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## Preventing Internalizing Symptoms Among Hispanic Adolescents: A Synthesis Across Familias Unidas Trials

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### Abstract

Studies document that there are efficacious interventions to prevent adolescent depression and internalizing symptoms, including several family-focused interventions. Questions remain about for whom interventions work (*moderation*) and by what mechanisms they work (*mediation*) to prevent internalizing symptoms. Unfortunately, single trials are often underpowered to address moderation and mediation, an issue addressed in this paper. This synthesis study combined individual-level, longitudinal data from 721 adolescents across 3 randomized clinical trials of Familias Unidas, a family-focused prevention intervention for Hispanic youth. Using integrative data analysis (IDA) methods applied to trials, the study examined intervention moderation and mediation effects on internalizing symptoms. Baseline internalizing symptoms were a significant moderator of the intervention's effects on internalizing symptoms, while baseline externalizing symptoms did not moderate intervention effects. Baseline parent–adolescent communication, a

modifiable risk factor and hypothesized mechanism by which the intervention works, significantly moderated the intervention's effects. Specifically, the intervention was more efficacious in its impact on internalizing symptoms for youth with lower initial levels of parent–adolescent communication compared to those with higher communication levels. Moderated mediation analyses showed that parent–adolescent communication changes mediated the intervention's effects on internalizing symptoms, with stronger effects for those with poorer baseline communication. Results suggest a potential benefit of identifying youth risks prior to interventions, and targeting specific modifiable mediators that lead to reductions of internalizing problems of adolescents. Findings also highlight advantages of utilizing data from combined trials and IDA for examining intervention moderators and mediators.

### Keywords

Adolescent; Internalizing symptoms; Family; Integrative data analyses (IDA)

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Existing research suggests that depression can be prevented (Muñoz et al. 2012; NRC/IOM 2009). Meta-analyses of interventions to prevent adolescent depression document that there is an overall benefit of these interventions on depressive and internalizing symptoms, with small to moderate effect sizes (Horowitz and Garber 2006; Merry et al. 2012; Stice et al. 2009). Parent and family-focused programs have emerged as promising interventions for preventing youth internalizing symptoms (Beardslee et al. 2003; Compas et al. 2010; Gonzales et al. 2012; Sandler et al. 2003). However, the literature suggests that there is considerable heterogeneity in effects across prevention trials (Horowitz and Garber 2006; Stice et al. 2009). This is not surprising given that interventions target youth at different levels of risk (e.g., universal, selective and indicated samples) and address different risk and protective factors (e.g., cognitive restructuring, interpersonal relationships, and parenting behaviors [Horowitz and Garber 2006]). To improve the efficacy and reach of preventive interventions, more studies are needed to determine for whom these interventions work (questions of *moderation*) and by what mechanisms they work (questions of *mediation*) (Horowitz and Garber 2006; Sandler et al. 2011). Analytically, moderation is examined by evaluating the strength of baseline covariate by intervention interactions on the outcome. Mediation can be examined in multistep analyses via the Baron and Kenny (1986) approach by including baseline by mediator interactions (Kraemer et al. 2008; see MacKinnon (2008) and Valeri and VanderWeele (2013) for methods comparisons).

### Moderators of Intervention Effects and Moderated Mediation Effects

Examining moderators of intervention effects can provide important information about which adolescent subgroups may respond differentially to interventions (Stice et al. 2009). When moderators are modifiable risk factors, findings can also add insights into mechanisms by which interventions prevent internalizing symptoms. Several depression prevention studies have reported intervention moderator effects related to parent and family risk factors. For example, Young et al. (2009) reported that baseline mother-child conflict moderated the effects of their preventive program, an intervention based on interpersonal therapy and adolescent skill building. Youth in the intervention condition with high levels of

mother-child conflict had greater decreases in depressive symptoms than those in the control condition with high conflict; yet, there were no differences between conditions for youth with low conflict. Because this intervention tried to reduce family conflict and improve relationships, reductions in parent-adolescent conflict brought about by the intervention could be a key mechanism by which the intervention prevents internalizing symptoms among high-risk youth.

Similarly, Tein et al. (2004) examined moderators and mediators of the New Beginnings program, an intervention to prevent mental health problems among children of divorcing parents. The intervention was directed at mothers and youth and addressed several risk and protective factors including quality of parent-child relationships. This study reported a significant intervention moderator effect, with reductions in internalizing symptoms only among youth who initially showed low levels of mother-child relationship quality. Moderated mediation analyses found that this effect was mediated by improvements in the quality of the mother-child relationship (Tein et al. 2004).

Despite the important insights that can be gained from moderation and moderated mediation analyses, prevention studies have not consistently reported such analyses. A possible reason is that individual studies are often underpowered to detect intervention moderation and mediation effects (Brown et al. 2011; O'Rourke and MacKinnon 2013). This lack of power may be addressed through integrative data analysis (IDA), which has emerged as a powerful method to pool datasets together and synthesize findings across trials (Curran and Hussong 2009). These synthesis analyses using IDA involve combining individual, and sometimes item-level data across multiple studies to yield larger sample sizes, increased statistical power, a wider range on important measures, and the capacity to test complex models (Brown et al. 2011).

The IDA approach differs from more traditional multilevel analysis of multisite randomized trials because each distinct trial can have different measurement times, a technical problem that can be addressed by using a common growth model. Moreover, distinct trials can have different measures, as the 'harmonization' of measures is an important area to which IDA has contributed (see Curran and Hussong 2009). Like traditional multilevel analysis of group-based trials, IDA can help answer new and important research questions that cannot be answered adequately by single trials, integrating study-level and participant-level data and then using multilevel modeling to evaluate overall intervention effects, as well as moderation and mediation at both the between-trial and within-trial levels. Pooling samples and conducting IDA provide other potential advantages such as increasing confidence in generalization, given that combined samples may lead to higher generalizability than any single trial can provide. By combining data from multiple trials that assess participants of different ages, IDA techniques have also been successfully used to examine developmental processes across multiple stages of life (Curran and Hussong 2009). IDA has also shown potential for calibrating results across age in randomized trials (Brown et al. 2011; Gibbons et al. 2012). As described below, the current study addresses the gap in the literature related to understanding moderators and mediators of parent and family-based preventive intervention effects on internalizing symptoms by pooling data across three trials of the Familias Unidas intervention (Prado and Pantin 2011), and using integrative data analyses.

