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The Moderating Effect of Family Involvement on Substance Use Risk Factors in Adolescents with Severe Emotional and Behavioral Challenges

Robert C. Schlauch^a, Ash Levitt^a, Christian M. Connell^b, and Joy S. Kaufman^b

^aResearch Institute on Addictions, University at Buffalo, 1021 Main St., Buffalo, NY 14203

^bThe Consultation Center, Department of Psychiatry, Yale University School of Medicine, 389 Whitney Avenue, New Haven, CT 06511

Abstract

Objective—The current study longitudinally examined the moderating effects of family involvement, which previous research has shown to be a protective factor against adolescents' substance use involvement, on the associations between internalizing and externalizing problems, respectively, and substance use (alcohol, marijuana, and tobacco) and problems in a unique sample of adolescents with severe emotional and behavioral problems.

Method—Adolescents ($n=4,786$) and their parents were assessed at three waves over a one-year period as part of the SAMHSA funded Comprehensive Community Mental Health Initiative (CMHI). Multilevel growth curve models were estimated using Hierarchical Linear Modeling (HLM) to examine the associations between time-varying internalizing and externalizing problems, respectively, and substance use involvement over time as a function of family involvement at baseline

Results—Results supported the hypothesis that family involvement protects against adolescent substance use involvement by buffering the adverse effects of both internalizing and externalizing problems. Specifically, for alcohol use, family involvement buffered the negative effects of high externalizing problems. For tobacco use, family involvement buffered the negative effects of both internalizing and externalizing problems, respectively. For substance use problems, family involvement buffered the effects of only internalizing problems. Family involvement did not moderate effects of emotional and behavioral problems on marijuana use, however, a significant main effect was observed such that family involvement was negatively related to marijuana use.

Conclusions—Results suggest that the beneficial effects of family involvement on at-risk adolescents' substance use involvement are dependent on the type of emotional and behavioral

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*Corresponding author: rschlauch@ria.buffalo.edu; Tel.: 1-716-887-2229; fax: 1-716-887-2477.

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Contributors

Robert C. Schlauch, Ash Levitt, and Joy Kaufman conceptualized and contributed to writing of the manuscript. Ash Levitt conducted all statistical analyses. Christian M. Connell contributed to the discussion sections and provided feedback on manuscript drafts. All authors contributed to and have approved the final manuscript.

Conflict of Interest
No conflict declared.

problems the adolescent experiences as well as the type of substance the adolescent uses. Implications for family- and adolescent-focused treatment are discussed.

Keywords

family involvement; substance use; adolescence; externalizing problems; internalizing problems

1. Introduction

By the 12th grade, the prevalence of adolescents who have used alcohol (72%), cigarettes (44%), or marijuana (42%) are dramatic (Johnston et al., 2010). Moreover, approximately 7.3% of 12- to 17-year-olds are diagnosed with substance use disorders (SAMHSA, 2011), indicating that a substantial percentage of adolescents are also experiencing serious problems as a result of their substance use. Research indicates that children and adolescents with severe emotional and behavioral challenges (SEB) are at greater risk for problematic substance use and receiving a substance use disorder diagnosis (e.g., Greenbaum et al., 1991). Further, rates of comorbid psychiatric disorders among adolescents with a substance use disorder are as high as 60 percent (Armstrong and Costello, 2002). Not only is occasional substance use during adolescence associated with lower social functioning and health problems (Tucker et al., 2005), but a history of substance use can also result in poorer treatment outcomes among adolescents with SEB (Walrath, et al., 2006). Although family involvement is generally considered to be a protective factor against increased risky behaviors in adolescents with SEB, research has not directly tested it as a moderating factor in the association between SEB and substance use outcomes. The current study examined whether family involvement protectively moderates the longitudinal associations between externalizing and internalizing problems and substance use frequency and problems over a one-year period in a sample of adolescents (ages 11–18) with SEB and their parents served in systems of care.

1.1 Externalizing and Internalizing Problems as Risk Factors for Adolescent Substance Use

Among the most studied and robust risk factors for early substance use and abuse are behaviors associated with externalizing behavior problems (King et al., 2004; Willens and Biederman, 1993; Iacono et al., 1999; McGue et al., 2001a; Disney et al., 1999). For example, childhood disorders characterized by behavioral disinhibition are associated with a younger age of first drink (McGue et al. 2001b). Moreover, prospective research has shown that youth diagnosed with conduct disorder, oppositional defiant disorder, and attention-deficit/hyperactivity at age 11 are at higher risk for having tried alcohol, nicotine, and marijuana by age 14, and those with conduct disorder and oppositional defiant disorder are more likely to engage in regular use across all three substances (King et al., 2004). In one of the few reports examining the relationship between externalizing problems and substance use within a clinical sample on adolescents with SEB, Greenbaum and Dedrick (2007) found that those classified as “heavy initial escalators” on substance use variables had significantly higher externalizing behavior problems than those classified as “light initial escalators”, suggesting that even among those already at greater risk, externalizing problems can significantly impact the developmental trajectory of substance use.

