

# Modeling Ecological Risk, Health Promotion, and Prevention Program Effects for Rural Adolescents

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**ABSTRACT** *Objective:* Universal prevention programs such as Positive Action (PA) mitigate risk factors and enhance promotive factors, often leading to improved adolescent functioning and school climate. The current study used 5 waves of data to assess the impact of PA on adolescent mental health and perceptions of school climate 1 year after completion of the program in a sample of low-income, rural youth. *Method:* Following multiple imputation and propensity score analysis, we ran 4 (2-level) hierarchical linear models to examine program effects. *Results:* PA program participants reported significant increases in self-esteem and significant decreases in school hassles relative to youths who did not participate in PA. Participation in PA did not have a significant impact on internalizing symptoms or aggression. Risk factors across the adolescents' ecology had a strong negative impact on the outcomes, and some promotive factors modestly bolstered adolescent functioning. *Conclusions:* Findings highlight the influence that risk factors—especially negative interpersonal conflicts—have on adolescent outcomes and indicate that, although PA can help improve adolescents' perceptions of themselves and their school climate, the program might need to be tailored for use in low-income, rural areas.

**KEYWORDS:** school-based intervention, positive action, adolescent functioning, rural

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According to the ecological systems theory (Bronfenbrenner, 1979), human development is impacted by multiple environments (see Figure 1 for a conceptual model) organized as microsystems, mesosystems, macrosystems, and chronosystems. Negative and positive interactions in the microsystem, referred

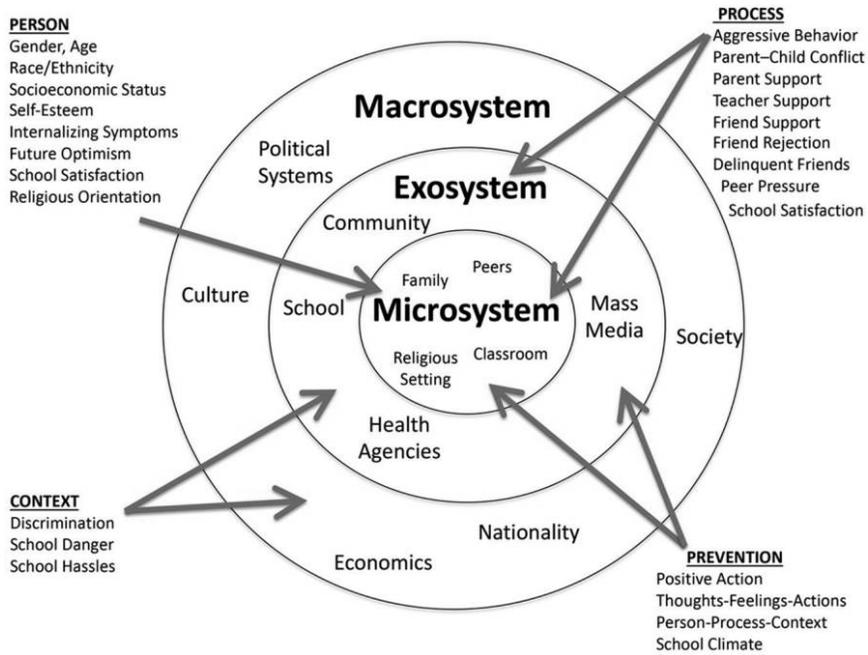


Figure 1. Person-process-context-time ecological model of risk and promotive factors and multilevel prevention.

to as proximal processes (Bronfenbrenner, 1994), are particularly influential in adolescent development. Subsequent revisions of the ecological systems theory have led researchers to focus on the complex interactions between person, process, context, and time (i.e., P-P-C-T model; Rosa & Tudge, 2013). *Person* characteristics include risk and promotive factors that can be individual attributes (e.g., gender, race) or cognitive functioning (e.g., self-esteem, future optimism, religious orientation, internalizing problems such as anxiety and depression). *Process* includes adolescent interpersonal behavior and social relationships in microsystems (e.g., aggressive behavior), family interactions (e.g., parent-child conflict, parent support), peer interactions (e.g., delinquent friends, peer pressure, peer rejection, friend support), and interactions at school (e.g., teacher support, school satisfaction). *Context* includes the surrounding macrosystemic environment (e.g., school climate such as danger, school hassles, discrimination, urban vs. rural settings, programs, and policies). Finally, *time* refers to age, cohort, events, or historical factors, previously called the chronosystem, that impact developmental trajectories (Rosa & Tudge, 2013). The four elements of the P-P-C-T model simultaneously impact developmental outcomes. In the final phase of bioecological model development, Bronfenbrenner asserted that

proximal processes were the most powerful predictor of human development (Bronfenbrenner & Morris, 1998, 2006). The ongoing scientific question underpinning the bioecological model is, “If proximal processes are indeed the ‘engines of development,’ what are the differences between those that produce dysfunction vs. competence?” (Bronfenbrenner & Evans, 2000, p. 118). We take up this question by testing a number of person-process-context risk and promotive factors, including Positive Action program participation, in our analyses.

### Risk and Promotive Factors

Risk, protective, and promotive factors influence adolescent behavior and outcomes. Risk factors increase the likelihood that adolescents engage in negative behavior. Protective factors are positive attributes and protective environmental influences that buffer or minimize the adverse effects of exposure to risk. Promotive factors simply advance positive development for all youth, regardless of the level or presence of risk (Fraser, Kirby, & Smokowski, 2004). Protective and promotive factors are often confused in the research literature. Classic protective effects are interaction terms that include both risk and protective factor terms (Rutter, 1987). Given the difficulty in grounding these interaction terms in theory and replicating them across studies, we focus on promotive factors that are relevant for all children and adolescents with or without the context of risk.

Typical adolescent risk factors span a young person’s entire ecology and include person factors (e.g., poor mental health, such as internalizing symptoms and aggression), process factors (e.g., poor family functioning, such as parent–child conflict, peer rejection, association with delinquent peers, peer pressure), and context factors (e.g., poverty; Centers for Disease Control and Prevention, 2016; Dubow, Huesmann, Boxer, & Smith, 2016; Fraser et al., 2004; Harford, Yi, & Grant, 2014; Lansford, Dodge, Pettit, & Bates, 2016; Shader, 2001; Substance Abuse and Mental Health Services Administration, 2015; see Youth Justice Board, 2005, for a review). Common promotive factors can be unique (e.g., a special talent or skill) but are also common across ecological levels; examples of promotive factors at each ecological level include person attributes (e.g., high future optimism, high self-esteem), process factors (e.g., social support from parents, friends, and neighbors, a positive relationship with school, school satisfaction), and context factors (e.g., religious involvement; Centers for Disease Control and Prevention, 2016; Dubow et al., 2016; Fraser et al., 2004; see Youth Justice Board, 2005, for a review).

The current study examines how ecological person-process-context risk (i.e., parent–child conflict, friend rejection, school danger, delinquent friends, discrimination, peer pressure) and promotive factors (e.g., religious orientation, school satisfaction, future optimism, social support) impact adolescent psychology and behavior (i.e., self-esteem, aggression, internalizing symptoms, school hassles). We

chose the following risk and promotive factors based on past research substantiating their salience and relationships to our outcomes of interest.

#### Person: Risk and Promotive Factors

We included the individual characteristics of gender, race, age, and receipt of free/reduced price lunch (a proxy for socioeconomic status) in our ecological models. These markers or attributes for the most part cannot be changed and ascribe certain social expectations and limitations upon adolescents.

**Internalizing symptoms.** Internalizing symptoms are associated with aggression (Crick, Ostrov, & Werner, 2006; Kofler et al., 2011; Marsee, Weems, & Taylor, 2008; Vitaro, Brendgen, & Tremblay, 2002) and school hassles (Menesini, Modena, & Tani, 2009). In addition, there is a link between internalizing symptoms and self-esteem. Some researchers have found that depression leads to low self-esteem, and others have found that low self-esteem leads to depression (see Sowislo & Orth, 2013, for a review). Few, if any, longitudinal studies of anxiety and self-esteem have been conducted, indicating the need to investigate this relationship (Sowislo & Orth, 2013). A meta-analysis of the relationship between depression, anxiety, and self-esteem found that the impact of self-esteem on depression was significantly stronger than the impact of depression on self-esteem, whereas self-esteem predicted anxiety and vice versa (Sowislo & Orth, 2013).

