



# Behavioral Science and the Prevention of Adolescent Substance Abuse

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## Abstract

This article reviews the evidence regarding behavioral science approaches to the prevention of substance use disorders. Prevention science grew out of research on family and school-based interventions that were designed to treat common behavioral problems of children and adolescents. That research showed that the amelioration of problems such as aggressive behavior could prevent the development of later problems including substance use, depression, and academic failure. We begin by reviewing evidence regarding the risk factors that contribute to the development of substance use disorders, as well as the protective factors that can reduce their likelihood. We then describe a variety of family, school, and community prevention programs that have been shown to prevent youthful use and abuse of substances. We conclude by describing the progress that has been made in getting these programs widely and effectively implemented, and the challenges we face in getting to the point where most communities are achieving considerable success in prevent substance use and the other common and costly behavioral and psychological problems of children and adolescents.

**Keywords** Prevention · Drug abuse · Family interventions · School interventions · Nurturing

## Introduction

This article presents an overview of behavioral science approaches to the prevention of substance abuse. We emphasize prevention in this article because our health-care system is heavily weighted to the treatment of disease. Indeed, as much as 95% of health-care costs involve the treatment of disease (McGinnis, Williams-Russo, & Knickman, 2002). Over the past 30 years, prevention scientists have developed a trove

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of effective family, school, and community programs that have proven benefits in preventing a range of child and adolescent behavioral and psychological problems, including not only drug use, but also antisocial behavior, academic failure, depression, and unhealthful behavior. Indeed, the National Academy of Medicine (Institute of Medicine, 2009) concluded that we have the knowledge “to begin to create a society in which young people arrive at adulthood with the skills, interests, assets, and health habits needed to live healthy, happy, and productive lives in caring relationships with others.” Behavioral science approaches to prevention focus on helping communities identify the risk and protective factors that influence child and adolescent development and to put in place effective programs to reduce risks and enhance protective factors (Hawkins, Catalano, & Miller, 1992). The potential of prevention science to significantly reduce the incidence and prevalence of substance abuse—and most other behavioral and psychological problems of childhood and adolescence—makes the widespread dissemination of effective prevention techniques a high priority.

In this article, and congruent with the theme of this special issue, we emphasize the prevention of adolescent substance use and abuse, given that the use of substances in adolescence has been linked to a variety of negative outcomes, including elevated aggression and antisocial behavior, academic failure and drop-out, risky sexual activity, and higher rates of injury and premature death (Chassin, Pitts, & De Lucia, 1999; Tapert, Aarons, Sedlar, & Brown, 2001; World Health Organization [WHO], 2014). Substance abuse also confers greater risk of preventable diseases, such as cirrhosis of the liver, diabetes, and cancer (Rehm et al., 2009), which creates significant costs for the health-care system and for society at large. Indeed, the cost of adolescent substance use abuse is estimated to be hundreds of billions of dollars per year (Miller & Hendrie, 2009). Such costs are even more onerous when one considers that a more widespread implementation of the prevention approaches discussed herein could have a significant positive impact on adolescent health.

## History of Prevention Science

Prevention science evolved out of research on the treatment of psychological and behavioral disorders. Over the past 40 years, behavioral scientists studying family processes have developed and validated a significant number of family-based interventions (for a review, see Van Ryzin, Kumpfer, Fosco, & Greenberg, 2015.) These programs were initially developed to help families deal with problems such as children’s aggressive behavior. However, over time it became clear that they are not only able to address a child’s more immediate behavioral problems, but can also prevent the development of more serious problems as the child matures. For example, by heading off behavioral problems in childhood, a prevention program can also reduce the likelihood of substance abuse or violence in adolescence or early adulthood (Fergusson, Horwood, & Ridder, 2007; Hawkins et al., 1992). Likewise, programs in schools, which were initially developed to address the behavioral problems of elementary school children, have been found to prevent further development of problems in late adolescence and early adulthood (Kellam et al., 2008).

## Risk and Protective Factors for Substance Abuse

The advances in prevention science would not have been possible without the research that pinpointed risk and protective factors that influence child and adolescent development (Hawkins et al., 1992). This research finds that the development of substance abuse in adolescence occurs in the context of the development of other problems such as antisocial behavior, academic failure, and depression (Biglan, Brennan, Foster, & Holder, 2004). The development of these problems is influenced by a variety of risk factors, and the prevention of these problems is facilitated by a number of protective factors. Here we briefly describe some of the most important factors in the context of the family, school, and community.

