PRIMARY PREVENTION MODELS: THE ESSENCE OF DRUG ABUSE PREVENTION IN SCHOOLS

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Being able to wrap this chapter around the book's central theme of the addiction syndrome is a challenge. The challenge occurs because most of what one encounters in school-based drug prevention targets youths at the very earliest stages of drug use (i.e., experimental or recreational use). At this point in their drug careers, most youths occupy the left-hand side (tail) of the distribution where behavior is not clearly exacerbated by psychosocial risk. By contrast, studies of addiction have generally concentrated on what occurs at the far right-hand side of the distribution, focusing on behavior that is more trenchant, with individuals occupying this tail being more reticent to change and experiencing more dire consequences (this latter signal event may be found to not be the case). When studying primary prevention programs that are delivered in the schools, researchers are customarily concentrating their efforts on behavior that appears on the left side of the distribution (think of a normal bell curve to get this picture right). In these cases, an intervention is meant to reach a broad audience before a particular behavior or disorder surfaces or is concerning from a public health perspective (Gordon, 1983). This effort stands in contrast to secondary prevention efforts that programs deliver to a population designated as being at risk and possibly suffering with disability (i.e., expression of symptoms); secondary prevention has the goal of reducing severity. Tertiary prevention concerns delivering services to people already suffering distress from some malady or affected by disease (e.g., addiction) and attempting to end further deterioration through rehabilitation.

The fact that prevention efforts target different stages of a disease helps to illuminate an important conceptual point. Here, one can add to the accumulating evidence reinforcing the view that addiction is part of a complex and progressive syndrome by unearthing its developmental origins, showing how it evolves over time as part of its phenotypic expression, and tracking putative risk factors that serve as markers of its developmental course. These efforts, recognizing the complex nature of addiction, can then inform both etiology and prevention. In this respect, the construction of this chapter deals primarily with the foundational experience of a particular behavior, and the chapter becomes incredibly important in understanding the effect of prevention on later addictive potential.

UNDERSTANDING THE COMPLEXITY OF PREVENTION

In this chapter, I discuss four basic components of understanding prevention. First, I briefly discuss drug use etiology and how it fuels the development of school-based drug abuse prevention. Much of what is known about etiology is gathered through epidemiology, with the goal of elucidating the role of risk processes. Epidemiology is responsible for gathering needed information about the quantity, location, cause, and mechanisms of various risk factors (Anthony, 2010). Because risk factors and the illnesses they create are distributed nonrandomly within a population, it becomes necessary to define the problem and to characterize the population

designated at risk that experiences the problem and the circumstances that place them at risk (Kellam & Langevin, 2003). An important literature has sought to clarify the role of risk at a more general level and enumerate how risk works to portend poor developmental outcomes; however, further discussion of this material is beyond the scope of this chapter (see, e.g., Clayton, 1992; Luthar, 2006; Rutter, 1987). Regardless of the way researchers manage the body of risk and epidemiology knowledge, the goal is always to better understand the causal interplay of risk processes because they promote early-stage drug use (see Kellam, Koretz, & Mościcki, 1999, for additional clarification of the differences between analytic and descriptive epidemiology). Eventually, these loose threads of information are sewn together into a patchwork quilt of psychosocial theory used to explain the etiology of drug use.

Epidemiology and etiology also serve another important function because they provide insight into the variation surrounding addictive processes and drug etiology. Not everyone uses drugs for the same reasons. The consequences of drug use vary among individuals, and the pathways to drug use also vary considerably. Some individuals use drugs to assuage emotional distress, whereas others fall prey to social influences and use drugs in response to peer pressure and developmental maturation. For prevention to be maximally effective, this information is necessary in case programs need to be tailored or intervention theory adjusted. It is clear that researchers need to gather more information about the beginning stages of addiction, the point at which primary prevention efforts can be useful and cost effective. In terms of the addiction syndrome model, this occurs as part of broad-brush efforts to protect youths from harm and inoculate them from various distal influences. Second, and related to this first point, inoculations, or vaccinations as they are cast in the disease model, have far greater efficacy than actual treatment of disease. Preventing the onset of drug use can forestall later involvement and curtail movement toward addiction. This activity alone can reduce the morbidity and mortality associated with drug abuse and addiction, thus yielding tremendous benefits to primary prevention.

After developmental studies have confirmed the relative importance of various risk processes within drug etiology, the next step includes providing this body of knowledge to those responsible for developing large-scale, mass-action prevention programs that seek to ameliorate these risk factors through concerted behavior change programs. How this information fuels the development of prevention programs is integral to an understanding of program efficacy. A second focus of this chapter is better understanding the theoretical frameworks that drive various prevention modalities, a body of information termed *intervention theory*. Later in the chapter, I discuss specific ways to test intervention theory. A third focus is on the evaluation tools available that are pressed into service to show that a particular program works in the manner hypothesized, or what are customarily termed *manipulation checks*.

The fourth and final focus is factors that moderate program efficacy and that have come under greater scrutiny in the past decade as evidence-based programs are implemented with greater rigor and frequency. The questions that need to be addressed once programs are taken to scale have more to do with what specific implementation factors influence a program's effectiveness (Botvin & Griffin, 2010). This area of concern becomes important because efficacy trial conditions call for strict adherence to protocols that are administered in tightly controlled research settings. In these cases, highly trained facilitators or teachers engage students in various training exercises and deliver the program content under careful scrutiny. When these programs are taken to scale, where regular teachers or members of the community teach the skills, and are conducted in naturalistic settings, many different factors such as implementation or program fidelity, adaptation, organizational support, and other hidden influences can come into play and alter the effectiveness of a program (e.g., Botvin, Baker, Filazzola, & Botvin, 1990; Pentz et al., 1990). I present a summary of these concerns as they have been continually reinforced in the literature focusing on program evaluation (e.g., Fullan & Pomfret, 1977).

IMPORTANCE OF LONGITUDINAL DESIGNS IN PROGRAM EVALUATION

As an important caveat, I try to find some balance in discussing these four elements of school-based drug

abuse prevention, not favoring any one particular focus over another. This caveat is necessary because I am inherently biased toward activities emphasizing manipulation checks and determining whether a program followed its theoretical suit to foster behavior change. This focus usually rests with testing the causal agents of change using methods appropriate for longitudinal designs. A comment about longitudinal designs is warranted at the very outset. It will become patently clear to readers that most, if not all, of the most promising research in drug prevention relies on longitudinal studies. However, most, if not all, of the studies examining drug prevention do not always attend to the importance of satisfying the necessary conditions to make causal inferences.

No matter what scientists say about the strength of longitudinal designs, this research strategy alone does not provide answers to causation (Rutter, 1994). Granted, when certain conditions are met, there is greater leverage with respect to what longitudinal data can address (e.g., philosophers such as David Hume have discussed these conditions as a major component of understanding the mental world; see, e.g., Norton & Norton, 2005). At a most basic level, longitudinal data provide the opportunity to address temporal relations, or whether one event, A, precedes another event, B, in time. Hume called this condition *succession* and also used the term *priority*. Furthermore, satisfaction of causation also requires the contiguity of behavior (B is always present when A occurs), which can also be stated as A and B are associated by their sheer contiguous presence. A third concern revolves around instituting controls for spuriousness or eliminating bias, because some other event, even after satisfying temporality and contiguity, is not likened to A is causing B. These conditions, according to Hume, are the perceptual features of causation and form the backbone of modern scientific reasoning.

The issue of "associating quality," as Hume called it (e.g., Norton & Norton, 2005), is incredibly important to prevention science, as the reader will soon see. The importance arises because numerous evaluations of prevention programs have reported very small associations between putative risk factors and behavioral endpoints such as drug use. This is problematic because no matter how successfully the intervention changes the intervening risk factor (e.g., skills, norms, self-esteem, attitudes, commitment, and beliefs), if these measures are unrelated to the outcome, then tests of the indirect effects will prove statistically unproductive. In other words, manipulation checks can show indisputably that an intervention satisfactorily changes the risk process by either attenuating risk (ameliorative effect) or boosting skills (augmenting effect), but that the skills themselves are not related to drug use. This occurs despite a significant body of etiological evidence that has supported including the designated intervening mechanism (i.e., social skills) as a putative risk factor in the process leading to drug use. Here one can restate the importance of the earlier statement about contiguity or association as a necessary condition for causation (that event B is always present when event A occurs). I deal with this issue in greater detail later in this chapter, but it is worth mentioning at the outset so that readers have some understanding why the conditions or logic of causation are so incredibly important to the field of prevention, if not to science as a whole.

