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For Whom Do Parenting Interventions to Prevent Adolescent Substance Use Work?

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Abstract

Adolescent substance use continues to be a significant public health problem. Parent training interventions are effective preventive strategies to reduce youth substance use. However, little is known about differences in effectiveness for youth across demographic characteristics. This review assessed the effectiveness of parent training programs at reducing adolescent substance use by participant gender, age, and race/ethnicity. Pubmed/MEDLINE, ERIC, CINAHL, and PsycINFO were searched from database origin to October 31, 2016. We included randomized controlled trials that evaluated parent training interventions; reported youth initiation or use of tobacco, alcohol, or other illicit substances; and included adolescents aged 10 to 19. Two independent reviewers extracted data. Disagreements were resolved by consensus or a third researcher. Data were synthesized using harvest plots stratified by participant demographics. A total of 1,806 publications were identified and reviewed; 38 unique studies were included. Risk of bias of included studies was high. No studies targeted male teens or youth in late adolescence. Few studies targeted Asian-American, Black/African-American, or Hispanic/Latino adolescents. Overall, interventions including male and female youth and youth in early adolescence (age 10 to 14 or in 5th to 8th grade) were more beneficial than interventions including female-only or both young and older adolescents. Programs tailored to specific racial/ethnic groups, as well as programs designed for youth from multiple races/ethnic groups were effective. Current evidence supports the benefits of offering parenting guidance to all families with adolescent children, regardless of the gender, age, or race/ethnicity of the adolescent.

Keywords

Prevention; Parenting; Adolescent; Smoking; Alcohol Drinking; Substance-related Disorders

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Compliance with Ethical Standards

Conflicts of Interest. The authors have no conflicts of interest to disclose.

Ethical Approval. Not applicable.

Informed Consent. Not applicable.

Adolescent alcohol, tobacco, and illicit drug use remain serious public health concerns (Feinstein, Richter, & Foster, 2012; U.S. Department of Health and Human Services [HHS], Office of the Surgeon General, 2016). Substance use during adolescence predicts problematic outcomes in adulthood such as lower educational attainment, mental health problems, criminal behavior, and mortality (Clark, Martin, & Cornelius, 2008; Lynne-Landsman, Bradshaw, & Ialongo, 2010). Although substance use has been declining among youth, 35% of high school seniors report drinking alcohol, 11% report smoking tobacco, and 24% report illicit drug use in the past month (Johnston, O'Malley, Miech, Bachman, & Schulenberg, 2015). Parenting interventions are effective in increasing age of substance use initiation and lowering subsequent use (Allen et al., 2016; Petrie, Bunn, & Byrne, 2007; Sandler, Schoenfelder, Wolchik, & MacKinnon, 2011; Velleman, Templeton, & Copello, 2005).

Parenting programs are designed to reduce family risk factors by training parents to improve family management, monitor adolescents, reduce family conflict, and increase positive parent-child interactions (Sandler et al., 2011). Most parenting interventions target high-risk youth; however, low-risk individuals generate the highest percentage of problems related to substance misuse because they make up a large percentage of the population (Rose, 2001; U.S. Department of Health and Human Services (HHS), Office of the Surgeon General, 2016). Although potentially beneficial for lowering population-level substance misuse, parenting interventions for parents of adolescents have not been systematically scaled-up. Interventions that have succeeded in community dissemination beyond research studies are the PROMoting School–community–university Partnerships to Enhance Resilience (PROSPER; Welsh, Chilenski, Johnson, Greenberg, & Spoth, 2016) and the Communities that Care (CTC; Haggerty, & Shapiro, 2013) models, which include strong collaboration between community organizations and intervention developers.

