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Bridging Science to Practice: Achieving Prevention Program Implementation Fidelity in the Community Youth Development Study

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Abstract This paper describes the development, application, and results of an implementation monitoring component of the Communities That Care (CTC) prevention framework used in the Community Youth Development Study (CYDS) to ensure high-fidelity prevention program implementation. This system was created based on research that community-based implementation of evidence-based prevention programs often includes adaptations in program design, content, or manner of delivery (Gottfredson and Gottfredson, *Journal of research in crime and delinquency, 39*, 3–35, 2002; Hallfors and Godette, *Health Education Research, 17*, 461–470, 2002; Wandersman and Florin, *American Psychologist, 58*, 441–448, 2003). A lack of fidelity to the implementation standards delineated by program designers is one indicator of a gap between prevention science and practice which can lessen the likelihood that communities will realize the positive participant effects demonstrated in research trials. By using the CTC model to select and monitor the quality of prevention activities, the 12 CYDS communities replicated 13 prevention programs with high rates of adherence to the programs' core components and in accordance with dosage requirements regarding the number, length, and frequency of sessions. This success indicates the potential of the CTC program implementation monitoring system to enhance community Prevention Delivery Systems (Wandersman et al.

American Journal of Community Psychology, this issue) and improve the likelihood of desired participant changes.

Keywords Prevention · Implementation fidelity · Community coalitions · Dissemination

Introduction

Advances in prevention science have resulted in the identification of numerous "best practice," "evidence-based," or "tested and effective" prevention programs (Center for Substance Abuse Prevention 2000; Elliott 1997; Hawkins and Catalano 2004; Sherman et al. 1997; U.S. Department of Health and Human Services 2001; Welsh and Farrington 2006). The National Registry of Effective Programs (NREP), for example, has identified 85 programs that have been shown in trials to significantly decrease adolescent substance use and other problem behaviors (Center for Substance Abuse Prevention 2000). A wide range of programs have shown effects in preventing adolescent problem behaviors, including programs focused on parent training, school-wide organizational change, individual social competencies, and mentoring (Hawkins and Catalano 2004; Mihalic et al. 2004; Welsh and Farrington 2006).

Despite the availability of programs identified as effective, there remains a substantial gap in communities' likelihood of adopting and effectively replicating such innovations. In other words, information from the Prevention Synthesis and Translation System, as conceptualized in the Interactive Systems Framework for Dissemination and Implementation (Wandersman et al. this issue), remains disconnected from communities' delivery of prevention services (the Prevention Delivery System). Widespread diffusion of evidence-based programs has not occurred, and

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communities that have implemented these innovations have often failed to replicate them with fidelity—that is, in accordance with the guidelines and methods of delivery specified by program developers. This paper offers a methodology for addressing the second issue by describing elements of a Prevention Support System used to build the capacity of community agencies and prevention providers to implement tested, effective prevention programs with a high level of fidelity to the programs' core components.

There has been increasing attention given to ensuring implementation integrity of prevention programs (Dusenbury et al. 2003; Elliott and Mihalic, 2004; Fixsen et al. 2005; Roth et al. 2005). Ensuring high-quality program implementation is important when evaluating the effectiveness of a new innovation, as outcomes can be attributed to the program with greater confidence if there is evidence that it was actually implemented as intended (Durlak 1998; Dusenbury et al. 2003). During program replications, high-fidelity implementation helps increase the likelihood of desired participant outcomes, given evidence that closer adherence to core components can result in stronger participant outcomes, and that some programs work only when implemented with a high degree of fidelity (Abbott et al. 1998; Botvin et al. 1998; Henggeler et al. 1997; Kam et al. 2003; Olweus et al. 1999; Spoth et al. 2002). Conversely, implementation failure results in wasted financial and human prevention resources and a reduced likelihood that community efforts will result in desired changes in participants' knowledge, attitudes, and behaviors.

Despite awareness of the benefits of implementation integrity, some effective programs have not been implemented according to the standards delineated by program designers when replicated by community-based organizations (Ennett et al. 2003; Mitchell et al. 2002; Wandersman and Florin 2003). For example, the National Study of Delinquency Prevention in Schools (Gottfredson and Gottfredson 2002) found poor implementation of school-based prevention programs. Only one-half of drug prevention curricula and one-fourth of mentoring programs met dosage requirements; the rest delivered fewer and less frequent sessions than were specified by program developers. Moreover, only half of the programs were taught in accordance with the recommended methods of instruction. Hallfors and Godette (2002) reported significant variability in program implementation of school-based prevention efforts across the United States. Programs frequently operated with untrained teachers, without the required materials, and with misspecification of the population to be served (e.g., targeting high-risk students with universal programs). Only 19% of all surveyed school districts faithfully implemented effective prevention curricula (Hallfors and Godette 2002). A multisite evaluation of Head Start programs (Paulsell et al. 2002) reported that after 2 years, 5 of 19 communities were unable to reach full implementation due to barriers related to staff turnover, lack of critical community partnerships, and difficulties in scheduling parent education classes.

The lack of fidelity achieved in many community-based replications of effective programs underscores the difficulties of translating science to practice, particularly in linking information regarding evidence-based innovations generated by the Prevention Synthesis and Translation System to communities' Prevention Delivery Systems. Despite this gap, there is growing evidence that training, technical assistance, and proactive monitoring can help enhance community-based delivery of innovations (Bodisch Lynch et al. 1998; Dumas et al. 2001; Fagan and Mihalic 2003; Henggeler et al. 1997; Roth et al. 2005; Spoth and Redmond 2002). One of the largest national evaluations of program implementation concluded that communities can replicate tested and effective prevention programs with fidelity (Elliott and Mihalic 2004). In the Blueprints for Violence Prevention Initiative, eight of the nine model violence prevention programs eligible for replication were successfully carried out in 42 communities. After 2 years of implementation, 74% of sites had implemented all core components of the programs, and 57% achieved all dosage requirements (i.e., the recommended number, length, and frequency of program sessions) (Elliott and Mihalic 2004). A separate evaluation of another Blueprints model program, the Life Skills Training (LST) drug prevention program, showed similar results in replications conducted in more than 300 schools. According to observations of classroom sessions, instructors taught an average of 81–86% of all required material, and nearly all students in the targeted grades received the program (Elliott and Mihalic 2004; Fagan and Mihalic 2003).