FINDINGS FROM THE FIRST ROUND OF PREVENTION STUDIES

It is now well over 2 decades since the first round of school-based drug abuse prevention programs took hold in the U.S. educational landscape (Ellickson & Bell, 1990; Moskowitz, Malvin, Schaeffer, & Schaps, 1983; Schaps, Moskowitz, Malvin, & Schaeffer, 1986; Shope, Copeland, Maharg, Dielman, & Butchart, 1993). Many of these programs followed on the heels of the "scaring them straight" period of drug education, when information about the consequence of drug use was central to prevention themes (e.g., R. G. Blum, 1976; R. H. Blum, Garfield, Johnstone, & Magistad, 1978; Gerstein & Green, 1993; Goodstadt, Sheppard, & Chan, 1982; Schaps, Moskowitz, Condon, & Malvin, 1982). Although there is some variability among program themes, information content focused almost exclusively on the negative consequences of drug use, the pharmacology of drug use, patterns of consumption, and factors implicating drug abuse. When program

evaluations of the drug education focus seemed to indicate their ineffective nature, the search began for better program content and better outcomes. In response, a new generation of affect-based programs emerged, focused on self-esteem building, interpersonal competencies, decision-making skills, clarification of values, and bonding to school (i.e., commitment and attachment).

Affective education programs used experiential learning and classroom activities as a means to improve personal growth, particularly emphasizing improving students' self-esteem and self-understanding and building personal core values (Moskowitz et al., 1983; Moskowitz, Schaps, & Malvin, 1982). In some cases, these programs instructed students about how to run school stores to increase school commitment, lay the foundation for teamwork, and participate in tutoring programs (e.g., middle school students would tutor younger elementary school students), all intended to stimulate personal growth. Teachers were also instructed in effective classroom management strategies to improve student bonding and affiliation to school (Schaps et al., 1982). Nonetheless, large-scale evaluations of these programs also produced disappointing results (Schaps et al., 1986) with very little evidence of real sustained behavior change after implementation. One criticism of these kinds of programmatic content was that, although instructional materials were well intentioned, they had little bearing on drug use, per se, and had limited, if any, theoretical connections to risk factors for drug use.

The next wave of studies used component analysis to dissect program mechanisms and empirically confirm the most effective program modalities. One comparison in particular pitted social skills training with normative (Hansen, Graham, et al., 1988) or affective education (Hansen, Johnson, Flay, Graham, & Sobel, 1988; Schaps et al., 1986). These and related studies indicated that resistance skills were less effective than normative education (Donaldson, Graham, & Hansen, 1994; Hansen & Graham, 1991; MacKinnon et al., 1991; Sussman, Dent, Burton, Stacy, & Flay, 1995; Wynn, Schulenberg, Maggs, & Zucker, 2000). Several argued that "theory failure" was responsible for the disappointing results of

resistance skills education (Donaldson et al., 1996); however, more recent evidence has supported the efficacy of resistance skills and refusal self-efficacy as effective barriers to drug use (Scheier, Botvin, & Griffin, 2001; Sussman, Dent, Simon, et al., 1995).

The next generation of programs involved truly multimodal programs in which decomposition of the essential working components was not considered essential. These psychosocial, ecologically minded programs took various cues from different modalities and blended them cohesively into a single prevention framework. Careful reviews (Gottfredson & Wilson, 2003) coupled with a sequence of meta-analyses conducted across diverse program modalities (Tobler, 1986, 1992; Tobler & Stratton, 1997) indicated that programs using small-group discussion, role playing, and behavioral rehearsal mixed with some didactic teaching methods—involving supportive feedback and that emphasized teaching youths to navigate developmental risks through problem-solving, resistance, and assertiveness skills—and values clarification were more successful than programs relying on didactic strategies emphasizing the negative harms from drug use (Hansen, 1992). Newer methodological approaches were also available to tease apart the relative efficacy of the different program modalities, ensuring that investigators could identify the active ingredients of behavior change (e.g., West, Aiken, & Todd, 1993).

The basic argument behind multimodal programs suggested that many risk factors were implicated in the etiology of drug use and that focusing on only one or two skills would not be sufficient (e.g., Botvin, 1995, 2000). In fact, and consistent with the addiction syndrome model, determinants of drug use extend far beyond social influences and involve internal cues and motivations to use drugs, requiring more extensive prevention modalities to counter the effects of anxiety, depression, expectancies, mood regulation, low self-esteem, and other compelling intrapersonal factors. Evaluation of several independent multimodal programs using experimentally rigorous, group-randomized field trials showed quite promising findings (Botvin, Baker, Dusenbury, Tortu, & Botvin, 1990; Ellickson, McCaffrey, Ghosh-Dastidar, & Longshore, 2003;

MacKinnon et al., 1991). In several cases, these results have now been extended to include long-term follow-up data (Botvin, Baker, Dusenbury, Botvin, & Diaz, 1995; Ellickson, Bell, & McGuigan, 1993; Pentz et al., 1989; Shope, Kloska, & Dielman, 1994). All of these examples provide evidence that theoretically consistent interventions (i.e., targeting risk factors with known relations to drug use) delivered with fidelity can significantly decrease drug use among experimentally treated youths compared with control youths.

UNRAVELING BASIC PREVENTION MODALITIES

With the passage of time, scientists have evaluated many different types of prevention programs, giving them a sense of what works for whom and why (Donaldson et al., 1996; Ellickson, 1999; Graham, Johnson, Hansen, Flay, & Gee, 1990; Hansen, 1992; Hansen et al., 2010). In this section, I review several different program modalities and present an overview of why these programs work in general and cases in which they have been implemented with special populations.

Social Learning and Social Skills Programs

Social learning and social influence programs stem primarily from the work of Evans and colleagues (Evans, 1976; Evans et al., 1978) and owe their theoretical lineage to persuasion (McGuire, 1964, 1968), communication (Hovland, Janis, & Kelley, 1953), and social learning models of human behavior (Bandura, 1977, 1986). The basic argument posed by social learning–social influence models is that youths are highly suggestible and vulnerable to pressure from their peers. An individual's suggestibility revolves around poor social skills, low self-esteem, conformity disposition, and lack of fortitude to withstand persuasive overtures. Given that the overwhelming majority of youths initiate cigarette or other drug use in social settings, Evans et al. (1978) used psychological inoculation as a principal means of deterring youths from using drugs. Fear arousal communication alone will not deter youths from smoking or drinking; however, affording them refusal skills and strengthening their

counterarguments to avoid persuasive influence (i.e., peer models for smoking) will prevent behavioral engagement. For example, prevention strategies included social skills training and persuasive communication tactics that taught youths how to avert negative drug-promoting social influences. The social skills training component taught youths a wide range of both verbal and nonverbal skills to refuse drug offers; specific strategies to resist negative influences from the media (e.g., cigarette or alcohol advertising), friends, family, and other sources of coercive influence; and how to form counterarguments against media influences. Students watched movies demonstrating situations in which refusal skills could be applied to deter offers to smoke cigarettes and then practiced these skills using behavioral rehearsal, modeling, and role-play situations in classroom settings. Collectively, these training methods are called *performance-based modeling*.

Competence Enhancement Programs

Strategies that focus on competence enhancement extend the premise of social skills training by arguing that more than social assertiveness and drug refusal skills should be the focus of prevention (Botvin, 2000; Pentz, 1985). In fact, vulnerability to drug use involves several individual personality characteristics that include poor problem-solving and decision-making strategies, inadequate personal control mechanisms (e.g., self-management, task persistence, and impulsivity), and intrapsychic factors (e.g., self-esteem, rebelliousness, and confidence). The transition from late childhood to early adolescence is fraught with difficult developmental tasks, causing a pile-up of life experiences for many youths (Larson & Ham, 1993). In these cases, and absent requisite skills to navigate these transitions, many youths use drugs to relieve anxiety and reduce stress. A significant body of research had already delineated the role of stress and coping within the etiology of drug use (Rhodes & Jason, 1990; Shiffman & Wills, 1985). Both theoretical overtures and empirical findings led some to posit that drug use is a form of problem-solving or emotion-focused coping (Labouvie, 1987; Labouvie, Pandina, White, & Johnson, 1990; Sussman et al., 1993; Swaim, Oetting, Edwards, & Beauvais, 1989; Wills, 1986), or

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what others have termed *self-medication* (Khantzian, 1985, 1997).