Explicit examination of the effectiveness of parenting interventions across gender, age/school grade, and race/ethnicity is lacking as many studies have not examined differential effects according to the characteristics of participant composition. This is particularly relevant as racial and ethnic diversity among children and adolescents is increasing (Johnson & Lichter, 2010), and because some processes that protect against substance use differ by youth ethnicity and gender (Chen & Jacobson, 2012; Pilgrim, Schulenberg, O'malley, Bachman, & Johnston, 2006; Waldron & Turner, 2008). In addition, differential effectiveness could inform efforts to address health equity and the personalization of these interventions based on participants' demographic profile before large scale dissemination is implemented.

In sum, little is known about the differences in effectiveness of parenting prevention programs across demographic characteristics of adolescents. This systematic review combines primary studies to address the question “*For whom do parenting interventions to prevent adolescent substance use work?*” Specifically, we examined the effectiveness of programs at their longest time of follow up during youth's adolescence across gender, age/school grade, and race/ethnicity of the recruited adolescents whose parents participated in

universal parenting-based prevention programs. The answers to this question become important to scale up evidence-based programs into the community.

Methods

This systematic review followed the Cochrane Collaboration and PRISMA guidelines. Study protocol can be found at the PROSPERO Systematic Review Registry: CRD42014013069.

eTable 1 presents the manuscript search strategy. Inclusion criteria were: a) parent training interventions focused on adolescents (mean age of youth participants between 10 and 19 years), and b) reported youth initiation or use of tobacco, alcohol, or other illicit substances. Studies were excluded if: a) the design was not a randomized trial, b) the control group included parenting education, c) interventions targeted specific populations (e.g., divorced families, adolescents as parents, or parents of children with a particular medical condition), or d) they tested family therapy interventions. The last two exclusion criteria aimed to select universal preventive interventions. Two independent reviewers screened titles, abstracts, and full texts of potential articles. A third reviewer resolved disagreements.

All data were extracted by two independent researchers using a standardized pre-piloted form. Disagreement in data extraction was resolved by consensus. Youth demographic characteristics extracted included *gender*, *age* and/or *school grade*, and *race/ethnicity* (as reported by study authors). If studies reported that 75% or more of the participants belonged to a particular demographic group, the study was classified as targeting that group; if no proportion of study participants reached that threshold, the study was classified as targeting multiple groups for the given demographic characteristic. Specific demographic groups were male or female, young adolescents (aged between 10 and 14 years or between 5th and 8th grade) or older adolescents (aged between 15 and 19 or between 9th and 12th grade), and youth of Asian-American, Black/African-American, Hispanic/Latino, or White/European/European-American race/ethnicity. No study focused in American Indians/Native Americans.

Extracted outcomes included youth tobacco, alcohol, drugs (including marijuana), and polysubstance initiation and use. If studies reported both substance initiation and use, substance use was selected to represent the study's results as substance use is an outcome that could be modified among previous users, but initiation only considers youth without previous substance use. If studies reported multiple follow-up time points, results for the longest time point during participants' adolescence (12th grade or less than 19 years) were included as the primary outcome of prevention is delay or avoidance of negative health risk behaviors over the long term. Outcomes were documented as either positive ($p < .05$ in favor of intervention group), no difference ($p = .05$), or detrimental ($p < .05$ in favor of control group). Risks for selection, detection, attrition, and reporting biases were evaluated as low, high, or unclear using the Cochrane Risk of Bias Assessment Tool (Higgins et al., 2011) based on publications that reported the study protocol and/or its results. Corresponding authors of studies with unclear or high risk of bias were invited to provide additional information about the study.

Due to the high intervention heterogeneity (dose, delivery setting, delivery method, and participants), data were synthesized with harvest plots (Ogilvie et al., 2008). In these plots, each intervention is represented by a vertical bar, and the properties of the bar represent characteristics of the study. This qualitative method of data synthesis is particularly useful for “complex interventions” as it allows examining the distribution of the findings in the literature that otherwise is difficult to rate in a narrative synthesis (Petticrew et al., 2013). Advantages of using this approach instead of a meta-analysis include the use of all data regardless of the differences in study characteristics or metrics used to report outcomes in the primary studies (as all studies can be rated as supporting a specific hypothesis or not), the ability to tailor the properties of the plots to what researchers want to highlight, and producing a graphical method to display the data (Ogilvie et al., 2008). Harvest plots have been used to synthesize findings of systematic reviews focusing in substance use (Allen et al., 2016; Ogilvie et al., 2008), physical activity (Barnett, van Sluijs, & Ogilvie, 2012), obesity (Te Velde et al., 2012), cardiovascular risk (Aneni et al., 2014), among other conditions. Table 1 explains how harvest plots developed for this review should be interpreted.