Internalizing problems and disorders have also been a major focus of past research seeking to identify risk factors for early substance use and abuse among adolescents. However, in contrast to externalizing behavior problems, the relationship between internalizing problems and early substance use is less clear. Some studies have found significant positive associations between internalizing problems and adolescent substance use (King et al., 2004;

Marmorstein and Iacano, 2001), whereas others have not (Bardone et al., 1998; Rao, et al., 2000). These inconsistencies suggest that the effects of internalizing problems on substance use may be more conditional than those of externalizing problems, and could depend on other factors such as the type of internalizing problem experienced (e.g., depression; King et al., 2004), other moderating situational or familial factors, and/or the type of substance used. Additionally, some research suggests that comorbid internalizing and externalizing problems are differentially related to substance use outcomes compared to either type of problems alone (Lansford et al., 2008), suggesting an interaction between internalizing and externalizing problems. However, to date, there is limited research examining the relationship between internalizing and externalizing symptoms, respectively or in concert, and early substance use among adolescents with SEB receiving services within mental health systems of care. Thus, in order to inform the development and application of effective interventions and treatment, further examination of the impact of internalizing and externalizing problems on early substance use among adolescents with SEB is needed. In particular, research aimed at identifying under what conditions (i.e., moderators) internalizing and externalizing problems result in less vs. greater risk of early substance use.

1.2 Family Involvement as a Protective Factor against Adolescent Substance Use

Research has identified several familial factors that are protective against increased adolescent substance use. For example, emotional support (Marta, 1997), open and frequent communication with parents (Stronski et al., 2000), engaging in family activities (Wang et al., 2005), parental rules for substance use (van der Vorst et al., 2005) and parental monitoring (Kosterman et al., 2000) are all associated with decreased substance use in adolescence. Further, parental monitoring mitigates the relationship between externalizing behaviors and later heavy alcohol use (Fallu et al., 2010). The consistency in findings across several familial factors suggests the presence of a broader construct of family involvement reflecting an overall quality of family interactions and environment.

Family involvement is defined as a “child’s participation in and relationship with members of his or her family” (Epstein, 2009, p.7), and represents a broad, holistic construct that reflects the overall quality of the family environment and interactions therein between adolescents and their parents. Most previous research on the effects of familial factors on adolescent substance use has focused narrowly on specific aspects of family involvement as opposed to a single construct assessing the multiple domains described above. With the increased focus on strength-based assessments and treatments for adolescents with SEB, we argue that understanding the effects that family involvement (construed more broadly as opposed to specific elements of family involvement) has on early substance use is crucial to future prevention and intervention efforts, particularly for adolescents with SEB.

1.3 Current Study

To our knowledge, the current study is the first to examine the longitudinal impact of family involvement on substance use outcomes in a clinical sample of adolescents with SEB and their parents. Specifically, the current study sought to examine whether and how family involvement serves as a protective moderating factor on the associations between internalizing and externalizing problems and substance use frequency and related problems in a sample of adolescents and their parents served in children’s mental health systems of care over a one-year period. Based on research and theory, we hypothesized that:

1. Greater internalizing and externalizing problems would be associated with greater reports of substance use (i.e., alcohol, marijuana, and tobacco use, respectively) and problems related to substance use. Based on the dearth of literature examining interactions between internalizing and externalizing difficulties, we offer no specific hypotheses for this interaction although we do test for it.

2. Family involvement would moderate the influences of internalizing and externalizing problems, respectively, on reports of substance use and related problems, such that greater family involvement would mitigate the negative effects of internalizing and externalizing problems on substance use outcomes. Furthermore, we expected the moderating effects of family involvement to be robust and to remain after controlling for other individual difference (e.g., gender, race, SES) and family factors (e.g., biological family history of substance abuse).

2. Method

2.1 Overview of Study and Participants

Participants were adolescents (ages 11–18) and their families enrolled in children's mental health systems of care. All data were collected as part of the evaluation of the Comprehensive Community Mental Health Services for Children and Their Families Program – the Children's Mental Health Initiative (CMHI),- funded by the Child, Adolescent and Family Branch, Center for Mental Health Services, Substance Abuse and Mental Health Services Administration, U.S. Department of Health and Human Services. The CMHI provides grants and cooperative agreements to communities to develop and enhance systems of care to serve children and adolescents with serious emotional and behavioral challenges. Youth enrolled in system of care services are referred from various agencies, including juvenile justice, school, mental health agencies, primary care physicians, substance abuse clinics, as well as caregiver and self-referrals (youth seeking help). The current study examined data collected at three waves over a one-year period (i.e., baseline, 6-month follow-up, and 12-month follow-up) for those who participated in the longitudinal outcome study of the national evaluation in communities initially funded between 1997 and 2000. A detailed description of the national evaluation protocol and data collection procedures can be found elsewhere (Holden et al., 2001). Adolescents were interviewed at each of three waves about their alcohol, marijuana, and tobacco use, and any problems associated with their substance use. Parents or caregivers of adolescents were interviewed at baseline about demographic and family background characteristics (e.g., SES, biological family history of substance abuse), and at all three waves about their child's internalizing and externalizing problems (i.e., Child Behavior Checklist subscales), and the degree of family involvement the adolescent experiences (i.e., Behavioral and Emotional Rating Scale, Family Involvement subscale).