### Family-Based Factors

Coercive social interactions are a well-established risk factor for problem development (Dishion & Snyder, 2016). In a typical coercive interaction, a mother asks a child to do something and the child resists, often by engaging in a temper tantrum or other aversive behavior. If the mother withdraws and does not insist on child compliance, then the child is negatively reinforced for their aversive behavior by the cessation of the mother's demand for compliance, and the mother is negatively reinforced for her withdrawal by the cessation of the child's aversive behavior. Thus, in families with aggressive children, family members frequently engage in such social exchanges, and they often continue until the conflict is escalated (e.g., yelling, threatening, hitting), which ends the argument and brings a brief respite from aversive stimulation to both parties. These interactions compound over time until parents withdraw their efforts to manage child behavior. Coercive families have also been found to have fewer interactions that involved warm and reinforcing interactions that would promote or reward prosocial behavior (Patterson, Reid, & Dishion, 1992). Thus, coercive family interactions can shape child behavior in very negative manner. Longitudinal studies of children from families with this risk profile showed that coercive processes contribute to the development of antisocial and violent behavior (Van Ryzin & Dishion, 2012, 2013), as well as substance abuse and mental and physical health problems, including increased risk for cardiovascular disease (Miller, Chen, & Parker, 2011; Repetti, Taylor, & Seeman, 2002).

Coercive family interactions often result in parental withdrawal of attempts to monitor and manage child behavior. In turn, this lack of parental monitoring enables young people to be in situations where they experiment with problem behavior and engage with delinquent peers (i.e., deviant peer clustering; Dishion, Patterson, Stoolmiller, & Skinner, 1991; Patterson, DeBaryshe, & Ramsey, 1989). In deviant peer groups, delinquent behavior is modeled, facilitated, and positively reinforced. As a result, deviant peer affiliation has been found to contribute to a variety of behavioral and psychological problems, in particular substance abuse (Van Ryzin & Dishion, 2014; Van Ryzin, Fosco, & Dishion, 2012; Van Ryzin & Leve, 2012).

At the same time, the family can also be a source of protective factors (Biglan, 2015). In particular, warm, supportive parental involvement with children is foundational for a child's development of the rich array of self-regulatory, social, language, and cognitive skills that children need to develop successfully. These warm parental

interactions, in which the parent follows the child's lead, involve extensive reinforcement of children's behavior in the form of positive parental social attention (Biglan, Flay, Embry, & Sandler, 2012). Such warm, supportive family environments have been linked to lower levels of alcohol and drug use across adolescence and early adulthood (Gutman, Eccles, Peck, & Malanchuk, 2011; Van Ryzin et al., 2012).

An additional source of protection is parental monitoring, in which parents consistently have knowledge of an adolescent's whereabouts, appropriately track and supervise their activities, and structure their unsupervised time. Parental monitoring is a consistent predictor of reduced alcohol and drug use and related behavioral problems, especially in early adolescence (Fosco, Stormshak, Dishion, & Winter, 2012; Van Ryzin et al., 2012). Parental monitoring and positive relationships can also reduce the promotive influence of deviant peers on adolescent alcohol and drug use and related problem behavior (Biglan et al., 2004; Van Ryzin et al., 2012).

### School-Based Factors

Coercive social interactions are also a risk factor in school settings. Coercive interactions in schools include bullying and harassment among students as well as punitive practices of school staff (Eddy, Feldman, & Martinez, 2016). Research estimates that anywhere from a quarter to a third of all students are bullied by peers at some point during their school years (Craig et al., 2009; WHO, 2012), and bullying has been linked to a variety of emotional and behavioral problems in later adolescence and early adulthood, including an increased likelihood of violent behavior, substance use, and suicide (Gini & Pozzoli, 2009; Ttofi, Farrington, & Lösel, 2012; Ttofi, Farrington, Lösel, Crago, & Theodorakis, 2016; Van Geel, Vedder, & Tanihon, 2014). In contrast, schools that create warm, supportive, and nonpunitive environments in which prosocial behavior is taught and richly reinforced can significantly reduce coercive and disruptive behavior and support the long-term development of prosocial behavior, while preventing the most common and costly child and adolescent problem behaviors, including substance use (Steffgen, Recchia, & Viechtbauer, 2013; Thapa, Cohen, Guffey, & Higgins-D'Alessandro, 2013).