**Religious orientation.** Religious orientation assessed the degree to which participants valued religion and how much it influenced their decision-making. High religious orientation serves as a promotive factor and is associated with increased self-esteem (Bagley & Mallick, 1997; Le, Tov, & Taylor, 2007), decreased aggression (Leach, Berman, & Eubanks, 2008; Smokowski, Guo, Cotter, Evans, & Rose, 2015), and decreased internalizing symptoms (Le et al., 2007; Rasic, Kisely, & Langille, 2011).

**Future optimism.** Future optimism is related to increased self-esteem and decreased internalizing symptoms over time (Smokowski, Guo, et al., 2014). Further, high future optimism is associated with decreased teacher and self-reports of aggression (Polgar & Auslander, 2009; Smokowski, Evans, Cotter, & Webber, 2014).

#### Process: Risk and Promotive Factors Related to Interpersonal Transactions

**Aggression.** Multiple researchers have found a strong association between aggression and internalizing symptoms (Crick et al., 2006; Kofler et al., 2011; Marsee et al., 2008; Vitaro et al., 2002). Indeed, aggression predicts internalizing symptoms, and one longitudinal study of rural youth found that for every one-unit increase in aggression, internalizing symptoms increased 39.1% (Smokowski et al., 2016). Researchers have found that low self-esteem predicts aggressive behavior (Donnellan, Trzesniewski, Robins, Moffitt, & Caspi, 2005), and other researchers

have found that aggression predicts decreases in self-esteem over time (Smokowski, Guo, et al., 2014).

**Parent-child conflict.** Parent-child conflict is associated with increased aggression and internalizing symptoms over time (Eichelsheim et al., 2010; Marmorstein & Iacono, 2004; Smokowski, Guo, et al., 2014; Smokowski et al., 2016; Suldo, Shaunessy, Thalji, Michalowski, & Shaffer, 2009) and correlates with decreased self-esteem (Shagle & Barber, 1993; Shek, 1997).

**Friend rejection.** Peer rejection results in poor mental and social development (Beeri & Lev-Wiesel, 2012; Kupersmidt & Coie, 1990; Lopez & DuBois, 2005; Parker & Asher, 1987). Specifically, youths who are rejected by their friends and peers are at risk for increased aggression and internalizing symptoms (Smokowski, Guo, et al., 2014).

**Social support.** In the current study, social support refers to support from parents, peers, and teachers; it is an important promotive factor for adolescents. Social support from these sources is associated with decreased internalizing symptoms (Rueger, Malecki, & Demaray, 2010; Stewart & Suldo, 2011; Witherspoon, Schotland, Way, & Hughes, 2009), decreased aggression (Arim, Dahinten, Marshall, & Shapka, 2011; Benhorin & McMahon, 2008; Rueger et al., 2010), and increased self-esteem (Arslan, 2009; Laible, Carlo, & Roesch, 2004; Reddy, Rhodes, & Mulhall, 2003; Rueger et al., 2010). Victimized youths often report low levels of social support (Berkowitz & Benbenishty, 2012; Holt & Espelage, 2007).

#### Context: Risk and Promotive Factors Related to Environmental Characteristics

**School hassles.** School hassles refer to victimization at school, such as being insulted, ignored, treated unfairly, or bullied. Victimized youths often display reactive aggression (Camodeca & Goossens, 2005; Camodeca, Goossens, Terwogt, & Schuengel, 2002; Salmivalli & Nieminen, 2002) and suffer from depression and anxiety (Menesini et al., 2009), highlighting the connection between school hassles and aggression and internalizing symptoms. Indeed, researchers have found that school hassles result in increased aggression and internalizing symptoms over time (Smokowski et al., 2016). Further, victimized youths commonly report low self-esteem (Graham & Juvonen, 1998; Huitsing, Veenstra, Sainio, & Salmivalli, 2012; Pollastri, Cardemil, & O'Donnell, 2009).

**School satisfaction.** School satisfaction is associated with decreased depressive symptoms (Eamon, 2002; Witherspoon et al., 2009) and increased self-esteem (Huebner & Gilman, 2006). A low level of school satisfaction poses a risk to youth and is associated with aggression, such as carrying a weapon and physical fighting (Valois, Paxton, Zullig, & Huebner, 2006). Research also suggests a strong connection between school satisfaction and teacher support (see Klem & Connell, 2004, for a review), indicating a connection between social support and school satisfaction.

**Time.** We used longitudinal data to see if developmental trajectories for adolescent self-esteem, internalizing symptoms, aggression, and school hassles changed over the course of 5 years.

### Prevention Programming Within an Ecology of Risk and Promotive Factors

Prevention programs often function within a child's ecology to promote positive skills and relationships and reduce risk factors (Robertson, David, & Rao, 2003). Many prevention programs focus on adolescent development and aim to stop problem behaviors before they begin, reducing the physical, emotional, and economic toll of negative adolescent behaviors on individuals; families; schools; law enforcement; and the child-welfare, mental health, and juvenile-justice systems (Hawkins et al., 2015).

Positive Action (PA) is a universal prevention program that targets risk and promotive factors across an adolescent's ecology at the individual, school, family, and community levels (Positive Action, n.d.). PA is a school-based program for use with pre-kindergarten (pre-K), elementary, middle, and high school students that aims to decrease risk factors (e.g., substance use, violence, truancy, sexual behaviors, family conflict) and increase promotive factors (e.g., academic achievement, school attendance, parent-child bonding, family cohesion; National Registry of Evidence-Based Programs and Practices, 2014).

We selected PA for the current study because it targets person, process, and context, seeking to both enhance the positive interactions in microsystem relationships with peers, teachers, and parents, and minimize negative risk factors (Positive Action, n.d.). Further, PA aims to change school climate by strengthening positive interactions among students, between students and teachers, and within the general school environment. The theory of change behind the PA program is that engaging in positive actions enhances positive feelings regarding the self (i.e., the person level of the P-P-C-T model; Positive Action, n.d.), ultimately leading to increased positive behaviors and social interactions across ecological microsystems (e.g., the process level of the P-P-C-T model) and resulting in a healthier school climate for everyone (e.g., the context level of the P-P-C-T model). The aim of the PA curricula is to introduce the interrelationships among thoughts, feelings, and actions (e.g., the thoughts-feelings-actions circle), emphasize positive self-appraisal (or self-esteem, feeling good about yourself), and teach skills needed to achieve and maintain positive self-appraisal (Lewis, Schure, et al., 2013). Gaining these skills is hypothesized to enhance adolescent functioning and improve social interactions across an adolescent's ecology (i.e., improved teacher-student relationships, student-student relationships, and student-parent relationships; Flay, Allred, & Ordway, 2001). The current study is the first investigation to examine PA's impact on the aforementioned negative and positive microsystem interactions 1 year following the completion of PA. Following the P-P-C-T model, we chose to

test program effects on person functioning indexed by self-esteem and internalizing symptoms (anxiety, depression), process behaviors (aggression), and context factors (school hassles that mark negative interpersonal interactions and poor school climate).