Because comparing counts of “positive” and “null” studies based on the study’s p value for the difference between intervention and control groups might be misleading (Higgins & Green, 2008), we conducted a binomial test of proportions to test the likelihood of finding the observed distribution of positive and null studies in each outcome and demographic category using the following formula:

$$X_{\text{score}} = [H - Kp / (Kp(1-p))^{1/2}],$$

where H is the number of “positive” studies, K is the number of total studies with the characteristic of interest, and p is the criterion for positivity by a two-sided test (in this case $.05/2 = .025$). p values were calculated from a normal distribution. Under the null hypothesis, 1 in 20 studies would be expected to meet this criterion. A statistically significant X_{score} suggests that there is sufficient evidence to conclude that the proportion of studies showing effective outcomes is greater than what would have been found by chance (Higgins & Green, 2008). Using the same formula, the number of studies needed to report either no statistical difference between interventions or detrimental effects to change the distribution of the findings in a way that would change the conclusion of the harvest plot (Number Needed to be Null, NNN) was estimated.

Results

We identified 1,806 unique manuscripts (Figure 1). A total of 1,717 articles were excluded, leaving 89 articles that were screened in full. Fifty-one of these were excluded based on the inclusion and exclusion criteria. Of the 38 included studies (eTable 2), six evaluated multiple parenting interventions. Studies and associated citations will hereafter be referred to by the study number in eTable 2 with letters indicating arms for multi-armed studies (e.g., 9a, 9b). These numbers are also presented as superscripts at the end of the citation in the list of references. Harvest plots summarizing study results are displayed in Figure 2.

Risk of Bias

Of the 38 included studies, about half described how the randomization sequences were generated ($n = 21$, 55.3%), about a third described how randomization was concealed ($n = 12$, 31.6%), and few reported blinding of participants, personnel, and outcome evaluators ($n = 9$, 23.7%) (eTable 3). Many had high attrition rates and were selective in the outcomes that were reported in published manuscripts (28.9% and 26.3% respectively). Because all the included studies had at least one domain that was either unclear or posed high risk of bias to the study findings, the overall risk of bias of this systematic review is high, and results must be interpreted with caution (Higgins et al., 2011). Selection and attrition bias were the most frequent sources of bias of this review.

Gender

Most studies included male and female youth (Figure 2, A). Six studies included only girls, and no interventions focused exclusively on boys. Of those that only included girls, there were no efficacious studies for tobacco use. For alcohol and illicit substance use, X_{scores} were significant suggesting intervention effectiveness. For mixed gender groups, X_{scores} were significant for all outcomes ($p < .0001$). The number of studies that would need to be null to change this conclusion was high for all outcomes. There was variation in the risk of bias in studies, but no clear pattern indicating that studies with greater risk of bias were either more or less effective than those with less risk of bias.

Age/School Grade

The vast majority of studies included young adolescents (Figure 2, B); none exclusively targeted adolescents older than 14 or in high school. In studies focusing on young adolescents, significant X_{scores} ($p < .0001$) suggest effectiveness of parenting interventions for all outcomes. Fewer studies included adolescents from multiple age/school groups; however, results suggest that these interventions were also effective across substance use outcomes (X_{scores} range 6.24 – 11.10; $p < .0001$). Variability in the studies' risk of bias was similarly distributed among effective and ineffective studies.

