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Internalizing Symptoms: Effects of a Preventive Intervention on Developmental Pathways from Early Adolescence to Young Adulthood

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Abstract

This study examined the mediated and moderated effects of a universal family-focused preventive intervention, delivered during young adolescence, on internalizing symptoms assessed in young adulthood. Sixth grade students ($N = 446$; 52% female; 98% White) and their families from 22 rural Midwestern school districts were randomly assigned to the experimental conditions in 1993. Self-report questionnaires were administered at seven time points (pre-test to young adulthood—age 21) to those receiving the Iowa Strengthening Families Program (ISFP) and to the control group. Results showed that growth factors of adolescent internalizing symptoms (grades 6–12) were predicted by ISFP condition and risk status (defined as early substance initiation). Moderation of the condition effect by risk status was found, with higher-risk adolescents benefitting more from the ISFP. Results also supported the hypothesis that the ISFP's effect on internalizing symptoms in young adulthood was mediated through growth factors of adolescents' internalizing symptoms; risk moderation, however, was only marginally significant in young adulthood. The relative reduction rate on clinical or subclinical levels of young adult internalizing symptoms was 28%, indicating that for every 100 young adults displaying clinical or subclinical levels of internalizing symptoms from school districts not offering an intervention, there could be as few as 72 displaying those levels of symptoms in school districts that offered middle school prevention programming. These findings highlight how the positive effects of family-focused

universal interventions can extend to non-targeted outcomes and the related potential public-health impact of scaling up these interventions.

Keywords

Internalizing symptoms; Preventive intervention; Adolescence; Young adulthood

Introduction

Internalizing symptoms during adolescence and young adulthood are associated with negative social, health, and behavioral consequences that impact the individuals, their families, and society. For this reason, it is critically important to evaluate preventive interventions that can positively alter the development of internalizing symptoms. This study examined the long-term effects of a family-focused universal preventive intervention (the Iowa Strengthening Families Program [ISFP]) that addresses empirically-supported risk and protective factors for both substance misuse and internalizing symptoms. ISFP was implemented during sixth grade, and effects on internalizing symptoms were assessed through young adulthood. An earlier investigation, upon which this study is based (Trudeau et al. 2007), established ISFP effects on the growth factors of adolescent internalizing symptoms. The current study extended those analyses by evaluating ISFP effects at age 21, mediated by developmental change in adolescent internalizing symptoms and moderated by participant risk status (i.e., early initiation of alcohol or tobacco).

Overview of the Current Study

Significance of Addressing Internalizing Symptoms

Internalizing disorders, specifically anxiety and depressive disorders, are among the most common psychological disorders during childhood, adolescence, and young adulthood (Costello et al. 2003; National Institute of Mental Health [NIMH] 2011). Even more common are internalizing *symptoms*, whether occurring in conjunction with a diagnosable disorder or subclinically. Internalizing symptoms are associated with many health and behavior problems during adolescence, such as diminished interpersonal functioning (Riley et al. 1998), substance misuse (Armstrong and Costello 2002), and other externalizing problems (Hinden et al. 1997). Adolescent internalizing symptoms increase the likelihood of major depression and other psychiatric disorders in young adulthood (Fergusson and Woodward 2002).

Research has identified family and individual risk and protective factors for internalizing symptoms. Regarding family risk, Sheeber et al. (2001) reviewed the literature and found a number of family characteristics that were related to higher levels of depressive symptoms in adolescents. These include the absence of parental support, attachment, and approval; the presence of family conflict, parental hostility, harsh discipline, and ineffective problem-solving skills; and authoritarian parenting. More recently, Sheeber et al. (2007) highlighted a consistent finding across the empirical literature; that is, adolescents in families that provide support, attachment, and approval tend to have lower levels of depressive symptoms (e.g., Côté et al. 2009). Individual factors include the risk factors of negative emotionality and stress reactivity (Hazel et al. 2008; Moffitt et al. 2010) and the protective factors of self-esteem (Orth et al. 2008), problem-solving (Aldao et al. 2010), and assertiveness (Thompson and Berenbaum 2011). Many family and individual risk and protective factors are targeted by the ISFP. Earlier articles from this project have established the ISFP effect on parenting factors, such as monitoring, consistent discipline, standard setting, and parent-child affective quality (Redmond et al. 1999; Spoth et al. 1998), along with effects on individual

factors, such as assertiveness and problem-solving (Lillehoj et al. 2004; Redmond et al. 2009).

For both the earlier study and the current extension, we chose to study internalizing symptoms as indicated by a continuous symptom measure, rather than a disorder diagnosis. During adolescence, measures of diagnosable disorders were not collected, and the sample at age 21 demonstrated a low percentage of diagnosable generalized anxiety and major depression disorders (9.4%); therefore, if only diagnosable disorders were analyzed, we would likely underestimate problematic symptoms. Further, research has suggested that dimensional, continuous measures are more sensitive to variation than categorical constructs and may prove to demonstrate more predictive value (Esposito and Clum 2002). The measure we chose has been identified as a distinct “anxious/depressed” dimensional syndrome by factor analysis (Achenbach 1995), consistent with the mixed anxiety and depression provisional diagnosis in the DSM-IV-TR that has been supported by taxometric analysis (Schmidt et al. 2007).

Examining ISFP Effects on Internalizing Symptoms

The established ISFP effects on internalizing symptoms across adolescence suggested evaluation of the continuity or discontinuity of those effects into young adulthood (Trudeau et al. 2007). Rutter and colleagues (Rutter 1995; Rutter et al. 2006) have recommended examining continuities and discontinuities of mental health symptoms across the transition from adolescence to young adulthood, with a focus on environmental influences (e.g., earlier interventions), as well as mediators and moderators of change or stability. A high degree of continuity in internalizing symptoms from adolescence to young adulthood was expected (see Harrington et al. 1990; Rutter 1995).