In the Blueprints Initiative, implementation success was related to organizational, program-level, and community factors (Mihalic and Irwin 2003). More specifically, better adherence to program components was related to having stronger host agencies (i.e., those with administrative support, good communication between members, clear goals and authority, etc.), consistent staffing, more favorable program characteristics (greater ease of implementation, less complexity, more flexibility, etc.), and higher levels of community support. Replication success was also attributed to the intensive training, technical assistance, and project oversight provided by program developers and Blueprints staff (Fagan and Mihalic 2003; Mihalic and Irwin 2003). Such assistance included site visits from research staff prior to implementation to assess the organization's commitment and ability to replicate programs with fidelity, training of all staff from program developers, phone and in-person technical assistance from program developers and research staff, and observations of program sessions conducted by local consultants (for the LST program).

There is other evidence to suggest that program monitoring can lead to better implementation outcomes. An evaluation of the Early Alliance efficacy trial attributed high levels of implementation fidelity to program monitoring protocols that included staff training workshops with lesson delivery and feedback, videotapes of all lessons to assess program content and delivery, and 3 h of individual and group-supervision sessions per week from research staff to address identified obstacles (Dumas et al. 2001). A replication of the Multisystemic Therapy (MST) program indicated more program drift and greater therapist variability when standard weekly feedback from MST consultants was eliminated (Henggeler et al. 1997). In this project, the local organization provided staff with weekly individual and group-supervision meetings, but therapists had no contact with MST staff, who typically provide weekly telephone consultation to assess whether or not MST knowledge and skills are being used during treatment and to help therapists become more proficient in the MST model (Schoenwald et al. 2004). The weaker findings demonstrated during replication without MST consultation led the authors to theorize that a lack of comprehensive technical assistance (i.e., an inadequate Prevention Support System) may account for less successful treatment outcomes for programs implemented in community settings compared to research trials (Henggeler et al. 1997).

Though monitoring of implementation procedures and proactive technical assistance have been related to better implementation of prevention programs, few models have translated research trial procedures used to ensure high-quality implementation into methods that can be used by community-based prevention organizations (Chinman et al. 2005; Henggeler et al. 1997; Mitchell et al. 2002). To date, many of the strategies used to monitor and ensure fidelity have been program-specific or developed for particular research projects, and have not been intended as general models that can work across programs and communities.

This paper describes the development, implementation, and results of an implementation monitoring and feedback system designed to promote the successful delivery of community-based prevention programs implemented as part of the Community Youth Development Study (CYDS), a multi-site efficacy trial of Communities That Care (CTC). The CTC framework itself is an example of a Prevention Support System designed to increase the capacity of communities to undertake effective prevention efforts that will reduce adolescent problem behaviors including substance use, delinquency, violence, teenage pregnancy, and school drop out. CTC is based on the public health model of prevention, which involves assessing the epidemiology of problem behaviors, identifying the factors that influence the likelihood of these outcomes, and addressing these factors with effective strategies (Hawkins

and Catalano 1992; Hawkins et al. 2002). The model is community-based and provides local key leaders and members of prevention-oriented coalitions with training and technical assistance in conducting needs assessments, setting prevention goals, selecting evidence-based programs, planning for implementation, and implementing and monitoring prevention activities.

In this paper we focus on the fifth step of the CTC process, during which community-based coalitions implement and monitor selected prevention programs. The goal at this stage of the CYDS was to create a program implementation monitoring system that would promote high levels of program fidelity across a number of newly installed prevention programs. Because CTC is a community-based and community-operated prevention system, local ownership and oversight of prevention activities was a priority in this study. Likewise, we sought to create a system that could be locally sustained.

Methods

The Community Youth Development Study

The CYDS is a 5-year community randomized trial of the efficacy of the CTC prevention operating system in reducing adolescent problem behaviors. Twenty-four small- to medium-sized communities in seven states participated in the study: 12 implementing CTC and 12 control sites conducting prevention services as usual. Beginning in 2003, the 12 intervention communities were provided with training and technical assistance in the CTC system, funding for a full-time CTC coordinator, and up to $75,000 annually to replicate research-based prevention programs targeting fifth- to ninth-grade students and their families. Training and technical assistance was provided by certified CTC trainers from the Channing Bete Company and by research staff at the Social Development Research Group (SDRG) at the University of Washington.

The CTC training workshops and materials educated intervention community members on the components of the five phases of the CTC system. These "milestones" and "benchmarks" outlined goals to be met by communities (milestones), and the actions that community members should take or conditions that must be present to achieve those goals (benchmarks). Technical assistance was provided to local CTC coordinators and prevention coalition members to help ensure completion of these steps and procedures, identify any barriers to successful implementation, and discuss strategies for overcoming obstacles. Assistance was delivered via weekly phone calls and e-mails and twice-yearly site visits. In addition to the qualitative information obtained through this contact with

sites, adherence to the CTC model was assessed through annual surveys that quantitatively rated the completion of milestones and benchmarks as reported by CTC trainers, SDRG staff, and the local CTC coordinators. This survey was the primary method by which adherence to the CTC model as a whole was evaluated, while implementation of the community-specific prevention programs was assessed using the methods described below (see Quinby et al. in press for further description of CTC implementation in the CYDS).

Prevention Program Selection

One of the first stages of CTC is the creation of a community board comprised of individuals and agencies that share the goal of fostering healthy youth development, including elected officials, law enforcement agents, school personnel, social service agencies, faith organizations, business representatives, parents, and youth. The CTC prevention board is the primary entity through which CTC activities are completed, including the selection and monitoring of prevention programs, which is overseen by a task force of the board.

In the first year of the CYDS, community boards were formed at the 12 intervention sites. Board members were then trained to analyze survey data collected from students in local schools in order to identify areas of high need (i.e., elevated risk factors and depressed protective factors). The community board next selected prevention programs that addressed their community-specific needs. Intervention sites were required to choose programs that had been previously evaluated in at least one study using a strong research design, had demonstrated effects on risk or protective factors and problem behaviors, and that offered training and materials, as described in the *CTC Prevention Strategies Guide* (Hawkins and Catalano 2004). In addition to examining student-reported risk and protective factor data, communities evaluated their current prevention services and selected programs that addressed areas of need not currently met, avoided duplication of services, and were compatible with community resources and capacity (see Fagan et al. in press, for further description of the processes used by communities to select prevention programs).