Race/Ethnicity

Most studies targeted adolescents from multiple-ethnic groups (Figure 2, C). Nine studies (23.7%) included a majority of White/Caucasian/European, five (13.2%) Black/African American, four (10.5%) Latino, and one (2.6%) of Asian youth, while 19 (50%) included diverse youth populations. For studies including youth from multiple races/ethnicities, X_{scores} were significant for all substance use outcomes ($p < .0001$) except for polysubstance use. For this outcome, there was no evidence of intervention benefit ($X_{\text{score}} -0.28$; $p = 0.6103$). Studies focused on White/European American populations were notable for the long length of follow-up. The five studies focusing on Black/African American populations suggested reduction in tobacco, alcohol, and poly-substance use (X_{scores} 8.83, 5.37, and 6.24 respectively; $p < .0001$ for all), but not for illicit substance use. Three of the interventions focusing on Hispanic/Latino populations were delivered in Spanish and suggested efficacy across all substance use outcomes (X_{scores} range 4.30 – 10.82; $p < .0001$ for all). The single study focusing on English-speaking Asian families showed efficacy for alcohol and illicit

substance use ($X_{\text{scores}} 6.24; p < .0001$), but not for tobacco. Variability in studies' risk of bias was similarly distributed among effective and ineffective studies, except for the case of tobacco outcomes for White/European American populations where ineffective studies showed consistently higher risk of bias.

Discussion

In this systematic review, we constructed harvest plots that qualitatively examined the effectiveness of parenting programs to prevent adolescent substance use. We stratified harvest plots by the gender, age/school grade, and race/ethnicity of participants included in selected studies. Results revealed patterns of effective parenting interventions by characteristics of the adolescents. While universal parenting programs targeting both males and females showed patterns of substance use reduction across all outcomes, they were particularly successful in reducing tobacco use. Though studies targeting male-only samples were lacking, there was evidence of alcohol-use prevention in studies targeting female-only samples. Regarding age/school grade, most studies in the review focused on young adolescents. Significant X_{scores} demonstrated the high proportion of effective studies with this age group and in groups that included both young and older adolescents. Although there were no studies focused on American Indians/Native Americans, programs tailored to specific racial/ethnic groups had distributions suggesting effectiveness at reducing substance use with few exceptions, and several programs for adolescents of multiple races/ethnicities demonstrated benefit in reducing the use of tobacco, alcohol, and illicit substances.

Studies have found that gaps between rates of substance use in boys and girls have been narrowing in recent years, and that girls in early and middle adolescence have higher incidence of alcohol use than males (Cheng, Cantave, & Anthony, 2016; Johnston et al., 2015). However, research from the National Longitudinal Study of Adolescent Health found that males have higher substance use in late adolescence (Chen & Jacobson, 2012). Few studies that included both boys and girls reported exploring effect modification based on youth's gender. Among the few that did, five did not find differences in study outcomes (Curry et al., 2003; Dembo, Wothke, Livingston, & Schmeidler, 2002; Dishion & Andrews, 1995; Guilamo-Ramos et al., 2010; Komro et al., 2008), and two found that the intervention was more effective for girls than boys (DeGarmo, Eddy, Reid, & Fetrow, 2009; West et al., 2008). As programs including both male and female adolescents were likely to report substance use reduction across all outcomes, our results support the importance of including the parents of male and female youth in preventive interventions. Ideally, practitioners should provide parenting guidance to the parents of boys and girls, and future research should continue to explore potential effect modification based on youth gender.