Importantly, although few universal family-focused interventions have been evaluated into young adulthood, previous research from the current project has found long-term intervention effects on substance misuse variables extending into young adulthood (Mason et al. 2009; Spoth et al. 2009). When evaluating interventions long-term, assessing mechanisms of effects can be challenging, in part because of developmental change between the implementation of the intervention and young adulthood. It is difficult to disentangle causal pathways leading to specific problem behaviors across time (Masten et al. 2005, 2008). In the context of intervention outcome research, it is likely that developmental sequences of effects set in motion by interventions implemented in early adolescence would affect the trajectory of internalizing symptoms through mechanisms that have varying influences across time and across individuals. The developmental model we examined posits that ISFP will decrease the average level and slow the rate of increase in internalizing symptoms across the adolescent years, possibly via the range of previously demonstrated proximal effects on parenting and adolescent social-emotional skills and substance misuse (Redmond et al. 2009; Spoth et al. 1996a, b, 1998a, b, 2001). We further posit that those effects on adolescent internalizing symptoms will be the primary means by which long-term effects into young adulthood are produced. Modeling long-term intervention effects on internalizing symptoms via effects on adolescent growth factors is a parsimonious way to capture intervention effects across a long developmental time span (see Blozis et al. 2007).

Relationship Between Developmental Patterns of Internalizing Symptoms and Substance Misuse

As stated earlier, a primary outcome targeted by the ISFP is the reduction of substance misuse. Many studies have supported the association between internalizing symptoms and substance misuse (see a review by O’Neil et al. 2011). Evaluating the long-term effects of the ISFP on internalizing symptoms during young adulthood requires consideration of the

interrelationship between substance misuse and internalizing symptoms across developmental stages. Mueser et al. (2006) articulated four basic theoretical models that may explain the relationship between psychological symptoms—including internalizing symptoms—and substance misuse: (1) a common factor model proposes that the relationship results from a set of common causes; (2) a self-medication model posits that substances are used to reduce or ameliorate existing psychological symptoms; (3) a symptom exacerbation model suggests that substance misuse can induce subsequent psychological symptoms; and (4) a bidirectional model proposes that psychological symptoms and substance misuse mutually influence one another. Mixed results in tests of these causal models suggest that the mechanisms that explain the relationship between substance misuse and psychological symptoms may vary by age, gender, and by specific categories of substance misuse and psychological symptoms. For example, Costello and colleagues found that depression and anxiety disorders in adolescence increased risk for later substance use disorders, but results were stronger for females and for specific types of anxiety disorders (Costello et al. 2003; Kaplow et al. 2001). Other studies have found that alcohol and drug use during adolescence are risk factors for young adult depressive symptoms, controlling for gender and earlier depression symptoms (Brook et al. 2002; Rao et al. 2000), and still others have found evidence for reciprocal effects between psychopathology and substance use among adolescents (Friedman et al. 1987).

Considering the theoretical and empirically-supported interrelationship between internalizing symptoms and substance misuse described above, it is reasonable to conclude that a family-focused skills training preventive intervention that targets adolescent substance misuse also would have effects on internalizing symptoms, potentially through multiple causal mechanisms. O'Neil et al. (2011) have suggested that prevention research that targets either internalizing symptoms or substance misuse be used to examine the other, either as a potential moderator or a secondary outcome. In addition, a recent analysis from the same project that provided data for the current study, but with a different subsample, found that problem alcohol and other drug use during adolescence had effects on young adult major depressive disorder (Mason et al. 2008).

Because possible differential effects of the intervention across subgroups might mask or distort effects when analyzing the entire sample (Brookes et al. 2004), an investigation into subgroup comparisons was conducted. Exploration of early substance misuse as a potential moderator of intervention effects is supported by findings that higher-risk participants may benefit more from preventive interventions than lower-risk participants (Olds et al. 2003; Spoth et al. 2008a, b, c). Although earlier project analyses have found limited family-related risk moderation of intervention effects on substance misuse (Spoth et al. 2006), early substance misuse can be a risk factor for developing internalizing symptoms (Brook et al. 2002) and might moderate the effects of the ISFP on internalizing symptoms. For example, if adolescents and their parents are aware of their family or individual risk, they might more conscientiously utilize the relevant intervention lessons and thus may receive more benefit.

Gender-Related Effects

Numerous studies have found that girls experience a higher level of internalizing symptoms than boys during adolescence and young adulthood (Angold et al. 2002; Costello and Angold 2000; Hankin et al. 1998). Although gender differences on both level and growth of internalizing symptoms across adolescence were expected in this study, we did not expect gender differences in ISFP effects. In the Trudeau et al. (2007) study, although girls demonstrated a higher overall level of internalizing, a greater rate of linear growth, and a lower rate of leveling off over time (quadratic factor) than boys, both genders benefited similarly from the ISFP. However, we again explored gender differences on the model

parameters in the current study to examine whether gender differences might emerge in young adulthood.