Using these guidelines, the 12 intervention communities selected 13 different prevention programs to implement during the 2004–2005 school year. As shown in Table 1, strategies included school-based programs (three drug prevention curricula and one school-wide organizational change strategy), after school programs (including skills-based interventions, mentoring and tutoring services), and parent-training programs (three group-based and one self-administered). Several programs were chosen by multiple

communities, and several communities replicated programs more than once during the year. For example, the LST™ program was delivered in one school in one community and four schools in a second community, resulting in five replications, or *cycles*. Similarly, Guiding Good Choices® (GGC) was provided 38 times (i.e., 38 *cycles*) across six communities. In total, 13 programs and 95 cycles were implemented during the 2004–2005 school year.

Once programs were selected, communities submitted a written action plan that detailed their proposed implementation procedures, including outcome goals, training needs, proposed staffing levels, dates of implementation, participant recruitment strategies, budgets, and anticipated implementation challenges and solutions to these challenges. Each plan was reviewed by SDRG staff and representatives from the seven state drug prevention agencies collaborating on the project. At least six members of this group completed written evaluations of each plan. These focused on the extent to which the selection of programs followed the CTC model (i.e., programs addressed areas of high risk or low protection and filled gaps in local prevention services), and whether or not the proposed implementation plan seemed feasible (based on local financial and human resources) and in accordance with program specifications. After the individual reviews, group members discussed the strengths, weaknesses, and recommended revisions of each plan. SDRG staff provided written summaries of these comments to community boards, who responded to concerns in revised plans. Reviewer recommendations often focused on methods to ensure high-quality program delivery and strong recruitment of the targeted population; however, in a few instances, they questioned the feasibility of specific programs chosen by communities and requested additional information related to program selection and planned delivery.

Prevention Program Implementation Monitoring System

Once the action plans were completed, communities moved to the program implementation and monitoring phase of CTC. The implementation monitoring system was designed to measure the extent of implementation fidelity achieved across all prevention programs chosen by CTC intervention communities. The components of this system are outlined in Table 2 and are described below.

Implementation Fidelity Assessment Instruments

Assessment instruments were developed to measure four primary dimensions of implementation fidelity: (a) adherence to the programs' components and content, (b) dosage

Table 1 Programs implemented in the Community Youth Development Study, July 2004–June 2005

Program name	Number of communities	Number of cycles
All Stars™ Core	1	1
Life Skills Training™ (LST)	2	5
Lion's-Quest Skills for Adolescence (SFA)	2	2
Program Development Evaluation (PDE) Training	1	1
Participate and Learn Skills (PALS)	1	3
Big Brothers/Big Sisters (BBBS)	2	2
Stay SMART	3	9
Tutoring	4	11
Valued Youth Tutoring Program	1	3
Strengthening Families 10–14 (SFP 10–14)	2	15
Guiding Good Choices® (GGC)	6	38
Parents Who Care® (PWC)	1	3
Family Matters	1	2

(i.e., number, length, and frequency of sessions), (c) quality of delivery, and (d) participant responsiveness. Although valid and reliable instruments to assess program implementation are recommended (Dusenbury et al. 2003; Fixsen et al. 2005; Mowbray et al. 2003), such tools are relatively rare. We were able to obtain fidelity monitoring tools, some of which had been validated in research studies, from program developers for 9 of the 13 programs selected by CYDS intervention communities. For the remaining four programs, we reviewed program materials, identified core components and processes, and developed monitoring tools ourselves.

Two types of fidelity assessment instruments were completed by program implementers and coordinators. For programs with a discrete number of sessions, session-specific checklists identified the content and activities to be taught each time the program met. Program implementers were asked to rate whether or not each objective was taught each session.[1] For less structured programs (i.e., programs without a specified number of meetings, or for which implementers were to adhere to general guidelines rather than teach specific content), program monitoring tools identified the core elements of the program (see Table 3 for more information regarding the number of required objectives or components for each program). At the end of the program, or regularly throughout implementation, implementers and program coordinators rated whether or not each criterion was achieved. For example, for tutoring programs, tutors and tutoring coordinators completed surveys during and at the end of the program that documented whether or not six critical components were accomplished: coordination of the program and supervision of tutors,

screening of tutors for criminal background and knowledge of subject matter, tutor training, use of an established curriculum during program sessions, a tutor:tutee ratio of less than 1:4, and assessments of changes in tutees' skills. While there was variability across programs in the content of the fidelity checklists, all instruments assessed adherence similarly, by documenting the extent to which program information and components were delivered.

Other aspects of implementation fidelity were measured to varying degrees, depending on the program. For example, other aspects of adherence were self-reported by implementers on fidelity instruments according to whether they made major modifications to the program, such as deleting material or adding activities, information, or untrained guest speakers. To measure dosage of session-specific programs, fidelity forms documented times and dates of program sessions.[2] Fidelity instruments measured the quality of delivery and participant responsiveness, where appropriate, by asking implementers to rate: the effectiveness of sessions, whether or not common implementation challenges were encountered (lack of time, participant misbehavior or lack of responsiveness, or inadequate facilities), level of participant involvement, and positive events and successes.

Observations of Program Sessions

Given that implementers may under- or overestimate the extent to which they adhere to program guidelines (Bodisch Lynch et al. 1998; Dusenbury et al. 2003; Mowbray et al. 2003; Rohrbach et al. 1993), observations of program sessions were used to validate self-reported information. Program observations were conducted for 10–15% of

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[1] Dichotomous (yes/no) ratings were used for all programs except Program Development Evaluation (PDE), which assessed adherence using a 3-point rating scale (not met, partially met, or fully met).

[2] Participant attendance was also recorded at every session, providing verification of dosage information.

