HHS Public Access

Author manuscript

Clin Psychol Rev. Author manuscript; available in PMC 2017 April 03.

Published in final edited form as:

Clin Psychol Rev. 2016 April ; 45: 72–80. doi:10.1016/j.cpr.2016.03.007.

A Component-Centered Meta-Analysis of Family-Based Prevention Programs for Adolescent Substance Use

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Abstract

Although research has documented the positive effects of family-based prevention programs, the field lacks specific information regarding *why* these programs are effective. The current study summarized the effects of family-based programs on adolescent substance use using a component-based approach to meta-analysis in which we decomposed programs into a set of key topics or components that were specifically addressed by program curricula (e.g., parental monitoring/behavior management, problem solving, positive family relations, etc.). Components were coded according to the amount of time spent on program services that targeted youth, parents, and the whole family; we also coded effect sizes across studies for each substance-related outcome. Given the nested nature of the data, we used hierarchical linear modeling to link program components (Level 2) with effect sizes (Level 1). The overall effect size across programs was .31, which did not differ by type of substance. Youth-focused components designed to encourage more positive family relationships and a positive orientation toward the future emerged as key factors predicting larger than average effect sizes. Our results suggest that, within the universe of family-based prevention, where components such as parental monitoring/behavior management are almost universal, adding or expanding certain youth-focused components may be able to enhance program efficacy.

Keywords

substance use; adolescence; family-based prevention; meta-analysis

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Introduction

Considerable research has been devoted to preventing adolescent use of tobacco, alcohol, and marijuana. Substance use often starts among a small percentage of youth during early adolescence, and the percentage continues to increase throughout adolescence. Results from a recent national survey indicated that among eighth grade students, 30.3% had tried alcohol and 12.2% had been drunk in the past year, and 11.8% had used marijuana; however, by 12th grade, 47% of students had been drunk and 32.8% had used marijuana (Johnston, O'Malley, Bachman, & Schulenberg, 2010). These elevations in substance use have serious implications for adolescent health and well-being. For example, adolescent substance use has been linked to maladaptive behavior such as delinquency, school drop-out, and high-risk sexual behavior (DuRant, Smith, Kreiter, & Krowchuk, 1999; Ellickson, Tucker, & Klein, 2001; Krohn, Lizotte, & Perez, 1997; Tapert, Aarons, Sedlar, & Brown, 2001). Adolescent substance use also has significant longer-term implications; specifically, substance use in early adolescence is a strong predictor of later dependence (Brook, Brook, Zhang, Cohen, & Whiteman, 2002; Clark, Kirisci, & Tarter, 1998; Dewit, Adlaf, Offord, & Ogborne, 2000; Grant et al., 2006; Lynsky et al., 2003; Van Ryzin & Dishion, 2014). In turn, substance dependence is linked to a variety of maladaptive outcomes in adulthood, including increased unemployment, a greater likelihood of psychiatric disorder, and higher levels of involvement in violent crime and incarceration (Brook et al., 2002; Kandel, Davies, Karus, & Yamaguchi, 1986; Lennings, Copeland, & Howard, 2003; Soyka, 2000). The societal costs of substance use, including impacts on individual well-being, crime, and lost productivity, are estimated to be more than one half of a trillion dollars annually (NIDA, 2008). These findings underscore the importance of identifying specific approaches that can reduce substance use among adolescents and forestall the progression to substance dependence in adulthood, not only to protect the individual, but also to benefit society at large (Miller, 2004).

Research has consistently linked family-based factors with the initiation and escalation of substance use in adolescence. For example, effective parental monitoring of adolescent activities and peer groups can reduce risk for ubstance use (Dishion & McMahon, 1998; Dishion, Nelson, & Kavanagh, 2003; Duncan, Duncan, Biglan, & Ary, 1998; Griffin, Botvin, Scheier, Diaz, & Miller, 2000; Svensson, 2000; Van Ryzin, Fosco, & Dishion, 2012). Research also supports a link between parent-adolescent relationship quality and adolescent substance use (Farrell & White, 1998; Ledoux, Miller, Choquet, & Plant, 2002; Van Ryzin et al., 2012). As a result, numerous family-based prevention programs have been developed to address adolescent substance use (for review, see Van Ryzin, Kumpfer, Fosco, & Greenberg, 2015). Family-based programs emphasize the manner in which parenting practices and family interaction patterns can impact adolescent substance use and related problem behavior. These programs work with family members in an attempt to modify and manage emotions, cognitions, and behaviors within the family and create positive change in both individual behavior and family interaction patterns (e.g., increased parental monitoring of youth activities, more constructive parent-youth problem-solving, more positive parental involvement). These changes in the family can, in turn, reduce risk for adolescent substance use (Dusenbury, 2000; Kumpfer, Alvarado, & Whiteside, 2003; Lochman & van den Steenhoven, 2002).