Schools also serve as a key context for deviant peer clustering, in which aggressive or social maladapted students, often from coercive homes, self-aggregate into deviant peer groups and reinforce delinquent behavior (Dishion et al., 1991; Patterson et al., 1989). As will be discussed later, instructional approaches that interrupt the process of deviant peer clustering and provide opportunities for positive socialization can have salutary effects on deviant peer affiliation and, in turn, adolescent substance use (Van Ryzin & Roseth, 2018a, 2018b, 2019a).

### Community-Based Factors

Coercive social interactions can also play a role in community settings. In particular, some of the most common punitive juvenile justice practices contribute to *increased* levels of problem behavior (Lipsey, Howell, Kelly, Chapman, & Carver, 2010). In contrast, interventions that take a therapeutic, as opposed to disciplinary or deterrence approach, are more effective (Lipsey et al., 2010). The key features of these therapeutic

approaches include restorative practices, skill building, counseling, and multiple coordinated services.

Research also demonstrates that the marketing of tobacco and alcohol to youth constitute a significant community-based risk factor (Biglan, 2015). Such marketing can alter adolescents' perceptions of the relative danger of tobacco and alcohol use. For example, a monograph of the National Cancer Institute reviewed five experimental studies of the impact of cigarette marketing exposure on well-established precursors of adolescent smoking, such as ratings of the positive and negative qualities of adolescent smokers, the perception of how many adolescents smoke, attitudes toward smoking, and intentions to smoke. The review concluded that even brief exposure to tobacco advertising can influence adolescents' attitudes and perceptions about smoking and smokers and their future intentions to smoke (National Cancer Institute, 2008).

Likewise, existing research suggests that exposure to alcohol advertising may influence both youth intentions to drink and actual drinking behavior (Grube & Waiters, 2005). These relationships have been found among both early adolescents (Collins, Ellickson, McCaffrey, & Hambarsoomians, 2007) and older youth (Chen, Grube, Bersamin, Waiters, & Keefe, 2005; Ross et al., 2014). This evidence shows, for example, that there is a significant link between youth's brand-specific exposure to alcohol advertising on television and their consumption of the same alcohol brand during the past 30 days (Ross et al., 2014). There is also research linking the amount of television viewing with the degree of alcohol consumption at a later date (Van den Bulck & Beullens, 2005).

## Preventing Substance Abuse

There is a range of different approaches to the prevention of adolescent substance use that mirror the risk and protective factors discussed above. In this section, we review prevention programs that target the family, the school environment, and communities, as well as public policy.

### Family Interventions

Effective family interventions were first developed in Oregon beginning in the 1960s (Patterson, 1986; Patterson et al., 1992); there are now more than a dozen established, widely implemented family-based prevention programs (Leslie et al., 2016). Most of these programs were developed based on careful analysis of the patterns of behavioral contingencies in nurturing versus nonnurturing families (Patterson et al., 1992). These programs help parents to abandon harsh, coercive, and inconsistent discipline practices that, as discussed above, are at the root of a variety of child and adolescent behavioral problems. In particular, family-based programs focus on providing education to families, improving the quality of family relationships, and teaching key family management skills. The goal of these programs is to transform the way parents manage and monitor child behavior, the way the family negotiates conflicts and solves problems, and the affective quality of the family environment. These programs view the family as the most influential and malleable context from which to promote long-lasting behavioral and emotional adjustment among children and youth. By improving parenting

practices and family relationships, these programs can promote positive outcomes by reducing salient risk factors and promoting more effective family functioning.