PA consists of a series of developmentally and age-appropriate kits that contain lesson plans and materials for pre-K through Grade 12. The elementary school PA curriculum consists of seven kits (for pre-K through Grade 5) with 140 lessons in each kit ranging from 10 to 15 minutes in duration. The middle school curriculum consists of three kits for Grades 6–8 that have 70 lessons each ranging from 15 to 20 minutes in length. The high school PA curriculum consists of four kits for Grades 9–12; three kits contain 132 lessons, and the fourth has 42 lessons (15 minutes in length; Positive Action, n.d.). We focused on the middle school PA curriculum because it has prior evidence; the elementary and high school versions have not been extensively researched. The philosophy of the PA program is that you feel good about yourself when engaging in positive actions, and there is a positive way to approach all aspects of life (Positive Action, n.d.). Each kit has age-appropriate lessons and activities that teach skills related to six main themes: (a) Self-Concept lessons enhance students' self-understanding and identity; (b) Positive Actions for Your Body and Mind lessons focus on proper hygiene, exercise, and creative thinking; (c) Managing Yourself Responsibly lessons teach students to effectively manage time and resources; (d) Treating Others the Way You Like to be Treated lessons teach positive social skills; (e) Telling Yourself the Truth lessons focus on teaching self-honesty; and (f) Improving Yourself Continually lessons teach students to use PA skills in every area of life (Positive Action, n.d.). These PA unit themes are closely connected to our dependent measures. Specifically, Unit 1 addresses self-esteem. Unit 2 addresses internalizing problems by going over positive actions for your body and mind. Units 3, 4, and 5 address aggressive behavior by focusing on treating other people in a positive way. Finally, Unit 6 discusses positive actions within context, particularly school, enhancing school climate and decreasing school hassles through prosocial behavior and improved relationships.

PA has been recognized for its effectiveness by the Substance Abuse and Mental Health Services Administration's National Registry of Evidence-Based Programs and Practices (2014), Blueprints for Healthy Youth Development (2012), the U.S. Department of Education (2007, 2009), and the National Institute of Justice (n.d.). PA participation has been associated with decreased risk factors such as violence (Flay et al., 2001; Flay & Allred, 2003; Lewis, Schure, et al., 2013; Li et al., 2011), bullying (Li et al., 2011), substance use (Beets et al., 2009; Li et al., 2011), sexual activity (Beets et al., 2009), and depression and anxiety (mediated by social-emotional and character development; Lewis, DuBois, et al., 2013). In rural areas in particular, PA participation has also been associated with decreased violence (Beets et al., 2009; Snyder et al., 2013), decreased school absenteeism and suspen-

sions (Snyder et al., 2010), substance use (Snyder et al., 2013), and school hassles (Guo et al., 2015). In addition, the PA program has been related to increased protective factors, including academic performance (Bavarian et al., 2013; Flay et al., 2001; Flay & Allred, 2003; Snyder et al., 2010 [rural area]; Snyder et al., 2013), school involvement (Flay & Allred, 2003), health behaviors (e.g., healthy eating, exercise, body mass index; Bavarian, Lewis, Acock, et al., 2016), positive youth development (e.g., self-concept, positive peer affiliation, respect, social skills; Lewis et al., 2015; Schmitt, Flay, & Lewis, 2014), social environments (e.g., school and neighborhood context; Bavarian, Lewis, Silverthorn, et al., 2016), and self-esteem (Silverthorn et al., 2017, Guo et al., 2015 [rural area]). However, despite PA's positive evaluation results, only one study has investigated if the impact of PA endures after the program ends. Further, few studies have been conducted independent of the original evaluator; Brian Flay is a listed author on all major evaluations of PA except for Guo and colleagues (2015). Given that Flay is a close collaborator with the program designer, this is a low level of independent evaluation for a widely disseminated program, warranting more external evaluation. See Table 1 for more information on the past studies of PA.

Although there are several longitudinal studies of PA, the majority of these studies assess the impact of PA during or immediately after its implementation period (e.g., Beets et al., 2009; Flay et al., 2001; Guo et al., 2015; Lewis, DuBois, et al., 2013; Lewis, Schure, et al., 2013; Li et al., 2011). These analyses are helpful in gauging if and how participation in PA was associated with changes in targeted outcomes, but most studies are unable to ascertain how long these effects last. One study did examine how PA participation in elementary school influenced outcomes in middle school and high school (Flay et al., 2003). However, the study did not follow the PA participants over time to assess individual effects and did not consider what these middle and high schools were like before PA students entered. Consequently, there are a number of threats to internal validity that the research design did not rule out.

One study of PA in a rural school district using four waves of data found that PA participants reported significant increases in self-esteem and significant decreases in school hassles relative to a control group (Guo et al., 2015). However, this study examined data collected during implementation and thus did not assess if the impact of the PA program endured after program completion. Aligned with the efforts of the American Academy of Social Work and Social Welfare's (2017) Grand Challenge to Ensure Healthy Development for All Youth, the current study assessed if PA impacted aggression, internalizing symptoms, self-esteem, and school hassles up to 1 year after participation ended. Many evaluations consider prevention programs as isolated effects with few other variables in analytic models. In contrast, we examined PA as one component acting within the adolescent's ecological context that has multiple risk and promotive factors. Prevention programming is not the

**Table 1**  
*Past Studies of Positive Action*

Authors	Grade	Location	Flay Involved in Evaluation	Matched-Pair, Cluster-Randomized Controlled Trial
Beets et al., 2009	1–5	Hawaii	Yes	Yes
Snyder et al., 2010	K–6	Hawaii	Yes	Yes
Snyder, Vuchinich, Acock, Washburn, & Flay, 2012	K–6	Hawaii	Yes	Yes
Snyder et al., 2013	K–6	Hawaii	Yes	Yes
Flay, Allred, & Ordway, 2001	K–6	Hawaii, Nevada	Yes	No (matched-control design)
Bavarian et al., 2013	K–8	Chicago	Yes	Yes
Bavarian, Lewis, Acock, et al., 2016	K–8	Chicago	Yes	Yes
Lewis, Schure, et al., 2013	3–8	Chicago	Yes	Yes
Lewis, DuBois, et al., 2013	3–8	Chicago	Yes	Yes
Li et al., 2011	3–5	Chicago	Yes	Yes
Silverthorn et al., 2017	3–8	Chicago	Yes	Yes
Schmitt, Flay, & Lewis, 2014	Preschool	Virginia	Yes	No (quasi-experimental design)
Flay & Allred, 2003	6–12	Southern U.S. school district	Yes	No (matched-schools design)
Guo et al., 2015	6–8	Rural North Carolina	No	No (quasi-experimental design)

Note. K = kindergarten.

only factor functioning in the adolescents' ecology. Following the P-P-C-T model, we tested a number of risk and promotive factors that influence adolescent functioning.

### Hypotheses for Current Study

First, we hypothesized that each part of the P-P-C-T model would display significant relationships with adolescent outcomes. An adolescent's ecology is complex, with multiple levels and constructs that can be conceptualized as either predictors or outcomes. We tested major variables (e.g., self-esteem, internalizing problems, aggression, school hassles) as both independent and dependent variables.

Second, although both risk and promotive factors impact adolescent outcomes, past research on rural youth (in the same counties as the current study) has found that, in general, risk factors have a stronger effect on adolescent outcomes than promotive factors (e.g., Smokowski, Cotter, Robertson, & Guo, 2013; Smokowski et al., 2015; Smokowski et al., 2016). The high rate of violence and poverty in the current rural counties might exacerbate the impact of risk factors. Thus, for the purposes of the current study, we selected salient risk factors from past studies as time-varying covariates; we expected that these risk factors would negatively impact the outcomes of interest over time.

Third, following Bronfenbrenner's assertion that proximal processes were the most powerful predictor of human development (Bronfenbrenner & Morris, 1998, 2006), we hypothesized that the risk and promotive factors related to interpersonal relationships (i.e., process-level factors) would have the strongest relationships with adolescent outcomes. We explored the differences between those proximal processes that produce dysfunction versus competence (Bronfenbrenner & Evans, 2000).

Finally, we hypothesized that PA participation would significantly impact self-esteem, internalizing symptoms (e.g., person variable), aggression (e.g., process behavior), and school hassles (e.g., context variable assessing school climate). Specifically, we hypothesized that PA participation would be associated with higher self-esteem and that reports of internalizing symptoms, aggression, and school hassles would be lower for PA participants.