Although research has documented the positive effects of family-based prevention programs, the field lacks specific information regarding *why* these programs have been successful. Liddle (2004) noted that although family-based programs have demonstrated favorable outcomes, we have a limited understanding of how these outcomes are achieved, and he called for more research on the exact "mechanisms of action" (p. 83). More recently, Sandler and colleagues (2011) reviewed the literature on family-based programs and noted that only a few studies examined mediational processes. In an era of increasing scarcity of resources, there is a critical need to closely examine existing family-based programs to identify the most effective program components (Lochman & van den Steenhoven, 2002; Westen, Novotny, & Thompson-Brenner, 2004). Existing meta-analyses have found significant heterogeneity of effect sizes across programs (e.g., Smit, Verdurmen, Monshouwer, & Smit, 2008), suggesting that not all family-based programs are equally effective, and this variance in effectiveness has not been explained by the amount of program time or the number of sessions specified by the program design (Lundahl, Risser, & Lovejoy, 2006). These meta-analyses evaluated programs as complete packages, and thus they cannot provide clear guidance on which components are most effective for given populations and circumstances. This is particularly true given the range of theoretical orientations, targeted recipients, and modes of delivery found in current programs (Van Ryzin et al., 2015).

Current Study

The goal of this study is to summarize the effects of family-based prevention programs on adolescent substance use using a component-based approach to meta-analysis. In addition to the traditional strengths of meta-analysis (i.e., the ability to generalize across research designs, sample characteristics, and operational definitions of variables; Cooper & Hedges, 1994), a components-based approach to meta-analysis enables us to identify the specific program aspects or characteristics that predict the largest reductions in adolescent substance use. This approach was based upon that taken by Kaminski and colleagues (2008), who conducted a meta-analysis of family-based programs for behavioral problems in children. The authors moved beyond an examination of complete programs to evaluate program strategies and processes of change. Characteristics of program content and delivery method were used to predict effect sizes on measures of parenting and children's behavior, and their findings added significantly to our understanding of family-based programs for young children. Although this work was promising, however, it has not yet been extended to adolescence or substance use prevention.

We wished to extend the work of Kaminski and colleagues (2008) to include a component-based approach, so we first decomposed each family-based prevention program into a set of key topics or components that were specifically addressed by program curricula. This included, but was not limited to, parenting practices (e.g., monitoring and behavior management, managing peer influences), individual behavior and attitudes (e.g., self-regulation and stress management, future orientation, substance use knowledge and attitudes), family interaction patterns (e.g., problem solving, positive family relationships), and external factors (e.g., success at school, dealing with discrimination). To accurately gauge the contribution of each component to the overall success of each program, we quantified the extent to which each component was present in each program in terms of the

amount of time dedicated to that component, which provided an accurate representation of the precise design of each program. We coded each component in terms of the amount of time spent delivering content to (1) youth without parents, (2) parents without youth, and (3) the whole family together. By linking components (rather than programs) to effect sizes, our results provide specific guidance regarding how to optimize family-based programs for adolescent substance use to achieve maximum effect.

Method

Studies

To ensure a broadly inclusive analysis of family-based prevention programs, our approach was to err on the side of over-inclusion. Thus, the population of primary studies included all available peer-reviewed studies in journals, books, dissertations, theses, and technical reporting on the effects of family-based prevention programs on adolescent substance use. The population of participants in the studies included all adolescents, defined inclusively from ages 11–12 (early adolescence) to 20–21 (late adolescence), regardless of gender, nationality, academic of physical abilities, or other characteristics. The population of studies included all family-based universal or selective programs aimed at preventing adolescent substance use.

Sampling Procedures—The initial document search was conducted in September 2012 using ERIC, PsycINFO, and MEDline databases. In order to error on the side of over-inclusion, we conducted the search in five steps, combining similar keywords (e.g., substance use, substance abuse) with the operator “OR,” and restricting the search in subsequent steps using the operator “AND”. Specifically, in Step 1, we searched for 36 keywords (e.g., substance, tobacco, marijuana, alcohol, chemical, narcotics, hard drug, dipsomania, etc.). In Steps 2–4, we limited the search using keywords prevention and intervention (Step 2), family, parenting, family-based, family-centered (Step 3), and adolescent, juvenile, teen, teenager, youth, children, child, middle school, junior high, elementary school (Step 4). In Step 5, we restricted the search to articles written in English. In addition to searching databases, we also reviewed lists of published work for known family-based programs, scanned citation lists for recent reviews, and perused databases of evidence-based prevention programs (e.g., SAMHSA’s National Registry Evidence-Based Programs and Practices).

These sampling procedures yielded 3,160 manuscripts from MEDline and 3,778 from ERIC and PsycINFO, resulting in 6,197 unique manuscripts after removing duplicates. We also identified an additional 485 unique manuscripts by way of reviewing citation lists and databases of evidence-based prevention programs. Thus, our initial sample included 6,682 manuscripts.