## The Familias Unidas Intervention

Familias Unidas is a parent and family-focused preventive intervention for Hispanic adolescents (Prado and Pantin 2011). Originally designed to prevent youth externalizing behaviors (i.e., drug use, sexual risk behaviors), the intervention's hypothesized mechanisms for promoting positive youth outcomes involve strengthening parenting skills and family functioning, including parent–adolescent communication. The intervention is delivered through multi-family parent groups and individual family sessions. A full description of the intervention may be found elsewhere (Prado and Pantin 2011). This intervention has been found to improve parenting and family functioning and reduce externalizing behaviors among youth, including substance use and sexual risk (Pantin et al. 2009; Prado et al. 2007, 2012). While the intervention was not initially designed to prevent youth internalizing symptoms, such as anxiety and depressive symptoms, many of the parent and family risk factors targeted by the intervention are common to the development of both externalizing and internalizing symptoms (NRC/IOM 2009; Restifo and Bogels 2009), and so it makes sense to also examine the effects of the intervention on internalizing symptoms. Positive family communication is key to parent–youth relationship quality, and a mediator of intervention effects for youth behavior problems (Zhou et al. 2008). In fact, there has been a substantial interest in interventions that target multiple risk and protective factors common to various youth health outcomes as a way to increase their public health impact (NRC/IOM 2009). In this study, we combine data from three Familias Unidas trials that targeted adolescents who varied on risk for mental, emotional and behavioral problems. Externalizing and internalizing symptoms are moderately co-occurring (Oland and Shaw 2003) and share certain common parent and family risk and protective factors (see NRC/IOM 2009). Other parent and family-focused programs to prevent youth externalizing problems have also found positive effects on internalizing symptoms (Connell and Dishion 2008; Trudeau et al. 2012).

### Aim and Hypotheses

This paper examines moderators and mediators of the Familias Unidas intervention's effects on youth internalizing symptoms. In terms of moderators, we hypothesized that the Familias Unidas intervention would be more efficacious in reducing internalizing symptoms for adolescents: (a) with higher levels of internalizing symptoms at baseline compared to those with lower levels (*Hypothesis 1a*); (b) with higher levels of externalizing symptoms at baseline compared to those with lower levels (*Hypothesis 1b*); and (c) with lower levels of family communication at baseline compared to those with higher levels (*Hypothesis 1c*). In terms of mediators, we hypothesized that improvements in family communication would mediate the impact of the intervention on adolescent internalizing symptoms, with a stronger mediated effect for those adolescents with low baseline levels of family communication (*Hypothesis 2*).

## Methods

### Population and Intervention

The present study combined data across three trials of the Familias Unidas intervention conducted by the same research team in the same geographic region (Pantin et al. 2009; Prado et al. 2007, 2012). All three trials tested the efficacy of the Familias Unidas prevention intervention, although there was minor variability across the three trials in intervention duration and in the type of control conditions, as described further below. Table 1 shows age, gender, and nativity distributions for the pooled sample of 721 Hispanic adolescents. These three trials included adolescents with varying baseline risk levels based upon externalizing behavior problems. A unique feature of this IDA is its ability to synthesize findings of a single intervention delivered as a universal prevention intervention. A second unique feature of this IDA is the ability to synthesize effects of the intervention on an outcome, internalizing symptoms, that is theoretically predicted to be affected by the mediating variable, but that was not the identified targeted outcome. Adolescents with a history of psychiatric hospitalization were excluded in all three trials. All studies were approved by the University of Miami's IRB. Informed consent for study participation was obtained from parents and assent was obtained from the adolescents. Good intervention adherence has been documented across the three Familias Unidas trials (see Pantin et al. 2009; Prado et al. 2007; Prado et al. 2012).

The *Universal Group* study included 266 eighth grade Hispanic adolescents and their primary caregivers recruited from middle schools (Prado et al. 2007). All Hispanic eighth grade students from three selected schools and a primary caregiver were eligible to participate. Participants were randomized to one of the following three conditions: (a) the Familias Unidas Prevention Intervention condition, which involved the Familias Unidas program, a Hispanic-specific, parent-centered intervention designed to strengthen parenting skills and family functioning to prevent adolescent risk behaviors (e.g., substance use and unsafe sexual behavior) plus Parent–Preadolescent Training for HIV Prevention (PATH), a Hispanic-specific, parent-centered intervention designed to prevent adolescent substance use and unsafe sexual behavior ( $n = 91$ ); (b) the Standard HIV Prevention condition, which involved PATH plus English for Speakers of Other Languages (ESOL) ( $n = 84$ ), with ESOL being an attention control; or (3) the Attention Control condition, which involved HeartPower! for Hispanics (HEART), a health promotion intervention to prevent heart disease through healthy eating and exercise, plus ESOL ( $n = 91$ ). Each condition included 49 h of activities, so that conditions would be equivalent on attention. The Familias Unidas intervention involved 15 group sessions, 8 family visits and 2 parent–adolescent group sessions. For the present analyses, participants in the latter two conditions were combined and classified as the control group ( $n = 175$ ) and compared to the Familias Unidas intervention group ( $n = 91$ ) because the aim of the present study was to isolate and understand the efficacy of the Familias Unidas intervention, which was only delivered in Condition 1 “Familias Unidas plus Parent–Preadolescent Training for HIV Prevention (PATH)”. Participants were assessed at baseline, and then at 6, 12, 24, and 36 months post-baseline.

The *Targeted Risk Group: Referred* study recruited 213 eighth grade Hispanic adolescents with behavior problems and their primary caregivers (Pantin et al. 2009). Hispanic eighth graders from the three selected high schools and a primary caregiver were eligible to participate if the school counselors and a caregiver had identified the youth as having problems in at least one of the following areas: conduct disorder, socialized aggression, or attention problems. Participants were randomly assigned to either the Familias Unidas intervention ( $n = 109$ ) or a community control condition ( $n = 104$ ). The Familias Unidas intervention involved eight 2-h group sessions, and four 1-h family sessions. Participants were assessed at baseline, 6, 18, and 30 months post-baseline.

