaptations that occur instead of treating them as failures of implementation. Future research that collects good data on aspects of both fidelity and adaptation that usually co-occur during implementation will be valuable in understanding how interventions work in real world settings.

Current research has relied on naturally occurring events to assess factors related to implementation. Experimental studies that manipulate conditions potentially affecting implementation and assign providers to different levels of these conditions would offer stronger scientific support for the various contextual factors affecting implementation.

A second type of study is also needed. It would be extremely helpful to compare the results of innovations offered in one setting that were conducted with high fidelity with innovations that were modified by providers. It seems feasible that some providers would be amenable to these types of experiments. "Let's compare the program already developed with the modified program you are suggesting to see how effective each one is in your setting." These direct comparisons would shed important light on how programs should operate in different contexts for maximum cost effectiveness, and, at the same time, help bridge the gap between research and practice. In the spirit of collaboration, providers would be encouraged to contribute actively to the scientific process, and researchers could learn from providers how to improve interventions.

Accordingly, we re-emphasize that researchers should carefully specify the theoretically important components of programs, and monitor the delivery of these components as well as any modifications made by providers during implementation. Repeated studies of this sort can clarify the appropriate combination of faithful replication and program modification that is necessary in different settings and for different innovations to achieve good outcomes.

A Future Research Agenda

Several research questions should be addressed in future studies. Which aspects of implementation are important for which innovations in order to achieve which types of outcomes for which participants? How much overlap exists in the currently identified contextual factors that affect implementation? Have any important factors been overlooked? What is the relative influence of different factors and how do they interact to affect how a program is conducted in real world settings? Can the strong presence of some factors offset the absence of others that would ordinarily promote implementation? Why does the level of implementation affect many, but not necessarily all program outcomes?

Previous comments have focused on several needed improvements in implementation research. These include clarifying the relative influence of fidelity and adaptation, monitoring comparison groups to detect their receipt of alternate services, the limited quantitative focus on some aspects of implementation (e.g., quality, adaptation, reach, program differentiation, and participant responsiveness) the importance of studying contextual variables at multiple levels of influence, the need for experimental studies that vary the conditions under which implementation occurs, and how the method of assessing implementation can affect the findings. There are nine additional research issues that deserve attention. These involve considerations related to measurement and general design issues, when implementation data should be collected, when programs are ready for evaluation, the importance of assessing each intervention component, of assessing multiple aspects of implementation in the same study, and conducting subgroup analyses, program modifications made for cultural or ethnic reasons, and testing for threshold effects. Finally, expanded journal policies regarding implementation data and analyses are necessary. Each of these issues is now briefly discussed.

1. Science cannot study what it cannot measure accurately and cannot measure what it does not define. Therefore, it is essential that future authors develop consensus on the terminology and the operational definitions of relevant constructs and use psychometrically sound assessment strategies to study implementation. Measurement of relevant constructs is one important aspect of a well-designed study, and useful design and measurement guidelines have been offered by several authors (Backer 2002; Bellg et al. 2004; Granner and Sharpe 2004; Mowbray et al. 2003; Nastasi and Schensul 2005). For example, qualitative studies should evaluate the convergent validity of their assessments by using multiple methods of data collection (e.g., interviews, observations, document analyses, and surveys). Both quantitative and qualitative work should employ theory-driven analytic procedures. Whenever possible, comparison groups should be used in lieu of one-group designs to strengthen the confidence regarding the relationship between implementation and program outcomes. There is also a need for more measures of organizational and

coalition functioning (Granner and Sharpe 2004). Given the multidimensional complexities of most innovations, it seems unlikely that standardized measures of all eight aspects of implementation can be developed that are applicable for all types of innovations. In each specific case, however, it is essential to document the reliability and validity of implementation measures.