Inclusion Criteria—Review of all 6,682 manuscripts was completed by the investigators. To be included in the meta-analysis, the studies were evaluated against the following criteria: (1) The study must report on adolescent (ages 11–21) substance use, defined broadly to include tobacco (smoked or chewed), alcohol, marijuana, or “hard drugs” (e.g., cocaine, inhalants, etc.); (2) The family-program must include some component in which program

staff actually communicate with the family, either face-to-face or by telephone or email (we excluded programs in which program staff simply mailed materials to families because it was not possible to assess whether the family actually made use of the material); (3) The prevention program must be aimed at limiting the number of youth who use substances or reducing the escalation of use, such as universal (Tier 1) and selective (Tier 2) interventions, rather than indicated (Tier 3) interventions aimed at youth already identified as having a substance use problem; (4) The study must include quantitative measures of substance use and report sufficient information to calculate an ES; and, (5) The study's design must support inferences about the relative effectiveness of a family-based prevention program compared to a control group or baseline (i.e., studies comparing two family-based prevention programs were excluded).

In all, 6,551 manuscripts from the original sample were excluded. Of these, a large number of manuscripts (n = 2,829) were excluded because they did not include a quantitative measure of substance use, 326 reported on an indicated (Tier 3) intervention, 1,504 did not report sufficient quantitative information to calculate an effect size, and 3,058 did not support inferences about the relative effect of a family-based prevention program (some manuscripts were excluded for more than one reason). In addition, another five relevant manuscripts were discovered during the process of reviewing the original sample. Thus, in all, 136 manuscripts met the criteria to be included in this meta-analysis (see Appendix A); unfortunately, an inability to acquire the necessary program documentation from program authors forced us to exclude 20 of these manuscripts, yielding a final sample of 116 manuscripts (650 ESs).

Coding Program Components—Each manuscript in our sample reported on the results from a specific prevention program. For each program, we solicited program manuals or related materials from program authors. For situations where these materials could not be obtained, no coded could be generated and thus all studies using that program were necessarily excluded from our sample (see Appendix A for studies excluded for this reason).

Our approach to coding programs was guided by recent narrative reviews (i.e., Kumpfer et al., 2003; Lochman & van den Steen, 2002), consultation with Dr. Kaminski, and our own review of the literature, and reflects a top-down approach to coding the key aspects of prevention programs. We began at the top level by coding program design, which noted the presence of external components alongside the family-based content (e.g., school or community components), as well as specific program modalities (e.g., whether the program was delivered in-person or remotely, and whether it was delivered individually or in a group setting). We also coded the presence of role-playing with the curriculum (as this was found to be a key predictor of effect sizes in Kaminski et al., 2008), and the presence of optional booster sessions in the program design (the booster sessions were optional and thus not formally coded as described in the following paragraph, but their presence was captured by a dichotomous indicator).

We then coded the proportion of time allocated to each family-based component, which served to capture key differences across programs. To perform this coding, the first and third authors developed a coding system that reflects the diversity of components across different

programs (see Table 1). This system evolved as program materials were reviewed but generally maintained its core design throughout the process. The codes corresponded to the types of activities, training, or information typically provided as part of family-based prevention programs. For each program session, we used documented times from program developers or, when necessary, estimated the amount of time (in minutes) spent on each topic in consultation with program developers, and these amounts were summed across all program sessions to arrive at a set of totals, by code, for each program. As discussed above, the time spent on each activity was broken down into whether it was delivered directly to parents without youth present, delivered to youth without parents present, or delivered to the whole family together.

Coding Study Characteristics—We coded each study for the following descriptive variables: (a) publication mode, such as journal or book, (b) sample demographics, such as youth age, gender, and ethnicity, (b) sample size and rate of retention, (c) adolescent risk status (universal vs. selected), and (d) family risk status, such socioeconomic status and parent psychopathology. Because the methodological quality of primary studies also influences the validity of meta-analytic findings, we also coded methodological quality variables: (a) random assignment, (b) active vs. passive control groups, and (c) assessment of implementation fidelity. We also coded several aspects of the measures used to assess youth substance use, such as whether the measures assessed individual substances (i.e., tobacco, alcohol, marijuana/hard drugs) or general substance use (i.e., polysubstance use, or all substances combined).

Calculating Effect Sizes—We coded sufficient information to calculate Cohen's *d* as the measure of effect size (ES) for each dependent variable, with *d* calculated so that a positive value indicated a favorable outcome for the treatment group (i.e., a reduction in substance use). Cohen's *d* represents the differences between the means of the treatment group and the control group, divided by the pooled standard deviation, adjusted for sample size. For studies that did not use a control group, *d* represents the difference between the pre-treatment and post-treatment scores, divided by a pooled standard deviation. Effect size calculations were completed using Lipsey and Wilson's (2001) web-based effect size calculator. Where possible, *d* was calculated directly using means and standard deviations, as this is the most precise method. If this was not possible, then *d* was calculated from other input data (e.g., *t* or *F* statistics, binary proportions, point-biserial correlations, etc.) according to formulas provided by Lipsey and Wilson (2001). Since the nature of the calculation may influence the size of the calculated effect, we coded the level of estimation required for all effect sizes, ranging from no estimation (coded as 1), where the ES was calculated based upon specific descriptive statistics (e.g., means and standard deviations), to a high degree of estimation (coded as 5), where the ES was based upon crude statistics (e.g., sample size and *p* value). Overall, we found that little estimation was required; the vast majority of studies were coded as "no estimation" ($N = 303$ of 650, or 46.6%) or "slight estimation" (coded as 2; $N = 227$ of 650, or 34.9%).