Table 2 Program implementation monitoring procedures in the CYDS

Component	Description	Purpose	Provider	Periodicity
Fidelity assessment instruments	Surveys listing program content to be taught each session *Or* Critical components to be achieved during the program	Assess program fidelity: (1) Adherence to core components (2) Dosage (3) Participant responsiveness (4) Quality of delivery	Program implementers and/or coordinators	After each session (programs with discrete sessions) *Or* Periodically throughout implementation (unstructured or ongoing programs)
Observations of programs	Trained observers viewed sessions and completed fidelity assessment instruments	Validate information from program implementers	CTC community board members, implementer supervisors, and program coordinators	Periodically, in 10–15% of all program sessions
Participant surveys	Surveys assessing program effects	Measure desired changes in participants' knowledge, attitudes, skills, and behaviors	All program participants who agreed to participate	Before the first session and after the last session
Staff training workshops	Program-specific training workshops *And* CTC Community Plan Implementation Training	Familiarize program staff with programs' theory, content, and methods of delivery *And* Emphasize fidelity and completion of fidelity assessment instruments	All program staff	Before program start *And* As needed to accommodate staff turnover
Local monitoring and accountability	Program monitoring and supervision through observation, review of data, and revisions in procedures	Identify implementation barriers and propose solutions to enhance fidelity	CTC community board members, CTC coordinators, and program coordinators	Throughout implementation
External monitoring and accountability	Program monitoring and supervision through on-site, telephone, and written technical assistance	Identify implementation barriers and propose solutions to enhance fidelity	CYDS research staff	Throughout implementation

program sessions in 8 of the 13 programs.[3] In these cases, observers completed the same fidelity instruments as program implementers, as well as an additional assessment tool which rated the quality of delivery of sessions, including aspects such as whether staff seemed prepared for lessons, kept on time, used relevant stories or examples to clarify material, or responded effectively to participant concerns.

Observations were completed by implementers' supervisors (typically school or agency administrators), CTC coordinators, CTC community board members, or other members of the community. All observers were trained by local CTC staff who reviewed the program content and implementation standards, methods for completing fidelity assessment instruments, and general procedures for conducting observations (e.g., being unobtrusive, refraining from participating in activities or interacting with participants, and maintaining confidentiality). In almost all cases, coordinators informed implementers in advance of the observation and avoided observing the first program session. Given that most observations were conducted by community members, corrective feedback was not provided at the time of the observation, but was delivered afterwards by staff's supervisors and/or the program coordinator (see below).

Participant Surveys

The CTC process guides communities to assess the degree to which program participants' knowledge, attitudes, and behaviors change in the desired direction during

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[3] The five programs not observed included a self-administered program (Family Matters), a schoolwide intervention (PDE), and three programs [tutoring, Valued Youth, and Big Brothers/Big Sisters (BBBS)] for which observations would have been overly intrusive given the one-on-one or small-group administration.

Table 3 Program adherence achieved in the CYDS communities, July 2004–June 2005

Program	Number of required objectives or core components per cycle	Adherence score (range[a])	Observer agreement score (number of matched comparisons)
All Stars	147	93% (0–100)	93% ($n = 13$)
LST	208	89% (0–100)	88% ($n = 10$)
SFA	167	73% (0–100)	98% ($n = 14$)
PDE	53	89% (n/a)	n/a
PALS	5	80% (60–100)	n/a
BBBS	5	90% (80–100)	n/a
Stay SMART	60	98% (95–100)	95% ($n = 15$)
Tutoring	6	91% (50–100)	n/a
Valued Youth	39	77% (67–95)	n/a
SFP 10–14	499	94% (81–99)	90% ($n = 45$)
GGC	24	99% (91–100)	99% ($n = 35$)
PWC	212	87% (82–91)	88% ($n = 7$)
Family Matters	135	93% (90–94)	n/a

[a] For All Stars, LST, and LQ-SFA, individual implementer reports were used to calculate the range; for all other programs, the range was based on the average score for each program cycle

implementation. While data based on pretests and posttests of program participants only (i.e., without a comparison or control group) cannot rule out other possible influences on participants, such information can be used to evaluate implementation processes. A lack of participant change could indicate potential implementation problems and, as a result, prompt changes in program procedures. Conversely, evidence of positive participant change could suggest good adherence to program specifications.

Participant evaluation surveys were available from program developers for 11 of the 13 programs chosen for implementation. For the remaining two programs, we developed survey instruments that included reliable measures of the risk or protective factors the programs were intended to address. For all programs, pretests were administered prior to the start of the first program session, and identical posttests were administered at the end of the last session. All surveys were administered by program implementers or coordinators and were anonymous, with participants creating a unique identifying code that allowed the pre- and post-surveys to be matched without revealing the participants' identities.

Staff Training Workshops

Prior research emphasizes the importance of training in increasing implementers' understanding and support of prevention programs, commitment to implementing the programs with integrity, and likelihood of sustainability (Ennett et al. 2003; Fixsen et al. 2005; Gottfredson and Gottfredson 2002; Greenberg et al. 2005; Kealey et al.

2000; Taggart et al. 1990). Communities were responsible for arranging trainings for all program implementers from the program developers and/or their certified trainers. Program training workshops were available for 10 of 13 programs.[4] To accommodate staff turnover before and during program implementation, most sites hosted multiple training workshops or sent new staff to other sites for training. Some communities also arranged for key personnel to become certified trainers themselves to enhance local resources and sustainability.

In addition to receiving training from program developers, all program implementers attended the last in the series of CTC training workshops, the Community Plan Intervention Training (CPIT), which was co-facilitated by SDRG research staff and CTC trainers. The CPIT emphasized the importance of implementation fidelity by reviewing evidence that increased fidelity leads to better outcomes and that deviations can undermine program success. Participants identified potential implementation challenges they envisioned during program delivery and discussed solutions to these barriers. The purpose of and protocols associated with program fidelity monitoring instruments were reviewed. Staff were informed that their completion of these forms would be monitored, but that honest, rather than perfect, reports were desired; furthermore, staff would not be penalized for reporting problems, nor publicly identified in written or published reports of results. The last component of the CPIT

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[4] Three programs [Parents Who Care® (PWC), Participate and Learn Skills (PALS), and Tutoring] did not provide developer-led training workshops. In these cases, program coordinators met with implementers to review program principles and procedures.

trained implementers in how to ensure the confidentiality and anonymity of information from participant surveys. Because communities typically required multiple CPIT trainings to accommodate implementer schedules and varying program start dates, CTC coordinators in the CTC intervention communities were trained to deliver subsequent CPIT trainings.