Competence enhancement approaches do not discard the social skills training component but rather invest in teaching youths specific skills that will boost their social and personal confidence. This approach suggests that provision of skills alone might be insufficient; in fact, most youths possess a modicum of social skills. Missing from the equation is the lack of sureness or confidence in applying these skills, mostly owing to developmental immaturity. The new competence enhancement formula includes making sure youths possess the requisite skills and boosting their confidence on the basis of performance history. Much of the theoretical impetus for this approach comes from Bandura's (1977, 1997) sociocognitive model of human agency, which imparts a motivational role for efficacy in driving task engagement. Briefly, Bandura rejected the notion that there are two people inside one's head and asserted that the person who engages in a task is one and the same as the person who evaluates his or her performance. A person's deliberations and self-reflection will ultimately motivate or limit future engagement. According to Bandura, a self-referent emphasis consisting of reflection and self-evaluation creates a belief in personal efficacy that the individual can execute the task, which prompts directives for behavior (i.e., causative power in doing). In other words, a person knows his or her own mastery level (performance), sees or anticipates the likely outcome (the consequence that a performance will produce), and then conducts "reflected" appraisal of what brought about these outcomes. The decision to engage in a particular task is thus based on an individual's perceived efficacy and not necessarily on what happened after the performance (i.e., reward, accolades, and prizes). In this framework, the cognitive self-regulatory guide that drives behavior reflects a combination of several independent psychological pieces including skills (i.e., performance), reflected appraisal (i.e., perceived capability after performance), reinforcements (i.e., incentives), and most important, beliefs of self-efficacy.

The idea that humans self-regulate in various domains of functioning led to the view that

proficiency in skills was not enough to enact behavior. What was missing, according to Bandura (1997), was the belief that the operation of skills would produce the desired behavior. Bandura wrote, "Perceived self-efficacy is not a measure of the skills one has but a belief about what one can do under different sets of conditions with whatever skills one possesses" (p. 37). Thus, if youths have skills to refuse drug offers, they might enact them depending on their self-referent thoughts regarding perceived efficacy. If a youth doubts he or she can perform a particular skill, this doubt would make him or her reluctant to engage this skill, for instance, refusing drug offers. To improve efficacy among youths, most cognitive–behavioral programs emphasize general social assertiveness skills, teaching youths how to approach people, make requests, and initiate conversations (i.e., overcome shyness and develop communication skills). Youths also learn how to express their own position during arguments, express countervailing opinions, and defend their individual rights (e.g., asking for money that was borrowed to be returned). The personal competence component addresses problem-solving confidence, decision making, self-reinforcement, anxiety management, and personal control skills (Botvin & Griffin, 2001; Griffin & Botvin, 2004). Youths are encouraged to make adaptive goal-setting decisions, identify problems and provide alternative solutions, regulate their emotional tone and develop self-talk skills (e.g., self-reinforcement and self-management), consider consequences and evaluate opportunities, and learn to how cope with anxiety and stressful situations. The latter is taught using progressive relaxation and meditation skills. Together, the social and personal competence components lay the foundation for self-efficacy and greater confidence to refuse drug offers and seek alternative drug-free lifestyles (Botvin & Griffin, 2001, 2004).

Normative Education

A third component of drug prevention has for a long time focused on normative education, emphasizing correcting youths' misperceptions that drugs are prevalent and socially acceptable (Donaldson et al., 1996; Hansen et al., 1991; Sussman et al., 1988). The strength of norms is tied inextricably to the

power of the peer group, which increases in salience during adolescence (e.g., B. B. Brown, 1990). As part of seeking personal autonomy, youths spend more time outside the supervision of their parents (e.g., Larson, Richards, Moneta, Holmbeck, & Duckett, 1996), using peers as surrogate support mechanisms (Berndt & Perry, 1986), thus opening new doors of social influence (Hartup, 1992). Through vicarious learning and direct observation, young people learn more about patterns of drug consumption, develop expectancies regarding their effects (Christiansen & Goldman, 1983; Christiansen, Goldman, & Inn, 1982), and, because of their conformity dispositions (e.g., B. B. Brown, Eicher, & Petrie, 1986), begin to act more impulsively and experiment with rebellious and deviant acts (Kopstein, Crum, Celentano, & Martin, 2001; Wills, Windle, & Cleary, 1998).

Two separate streams of evidence seem to point toward normative perceptions as a focal part of drug prevention. First, experimental evidence gathered by social psychologists has suggested that people tend to overestimate behaviors, particularly if they themselves engage in this behavior (Ross, Greene, & House, 1977; Sussman, 1989). Within the context of tobacco and other drug use, considerable evidence has shown that youths overestimate the number of people they think smoke or drink given their tacit approval of this behavior (Sussman et al., 1988). A second body of empirical evidence has suggested that during the early stages of drug use, two forces are at work: one form of social influence including active pressures or direct offers that require confrontation, assertiveness, and refusal skills, and a second, termed *passive pressures,* that reflects the perception of social acceptance and prevalence of behavior (Graham, Marks, & Hansen, 1991). Youths can vicariously observe their friends engaging in behavior or have discussions with their friends regarding drug use; however, in either case there are no exhortations to use drugs, leading to their designation as passive modeling influences. The literature on passive influences has gained momentum from studies of compliance and conformity, from studies of social support, and from the growing body of evidence showing that social comparison actively promotes behavioral similarity (Festinger, Schacter, & Back, 1950; Wills, 1991).

This second emphasis also garners support from the theory of reasoned action, which suggests that perceived normative prevalence and social acceptability fuel intentions to engage in behaviors (Ajzen & Fishbein, 1970, 1977; Fishbein & Ajzen, 1975). For example, if youths survey the landscape and see numerous adults and their peers smoking cigarettes, they quickly develop beliefs that these behaviors are socially acceptable, in effect representing tacit endorsement of their own participation in this behavior. Correcting these misperceptions and providing more accurate standards that show only a fraction of the population, for instance, smokes cigarettes and only a small percentage of youths drink underage or drink excessively (i.e., alcohol misuse) should dampen motivations to engage in the behavior.

Visible role models and media portrayals of socially significant individuals can also glamorize drug use, depicting it as normative or socially acceptable. Research has shown that youths form positive social images of highly visible actors depicted as smokers in the media or derived from powerful social influences (parents or friends). This information creates learned associations that guide future behaviors (Barton, Chassin, Presson, & Sherman, 1982; Gerrard, Gibbons, Stock, Vande Lune, & Cleveland, 2005; Gibbons & Gerrard, 1997). Thus, some portion of normative education also attends to the social significance of drug use and teaching youths how to decipher media messages correctly. Equipped with media literacy skills, youths learn how to resist persuasive appeals by advertisers, reconcile the conflicting messages they receive about drugs, and become more critical and skeptical of pro-drug media overtures (e.g., Alverman & Hagwood, 2000).

The previous discussion identifying three popular modalities used in school-based drug abuse prevention is not meant to be exhaustive. There are programs that blend different instructional formats including lifestyle incongruence, commitment to not use drugs, and working with youths who are socially isolated to become integrated with their peers in school (e.g., McNeal, Hansen, Harrington, & Giles, 2004). Other programs involve family intervention strategies in concert with school activities (e.g.,

Hawkins, Catalano, Kosterman, Abbott, & Hill, 1999; Hawkins, Guo, Hill, Battin-Pearson, & Abbott, 2001). A few studies have produced positive findings suggesting that the additional components do make a difference; however, coverage of this material is far beyond the scope of this chapter (see Flay, 2000, for coverage of these issues).

How Drug Prevention Works: Studies of Mediation

One of the criteria detailed in the standards for prevention science (Flay et al., 2005) requires that programs examine the causal agents of change or mediators hypothesized to lead to behavior change. Studies of mediation have become a staple of prevention science (Botvin et al., 1992; Donaldson et al., 1994; Hansen & McNeal, 1997; MacKinnon et al., 1991; Wynn et al., 2000). These and related studies gained traction with the introduction of the law of indirect effect and the law of maximum expected potential effect (Hansen & McNeal, 1996). The law of indirect effect is an axiomatic principle that states the obvious: Programs influence behavior somewhat indirectly through putative risk or protective factors. After program implementation, the expectation should be that behavior changes because there are changes within the individual or the environment (e.g., social norms); either way, change in mediating mechanisms drives change in behavior. In support of this proposition, Hansen and McNeal (1997) stated, "The essence of health education is changing predisposing and enabling factors that lead to behavior, not the behavior itself" (p. 503). If an intervention is hypothesized correctly and mediators are sufficiently represented, the program will have no direct effects on behavior; rather, all effects will be mediated.