Reliability—To ensure reliable study and ES coding, graduate student coders completed intensive training over 4 weeks supervised by the second author. The training regimen called

for double-coding of all studies until graduate student coders achieved sufficient reliability (exceeding 90% agreement). During the process of coding, coders met at least once a week to review coding issues, answer questions, and modify the coding system if necessary. Differences in coding decisions were resolved by consensus or adjudicated by the first and second authors, who also periodically reviewed coded studies to ensure a high degree of accuracy in coding and to uncover any unforeseen issues. For the variables coded in the meta-analysis, all intraclass correlation alphas (for continuous variables) were > .87 and Cohen's kappas (for categorical variables) were > .90.

With regards to the program coding, the first and third authors double-coded a randomly selected subsample of programs (~10% of programs) and consistently achieved intraclass correlations (ICC's) > .90. The complete program coding system can be obtained from the first author.

Analysis Plan

We used hierarchical linear modeling (Raudenbush & Bryk, 2002) to link program codes with ESs. Given our study design, we initially assumed a three-level model, with ESs nested within studies nested within programs. However, nearly half the programs (N = 18 out of 41) had only one study in our sample; since study-level estimates were not possible for these programs, we were forced to use a two-level model, with ESs nested within programs. The model was as follows (the effects of Level 1 covariates were initially assumed to be fixed at Level 2 and variance terms were explicitly tested as part of the model-building process):

(Level 1) $Effect\ Size_{ij} = \beta_{0j} + \beta_{1j}\,(\text{Covariate})_{ij} + e_{ij}$

(Level 2) $\beta_{0j} = \gamma_{00} + \gamma_{01}\,(\text{Program Component})_{j} + \gamma_{02}\,(\text{Covariate})_{j} + u_{0j}$

(Level 2) $\beta_{1j} = \gamma_{10}$

Our first step was to estimate an unconditional model (i.e., no predictors) to derive an average ES (i.e., program effect) across the sample. From these results, we also calculated the intraclass correlation (ICC), which indicated the amount of variance at Level 2 as compared to Level 1.

We then evaluated differences in ES by type of substance (i.e., tobacco use vs. alcohol use vs. marijuana/hard drugs/polysubstance use) using two dummy codes with tobacco use as the baseline for comparison. We then evaluated the effects of various covariates at both the ES level (Level 1) and the program level (Level 2) using a model-building approach; all covariates were tested individually, and only those that were significant were retained in the final model. At the ES level, we evaluated the nature of the control group (i.e., active vs. passive), the level of estimation required for the ES (from 1=none to 5=high), sample size and retention rate, average age, sex (i.e., percent female), ethnicity (i.e., percent non-White), adolescent risk status (i.e., selected vs. universal or mixed), and family risk status (i.e., socioeconomic status). Finally, we coded for the presence of a school-based program alongside the family-based program; this covariate had to be analyzed at Level 1 because the programs in our sample were sometimes evaluated with and without a school-based program, both within and across studies.

At the program level, we evaluated the program delivery method (i.e., traditional in-person/group-based vs. other models, such as Internet, DVD, in-home, etc.), the presence of role-playing exercises and booster sessions in the program design, and the presence of a community-based program alongside the family-based program (unlike above, where we analyzed the presence of school-based programs at Level 1, the presence of community-based programs did not vary across studies or ESs – in other words, the community-based programs were either part of the program model or they were not, and thus were analyzed at Level 2). Finally, we evaluated the effects of the program codes; as with the covariates, we took a model-building approach in which we initially evaluated each code individually and then created a combined model.

Several covariates were excluded from the analysis due to limited variance or a high degree of missing data (i.e., could not be coded based upon information provided in the manuscripts): study design (~95% randomized controlled trial vs. 5% quasi- or non-experimental); publication mode (only 1 manuscript was not a journal article); implementation fidelity (~50% missing); and, the presence of parental psychopathology (only ~10% affirmative). In addition, we did not analyze the following program codes, since more than 90% of the programs were coded as spending no (zero) time on these topics: Parental Monitoring and Behavior Management (delivered to youth without parents present); Fostering School Success (youth and whole family); and Ethnic Identity (parent, youth, and whole family). Finally, several program codes exhibited a severe degree of skewness (> 4.0) and were dichotomized, wherein any value greater than zero was re-coded as 1; these effects included Positive Family Relations (youth) and Problem Solving (youth and whole family). This approach addressed issues of severe skewness but reduced the amount of overall variance and thus was maximally conservative.

All modeling was conducted using Mplus 7.1 (Muthén & Muthén, 1998–2012) with Robust Maximum Likelihood (RML) estimation, which provides so-called “sandwich” or Huber-White standard errors. RML can provide unbiased estimates in the presence of missing and/or non-normal data. For each model, standard measures of fit are reported, including the comparative fit index (CFI), non-normed or Tucker-Lewis index (TLI), and root-mean squared error of approximation (RMSEA). CFI/TLI values greater than .95 and RMSEA values less than 0.5 indicate good fit (Bentler, 1990; Bentler & Bonett, 1980; Hu & Bentler, 1999).