Monitoring, Supervision, and Reporting Processes

Program implementation was locally monitored by CTC coordinators, program coordinators, staff from implementing agencies, and members of the CTC community boards. CTC and program coordinators regularly collected and reviewed the fidelity assessment instruments. Along with agency administrators, they also supervised program implementers and provided feedback regarding implementation delivery. SDRG staff trained CTC coordinators to deliver feedback using a general method which included reinforcement of positive behaviors and corrective feedback. For example, coordinators solicited from staff "one thing they liked about their performance," then asked "what is one thing you would do to improve your delivery of this program?" After observations were performed, coordinators were to meet individually with staff to provide such feedback. Coordinators were also encouraged to hold staff meetings either during or after program delivery, so that implementers could discuss as a group the positive and challenging aspects of implementation and potential changes in implementation that could overcome obstacles.

Community board members were also involved in program monitoring to observe program sessions, review program data and written reports, and help to make changes in implementation procedures when needed to achieve prevention goals. The CTC coordinator and board members were encouraged to share information regarding program implementation with the larger community to enhance local ownership of prevention efforts. The extent and type of promotional activities varied by community, but included Letters to the Editor or articles in local newspapers describing the program and its effects on participants; program banners, posters, or fliers placed in high-visibility areas of the community; and celebration events that publicly highlighted program graduates. Additional promotional activities included collaborations with local businesses to provide incentives for program participants, and formal presentations at meetings of school boards, school staff, city councils, county commissioners, service clubs (e.g., Kiwanis and Rotary groups), and churches. Individual meetings with key leaders (e.g., school superintendents, police chiefs, social service agency directors, etc.) were also held to increase awareness of and garner support for programs.

SDRG staff provided ongoing supervision and technical assistance to CTC coordinators to support program implementation. During weekly telephone calls and e-mail consultation, we reviewed any major program deviations or concerns and brainstormed potential solutions to these problems. SDRG staff made site visits at least twice annually to observe program sessions, meet program staff and administrators, and personally support the implementation process. Research staff also analyzed program implementation data and provided regular written reports summarizing the results. These reports both acknowledged the successes achieved during program delivery and provided recommendations for future program improvements. Community board members then used this information to provide feedback to staff and/or make changes to program implementation as needed.

Results

The following sections describe the extent of implementation fidelity achieved during the 2004–2005 school year for the 13 prevention programs implemented by the 12 CTC communities. Findings focus on program adherence and dosage. Information regarding implementation challenges and participant recruitment and attendance demonstrates the quality of delivery of programs and participant responsiveness, respectively.

Program Adherence

Program adherence refers to the degree to which implementers taught the required program objectives or fulfilled the program's core components. For more structured programs, program implementers self-reported whether or not they taught each objective during each program session. The adherence score was then calculated as the percent of objectives taught divided by the total number of objectives in the program. For example, an adherence score of 89% for LST™ indicates that 185 of the required 208 objectives were taught. For less structured programs, the adherence score represents the percentage of core components that were completed during the program replication. Adherence scores were calculated based on the number of required objectives or components summed across all communities that delivered the program and all cycles that occurred during the 2004–2005 school year.

Ninety-two percent of the required fidelity assessment instruments used to calculate adherence scores were completed by program staff. Rates of missing data were minimal for most of the parent-training and after school programs (less than 2%, on average) and highest for the school-based curricula, particularly LST™ (23% missing

data) and Skills for Adolescence (SFA; 21% missing data). Missing surveys could signify that lessons were not taught, but some teachers returned checklists even for lessons that were skipped. Given that only 8.2% of surveys were missing overall, adherence scores were calculated using only data from returned materials. Missing data related to individual items on surveys were also minimal (1.9% across all programs). When data assessing completion of program objectives were missing, omitted items were counted as unmet objectives.

As shown in the third column of Table 3, adherence rates were very high in the CYDS programs conducted during 2004–2005. Scores ranged from 73% to 99%, indicating that implementers reported achieving the majority of core components and/or teaching most of the required objectives in the school-based, after school, and parent-training programs. While the overall rates of adherence for all three school-based drug prevention curricula were high (73–93%), individual instructors reported varying degrees of adherence (0–100%) on session-specific surveys. The adherence score for the PDE program demonstrated that the school completed 89% of the required program components during the 2004–2005 school year.

Strong adherence to the programs' guidelines was also achieved in the after school and parent-training programs. The two lowest scores for after school programs—77% for Valued Youth and 80% for PALS—indicated that the majority of core components were followed, and rates were higher (90–98%) for the other three after school programs. Parent-training workshops consistently achieved high implementation fidelity scores. In the three facilitator-led programs, the Strengthening Families Program (SFP) 10–14 averaged a 94% adherence rate during the 15 cycles of program implementation, GGC® averaged 99% across 38 cycles, and PWC® averaged 87% over the three cycles taught during 2004–2005. The self-administered Family Matters program also demonstrated high adherence. According to program staff's follow-up phone calls to families, participants completed, on average, 93% of the activities.

Observation Data

Observers were asked to complete the same session-specific fidelity instruments that program implementers completed. A reliability score was calculated by comparing the number of objectives on which the observer and implementer agreed on the level of coverage. For example, if a program session had nine objectives to be taught, and both raters indicated that seven objectives were met but disagreed on the level of coverage of two objectives, the level of agreement would be calculated as 78%. Agreement scores were calculated for seven of the eight programs in which observations were conducted. For one program

(PALS), there were too few matched observations upon which to calculate an agreement score. For the rest of the programs, the number of matched observer:implementer comparisons ranged from 7 (PWC®) to 45 (SFP 10–14). Agreement scores were totaled across all observed sessions for each program to achieve an overall level of agreement between observer and implementer. Missing data were not included in the agreement calculations.