Data from a total of 9,141 adolescents and their families were available for analysis. Data on substance use was only collected among adolescents aged 11 – 18 ($n = 6,205$). Of those 6,205 adolescents, 4,786 provided information regarding their history of substance use at baseline. For the current study, each analysis (alcohol, marijuana, cigarettes, respectively) was conducted on subgroups of participants indicating at baseline having ever used the substance in their lifetime, resulting in final analysis samples of 2,433 adolescents who had used alcohol, 2,048 who had used marijuana, 2,704 who had used cigarettes, and 3,140 who had used any of the three substances (see Table 1 for a summary of demographic information for each sub-sample).¹ The rationale for this decision was two fold. First, theoretically the present study was interested in examining risk and protective factors for substance use among a high risk sample, and not the examination of factors influencing

¹Examination of the differences between those indicating having ever tried any of the three substances under investigation ($n=3140$) and those who have never tried ($n=1584$) at baseline revealed statistically significant differences on externalizing problems [$F(1, 4463) = 29.59, p < .001$], internalizing problems [$F(1, 4462) = 8.27, p = .004$], family involvement [$F(1, 4352) = 60.59, p < .001$], and age [$F(1, 4723) = 924.62, p < .001$]. Specifically, those who have ever tried were higher on externalizing problems (69.59 vs. 67.74), lower on internalizing problems (63.93 vs. 64.96), lower on family involvement (7.9 vs. 8.7), and on average 1.56 years older (14.47 vs. 12.91). Such differences are consistent with the literature and our hypotheses, and confirm our strategy for selecting those at highest risk.

onset (i.e., including those who have never tried substances at baseline but indicated use at either 6 months or 12). In addition, from a statistical standpoint, including those who indicated not ever trying alcohol, tobacco, or marijuana raises potential problems with inflated zero's on the outcomes of interest. For example, those reporting never using may be the result of true nonuse while others may be due to limited or no access to the substance under investigation. The latter of which can result in a misinterpretation of the data.

2.2 Measures

2.2.1 Behavioral and Emotional Rating Scale (BERS; Epstein and Sharma, 1998)—The BERS is a 52-item parent-report measure that assesses emotional and behavioral strengths of adolescents across five dimensions: Family Involvement, Interpersonal Strength, Intrapersonal Strength, School Functioning, and Affective Strength. The BERS was specifically developed to assess strengths in youth with severe emotional and behavioral difficulties. The current study focused only on the Family Involvement subscale of the BERS. The 9-item Family Involvement subscale assesses the relationships of the adolescent to his/her family, and includes items that tap into several previously identified familial protective factors including, engaging in family activities (e.g., “participates in family activities”), open communication (e.g., “communicates with parents about behavior at home”), and discipline (e.g., “complies with rules at home”). Items were rated on a 4-point scale by the parent or caregiver ranging from 0 = “not at all like the child,” to 3 “very much like the child.” As part of the scoring procedures, raw scores were converted to standardized scores (i.e., mean of 10, standard deviation of 3). The BERS subscales, including Family Involvement, have demonstrated good psychometric properties, including test–retest reliability, inter-rater reliability, internal consistency, content validity, criterion validity, and convergent validity (Epstein et al., 1999; Epstein, 1999; Harniss et al., 1999; Epstein et al., 2002).

2.2.2 Child Behavior Checklist (CBCL; Achenbach, 1991)—The CBCL is a 119-item parent-report questionnaire designed to provide a standardized measure of symptoms and behavioral and emotional problems among children aged 4 through 18 years. Items were rated on a 3-point scale by the parent or caregiver (0 = “not true,” 1 = “somewhat or sometimes true,” and 2 = “very true or often true”), resulting in two broadband syndrome scores of Internalizing and Externalizing problems, respectively. The CBCL has demonstrated good psychometric properties (see Achenbach, 1991) and has been nationally normed on a proportionally representative sample of children across income and racial and ethnic groups (i.e., T-scores).

2.2.3 Descriptive Information Questionnaire (DIQ)—The DIQ was developed for the national evaluation of the CMHI program to standardize the method of collecting important descriptive information regarding the adolescents and families being served within the systems of care initiative. Information from the DIQ, as reported by the parent or caregiver, was used to control for theoretically important variables including age, gender, race, parent SES, and family history of substance abuse among the adolescent's biological relatives (coded as “yes” or “no”).