Results

Descriptive data for the program codes are presented in Table 2 (intercorrelations can be obtained from the first author). Other program characteristics were as follows: 14.6% (6 programs) had a community-based component that was delivered in conjunction with the family-based content; 63.4% (26 programs) were delivered in-person in a group setting (the remainder were delivered on-line, via DVD, or in-person in the home); 29.3% (12 programs) contained some sort of optional booster session(s); and, 51.2% (21 programs) involved role playing.

Descriptive data for effect sizes and sample sizes/retention rates are presented in Table 3 (intercorrelations can be obtained from the first author). Other ES covariates were as follows: 52.5% (335 of 638) had an active control group; 41.8% (272 of 650) had a school-based component alongside the family-based program; 26.8% (124 of 462) used low-SES families; and, 20.0% (127 of 636) used at-risk or Tier 2 adolescents.

Overall effects

We fit an unconditional model and found that the ICC was .51, or that 51% of the variance was at Level 2 (the program level; *Var* = .21, *SD* = .45) as opposed to Level 1 (the ES level; *Var* = .20, *SD* = .45); the overall mean ES was .31. Model fit was good: CFI = 1.00; TLI = 1.00; RMSEA = .00 (confidence intervals for RMSEA were not provided by Mplus).

Effects by type of substance

Differences in ES by type of substance were not statistically significant, with tobacco ES = .25 (*N* = 103), alcohol ES = .31 (*N* = 290), and marijuana/hard drugs/polysubstance use ES = .35 (*N* = 257). In addition, the effects of the type of substance did not vary significantly across Level 2 units (i.e., prevention programs), suggesting that, although there were significant differences in overall program effectiveness, programs were equally effective across different types of substances. As above, model fit was good: CFI = 1.00; TLI = 1.00; RMSEA = .00.

Effects of covariates

The effects of Level 1 and Level 2 covariates are reported in Table 4; in each instance, model fit was good (as above). Several Level 1 covariates were significant and were retained for the final model, including age, family SES, sample size, and the presence of a school-based program. In no instance did the effect of a Level 1 covariate vary at Level 2, suggesting that the overall effect of the covariate was the same between programs.

Effects of program components

The effects for the program components are also presented in Table 4; in each instance, model fit was good (as above). Several program codes were retained for the final model, including Positive Family Relations (youth; this was dichotomized, as discussed above), Problem Solving (youth; dichotomized), Resisting Peer Risk (parent; marginally significant), and Future Orientation (youth). All significant codes predicted larger effect sizes.

Final model

The final model is presented in Table 5; model fit was good (as above). Two program codes emerged as the strongest predictors: Positive Family Relations (youth); and, Future Orientation (youth). Sample size was the only covariate that remained significant in the final model, with larger samples predicting smaller effects. Overall, the final model explained 59.0% of the outcome variance between programs.

Discussion

This study reports on the results of a meta-analysis of family-based prevention programs for adolescent substance use. Overall, we find that these programs had significant, small-to-moderate effects sizes on adolescent substance use (mean ES = .31), and the effect sizes were not significantly different for tobacco use vs. alcohol use or tobacco use vs. marijuana/hard drugs/polysubstance use. Although there was significant variance between programs in terms of overall effectiveness, there were no differences in terms of their relative effectiveness for different types of substances. These results are similar, if somewhat more positive, than the findings from a previous meta-analysis of family-based programs that targeted adolescent substance use (i.e., mean ES = .25 for alcohol use; Smit et al., 2008).

Effects of covariates

Very few covariates were significant, suggesting that effect sizes were not influenced by factors such as the presence of an active vs. passive control group or the risk status (Tier 2 vs. Tier 1 or mixed) or sex/ethnicity ratio of the sample. We did find a few significant covariate effects at Level 1, suggesting that samples with older youth predicted larger effect sizes, as did low-SES samples. Large samples, and pairing the family-based program with a school program, predicted smaller effect sizes. However, only the effect for sample size remained significant in the final model. We hypothesize that larger samples can present unique problems related to the scale of implementation (e.g., staffing, fidelity) that are not present with smaller samples.

At Level 2, we found no significant differences for delivery mode (in-person/group-based vs. otherwise), the inclusion of a community-based program, the inclusion of role-playing, the presence of booster session(s), or even for overall dosage (total minutes). These findings support the notion that family-based programs can be delivered effectively by a variety of different mechanisms. The lack of findings for dosage mirror previous research on family-based programs in which the amount of time and number of sessions were not significantly correlated with child or parent outcomes (Lundahl et al., 2006).