Most parenting programs focused on young adolescents (typically middle school) rather than on older adolescents (typically high school). Early adolescence is the developmental stage when substance use begins to emerge for some youth, and early intervention may be particularly useful for preventing substance use initiation (Robertson, David, & Rao, 2003). However late adolescence may still be important. Though our findings showed stronger evidence for early interventions, results indicate that including parents of older adolescents could also lead to improved outcomes. Parent training for families with older adolescents

might be a “just in time” intervention (Klasnja et al., 2015; LaVenture & Gatewood, 1998), that is salient for parents and meaningful for children. Although the influence of peer relationships increases in adolescence, parents remain important (Hair, Moore, Garrett, Ling, & Cleveland, 2008; Patock-Peckham & Morgan-Lopez, 2006). Older adolescents with parents who are warm and caring but also have high behavioral expectations are less impulsive and have lower substance use rates compared to youth with authoritarian or permissive parents (Patock-Peckham & Morgan-Lopez, 2006). Other research demonstrates that parent support and involvement deter heavy drinking during the college years (Madkour et al., 2017). In addition, positive parent-child relationships have been related to substance use both among 8th grade students and 10th grade students (Pilgrim et al., 2006); this suggests that parents continue to influence the behaviors of older adolescents. As the original studies that included older adolescents did not test for effect modification by age, future research is needed to evaluate these hypotheses.

Regarding youth’s race/ethnicity, research on longitudinal patterns of substance use suggests different sensitive periods for youth substance use across racial/ethnic groups. For example, Latino youth have higher substance use in early adolescence (Chen & Jacobson, 2012). In contrast, White youth are more at risk for drinking during late adolescence and Black/African American youth have higher risk for tobacco and marijuana use in young adulthood (Chen & Jacobson, 2012). These differences across groups in terms of substance use uptake and evidence of differential responsiveness to family-based programming (Gonzalez et al., 2012; Waldron & Turner, 2008) argue for the utility of existing programs tailored to racial or ethnic groups (Lee, Vu, & Lau, 2013). Despite these differences, our results showed that there is a limited number programs developed specifically for non-White families. Although population-specific programs had positive results, more research is needed including minority families.

Even though the development of culturally appropriate interventions is relevant, our study found evidence for the effectiveness of several interventions targeting families with youth of diverse racial/ethnic composition for reducing tobacco, alcohol, and illicit substance use. This might exemplify common principles of positive parenting across racial/ethnic groups and that adapting parenting messages to the background of participants may not be necessary, although language is relevant (Gonzalez et al., 2012). Rather, if adapting a program for a culturally diverse population is not possible, implementing one of the prevention programs for diverse groups of families could benefit those families. However, as most of the studies included in this systematic review that targeted participants from multiple racial/ethnic groups did not test for effect modification by youth’s race/ethnicity, it was not possible to determine whether universal programs were equally effective for youth from all racial/ethnic groups. Indeed, programs that have included participants from multiple races without tailoring to their specific cultural background have had lower rates of engagement (Baker, Arnold, & Meagher, 2011), and one study that did examine effect modification found reduced effects on participants from racial/ethnic minority groups (Bauman et al., 2001). Future studies are needed to determine the specific contribution of cultural adaptations on study implementation and outcomes. Studies targeting diverse groups of adolescents should evaluate and report whether outcomes were similar or different for participants across their ethnicities.

This systematic review has significant strengths, including using broad inclusion criteria to identify all relevant intervention studies and strict exclusion criteria to select articles that would enable us to respond to a specific research question. We also used harvest plots to graphically summarize multiple dimensions of the included interventions, calculated binomial tests of proportions to determine the probabilities of observing the identified distributions of intervention results for each subgroup, and estimated the number needed to null as a measure of assessing the robustness of the evidence.