The *Targeted Risk Group: Adjudicated* study recruited 242 delinquent Hispanic youth between the ages of 12 and 17 from the school system and juvenile justice system, as well as their primary caregivers (Prado et al. 2012). Hispanic adolescents and a caregiver were eligible to participate if the youth had been arrested or had committed at least one Level III behavior problem as defined by the Miami-Dade County Public School System, which involved any of the following: assault/threat against a non-staff member, breaking and entering/burglary, fighting (serious), hazing, possession or use of alcohol and/or controlled substances, possession of simulated weapons, trespassing, or vandalism. Participants were randomized into either the Familias Unidas intervention ( $n = 120$ ) or a community control condition ( $n = 122$ ). The Familias Unidas intervention involved eight 2-h group sessions, and four 1-h family sessions. Participants were assessed at baseline, and then at 6 and 12 months post-baseline.

## Measures

The measures used to test the study hypotheses were common across all three Familias Unidas trials. All measures were reported by the parent.

**Adolescent Internalizing Symptoms**—Adolescent internalizing symptoms were measured at each assessment using the Anxiety-Withdrawal Subscale of the Revised Behavior Problem Checklist (Quay and Peterson 1993). This is an 11-item subscale measuring adolescent internalizing symptoms, both depressive and anxiety symptoms ( $\alpha = 0.82$ ). Each item is rated on a three point Likert scale ranging from “0=No problem” to “2=Severe problem”. Sample items are: “Depressed; always sad,” “Generally fearful; anxious.” Possible scores ranged from 0 to 22 with higher scores indicating higher levels of internalizing symptoms. A square root transformation of internalizing symptoms was used for this outcome. Construct validity for the RBPC has been established, including discrimination between clinic-referred and community samples of youth (Quay and Peterson 1993). Reported norms for this scale indicate that mean (SD) scores for community youth are 4.47 (4.07) for females and 3.85 (3.66) for males, while for clinical youth are 11.12 (4.77) for females and 9.71 (4.58) for males (Quay and Peterson 1993).

**Adolescent Behaviors**—This construct was measured using four subscales of the Revised Behavior Problem Checklist (Quay and Peterson 1993): attention problems (16 items;  $\alpha = 0.95$ ), motor excess (5 items;  $\alpha = 0.84$ ), socialized aggression (17 items;  $\alpha = 0.93$ ) and conduct disorder (22 items;  $\alpha = 0.96$ ). Item examples are: “Distractible; easily diverted

from the task at hand,” “Hyperactive; always on the go;” “Fights;” “Steals from people outside the home.” Higher scores indicate higher levels of externalizing problems. A latent variable composed of these four indicators was used as an index of externalizing problems. Standardized loadings were 0.88, 0.84, 0.77 and 0.95, for attention problems, motor excess, socialized aggression, and conduct disorder.

**Parent–Adolescent Communication**—Parent–adolescent communication was measured using the Parent–Adolescent Communication Scale (Barnes and Olson 1985). This 20-item report assesses the quality of parent–adolescent communication ( $\alpha=0.82$ ). Each item is rated on a 5-point Likert scale from “1=Strongly disagree” to “5=Strongly agree”. Item examples include: “When I ask questions, I get honest answers from my child;” “I find it easy to discuss problems with my child;” “I openly show affection to my child.” Possible scores ranged from 20 to 100 with higher scores indicating better parent–adolescent communication.

## Analysis Plan

**Preliminary Analyses**—We first tested whether each of the three trials had similar distributions of baseline scores for internalizing, externalizing, and parent–adolescent communication across intervention condition. These comparisons controlled for age and gender. We also compared attrition rates by condition within each trial as well as the prevalence of a major depressive disorder based on the DISC Predictive Scale, which have established cut-points that are predictive of diagnoses (Lucas et al. 2001). Because the Universal Group study did not include this measure, we calculated estimated prevalence using a logistic regression model that predicted diagnosis from RBPC symptom scores. Among these 15 comparisons, we found only one significant difference by condition. In the Targeted Risk Group: Adjudicated trial, participants in the intervention condition reported higher levels of baseline externalizing symptoms than those in the control condition ( $b = -3.54$ ,  $se = 1.42$   $p = 0.013$ ), which would not be considered significant by the Bonferroni multiple comparison method that takes into account the number of comparisons.

**Assessment of Models.** To address each hypothesis, we fit linear latent growth models (LGM) for the repeated measures of adolescent internalizing symptoms. Linear growth was tested against quadratic growth and the linear was found to be adequate (mean quadratic=14.31,  $se = 32.688$ ,  $p = 0.66$ ). These latent growth models are equivalent to mixed effects multilevel models where level-1 models the repeated measures and level-2 models the individual participant. Because there were only three trials, we did not include trial as a third level but instead examined trial heterogeneity by comparing fixed effect estimates using standard Wald tests. Linear growth models provide a common metric for examining change over time even when the follow-up times differ across trials (Brown et al. 2011; Gibbons et al. 2012), as they did in these three trials. Thus the measurement model for the first level, involving observed outcomes  $Y_{t(ij)}$  at time  $t_{ij}$  for subject  $i$  in trial  $j$ , is

$$Y_{t(ij)} = a_{ij} + b_{ij}t_{ij} + \varepsilon_{t(ij)}$$

where the individual level intercept  $a_{ij}$  and slope  $b_{ij}$  are random, with their own predictors and unique errors as given below. The regression of the latent slope  $b_{ij}$  on intervention condition measures difference in mean internalizing trajectory for individuals in Familias Unidas compared to control. The effect size of the intervention in each trial was computed as the difference in the slope for intervention and control group divided by the standard deviation of the slope; the effect size across all three trials was computed as the difference in the slope for intervention and control group divided by the pooled standard deviation of the slope that was weighted by each trial's sample size. Covariates included age, gender, baseline externalizing symptoms and parent-child communication, as well as the latent intercept for internalizing symptoms. Interactions of these baseline variables with intervention provided parameter estimates to test our specific hypotheses. A general model for the subject  $i$ 's latent slope in trial  $j$ ,  $b_{ij}$ ,  $j=1, 2, 3$ , can be written in terms of the measured covariates  $X_{ij}$ , intervention condition  $Tx_{ij}$  (1=intervention and 0=control), latent intercept  $a_{ij}$  and residual variance  $\varepsilon_{ij}$  as follows:

$$b_{ij} = \alpha_0 + \alpha_1 X_{ij} + \alpha_2 a_{ij} + \alpha_3 Tx_{ij} + \alpha_4 X_{ij} Tx_{ij} + \alpha_5 a_{ij} Tx_{ij} + \varepsilon_{ij}$$