2.2.4 Substance Use Survey (SUS–AB)—The SUS–AB is an adolescent self-report questionnaire assessing history of substance use and problems. The SUS–AB has two parts: (1) SUS–A, which assesses information about the frequency of an adolescent's substance use, including use of cigarettes, alcohol, and marijuana, and (2) SUS–B, which focuses on the consequences of substance use that adolescent have experienced ever and during the past 6 months. Adolescents reported the frequency of their alcohol use within the past 6 months on a scale of one to six where 1 = “not at all,” 2 = “less than once per month,” 3 = “1–3

times per month,” 4 = “1–2 times per week,” 5 = “3–6 times per week,” and 6 = “daily.” In contrast, adolescents only reported dichotomously (Yes/No) whether they had used marijuana or cigarettes, respectively, within the past 6 months (i.e., the national evaluation did not assess data on frequencies of marijuana and cigarette use, respectively). Substance use problems were measured using 21-items that dichotomously (yes/no) assessed whether adolescents had experienced any consequence as a result of their substance use in the past 6 months. Scores were then summed to create a substance use problems composite, and then rescored to improve normalcy of the distribution such that 0 = “0 problems over the past 6 months,” 1 = “1 problem,” 2 = “2–3 problems,” 3 = “4–6 problems,” 4 = “7–9 problems,” and 5 = “10+ problems.” The items were adapted from the Child and Adolescent Functional Assessment Scale (CAFAS) Parent Report (Hodges, 1990) with permission of the author and are for use only in the CMHI national evaluation.

2.3 Data Analytic Strategy

The data for the current study are hierarchically nested (i.e., repeated measures nested within individuals). Thus, multilevel linear growth analyses were conducted using Hierarchical Linear Modeling (HLM 6; Raudenbush and Bryk, 2004). Following recommendations by Mehta and West (2000), repeated measures of substance use outcomes, internalizing and externalizing problems, and levels of family involvement were modeled as time-varying variables at Level 1 as a function of time (centered at baseline and coded such that a one unit increase in time reflects an actual time span of 6 months) and nested within individuals (Level 2). HLM is ideal for analyzing such data because it allows for missing data at Level 1. Individual-level variables (i.e., age, gender, race, parent SES, and biological family history of substance abuse) were modeled at Level 2 and were allowed to predict intercepts and linear time coefficients at Level 1. As such, significant intercept effects reflect differences in the outcome at baseline, and significant linear effects reflect interactions between that variable and time to predict the outcome. Models with dichotomous outcomes were run using Bernoulli estimation in HLM, which models outcomes with nonlinear, binary distributions. Because the interest of the current study concerns how family involvement protects against or reduces existing increased substance use over time in these troubled youth, and because examining onset of substance use is a separate research question that extends beyond the scope of the current study, analyses were conducted in subsets of the current sample for each substance use outcome based on whether the adolescent had ever used that particular substance at baseline. Models pertaining to substance use problems were based on a subset of adolescents who had ever used any substance at baseline. Ns for these subsets are reported in Table 2 and 3.

The same iterative procedure was used in the estimation of all models. First, base models (i.e., the intercept and linear effects of time), were estimated for each outcome. Second, demographic and background variables were added simultaneously to base models. Third, main predictors of interest (i.e., family involvement, internalizing and externalizing problems) and interaction terms between main predictors were added simultaneously. Because trimmed models have been shown to yield more stable estimates (Raudenbush and Bryk, 2002), non-significant terms were trimmed starting at the highest order at each step of this procedure, and models were iteratively re-estimated until only significant predictors remained. However, non-significant main effect terms were controlled when in the presence of a significant higher-order interaction. For the sake of brevity, only results from final, trimmed models are reported.

Additionally, all terms were entered as fixed effects (intercepts and error terms were allowed to be random), and all models controlled for other substance use and/or substance use problems (e.g., models predicting alcohol use controlled for marijuana and tobacco use and substance use problems). Finally, dichotomous variables at Level 1 were entered into

models uncentered; continuous substance use controls at Level 1 (i.e., past 6 month alcohol use and substance use problems) were entered into models centered around the adolescents' own means; and Level 1 predictors of interest (i.e., family involvement, internalizing and externalizing behaviors) and all covariates at Level 2 were entered grand mean centered (Enders & Tofighi, 2007).

3. Results

Results from the final, trimmed multilevel growth models can be seen in Table 2 (continuous outcomes) and Table 3 (dichotomous outcomes). As shown in the top panel of Table 2, each continuous outcome (i.e., alcohol use and substance use problems) was significantly greater than zero at baseline. For dichotomous outcomes (Table 3), the negative intercept value for the marijuana use model indicated that there was a significantly less than 50% likelihood of marijuana use over the past 6 months among adolescents who had ever used marijuana, whereas the positive intercept value for the cigarette use model indicated that there was a significantly greater than 50% likelihood of smoking cigarettes over the past 6 months among adolescents who had ever smoked. None of the outcomes significantly changed over the 12-month study period as a function of time with the exception of substance use problems, which showed a significant linear decline over 12 months. Results also revealed a differential set of demographic and background control variables for each outcome suggesting unique influences depending on the substance used or whether adolescents experienced problems associated with their use. Additionally, controls for other substance use variables generally indicated significant positive associations between substance use variables, suggesting that substance use among these adolescents is not limited to a single substance.