## Method

### Current Study

The current study was funded through a collaborative partnership between the Centers for Disease Control and Prevention and the North Carolina Youth Violence Prevention Center. Using five waves of panel data, the current study assessed the extent to which participation in PA was associated with changes in adolescent self-esteem, internalizing symptoms, aggression, and school hassles 1 year after the end of the PA program, compared to a similar rural county that received no intervention. The sample came from the NC-YVPC Rural Adaptation Project (RAP), a 5-year panel study of more than 7,000 adolescents from 27 public middle schools and 11 public high schools in two rural, low-income counties in North Carolina. The overarching goal of the RAP study was to reduce rates of youth violence in one county, which served as the intervention county and received the PA program for all grades in 13 middle schools. The second county served as the no-treatment comparison county. The current study used five waves of RAP panel data collected between 2011 and 2015 to assess how participation in PA impacted rates of self-esteem, internalizing symptoms (person outcomes), aggression (process outcome),

and school hassles (context outcome). In addition, we examined how salient risk and promotive factors impacted these outcomes over time with special attention given to proximal process-level variables such as parent–child conflict, peer rejection, parent support, friend support, teacher support, and delinquent friends.

PA was adopted as a standard part of the treatment school district's middle school curriculum. Consequently, there was no consent or assent for intervention participation. Because we completed a comprehensive program inventory for the comparison county, we were certain that there were no activities or programs similar to PA occurring in control schools. IRB approval was obtained from a major research university, and nearly identical data collection procedures were used in each county. Students took the online assessment in a computer lab closely monitored by NC-YVPC staff. Participants assented to participation by electronically signing an information screen, and unique identification numbers were used to maintain confidentiality.

### Sample

In 2011 (Year 1 of the RAP study), all middle school students (Grades 6–8) in the no-treatment comparison county were included in the RAP sample. Due to the larger geographic size and student population of the intervention county, a random sample of 40% of the middle school students in Grades 6–8 were included in the RAP sample. At the beginning of each school year for the next 4 years, all incoming sixth-grade students from the no-treatment comparison county were added to the sample. Due to the large size of the student population in the intervention county, we were not able to add all incoming sixth-grade students to the sample, so a random sample of 500 sixth-grade students were added to the sample each fall; these students were exposed to the PA program. PA was administered during Years 2, 3, and 4 (2012–2014) of the RAP study to more than 14,000 adolescents (4,700 students per year) in the 13 middle schools in the intervention county. Students participating in PA were followed across the five waves of data collection and were compared to no-treatment students who were also followed over time.

In terms of racial/ethnic diversity, the current sample matched the surrounding community, and 27.3% of students identified as White, 29.2% identified as American Indian, 23.2% identified as African American, 12.1% identified as mixed race/other, and 8.2% identified as Hispanic/Latino (see Table 2 for race/ethnicity of analytic sample, intervention county, and comparison county). About half (52.5%) of the sample was female, 92.6% of participants received free or reduced-price lunch, and the average age at baseline was 12.8 years.

### Implementation, Fidelity, and Data Collection Procedures

NC-YVPC staff provided training, training materials, and supervision for all 55 teachers implementing PA in the 13 middle schools. Each fall, NC-YVPC staff trained

**Table 2***Race/Ethnicity of Analytic Sample, Intervention County, and Comparison County*

Race/Ethnicity	Analytic Sample	Intervention County	Control County
African American	23.2%	24.2%	30.9%
American Indian	29.2%	41.0%	3.5%
Hispanic/Latino	8.2%	8.6%	5.3%
Mixed race/other	12.1%	0.9%	0.9%
White	27.3%	25.5%	60.4%

*Note.* Intervention county rates are from 2016 (U.S. Census Bureau, 2017a); control county rates are from 2016 (U.S. Census Bureau, 2017b).

teachers in the PA schools how to facilitate the program with fidelity. The NC-YVPC staff modeled program implementation by teaching one or more PA lessons and then observed the PA teachers to ensure the program was implemented with fidelity. During observation, the NC-YVPC staff completed rating forms to document that teachers had attained adequate implementation skills and were implementing the PA program with fidelity. The fidelity monitoring plan also included ongoing observations of teachers' lesson delivery using program content checklists to track fidelity to the PA implementation model. NC-YVPC staff observed teachers implementing PA lessons and would assist the teacher if needed. The majority of schools implemented PA during social studies or health classes two or three times per week. Teachers tracked their weekly PA implementation in logs that the NC-YVPC staff collected; the staff then entered these logs into an Excel spreadsheet to monitor implementation across the 13 middle schools. All teachers met and/or exceeded their implementation goals; Grade 6 teachers taught 73 lessons each year, teachers in Grade 7 taught 51 lessons each year, and teachers in Grade 8 taught 45 lessons per year. This level of implementation is much higher than the average number of 26 lessons taught by PA teachers in previous studies (C. Allred, personal communication, 2013). To reinforce the program themes and positive messages, the 13 PA schools were provided with climate and counselor kits to post PA materials around the school. We invested significant time, effort, and resources into achieving high implementation rates. We paid teachers monthly stipends (\$50) if they met implementation goals, and when teachers were sick or fell behind, which was common, trained NC-YVPC program implementation staff would go into the classes to teach the lessons, keeping implementation on track. These are just some examples of the extraordinary attention we paid to implementation.

## Measures

The RAP study used a modified version of the School Success Profile (SSP; Bowen & Richman, 2008) to collect data in both counties. The SSP is a 195-item youth self-report with 22 subscales that assess perceptions about school, friends, family, neighborhood, self, health, and well-being. The SSP has been used with thousands of middle and high school students since its creation in 1993 and has well-established reliability and validity (Bowen, Rose, & Bowen, 2005). The RAP study used the School Success Profile Plus (SSP+), which includes 17 of the original SSP subscales and 12 additional subscales. The current study used 11 subscales from the SSP and five additional subscales. The four dependent variables were internalizing symptoms (youth self-report; Achenbach & Rescorla, 2001), aggression (youth self-report; Achenbach & Rescorla, 2001), school hassles (SSP; Bowen et al., 2005), and self-esteem (Rosenberg, 1965). Internalizing symptoms, aggression, and school hassles served as time-varying covariates when they were not used as dependent variables. Each model included person variables (i.e., gender, race, age, receipt of free/reduced-price lunch, religious orientation, school satisfaction, future optimism), process variables (i.e., parent-child conflict [time varying; Prinz, Foster, Kent, & O'Leary, 1979], friend rejection [time varying], delinquent friends, peer pressure, parent support, teacher support, friend support), and context variables (i.e., perceived discrimination [Gil, Vega, & Dimas, 1994; Gil & Vega, 1996], school danger). See Table S1 (online) for a full description of measures.

## Analytic Plan

The current study aimed to examine P-P-C-T risk and promotive factors, including PA participation, for adolescent mental health, behavior, and school-climate outcomes. Because it was not feasible to randomly assign adolescents into the intervention or comparison counties, the study used a quasi-experimental design comparing schools in two counties. The samples from the two counties had several factors that differed significantly, which could result in selection bias (Guo & Fraser, 2015). In addition to controlling for the selection bias, our data analysis also needed to address the violation of the normality assumption embedded in the linear model and the clustering effects existing in the study of change trajectories. Thus, we conducted propensity score and growth-curve analyses.

**Propensity score analysis.** Participants from the intervention and comparison counties were imbalanced on demographic variables and other covariates. For example, the intervention county had more Native American students than the comparison county, students in the intervention county were younger than those in the comparison county, and more students in the intervention county received free lunch than those in the comparison county. The intervention and comparison counties also had significant differences in terms of the following covariates: reli-

gious orientation, school satisfaction, future optimism, parent support, teacher support, friend support, delinquent friends, peer pressure, perceived discrimination, school danger, friend rejection, and parent–child conflict. We used propensity score analysis to control for selection bias by making students in the intervention county and those in the comparison county statistically indistinguishable across observed covariates. (Results of the imbalance check of the baseline data between the intervention and control counties are available upon request.) A propensity score is a predicted probability of receiving treatment, given observed covariates (Rosenbaum & Rubin, 1983). We used a binary logistic regression to estimate propensity scores when controlling for a set of covariates that potentially affect the selection of participants to the two counties. We then used the estimated propensity scores to conduct the growth-curve analysis in conjunction with two propensity score models: propensity score matching and propensity score weighting.