Effects of program components

With regards to program components, we initially found effects for Positive Family Relations (youth; dichotomized), Problem Solving (youth; dichotomized), Resisting Peer Risk (parent), and Future Orientation (youth); however, only Positive Family Relations and Future Orientation were significant in the final model. The standardized coefficients suggest that these components may boost the overall mean effect size (ES = .31) with the addition of a Positive Family Relations component for youth (since this component was dichotomized to represent presence vs. absence) by .44 of a standard deviation (SD * .44 = .20). Similarly, an hour's worth of youth-based programming related to Future Orientation (since this component was not dichotomized) predicts an even larger boost to effect sizes (SD * .56 = .25).

Traditional models of prevention have emphasized parent training, presuming that changes in parenting can elicit changes in family processes and, in turn, child behavior (Van Ryzin &

Fosco, 2015). Our results suggest that including youth-focused components in family-based programs can enhance program efficacy, which reflects previous research suggesting that the integration of youth, parent, and family curricula can produce better outcomes than targeting youth or parents separately (Foxcroft, Ireland, Lister-Sharp, Lowe, & Breen, 2003; Foxcroft & Tsertsvadze, 2012). These results should not be taken as a repudiation of the basic tenants of family-based prevention, such as the centrality of parental monitoring and management of child behavior (as seen in Table 2, this component was large in terms of total time, and the vast majority of the programs contained this component). Instead, our results suggest that, within the universe of family-based prevention, where components such as parental monitoring and management of child behavior are nearly universal, there was simply not enough variance across programs to predict differences in effect sizes.

Interestingly, Table 2 suggests that many programs lack youth-focused components, but this does not indicate that youth are totally uninvolved in these programs. Rather, youth are involved in the "whole family" activities, which are far more common across programs, particularly the components focused on Parental Monitoring and Behavior Management, Positive Family Relations, Problem Solving, and Resisting Peer Risk.

Implications for family-based prevention research and policy

In addition to documenting the effectiveness of family-based programs in preventing adolescent substance use, our results also provide specific direction as to the type of curricula that can be incorporated into existing family-based programs in order to enhance program effects. The youth-focused components for Positive Family Relations and Future Orientation both represent situations in which youth are asked to spend time in reflection. In a typical youth-focused activity for Positive Family Relations, youth are asked to think about issues and conflicts from their parents' point of view, or are asked to list ways in which their parents help and support them; these activities are meant to strengthen youths' empathy for and appreciation of their parents. In a typical youth-focused activity for Future Orientation, youth are asked to envision their long-term goals and to list the steps that are required to attain those goals, which can help youth to gain insight into the ways in which their current behavior can either move them toward, or away from, their goals.

Although family systems theorists have long argued for a wholistic approach to family-based prevention (e.g., Minuchin, 1974), empirical guidance about the specific ways in which to most effectively include youth in family-based programs has been less readily available. Prior work focusing on family therapy has found that adolescent-focused content plays a key role in improving family relationship quality (Hogue, Dauber, Samuolis, & Liddle, 2006). These findings, and ours, provide important feedback for programs developers that heretofore have focused more on parent-only or whole-family content. Considering that only 17.1% of programs have youth-focused content aimed at Positive Family Relations, and only 22% of programs include any youth-focused Future Orientation content (see Table 2), there is clearly widespread room for improvement in family-based prevention programs.

Our findings also emphasize the importance of including accurate reports of key information in all published findings from prevention programs, including sample demographics (e.g., age, gender, SES), program fidelity, and a straightforward way in which program

documentation can be obtained. In the current study, it was not possible to analyze program fidelity as a covariate because nearly 50% of studies did not report assessments of fidelity. We were also forced to remove 20 studies from our sample because of an inability to procure program manuals or related documentation. A greater emphasis on complete documentation (e.g., the CONSORT standards, http://www.consort-statement.org/), and a greater willingness to collaborate and share information, would better support future efforts at meta-analysis.

There also are several implications for policy. At a general level, this meta-analysis adds to the growing consensus that family-based programs can be an effective approach for reducing adolescent substance use, and the effects are robust across different substance use types. Given the negative implications of adolescent substance use for later physical and mental health (Brook et al., 2002; Kandel et al., 1986; Lennings et al., 2003; Soyka, 2000), these findings suggest that it would be wise to embed universal family-based programs into key settings that have a broad reach, such as educational or primary care settings. For example, training school counselors to provide family-based programming could have a population-level effect on adolescent substance use. Beyond these general implications, our component-based analyses suggest that further investment in existing programs to support the integration of youth-focused components targeting Positive Family Relationships and Future Orientation could enhance the effects of these programs. Thus, investing resources in this work could maximize the public health impact of family-based programming.