The rates of agreement between observers and implementers were high. For all programs that were assessed, at least 88% of the material was scored the same between observers and implementers, and for GGC®, the forms matched in nearly all cases, with an agreement score of 99%. These results indicate a strong overall correspondence between observer and implementer reports of program adherence (see Table 3).

Program Modifications

While very high rates of adherence were reported by program implementers and verified through observations of program sessions, some modifications were made to the programs' content and method of delivery, as reported by program implementers on the fidelity assessment instruments. On most forms, implementers were asked to record if they added or deleted material, used guest speakers, showed audio–visual materials, or made other changes. SDRG staff reviewed all reports and characterized changes as either (acceptable) enhancements to the program or (unacceptable) deviations from the standard protocols.

Acceptable changes were made by implementers to further illustrate or reinforce program content. For example, some implementers reported using local drug use statistics rather than the national data supplied in program materials. Implementers sometimes completed activities as a large group rather than in the recommended small-group or individual format. In school-based programs, some teachers reported creating handouts to review material or conducting tests of student knowledge.

Implementers occasionally reported more substantial deviations from the programs' content, theory, or intended practices. Most frequently, and often citing time constraints, implementers deleted material or activities, particularly interactive exercises. In some cases, role-playing activities were omitted because small group size precluded effective practice. Changes may have also been made by implementers who were uncomfortable teaching the interactive material or who anticipated participant misbehavior when doing so. Some instructors reported adding information or videos to lessons in order to teach *new* content. These additions were considered as major deviations as they could take time away from teaching required information and could contradict program objectives.

Overall, the number of unacceptable modifications was minimal. On average, fewer than two major deviations per program cycle were reported by teachers implementing the school-based curricula. About two changes per cycle were reported by workshop facilitators in SFP 10–14. The other two parent programs had fewer than one major change per program cycle.

When major alterations to the curriculum were identified, local coordinators provided feedback to program implementers and made changes to correct problems, if possible. Coordinators typically reminded implementers to balance didactic instruction with facilitation of discussions and role-playing exercises. In some cases, they also modeled these skills by teaching lessons. Repetition in teaching lessons also helped staff gain more practice in unfamiliar teaching techniques and cover material more efficiently. To address time shortages, some coordinators worked with implementing agencies to lengthen class time.

Program Dosage

Program dosage scores represent the extent to which programs achieved the required number, length, and frequency of sessions,[5] as reported by program staff on the fidelity assessment instruments. Scores for each dosage element (number, length, and frequency) were calculated according to the following criteria. First, the percentage of required sessions taught was assessed, such that teaching 6 of 12 sessions resulted in a dosage score of 50%. Second, the actual length of the program session was compared to the required length. Program cycles in which the average session length matched the requirement were scored 100%. If sessions were shorter than recommended, the percent of the recommended time that was achieved was calculated (e.g., cycles that had 30-min rather than 45-min sessions were scored 67%).[6] Third, the frequency of sessions delivered during the program cycle was coded as a dichotomous measure. Program cycles that met this specification received a score of 100% and those that did not were scored zero. Programs for which a required number, length, or frequency of sessions were not specified by developers were coded as missing that component of the dosage score. The three dosage elements were then averaged to form a dosage

score for the program cycle, and all cycles were averaged to calculate the overall program dosage.

Table 4 identifies the dosage requirements and dosage scores achieved for the 13 prevention programs implemented in the CYDS during the 2004–2005 school year.[7] Overall, high rates of dosage were demonstrated, with most programs delivering the required number, length, and frequency of sessions. Only the BBBS program fulfilled less than 90% of the dosage requirements, as meetings between matched adult mentors and adolescents occurred less frequently than required (75% of cases met the requirement). The last column of Table 4 indicates the percentage of cycles in which all required dosage elements were achieved; that is, all cycles were conducted with the recommended number of sessions, for the recommended amount of time, and with the recommended frequency of delivery. Full dosage was achieved in 76 of the 94 (81%) program cycles implemented. For about half the programs, all dosage elements were achieved in most cycles; for the other half, most program cycles failed to meet at least one of the three dosage elements. One of the three school programs, two of the five after school programs, and three of the four parent-training workshops met all dosage requirements in most cycles.

When deviations in dosage occurred, they were generally minor. For example, during the implementation of one cycle of LST™, one teacher failed to deliver 1 of the required 12 lessons. Likewise, in 3 of the 11 tutoring cycles, sessions were held for 30 rather than 45 min. In GGC®, the only deviation from dosage requirements occurred in one cycle that was postponed for several weeks due to a combination of holidays and staffing issues. As with challenges related to adherence, these problems were identified and steps taken locally to address them, primarily by reminding implementing agencies and staff why it was important for lessons to be taught consistently and for long enough periods to deliver all the required information.

Participant Attendance

Overall program attendance was defined as the number of students (in school-based and after school programs) and families (in parent-training programs) who attended at least one session of the program offered during 2004–2005. As shown in Table 5, school programs were delivered to 1,432 middle or junior high school students in the CYDS communities. After school programs reached 546 students across all communities, and 517 families attended parent-training workshops. The number of *individuals* exposed to parent-training workshops was higher (not shown) because

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[5] This definition refers to the amount of dosage offered during implementation; that is, the amount of the curriculum delivered to individuals, not individual dosage (i.e., the amount of material *received by* participants).

[6] We did not penalize program cycles in which the number of sessions or session length exceeded the requirements. These deviations usually occurred in school-based curricula, as teachers often found that two class periods were needed to cover all the required information, and in parent-training programs, when sessions were lengthened to provide meals or allow more social interaction.

[7] A dosage score for the PDE program was not calculated, as the program does not specify any of the three dosage elements.