The purpose of matching was to create a new sample of participants that shared a similar probability of being assigned to the treatment condition to make the two groups comparable (Guo & Fraser, 2015). We used 1-to-1 nearest-neighbor within-caliper matching to generate the new sample. Following convention, a caliper size of a quarter of a standard deviation of the sample estimated propensity scores (i.e., 0.25 standard deviation of the estimated propensity scores of the sample) was used (Rosenbaum & Rubin, 1983). After matching, we conducted a growth-curve analysis based on the matched sample.

One limitation of the 1-to-1 nearest-neighbor within-caliper matching is that cases without matched cases will be dropped from the analysis. To address this limitation, we also conducted propensity score weighting analysis, which balances groups without the loss of sample cases. Because the various propensity score models are based on different assumptions about data (Guo & Fraser, 2015), propensity score weighting served as a sensitivity analysis to ensure robust findings. To estimate the propensity score  $\hat{e}(x_i)$  for the  $i^{\text{th}}$  observation, we first used logistic regression with a set of covariates that potentially affect the selection of participants to groups. Second, we calculated two types of weights:

- average treatment effect, which is  $1/\hat{e}(x_i)$  for a treated participant and  $1/(1 - \hat{e}(x_i))$  for a comparison participant; and
- average treatment effect for the treated, which is 1 for a treated participant and  $\hat{e}(x_i)/(1 - \hat{e}(x_i))$  for a comparison participant.

Third, we used the two weights as sampling weights in the following growth-curve modeling.

Propensity score methods are robust to address overt selection bias, but they still cannot balance unobserved covariates between treatment and comparison groups

(Guo & Fraser, 2015). If students from the two groups are inherently imbalanced on socioeconomic factors that are not available in our data set, such selections remain as threats to the study's internal validity.

**Analytic sample and sample size.** The analytic sample varied by the propensity score method used to account for the number of participants who provided nonmissing data on the outcome variables at a specific wave. In general, the sample size for the analysis using propensity score matching ranged from 2,610–2,818 participants, and the sample size for the analysis using the inverse probability of treatment weighting ranged from 9,728–10,064 participants.

**Growth-curve analysis.** In the current data, study times (i.e., five waves) were nested within students, and students were nested within schools. These clustering effects violated the independent-observation assumption embedded in a linear regression model, so we used hierarchical linear modeling (HLM) to control for the nesting structure of the data. Because of the trivial clustering of students within a school and within classrooms (i.e., the intraclass correlation coefficients were below .03), we did not treat school or classrooms as one study level. Our previous analyses of school and classroom influences showed no reason to model schools or classrooms as a study level (Guo et al., 2015). Instead, we applied a two-level HLM model that treated time as Level 1 and students as Level 2. The combined HLM equation is

$$\ln(Y_{ti}) = \gamma_{00} + \gamma_{10}(Time)_{ti} + \sum_{p=2}^P \gamma_{p0}(TV)_{pti} + \sum_{q=1}^Q \gamma_{0q}(X)_{qi} + r_{0i} + e_{ti},$$

where  $\ln(Y_{ti})$  is the outcome variable of interest,  $(Time)_{ti}$  is the time variable measured in months from baseline or Wave 1,  $(TV)_{pti}$  are  $P-1$  time-varying variables,  $(X)_{qi}$  are  $Q$  student-level variables,  $r_{0i}$  is a random effect for the  $i^{\text{th}}$  student, and  $e_{ti}$  is a residual term incorporating a temporal random effect for the  $i^{\text{th}}$  student at time  $t$ .

Using a quadratic or other type of curvilinear model in the growth-curve analysis using a 4- or 5-point panel adds unnecessary complexity (Raudenbush & Bryk, 2002), so we only used a linear time variable at Level 1. To best capture the relationship between a predictor and the outcome variable from a dynamic point of view, we chose four salient time-varying covariates for the outcomes of aggression, internalizing behavior, and school hassles, and we chose five time-varying covariates for the outcome of self-esteem based on the literature and our past research (Smokowski, Guo, et al., 2014). These time-varying covariates were internalizing behavior (when not the dependent variable; person factor), aggressive behavior (when not the dependent variable), parent-child conflict, friend rejection (process factors), and school hassles (when not the dependent variable; context variable measuring school climate). Variables were modeled as both independent and de-

pendent to allow for the ecological complexity and lack of past research on the direction of the relationship.

In addition to the intervention county variable at Level 2, we used 14 predictor variables (i.e.,  $Q = 14$ ) that were measured at the study entry. These variables can be categorized into the following four types: (a) person variables; (b) process variables; (c) context variables; and (d) time, which was the repeated measure of the dependent variable across the five-wave trajectory. For the intervention county variables, we performed directional hypothesis tests (i.e., one-tailed tests) of treatment effects because the analysis examines whether PA has beneficial impacts for the participants. A one-tailed test under the current context is legitimate because according to the theory of change for the development of the PA program, the intervention's positive impacts are predictable, and efforts have been made to minimize the unintended and undesirable side effects. Specifically, the hypothesized sign for aggression, internalizing, and school hassles was negative ( $-$ ), indicating hypotheses about a negative sign for the coefficient. The hypothesized sign for self-esteem was positive ( $+$ ), indicating hypotheses about a positive sign for the coefficient. We performed nondirectional hypothesis tests for the P-P-C-T covariates.

Because the outcome variables had skewed distributions, which violated the HLM normality assumption, we undertook a natural-logarithm transformation of the outcome variables (Greene, 2003). We used the exponent of estimated coefficient [ $\exp(B)$ ] to ease the burden of interpreting the findings. A value of  $\exp(B)$  that is greater than 1 indicates a positive sign of the coefficient, whereas a value of  $\exp(B)$  that is less than 1 indicates a negative sign of the coefficient.

**Multiple imputation.** The analysis sample has missing values for both the dependent and independent variables. Multiple imputation analysis was conducted before analyzing the data. We generated 15 imputed data sets, and then we estimated the propensity scores for each of the 15 imputed files. For propensity score matching, we created a matched sample for each of the 15 imputed files and then conducted growth-curve analysis for each of the 15 matched samples. For propensity score weighting, we applied weighting-growth-curve analysis using the estimated propensity score for each of the 15 imputed files. Finally, we aggregated the 15 sets of estimated results into a single set of results using Rubin's (1987) rule.

## Results

We report significant results in the following sections. Table 3 shows the baseline sample descriptive statistics for both intervention and nonintervention groups for matched and weighted sample. All the analysis models had excellent fit to the data with Wald chi-square values that were significant at the 0.001 level. All results from propensity score weighting and average treatment effect analysis are shown in Table 4. (Results of other propensity score analysis methods are available upon request.)

**Table 3**  
Baseline Sample Descriptive Statistics

Variables	Matched Sample				Weighted Sample			
	Intervention Group		Comparison Group		Intervention Group		Comparison Group	
	% or M	SE	% or M	SE	% or M	SE	% or M	SE
Aggression (time-varying)	1.32	0.011	1.34	0.013	1.36	0.007	1.30	0.010
Internalizing behavior (time-varying)	1.42	0.016	1.45	0.019	1.47	0.010	1.40	0.014
School hassles (time-varying)	1.46	0.013	1.55	0.017	1.50	0.009	1.48	0.013
Parent-child conflict (time-varying)	1.85	0.078	1.94	0.090	2.22	0.049	1.67	0.063
Friend rejection (time-varying)	1.30	0.015	1.32	0.018	1.30	0.009	1.27	0.012
African American	0.38	0.015	0.35	0.018	0.22	0.008	0.27	0.012
Hispanic	0.09	0.010	0.11	0.011	0.09	0.005	0.07	0.007
Native American	0.06	0.008	0.10	0.010	0.41	0.010	0.07	0.007
Mixed race and other	0.12	0.011	0.13	0.012	0.14	0.007	0.09	0.008
Gender female (reference male)	0.51	0.016	0.53	0.018	0.53	0.010	0.53	0.014
Age at baseline (years)	12.85	0.036	12.81	0.039	12.81	0.021	12.80	0.030
Receipt of free/reduced lunch (reference number)	0.95	0.007	0.95	0.009	0.96	0.004	0.85	0.010
Religious orientation	2.30	0.018	2.32	0.020	2.25	0.011	2.39	0.015
School satisfaction	2.36	0.015	2.35	0.017	2.34	0.010	2.41	0.013
Future optimism	3.46	0.017	3.45	0.019	3.47	0.010	3.44	0.014
Parent support	2.70	0.017	2.68	0.017	2.66	0.010	2.70	0.013
Teacher support	3.19	0.019	3.17	0.020	3.13	0.011	3.21	0.015
Friend support	2.44	0.022	2.45	0.021	2.46	0.011	2.51	0.015
Delinquent friends	1.37	0.015	1.38	0.016	1.43	0.010	1.33	0.011
Peer pressure	1.29	0.012	1.32	0.015	1.32	0.008	1.29	0.010
Perceived discrimination	1.43	0.018	1.46	0.020	1.46	0.011	1.40	0.014
School danger	1.75	0.012	1.77	0.014	1.86	0.008	1.68	0.010

Note. Descriptive statistics are based on 15 imputed files for a matched and weighted sample. Standard error (SE) was estimated by aggregating 15 imputed files using Rubin's rule.