Hypotheses

The developmental model we examined posits that the previously demonstrated effects of ISFP on adolescent internalizing symptoms will be the primary mechanism by which ISFP long-term effects into young adulthood are produced. Similar to the Spoth et al. (2009) analyses, the analytic method of the current study entails latent growth modeling that specifies proximal ISFP effects on adolescents' average level and change over time in internalizing symptoms, with effects on young adult internalizing symptoms modeled as more distal indirect effects. The current article, however, further posits that early substance misuse will predict adolescent internalizing symptoms and may moderate intervention effects. We specify early substance misuse risk, participation in the intervention, and the interaction between the two as predictors of adolescent level and growth in internalizing symptoms, which, in turn, are expected to influence young adult internalizing symptoms. Based on earlier findings regarding intervention effects on risk-related subpopulations (Olds et al. 2003; Spoth et al. 2008a, b, c), we hypothesized that, if risk moderation were found, higher-risk participants would benefit more from the intervention. Another issue we addressed is the clinical significance of the intervention effects observed at points well beyond the implementation of the intervention.

Method

Sample

At the beginning of the study, participants were sixth graders enrolled in 33 rural schools in Iowa. Eligibility requirements were school districts with >15% of families eligible for free or reduced-cost school lunches and community populations of <8,500. Schools were randomly assigned to three experimental conditions: those receiving the seven-session ISFP, the five-session Preparing for the Drug Free Years (PDFY), or a minimal-contact control condition. The PDFY condition was not analyzed in the current report because the Trudeau et al. (2007) article on which the current extension was based analyzed only the ISFP and control conditions; however, PDFY effects on adolescent depressive symptoms have been presented in an earlier article (Mason et al. 2007).

All families with sixth graders in participating schools were eligible and were recruited for participation; although they were aware interventions would be offered in some schools, they did not know the experimental condition to which their child's school had been assigned. Of the eligible families recruited from the 22 schools assigned to the ISFP or the control condition, 446 (51%) agreed to participate in the project and completed pretesting (238 ISFP group families and 208 control group families). Refusal rates for family participation in the study were similar across conditions. All intervention condition families who participated in pretest assessments were recruited for the intervention programs. In addition, families of sixth graders in the intervention condition schools who did not participate in the study were permitted to enroll in the interventions, but were not actively recruited and provided no data for analyses.

At the sixth grade posttest assessment, 374 families participated (84% of those pretested; 188 ISFP and 186 control group families). For the 7th grade follow-up, 317 families participated (71% of those pretested; 161 ISFP and 156 control); 293 participated in the 8th grade follow-up (66% of those pretested; 152 ISFP and 141 control); 303 participated in the 10th grade follow-up (68% of those pretested; 152 ISFP and 151 control); 308 participated

in the 12th grade follow-up (69% of those pretested; 151 ISFP and 157 control); and 331 participated in the age 21 follow-up (74% of those pretested; 170 ISFP and 161 control).

At pretest, 86% of participating families were dual-parent (64% dual-biological parents). The mean age of the target child was 11.3 years; 52% were female; 98% were White. Almost all mothers and fathers had completed high school (97 and 96% respectively), and over half reported additional education. Median household income was \$33,900.

Sample Quality

Earlier reports described tests of sample representativeness, pretest equivalence, and attrition (Spoth et al. 1998, 2001). These reports found that the sample was representative of the study population, as determined by comparisons from a prospective participation factor survey conducted by telephone with eligible families ($n = 1,192$; approximately 90% of the sampling frame) on a range of family sociodemographic characteristics (e.g., parent education, income, marital status, number of children) and parent social-emotional distress. Parent education was significantly predictive of trial participation, but the mean levels of education differed by only 0.4 years between ISFP participants and non-participants. Analyses also found there was intervention/control pretest equivalence on family sociodemographic characteristic. The current analyses found pretest equivalence on adolescent internalizing symptoms ($t = 1.10$, $P = .27$). In addition, there was no evidence of differential attrition between intervention and control conditions through the young adulthood assessment and no evidence of attrition based on internalizing symptom scores across waves. The average number of waves completed was 5.3 out of 7 (76%). Finally, a greater percentage of higher-risk participants did not participate in all waves of data (61.5%) than lower-risk participants (49.2%) ($\chi^2_{(1)} = 4.45$, $P = .04$). No other variables in the study differed significantly between those who participated in every wave and those who were absent for at least one assessment.

Data Collection Procedure

Procedures for human subjects were approved by the university's Institutional Review Board; confidentiality was assured. Questionnaire data were collected from sixth to twelfth grade as part of the family assessments. The young adult follow-up assessment was completed by telephone and did not include parents. Participants received monetary compensation for the time required to complete all assessments.

Iowa Strengthening Families Program (ISFP)

The ISFP intervention (now called the Strengthening Families Program for Parents and Youth: 10–14 [SFP 10–14]) was conducted following pre-test in the sixth grade. The ISFP is based on empirically-supported risk and protective factor theoretical models (Kumpfer et al. 1996). The first six sessions begin with separate, concurrently running parent and child skill-building sessions of 1 h in duration, followed by a second 1-h joint session in which parents and children together practice skills introduced during their separate sessions. The seventh session included only a 1-h family session. Key program content for parents included effective family management, managing emotions, and communicating family rules related to substance misuse. For adolescents, programming emphasized peer resistance skills (e.g., substance misuse refusal skills), pro-social attitudes, and handling stress and emotions. For the family sessions, key content included problem-solving and communication, particularly as it relates to establishing rules about substance misuse. The program is standardized and interactive, with group discussion and activities. Essential program content was presented on videotapes that included family interactions to illustrate key program concepts.

