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The Role of Emotional Reactivity, Self-regulation, and Puberty in Adolescents' Prosocial Behaviors

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Abstract

This study was designed to examine the roles of emotional reactivity, self-regulation, and pubertal timing in prosocial behaviors during adolescence. Participants were 850 sixth graders (50% female, Mean age = 11.03, *SD* = .17) who were followed up at age 15. In hierarchical regression models, measures of emotional reactivity, self-regulation, pubertal timing and their interactions were used to predict (concurrently and over time) adolescents' prosocial behaviors in the home and with peers. Overall, the findings provide evidence for pubertal and temperament based predictors of prosocial behaviors expressed in different contexts. Self-regulation was positively related to both forms of prosocial behavior, concurrently and longitudinally. Emotional reactivity showed moderately consistent effects, showing negative concurrent relations to prosocial behavior with peers and negative longitudinal relations (four years later) to prosocial behavior at home. Some curvilinear effects of temperament on prosocial behaviors were also found. Effects of pubertal timing were found to interact with gender, such that boys who were early maturers showed the highest levels of prosocial behavior at home concurrently. Discussion focuses on the role of temperament-based mechanisms in the expression of prosocial behaviors in different contexts in adolescence.

Keywords

puberty; emotionality; self regulation; prosocial behaviors; adolescence

There is growing interest in the biological and emotion-related bases of adolescent functioning (Dahl & Gunner, 2009). Emotionality, self-regulation, and puberty in particular, have been of interest to developmental scholars because of their links to adjustment (Calkins & Marcovitch, 2010; Kagan & Fox, 2006; Susman & Dorn, 2009; Thompson, Meyer, &

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McGinley, 2006). Indeed, an increasing number of findings suggest that high levels of emotional reactivity, low levels of self-regulation, and early and late pubertal maturation place children and adolescents at risk for negative behavioral outcomes (Baumeister, Leith, Muraven, & Bratslavsky, 1998; Brody & Ge, 2001; Eisenberg, Fabes, Guthrie, & Reiser, 2000; Graber, Lewisohn, & Seely, 1997; Raffaelli & Crockett, 2003). However, the associations between these predictors and positive social adjustment are less well studied, especially in adolescence. Furthermore, theorists posit that the relations between these biologically based processes and social functioning are complex (Eisenberg et al., 2000; Rothbart & Bates, 1998). Yet, research that examines the multiplicative, rather than additive, effects of biological and emotion-related processes on positive adjustment is especially scarce. One positive indicator of adolescent social functioning is prosocial behaviors (i.e., actions intended to benefit others), which are associated with indicators of health, psychological well being, and social competence (Carlo, 2006; Eisenberg, Fabes, & Spinrad, 2006). The present study was designed to investigate the additive and multiplicative links between emotional reactivity, self-regulation, and puberty and adolescents' prosocial behaviors.

Although several theories emphasize the role of biological and emotion-related processes in youth development, Rothbart's theory (Rothbart, 2007; Rothbart, Ahadi, & Evans, 2000; Derryberry & Rothbart, 1988) integrates two primary mechanisms, physiological reactivity and self-regulation. Physiological reactivity (or arousal) is assumed to reflect peripheral and central nervous systems and includes cognitive, perceptual, and motor processes. Rothbart asserts that these reactivity processes are linked to both positive-valenced emotions (e.g., pleasure) and negative-valenced emotions (e.g., sadness, frustration). Individuals who are more reactive would be more prone to experience emotions than less reactive individuals. In contrast, self-regulation includes cognitive (e.g., attention shifting and focusing) and behavioral (e.g., inhibitory control, activation) regulatory processes, which are postulated to moderate the links between arousal and emotional responding and behavioral outcomes. Evidence to support the distinction between emotional reactivity and self-regulation is substantial (Putnam & Rothbart, 2006; Derryberry & Rothbart, 1988). In recent years, considerable attention has focused on emotional reactivity and self-regulation, and their links to behavioral adjustment.