### P-P-C-T Model for Self-Esteem

**Person variables.** Females reported significantly lower self-esteem than males. Students from all minority groups reported higher self-esteem compared to their Caucasian classmates. Self-esteem scores did not significantly vary by age or poverty (i.e., free/reduced lunch status). For every one-unit increase in internalizing symptoms, self-esteem decreased 7.3% ( $p < .001$ ). For every one-unit increase in

**Table 4**  
*Differences in Self-Esteem, Internalizing, Aggression, and School Hassles Scores for Intervention and Comparison Counties*

	Adolescent Outcomes Estimation Based on 15 Imputed Files [exp(B)]				
	Fixed and Random Effects	Self-Esteem	Internalizing Symptoms	Aggression	School Hassles
Fixed effects: Level 1 (time)					
Time (months since baseline) [T]		0.998 (0.000)***	1.000 (0.000)	1.000 (0.000)	0.997 (0.000)***
Aggression (time-varying) [PR]		1.012 (0.022)	1.404 (0.017)***	–	1.079 (0.010)***
Internalizing symptoms (time-varying) [P]		0.927 (0.010)***	–	1.264 (0.007)***	1.112 (0.008)***
School hassles (time-varying) [C]		0.962 (0.014)**	1.116 (0.009)***	1.055 (0.007)***	–
Parent-child conflict (time-varying) [PR]		0.987 (0.002)***	1.026 (0.002)***	1.009 (0.002)***	1.005 (0.001)***
Friend rejection (time-varying) [PR]		0.962 (0.015)**	1.062 (0.009)***	1.016 (0.010)	1.140 (0.009)***
Fixed effects: Level 2 (individual)					
Intervention county (comparison)					
Treatment effect: Exponent of coefficient		1.015 (0.007)*	1.021 (0.007)	0.992 (0.006)	0.969 (0.008)***
Gender (male) [P]					
Female		0.981 (0.008)*	1.089 (0.007)***	1.011 (0.007)	0.984 (0.010)
Race (White) [P]					
African American		1.074 (0.007)***	0.995 (0.007)	1.017 (0.006)**	0.968 (0.008)***
Hispanic		1.058 (0.011)***	1.021 (0.012)	0.968 (0.009)***	0.946 (0.013)***
American Indian		1.029 (0.010)**	0.987 (0.010)	1.007 (0.010)	0.974 (0.012)**
Mixed race/other		1.062 (0.010)***	1.009 (0.010)	1.013 (0.008)	0.983 (0.011)
Age at baseline [P]					
Free/reduced lunch at baseline (No) [P]		0.996 (0.003)	1.004 (0.003)	1.002 (0.003)	0.982 (0.004)***
Yes		1.012 (0.011)	1.029 (0.011)**	1.011 (0.011)	1.024 (0.014)

Promotive factors					
Religious orientation at baseline [P]	1.073 (0.007)***	0.999 (0.006)	0.972 (0.005)***	1.008 (0.008)	
School satisfaction at baseline [C]	1.021 (0.010)*	1.003 (0.009)	0.956 (0.009)***	0.973 (0.011)*	
Future optimism at baseline [P]	1.035 (0.010)***	1.000 (0.012)	0.991 (0.007)	1.026 (0.014)	
Parent support at baseline [PR]	1.030 (0.010)***	0.969 (0.010)**	1.014 (0.007)	0.999 (0.014)	
Teacher support at baseline [PR]	1.002 (0.012)	1.024 (0.010)*	1.003 (0.006)	1.005 (0.013)	
Friend support at baseline [PR]	1.019 (0.010)	0.990 (0.009)	1.017 (0.007)*	0.976 (0.009)*	
Risk factors					
Delinquent friends at baseline [PR]	1.009 (0.013)	1.008 (0.014)	1.081 (0.014)***	1.007 (0.016)	
Peer pressure at baseline [PR]	0.988 (0.010)	1.020 (0.010)*	1.013 (0.009)	1.007 (0.014)	
Discrimination at baseline [C]	1.005 (0.010)	1.021 (0.008)**	0.988 (0.008)	1.069 (0.010)***	
School danger at baseline [C]	1.016 (0.011)	0.964 (0.014)**	1.002 (0.010)	1.103 (0.018)***	
Intercept	2.044 (0.059)***	0.583 (0.067)***	0.785 (0.064)***	0.906 (0.075)	
Random effect (variance component)					
Level 2 intercept	0.011 (0.001)***	0.014 (0.001)***	0.010 (0.001)***	0.017 (0.001)***	
Level 2 intercept residual	0.035 (0.001)***	0.038 (0.001)***	0.027 (0.002)***	0.036 (0.001)***	
Model Wald chi-square ( <i>df</i> ) shown by one imputed file	1,735.37 (24)	8,185.17 (23)	3,911.77 (23)	2,878.34 (23)	

Note: Differences determined using propensity score weighting and average treatment effect analysis. P = person, PR = process, C = context, and T = time models predicting adolescent outcomes. Reference group and standard error (*SE*) are in parentheses; one-tailed tests for intervention county and two-tailed tests for all others; *df* = degrees of freedom.

\*  $p < .05$ .

\*\*  $p < .01$ .

\*\*\*  $p < .001$ .

religious orientation, self-esteem increased 7.3% ( $p < .001$ ). For every one-unit increase in future optimism, self-esteem increased 3.5% ( $p < .01$ ).

**Process factors.** For every one-unit increase in friend rejection, self-esteem decreased 3.8% ( $p < .01$ ). For every one-unit increase in parent–child conflict, self-esteem decreased 1.3% ( $p < .001$ ). For every one-unit increase in parent support, self-esteem increased 3.0% ( $p < .01$ ).

**Context factors.** For every one-unit increase in school hassles, self-esteem decreased 3.8% ( $p < .01$ ). For every one-unit increase of school satisfaction, self-esteem increased 2.1% ( $p < .05$ ).

**Time factors.** Self-esteem decreased over time at a statistically significant average rate of .002 units per month.

#### P-P-C-T Model for Internalizing Symptoms

**Person factors.** Females reported significantly higher internalizing symptoms relative to males. Internalizing symptoms did not significantly vary by race or age, but students who received free/reduced lunch had significantly more internalizing symptoms.

**Process factors.** For every one-unit increase in aggression, internalizing symptoms increased 40.4% ( $p < .001$ ). For every one-unit increase in friend rejection, internalizing symptoms increased 6.2% ( $p < .001$ ). For every one-unit increase in parent–child conflict, internalizing symptoms increased 2.6% ( $p < .001$ ). For every one-unit increase in parent support, internalizing symptoms decreased 3.1% ( $p < .01$ ). For every one-unit increase in teacher support, internalizing symptoms increased 2.4% ( $p < .05$ ). For every one-unit increase in peer pressure, internalizing symptoms increased 2.0% ( $p < .05$ ).

**Context factors.** For every one-unit increase in school hassles, internalizing symptoms increased 11.6% ( $p < .001$ ). For every one-unit increase in discrimination, internalizing symptoms increased 2.1% ( $p < .01$ ). For every one-unit increase in school danger, internalizing symptoms decreased 3.6% ( $p < .01$ ).