In general, and as expected, increased family involvement was associated overall with less substance use and related problems (i.e., main and interaction effects), whereas internalizing and externalizing problems were positively associated with substance use. Furthermore, and also as expected, family involvement moderated the effects of internalizing or externalizing problems in 3 out of the 4 outcomes. The only exception to this pattern was for marijuana use. As shown in Table 2, family involvement did not moderate the effects of internalizing or externalizing problems on marijuana use. Nevertheless, greater family involvement remained a significant predictor of less marijuana use at baseline above and beyond the effect of externalizing problems, suggesting that there is still a unique protective effect of family involvement on marijuana use on average.

Plotting the moderating effects of family involvement revealed a generally consistent pattern (see Figures 1–4). Two interaction effects were found for the frequency of alcohol use in the past 6 months. First, as shown in Figure 1, adolescents low in internalizing problems were protected from increased alcohol use at baseline if they had relatively high levels of family involvement, a difference that was maintained over time. No such difference was found among adolescents high in internalizing problems. Second, as shown in Figure 2, family involvement protected against increased alcohol use at baseline among adolescents high in externalizing problems, a difference that was maintained over time. No such difference was found among those low in externalizing behaviors. Taken together, family involvement buffers adolescents from increased alcohol use, particularly for those high in externalizing problems and low in internalizing problems, and that these buffering effects do not differentially change as a function of time over a 1-year period.

Additionally, a 4-way family involvement $\times$ internalizing problems $\times$ externalizing problems $\times$ time interaction was found predicting the probability of tobacco use over the past 6 months indicating that trajectories of tobacco use differ over time for varying

combinations of family involvement and SEB. As shown in Figure 3, the 4-way interaction is broken down into 2-way interactions to facilitate presentation of the interaction, and to show the moderating effect of family involvement for each combination of internalizing and externalizing problems. Taken together, these plots show a generally consistent pattern of protective effects of family involvement against tobacco use for adolescents who are high in either internalizing problems (top left panel), externalizing problems (top right panel), or both (bottom left panel). No difference was found for family involvement among adolescents low in both internalizing and externalizing problems (bottom right panel). Specifically, high family involvement protected against tobacco use at baseline and over time for adolescents high in internalizing problems and low in externalizing problems (see top left panel). As shown in the top right panel, despite having an initially higher probability of tobacco use, adolescents high in externalizing problems but low in internalizing problems also showed greater decline in tobacco use over time if they experienced high levels of family involvement. Also, adolescents high in both internalizing and externalizing problems had a lower likelihood of smoking at baseline if they experienced high family involvement compared to low (see bottom left panel).

Finally, as shown in Figure 4, a 3-way family involvement $\times$ internalizing problems $\times$ externalizing problems interaction was found for substance use problems. Again, the interaction is broken down into 2-way interactions to highlight the moderating effect of family involvement for each combination of internalizing and externalizing problems. As shown in the top left panel of Figure 4, high family involvement protected against substance use problems at baseline – an effect that was maintained over time – among adolescents high in internalizing problems but low in externalizing problems. No differences in substance use problems were found at baseline or over time as a function of family involvement for adolescents with other configurations of internalizing and externalizing problems.

All significant interaction coefficients were tested for further moderation by individual-level variables (i.e., age, gender, race, parent SES, and biological family history of substance abuse). None of these variables further moderated the interactions between family involvement and internalizing or externalizing problems, suggesting that the moderating effects of family involvement are robust and apply across adolescents of various demographics and family backgrounds.

4. Discussion

The current study longitudinally examined the moderating effects of family involvement on the associations between internalizing and externalizing symptoms and substance use frequency and related problems over a one year period in a sample of adolescents with SEB who were served in children's mental health systems of care. To our knowledge, the current study is the first to examine how family involvement moderates the relationship between internalizing and externalizing behavior problems and substance use outcomes in a group of high risk adolescents while controlling for theoretically important sociodemographic and family history variables. In doing so, we examined such relationships across three of the most common substances used by adolescents (alcohol, cigarettes, and marijuana), as well as substance use related problems.

Consistent with our predictions, results showed that family involvement served as a protective factor against substance use frequency and problems associated with substance use among adolescents with SEB, and that it largely buffered the negative effects of internalizing and externalizing problems on substance use outcomes. In all cases, whether main or interaction effects, increased family involvement was associated with decreased substance use frequency and related problems. Moreover, the effects of family involvement

were robust and remained after controlling for demographics and familial factors. This suggests that the overall quality of the familial environment is of critical importance for adolescents with SEB.