Table 4 Program dosage achieved in the CYDS communities, July 2004–June 2005

Program	Minimum dosage requirement	Dosage score[a] (%)	Percent of cycles achieving all dosage elements (%)
All Stars	14, 45-min weekly sessions	93	0
LST (Level 1)	12, 45-min weekly sessions	90	60
SFA (Level 1)	40, 45-min weekly sessions	94	0
PDE	n/a	n/a	n/a
PALS	10, 45-min sessions 2X/week	97	33
BBBS	Matches meet 2X/month	75	0
Stay SMART	12, 60-min weekly sessions	99	89
Tutoring	45-min sessions 2X/week	94	64
Valued Youth	45-min sessions 4X/week for 30 weeks	92	33
SFP 10–14	7, 2-h weekly sessions	100	100
GGC	5, 2-h weekly sessions	99	97
PWC	7, 2-h weekly sessions	94	33
Family Matters	Completion of material in 6 months	100	100

[a] The extent to which program replications implemented the required number of sessions, for the required length of time, and with the required frequency, averaged across all cycles and communities

Table 5 Program attendance and retention in the CYDS, July 2004–June 2005

Program type	Attendance (number attending at least one session)	Percent of target population (range)	Retention (percent attending at least 60% of sessions) (%)
School-based	1,432 youth	97% (75–100)	96
After school	546 youth	17% (7–98)	77
Parent-training	517 families	8% (3–28)	79

two parents/caretakers from the same family sometimes attended sessions.

The third column of Table 5 identifies the proportion of the targeted population that attended at least one session. For the universal school-based programs, 97% of the intended population received the programs, with eight of the nine cycles delivered to *all* children in the targeted grade, and one cycle delivered to only 75% of targeted students due to scheduling conflicts of some students in the school. After school programs varied in their ability to reach targeted individuals, with an average of 17% of those in the intended age range attending at least one session; across all communities, the proportion ranged from 7% to 98%. Recruitment was most difficult for parent-training workshops; only 8% of the targeted population was reached, on average, across communities.

Though recruitment was challenging, retention of participants was successful across all programs. As shown in Table 5, nearly all (96%) children were exposed to at least 60% of the required number of sessions in school-based programs,[8] and the majority of students and families attended at least 60% of the after school and parent-training

sessions (77% and 79% of participants, respectively). While strong retention rates were expected in the school programs, the results from the other types of programs suggest that once involved in the program, a large majority of participants continued to participate for multiple sessions.

Participant Survey Outcomes

The final component of the program monitoring system involved surveying program participants to determine the extent to which they demonstrated desired changes in their knowledge, attitudes, or behaviors as a result of program participation. Participant survey data were analyzed for 8 of the 13 programs, including three school-based, three after school, and two parent-training programs. Results could not be analyzed for two programs (PWC and Family Matters) due to small numbers of participants. Survey results for the two other programs (PDE and Valued Youth) are not reported, as the data were analyzed by the program developers using different methodologies and were reported directly back to communities.

Only surveys that could be matched to the same individual at pretest and posttest were included in the analyses. On average, matches were made for 70% of the individuals

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[8] Student attendance records were available for six of the nine cycles of school-based programs.

completing surveys, though rates varied across program cycles (from 58% to 100%). For two programs (tutoring and GGC™), changes from pretest to posttest were evaluated using single survey items, while results for all other programs were assessed using scales identified by program evaluators in the original research trials, or a mixture of scales and individual items. In all cases, matched t-tests were utilized to calculate effects.

The number of matched pretests and posttests, number of items or scales assessed, and results of the participant survey analyses are shown in Table 6. For school-based programs, pretest to post-survey changes were generally positive for the LST™ program, but primarily negative or nonsignificant effects were found for the other two school curricula (All Stars™ and SFA). More than half the assessed scales changed significantly in the desired direction for LST participants, including knowledge of the program concepts, positive attitudes regarding drug use, drug refusal skills, and normative beliefs regarding teen and adult drug use. The evaluation of All Stars™ indicated significant reductions in normative beliefs regarding violence, but also significant reductions in students' bonding to school. In the SFA program, significant negative effects from pretest to posttest were observed for scales including drug refusal skills, perceived harm of drug use, normative beliefs regarding friends' drug use, and commitment to school.

After school program participants evidenced almost no significant changes in attitudes or behaviors from pretest to posttest. In contrast, significant effects in the anticipated direction were found for the two parent-training programs. Significant and positive child and parent changes were demonstrated for 13 of the 20 measured scales assessed in SFP 10–14, including family communication, youths' relationships with parents, youths' stress management skills, parents' school involvement, and nurturing and support from parents. For the GGC participants, 85 of the 221 assessed items significantly changed, in the expected direction.

Discussion

As noted by Wandersman et al. (this issue), there is a substantial gap between science and practice, particularly in spreading information from the Prevention Synthesis and Translation System to the Prevention Support System and Prevention Delivery System. Innovations that have demonstrated success in preventing the development of adolescent substance use and delinquency have not yet been widely and consistently implemented with fidelity across the US. This paper proposed a system for bridging this gap. Given evidence that careful program monitoring and proactive technical assistance can help communities overcome implementation challenges (Bodisch Lynch et al. 1998; Dumas et al. 2001; Fagan and Mihalic 2003; Henggeler et al. 1997; Spoth et al. 2002), we developed and implemented a Prevention Support System to support high-fidelity replications of tested preventive interventions. Program implementation monitoring tools and procedures were implemented as part of the CTC program that was evaluated in the CYDS. Our results indicate that this program monitoring system, along with the training and technical support necessary to apply these tools and procedures, enhanced the intervention communities' Program Delivery Systems.

Table 6 Participant survey results in the CYDS communities, July 2004–June 2005

Program	Matched surveys (N)	Items/scales assessed (N)	Desired changes in item/scale (N)[a]	Undesired changes in item/scale (N)[a]	No change in item/scale (N)
All Stars	72	10	**1** (2)	**1** (6)	0
LST (Level 1)	165	19	**12** (5)	**0** (2)	0
LQ-SFA (Level 1)	283	52	**0** (3)	**21** (27)	1
PDE	n/a	–	–	–	–
PALS	62	5	**0** (3)	**0** (1)	1
BBBS	0	–	–	–	–
Stay SMART	47	39	**1** (22)	**0** (15)	1
Tutoring	79	48	**3** (20)	**2** (20)	8
Valued Youth	n/a	–	–	–	–
SFP 10–14	201	20	**13** (4)	**0** (3)	0
GGC	232	221	**85** (93)	**1** (30)	12
PWC	19	–	–	–	–
Family Matters	9	–	–	–	–

[a] Number of significant ($p < .05$) changes based on matched t-tests are shown in bold; number of nonsignificant changes are shown in parentheses

The 12 intervention communities using this system successfully replicated the 13 different prevention programs chosen to address the needs of their adolescent populations. After 1 year of implementation, communities implemented their selected programs with high rates of adherence to the core components of the programs and fulfillment of dosage requirements regarding the number, length, and frequency of required sessions. Adherence scores ranged from 73% to 99% across all program replications, indicating that program staff taught the majority of program objectives and ensured completion of most of the program components. Dosage scores were also high, as 94% of the dosage criteria were met across all communities. In addition, 81% of the program cycles delivered all required lessons, in the specified amount of time, and with the recommended frequency of delivery. Although some deviations from the programs' content, method of delivery, and dosage were reported, they were generally minor. Good participant retention in sessions further suggested that programs were conducted in a high-quality manner that engaged participants.