**Time factors.** Internalizing scores remained stable over time without significant fluctuations.

#### P-P-C-T Model for Aggression

**Person factors.** Aggression scores for females and males did not significantly differ. African American students reported significantly higher aggression scores than Caucasian students, whereas Hispanic students reported significantly lower aggression. Aggression scores did not vary by age or poverty. For every one-unit increase in internalizing symptoms, aggression increased 26.4% ( $p < .001$ ). For every one-unit increase in religious orientation, aggression decreased 2.8% ( $p < .001$ ).

**Process factors.** For every one-unit increase in parent–child conflict, aggression increased 1.9% ( $p < .001$ ). For every one-unit increase of friend support, aggression

increased 1.7% ( $p < .05$ ). For every one-unit increase in delinquent friends, aggression increased 8.1% ( $p < .001$ ).

**Context factors.** For every one-unit increase in school hassles, aggression increased 5.5% ( $p < .001$ ). For every one-unit increase of school satisfaction, aggression decreased 4.4% ( $p < .001$ ).

**Time factors.** Aggression scores remained stable over time without significant fluctuations.

#### P-P-C-T Model for School Hassles

**Person factors.** Scores for school hassles did not differ between females and males. Older students reported significantly fewer school hassles compared to younger students. African American, Hispanic, and American Indian students reported significantly more school hassles than Caucasian students. For every one-unit increase in internalizing symptoms school hassles increased 11.2% ( $p < .001$ ). For every one-unit increase in school satisfaction, school hassles decreased 2.7% ( $p < .05$ ).

**Process factors.** For every one-unit increase in aggression, school hassles increased 7.9% ( $p < .001$ ). For every one-unit increase in friend rejection, school hassles increased 14.0% ( $p < .001$ ). For every one-unit increase in parent–child conflict, school hassles increased 0.50% ( $p < .001$ ). For every one-unit increase in friend support, school hassles decreased 2.4% ( $p < .05$ ).

**Context factors.** For every one-unit increase in discrimination, school hassles increased 6.9% ( $p < .001$ ). For every one-unit increase in school danger, school hassles increased 10.3% ( $p < .001$ ).

**Time factors.** School hassles decreased over time at a statistically significant average rate of .003 units per month.

#### Impact of the Positive Action Program

After controlling for selection biases at any point in time during the study period and other things being equal, participation in the PA program was associated with statistically significant improvements in self-esteem and school hassles. Students in the intervention group had a self-esteem score that was 1.5% higher ( $p < .05$ ; see Table 4) and a school hassles score that was 3.1% ( $p < .001$ ) lower compared to students the control group. The results for aggression and internalizing symptoms did not reach statistical significance.

## Discussion

### Exploring the Person-Process-Context-Time Model of Bioecological Systems

We tested multiple factors within the P-P-C-T model of adolescent bioecological systems to evaluate their value in predicting developmental outcomes and their rela-

tive weight across levels of influence. Results confirm that each part of the P-P-C-T model displayed significant relationships with adolescent outcomes; however, the effects of factors within the model varied by outcome. It is interesting to note that a higher number of risk factors impacted outcomes compared to promotive factors. In general, the risk factors caused a larger percentage change in the outcomes than did promotive factors. Our findings reinforce the detrimental impact of ecological risk factors on adolescent outcomes and suggest that the negative impact of risk factors might overpower the positive impact of promotive factors.

Person factors played a limited role, especially in predicting person-level outcomes. For example, females reported lower self-esteem and higher internalizing symptoms, older students reported fewer school hassles, and disadvantaged students had more internalizing symptoms. The most profound person factor was internalizing symptoms, which had a highly significant impact as a time-varying covariate on self-esteem, aggression, and school hassles. This finding provides evidence for the foundational importance of adolescent mental health, particularly feelings of anxiety and depression, in setting the stage for all of the other multilevel transactions that occur in an adolescent's ecology.

As a person-level outcome, self-esteem appears to be particularly malleable and was impacted by all six time-varying risk factors and four promotive factors. In line with our hypotheses, a one-unit increase in internalizing symptoms, school hassles, friend rejection, and parent-child conflict resulted (depending on the propensity score analysis method used) in decreases in self-esteem ranging from 1.1%–7.7%; a one-unit increase in religious orientation, school satisfaction, future orientation, and parent support resulted in increases in self-esteem ranging from 2.1%–7.3%. The malleability of adolescent self-esteem suggests that this construct is quite sensitive to relatively small changes in an adolescent's milieu and is impacted by both risk and promotive factors. Self-esteem was the only outcome influenced by promotive factors (i.e., religious orientation, school satisfaction, future optimism, parent support) as much as by risk factors. This is encouraging for prevention scientists because these promotive factors are malleable targets for program content. The fact that PA increased self-esteem indicates that schools should consider implementing PA or another universal prevention program that could bolster self-esteem above and beyond the impact of risk factors.

Process factors—especially risk factors that assessed negative interpersonal transactions—had a significant, wide-ranging impact across developmental outcomes. Parent-child conflict and friend rejection, for example, were particularly strong risk factors associated with all of the adolescent outcomes. Following Bronfenbrenner's assertion that proximal processes are the most powerful predictor of human development (Bronfenbrenner & Morris, 1998, 2006), we hypothesized that the risk and promotive factors related to interpersonal relationships (i.e., process-level factors) would have the strongest relationships with adolescent

outcomes. Our results provide evidence for the veracity of this assertion and the primary importance of relationship processes. Further, in examining the differences between those proximal processes that produce dysfunction versus competence (Bronfenbrenner & Evans, 2000), our results indicate that conflict and negativity in relationships is a key ingredient in fostering dysfunction. The role of proximal processes in fostering competence is less clear. Parent support was associated with increased self-esteem and fewer internalizing problems but did not protect against aggression or school hassles. Teacher support was related to higher internalizing symptoms, which appears enigmatic on the surface but could simply indicate that students with higher levels of depression and anxiety are on the teacher's radar as needing support. Friend support appeared to lower school hassles but was associated with higher aggressive behavior. Based on this array of effects, we conclude that adolescent competence is derailed and dysfunction is fostered in the presence of negativity, conflict, and rejection in proximal processes. The development of competence is harder to discern and warrants further detailed research with nuanced measures.

Aggression, our process-level outcome, was positively associated with internalizing symptoms, parent-child conflict, friend support, delinquent friends, and school hassles. Religious orientation and school satisfaction served as promotive factors associated with decreased aggressive behavior. Negative proximal processes, especially conflict-ridden relationship transactions, seem to be particularly salient in the development of aggression. Also notable is the strong relationship between internalizing symptoms and aggression. On the surface, depression and anxiety seem to be quite distinct from aggression; however, current findings indicate that these behaviors might fuel each other. For every one-unit increase in aggression, internalizing symptoms increased 38.7%–43.2%, and for every one-unit increase in internalizing symptoms, aggression increased 26%. It is possible that youths who are aggressive become alienated from their peers over time, which increases internalizing symptoms. Depressed and anxious youths are likely quiet and withdrawn and might begin to act aggressively to get attention or as a cry for help. Acting out aggressively could be used as a mechanism to express anguish and a desire for support.

Context factors typically have modest predictive utility, as reflected in the literature on neighborhood influences on child development (Brooks-Gunn, Duncan, Klebanov, & Sealand, 1993). Because intraclass correlation coefficients were so low, we chose not to consider school-level effects as a separate level in our HLM models. However, we assessed adolescent reports of context factors—notably school hassles, school danger, school satisfaction, and discrimination—to index attitudes concerning school climate and the larger environment. Higher levels of school hassles were reported by females, younger adolescents, and aggressive students with less friend support, higher internalizing symptoms, parent-child conflict, and friend rejection. Importantly, toxic context factors tended to be interrelated, as evidenced

by positive relationships between school hassles, school danger, and discrimination along with low levels of school satisfaction.