Additionally, the moderating effects of family involvement were found to differ across types and combinations of emotional or behavioral problems. Family involvement buffered the effects of externalizing problems for alcohol use (see Figure 2) and tobacco use (see Figure 3), whereas it buffered the effects of internalizing problems for tobacco use and substance use problems (see Figures 3 and 4, respectively). Interestingly, in contrast to externalizing problems, internalizing problems had few direct effects on substance use and related problems. Combined, these results suggest that the effects of internalizing problems on substance use may be more conditional on other factors, such as family involvement and levels of externalizing problems, than those of externalizing problems alone. One explanation for these differences is that those who are experiencing greater internalizing problems might use the family as a primary source of social support due to a greater likelihood of being socially withdrawn from peers (see Sanson et al., 2004 for a review). As such, adolescents with internalizing problems might be exposed less to peer influence surrounding substance use, which is predictive of adolescent substance use above and beyond parent influence (Beal et al., 2001). In contrast, those experiencing externalizing problems are more likely to have greater peer involvement (Witvliet et al., 2010), including greater peer deviance, an individual variable that has been associated with both increased delinquency and substance use (Barnes et al., 2006). Unfortunately, our data did not allow us to explore the moderating role of peer deviance on the relationships between internalizing and externalizing problems and substance use and related problems. Thus, future research should continue to explore other social and environmental factors beyond the family that might moderate the effects of SEB on adolescent substance use outcomes.

Beyond differences between internalizing and externalizing problems, effects also differed across different substances and problems related to use. Alcohol use appeared to be influenced more by family involvement and externalizing problems (see Figure 2) than internalizing problems (see Figure 1). Family involvement also buffered the effects of high externalizing problems on tobacco use among adolescents who were also low in internalizing problems (see Figure 3). In contrast, the buffering effects of family involvement on internalizing problems were found for tobacco use and substance use related problems (see Figures 3 and 4, respectively). Furthermore, marijuana use, which was the only outcome that did not show an interaction between family involvement and either internalizing or externalizing problems was still uniquely predicted by both family involvement and externalizing problems (see Table 3). This differential pattern of effects is not surprising considering that each substance examined has different pharmacological properties, and that individuals have different motivations for using these substances to achieve various effects (Cooper et al., in press). However, this does suggest that the type of substance should be taken into account when considering implications of these findings, particularly as they might apply to individualized treatment applications.

Interestingly, substance use outcomes largely did not linearly change over time as functions of internalizing or externalizing problems, or family involvement. Instead, most differences at baseline were maintained over time. Only in the case of tobacco use did trajectories differentially change over time for various combinations of family involvement and internalizing and externalizing problems. There are several possible explanations for this finding. First, it is possible that the length of time from baseline to follow-up (i.e., 12 months) was not sufficiently sensitive to examine the potential developmental growth in other substance use and related problems. It is also possible that growth in substance use was affected by the services that adolescents and their families were receiving in the systems

of care during the course of the data collection. Indeed, our initial analyses found no growth over time in the frequency of alcohol use, but did show decreases in the frequency of marijuana and tobacco use, as well as substance use related problems over time.

The results of the current study have important implications for family-based treatment efforts, which are considered to be the most successful type of treatment for adolescent substance use (Waldron and Brody, 2010; Liddle, 2010). For example, an underlying assumption to Multidimensional Family Therapy, an empirically supported treatment for adolescent problematic substance use, is that “family functioning is instrumental in creating new, developmentally adaptive lifestyle alternatives for adolescents” (Liddle, 2010, p.417). Our results suggest that such approaches may protectively impact adolescents with SEB, and that these effects differ depending on the combined levels of internalizing and externalizing problems as well as the substance use outcome in question. Our results also suggest that the administration of the BERS in treatment settings, in combination with identifying adolescents with particularly risky combinations of internalizing and externalizing problems given their history of substance use, could help clinicians better tailor treatment plans that are specific to the adolescent’s individual substance use, SEB, and family situation.

Finally this study provides support for the strong focus on family involvement that is an essential tenet of the systems of care approach (Stroul and Friedman, 1994). Systems of care have become the major structure for funding behavioral health services for children in the US (Blau et al., 2010), and are designed to focus on child and family strengths, deliver services that are culturally competent and work to empower the parent and enhance family involvement in services (Stroul and Friedman, 1994). These analyses demonstrate that providing the types of supports and services offered in systems of care with their focus on enhancing the relationship between the youth and their family may protect youth from problematic substance use involvement.

Despite the robust and consistent effects found, the current study is not without its limitations. As previously noted, all families and adolescents in the current study were part of children’s mental health systems of care initiatives, and thus receiving various treatment services. Unfortunately, data available for secondary analyses does not permit us to examine the effects of services received on substance use outcomes due to a lack of control conditions. As such, the generalizability of our findings is limited to adolescents with SEB who are already receiving services. Nevertheless, the goal of the current study was not to examine treatment effects but rather examine the relationship between potential risk and protective factors associated with substance use. Future research should examine whether family involvement in adolescents with SEB is as protective when the youth and family are not receiving services compared to when they are. Similarly, we are also unable to generalize our findings to onset of substance use among adolescents with SEB. Testing temporally lagged effects is necessary to address research questions pertaining to onset of substance use longitudinally. The 3-wave design of the current study does not allow for the testing of temporally lagged effects because lagged analyses inherently create $n-1$ waves of data (i.e., 2 in the case of the current study), which is not appropriate given that at least 3 waves of data are required to sufficiently test longitudinal effects (Donnellan & Conger, 2007). It is also important to note that the current study did not permit examination of specific components of family involvement. Future research examining components of family involvement (e.g., parental monitoring, open communication) and how they interact with externalizing and internalizing problems may inform treatment, including prevention efforts. Finally, as alluded to previously, the current study was limited in its assessment span of one year. Considering that substance use, particularly alcohol use, is known to increase during adolescence (Johnston et al., 2010) through emerging adulthood (Cooper et al., 2008) and then taper off or “mature out” in young adulthood (Jackson et al., 2001), the slice of

time examined in the current study is thin indeed. Thus, future research should examine these processes over a longer period of time, with multiple waves of data, and across different developmental periods (e.g., early adolescence vs. late adolescence).