Systematic reviews and meta-analyses have found family-based programs to be effective at preventing or reducing a wide range of behavioral problems among children, including externalizing and disruptive behavior, attention deficit/hyperactivity, and oppositional defiant disorder, while also promoting social competencies and academic performance (Reyno & McGrath, 2006; United Nations Office on Drugs & Crime [UNODC], 2010). There are similar findings for adolescents, including reductions in behavioral problems such as delinquency, violence, substance abuse, depression/anxiety, and HIV risk, as well as enhancements to family and peer relations (Farrington & Welsh, 2003; UNODC, 2010; Van Ryzin, Roseth, Fosco, Lee, & Chen, 2016). These family-based programs are not only effective, but are actually superior to other approaches in preventing behavioral and emotional problems. For example, Stanton and Shadish (1996) conducted a meta-analysis and found that family-based programs for substance use were more efficacious than individual counseling or peer group therapy. More recent reviews of substance abuse prevention likewise found that family-based prevention programs were more effective than youth-only programs (Foxcroft, Ireland, Lister-Sharp, Lowe, & Breen, 2003; Foxcroft & Tsertsvadze, 2012). Finally, cost-benefit analyses have found family-based programs to be among the most cost effective at addressing a range of problem behaviors despite having higher implementation costs (Miller & Hendrie, 2009).

### School-Based Interventions

School-based programs targeting substance use often ask teachers or school counselors to deliver psychosocial content aimed at changing attitudes, normative beliefs, and/or resistance skills related to use of alcohol and other drugs (Greenberg et al., 2003). Although research has found these programs to be effective, meta-analyses have found them to have only small effects on substance use (Tobler et al., 2000; Wilson, Gottfredson, & Najaka, 2001). These school-based programs can also be complex and expensive, with a significant amount of fixed curricula delivered over extended timeframes, and reviews of research on the implementation of substance use prevention programs have found that most teachers (1) do not cover everything in a curriculum, (2) are likely to teach less over time, and (3) require more than training alone to ensure a high fidelity of implementation (Dusenbury, Brannigan, Falco, & Hansen, 2003). In addition, research on these programs generally does not consider their impact on academic achievement. Because these programs require the expenditure of valuable instructional time on activities that do not directly contribute to academic achievement, schools and districts may not be strongly compelled to adapt them, reducing their overall impact on adolescent health.

An alternative school-based approach to prevention focuses on promoting the social and emotional competencies of students. Durlak, Weissberg, Dymnicki, Taylor, and Schellinger (2011) define social-emotional learning as a “process of acquiring core competencies to recognize and manage emotions, set and achieve positive goals, appreciate the perspectives of others, establish and maintain positive relationships, make responsible decisions, and handle interpersonal situations constructively.” Durlak et al.’s meta-analysis of the impact of social-emotional learning programs such as

Positive Action (Flay & Allred, 2003) and the PATHS program (Riggs, Greenberg, Kusché, & Pentz, 2006) found that, on average, such programs have moderate benefits in increasing social-emotional skills, promoting positive social behavior, preventing conduct problems and emotional distress, and enhancing academic performance. However, the evidence for a long-term impact of these programs on substance use is limited at this point, in part because much of the research on social-emotional learning has focused on elementary school, where substance use has generally not yet begun. These programs are also curriculum-based and thus can have many of the same drawbacks as the curriculum-based substance use prevention programs highlighted above.

There are two programs that affect social and emotional competencies that do have clear evidence for their impact on substance use: Cooperative Learning and the Good Behavior Game. It is not a coincidence that these programs also focus on instructional practice and do not require teachers to cover a predesigned curricula.

**Cooperative Learning** Cooperative Learning addresses deviant peer affiliation and subsequent risk for substance use by increasing students' social contacts through the implementation of collaborative, group-based learning activities. These group-based learning activities help to establish positive social relationships between at-risk youth and their lower-risk classmates, providing a mechanism for socially marginalized students to obtain more prosocial influences (as opposed to the generally antisocial influences that occur in deviant peer groups).

Cooperative learning supports the development of positive social relationships among students by establishing *positive interdependence* in group-based learning activities and explicitly rewarding the use of positive social skills in group settings. Positive interdependence implies that individual striving toward goal attainment also supports others in achieving their own goals; in other words, the success of the individual and the success of the learning group are mutually dependent. Under positive interdependence, within-group peer interaction is not indifferent or antagonistic, as in many other classrooms, but rather becomes supportive and promotive of one another's success (Deutsch, 1949, 1962). These positive social interactions can increase interpersonal acceptance and support the development of positive social relationships (Roseth, Johnson, & Johnson, 2008). These positive relationships can interrupt the process of deviant peer clustering and, in turn, reduce substance use (Van Ryzin & Roseth, 2018a, 2018b, 2019a). Cooperative learning can also significantly reduce bullying, victimization, stress, and emotional problems, and enhance prosocial behavior and social-emotional skills (Van Ryzin & Roseth, 2018c, 2019b, *in press*). Finally, cooperative learning has demonstrated robust positive effects on academic engagement and achievement (see meta-analyses by Johnson & Johnson, 1989, 2005; Roseth et al., 2008). These findings suggest that, unlike the prevention and social-emotional learning programs reviewed above, cooperative learning can address a wide range of student behavioral problems while simultaneously promoting academic achievement without the need to purchase a predesigned curriculum, making it a compelling value proposition for teachers and schools.