In this model, the coefficient  $\alpha_0$  represents the mean slope; coefficient  $\alpha_1$  (fixed effect) adjusts for known covariates and  $\alpha_2$  (fixed effect) adjusts for the intercept in the control group; coefficient  $\alpha_3$  (fixed effect) compares the average slope for treatment and control, and  $\alpha_4$  (fixed effect) and  $\alpha_5$  (fixed effect) examine the interaction between intervention condition and control as a function of the measured and latent covariates. Thus moderator effects are assessed by the coefficients  $\alpha_4$  and  $\alpha_5$ . Coefficients were coded so that positive regression coefficients mean Familias Unidas improves more rapidly than did control. To model between-trial heterogeneity, we allowed all or some of the  $\alpha$  coefficients to differ for each trial. Moderation could involve a nonlinear relationship between a baseline covariate and treatment. As a means of examining whether our findings depended on linearity assumptions, we examined these effects using nonparametric smoothers for measured covariates (Cleveland 1981) and quadratic terms for the latent intercept on internalizing (Klein and Muthén 2007). There was no evidence of nonlinearity in these interactions. Variations in formula (1) were used for assessing specific hypotheses with model testing to confirm that these fits were not distorting the data (e.g., checking that the intercept distribution does not differ across intervention condition, as one would expect from a balanced randomized trial (Brown et al. 2008).

**Synthesis Analyses Using Integrative Data Analysis**—To conduct these synthesis analyses, we created a dataset including individual level data from all three trials, and conducted integrative data analyses (IDA) for randomized trials using methods described in Brown et al. (2011). Missing data for the repeated measures were addressed using full information maximum likelihood. Because trials differed on follow up time points, we used individually varying times of observation to estimate growth curves and set baseline as the common zero time point. All latent growth analyses were conducted in Mplus version 7.0 (Muthén and Muthén 2012).



For all analyses, we considered predictor variables to be in one of two groups. Primary predictors included variables that were specifically related to the hypothesis (e.g. interaction terms for the moderation hypotheses). Covariates included age, gender, intercept of trajectory, intervention condition, baseline internalizing, baseline externalizing, and baseline parent-adolescent communication. We first compared the fit between a model in which all regression paths were freely estimated for each trial to a model in which the effects of covariates were constrained to be equal across trials. We freed paths necessary to ensure comparable fit using likelihood ratio tests. We then tested for the presence of heterogeneity in the effects of interest across the three trials using Wald tests. If no heterogeneity was present, the final IDA model was achieved by constraining the effects of the primary predictor to be equal across the three trials to obtain an estimate of the overall hypothesized effect. For the main effect and moderation analyses, we present findings from individual trial analyses as well as estimates produced by the overall IDA analysis that synthesizes across the three trials.

**Moderation Analyses**—To test the moderation hypotheses, we modeled baseline internalizing symptoms, baseline externalizing symptoms and baseline parent-adolescent communication as moderators of the relationship between intervention and trajectory of internalizing symptoms. We tested baseline internalizing symptoms, baseline parent-adolescent communication and baseline externalizing symptoms as potential treatment moderators, using separate analyses for each (Hypotheses 1a, 1b, 1c). A most efficient and parsimonious model was estimated in multi-group LGM analysis using the IDA procedures described above to increasingly constrain parameters in the model across trials. Finally, parameters of interest (i.e., interaction terms) were constrained equal across trials if the parameters did not differ significantly across trials.

**Moderated Mediation Analysis**—To test the moderated mediation hypothesis (Hypothesis 2), we modeled post-intervention parent-adolescent communication as a mediator of the relationship between intervention condition and trajectory of internalizing symptoms using the “product of coefficients method” (MacKinnon 2008). Baseline (pre-intervention) communication was modeled as a moderator of the relationship between intervention and post-intervention communication as well as the relation between intervention and the internalizing trajectory (Fig. 1; Tein et al. 2004). The extended Johnson-Neyman approach was used to assess where mediation occurred as a function of baseline levels (Preacher, Rucker, and Hayes 2007).

## Results

### Descriptive Analyses

Table 1 provides sample sizes, gender distribution, mean ages, nativity, and baseline subscale means for participants in each of the three studies, as well as the overall combined sample across the three studies. The overall sample was 42 % female with a mean of 14 years ( $SD=1.14$ ) and approximately 53 % being born in the U.S. The individual study samples were different in gender, age and nativity. Specifically, the proportion of females was significantly larger in the Universal sample compared to the other two samples, a

consequence of adolescent males exhibiting externalizing behavior more often. The Universal sample's mean age was youngest while the Adjudicated sample was oldest. The Adjudicated sample had a significantly larger proportion of youth born in the U.S. compared to the other two groups. In terms of parent–adolescent communication, the Universal sample's baseline mean was significantly higher than the other groups. The Universal sample also had significantly lower mean levels of externalizing and internalizing symptoms compared to the other two groups. For internalizing symptoms, the overall sample's mean (SD) was 5.04 (4.98), the Universal sample's was 3.25 (3.63), the Referred sample's was 6.55 (5.35), and the Adjudicated sample's was 5.68 (5.34). Because this subscale is not diagnostic, Table 1 includes the prevalence of Major Depressive Disorder levels at baseline per the Diagnostic Interview Schedule for Children (DISC) Predictive Scales (Lucas et al. 2001), which was administered to the two targeted samples only. The percent of the Referred and Adjudicated in the sample with MDD diagnosis levels is substantial, 20.6 % and 21.2%, respectively, double the levels estimated for the Universal sample.

### Main Effect Analyses

Please note that for clarity purposes, the results from the single trials analyzed separately are labeled “individual trial analyses,” while the synthesis analyses of the data from the combined trials using integrative data analysis (IDA) are labeled “synthesis analyses.” Individual trial analyses found no significant intervention effects on the trajectory of adolescent internalizing symptoms for the Universal and Referred groups (Universal  $b = -0.033$ ,  $se = 0.323$ ,  $d = 0.027$ ; Referred  $b = 0.731$ ,  $se = 0.578$ ,  $d = 0.305$ ), but did find a significant intervention effect for the Adjudicated group, with control participants having a less favorable trajectory of internalizing symptoms (Adjudicated  $b = 2.45$ ,  $se = 1.234$ ,  $d = 0.724$ ). There was no significant between-trial heterogeneity in this intervention effect (Wald  $\chi^2_{(2)} = 4.912$ ,  $p = 0.086$ , also  $p = 0.085$  by likelihood ratio test, LRT). In the synthesis analysis that combined data across trials, the overall estimate of the intervention effect on change in internalizing symptoms was not significant ( $b = 0.232$ ,  $se = 0.295$ ,  $p = 0.433$ ,  $d = 0.082$ ).