In conclusion, the current study was the first to longitudinally examine the moderating role of family involvement on internalizing and externalizing problems in a sample of adolescents with SEB and their parents who are receiving services within a children's mental health systems of care. This research provides an important step in better understanding substance use among at-risk adolescents and how family involvement may help protect them from risky health behaviors and negative outcomes.

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Highlights

- Examined family involvement as moderator of emotional and behavioral problems.
- Tested effects for alcohol, marijuana, tobacco, and substance use problems outcomes.
- Estimated multilevel growth curve trajectories of outcomes over 1-year period.
- Family involvement buffered adverse effects of emotional and behavioral problems.
- Moderation and main effects depended on substance use outcome.

Figure 1. Family involvement by internalizing problems interaction predicting past 6 month alcohol use. Low and high values correspond to the 15% and 85%, respectively, of the predictor variable's distribution.

Figure 2.

Family involvement by externalizing problems interaction predicting past 6 month alcohol use. Low and high values correspond to the 15% and 85%, respectively, of the predictor variable's distribution.

Figure 3.

Tobacco use probability trajectories as a function of family involvement for those high in internalizing problems and low in externalizing problems (left top panel), those low in internalizing problems and high in externalizing problems (right top panel), those high in both internalizing and externalizing problems (left bottom panel), and those low in both internalizing and externalizing problems (right bottom panel). Low and high values correspond to the 15% and 85%, respectively, of the predictor variable's distribution.

Figure 4.

Substance use problems trajectories as a function of family involvement for those high in internalizing problems and low in externalizing problems (left top panel), those low in internalizing problems and high in externalizing problems (right top panel), those high in both internalizing and externalizing problems (left bottom panel), and those low in both internalizing and externalizing problems (right bottom panel).. Low and high values correspond to the 15% and 85%, respectively, of the predictor variable's distribution.

Table 1

Summary of Level 1 and Level 2 variables for each analysis

	Alcohol (n=2433)	Cigarettes (n=2704)	Marijuana (n=2048)	Problems (n=3140)
Mean Age (SD)	14.72 (1.58)	14.50 (1.66)	14.87 (1.50)	14.47 (1.68)
% Female	39.3%	39.5%	39.2%	38.4%
% with Family History of Substance Abuse	70.1%	70.9%	72.0%	69.8%
% Caucasian	52.9%	55.8%	50.4%	53.6%
SES	2.34 (0.86)	2.32 (0.86)	2.32 (0.86)	2.32 (0.86)
Wave 1 (baseline)				
Use Past 6 Months ^a	1.11 (1.26)	67.6%	55.4%	0.99 (1.52)
Family Involvement	7.92 (2.94)	7.94 (2.96)	7.86 (2.98)	7.97 (2.94)
Internalizing Score	63.47 (11.30)	64.10 (11.21)	63.09 (11.25)	63.94 (11.32)
Externalizing Score	69.36 (10.83)	69.89 (10.63)	69.56 (10.78)	69.61 (10.74)
Wave 2 (6 month follow-up)				
Use Past 6 Months ^a	.98 (1.21)	67.6%	45.4%	0.44 (1.11)
Family Involvement	8.10 (2.93)	8.19 (2.96)	8.01 (2.98)	8.21 (2.94)
Internalizing Score	60.95 (12.07)	61.64 (12.01)	61.04 (12.04)	61.38 (12.09)
Externalizing Score	66.62 (11.42)	67.02 (11.34)	67.06 (11.38)	66.80 (11.35)
Wave 3 (12 month follow-up)				
Use Past 6 Months ^a	1.03 (1.30)	66.1%	45.6%	0.32 (0.95)
Family Involvement	8.28 (2.82)	8.41 (2.84)	8.23 (2.83)	8.37 (2.84)
Internalizing Score	59.49 (12.04)	59.85 (12.00)	59.30 (11.98)	59.87 (12.06)
Externalizing Score	64.88 (11.33)	65.30 (11.30)	65.06 (11.21)	65.29 (11.37)

^aFor the alcohol and problems sub-samples, values represent means (SDs) on the alcohol frequency measure or substance related problems measure, whereas cigarettes and marijuana represent % indicating use.

Table 2

Base and Interaction Models of Change in Internalizing/Externalizing Behavior and Family Variables Predicting Alcohol Use Frequency and Substance Use Problems Over 1 Year (Continuous Outcomes).