The trained implementers included 21 three-person teams conducting weekly groups in the 11 ISFP schools. Group sizes ranged from 3 to 15 families, with an average attendance of 8 families or 20 individuals. Approximately 49% of pretested families attended at least one intervention session; approximately 94% of attending families participated in five or more sessions. Trained observers monitored the implementation fidelity of each team two or three times and reported average coverage of 87, 83, and 89% of the component tasks in the group leader's manual for the family, parent, and youth sessions, respectively. Further detail on the ISFP, implementation procedures, and quality of implementation can be found in Kumpfer et al. (1996) and Spoth et al. (1998, 2001).

Minimal Contact Control Condition

Families in the control group were mailed four leaflets describing aspects of adolescent development (e.g., physical and emotional changes, as well as parent-child relationships) concurrent with the implementation of the ISFP program in the intervention group.

Measures

Adolescent Internalizing Symptoms—Adolescent internalizing symptoms were measured as the average of 11 of the 13 items of the anxious/depressed syndrome scale from the Youth Self-Report (YSR; Achenbach and Rescorla 2001). (The YSR was truncated in the questionnaire due to space constraints. Items that were excluded were related to fears of animals, situations, or places and fears of going to school.) The item stem was “How true is each of these statements for you now or in the past 6 months?” (e.g., “I feel that no one loves me,” “I am nervous or tense,” and “I feel too guilty”) rated on a three-point scale from 0 to 2 (“not true,” “somewhat or sometimes true,” “very true or often true”), with an average alpha reliability of .89 across the 6 waves. Studies have supported the validity of adolescent self-reports for assessment of internalizing symptoms (Merrell et al. 2002), and validity of this instrument is well-established (Achenbach and Rescorla 2001; Ivanova et al. 2007).

Adult Internalizing Symptoms—Adult internalizing symptoms, measured with 12 of the 18 items of the anxious/depressed syndrome scale of the Adult Self-Report (Achenbach and Rescorla 2003), was scaled the same as the YSR. (The truncated scale excluded items related to feeling lonely, feeling confused, fears about doing something bad, feeling that others are out to get him/ her, suicidal thoughts, and fears that he/she can't succeed.) Eight of the items were identical to those measured in adolescence, and the other four were more appropriate to young adults (e.g., “I worry about my future”). Alpha reliability was .85; validity of the 18 item scale has been well supported (Achenbach et al. 2005; Achenbach and Rescorla 2003).

Substance Initiation-Related Risk—Risk, measured at pretest, was defined as early substance initiation. The large majority of sixth graders in this cohort had not tried substances; those that did were expected to be at risk for a range of later problems, not limited to substance misuse (Cho et al. 2007; Gil et al. 2004). Higher risk was defined as “any use” and was scored as 1 if the adolescent reported initiation of alcohol or tobacco, while lower risk was defined as “no use” and was scored as -1 if initiation had not yet occurred. The total percentage of higher-risk young adolescents was 20.7; 18.1% of ISFP young adolescents and 23.8% of control adolescents were classified as higher-risk, a non-significant difference ($\chi^2_{(1)}=2.16, P=.15$).

ISFP—The ISFP intervention condition was given a score of 1 and the control condition was scored as -1. Contrast coding for the Risk and the ISFP condition variables was used to

create orthogonal terms to facilitate interpretation of main and interaction effects. The interaction term was ISFP $\times$ Risk.

Gender—Gender was coded 0 for females and 1 for males.

Data Analysis

ISFP was offered as a universal intervention, but not all families in the intervention group participated; in order to avoid potential bias due to self-selection effects, analyses were conducted on the assigned and pretested sample, rather than only those who attended ISFP (i.e., intent-to-treat analyses; Friedman et al. 1998; Shadish 2002).

The technique chosen for handling missing data was full-information maximum likelihood estimation (FIML). This method has been found to yield more efficient and less biased parameter estimates than traditional methods for dealing with missing data, such as pairwise or listwise deletion of cases (Muthén et al. 1987; Wothke 2000), and has become a preferred strategy for dealing with missing data under the assumption that variables associated with missingness are measured and included in the models (Allison 2003; Schafer and Graham 2002). Analyses were conducted with *Mplus* 6.1 (Muthén and Muthén 1998–2010), a program that computes FIML estimates with incomplete data.

Structural equation modeling (SEM) analyses were conducted, adjusting for clustering within schools and for non-normality of the variables. The robust maximum likelihood (MLR) estimator was specified for all analyses, and provided maximum likelihood parameter estimates with standard errors and a χ^2 test statistic that is robust to non-normality and non-independence of observations (Muthén and Muthén 1998–2010).

A latent growth curve approach was used to address the research questions. First, the adolescent time period was evaluated to estimate average intercept and slope values and the variance around those averages. Next, using a group code approach due to limited sample size (Aiken et al. 1994; Hancock 1997), the influence of ISFP, Risk, and the ISFP $\times$ Risk interaction on the growth factors was evaluated.¹ Contrast coding of ISFP and Risk facilitated the interpretation of coefficients. For example, it allowed an examination of the overall intervention effect on the outcome at the average level of substance misuse risk and the overall effect of risk across both intervention groups. In the last step, the young adult internalizing symptoms outcome variable was added to the model, predicted by the growth factors of adolescent internalizing symptoms. This type of model has been identified as a blend of mediation and moderation; that is, a conditional indirect effect is represented by the magnitude of an indirect effect at a particular value of a moderator—in this case, higher or lower risk (see Preacher et al. 2007). Further, recent literature on mediation has suggested that under certain circumstance, including when assessing distal effects, it is not necessary to have a significant direct effect in order to test for mediation (MacKinnon et al. 2007; Shrout and Bolger 2002).