The second key idea to result from mediation studies is that the effect size associated with mediation is limited. In other words, there is a maximum potential effect associated with the indirect effect. This arises because there is determination in the model used to test mediation. By this, Hansen and McNeal (1997) meant that the effect from the program (i.e., intervention or indirect effect) to the mediator might change, but there is an asymptote to the overall program effect when the path from the

mediator to the behavior is modeled statistically. Hansen and McNeal (1996) stated this as "Increases in program effect on any mediator are met with diminishing returns regarding the magnitude of the expected effect on the behavior" (p. 505). Other factors come into play when determining the maximum potential effect (i.e., the size of the standard errors), and these limits, when collectively imposed, constrain the maximum effect on behavior. In all of these cases, the relationship between the mediator and the designated outcome regulates or caps the total indirect effect. The important take-home message from this notion is that interventions have a much greater chance of succeeding when the program curriculum does effectively change the mediators but also when there is a strong association between the mediator(s) and the designated outcome (i.e., mediators with high payoff value).

Consistent with the major percepts of the syndrome model, mediators are usually risk processes that have been identified as part of the etiological web contributing to drug use. In most cases, these mediators derive from extensive research in etiology and epidemiology and are consonant with developmental studies (e.g., Hawkins, Catalano, & Miller, 1992; Petraitis, Flay, & Miller, 1995; Scheier, 2001). Specific examples of mediators that have gained substantial recognition in the field include drug-refusal skills, general assertiveness, personal competence (i.e., goal setting and decision making), normative perceptions of drug or alcohol use, and classroom belonging or attachment. In each of these examples, program instructional materials would be structured to improve students' skills, change their attitudes, or modify their beliefs so they are more prosocial and antidrug. A requirement, then, of conducting program evaluations for drug prevention is to show that the program instructional materials (i.e., curriculum content) lead to change in the intervening mechanisms and that these changes net the intended preventive effects (Flay et al., 2005). Demonstrating this causal sequence is, in many respects, the backbone of what many have termed *evidence-based prevention* and a key factor in establishing the basic criteria for a model program; some have termed these criteria *best practices.* In the case of primary prevention programs, the intended effect of modifying

designated risk factors is to keep nonusers from transitioning to use, to maintain any behavioral gains over time, and to prevent youths who might already have experimented with drugs or alcohol from progressing in their involvement.

Graphical Depiction of Program Effects

Figure 9.1 graphically shows one of the more convenient ways to think about the standards of evidence in terms of program evaluation. This figure shows a simple three-construct mediation model with statistical controls for early behavior required in a longitudinal design. The construct labeled *Social Skills* is designated the target mediator, and drug involvement is the distal outcome. Program assignment can be dummy coded to represent treatment versus control. The paths designated b_1^* and b_2^* represent stability effects, and inclusion of these controls allows a researcher to infer that any change in behavior above and beyond stability is attributed to the program—albeit most researchers tacitly acknowledge that in simplified models of this nature, other forces are at play. There is no path from early drug

use (Time 1) to the social skills measures at Time 2 because this reflects a consequence paradigm that is not an initial focus of the program evaluation. To demonstrate that the program had a theoretically consistent and positive effect on behavior, there needs to be a significant and positive effect from the program to the mediator (pathway α), indicating that exposure changes skills (controlling for baseline skill level). There also needs to be a significant and negative effect from the mediator to the outcome (pathway β), indicating that social skills dampen drug involvement while controlling for baseline drug use levels. Hansen and McNeal (1996) suggested this latter effect is empirically fixed in that the magnitude of this relation does not change by introduction of the program (i.e., what changes is social skills after treatment, and this change in turn influences drug use).

The path from the program to the outcome (pathway τ) indicates that the program has a direct effect on behavior. This path is important from a statistical point of view, but it does not comport with the stated theoretical model. Traditional tests of
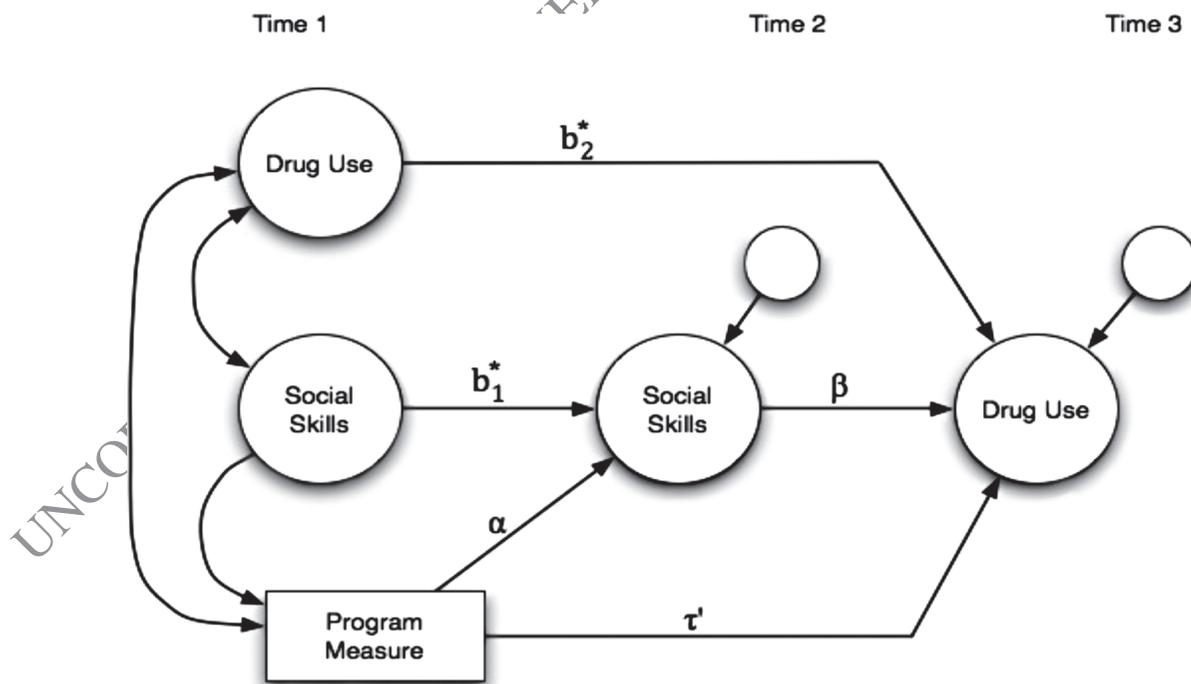

FIGURE 9.1. Graphical portrayal of simple meditational model with extended 3-year longitudinal panel data.

mediation stipulate that the magnitude of the direct effect drops when the mediator is included (the adjusted path is designated τ'), which supports that the hypothesized causal sequence or the intervening processes do account for variation in the outcome. In any case, a model positing no mediation would produce a direct effect that is greater in magnitude than would be obtained in a model positing mediation. Decomposition of the direct and indirect effects and tests of their respective significance using the Sobel (1982) method is considered the appropriate test (MacKinnon, 2008). If the pathway designated τ' is zero and nonsignificant after inclusion of the mediator, it suggests that the effect of the program on behavior is entirely mediated.

If one thinks of the 1st decade of prevention studies as focused on behavioral outcomes, providing support that programs led to behavior change, then the 2nd decade of prevention studies emphasized demonstrating that prevention programs worked in the manner hypothesized. In other words, the 2nd decade witnessed greater compliance with the published standards and found an increasingly larger number of publications emphasizing mediation to demonstrate program success (e.g., Botvin et al., 1992; Donaldson et al., 1994; Hansen, 1996; Hansen & Dusenbury, 2004; Harrington, Giles, Hoyle, Feeney, & Yungbluth, 2001; MacKinnon et al., 1991; McNeal et al., 2004; Scheier et al., 2001; Wynn et al., 2000). In some cases (Hansen & McNeal, 1997), computation of indirect effects using a traditional path analysis formula did not yield significant findings, reinforcing that certain programs did not achieve their behavioral outcomes in the manner hypothesized. Albeit manipulation checks might indicate that the skills changed, there was no significant mediation effect showing corresponding declines in behavior. This, in fact, was the case with Project Drug Abuse Resistance Education when it proved to be ineffective in several independent, high-quality, prospective evaluations (e.g., Clayton, Cattarello, & Johnstone, 1996; Rosenbaum & Hanson, 1998). An eight-study meta-analysis also bore the same results, showing that immediate short-term posttest gains on drug use (effect size = .06), knowledge (effect size = .42), and attitudes toward drugs (effect size =.11) were

not sustained over the long term (Ennett, Tobler, Ringwalt, & Flewelling, 1994) and were not the result of changes in skills, thus providing no evidence reinforcing mediation and theoretically consistent effects.