Emotional reactivity has been linked to prosocial competencies and social competence in a number of studies. Most of the existing research on emotional reactivity has been conducted with young children, and these studies suggest an inverse association between negative emotional reactivity and prosocial and social competencies (Eisenberg, Fabes, & Murphy, 1994, Eisenberg, Fabes, Murphy, Karbon, Smith, Mazsk, 1996; Fabes, Eisenberg, Karbon, Bernzweig, Speer, & Carlo, 1994; Miller & Jansen op de Haar, 1997; Rothbart, Ahadi, & Hershey, 1994). Similarly, in the sparse research on adolescents, strong negative emotional reactivity was inversely associated with prosocial competence and better social functioning (Eisenberg, Cumberland, Guthrie, Murphy, & Shepard, 2005; Murphy, Shepard, Eisenberg, & Fabes, 2004; Murphy, Shepard, Eisenberg, Fabes, & Guthrie, 1999). Furthermore, there is also evidence that negatively-valenced emotions (which presumably reflect negative-valenced emotional reactivity) are associated with prosocial behaviors. For example, anger is inversely related to prosocial behaviors (Carlo, Roesch, & Melby, 1998; Eisenberg et al.,

1999). However, other negative-valenced emotions (such as empathy, guilt, and shame) are positively related to prosocial behaviors (Estrada, 1995; Laible, Eye, & Carlo, 2008; see Eisenberg & Miller, 1987). These findings suggest that the relations between emotional reactivity and prosocial outcomes are complex.

Self-regulation, on the other hand, is consistently positively associated with prosocial and socially competent behaviors (Eisenberg, Hofer, & Vaughn, 2007; Rothbart et al., 1994; Spinrad, Eisenberg, & Gaertner, 2007). To engage in caring actions towards others requires effective regulation of one's own emotions, attentional processes, and behaviors so that the helper's orientation is outward and focused on the needs of others. Moreover, given the development of self-regulation skills from childhood into adolescence, one might expect positive relations between self-regulation and prosocial behaviors in adolescence. In contrast, failure to effectively regulate one's own emotions could lead to personal distress, a self-focused, aversive overarousing emotional response to the needs of others (Eisenberg et al., 2006; Hoffman, 1975). Personal distress, in turn, is usually either negatively associated with or unrelated to prosocial behaviors except when the situation is difficult to escape (as a means of making one's self feel better; see Batson, 1998; Eisenberg et al., 2006). Therefore, based on theory and prior research, adolescents who are either low on negative emotional reactivity or high on self-regulation would be expected to display more prosocial behaviors.

Several theorists have postulated that to better predict the effects of negative emotional reactivity and self-regulation on social behavioral outcomes, researchers need to examine possible interaction effects (Fox, 1989; Eisenberg & Fabes, 1992; Rothbart & Bates, 1998; c.f. Block, Gjerde, & Block, 1991). Based on an extensive review of this literature, Eisenberg and Fabes' (1992) postulated that the relations between emotional reactivity and prosocial behaviors will depend upon the relative level of self-regulation. Relatively low negative emotional reactivity should be associated positively with prosocial behaviors but primarily for adolescents who are relatively high on self-regulation. In contrast, relatively high negative emotional reactivity should be associated negatively with prosocial behaviors but primarily for adolescents who relatively low on self-regulation. Finally, the expected positive relation between self-regulation and prosocial behaviors is expected to be attenuated in those adolescents who exhibit high negative emotional reactivity. To date, supportive evidence on the interactive effects of emotional reactivity and self-regulation is lacking or exists only for one gender or the other in particular studies (Eisenberg et al., 1996; Eisenberg et al., 2000; Eisenberg, Smith, Sadovsky, & Spinrad, 2004; Laible, Carlo, Panfield, Eye, & Parker, 2010). Alternatively, the theoretical models also suggest possible curvilinear main effects such that intermediate levels of self-regulation and emotional reactivity (which should enhance prosociality towards others needs) could be associated with optimal psychosocial functioning (similar to the notion of ego resilience, Block et al., 1991; Eisenberg & Fabes, 1992). Because empirical studies on this latter possibility are sparse though supportive (e.g., Eisenberg et al., 2000), we also explored possible curvilinear effects. Thus, we examined both the possible linear interaction effects between emotional reactivity and self-regulation as well as the curvilinear main effects of self-regulation and emotional reactivity on prosocial behaviors, in addition to the postulated linear main effects.