Strengths and limitations

This study had many strengths, including our comprehensive search of the literature, our extensive list of covariates, our innovative approach to capturing variance across programs, and our highly reliable coding mechanisms. These strengths add a degree of validity to our findings. However, there were also several limitations to this study that should temper interpretation of the results. First, we were forced to exclude a substantial portion of our initial sample of studies due to an inability to obtain program manuals or related program documentation; in some cases, such documentation was no longer accessible, and in other cases program authors simply did not respond to requests for this material. Second, since a substantial portion of our programs included only a single study, we were forced to collapse our analytical model from three to two levels, which may have created an unknown degree of bias. This lack of replication of findings should be a concern for the field of family-based prevention, given the emphasis on replication as an important aspect of program efficacy and effectiveness (Flay et al., 2005). Finally, we wished to explore cross-level interactions between key Level 1 covariates (e.g., type of substance, age, ethnicity) and Level 2 program codes, but were faced with (1) a lack of variance at Level 2 in the effects of these covariates, suggesting that the effects were similar among programs, and (2) a high degree of missing data in a few cases (for example, sample age was only available for N=378, or 58.2%, of the ES). This lack of documentation should be a concern for the field, given the limitations that it can present for meta-analyses and other summarization efforts.

Conclusion

In conclusion, we find that family-based interventions exhibit small-to-medium effects when targeting adolescent substance use, with non-significant differences in effect sizes across classes of substances, including tobacco, alcohol, and “other drugs” (i.e., marijuana, hard drugs, and polysubstance use). Programs themselves differed in a number of ways, with a variety of different delivery mechanisms, substantial differences in overall dosage, and the presence or absence of school-based or community-based components; however, in our final model, none of these differences predicted program efficacy. Importantly, we identified youth-focused components (Positive Family Relations and Future Orientation) that offered additive benefits to the overall program effect size. Our results suggest that delivering content directly to youth that is designed to encourage more positive family relationships and spur youth to think more concretely about their future may be able to add considerable impact to family-based programs. Future research should not only strive to explore and evaluate this hypothesis but should also extend our approach to different outcomes at different ages, providing additional opportunities for developers to strengthen family-based programs.

Acknowledgments

This project was supported by Grant DA032871 from the National Institute on Drug Abuse (NIDA) to Mark J. Van Ryzin. Gregory M. Fosco was supported by the Karl R. and Diane Wendle Fink Early Career Professorship for the Study of Families. The findings are solely the responsibility of the authors and do not necessarily represent the official views of the National Institutes of Health. We also wish to acknowledge the many program authors who generously provided materials and answered questions to enable us to code their prevention programs. You represent the true collaborative spirit of science.

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Appendix A – Study sample

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Highlights

- Little is known about why family-based prevention programs have been successful.
- We conducted a components-centered meta-analysis of existing family-based programs.
- We coded each program in terms of the amount of time spent on each component.
- Using multi-level modeling, two youth components predicted larger effect sizes.
- Enhancing youth components may increase the efficacy of family-based programs.

Table 1

Program coding system

Code (component)	Description
1. Parental Monitoring and Behavior Management	Training (generally targeting parents) that develops skills for effective monitoring and management of behavior.
2. Fostering School Success	Behavior that relates specifically to school, which includes parental actions aimed at fostering the family's involvement with school as well as youth actions that contribute to increased success in school, such as being productive and efficient with their time.
3. Positive Family Relationships	Training, activities, and experiences that are designed to promote a warm, friendly, engaged relationship between parents and youth, including skills related to emotional closeness, sharing, listening, and disclosure.
4. Substance Use Knowledge, Attitudes, and Values	Information and training that helps parents and youth to understand the facts regarding substance use and to clarify attitudes and values regarding substance use.
5. Self-Regulation and Stress Management	Training that enables parents and youth to cope with stress and anger.
6. Problem Solving	Training that assists parents and their youth with resolving on-going problems and sources of conflict. This entails facilitating conversations about problems where all sides contribute their own point of view and an agreement is reached that is equitable to all sides.
7. Resisting Peer Risk	The development of skills and values that help youth to resist peer pressure to get involved in risky situations or engage in risky behavior. For parents, this code includes information and skills related to supporting their teen in avoiding or dealing with risky situations.
8. Psycho-Education	Information and training that provides parents with insight into biological, cognitive, and social development during childhood and/or adolescence.
9. Ethnic Identity	Activities designed to develop an awareness of or pride in one's ethnic identity. This also includes development of skills for dealing with racial discrimination.
10. Future Orientation	Envisioning dreams for the future and setting long-term goals related to these dreams. This includes youth working with their own goals, parenting thinking about goals for their youth and how to help youth attain them, and parents supporting and encouraging youth with their own goals.
11. Other	All time taken by prevention programs that could not be allocated to a specific code (e.g., program introductions and overviews, icebreaker activities, discussion of rules, general reviews of material, program evaluations, celebrations, etc.).