Analyses of the pretest and posttest participant survey data demonstrated mixed results regarding the programs' immediate impact on knowledge, attitudes, and behaviors. While parents participating in two of the parent-training programs generally showed significant and positive results on a range of outcomes at posttest, adolescents who participated in the school-based and after school programs demonstrated less change (with the exception of positive results for the LST program). These findings were surprising, given that all programs were replicated with integrity and were expected to produce desired changes. These results could indicate ceiling effects for some items. Most students reported healthy attitudes and behaviors on most items at pretest, which left little room for improvement. Post-survey results continued to indicate strong prosocial attitudes and behaviors, though not significant improvements from pretest. In addition, these programs targeted children in grades 5 through 9, and during this stage of adolescence, many teens tend to develop attitudes more permissive of substance use and delinquency. Prevention programs seek to counter this developmental trend, but may only slow down the process, not reverse it. Because the CYDS project design did not involve control subjects in the prevention programs selected by intervention communities, we were unable to compare intervention student results with control student outcomes on these program pretest and posttest surveys.[9]

Despite these findings, evaluation of participant change is an important part of the CTC process, and results have been used in the CYDS intervention communities to improve implementation processes. Where participant survey findings differed from those reported in earlier program evaluations, communities did not initially drop programs, but instead carefully reviewed their implementation procedures and challenges and made changes to address identified concerns. For example, two communities implementing tutoring programs associated the lack of significant participant effects with poor student attendance and relatively short (e.g., 5- to 8-week) cycles of implementation, and each planned to offer more incentives for attendance and to lengthen their program's duration.

Although parent-training programs were conducted with strong implementation fidelity and evidenced desired changes in participants, small proportions of eligible parents were recruited into these programs during the first year of implementation. Other research has emphasized the difficulty of obtaining high rates of participation in universal parenting programs (Bauman et al. 2001; Dumka et al. 1997; Heinrichs et al. 2005; Spoth and Redmond 2002), and the CYDS intervention communities faced common recruitment challenges, such as parent scheduling conflicts, competing commitments and time demands, belief that the program was not needed, concerns about privacy, and so on. After reviewing participant recruitment rates, most communities planned to increase and diversify recruitment strategies in future replications of these programs.

When challenges arose during implementation, the program monitoring component of the CYDS allowed community members to identify and address them. Thus, the findings suggest that a Prevention Support System that includes program implementation monitoring tools and procedures, as well as training and technical assistance in how to use them, can help bridge the gap between the quality of program implementation typically achieved in prevention research studies (as demonstrated by the Prevention Synthesis and Translation System) and that achieved in widespread practice (as implemented in the Prevention Delivery System). By following program implementation monitoring procedures like those outlined here, community-based organizations may be better able to replicate programs, increase their adherence to program protocols and procedures, and, as a result, enhance their likelihood of realizing anticipated benefits to program participants.

An important component of this process, which likely enhanced the quality of program implementation fidelity, was the provision of regular technical assistance that was responsive to local community needs. In the CYDS, training and proactive technical support was provided by CTC trainers and staff from the SDRG, who worked in concert with intervention community members. Programs were

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[9] However, overall effects of the CTC intervention are assessed using student-reported levels of risk and protective factors and involvement in substance use and delinquency, from students in intervention communities compared to control communities.

locally implemented and community coalition members were actively involved in program monitoring to ensure that the community's prevention goals were being met. SDRG staff provided community coalition members with ongoing feedback regarding the effectiveness of prevention efforts, which enhanced the capacity of local prevention providers to deliver prevention programs in a high-quality manner. This success suggests that a Prevention Support System should include, at a minimum, an organizing framework; user-friendly tools and procedures; and training, technical assistance, and feedback systems in order to build the capacity of the Prevention Delivery System to replicate proven effective prevention innovations.

Several limitations of the current report should be noted. Although the results suggest that Prevention Support Systems can improve the quality of community Prevention Delivery Systems, the CYDS has not been designed to measure the impact of the program monitoring component itself. Data comparable to those reported here were not collected from communities assigned to the control condition in this study. Further, intervention communities were provided with up to $75,000 annually to conduct prevention activities, which likely reduced some implementation challenges. For example, communities had funding to hire program coordinators, train all staff, and provide all participants with program materials. Without this funding, it is possible that communities would have omitted, or only partially implemented, these components.

Finally, although the CTC program monitoring system was designed to be sustainable by CTC and other community coalitions, to date it has been implemented only in the context of this research project. Further research is needed to document whether and how well the system can be sustained beyond the CYDS project and without the assistance of SDRG staff.

In summary, the CTC implementation monitoring system was developed and technical support was provided to increase the capacity of local communities to implement prevention programs with high fidelity and to sustain these efforts over time. The system has supported 12 communities to adopt and implement 13 different tested, effective prevention programs with a high degree of fidelity. While the provision of training, technical assistance, and program monitoring has been associated with high-quality delivery of prevention programs in prior studies (Dumas et al. 2001; Fagan and Mihalic 2003; Fixsen et al. 2005; Gottfredson and Gottfredson 2002; Greenberg et al. 2005; Henggeler et al. 1997), the CTC monitoring system offers a specific methodology for helping to bridge the gap between science and practice. It translates the rigorous program monitoring strategies that characterize many research trials (and as described in the Prevention Synthesis and Translation System) into tools and procedures that can be utilized by local community organizations to improve their Prevention Delivery Systems.

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