In addition to the χ^2 value, model fit was evaluated with two indices: the root mean square error of approximation (RMSEA: Steiger and Lind 1980) and the comparative fit index (CFI: Bentler 1988). Values of the CFI .95 and the RMSEA .06 are considered to reflect good fit (Hu and Bentler 1999). Gender differences were evaluated by conducting a two-

¹In this case, a 4-group model ($N = 440$) had 114 estimated parameters. Guidelines suggest a ratio of at least 5:1 for accurate parameter estimates, which would indicate a minimal sample size of around 570. (The n s for higher-risk groups were 43 and 48.) With a 4-group unconstrained model, the fit was not acceptable, CFI=.841, and Heywood cases (negative error variances) were found in two of the subgroups (higher- and lower-risk control groups). These problems in modeling were not found using the group code approach, supporting our choice.

group stacked model, first constraining, then freeing the structural pathways; indicator loadings were constrained to equality across groups. Differences were evaluated utilizing the Yuan-Bentler T2* test statistic, an empirically-supported test developed to adjust for clustered sampling and conditions of multivariate non-normality (Fouladi 2000; Muthén and Muthén 1998–2010).

Finally, to estimate the clinical/subclinical impact of the ISFP intervention, the sample was divided into non-clinical and clinical/subclinical groups, coded 0 for “non-clinical” and 1 for “clinical/subclinical,” based upon guidelines from the ASEBA manual (Achenbach and Rescorla 2003), adjusting for the number of items included in our scale. This cut-off score was determined because it is likely to capture the degree of symptomatology that incorporates both diagnosable conditions and subclinical levels of distress that would be associated with dysfunction (Graber and Sontag 2009; Miu and Visu-Petra 2010). Relative reduction rates (RRRs) were calculated to estimate the percentage of clinical/subclinical cases in the control group that could have been prevented if they had assigned to an intervention group. RRRs are calculated by subtracting the percentage of people above the cut-point in the intervention group from the percentage above the cut-point in the control group and dividing by the percentage above the cut-point in the control group.

Results

Table 1 presents the means and standard deviations of the internalizing symptoms variables by intervention group. The covariance matrices used in the analyses are available from the first author.

First, a growth curve model based on examination of raw means (with pretest as a covariate) was tested to determine the appropriate specification of growth parameters. The intercept was established as the average level of internalizing symptoms over the five follow-up assessments during adolescence (i.e., 6th grade posttest, 7th, 8th, 10th, and 12th grades); differences between ISFP and control groups on this time-averaged intercept would be one indication of overall program effect (Taylor et al. 2000; Singer and Willett 2003). In contrast, models that specify the intercept at the initial time point would evaluate program effects immediately post-intervention; however, intervention effects take time to develop and specifying the intercept as centered across time points is a more accurate indication of overall intervention effects. Loadings of the repeated measures on the intercept were fixed at 1.0, and the linear $[-2.4, -1.4, -0.4, 1.1, 3.1]$ and quadratic $[5.76, 1.96, .16, 1.21, .961]$ slope factors were specified using orthogonal polynomial contrast coefficients to center the zero-point over the five unequally spaced measurement occasions and to aid in the interpretation of a quadratic effect, addressing multicollinearity. In a quadratic model, the slope represents the rate of growth at the intercept point and, if the rate of curvature as represented by the quadratic term is small, the slope will be nearly the same regardless of the location of the zero point on the intercept factor. The growth factors residuals were allowed to correlate. The first model tested included only the intercept and linear slope factor. The addition of the quadratic term, however, improved model fit significantly ($\Delta\chi^2_{(5)}=38.80, P < .001$). The best-fitting model was the three-factor model, specifying an intercept factor, a linear slope factor, and a quadratic slope factor ($\chi^2_{(8)} [N=446]=12.97, P = .11; CFI = .99; RMSEA = .04$). Results showed that the average intercept was significantly greater than zero ($M_{\text{intercept}} = .254, P < .001$), the average rate of linear increase over time was significant ($M_{\text{slope}} = .026, P < .001$), and the average quadratic factor was significant and negative, indicating deceleration in growth across time ($M_{\text{quadratic}} = -.006, P < .001$). A value near zero on the quadratic term indicates that the average rate of deceleration is minimal. There was also significant variance around the intercept (.069, $P < .001$), the linear slope factor (.069, $P < .001$), the quadratic slope factor (.069, $P < .001$), and the error term (.069, $P < .001$).

.002, $P = .002$), and the quadratic slope factor (.001, $P = .004$), indicating individual differences on these model parameters and suggesting the inclusion of explanatory variables.

Next, the model was expanded by specifying ISFP, Risk, and the ISFP $\times$ Risk interaction (along with the pretest and gender covariates) as predictors of the intercept and slope factors. (Six individuals had missing values for the risk variable and were excluded from analyses.)