**Good Behavior Game** The Good Behavior Game (GBG) represents a similar approach, although tailored specifically for elementary school. Like cooperative learning, the GBG is a teaching strategy rather than a curriculum, operating on principles of social



reinforcement of on-task and prosocial behavior. Children in the GBG classrooms learn to inhibit aggressive or disruptive impulses, regulate emotions, and monitor the behavior of their classmates in a game-like setting. As a social learning-based strategy, the GBG increases the likelihood that students' newly acquired social skills are appropriately prompted and rewarded by teachers and peers. With this approach, continual practice of inhibitory control and social reinforcement of prosocial behavior can serve to sharpen self-regulatory skills and enhance social competence. The GBG has consistently proven effective at reducing aggressive/disruptive and off-task behaviors (Dolan et al., 1993; Kellam, Rebok, Ialongo, & Mayer, 1994). Long-term follow-ups of children from GBG classrooms has also found reduced levels of substance abuse later in adolescence and early adulthood (Kellam et al., 2008).

### Community Interventions

As effective family and school programs have accumulated, community-wide interventions have been developed and evaluated in an effort to reduce the incidence of substance use and related problems in entire populations. These community interventions typically involve efforts to organize widespread support for the implementation of one or more family and/or school-based prevention programs. Such studies have shown that youth use of tobacco, alcohol, and marijuana can be reduced across entire populations (Biglan, Ary, Smolkowski, Duncan, & Black, 2000a; Oesterle et al., 2018; Spoth et al., 2017).

Research also points to the effectiveness of community interventions that explicitly target youth access to alcohol and tobacco. One program, Reward & Reminder, was established as a community-based preventive mechanism against sales of tobacco to youth (Biglan, Henderson et al., 1995b; Biglan et al., 1996). In Reward & Reminder, undercover confederates, legally able to make a purchase but who appear younger, visit retail outlets that sell tobacco or alcohol (e.g., convenience stores). These confederates attempt to purchase substances but do not possess valid identification. Depending on the outcome of these purchase attempts, the confederates then either (a) *reward* clerks who refuse to sell to them, or (b) *remind* those who do sell that it is against the law to sell substances to underage youth. To further emphasize the reward aspect, Reward & Reminder calls for public recognition of the clerks who refuse to sell without valid identification. Community-based prevention studies have found that Reward & Reminder is effective in reducing the willingness of targeted retail outlets to sell tobacco (Biglan, Henderson et al., 1995b, Biglan et al., 1996) and alcohol (Flewelling et al., 2013; Van Ryzin, Lee, & Biglan, *in press*) to youth. Given the number of states permitting the sale of recreational marijuana, future research should explore whether Reward & Reminder can serve a similar purpose with licensed marijuana retailers.

### Policy Interventions

The preventive interventions described thus far all involve direct contact with families and/or children. However, a thorough public health approach to human well-being includes the creation of laws and regulations that can influence behavior in an entire population without having to make direct contact with individuals. Wagenaar and



Burris (2013) provide a comprehensive description of policy interventions that affect health. Here we provide examples of noteworthy policies that have proven benefits, as well as examples of related situations where increased attention from policymakers would be beneficial to adolescent health.

**Restrictions on Marketing** In 1998, most U.S. states reached the Master Settlement Agreement (MSA) with the major tobacco companies, which resolved state lawsuits to recover billions of dollars in costs associated with treating smoking-related illnesses. As a consequence, to reduce smoking, in particular among young people, states adopted policies that restrict the advertising of tobacco products. These policies included prohibiting the use of cartoon characters, restricting advertising via billboards and in magazines that reach large numbers of youth, and limiting sponsorship of sporting events.