PROBLEMS ENCOUNTERED WITH PREVENTION STUDIES

During the course of conducting science, an investigator has to make innumerable decisions that can potentially influence scientific outcomes. These issues can range from the design of the study (i.e., assignment methods, program dose, disparate nature of the treatment conditions), sample selection (e.g., convenience, stratified, purposive, randomized), subject recruitment (e.g., incentives, consenting [active vs. passive], sampling time frame), measurement concerns (e.g., paper-and-pencil vs. computer-assisted personal interviews, survey fatigue, and Flesch–Kincaid required reading level), ensuring sufficient statistical power for a determined effect size (e.g., factors that influence power need to be considered, such as an a priori estimation of the effect, autocorrelation, reliability of measures, magnitude of clustering in nested designs, type of outcome [ordinal vs. categorical], and variance of the outcome, to name a few), and a host of issues, most of which are covered in texts on research design (Shadish, Cook, & Campbell, 1979). Added to this, researchers working with randomized designs still face additional concerns dealing with implementation, barriers to adoption, level of community interest (e.g., level of commitment at the school), infiltration of the experimental conditions (e.g., compensatory rivalry or experimental cross-over), contamination (e.g., sampling drift or residential instability), and a host of other potential threats to internal validity including differential attrition by condition. Perhaps the most glaring challenge is to keep the protocols for randomization pure and unaffected by political overtones (e.g., principals competing for evidence-based programs in an era in which demands for use of these types of programs promote competition between schools).

Methodological challenges have also recently become a part of the landscape of program evaluation,

owing mainly to the introduction of latent-variable modeling techniques within longitudinal designs. With latent-variable methods, researchers are more prone to bundle measures, create parcels (i.e., test-lets), or use multiple indicators to reflect latent (unobserved) constructs reflecting psychological processes (i.e., self-efficacy). In some instances, there is a loss of detail or specificity with parcels or aggregated measures; however, even with this pen-alty and loss of refinement in determining program outcomes, one goal of bundling measures is to increase reliability.

There is also a need to demonstrate measurement invariance, both over time and between experimen-tal units. Measurement invariance is required in lon-gitudinal studies to show that the focal measures (constructs) of skills and behavior remain develop-mentally consonant over time (measure the same underlying process) and that differences in treated and control participants are not attributed to hetero-geneity in variances. In other words, if a researcher implements a program that seeks to alter behavior through skills training, the various measures of skills used to assess students' responses to the intervention need to retain the same meaning to the students irrespective of time or experimental condi-tion. If this is not the case, then any change in the underlying psychological processes is not the result of the treatment's causing mean differences (ele-vated scores over time and between groups) but rather of systematic group differences in the under-lying variances of the measures (i.e., the covariance structures are different for the groups). This system-atic heterogeneity would be treated as error, and introduction of this component into the model parameter estimates will diminish the overall effect of the treatment (Lawrence & Blair, 2003).

One way to think about these requirements for measurement invariance is that the measures of skills must be behaviorally isomorphic from year to year; otherwise, one cannot point a finger at the pro-gram as being responsible for change. Prevention scientists are in many respects behind the eight ball, so to speak, given that this issue has been summarily dealt with in studies of cognitive development and aging (Horn & McArdle, 1992) as well as in other psychological studies (Meredith, 1993; Millsap,

1995). Unfortunately, only a handful of studies have recognized this requirement and put it into practice in studies of drug prevention (Pentz & Chou, 1994; Scheier et al., 2001; Widaman & Reise, 1997).

Importance of Pedagogical Caring: Testing the Real Versus the Ideal

There exist a host of additional contextual and peda-gogical factors that might influence prevention out-comes. These factors include the spirited nature of the teacher and the teacher's competence, willing-ness to engage with the program, management of students in the classroom, and adherence to the pro-gram content (i.e., fidelity to the program curricu-lum content). These program implementation concerns have been of considerable scrutiny for a long time (e.g., Botvin, Renick, & Baker, 1983; Dusenbury, Brannigan, Falco, & Hansen, 2003; Hansen et al., 1991; Malvin, Moskowitz, Schaef-fer, & Schaps, 1984; Pentz et al., 1990), owing per-haps to a long legacy of research showing that poor implementation is related to diminished program effectiveness (Dane & Schneider, 1998; Payne & Eckert, 2010). In this section, I review a handful of these program characteristics and include a careful examination of recent research that addresses the influence these factors have on program outcomes.

When researchers develop a program and wish to test the theoretical content and intervention theory with students, they must also develop a systematic way to train teachers or health educators to handle implementation. Teachers are arguably the principal means of delivering psychoeducational programs (Gottfredson & Wilson, 2003), and several program evaluations have indicated that they are the superior method of program delivery when pitted against trained intervention specialists (McNeal et al., 2004). Teachers are usually more adept at imple-menting effective classroom management strategies (Botvin & Griffin, 2001), given that they are tasked with creating learning environments with the objec-tive of stimulating academic growth. This does not mean that interventions cannot be delivered by peer leaders or health care professionals, only that several studies have implicated teachers as better skilled than other providers. Regardless of mode of deliv-ery, program evaluators can handle training of

implementers in myriad ways, including standardized training manuals, videotapes, and scripted activities. Prevention scientists can supervise or monitor teachers and provide immediate feedback about how well they are doing and whether their instructional formats deviate from the program objectives. Any problems can be resolved through discussion. Teachers need to implement the program the way it is intended and not deviate from the content or style of delivery. Likewise, they must refrain from introducing personal touches they think make the program more effective and palatable to students. It is well known that teachers often adapt program materials, and this adaptation can interfere with (bias) program outcomes (Hill, Maucione, & Hood, 2007).

Factors Influencing Program Adoption Versus Adaption

There is considerable debate about how "tight" or rigorous program implementation should be and whether local adaptations can ultimately have a positive influence (Dane & Schneider, 1998; Mihalic, Fagan, & Argamaso, 2008). Many have claimed that sustainability is more pressing than fidelity because the longevity of the program ensures that something is being done rather than adhering to a program with little support. Notwithstanding, there are many reasons for tweaking program content, some defensible, others not. For instance, the structure of the classroom or academic day can interfere with classroom time, and classes may be abbreviated because of required assembly time, fire drills, school announcements, or scheduled achievement testing that can interfere with program activities. Teachers in these situations might opt to eliminate lessons or shorten their content (Meyer, Miller, & Herman, 1993). Regardless of on which side of this debate one resides, the bottom line suggests that teacher training boosts fidelity (Hanley et al., 2009). Studies have also shown that when teachers report higher confidence in program content, satisfaction with training, recency of training, and feeling actively involved in the implementation process (e.g., interest and enthusiasm), it can effectively improve student outcomes (Ennett et al., 2003) and in some cases increase use of effective program content and improve delivery methods.

Student-level factors can also influence program outcomes. For instance, students need to receive sufficient doses of the program content. They should not miss sessions and should receive program instructional materials that are based on the most optimal way to acquire, refine, and learn new skills, skills that theoretically cause behavior change. Missing key program content can only weaken overall program effects, especially if program developers hypothesize that specific modules attending to relevant skills stimulate behavior change. Moreover, if a program specifies that group sizes for activities should be 10, classrooms of 20 or more can be disruptive; teachers might struggle to maintain control, and students might lack sufficient opportunities to engage in program exercises (i.e., behavioral rehearsal and role-playing skits). Rarely, if at all, do program developers attend to the student-level characteristics that can undermine program efficacy.

In addition, schools must buy in to the program and lend support (e.g., make classrooms available for training and assessment, schedule time for conducting paper-and-pencil assessments, allow teachers to attend trainings). Leadership at the school level should show support for the program, including scheduling in-service training for teachers, providing access to the students, and lending organizational resources that enable program delivery (Rohrbach, D'Onofrio, Backer, & Montgomery, 1996). Schools, and even districts, are not passive recipients of programs but rather play an active role in determining the success of a program. For a long time, researchers studying adoption and implementation have argued that local adopters should be permitted some latitude so they can reinvent programs to suit their local needs and that such adaptation (fine-tuning) should not interfere with program efficacy (e.g., Blakely et al., 1987). In fact, allowing for a modicum of decentralization in program uptake promotes ownership (i.e., promotes capacity); permitting local enhancements can go far to promote program longevity. One other component of program success involves parents. Parents need to be informed through various channels so they are aware of the school's participation, become informed about consent processes (e.g., using minors in research), and have opportunities to

attend open forums at which they can openly address their concerns about program content. This was perhaps best reinforced by Kellam and Langevin (2003) when they stated, "Random assignment at the individual, classroom, and family levels is not possible without community leaders and parents who allow their children to be so assigned" (p. 138). More than anything, parents want to know the intrinsic value of having their child participate in a drug prevention program offered at the school. Reticent parents can quell a program's success out of sheer ignorance about the theoretical content, the purpose and method of delivery, and the scientific rationale. Without their concerted voice, many programs that contain homework and parent–child interactive components will fall short of the high-fidelity mark required for efficacious implementation.