### Moderator Analyses

**Baseline Levels of Internalizing Symptoms (Hypothesis 1a)** To test the moderating effect of baseline internalizing symptoms, we created interaction terms that crossed the latent intercept with the intervention condition. Comparing the fit of a model in which all paths were freely estimated across the three trials, and one in which the effects of the covariates (age, gender, baseline internalizing symptoms, intervention condition) were constrained equally, we concluded that the effects of the covariates were not significantly different across trials, with the exception of the regression of the intercept on age, which was allowed to differ within trial ( $\chi^2_{(16)} = 20.02$ ,  $p = 0.22$ ). Individual trial analyses showed baseline internalizing symptoms were a significant moderator of intervention effects in the Universal trial, but was not significant in the Adjudicated or Referred trials. There was no significant between trial heterogeneity in this moderation effect (Wald  $\chi^2_{(6)} = 10.667$ ,  $p = 0.10$ , also  $p = 0.10$  by likelihood ratio test, LRT). In the synthesis analysis, Baseline internalizing symptoms were a significant moderator of the relationship between the intervention and trajectory of internalizing symptoms ( $b = 0.737$ ,  $se = 0.318$ ,  $p = 0.02$  Table 2).

Baseline Levels of Externalizing Symptoms (Hypothesis 1b) To test the moderating effect of baseline externalizing symptoms, we created interaction terms that crossed the latent externalizing variable with the intervention condition. When comparing the fit of a model in which all paths were freely estimated across the three trials, and one in which the effects of the covariates were constrained equal, we concluded that effects of all the covariates, except for regression of trajectory intercept on age, were not significantly different across trials ( $\chi^2_{(14)}=20.6, p=0.11$ ) and so these were set equal across trials. In individual trial analyses, baseline externalizing symptoms was not a significant moderator of intervention effects in any of the three trials. There was no significant between-trial heterogeneity in this moderation effect (Wald  $\chi^2_{(2)}=5.665, p=0.06$ ). The synthesis analysis also did not find that baseline externalizing symptoms influenced significantly the treatment effect on change in internalizing symptoms ( $b = 0.038, se = 0.031, p = 0.22$  Table 2).

**Baseline Parent–Adolescent Communication (Hypothesis 1c)**—To test the moderating effect of baseline parent–adolescent communication, we created interaction terms that crossed baseline communication with the intervention condition. Again comparing the fit of a model in which all paths were freely estimated across the three trials, and one in which the effects of the covariates were constrained equal, we concluded that the effects of the covariates were not significantly different across trials ( $\chi^2_{(16)}=19.45, p=0.25$ ). The exception was again the regression of intercept on age, which was allowed to differ within trial. In individual trial analyses, baseline parent–adolescent communication was not a significant moderator of intervention effects in any of the three trials. There was no significant between-trial heterogeneity in this moderation effect (Wald  $\chi^2_{(2)}=3.116, p=0.21$ ). The synthesis analysis suggested that the intervention effect on internalizing symptoms was higher at lower levels of baseline parent–adolescent communication ( $b = -0.054, se = 0.025, p = 0.03$ ; Table 3).

**Summary of Moderator Effects**—The left panel of Fig. 2 shows a greater improvement on internalizing symptoms with Familias Unidas compared to control when family communication was below the mean at baseline. The right panel of Fig. 2 shows a greater intervention effect for those with higher internalizing symptoms at baseline. Additional analyses on the intervention effect and its standard error at different levels of the moderator found that the intervention effect was significant if the baseline parent–adolescent communication score was lower than 60 or the internalizing score was higher than 6.76 (i.e., Major Depressive Disorder probability of 18 %). This score on internalizing symptoms lies somewhere between the mean scores for community samples and clinical samples of youth as reported by Quay and Peterson 1993 (i.e., community females' mean: 4.47; community males: 3.85; clinical females: 11.12; clinical males: 9.71), suggesting that this intervention was efficacious for youth with preclinical or higher baseline internalizing symptoms levels. An analysis with both significant moderators in the model was conducted to examine how robust these findings were and found that in the presence of both interaction terms, neither was significant.

## Moderated Mediation Analysis

Mediation analyses were conducted only for models involving parent–adolescent communication, given that communication was our hypothesized mediator. To test the moderated mediation hypothesis, a baseline parent–adolescent communication by intervention interaction term was included as a predictor of both the hypothesized mediator (post-intervention parent–adolescent communication) and the outcome (trajectory of internalizing symptoms; see Fig. 1). Likelihood ratio tests indicated there was no heterogeneity in these interaction effects; thus the paths were constrained equal across the three trials. In the synthesis analysis we found baseline parent–adolescent communication significantly moderated the intervention effect on post-intervention parent–adolescent communication ( $b = 0.252$ ,  $se = 0.065$ ,  $p < 0.001$ ; Table 4), indicating greater improvement from Familias Unidas versus control for those who had poor communication at baseline. We also found post-intervention parent–adolescent communication was significantly related to the slope of internalizing symptom trajectory ( $b = -0.057$ ,  $se = 0.018$ ,  $p = 0.002$ ), indicating greater reduction in symptoms with better communication. The indirect effect at the average level of baseline parent–adolescent communication (72.63) was significant ( $b = 0.126$ ,  $se = 0.057$ ,  $p = 0.021$ ). Using the extended Johnson–Neyman approach presented by Preacher, Rucker, and Hayes (2007), we found the indirect effect was not significant for values of baseline family communication above 75 (see Fig. 3). This effect appears to involve full mediation, as the direct effect of the interaction term on internalizing trajectories is reduced to non-significance when modeled in the presence of the indirect effect.