In contrast, most regulations regarding alcohol marketing to young people are entirely voluntary. Data collected by the Federal Trade Commission ([FTC], 2014) found that alcohol companies are not meeting their own voluntary standards for advertising. Further, even if these standards are met, there will be many youth who are exposed to alcohol advertising anyway. Regardless of self-regulatory codes, evidence indicates that alcohol companies target advertising at adolescents, with ad expenditures growing as the percentage of underage viewers increases (Chung et al., 2010; Jernigan, Ostroff, & Ross, 2005; Noel, Babor, & Robaina, 2017). There is also evidence that exposure to alcohol ads among underage viewers (ages 18–20) grew faster than any adult age group between 2005 and 2011 (Ross et al., 2014). Finally, research has shown an increase in alcohol advertising targeting youth through social media (Barry et al., 2014; Jernigan & Rushman, 2014) and internet-based television programs (Siegel et al., 2016).

The situation is similar for adolescent use of Electronic Nicotine Delivery Systems (ENDS), also called electronic cigarettes, e-cigarettes, e-hookah, vaporizers, or vapor pens. Research shows dramatic increases in adolescent use of ENDS in recent years (Wang et al., 2017). ENDS expose users to a variety of toxic chemicals, including benzene and heavy metals (Hess et al., 2017; Pankow et al., 2017), and the nicotine in ENDS can have adverse effects on adolescent brain development (England, Bunnell, Pechacek, Tong, & McAfee, 2015). Unfortunately, youth routinely encounter ENDS marketing (Singh et al., 2016), and preliminary evidence indicates that such exposure influences them to begin using ENDS (Mantey, Cooper, Clendennen, Pasch, & Perry, 2016; Pu & Zhang, 2017).

**Economic Policy** There are a number of community economic policies that can also contribute to reductions in substance use. Komro, Tobler, Delisle, O'Mara, and Wagenaar (2013) reviewed the effects of tenant-based rental assistance. They concluded that such assistance increased positive social relations in neighborhoods and contributed to reduced psychological and behavioral problems of children. Other policies attempt to increase family income, which in turn can reduce child and adolescent behavioral problems (for a review, see Van Ryzin, Fishbein, & Biglan, 2018.) Examples of such policies include alternatives to incarceration, reducing prison reentry, improvements in the psychosocial work environment, and community-based participatory research (Komro et al., 2013).

**Retail Licensing and Tax Policy** Komro et al. (2013) also identified a variety of policies affecting the selling of alcohol that are associated with lower levels of child and adolescent problems. Reducing the density of alcohol outlets and increasing the tax on alcoholic beverages can reduce alcohol-related accidents and violence and prevent youth alcohol use. Likewise, increasing taxes on tobacco can reduce overall tobacco consumption and improve public health, including reductions in initiation and uptake among young people, more frequent cessation among current users, and reductions in consumption among those who continue to use (Biener, Aseltine, Cohen, & Anderka, 1998; Chaloupka, Straif, & Leon, 2011).

### **Large-Scale Implementation**

As evidence-based family and school preventive interventions have accumulated, prevention scientists have increasingly turned to the question of how we can get these programs widely and effectively implemented. One of the most promising ways to do this is by expanding the number and scope of community-wide interventions. For example, we are working with communities in Oregon to bring all sectors of the community together around an effort to improve supports for successful development at every phase from preconception through adolescence. Such comprehensive interventions have the potential to produce significantly lower levels of substance use and other psychological and behavioral problems than have previously been achieved. Although randomized trials of such interventions are widely believed to be the only valid experimental design, funds for conducting them in community research are scarce. Moreover, multiple baseline designs in which such interventions are introduced in a sequence of communities over time are actually a better strategy not only in terms of the cost, but in terms of their ability to allow researchers to continuously improve the intervention based on experience in initial implementations (Biglan, Ary, & Wagenaar, 2000b).

### **Measurement Issues in Behavioral Science**

We would be remiss in our analysis of behavioral science and the prevention of substance use if we did not comment on the use of self-report measures in much of the existing prevention science research. Along with others in the field, we find that rigid definitions of what counts as “behavior analysis” have either (1) impeded research on many problems of great social importance or (2) have driven people out of the behavior analysis community who were willing to work on these problems (Critchfield & Reed, 2017; Friman, 2017; Hantula, 2018; Killeen & Jacobs, 2017; Washio & Humphreys, 2018).