In addition, cultural adaptations can be made to ensure the program is user friendly and can be delivered to diverse ethnic or racial groups (Castro, Barrera, & Martinez, 2004). Precise tests of the cultural adaptations are required to ensure the program has equal fit despite the change in focus or population before wide dissemination. There are numerous examples of studies exemplifying cultural adaptation that led to successful translation and effectiveness (Botvin et al., 1989; Botvin, Schinke, Epstein, & Diaz, 1994; Schinke et al., 1988). Ringwalt et al. (2004) suggested that adaptation might be necessary, if not inevitable, to make programs suitably fit local needs. One important consideration is that efficacy trials are most often conducted with populations dramatically different from those where effectiveness trials may take place. Learning styles, family background differences, special needs of the students, and local social mores may require cultural tailoring. Each of these concerns, individually or collectively, can disrupt the efficacy of a program, inadvertently influencing program outcomes (Botvin & Griffin, 2005).

Hill et al. (2007) suggested that, despite varied reasons for making adaptations to program content or delivery mode, the Pareto principle can come into play. The Pareto principle can be stated simply as "the minority accounts for the majority." First applied to explain income disparity, this principle suggests that a handful of motivations for adaptation

should adequately account for the bulk of the reasons provided for changing program content or delivery method. In the study by Hill et al., the most frequently mentioned reason for adaptation by teachers and program implementers was running out of time. Grounded theory produced 13 types of adaptations and 15 reasons for making them (κ = .89). Four of 15 reasons given by 41 facilitators of a family-based drug prevention program accounted for 67% of the adaptations (e.g., changing, omitting, and adding). The most frequently mentioned reasons included running out of time, disagree with content, group attributes required change, and clarification.

Core Measures of Program Fidelity and Implementation

Several core measures of program integrity have come under considerable scrutiny, including adherence, program exposure, and reinvention (Dane & Schneider, 1998). Adherence has to do with specific research design features including randomization to condition and contamination (e.g., whether schools assigned to the control condition attempt to become experimental, implement their own programs as part of compensatory rivalry, or seek to disrupt the treatment). Program exposure has to do with dose of the program (e.g., how many sessions a student attends and the relations between dose and behavior; see, e.g., Botvin et al., 1995). Reinvention, also called *fidelity* or *implementation quality,* has to do with whether the program is delivered to the experimental students and not to control students via contamination in a consistent manner according to the instructional format. It has also been called *quality of program delivery* or *program integrity* and focuses on what actually happened during the intervention (i.e., what percentage of the materials are actually taught). It is worth mentioning that there is some debate as to whether reinvention (e.g., active changes to the program at the local level) truly represents low-fidelity implementation. Reinvention can consist of adding something new or innovative to make a program work seamlessly as opposed to modifying something already resident in the program content to fit local needs. Although these are only three factors taken from a host of program

integrity measures that could potentially influence outcomes, they seem to represent the most serious threats to program efficacy that have been researched to date (Griffin, Mahadeo, Weinstein, & Botvin, 2006; Mihalic et al., 2008).

For almost 2 decades now, process evaluations have been quite fruitful in pointing toward the myriad reasons that adherence, exposure, and reinvention disrupt program outcomes (Moskowitz et al., 1982; Pentz et al., 1990; Schaps et al., 1982). For instance, Pentz et al. (1990) assessed adherence, exposure, and reinvention using teacher questionnaires and process evaluations, the latter conducted by trained researchers. They used this information to supplement student reports of psychosocial risk and drug use in a group-randomized (i.e., schools were the unit of assignment), multicomponent drug prevention program administered to sixth- and seventh-grade students located in the Midwestern portion of the United States. Program contents reflected social learning (i.e., resistance skill training) and problem behavior theory, mixed with transactional and systems theories of environmental change and communication (persuasion; see MacKinnon, Weber, & Pentz, 1989, for a more thorough discussion of program contents). Process evaluations included observer ratings of class participation, perceived student interest in the materials, and teacher completion of the assigned session activities. Statistical analyses included estimating the effects (with school as the unit of analysis) of process measures on designated program outcomes, including prevalence rates for monthly and weekly use of alcohol, cigarettes, and marijuana.

What Pentz et al. (1990) found is that both adherence and exposure (i.e., dose) were not related to consumption differences at the first assessment after implementation but were significantly related to drug use change during the next year. Using a two-way median split on the experimental schools to designate low and high implementation (the control group served as a null-implementation third comparison group), schools with high levels of implementation decreased past 30-day cigarette use, and their rates of increases in weekly use of substances were lower than the low-implementation (or no-implementation) groups (adjusted for socioeconomic differences, grade, and gender). Thus, sticking to the program content and having higher doses of exposure to the students were partly responsible for suppressing rates of drug use among treated students.

Increasingly, researchers have found that several factors influence program fidelity (Hansen et al., 1991; Lillehoj, Griffin, & Spoth, 2004). Both Hansen et al. (1991) and Lillehoj et al. (2004) examined relations between implementation fidelity and program success (i.e., youth outcomes) using self-report data obtained from the program providers (i.e., teachers) as well as objective ratings obtained from trained professional observers. Using a hybrid school- and family-based intervention model, Lillehoj et al. found that process evaluations are more veridical when conducted by trained observers than by the actual implementers. Teachers attended a 2-day workshop to learn program content and theory, and observers attended a similar-length training to acquire observation skills as well as to familiarize themselves with program content and implementation strategies. Process evaluation by teachers and observers included assessing lesson coverage (content and activities), time on task (in minutes), and student receptivity. Student outcomes included attitudes toward and knowledge of drugs and beliefs about perceived social acceptability of drugs among peers and adults. Interestingly, evaluations obtained from trained experts were related statistically to youth outcomes (i.e., attitudes toward alcohol and marijuana use), but those obtained from the actual providers were not.

Hansen et al. (1991) took a slightly different tactic to assess program integrity. As before, they measured fidelity to the content; however, they also evaluated the program specialists' assessment of student receptivity and their own effectiveness in managing classroom activities. The measure of association between program specialist ratings and trained observers was modest ($r = .61$), indicating some deviation in the rating procedure. On the basis of their own evaluations, program specialists who adhered to the curriculum (on the basis of a median split using the two-thirds mark of adherence) had a significant influence on the students' knowledge about drugs, their skills to resist peer pressure, and

the acceptability of program content, whereas the same ratings for trained observers were significant only for knowledge and acceptability. The overall influence of program integrity remained intact regardless of which component was being taught (resistance skills training vs. normative education). Student characteristics that qualified these relations were grades and rebelliousness in the program specialist models and parental attitudes toward students' friends and rebelliousness in the trained observer models.

Structural Influences on Program Implementation

A recent study has involved a much broader and comprehensive look at the various structural, school, community, and provider factors that can influence program outcomes (Payne & Eckert, 2010). That is, rather than identifying factors that influence program outcomes one by one, Payne and Eckert (2010) bundled them together and tested their relative efficacy in predicting program outcomes in a single multilevel analysis. They identified motivational characteristics of the implementer (e.g., self-efficacy for implementation, good leadership and teaching skills), program structure characteristics (e.g., buy-in and selection of program by school personnel, program training, coaching), school climate factors (e.g., administrative support, organizational resources support, staff morale), and structural factors (e.g., urban density, school size, school or local policies) that can influence program success.

Researchers (Gottfredson & Gottfredson, 2002) took data for this study from the National Study of Delinquency Prevention in Schools, a program evaluating implementation practices for school-based programs emphasizing a wide range of behavioral outcomes (e.g., criminal activity, drug use, truancy, school dropout, tardiness, classroom management, risky sexual behavior). They drew a probability sample of schools and surveyed principals, teachers, students, and program providers about various aspects of their program and target outcomes. Although the research evidence compiled from this study focused solely on prevention practices related to deviance, per se, there are still lessons to be learned that can be applied to drug prevention.