Although puberty has generally been studied in relation to negative outcomes such as depression or delinquency, puberty also may be linked to prosocial behaviors. To date, no research has explored this association but conceptual links to prosocial behavior have been proposed. Fabes et al. (1999) suggested that puberty might induce an increased emotional reactivity, which could either inhibit or enhance prosocial competence. On one hand, puberty might increase emotional reactivity, which could lead to more prosocial behavior because the adolescent is more attuned to the emotions of others. Enhanced emotional reactivity due to puberty could explain the finding that adolescent girls show higher levels of empathy and prosocial behaviors than adolescent boys, given that adolescent girls tend to mature earlier than boys (Eisenberg et al., 2006). Alternatively, if pubertal development is associated with an increased tendency to experience strong negative-valenced emotions (e.g., anger) it might interfere with prosocial responding, especially if such intense emotionality is not effectively regulated (Fabes et al., 1999).

Research indicates that the pubertal transition is associated with increased physiological and emotional reactivity (Dahl & Gunnar, 2009; Walker, Sabuwalla, & Huot, 2004) and enhanced stress reactivity (Gunnar et al., 2009). Moreover, pubertal development and especially early pubertal timing has been linked to negative emotionality and affect (see Susman & Rogol, 2004 for a review). If the pubertal transition is associated with heightened emotional reactivity, then we would expect to see the effects on behavior primarily among early maturers, who experience puberty before their peers at young ages when they are less cognitively and emotionally equipped to cope with the stresses of this transition. Related to this, there is evidence that underregulated negative-valenced emotionality (e.g., anger) is negatively associated with prosocial competence in adolescence (Carlo et al., 1998; Murphy et al., 2005; Wentzel & McNamara, 1999). If pubertal changes are associated with increases in *underregulated* negative emotionality, then this could also explain reported decreases in prosocial behaviors during adolescence (Carlo et al., 2007; Eisenberg et al., 2005). However, the effects of early pubertal timing on prosocial behaviors might differ for boys and girls. Whereas girls likely experience socialization pressures to exhibit prosocial tendencies across childhood and adolescence, early pubertal maturation could bring increased socialization pressures for boys. For example, by virtue of their more adult like appearance, early maturing adolescent boys might experience greater pressure to take on responsibilities and more demands to assist and help others. If they experience enhanced emotional sensitivity as well it could increase their tendency to behave prosocially, compared to their later maturing peers. Unfortunately, to our knowledge, no previous research has examined the relations between pubertal development and prosocial behaviors.

Scholars have recently noted the importance of studying prosocial behaviors in different contexts (Carlo, 2006). Prosocial behaviors in the home are distinct from prosocial behaviors directed at peers (Eberly & Montemayor, 1998; Tisak, Holub, & Tisak, 2007). For example, helping in the home often entails actions that are obligatory or expected by parents, who have greater power and status than the child does. In contrast, helping peers is often less obligatory, because peers are similar in social status and power, although helping behavior is still subject to peer group pressures. Although self- regulation might be relevant in predicting both helping at home and helping peers, emotional reactivity may be somewhat less relevant than self-regulation in predicting prosocial behaviors at home if the behaviors

are more obligatory. Thus, we explored the relations among these predictors and prosocial behaviors at home and those directed at peers.

In summary, the present study was designed to examine the concurrent and longitudinal relations between emotional reactivity, self-regulation, and pubertal timing and adolescents' prosocial behaviors in the home and with peers. It was hypothesized that negative emotional reactivity would be inversely related, and self-regulation positively related, to prosocial behaviors. Furthermore, interaction effects of negative emotional reactivity and self-regulation were expected. Relatively low negative emotional reactivity should be associated positively with prosocial behaviors but primarily for adolescents who are relatively high on self-regulation. In contrast, relatively high negative emotional reactivity should be associated negatively with prosocial behaviors but primarily for adolescents who are relatively low on self-regulation. We also expected that high negative emotionality would attenuate the relations between self regulation and prosocial behaviors. Finally, because the sparse literature shows that the effects of pubertal timing, and the interactions between negative emotional reactivity and self-regulation, are often found for one gender and not the other, we further explored gender as a possible moderator of these effects. Given the nonexistent or sparse prior research, we also explored for the possibility of curvilinear effects such that moderate levels of negative emotional reactivity and self regulation might be expected to be positively associated with prosocial behaviors, and for the possibility that the predictors of prosocial behavior in the home and peer contexts might differ.

Method

Participants

Data for this study came from Waves 3 and 4 of the NICHD Study of Early Child Care and Youth Development (SECCYD). In 1991, 8,986 newborns and their mothers were recruited at 24 hospitals in ten sites across the United States. Mothers who had multiple births, were younger than 18 years of age, were considering adoption for their infant, or showed evidence of substance use were not included. Conditional random sampling was used to select 1,364 children and their families from the 5,416 families who met study criteria for participation. This sample included 80.4% Whites, 12.9% Blacks, 1.6% Asians, .4 % American Indians, and 4.7% labeled "other".