The model fit the data well, $\chi^2_{(16)} [N=440]=34.44$, $P < .01$; CFI = .97; RMSEA = .05. ISFP was a significant predictor of the intercept ($\beta = -.15$, $P = .01$) and a marginally significant predictor of the slope ($\beta = -.23$, $P = .07$), indicating that the ISFP condition adolescents demonstrated a lower average level and a trend toward a lower rate of increase across time than the control condition adolescents. The ISFP also was a marginally significant predictor of the quadratic slope factor ($\beta = .15$, $P = .08$), indicating that ISFP participants tended toward a slower rate of deceleration across time than the control condition students. Risk was a significant predictor of the intercept only ($\beta = .12$, $P = .01$), indicating that higher-risk adolescents displayed a higher average level of internalizing symptoms across adolescence. Finally, the ISFP $\times$ Risk interaction was a significant predictor of the intercept ($\beta = -.17$, $P < .01$) and the quadratic slope component ($\beta = .26$, $P = .01$); the ISFP $\times$ Risk effect on the linear slope component was non-significant. The interaction indicates that ISFP's effect on the average level of internalizing symptoms across adolescence was stronger for the higher-risk group, compared with the lower-risk group. Model parameters were used to plot the trajectories, as illustrated in Fig. 1, and indicated that the higher-risk ISFP and control groups demonstrated about the same level of internalizing symptoms at post-test in the 6th grade. During adolescence, however, the higher-risk control group demonstrated a higher level of internalizing symptoms than the higher-risk ISFP group through the 12th grade. At 12th grade, the ISFP higher-risk group's level of internalizing symptoms was comparable to the ISFP lower-risk group. Internalizing symptom levels for the lower-risk groups were more similar across adolescence, although the deceleration in the ISFP group was greater than in the control group, as shown by the difference between the lower-risk ISFP and control group levels of internalizing symptoms in the 12th grade.

To test the indirect effects of the ISFP on young adult internalizing symptoms, mediated through effects on adolescent internalizing symptoms and moderated by early substance initiation risk, the growth model was extended by including pathways from the adolescent internalizing symptom growth factors to the young adult internalizing symptoms. This model also exhibited good fit, and is illustrated in Fig. 2.² Significant paths from the adolescent internalizing symptom intercept and linear slope factors to the young adult internalizing symptom outcome were found; effects from the quadratic factor were non-significant. Regarding indirect effects, the ISFP total indirect effect on young adult internalizing symptoms was significant ($\beta = -.11$ [95% CI $-.20$ to $-.03$], $P = .01$), the Risk total indirect effect was significant ($\beta = .07$ [95% CI $.02$ – $.12$], $P = .01$), and the ISFP $\times$ Risk interaction total indirect effect was marginally significant ($\beta = -.09$ [95% CI $-.20$ to $.01$], $P = .07$). In this context, it is important to note that *Mplus* utilizes the delta method developed

²Nested model testing was conducted to determine the best fitting model(s) with the Yuan-Bentler T2* test. The model with only the control variables (baseline internalizing and gender) as predictors of the intercept, slope, and quadratic factors and young adult internalizing symptoms was compared with (a) the model that included intervention condition and risk predicting the intercept, slope, and quadratic factors, and young adult internalizing symptoms ($\Delta\chi^2_{(13)}=42.53$, $P < .001$); (b) the model described in (a) was compared with the model that added the interaction term predicting the same outcomes, ($\Delta\chi^2_{(18)}=43.64$, $P < .001$); and (c) the model described in (b) was compared with the model that added mediation of condition, risk, and the interaction by the intercept, slope, and quadratic factors, and eliminated the direct paths to young adult internalizing symptoms for condition, risk, and the interaction ($\Delta\chi^2_{(2)}=8.15$, $P = .02$). Including the direct paths, as described in the text, did not improve model fit and the paths were non-significant.

by Sobel (1982) for indirect effect significance levels and confidence intervals. Results suggest that ISFP effects on young adult internalizing symptoms were mediated by effects on adolescent growth factors, but that risk level was only marginally significant as an indirect moderating factor. Gender differences were evaluated with a two-group model and overall differences were non-significant, $\Delta\chi^2_{(12)}=11.67$, $P=.47$, indicating the model pathways didn't differ between males and females. Therefore, it was appropriate to control for gender. Fig. 3 illustrates the model-based internalizing symptom levels at young adulthood for the ISFP and control groups, by risk status.

To further test mediation, direct paths from ISFP, Risk, and ISFP $\times$ Risk to young adult internalizing symptoms were added to the model. Model fit did not improve ($\Delta\chi^2_{(3)}=0.48$, $P=.92$), the added paths were non-significant, and the indirect effects retained their significance levels.

Finally, to examine the effects of ISFP on overall clinical/subclinical levels of internalizing symptoms in young adulthood, scores on the young adult internalizing symptom scale were dichotomized, as noted earlier. The percentage of those above the cut-point was 11.2% in the intervention group and 15.5% in the control group, yielding an RRR of approximately 28% [$15.5-11.2/15.5\% = 27.7\%$]. If the RRR results were to replicate, for every 100 young adults (age 21) displaying clinical or subclinical levels of internalizing symptoms in school districts not offering an intervention, there could be as few as 72 displaying that level of internalizing symptoms in intervention school districts.

Discussion

Internalizing disorders and symptoms, specifically anxiety and depressive symptoms, are the most common psychological disorders during childhood, adolescence, and into young adulthood (Costello et al. 2003; NIMH 2011). Because of the negative sequelae associated with adolescent internalizing symptoms, such as diminished interpersonal functioning (Riley et al. 1998), increased substance misuse (Armstrong and Costello 2002) and other externalizing problems (Hinden et al. 1997), negative effects on health as well as social and occupational functioning (Bardone et al. 1998; Lillehoj et al. 2004), and increased risk for major depression and other psychiatric disorders in adulthood (Fergusson and Woodward 2002), prevention of these symptoms can be beneficial to both individuals and society. An earlier study examined the effects of the family-focused ISFP preventive intervention on adolescent internalizing symptoms and found significant effects on internalizing symptoms across adolescence (Trudeau et al. 2007). The current study extended those results by examining effects into young adulthood (age 21), and also examined the effects of early substance initiation risk and the interaction between intervention condition and risk.