Although this study fulfils the standards of a high quality systematic review, conclusions should be interpreted with caution because all included studies had domains with either unclear or high risk of bias assessments. Researchers reporting the results of new primary studies should adhere to the CONSORT (Consolidated Standards of Reporting Trials) guidelines for behavioral interventions to strengthen the level of evidence of systematic reviews evaluating the impact of parenting and other behavioral interventions (Boutron, Moher, Altman, Schulz, & Ravaud, 2008). We did not perform a meta-analysis to estimate intervention effects for each of the subgroups of interest due to the high heterogeneity of interventions (dose, delivery setting, delivery method, participant composition, etc.). Although using harvest plots has many advantages, it also has limitations (Ogilvie et al., 2008). First, although plots are appealing, they need to be interpreted considering the methodological procedures of the primary studies, especially when all primary studies might suffer from bias. Also, as this method does not differentiate studies with respect to their characteristics or measures used, we included only studies focused in substance use initiation or use, and decided to include only the longest time of follow-up within participants' adolescence. These decisions allowed focusing on outcomes that are relevant (e.g., excluded intention to use substances) at the longest time of follow-up of each trial (which varied between studies). Although intervention effects might decay over time, prior evaluations have shown sustained effects of parenting interventions on tobacco, alcohol, and illicit drugs (Allen et al., 2016), supporting the importance of long-term outcomes. Finally, researchers leading primary studies should explore and report in their publications whether effect modification by participant demographics was observed. Future systematic reviews could use these analyses to confirm the presented findings as binomial tests of proportions do not take into account sample sizes of the included studies or risk of bias assessments.

Conclusion

As parenting programs are scaled-up (Chamberlain, 2017; Haggerty, & Shapiro, 2013; Welsh, et al., 2016), providers need information to understand how different populations may respond to available interventions. This review summarizes the effectiveness of parent training programs in reducing substance use across gender, age/school grade, and race/ethnicity of youth participants. Studies including older adolescents are lacking, and few target adolescents from racial/ethnic minority groups. However, our study highlights the benefits of offering parenting guidance to all families, regardless of the demographic characteristics of the adolescent.

Supplementary Material

Refer to Web version on PubMed Central for supplementary material.

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Note. Number in superscript after the study's doi identifies the study ID# of the review.

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Figure 1.
PRISMA study flow diagram

Figure 2.

A. Effects of parenting interventions on tobacco, alcohol, illicit substance, and polysubstance use or initiation at the longest follow-up time according to the gender of participants included in the studies; B. Effects of parenting interventions on tobacco, alcohol, illicit substance, and polysubstance use or initiation at the longest follow-up time according to the age of participants included in the studies; C. Effects of parenting interventions on tobacco, alcohol, illicit substance, and polysubstance use or initiation at the longest follow-up time according to the race/ethnicity group of participants included in the studies.

Note. Guidelines to interpret harvest plots are presented in Table 1. Bar color represents length of follow up: white: 12 months, dotted: 12.1–24 months, horizontal stripes: 24.1–48 month, and black: >48 months; taller bars represent studies with lower risk of bias, numbers indicate study ID; X_{score} denotes the result of the binomial test of proportions and NNN the number of studies needed to report no differences in the outcome to change the plot's conclusions.

Table 1

Guidelines to interpret harvest plots

Number over bar	Denotes the ID of the study included in the systematic review. The citation associated with each study ID is presented in eTable 2
Bar height	Denotes study risk of bias; studies with fewer sources of bias have taller bars. Because some studies did not achieve low risk of bias on any criteria and thus received a score of zero, the heights on the harvest plots represent the raw scores plus one
Bar color	Denotes the length of follow up of each study: white = 12 months; dotted = 12.1–24 months; horizontal stripes = 24.1–48 months; black = >48 months
Location within a column	Denotes how the study results were classified for each outcome of interest based on the tests for statistical significance estimated by the authors: detrimental, no difference, or positive
Location within a row	Denotes the demographic characteristics of youth included in the studies: <i>gender</i> : female only or multiple gender groups; <i>age/school grade group</i> : young adolescents only or multiple age groups; <i>race/ethnicity</i> : Asian-American, Black/African-American, Hispanic/Latino, White/European/European-American, or multiple race/ethnicity groups
X_{score}	Denotes the results of the binomial test of proportions for each outcome of interest. A statistically significant X _{score} suggests that there is sufficient evidence to conclude that the proportion of studies showing effective outcomes is greater than what would have been found by chance (Higgins & Green, 2008).
Number needed to be null (NNN)	Number of studies needed to report either no statistical difference between interventions or detrimental effects to change the distribution of the findings in a way that would change the conclusion of the harvest plot