## Discussion

By utilizing pooled data across several trials of the Familias Unidas preventive intervention and applying integrative data analyses (IDA) to account for different times of outcome and population, this paper extends our understanding of this parent and family-based preventive intervention in terms of its impact on youth internalizing symptoms. Importantly, these synthesis analyses were able to identify findings that were either not evident or were not consistently evident in the individual, trial-level analyses. Specifically, baseline adolescent internalizing symptoms and baseline parent–adolescent communication moderated the effects of the intervention on changes in youth internalizing symptoms. Moreover, the synthesis analyses showed that improvements in youth internalizing symptoms were mediated by improved parent–adolescent communication among those with lower communication levels at baseline. The results clarify questions about for whom this intervention works and through what mechanisms it works, and suggest that Familias Unidas has a broader preventive impact than originally thought. Along with its previously documented impact on substance use, sexual risk and externalizing problems (Pantin et al. 2009; Prado et al., 2007; 2012), the present analyses show that the intervention can also influence internalizing symptoms among high-risk youth. This is noteworthy because the intervention did not originally target internalizing symptoms as an outcome. The methodological and practical implications of these findings, as well as study limitations, are discussed below.

Examining moderators and mediators of intervention effects is important because not all youth benefit similarly from preventive interventions (Horowitz and Garber 2006; Stice et al. 2009); yet individual trials are often underpowered to detect these effects (Brown et al. 2011; O'Rourke and MacKinnon 2013). The synthesis analyses found that initial levels of internalizing symptoms moderated the intervention's effects on changes in youth internalizing symptoms, which is consistent with meta-analytic findings that preventive intervention effects are often stronger for youth with higher symptom levels (Stice et al. 2009). The estimated proportion of youth reaching the Major Depressive Disorder cut-point in this study's combined sample was 13.4 %, with approximately 20 % in the targeted trials at baseline. These clinically-relevant symptom rates are high, exceeding the 2.6 % 30-day prevalence of Major Depressive Disorder or Dysthymic Disorder found in national studies (Kessler et al. 2012). The greater efficacy of the intervention for youth high in internalizing symptoms may be the result of greater motivation to participate in interventions (Stice et al. 2009).

Baseline parent–adolescent communication was another significant moderator of the intervention's effects on internalizing symptoms, with the Familias Unidas intervention being more efficacious in reducing internalizing symptoms in adolescents with poorer parent–adolescent communication than those with better communication. The moderated mediation analyses showed that the effects of the Familias Unidas intervention on internalizing symptoms were mediated by improvements in parent–adolescent communication, specifically for those adolescents with lower initial levels of parent–adolescent communication. This suggests that enhancing the quality of family communication is an “active ingredient” of this intervention for prevention of internalizing symptoms, and that strengthening family communication should continue to be a key intervention target. This is consistent with research on the importance of nurturing environments for promoting youth mental health, especially the value of healthy parent–adolescent relationships (see Restifo and Bogels 2009) and low levels of family conflict (Young et al. 2009). Positive communication is an important component of healthy parent–youth relationships, and an important mediator of intervention effects for both internalizing and externalizing problems (Zhou et al. 2008). While studies have found that positive parenting and family functioning are protective for youth from multi-ethnic samples, interventions that strengthen family and parenting factors are especially consonant with Hispanic values, and may be especially appropriate for these groups (Gonzales et al. 2012; Prado and Pantin 2011). These analyses controlled for baseline internalizing symptoms, indicating that this finding was not driven by initial levels of youth internalizing symptoms.

Along with these significant findings, it should be noted that the synthesis analyses found no overall impact or main effect of the intervention on youth internalizing symptoms, and that baseline levels of youth externalizing problems did not moderate the intervention's effects. Nonetheless, the significant intervention moderator and moderated mediation findings demonstrate that Familias Unidas is an efficacious “selective” intervention to reduce internalizing symptoms among certain high-risk youth: those starting with high internalizing symptoms, and those with poor family communication. It adds to the group of evidence-based prevention interventions for internalizing symptoms among youth at high risk for these problems (e.g., Beardslee et al. 2003; Compas et al. 2010; Gonzales et al. 2012;

Sandler et al. 2003;). Future programs may consider administering this intervention to youth who show high internalizing symptoms or family communication problems.

This study has several limitations. From a substantive perspective, the outcome variable focused on parent reports of youth symptoms, rather than youth reports or a combination of youth and parent reports, which can sometimes differ. Parent reports were selected for these analyses because the Revised Problem Behavior Checklist was the only measure of problem behaviors consistently used across these three trials. Using this common measure facilitated the synthesis analyses and permitted direct comparisons across studies. It should be noted that in previous research, parent reports and youth self-reports about internalizing symptoms using the RBPC have shown significant correlations (McCombs-Thomas et al. 1990). Another limitation is that the synthesis analyses involved only three trials; thus, the potential to examine the extent of heterogeneity across trials was limited. Related to this, the null distribution of the Wald-type tests based on robust standard errors with a small number of trials can sometimes depart from a standard chi-square distribution (Brown 1993). Finally, there are limitations related to the analyses. One limitation is that heterogeneity is inherently difficult to measure with only 3 trials. We note that heterogeneity of moderators, even when non-significant across these 3 studies, can still affect the power of our moderator tests. For numerical comparison we calculated the power for testing an overall effect of baseline internalizing symptoms as a moderator using our empirical estimates (i.e., “observed power”) and found 0.64 power when heterogeneity was included and 0.98 when heterogeneity was not included. Another possible heterogeneity concern may be psychometric differences in the internalizing symptoms measures across these different populations. We found no significant differences, but small undetectable heterogeneity could potentially affect our conclusions.

Taken together, these findings have important implications for preventive interventions. First, by targeting common risk and protective factors for multiple adolescent health outcomes (NRC/IOM 2009; Restifo and Bogels 2009), family-focused preventive intervention like Familias Unidas can produce substantial benefits on internalizing outcomes, specifically in high-risk adolescents. Second, poor parent-child communication can be modified through the Familias Unidas intervention, leading to broad-based outcomes for high-risk youth, including prevention of externalizing and internalizing symptoms. Third, the findings, when combined with findings from other family-based intervention studies (Compas et al. 2010; Gonzales et al. 2012; Tein et al. 2004), suggest a benefit to identifying youth at risk prior to preventive interventions and ensuring that interventions address those modifiable risk and protective factors that youth and families present with.

Conducting *both* moderator and mediator analyses (Kraemer et al. 2008) can improve our understanding of interventions in several ways. When an intervention moderator effect is identified, it can inform intervention dissemination work by specifying for whom interventions are likely to be effective. When the moderator variable is modifiable and also a target of the intervention, examining this variable as a mediator using moderated mediation analyses can help uncover intervention targets related to outcome improvements for specific subgroups of youth, as well as identify effective intervention components (Sandler et al. 2011) to improve our understanding of the intervention's mechanisms.