2. Fixsen et al.'s (2005) recommendation to create a systematic monitoring and feedback system for implementation is particularly helpful because of the variability that has been observed in levels of implementation over time. Implementation is not a static event but a process that enfolds over time and so the timing of data collection is important. Several studies indicate that implementation can deteriorate over time. This has occurred in eight studies that examined this issue over periods ranging from 2 to 3 days to a year (Levenson-Gingiss et al. 1994; McCormick et al. 1994; Noell et al. 1997; Rohrbach et al. 1993; Smith et al. 1992; Story et al. 2000; Tappe et al. 1995; Vadasy et al. 1997). Data collected early in the intervention might easily overestimate the level of implementation delivered at the end of the program, indicating the need for data collection at multiple time points.
3. A related issue concerns when innovations are ready for evaluation. Several years ago, a popular advertising campaign emphasized how important it was to "serve no wine before its time" suggesting that wines must age properly before they are ready to be consumed. This admonition can be transposed into the current discussion by recommending that no program should be evaluated until sufficient time has been allotted for its effective implementation. For example, some researchers conduct pilot programs to determine how well a program does in a new setting in order to improve implementation, sometimes by making program adjustments to increase its ecological fit (e.g., Komro et al. 2006). How much time to allot for effective implementation varies with the complexity of the intervention. Fixsen et al. (2005) recommend at least 1 year, whereas Felner et al. (2001) suggest that at least 3 years are required for major school-wide reforms. In contrast to investigations indicating deterioration in implementation levels over time, some reports of large scale multi year interventions have shown that implementation improves from year to year (e.g., Cook et al. 1999; Elder et al. 1996; Felner et al. 2001; Riley et al. 2001). It is reasonable to assume that complicated interventions require more time to be conducted properly. Program evaluations conducted before implementation is sufficiently established will not do justice to the true impact of the intervention. When a particular program is ready for evaluation has to be made on a case-by-case basis, but the collection of implementation data is important for making such determinations.
4. It is important to monitor implementation in each major innovation component. This is exemplified by findings from a physical health promotion programs that contained classroom- and cafeteria-based components and a home component (Story et al. 2000). The implementation of the two school-based components was good and related to outcomes measured in the school setting, but few parents participated in the home component and positive results were not obtained for this part of the program. Instead of dismissing the value of the home component, the authors discussed how to improve that component's implementation.
5. Because there are eight different aspects to implementation, it is beneficial to analyze multiple aspects of implementation for the same intervention. This point is nicely illustrated in an outcome study of the Early Risers program, in which the fidelity, quality, and reach of implementation of separate child and family components was assessed (August et al. 2006). The fidelity and quality of implementation for each component was considered acceptable based on observational data; however, participation rates for each component (reach) were less than desired. In this study, neither fidelity nor quality of implementation affected the outcomes, but reach did (see Table 1). More studies comparing the effects of different aspects of implementation will shed light on which aspects are more important for different types of interventions.
6. It is also necessary to relate implementation data to gains achieved by different subgroups of participants. For example, some authors (e.g., Botvin et al. 1990; Elias et al. 1986) found more positive effects for girls than for boys in a school based intervention under conditions of better implementation. Felner et al. (2001) found that at intermediate levels of implementation high risk students showed little or no benefit, (i.e., the effect sizes for the outcome measures were near zero) but at high implementation levels, this same group demonstrated substantial improvements (i.e., effect sizes between 0.50 to 0.75 depending on the outcome domain). The Felner et al. (2001) results also suggest that different implementation thresholds might exist for different participants (see below).
7. Cultural factors are not listed explicitly in Table 2 as affecting implementation; nevertheless, they are pervasive and fundamental considerations. For example, social scientists have recognized the value of modifying interventions to suit the needs, preferences, and

values of specific racial and ethnic populations (American Psychological Association 2003; National Research Council and Institute of Medicine 2002). This is another example of the importance of adaptation. It remains an empirical issue how much impact interventions have when they are conducted in a similar fashion for all groups or when they are modified for different cultural groups (Miranda et al. 2005). Once again, the issue of whether core components are changed is an important one. Resnicow et al. (1999) offered some useful distinctions with respect to cultural adaptations in terms of what they call "surface and deep structure." Surface structure involves decisions regarding how messages or materials are changed to match the observable characteristics of a population (e.g., language and cultural symbols). Such modifications would usually not affect core components. However, deep structure refers to pivotal cultural, social, environmental, or psychological factors specific to a group, and incorporating these elements into the intervention is more likely to involve an intervention's core components. Researchers should clarify if and how core components are being affected when they modify innovations for use with different cultural or racial groups.

8. The variability achieved across studies in levels of implementation suggests the potential value of examining implementation threshold effects. For example, although it might seem that "more is always better," it is possible that once a certain level of implementation is attained (e.g., in dosage or fidelity), higher levels may not lead to significantly better outcomes, particularly if the intervention's core components have already been effectively delivered. One research group (Botvin 2000) has used a 60% level to assess the impact of implementation, although whether other thresholds would produce similar results is unknown. While the results of the Felner et al. (2001) investigation indicate that threshold effects are possible for different subgroups of participants, findings for the School Health Education Evaluation have indicated threshold effects for different types of outcomes (Connell et al. 1985). For example, gains in students' knowledge appeared much more quickly than behavioral changes (after 15 h of intervention compared to 35 h, respectively) but the highest gains in each area were not stable until after 50 h of intervention. The cost benefit effectiveness of evidence-based programs could be increased substantially if it were known which aspects and levels of implementation were necessary to achieve the best results for different target populations and for different outcomes.
9. Current data confirming the importance of implementation data for program evaluations have implications for what information should be present in research reports. A few journals now require authors evaluating interventions to describe the steps taken to insure good implementation. In most cases, however, authors focus on fidelity, and only say that implementation was effectively achieved without supplying any data. This is insufficient. Researchers should routinely examine more aspects of implementation than fidelity, and journal requirements should be expanded to require authors to present their implementation data and assess its relationship to different program outcomes. Otherwise, reviewers will continue to find only a small percentage of outcome studies with enough information to study implementation adequately.

Limitations and Final Comments

Some of the limitations in the current review should be noted. It was a challenge to translate the terms used in different disciplines and emanating from different conceptual perspectives into a common language. We offered working definitions of the major constructs that we investigated and noted the different terminology used across reports. However, others might define these constructs or interpret the findings of studies differently. We concluded that a factor affected implementation if its importance was confirmed in at least five studies. However, it is possible that investigators have overlooked some important factors. Results were consistent in investigations using better quantitative and qualitative procedures, but judgment was involved in evaluating the quality of different studies. Although the co-authors only included information reached through discussion and final agreement, others might construe the original data differently. Finally, although many studies were reviewed, this literature represents, at best, only one-third of all the outcome research on prevention and promotion programs for children and adolescents. Data relevant to implementation are missing for a majority of youth programs.

Nevertheless, current data offer strong empirical support to the conclusions that implementation affects the outcomes of promotion and prevention programs, and that multiple ecological factors affect the implementation process. Hopefully, the results of this review will help future researchers understand how programs can be conducted effectively in new settings to achieve maximum impact.

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