First, the study included several objective measures of implementation intensity or what is termed *program-level outcomes.* To illustrate the level of detail in the assessment protocol, several indicators were used to assess intensity, including the level of integration of the program in the school (i.e., whether the program was part of the regular school day), frequency of operation, frequency of student participation, number of lessons, and duration of the program. The activity coordinator (provider), principal, and teachers in the school also provided questionnaire information. These items assessed provider (i.e., previous training and experience, leadership and organizational style) and program structure factors (i.e., standardization of training materials, integration of the program into school activities, how the program was selected, degree of training for the program, whether coaching was provided, degree of monitoring of program activities). School structural factors included the size of the school, student enrollment, number of students enrolled in the program, grade levels participating, and teacher turnover.

Given the nested nature of these data (providers are bundled within schools), Gottfredson and Gottfredson (2002) used hierarchical linear modeling to examine school and structural influences on program-level implementation outcomes; this created one equation for within-school model effects and one equation for between-school model effects. The hierarchical linear modeling controls for the similarity that one might find with responses within schools and that departs from what one might find in terms of responses between schools. In other words, the analytic approach enables the investigator to address how much variance can be accounted for between as opposed to within schools on some measurable outcome. Stated differently, the hierarchical linear modeling approach can estimate the effect of school-level measures on program implementation as well as provider-level information and its effects on implementation quality.

Results seem to confirm what prevention experts have suggested as important fidelity considerations. Programs more likely to be better implemented are also those that are standardized, receive greater supervision, and are more integrated into the

mainstream of school activities. Provider characteristics such as conscientiousness appear spuriously related to implementation quality so that once program characteristics are introduced into the model, the individual qualities of the provider are no longer important. Among Level 2 or school characteristics, higher quality implementation results from having a committed principal and an urban school with a high percentage of minority students living in poverty. The full model with both Level 1 and Level 2 predictors reinforced that standardization of program training materials was important, as was supervision and low teacher turnover. Greater training effort was matched by less implementation intensity, and schools better situated to implement programs because of organizational capacity were also less likely to achieve high implementation quality, that is, they might not have paid attention to details given their heightened sense of accomplishment.

Gottfredson and Wilson (2003) took a slightly different angle on the question of what makes some drug abuse prevention programs successful. They emphasized population characteristics (i.e., does risk status calibrate program effectiveness?), age or developmental stage (i.e., do programs vary in their effectiveness depending on age of the population?), program duration (do longer programs or booster sessions after initial program delivery enhance program effectiveness?), and the traditional inquiry about whether who delivers the program matters. Their meta-analysis of 94 independent school-based prevention studies that met the stringent criteria for inclusion showed that programs targeting high-risk students garnered effect sizes equal to those for universal programs delivered to general student populations. This interesting finding has to be stacked against cost–benefit ratios, which have been shown to be much greater with universal programs (on the order of 23:1) than with selected programs delivered to high-risk youths (Miller & Hendrie, 2009). Costs might be artificially driven up for selected programs because fewer youths attend selected programs, their behaviors are more intransigent, and they require more hands-on work than youth attending universal programs.

Mean effect sizes were almost double for programs delivered to middle-school-age youths than

for elementary or high school students, but this difference was not statistically significant. Follow-up periods, which tend to be longer for youths in elementary schools, can confound the age of participants when the program is delivered and, therefore, the mean effect sizes of these programs. However, this hypothesis was not supported. Thus, given the superior effect sizes for middle schools (.09 vs. .05), it would appear there is no benefit to introducing elementary school youths to prevention programs when the behaviors in question are much less likely to occur. There was also no apparent benefit to program length, which did not alter effect sizes. On average, most schools use the full 9-month school year to implement programs; however, there is considerable variability in this measure. Programs are most often delivered by teachers; however, there does not appear to be a statistically significant benefit in the effect sizes when teachers deliver program materials than when peers, police, researchers, or trained paraprofessionals deliver them. Finally, methodological quality of a particular study did not appear to matter or influence effect sizes. Many of the measures included in this analysis comport with the earlier discussion regarding factors that can influence study outcomes (i.e., differential attrition, pretest equivalence, randomization, unit of analysis, reliability of measures).

STATUS OF DRUG PREVENTION AFTER GOVERNMENT INTERVENTION

To this point, I have addressed several pressing scientific concerns regarding the efficacy of school-based drug abuse prevention. One additional concern is whether there have been noticeable changes in the prevention landscape after the passage of government legislation or mandates to implement evidence-based programs. Specific legislation includes the "Principles of Effectiveness," published in the *Federal Register* in 1998, a set of guidelines provided by the U.S. Department of Education (1998) and eventually supported through creation of the Office for Safe and Drug-Free Schools. Efforts demanding schools use evidence-based programs for drug use and violence prevention were eventually incorporated into the No Child

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Left Behind Act of 2001. In effect, schools may not receive Title IV federal funds if they do not comply with these principles, making them accountable for their choices of programs targeting drug and violence problems. The principles require schools and districts to gather objective data about drug and violence problems in the communities served, delineate measurable goals and objectives, engage in selection of evidence-based programs that are guided by research or evaluation information, and conduct periodic evaluation of their progress toward achieving these goals and objectives. Implementation of these regulations provides a natural means to examine whether issuance of government guidelines has induced any change in the uptake and selection of science-based programs (e.g., Ringwalt et al., 2009, 2010; Simons-Rudolph et al., 2003).

Simons-Rudolph et al. (2003) used a random stratified sample of schools and their corresponding districts to survey prevention coordinators and practitioners to determine whether they were receiving information about the principles and whether they were able to comply with the new mandate. Looking at the school-level results—where programs are actually implemented—fewer than one in four was aware of the principles, fewer than one in three had plans for surveying students, fewer than one in four had plans for measurable goals and objectives to remedy drug use and violence, fewer than one in five had plans for adopting an evidence-based program, and fewer than one in three had plans for conducting an evaluation of a program in place.

More recently, Ringwalt et al. (2010) used a representative (weighted) sample of middle schools ($N = 1,892$) to ask the same question, whether use of evidence-based programs had increased in a defined period given the stated mandate of the Department of Education's principles. Eligible schools were stratified by school size, poverty level, and population density. Participating individuals who were responsible for coordinating the prevention curriculum in their school indicated what type of prevention curriculum was used (by name), whether it was developed locally, and whether it had been listed on either the National Registry of Effective Programs and Practices or the Blueprints for Violence Prevention or approved by the Office of

Safe and Drug-Free Schools. Compared with a previous survey conducted in 2005 (Ringwalt et al., 2009), there was an increase (albeit not significant) in the number of schools using evidence-based programs (from 42.6% to 46.9%). The percentage using a locally developed or home-brewed prevention curriculum grew significantly from 17.6% to 28.1%, and the proportion using manualized drug prevention curricula that were not on the list of benchmark evidence-based programs decreased from 59.7% to 45.9%, perhaps owing to the emphasis by the government on using evidence-based programs during this period.

ODE TO THE DEVIL

During the past few years, considerable discussion has arisen over various claims regarding program efficacy (Kellam & Langevin, 2003). In fact, several authors have suggested that guidelines for establishing program efficacy have not gone far enough, leaving open the door for potential conflicts in the evaluation process (Gandhi, Murphy-Graham, Petrosino, Chrismer, & Weiss, 2007; Gorman, 1998, 2003, 2005). This situation has sparked considerable debate (Botvin & Griffin, 2005) owing to the allegiance of investigators to the principles of logical positivism and Popper's (1963) basic premise of critical rationalism (i.e., the falsification hypothesis). According to Popper, one can never really prove a theory to be true because one will never have all the facts. Rather, one can falsify weaker theories because their axioms and postulates do not hold for the real world. In the case in which a program is evaluated scientifically, using rigorous methodology and ruling out alternative explanations, then the remaining explanation supporting program efficacy should seem plausible, or at least have passed the criteria of testability.

When programs do not achieve their predicted outcomes, one should not try to rescue the theory by investing in ad hoc explanations of what might have occurred; rather, one needs to accept that the program did not achieve its objectives in the manner hypothesized. Popper (1963) stated his idea of inductive logic (i.e., moving from the particular to the universal in search of truth) as a basis for ruling

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out inferior theories, that is, theories for which the preponderance of evidence suggests they do not work. When theories are supported—when they prove their mettle and can be corroborated—they should become part of the fabric of one's knowledge. However, when they do not work, when evidence refutes their applicability to the real world, these theories in particular should be overthrown or discarded. In other words, theories that have been subject to tests and verification and have been falsified, according to critical rationalism, should not be left as part of one's epistemological pursuit.