To put it plainly, the most common measures of adolescent and adult substance use are self-report measures. Viewed historically, it was certainly the case that self-reports were widely believed to assess the in-dwelling causes of behavior. Behavior analysts rightly pushed for analyses of the contextual influences on behavior that were obscured by the assumption that behavior was the result of indwelling traits. However, more sophisticated analyses of the relationship between verbal behavior and other aspects of behavior have led most investigators to treat self-report measures as samples of

behavior whose relationship to other aspects of behavior need to be empirically evaluated on a case-by-case basis (Kormos & Gifford, 2014).

There is no question that it would be ideal to have physiological or direct observation measures of substance use, but there is considerable evidence that self-reports of adolescent problem behavior are valid for the purpose of assessing the impact of preventive interventions. The evidence includes longitudinal analyses of the relationship between self-reports of substance use and other more objectively verifiable measures of behavior, such as dropping out of school and arrest rates (Biglan et al., 2004). It also includes evidence that ratings of behavior by parents are predictive of student-reported smoking (Biglan, Duncan, Ary, & Smolkowski, 1995a). There is also evidence that self-reports correlate with physiological measures of substance use (Biglan, Gallison, Ary, & Thompson, 1985; Del Boca & Darkes, 2003; Jackson, Covell, Frisman, & Essock, 2005; Winters, Stinchfield, Henly, & Schwartz, 1990).

As we look at the history of prevention research, we realize that a number of people with behavior analytic backgrounds chose to rely on self-report data and drifted out of the behavior analytic community, perhaps in part because they could not publish such data in behavior analytic journals. In short, the rejection of self-report evidence may be one of the reasons why behavior analysis has failed to address many of the important problems in human behavior to the extent that it could. In this respect, behavior analysis may have failed to achieve its promise as a field.

It is worth noting that behavior analysts have made a strong contribution to the treatment of substance use disorders through their development of contingency management ([cite articles in this special issue]), but have done little research on the prevention of substance use. Could this be because of their unwillingness to rely on self-report measures? In general, categorical eschewal of the use of self-report measures would make it virtually impossible to do research on public health problems where the goal is to reduce the incidence or prevalence of behaviors or disorders in entire populations.

## The Power of Prevention

We have attempted to make the case that prevention science has the potential to vastly change our communities so that they become much more effective in preventing drug abuse and related psychological and behavioral problems, as well as much of the chronic disease that contributes to premature death. We can also nurture the prosocial development of our young people and ensure their positive contribution to their communities. However, enormous challenges remain before we can realize these benefits.

Our first priority must be to increase public understanding of the power of prevention science to prevent problems and promote well-being. Research has shown that communities can be helped to identify risk and protective factors that affect youth development and put into place tested and effective interventions that significantly reduce the incidence and prevalence of youth problem behaviors, including substance abuse (Oesterle et al., 2018). At the same time, numerous family and school interventions are being widely and effectively implemented. Family interventions that are being widely implemented around the world include the Incredible Years (Webster-Stratton,

Reid, & Stoolmiller, 2008), Triple P (Sanders, Cann, & Markie-Dadds, 2003), and Parent Management Training Oregon (Forgatch, Patterson, & Gewirtz, 2013). School interventions that are being widely disseminated include Cooperative Learning (Roseth et al., 2008), the PAX Good Behavior Game (Embry, 2011), Positive Action (Flay & Alled, 2003), and Positive Behavioral Intervention and Support (Horner et al., 2009).

Few of these programs would exist if it not been for the foundational work of behavior analysis (Biglan, 2015). This is because the precise experimental analysis of the contingencies influencing behavior and development led directly to effective family and school prevention programs. However, most of the programs we have described are not directly connected with the behavior analytic community.

We do not raise this issue to criticize any of the thousands of people who have contributed to the tremendous advances of behavioral science of the last 50 years. Rather we believe that a rapprochement among the disparate communities of behavioral science researchers is underway. We hope that this article will serve to (1) inform behavior analysts about the diversity of interventions that are available to create more nurturing communities, (2) stimulate the wider use and implementation of evidence-based preventive interventions, and (3) encourage behavioral analysts to use their methodological skills to conduct experimental analysis of strategies for influencing communities to adopt the evidence-based programs and policies that are available. With increased collaboration and cooperation among these fields, and among researchers, policymakers, and community leaders, we can get to the point where most communities are achieving considerable success in prevent substance use and the other common and costly behavioral and psychological problems of children and adolescents.

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