When examining effects of an intervention across developmental periods, assessing mechanisms of effects can be difficult because of the extent of developmental change between the implementation of the intervention and young adulthood, in this case, from early adolescence to age 21. Developmental sequences of effect set in motion by an intervention can vary across time and across individuals (Masten et al. 2005, 2008). Using SEM analyses, adjusting for clustering within schools and for non-normality of the variables, we examined whether the ISFP, implemented during middle school, would reduce young adult internalizing symptoms indirectly, through its effects on adolescent internalizing symptoms. We also examined whether intervention effects would be moderated by early substance misuse risk. Our analyses could be described as a blend of mediation and moderation (Preacher et al. 2007).

We found clear support for the meditational hypothesis—that is, ISFP effects on young adult internalizing symptoms were indirect, mediated through effects on the level and rate of change in adolescent internalizing symptoms. Although research has shown that internalizing symptoms increase during adolescence (Costello and Angold 1995) and that continuity between adolescence and young adulthood is likely (Harrington et al. 1990; Rutter 1995), no studies could be found that addressed the primary hypotheses of this article regarding the long-term effects of universal family-based preventive interventions on internalizing symptoms. Support for the moderation hypothesis was mixed—that is, the effect of the interaction between risk level and ISFP on internalizing symptoms was significant during adolescence, but its indirect effect on young adult internalizing symptoms was only marginally significant. In general, results indicated stronger intervention effects for higher-risk participants.

It is important to underscore that young adult internalizing symptoms were not a targeted outcome of the ISFP. Three considerations—theory reviewed in the introduction regarding the relationship between substance misuse and internalizing symptoms (Mueser et al. 2006) and the relationship between family factors and internalizing symptoms (Sheeber et al. 2001, 2007), earlier empirical research that evaluated ISFP effects on adolescent internalizing symptoms (Trudeau et al. 2007), and the expectation of continuity between adolescence and young adulthood (Rutter 1995)—suggested the hypothesized continuity of ISFP effects on internalizing symptoms during young adulthood. Non-targeted long-term intervention outcomes should be explored when theory and evidence suggest positive effects could generalize across outcome domains (O’Neil et al. 2011).

Our findings suggest the possibility that common causal factors and reciprocal, developmental effects could be operative. The relationship between substance misuse and internalizing symptoms has been well documented (O’Neil et al. 2011). There are, however, several theoretical models postulated to explain that relationship (Mueser et al. 2006); thus, there are multiple potential mechanisms that could explain the ISFP effects on adolescent internalizing symptoms. For example, the ISFP addresses several risk and protective factors that relate to both substance misuse and internalizing symptoms, such as parental warmth/affection, parental behavioral control, and deficits in adolescent coping skills (Redmond et al. 1999; Spoth et al. 1996a, b, 1998). These common factors are associated with stronger parent/adolescent relationships and adolescent social/emotional skills, likely contributing to lower levels of substance misuse and internalizing symptoms, both during adolescence and, ultimately, into young adulthood. Other related, developmental sequences of effects also could be operative. For example, with the aforementioned ISFP-produced reduction in substance misuse (Spoth et al. 1998, 2001), and earlier studies finding that adolescent substance misuse predicts later internalizing disorders, controlling for earlier levels of internalizing disorders (Brook et al. 2002; Rao et al. 2000), early adolescent reduction in substance misuse could play a role. Regarding reciprocal effects, internalizing symptoms may motivate initial substance misuse, which, if continued or increased across time, may exacerbate initial levels of internalizing symptoms (Friedman et al. 1987; Mueser et al. 2006). The ISFP may interrupt that pattern. Although specifying adolescent internalizing symptoms as the mediating mechanism for ISFP effects on young adult internalizing symptoms was an appropriate choice for a parsimonious model, it should be noted that this approach limits clarification of specific developmental processes that may be operative.

ISFP could have set in motion a range of positive consequences associated with a decrease in adolescent internalizing symptoms, including improved school and occupational functioning and improved social relationships (Bardone et al. 1998; Fergusson and Woodward 2002; Masten et al. 2005; Spoth et al. 2008a, b, c), which may be expected to affect levels of internalizing symptoms in young adulthood. As in past research, our study

generally demonstrated continuity in internalizing symptoms from adolescence to young adulthood. The ISFP effect, however, resulted in an alteration in the expected trajectory of internalizing symptoms across adolescence, as demonstrated by comparison with the control condition participants. Etiological research and theory suggest that a range of possible mediating mechanisms (Rutter et al. 2006) could initiate a “turning point,” as described in the developmental literature (Schulenberg and Zarrett 2006). That is, exposure to ISFP may have resulted in an enduring change in the trajectory of internalizing symptoms. It is also important to note that an examination of gender moderation of ISFP effects on young adult internalizing symptoms suggested the effects were similar for males and females.