By Wave 3, 339 of the original children had been lost due to attrition, resulting in a possible sample of 1,025. Only White adolescents were included in the present analysis because there were too few ethnic minority adolescents to permit analysis of ethnic subsamples (see Belsky et al., 2007; NICHD, 2001) and because the criteria for determining Tanner stage (see below) were developed with Caucasians and have not been updated for minority samples (Dorn, Dahl, Woodward, & Biro, 2006). The resulting sample for this study consisted of 850 sixth graders (50% female, mean age = 11.03, SD = .17). Follow-up occurred when the adolescents were age 15 (mean age = 15.5, SD = .16 years). The majority of parents of the study youth had graduated from college or completed some college (56.3%), and the median total family income at Wave 3 was $75,000 per year (range = $2,500-$1,000,000). Attrition analyses compared the demographic characteristics of children in the original SECCYD sample who remained in the study at the 6th grade

assessment with those who dropped out prior to that time. Results of ANOVAs indicated that boys, $F(1,1095) = 7.03$, $p<.01$, $\eta^2 = .01$, children born to mothers with lower educational attainment, $F(1,1094) = 21.72$, $p<.001$, $\eta^2 = .02$, and children with lower family incomes, $F(1,1043) = 4.02$, $p<.05$, $\eta^2 < .01$, were more likely to have dropped out by 6th grade. However, the effect sizes were small. To minimize potential bias resulting from missing data at T1 (6th grade, age 11) and T2 (age 15) of the present study, our analyses used FIML which utilizes all available data from participants at each time point.

Measures

Emotional reactivity, self-regulation, pubertal timing, and family income-to-needs ratio were assessed at age 11 (T1). The income-to-needs ratio (a proxy for SES) is the ratio of a family's income to the income level of the poverty line for a family of that size in the U.S. (Thus, the income-to-needs ratio for a family whose income is exactly at the poverty line for their family size is 1.0; Acs & Gallagher, 2000). In the current analyses, we used a categorical variable in which those living above the poverty level (95%) were labeled 1 and those living below poverty level (5%) were labeled 0. Prosocial behaviors were assessed at age 11 (T1) and age 15 (T2). Data on child emotional reactivity, self-regulation, and prosocial behaviors were collected via maternal report. Pubertal development was assessed via physical exam.

Pubertal timing (T1)—Tanner staging by physical exam is the most appropriate measure in studies where the hormonal or physical changes of puberty are expected to influence the outcomes of interest (Dorn et al., 2006). In the SECCYD, a nurse or physician rated each adolescent's level of pubertal development according to Tanner stage during an annual physical examination. Girls' breast development and pubic hair were rated based on the American Academy of Pediatrics manual (Herman-Giddens & Bourdony, 1995); boys' genital development and pubic hair were rated for boys following Tanner's original criteria (adapted from Tanner, 1962). Each adolescent received a Tanner stage score of 1–5 on each characteristic. In this study, Tanner scores for girls' breast development and boys' genital development at 6th grade were used to index pubertal status. These changes are among the earliest visible signs of pubertal maturation and are thus appropriate for determining pubertal status during early adolescence. For boys, the resulting Tanner stage frequencies were: Stage 1 ($n = 63$), Stage 2 ($n = 220$), Stage 3 ($n = 74$) and Stage 4 ($n = 15$). For girls the frequencies were: Stage 1 ($n = 30$), Stage 2 ($n = 122$), Stage 3 ($n = 151$), Stage 4 ($n = 64$), and Stage 5 ($n = 10$).

To assess *pubertal timing*, we standardized the sixth grade pubertal status scores within sex (c.f., Ge et al., 2001). This resulted in a variable, pubertal timing, with a mean of 0 and a standard deviation of 1 for each gender. Because of the low variability in age in our sample (the 6th grade physical exam was scheduled as closely as possible to age 11.5 years), standardizing within grade and sex yielded a measure of relative pubertal timing for both boys and girls. Higher timing scores reflected earlier maturation.