Although most of the work involving prevention science does not touch on the criterion of demarcation or falsifiabilty, several concerns have been raised about methods or conventions of program evaluation. One glaring criticism of several promising programs has been their reliance on segmented analyses using high-fidelity samples (Gorman, 2005). In the illustrated cases, program evaluation is based on a selected subsample of youths who have received a defined amount of exposure to the program contents (usually <60% of possible classroom activities). Gorman (2003, 2005), for instance, suggested this was post hoc sample refinement and that as a matter of best practices programs should work for all youths exposed to the treatment condition, not just those receiving a high dose. A considerable body of evidence has suggested that the use of high-fidelity samples has been a usual tradition (Botvin et al., 1995; Moskowitz et al., 1983; Pentz et al., 1990). The argument that more of any treatment is better owes perhaps to overtures from the drug treatment literature suggesting that better treatment outcomes are associated with more participation and greater attendance at psychotherapy sessions (e.g., Crits-Christoph et al., 1999). According to Botvin and Griffin (2005), analysis of high-fidelity samples also provides a means to assess the value and importance of program implementation (i.e., fidelity). As mentioned earlier, programs that suffer from poor implementation will not work favorably, especially given that real-world pressures (e.g., teacher adaptations) can hamper effectiveness.

Other criticisms include the omission of negative (i.e., null) findings, particularly those addressing program effects on alcohol. A different way to

conceptualize this problem is that many middle school programs attempt to deter youths from smoking cigarettes, drinking alcohol, or using marijuana on the basis of the gateway notion that early-stage drug use proceeds in an invariant hierarchical sequence. However, when results are reported they are often specious, including positive program effects for only one or two drugs (J. H. Brown & Kreft, 1998). With few exceptions, early findings seemed to neglect program effects on alcohol (Dwyer et al., 1989; Ellickson, Bell, & Harrison, 1993; Johnson et al., 1990). To wit, Botvin, Baker, Botvin, Filazzola, and Millman (1984); Ellickson et al. (2003); Shope, Dielman, Butchart, Campanelli, and Kloska (1992); and Shope et al. (1994) all emphasized different facets of alcohol use, including measures of alcohol misuse in their prevention findings (see also Botvin, Griffin, Diaz, & Iffil-Williams, 2001, for program effects on binge drinking). Data from several multimodal, multiarm studies involving school, parent, or community interventions have reinforced that treated youths showed significant declines in one or more of the designated behavioral outcomes, but findings were not consistent across the board for all the target outcomes (Hawkins et al., 1999; Spoth, Redmond, Trudeau, & Shin, 2002).

The complaint by Gorman (2003, 2005) and others (Gandhi et al., 2007) is that there is no logic to obtaining specious effects as has been reported (at best, the search for individual effects constitutes ad hoc analyses). If the program targets multiple drugs, there should be powerful conceptual arguments about why there is no effect on youth drinking but effects are obtained for cigarette smoking or marijuana use. Critics of primary prevention have suggested that benefits of refusal skills training after program exposure should extend to all drugs, not just a few. However, consideration of historical and cultural factors may temper this criticism. For instance, program effects on alcohol may be more difficult to obtain for several reasons, including the latitude shown to underage alcohol use in U.S. society, the prevalence of alcohol use among youths, and the disjoint many youths experience because they vicariously observe moderate alcohol use and its consequences among their peers, thus contradicting much of what they hear during the intervention

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regarding deleterious effects stemming from sporadic alcohol use.

Woven in with the notion of specious effects is the argument that positive program effects can occur by chance with multiple comparisons. In many of the studies reviewed here, investigators tested program effects on measures of ever use, monthly use, and weekly use. In the case of cigarette smoking, these tests also involve the cumulative number of cigarettes smoked during the past 30 days and during the past week and the number of cigarettes smoked on average per day. The same breadth of assessment occurs with alcohol, including measures of lifetime and 30-day frequency and additional items assessing intensity (usual number of drinks) and binge drinking (five or more drinks on one occasion). In some cases, researchers posited a latent construct reflected by indicators capturing frequency of alcohol, cigarette, and marijuana use to reflect general drug involvement (Scheier et al., 2001; Spoth et al., 2002). Running so many tests requires applying more stringent nominal alpha levels (i.e., using a Bonferroni adjustment to control the experimentwise error rate) and creating a means to limit Type I error (i.e., dividing alpha by the number of test comparisons).

In response to some of these claims, Ellickson et al. (2003) revamped their Project ALERT program to consider these inconsistencies and target alcohol misuse rather than focus on more moderate levels of use. They reported significantly lower rates of alcohol misuse scores (i.e., a composite reflecting negative symptoms from alcohol use and high-risk binge drinking and a measure combining alcohol with marijuana) among experimentally treated youths compared with control youths. The program did not, however, curb initiation of alcohol use or current use, replicating what many other programs have found. The same study showed that high-risk drinkers (with levels of use that are based on baseline experience) responded favorably (lower alcohol misuse) compared with youths at less risk for drinking experience. Shope et al. (1994) reported very similar findings in a program dedicated to reducing alcohol misuse as early as elementary school with follow-up in middle school. Obtaining different outcomes with different drugs raises the issue that youths seem to move through unique stages in the uptake of drugs, varying their progression depending on which drug they use. For instance, early use of tobacco can lead more quickly to nicotine dependence, whereas early use of alcohol might be intermittent (e.g., infrequent at parties) and not accompanied by dependence. Regardless of drug or sequence of uptake, the differences observed in prevention program effectiveness might be tied to pharmacological features of the drug, consumption variables, or other factors that are typically not considered by program evaluation.

SUMMARY AND CONCLUSION

In this chapter, I identified four components of research in drug abuse prevention, including the role of etiology as it informs prevention, theoretical frameworks that serve as driving forces in the construction of different prevention modalities, various tools of program evaluation, and the importance of conducting process evaluation and fidelity checks. These four pieces of drug abuse prevention research are instrumental in determining what makes a program successful; in addition, these research areas contribute to the eventual classification of programs as evidence based. More important, the current "political arithmetic" of program evaluation requires that investigators conduct manipulation checks and determine whether an intervention's instructional methods attenuate risk and promote behavior change. This is to a large degree what the new standards of evidence suggest as the future of prevention science.

The addiction syndrome model suggests that addiction should be cast in terms of relationships between the individual and the environment, including, but not limited to, the objects of their addiction. In these terms, addiction is not defined by the drug per se, but rather by an allostatic attraction that pulls an individual to drug use. During the earliest stages of drug use, the relationships of greatest concern involve peers providing information about drugs (i.e., knowledge), the perceived social acceptability of drugs (i.e., normative climate), and social pressures to conform (i.e., assertiveness skills).

Unfortunately, almost a decade of empirical studies revealed the ineffective nature of information programs alone and led to claims of flawed program theory.

Later empirical studies identified normative education correcting misperceptions regarding the prevalence and social acceptability of drug use as superior prevention modalities; this research also showed that resistance skills training either alone or in combination with normative education was less effective. Multimodal programs then incorporated strengths of normative education, resistance skills, and personal competence training in an effort to combat factors increasing vulnerability during adolescence. One of the most important developments in the field is the recognition that individuals transact with their environments and through self-verification and behavioral homogeneity seek like-minded peers who supply esteem-building supportive feedback. Thus, drug-abusing youths search for peers who can provide social support and lessen their feelings of disenfranchisement from conventional institutions. In the company of these peers, drug-abusing youths observe inappropriate behavioral standards (i.e., excessive alcohol use or smoking cigarettes). Coupled with these deviant associations, they also invest in inefficient reward contingencies, often pursuing temptation instead of commitment. This approach dovetails with the addiction syndrome model, which claims that there are diverse pathways to addiction but that the end result is still rooted in transactions or relationships tethering the individual to societal mores. It also reinforces that drug use, even at its earliest stages, is tied to subjective shifts in mental states that are part of the currency of these transactions, albeit they are deviant in nature.

Once stakeholders grounded prevention program implementation in developmental and social cognitive theory, the search began for factors that moderate and mediate program effectiveness. Perhaps the most significant finding to come from this rash of fidelity studies is that when teachers are used as delivery agents, their training and supervision matter. The current emphasis on primary prevention rests with strategies to improve dissemination, ensuring that viable programs are used, implemented well, and have the expected effects of protecting youths from harm.

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