### Positive Action Program Effects

The current study extended a pretest–posttest study on the effects of PA in a rural school district (Guo et al., 2015) by adding one wave of data and examining the impact of risk and promotive factors on outcomes. The additional wave of data allowed for an examination of program effects 1 year after the end of the PA program to ascertain if program effects endured even when youths were not participating in multiple PA lessons per week. In line with previous research (Guo et al., 2015), we found that PA participants reported significant increases in self-esteem and significant decreases in school hassles compared to youths in the control county. Previous findings indicated that the scores in self-esteem for PA participants ranged from 1.6%–2.1% higher than the control group, and current increases in self-esteem ranged from 1.5%–2.3% higher than the control group (depending on the propensity score analysis method). For school hassles, previous findings indicated that PA participants had a school hassles score that was 2.2% to 4.6% lower than non-PA youth. Our findings mirror these results: PA participants had a school hassles score that was 2.2%–3.6% lower than the control group. Both studies have similar findings, indicating that the impact of PA on self-esteem and school hassles endures up to 1 year after program completion.

These findings suggest that the PA lesson content effectively bolsters adolescent self-esteem and positively impacts perceptions of the school climate, improving social interactions and decreasing school hassles. These findings appear to endure over time, indicating that PA results in sustained, positive changes.

One other study assessed how PA impacts self-esteem, finding that PA slowed the decline of peer and school self-esteem (Silverthorn et al., 2017). However, in that study, there were no statistically significant findings for global self-esteem, the construct we assessed. Silverthorn and colleagues (2017) found that participation in PA was related to a slower decline in peer self-esteem (e.g., I am as well liked by other kids as I want to be) and school self-esteem (e.g., I feel OK about how good of a student I am) compared to the control condition. In contrast, we found that participation in PA was associated with increased self-esteem over time, not simply a slower decline in self-esteem. Although it is helpful to slow the rate at which self-esteem declines, current findings are quite optimistic and indicate that PA might have the power to actually increase self-esteem.

Self-esteem is a crucial promotive factor to foster in adolescents. For example, youths who smoke cigarettes and use heroin, alcohol, and ecstasy reported significantly lower self-esteem compared to their nonusing counterparts, suggesting that self-esteem protects youth from substance use (Khajehdaluae, Zavar, Alidoust, & Pourandi, 2013). Further, low self-esteem was associated with problem eating, early

sexual activity, and suicidal ideation (McGee & Williams, 2000). Bolstering adolescent self-esteem is vital to help prevent youth from engaging in the risky behaviors associated with low self-esteem. PA lessons focus on enhancing students' self-understanding, encouraging positive actions for the mind and body, and self-improvement (Positive Action, n.d.), which seems to translate into increased self-esteem. Youths who feel positively about themselves are likely to engage in prosocial and positive behaviors. It is possible that many of the positive effects that result from PA are due in part to increased self-esteem. Future research on PA could examine self-esteem as a mediator that leads to other improvements (e.g., academic success, decreased violence, decreased substance use).

Also aligned with past research (Guo et al., 2015), we found that PA participation was associated with a significant decrease in school hassles. Other studies of PA examined constructs related to school hassles such as violence, bullying, and school suspension and found that PA successfully decreased these problem behaviors (e.g., Beets et al., 2009; Li et al., 2011; Snyder et al., 2010). For example, one study in urban Chicago found that PA participation resulted in 37% fewer violence-related behaviors and 41% fewer bullying behaviors compared to control schools (Li et al., 2011). Further, in a study of PA in rural Hawaii, PA participation was associated with about a 58% reduction in the odds of engaging in violence (Beets et al., 2009). The same study in Hawaii found that PA intervention schools reported 72.6% fewer suspensions compared to control schools (Snyder et al., 2010). Although our findings did not mirror this past research on aggression reduction, they do reinforce the notion that PA functions to improve the overall school climate by decreasing school hassles. PA encourages positive social interactions and discourages bullying, exclusion, and intimidation, which could translate into decreased school hassles. The fact that school hassles decreased suggests that youths in the PA schools behaved more positively and that this change in behavior was maintained after the completion of the program. Climate kits were used to display PA curricula around the school so that all students were exposed to the positive messages. In this regard, PA may have positively affected the entire school climate. It is important to note that middle school students received PA twice a week during 6th, 7th, and 8th grades. Thus, a high program dosage is necessary to achieve these positive effects. Nevertheless, current findings support the notion that PA is a promotive factor that functions to increase other promotive factors (e.g., self-esteem) and decrease risk factors (e.g., school hassles).

Counter to our hypothesis, PA did not result in significant changes in internalizing symptoms or aggression. This finding is in contrast to other research on PA in an urban school setting showing that PA was associated with significant decreases in depression (effect size =  $-0.14$ ) and anxiety (effect size =  $-0.26$ ; Lewis, DuBois, et al., 2013). It is possible that the PA curriculum was not able to counteract some of the risk factors in the current study's rural environment. The PA program does

not have lesson content that specifically targets internalizing symptoms. Given that internalizing symptoms have been associated with a host of negative outcomes (e.g., aggression, bullying victimization, parent–child conflict, friend rejection; Crick et al., 2006; Menesini et al., 2009; Smokowski, Guo, et al., 2014), universal prevention programs such as PA might benefit from specific programming targeting depression and anxiety.

In terms of aggression, PA might have been unable to impact aggression due to pervasive violence in the surrounding community. The rural school district where the current study took place has high rates of violence, exposing youth to aggression and violence on a routine basis. In 2014, for example, this community had a crime rate of 6,844 per 100,000—the highest in the state (North Carolina Department of Justice, 2015). Although the PA curriculum focuses on bullying, exclusion, and intimidation, PA does not specifically address coping with exposure to community violence. Communities affected by violence may benefit from supplemental programming that specifically addresses exposure to community violence. Indeed, many youths who are exposed to community violence do not receive appropriate treatment (Aisenberg & Mennen, 2000), thus supplemental programming could address this gap in services. Past research has established that PA reduces violence (e.g., Beets et al., 2009; Flay & Allred, 2003; Lewis, Schure, et al., 2013), but the current study's null effects for aggression suggest that more research is needed in this area.

### Limitations

It is important to consider certain limitations when evaluating the findings of the current study. First, randomly assigning schools to participate in PA would have been ideal. Because randomization was not feasible, we used propensity score analysis to resolve this shortcoming. Second, the propensity score analysis weighting and matching methods did not always provide the same coefficients, resulting in uncertainty about the true treatment effects. However, for each outcome, the propensity score models show treatment effects in the same direction. We assumed that data are missing at random, although alternative explanations for missingness (5%–15% of variables per case) are tenable. Second, the P-P-C-T model provides ample possibilities for exploring interaction effects among risk and promotion factors at different ecological levels. Although fascinating, this was beyond the scope of this paper. Interaction terms are difficult to ground in past theoretical research, difficult to interpret, and hard to replicate. Consequently, we decided our ecological models were complex enough without interactions, leaving this exploration for future research. Third, participants filled out online assessments in computer labs, and their responses might have been impacted by the presence of their peers. Given limitations of time and space, it was not possible for participants to take the assessment in private rooms. This is a common limitation with large-scale data collection.

To remedy this issue, trained research staff monitored participants to ensure confidentially. Fourth, it would have been ideal to collect other forms of data, such as teacher reports of behavior or academic performance; however, due to limited time and resources, this was not feasible. Finally, participants in the PA group were taught PA from different teachers; it is possible that teaching style could have affected program impact.

### Conclusion

A number of P-P-C-T risk factors impacted the four outcome measures over time and seemed to have stronger effects as compared to promotive factors. These findings provide ecological risk and promotion profiles for major developmental outcomes and provide additional evidence for the importance of proximal processes in Bronfenbrenner's bioecological systems theory. The current study extended preliminary research on the effectiveness of the PA program for aggression, internalizing symptoms, school hassles, and self-esteem in a sample of rural youth. Specifically, this study used five waves of data to assess whether the impact of the PA program endured after program participation ended. In line with past findings, we found that participation in PA was associated with a statistically significant reduction in school hassles and a statistically significant increase in self-esteem 1 year after the program ended. These findings suggest that the effects of PA led to lasting change. However, changes to PA lesson content might be necessary to impact internalizing symptoms and aggression, especially in a violent context like that of the current study.

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