Table 2

Descriptive data for program codes (minutes)

Program Code	M	SD	Range	% Programs w/zero min.
1. Parental Monitoring and Behavior Management				
Parent	191.33	266.34	.00–1080.00	26.8%
Youth	3.43	11.06	.00–45.00	90.2%
Whole family	17.20	35.61	.00–165.00	63.4%
2. Fostering School Success				
Parent	47.51	104.83	.00–420.00	68.3%
Youth	3.90	17.59	.00–90.00	95.1%
Whole family	2.34	9.48	.00–46.00	92.7%
3. Positive Family Relationships				
Parent	73.24	130.15	.00–480.00	39.0%
Youth	8.41	27.70	.00–145.00	82.9%
Whole family	46.33	81.46	.00–305.00	58.5%
4. Substance Use Knowledge, Attitudes, and Values				
Parent	47.76	118.75	.00–750.00	46.3%
Youth	6.83	25.64	.00–155.00	85.4%
Whole family	11.56	23.65	.00–99.00	70.7%
5. Self-Regulation and Stress Management				
Parent	46.15	94.76	.00–475.00	51.2%
Youth	39.12	120.67	.00–560.00	82.9%
Whole family	9.57	32.30	.00–185.00	80.5%
6. Problem Solving				
Parent	124.62	192.55	.00–780.00	39.0%
Youth	42.37	125.45	.00–595.00	80.5%
Whole family	51.41	125.76	.00–650.00	70.7%
7. Resisting Peer Risk				
Parent	7.71	16.82	.00–65.00	70.7%
Youth	15.20	42.99	.00–190.00	82.9%
Whole family	18.00	32.33	.00–110.00	61.0%
8. Psycho-Education				
Parent	17.63	34.53	.00–150.00	63.4%
9. Ethnic Identity				
Parent	7.33	31.56	.00–182.50	90.2%
Youth	4.09	19.98	.00–120.00	95.1%
Whole family	.00	.00	.00–.00	100.0%
10. Future Orientation				
Parent	4.34	11.98	.00–60.00	82.9%
Youth	9.61	27.22	.00–135.00	78.0%
Whole family	10.85	41.28	.00–255.00	85.4%
11. Other	225.41	307.24	.00–1310.00	68.3%

Note. “Parent” refers to intervention content delivered only to parents, “Youth” refers to intervention content that is delivered only to youth, “Whole family” refers to intervention content delivered to parents and youth simultaneously.

Table 3

Descriptive data for ES codes

Variable	M	SD	Range
Sample Size (*N* = 649)	1568.43	2641.38	16.00–11024.00
Retention Rate (%; *N* = 621)	78.71	11.90	46.00–100.00
Age (*N* = 378)	12.64	2.60	5.70–18.50
Sex (% female; *N* = 510)	53.95	16.62	.00–100.00
Ethnicity (% non-White; *N* = 552)	35.51	38.30	.00–100.00

Table 4

Initial model results

Level 1 covariates	**β**	**Var at Level 2**
Control group (active vs. passive)	.14	.06
Supplementary school-based program (yes vs. no)	−.15*	.02
Estimation (1=none, 5 = high)	.03	.04
Sample size (/1000)	−.18**	.00
Retention (%)	.03	.00
At risk (Tier 2 vs. Tier 1 or mixed)	−.17	.08
Age	.40**	.00
Socio-economic Status (low vs. middle or mixed)	.10*	.00
Sex (% female)	.18	.00
Ethnicity (%)	.03	.00
Level 2 covariates	*β*	
Delivery mode (in-person/group-based vs. otherwise)	.06	-
Community-based program (yes vs. no)	−.14	-
Role-playing (yes vs. no)	.05	-
Booster session(s) (yes vs. no)	.05	-
Dosage (total minutes/1000)	.13	-
Level 2 program codes (minutes/60)	*β*	
1. Parental Monitoring and Behavior Management		
Parent	.12	-
Youth	-	-
Whole family	−.03	-
2. Fostering School Success		
Parent	.06	-
Youth	-	-
Whole family	-	-
3. Positive Family Relationships		
Parent	−.04	-
Youth	.49*	-
Whole family	.26	-
4. Substance Use Knowledge, Attitudes, and Values		
Parent	−.05	-
Youth	.14	-
Whole family	−.11	-
5. Self-Regulation and Stress Management		
Parent	−.10	-
Youth	.16	-

Level 1 covariates	β	Var at Level 2
Whole family	−.04	-
6. Problem Solving		
Parent	−.13	-
Youth	.41 *	-
Whole family	−.05	-
7. Resisting Peer Risk		
Parent	.29 †	-
Youth	.16	-
Whole family	−.15	-
8. Psycho-Education		
Parent	−.02	-
9. Ethnic Identity		
Parent	-	-
Youth	-	-
Whole family	-	-
10. Future Orientation		
Parent	−.11	-
Youth	.64 *	-
Whole family	−.05	-

Note. Estimates were not derived for the following codes due to lack of variance (i.e., > 90% of programs had no/zero time): Parental Monitoring and Behavior Management (youth); Fostering School Success (youth and whole family); and Ethnic Identity (parent, youth, and whole family).

† $p < .10$.

* $p < .05$.

** $p < .01$.

Table 5

Final model results

Level 1	**β**	**Var at Level 2**
School-based program (yes vs. no)	.14	.04
Sample size (/1000)	−.22**	.00
Age	.29	.00
Socio-economic Status (low vs. middle or mixed)	−.05	.06
Level 2		
Positive Family Relations (youth)	.44*	-
Problem-Solving (youth)	−.11	-
Resisting Peer Risk (parent)	−.02	-
Future Orientation (youth)	.56*	-

* $p < .05$.

** $p < .01$.