Although earlier project studies did not find moderation of ISFP intervention effects on substance misuse by early family risk (Spoth et al. 2006), we examined whether higher-risk individuals—those who had initiated alcohol or cigarette use prior to the intervention in the sixth grade—could benefit more from the intervention than lower-risk individuals. Early substance misuse can be a risk factor for developing internalizing symptoms (Brook et al. 2002) and the preventive intervention outcome literature has suggested that when risk moderation has been found, higher-risk participants typically benefit more from interventions (e.g., Olds et al. 2003; Spoth et al. 2008a, b, c). We speculated that adolescents and their parents who recognized that they may exhibit risk factors would be more likely to conscientiously apply the relevant intervention lessons and thus may receive more benefit. There was some support for this expectation; however, results were mixed. Analyses found significant risk moderation on adolescent growth; the higher-risk ISFP group adolescents, compared to the higher-risk control group adolescents, demonstrated a significantly lower average level of internalizing symptoms and, by 12th grade, their internalizing symptoms were comparable to the lower-risk ISFP adolescents (see Fig. 1). For the lower-risk adolescents, the ISFP and control groups’ level and growth in internalizing symptoms across adolescence were more similar. During young adulthood, however, only a marginally significant indirect interaction effect was found, indicating a trend for ISFP higher-risk young adults benefitting more from the intervention (see Fig. 3). The higher-risk population was about 20% of the total population (i.e., about 90 individuals), suggesting the possibility of limited power to detect the risk moderation effect. Although the higher-risk subpopulation tended to benefit more from intervention effects, ISFP was designed as a universal intervention and it is likely that the mix of higher- and lower-risk participating families contributed to the beneficial effect for the higher-risk participants. Past research has suggested that isolating higher-risk youth and families may contribute to iatrogenic intervention effects, whereby harm may be done via peer contagion; that is, interventions that aggregate higher-risk peers tend to reduce the effect size of interventions and may produce negative effects (Dishion and Dodge 2005; Dishion and Stormshak 2007).

To address the potential public health benefit of the tested intervention by evaluating the clinical significance of the findings, we estimated the relative reduction rate (RRR) for the intervention group compared to the control group. The estimated RRR of 28% suggested that, if results were to replicate, for every 100 young adults displaying clinical or subclinical levels of internalizing symptoms in communities not offering an intervention, there could be as few as 72 displaying those levels of symptoms in communities that offered prevention programming in early middle school. That is noteworthy, considering that approximately 10 years elapsed from the brief intervention in question to the age 21 assessments, and intervening events (e.g., financial concerns, health problems) could have worked at cross-purposes with the intervention. It is likely that ISFP effects on both parenting and adolescent attitudes and skills set in motion a chain of effects that resulted in reductions for both long term substance misuse (Spoth et al. 2009) and internalizing symptoms that could have positive public health benefits.

Limitations of this study are important to consider. The sample was rural Midwestern, USA, and almost entirely White. Differences may exist in the distribution of internalizing symptoms or substance initiation, or in the many influences on these symptoms and behaviors, between rural Midwesterners and other populations. Further testing of the intervention with other populations is recommended. Another consideration is that both internalizing symptoms and substance initiation were self-reported, although self-reports are considered to be an accurate method of assessing both and have been validated in past research (Achenbach and Rescorla 2001; Williams et al. 1995).

In conclusion, this report further supports the potential public health impact of larger-scale implementation of the universal family-focused intervention evaluated in this report. Previous work has indicated the public health benefits of the intervention by documenting positive effects on adolescent and young adult substance misuse, health-risking sexual behavior, and offending behaviors (Spath et al. accepted, 1998, 2001, 2008a, b, c, 2009). This analysis extends earlier work that demonstrated positive ISFP effects on adolescent internalizing symptoms (Trudeau et al. 2007). Considered collectively, these ISFP outcome results support the benefit of implementing ISFP in a community to expose young adolescents and their parents to a skill-building intervention with positive effects on a range of risk and protective factors (e.g., family communication, child management skills, adolescent coping skills), providing evidence that it impacts internalizing symptoms across adolescence and into young adulthood.

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Biographies

Linda Trudeau is an associate research scientist at the Partnerships in Prevention Science Institute at Iowa State University. She received her Ph.D. in Human Development and Family Studies at Iowa State University. Her research interests are the evaluation of prevention programs on substance misuse outcomes and related problems, along with intervention mediators and moderators. She also has studied risk and protective factors for adolescent and young adult problem behaviors.

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Kevin Randall is an Assistant Professor of Family and Consumer Sciences, and Director of the C. C. Wheeler Institute at Bradley University. His research evaluates programs designed to reduce adolescent substance misuse and other problem behaviors. In addition, he is interested in the role played by risk and protective factors, such as negative peer influence and positive parenting, in adolescent development and academic success. Kevin received his Ph.D. in Human Development and Family Studies from Iowa State University.

W. Alex Mason is Associate Director of the Boys Town National Research Institute for Child and Family Studies. He received his Ph.D. in Social Psychology from the University of Nevada-Reno. His major research interests include the developmental etiology and family-based prevention of adolescent and young adult substance misuse and co-occurring problems. He also has interests in longitudinal and intervention-related methods and analytic techniques.

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Fig. 1.

Trajectory of adolescent internalizing symptoms by condition and risk, estimated by structural equation model parameters

Fig. 2.

Long-term ISFP and risk effects on young adult internalizing symptoms. $^{+}P < .10$; $^{*}P < .05$;

$^{**}P < .01$; $^{***}P < .001$. $N = 440$; $\chi^2_{(22)} = 37.12$, $P = .02$; CFI = .98, RMSEA = .04.

Completely standardized MLR estimates, with 95% CI in *brackets*. Variables within *circles* are latent variables, and variables within *squares* are manifest variables. The model controls for baseline internalizing symptoms and gender, not depicted; indicator variables for the latent factors and correlations among the growth factor residuals are not depicted. *Dotted lines* are nonsignificant

Fig. 3.
Young adult internalizing symptoms by risk and intervention condition

Table 1

Means and standard deviations of the internalizing symptoms variables

Internalizing symptoms		6th Grade pre-test	6th Grade post-test	7th Grade	8th Grade	10th Grade	12th Grade	Young adult
ISFP								
Means	.34	.31		.35	.32	.35	.30	.34
SD	.32	.31		.38	.33	.36	.33	.29
Control								
Means	.31	.29		.34	.38	.38	.39	.37
SD	.28	.26		.34	.38	.38	.36	.27

The range of scores was 0–2