	Alcohol Use Frequency						Substance Use Problems					
	Intercept			Linear			Intercept			Linear		
	Estimate	p	d	Estimate	p	d	Estimate	p	d	Estimate	p	d
Time (6 months)	1.229	.000	.82	.042	.245	.06	.478	.000	.40	-.112	.000	-.15
<u>Covariates</u>												
Age	.145	.000	.24	--	--	--	.090	.000	.20	--	--	--
Gender	.252	.000	.35	--	--	--	--	--	--	--	--	--
Race	--	--	--	--	--	--	--	--	--	--	--	--
Family History	--	--	--	--	--	--	.169	.014	.13	--	--	--
Parent SES	--	--	--	--	--	--	.134	.000	.17	--	--	--
Marijuana Use (yes/no)	.478	.000	.38	--	--	--	1.274	.000	.86	--	--	--
Tobacco Use (yes/no)	.104	.239	.06	--	--	--	.303	.000	.19	--	--	--
Alcohol Use Frequency	n/a	n/a	n/a	n/a	n/a	n/a	.262	.000	.30	--	--	--
<u>Main Predictors</u>												
Internalizing Problems	-.003	.383	.04	--	--	--	.000	.955	.00	--	--	--
Externalizing Problems	.015	.000	.18	--	--	--	.022	.000	.23	--	--	--
Family Involvement	-.021	.096	.08	--	--	--	-.020	.110	.06	--	--	--
<u>Interactions</u>												
Internalizing Problems × Family Involvement	.002	.052	.09	--	--	--	-.002	.118	.06	--	--	--
Externalizing Problems × Family Involvement	-.003	.009	.12	--	--	--	.001	.244	.05	--	--	--
Internalizing Problems × Externalizing Problems	--	--	--	--	--	--	.000	.899	.00	--	--	--
Internalizing Problems × Externalizing Problems × Family Involvement	--	--	--	--	--	--	.0001	.059	.07	--	--	--

Note. Coefficients are unstandardized. For alcohol outcome models, run time Level 2 n = 2,161. For substance use problems outcomes, run time Level 2 n = 2,802, or adolescents who had ever used any of the three substances of interest at baseline. Dashes indicate that the term was dropped in the relevant model due to nonsignificance. Gender was coded as Male = 1, Female = 0. Race was coded as White = 1, non-White = 0. Family History of substance abuse was coded as Yes = 1, No = 0. Terms for the interaction models were added to the corresponding base model for that outcome. d = estimated Cohen's d.

Table 3

Base and Interaction Models of Change in Internalizing/Externalizing Behavior and Family Variables Predicting Marijuana and Tobacco Use Over 1 Year (Dichotomous Outcomes).

	Marijuana Use (Yes/No)						Tobacco Use (Yes/No)					
	Intercept			Linear			Intercept			Linear		
	Estimate	p	d	Estimate	p	d	Estimate	p	ES	Estimate	p	d
Time (6 months)	-.731	.000	.36	-.076	.154	.06	.923	.000	.51	-.085	.214	.05
<u>Covariates</u>												
Age	--	--	--	--	--	--	.160	.000	.21	--	--	--
Gender	--	--	--	--	--	--	--	--	--	--	--	--
Race	-.214	.033	.11	--	--	--	.632	.000	.29	--	--	--
Family History	--	--	--	--	--	--	.276	.059	.10	-.306	.013	.10
Parent SES	--	--	--	--	--	--	--	--	--	--	--	--
Marijuana Use (yes/no)	n/a	n/a	n/a	n/a	n/a	n/a	1.231	.000	.48	--	--	--
Tobacco Use (yes/no)	1.247	.000	.47	--	--	--	n/a	n/a	n/a	n/a	n/a	n/a
Alcohol Use Frequency	.331	.000	.21	--	--	--	.178	.007	.11	--	--	--
<u>Main Predictors</u>												
Internalizing Problems	--	--	--	--	--	--	-.011	.162	.06	.010	.103	.07
Externalizing Problems	.018	.000	.14	--	--	--	.014	.116	.06	.001	.870	.00
Family Involvement	-.071	.000	.16	--	--	--	.003	.907	.00	-.045	.059	.08
<u>Interactions</u>												
Internalizing Problems × Family Involvement	--	--	--	--	--	--	-.007	.009	.11	.003	.271	.04
Externalizing Problems × Family Involvement	--	--	--	--	--	--	.002	.558	.02	-.001	.658	.02
Internalizing Problems × Externalizing Problems	--	--	--	--	--	--	-.001	.266	.04	-.0001	.824	.01
Internalizing Problems × Externalizing Problems × Family Involvement	--	--	--	--	--	--	-.0002	.097	.07	.0003	.036	.08

Note. Coefficients are unstandardized. For marijuana outcome models, run time Level 2 n = 1,798. For tobacco outcome models, run time Level 2 n = 2,384. Dashes indicate that the term was dropped in the relevant model due to nonsignificance. Gender was coded as Male = 1, Female = 0. Race was coded as White = 1, non-White = 0. Family History of substance abuse was coded as Yes = 1, No = 0. Terms for the interaction models were added to the corresponding base model for that outcome. d = estimated Cohen's d.