From a methodological perspective, it is noteworthy that while parent–adolescent communication was not a significant intervention moderator at the individual trial level, it emerged as a significant moderator when the datasets were combined and IDA was used. This suggests that these individual studies may have been underpowered to detect moderation effects, and that synthesis analyses provided the required power to detect them (Brown et al. 2011; O'Rourke and MacKinnon 2013). Synthesizing findings across multiple studies using IDA holds substantial promise to understand for whom interventions work and the pathways by which interventions have their effects, ultimately strengthening the efficacy and reach of preventive interventions.

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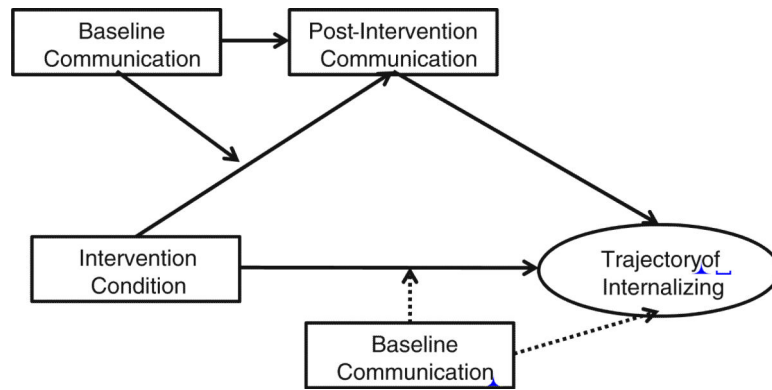
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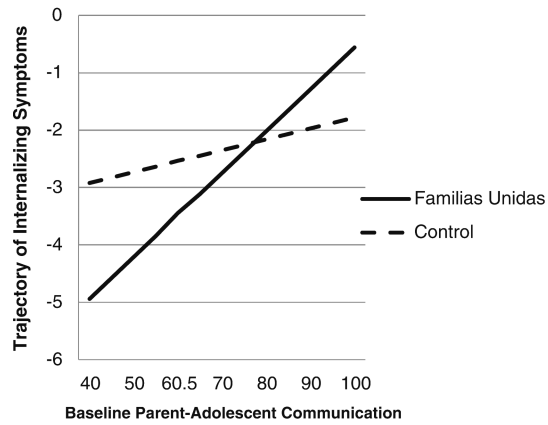


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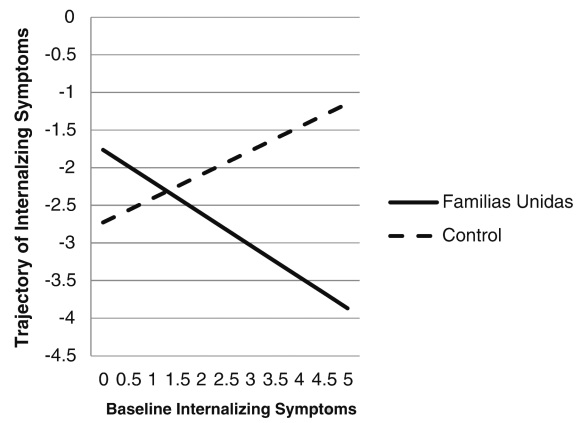


**Fig. 1.** Mediation model with baseline parent–adolescent communication as a moderator of the direct and indirect intervention effect. For simplicity, secondary predictors are not included in the figure. The *solid paths* indicate statistically significant relationships and the *dashed paths* indicate non-significant relationships

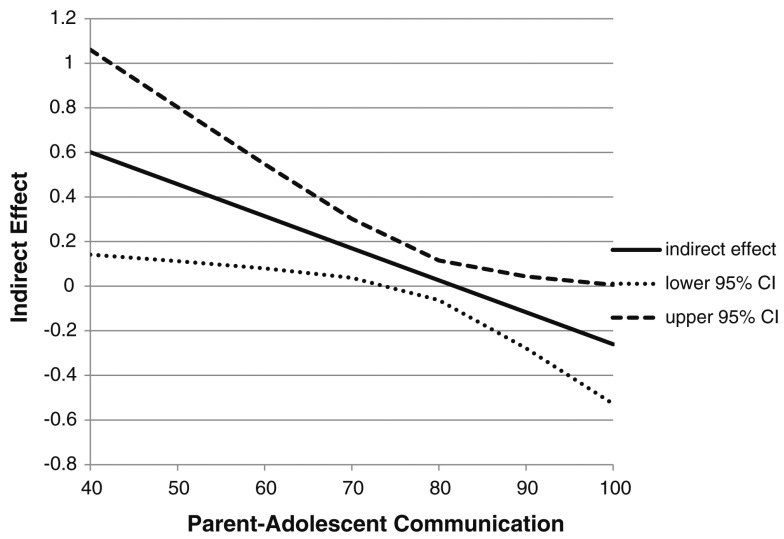
**Moderator Analysis: Baseline Parent-Adolescent Communication**



**Moderator Analysis: Baseline Internalizing Symptoms**



**Fig. 2.** Baseline parent-adolescent communication and baseline youth internalizing symptoms moderating the intervention's effects on youth internalizing symptoms



**Fig. 3.** Estimates of the indirect effect at different levels of baseline parent–adolescent communication

Table 1

## Descriptive data

	Universal	Targeted risk: referred	Targeted risk: adjudicated	Overall
Sample size	266	213	242	721
Percent female	52 % <sup>*</sup>	36 %	36 %	42 %
Mean age (SD)	13.4 (0.68) <sup>*</sup>	13.8 (0.76) <sup>+</sup>	14.7 (1.38) <sup>‡</sup>	14.0 (1.14)
Percent born in the U.S.	40.2 %	56.1 %	65.3 % <sup>‡</sup>	53.4 %
Mean baseline internalizing symptoms (SD)	3.25 (3.63) <sup>*</sup>	6.55 (5.35)	5.68 (5.34)	5.04 (4.98)
% baseline Major Depressive Disorder-MDD <sup>a</sup> (SE)	9.6 (1.6) <sup>*b</sup>	20.6 (2.8)	21.2 (2.6)	13.4 (1.8) <sup>b</sup>
Mean baseline conduct disorder (SD)	5.73 (7.86) <sup>*</sup>	15.36 (10.92)	13.47 (11.28)	11.18 (10.88)
Mean baseline socialized aggression (SD)	1.81 (5.68) <sup>*</sup>	5.27 (5.99)	6.19 (7.32)	4.31 (6.64)
Mean baseline attention problems (SD)	4.70 (6.01) <sup>*</sup>	12.68 (8.41)	10.76 (8.79)	9.10 (8.47)
Mean baseline motor excess (SD)	1.35 (1.90) <sup>*</sup>	3.16 (2.75)	2.75 (2.79)	2.36 (2.61)
Mean baseline parent-adolescent communication (SD)	77.42 (8.89) <sup>*</sup>	69.92 (10.62)	69.78 (11.42)	72.63 (10.93)

\* Pairwise comparison analysis with Tukey's correction indicates this mean is significantly different than means from Referred and Adjudicated samples ( $p < .001$ )

<sup>+</sup> Significantly different from Universal and Adjudicated samples

<sup>‡</sup> Significantly different from Universal and Referred samples<sup>b</sup>

<sup>a</sup> Percentage reaching Major Depressive Disorder (MDD) diagnosis cut-point on DISC Predictive Scale (Lucas et al. 2001). Note that only the Referred and Adjudicated samples were administered the DISC Predictive Scale

<sup>b</sup> Because the DISC Predictive Scale is not available for the Universal sample, this is the estimated probability of reaching MDD diagnosis cut-point at mean level of baseline internalizing symptoms (i.e., 3.25). Logistic regression analysis was conducted with baseline internalizing symptoms as predictor and MDD Diagnosis at the outcome, using data from the combined Referred and Adjudicated samples

**Table 2**

Regression analysis testing whether baseline internalizing symptoms or baseline externalizing symptoms moderate the relationship between intervention and internalizing symptoms trajectory

	<b>Moderator: baseline internalizing symptoms</b>	<b>Moderator: baseline externalizing symptoms</b>
	<b>Final model<sup>+</sup> b (se); p value</b>	<b>Final model<sup>*</sup> b (se); p value</b>
Internalizing trajectory on Intercept	-1.158 (0.632); 0.067	Internalizing trajectory on Intercept 2.364 (0.692); 0.001
Intervention Condition	-0.965 (0.525); 0.066	Intervention Condition 0.012 (0.424); 0.977
Age	-0.280 (0.204); 0.169	Age -0.514 (0.258); 0.046
Gender	0.353 (0.303); 0.245	Gender 0.015 (0.349); 0.965
Intervention * Internalizing	0.737 (0.318); 0.020	Baseline Externalizing -0.397 (0.083); <0.001
Baseline family communication	0.04 (0.02); 0.042	Intervention * Externalizing 0.038 (0.031); 0.220
Baseline Internalizing on Intervention Condition	0.135 (0.069); 0.050	Baseline Internalizing on Intervention Condition 0.162(0.055); 0.003
Age		Age
Universal trial	0.047 (0.064); 0.463	Universal trial 0.071(0.054); 0.188
Referred trial	0.175 (0.083); 0.034	Referred trial 0.146 (0.057); 0.011
Adjudicated trial	-0.109 (0.049); 0.027	Adjudicated trial -0.044 (0.032); 0.161
Gender	-0.219 (0.069); 0.002	Gender -0.018(0.059); 0.763
Baseline family communication	-0.032 (0.003); <0.001	Baseline Externalizing
		Universal trial 0.072(0.007); <0.001
		Referred trial 0.076 (0.005); <0.001
		Adjudicated trial 0.088(0.005); <0.001

<sup>+</sup> All paths were constrained equal across trials with the exception of latent intercept regressed on age

<sup>\*</sup> All paths were constrained equal across trials with the exception of latent intercept regressed on age and baseline internalizing on baseline externalizing

**Table 3**

Results of the regression analysis testing whether baseline family communication moderates the relationship between the intervention and trajectory of internalizing symptoms

<b>Outcome: Internalizing Trajectory<sup>a</sup></b>	<b>Final model<sup>+</sup> b (se); p value</b>
Internalizing Trajectory on Intercept	0.033 (0.404); 0.936
Intervention Condition	4.180 (1.912); 0.029
Age	-0.298 (0.206); 0.149
Gender	0.296 (0.302); 0.327
Baseline Communication	0.127 (0.047); 0.007
Intervention* Communication Baseline Internalizing on	-0.054 (0.025); 0.034
Intervention Condition	0.136 (0.069); 0.050
Age	
Universal trial	0.047 (0.064); 0.460
Targeted Risk: Referred trial	0.177 (0.082); 0.032
Targeted Risk: Adjudicated trial	-0.108 (0.049); 0.028
Gender	-0.216 (0.069); 0.002
Baseline Communication	-0.032 (0.003); < 0.001

<sup>+</sup> All primary and secondary paths were constrained equal across trials with the exception of latent intercept regressed on age

**Table 4**

Mediation model parameter estimates, standard errors, and significance values

	<b>b (se); p value</b>
Mediator: Post-Intervention Communication on Baseline Communication	
Universal	-0.085 (0.119); 0.476
Targeted Risk: Referred	0.073 (0.126); 0.561
Targeted Risk: Adjudicated	0.297 (0.112); 0.008
Intervention Condition	-20.627 (4.863); < 0.001
Baseline Communication x Intervention	0.252 (0.065); < 0.001
Outcome: Internalizing Trajectory Slope on Baseline Internalizing (latent)	
Age	-0.342 (0.205); 0.096
Gender	0.259 (0.287); 0.366
Baseline Communication	0.068 (0.045); 0.132
Intervention Condition	3.805 (1.928); 0.048
Post-Intervention Communication	-0.057 (0.018); 0.002
Baseline Communication x Intervention	-0.046 (0.026); 0.074
Baseline Internalizing on Age	
Universal	0.073 (0.072); 0.309
Targeted Risk: Referred	0.173 (0.092); 0.061
Targeted Risk: Adjudicated	-0.107 (0.053); 0.043
Gender	-0.202 (0.074); 0.006
Average Indirect Effect	0.126 <sup>a</sup> (0.057); 0.021

<sup>a</sup> Average indirect effect:  $a*b = [-20.63 + 0.252 * (\text{mean baseline FC} = 72.63)] * [-0.054] = 0.126$