Emotional reactivity (T1)—Mothers rated their child's emotional reactivity using three items from Eisenberg's emotional reactivity scale (Eisenberg, Fabes, Bernzweig, & Karbon,

1993). Because the focus of the study was on emotional reactivity, we selected items that reflected reactivity rather than other aspects of emotionality (e.g., intensity). The items were: "When angry, it is easy for my child to still be rational and not overreact," "My child is slow to become nervous, upset, or angry," and "My child is calm and not easily aroused." These items were rated on a 5-point scale, ranging from 1 (*never*) to 5 (*always*); α = .75. Items were reverse scored and averaged so that higher scores indicated greater emotional reactivity.

Self-regulation (T1)—A 21-item self-regulation measure was created for this study based on items drawn from two mother-report scales: the self-control subscale of the Social Skills Rating System (SSRS; Gresham & Elliott, 1990) and the Disruptive Behavior Disorders Rating Scale (DBD; Pelham, Gnagny, Greenslade, & Milich, 1992). The self-control subscale of the SSRS consists of 10 items (α = .83) with response options ranging from 0 (*never*) to 2 (*always*). A sample item is, "Does your child end disagreements with you calmly?" The Disruptive Behavior Disorders Rating Scale (DBD) assesses a range of behaviors including items reflecting attention problems and emotion regulation problems. From this scale, we selected 18 items (α = .92) that, based on face validity, matched our conceptualization of self-regulation (i.e., regulation of attention, affect, and behavior) and not externalizing behaviors (see Raffaelli & Crockett, 2003 for a similar procedure). Mothers were asked to rate the extent to which each item described her child (e.g., "Often is easily distracted) using a scale from 0 (*not at* all) to 3 (*very* much). The item scores were reverse scored so that higher scores indicated better self-regulation.

An exploratory factor analysis (EFA) was performed on the full set of 28 items. After deleting four multivocal items, five factors emerged. One factor, reflecting verbal self-regulation, was dropped because it did not fit our conceptualization of self-regulation. Two of the remaining factors were based on items from the SSRS, and the other two were based on the DBD items; intercorrelations among the four factors ranged from $r = .29$ to .65. Scale scores for these four factors were standardized to correct for the different response options in the two original scales. When submitted to an EFA the standardized subscales loaded onto a single factor (eigenvalue = 2.26). Accordingly, factor scores from this higher order factor were used to measure self-regulation, which showed good internal consistency (α= .90).

Prosocial Behaviors—Mothers reported on their adolescent's prosocial competence in two different contexts: at home and with peers. *Prosocial behavior at home* was assessed concurrently at 6th grade and longitudinally at 10th grade (T1 and T2, respectively) and prosocial behavior with peers was assessed at T1 only because this measure was not available at the later time point. Prosocial behavior at home (6 items; α =.80 at T1 and α =. 72 at T2) was based on the cooperation subscale from the SSRS, whose validity has been documented previously (Gresham & Elliott, 1990). This scale measures helping behaviors around the house, e.g., "My child volunteers to help family members with tasks." These six items reflecting prosocial behavior (as opposed to other forms of cooperation) were selected from the cooperation subscale of the SSRS based on face validity. A confirmatory factor analysis (CFA) was conducted with Mplus 5.1 (Muthén & Muthén, 2007) to determine if the

chosen items loaded onto one factor. The one-factor model showed marginally adequate fit, χ^2 (9) = 95.21, CFI=.95, RMSEA=.10, SRMR=.04.

The measure of *prosocial behavior with peers* (T1) (6 items; α = .77), was based on a shortened version of the prosocial subscale of the Child Behavior Scale (Ladd & Profilet, 1996). This scale was found to have good validity as it correlated negatively with aggression and withdrawn scales and positively with measures of positive interactions (Ladd & Profilet, 1996). A sample item is, "My child is kind toward peers." Three items that assessed empathy were dropped from the original scale. A CFA was conducted to determine if the chosen items loaded onto one factor. The one-factor model had good fit, χ^2 (9) = 45.76, CFI=.97, RMSEA=.06, SRMR=.03. This scale was available only at T1.

Results

Preliminary Analyses

Descriptive statistics and intercorrelations among the main study variables are provided in Table 1. Pubertal timing was negatively related to prosocial behavior with peers, but unrelated to all other study variables. Emotional reactivity was significantly related to self-regulation and all measures of prosocial behaviors. Self-regulation was positively correlated with all measures of prosocial behavior, and the measures of prosocial behavior were positively correlated with each other.

Bivariate ANOVAs revealed that, compared to boys, girls were significantly more pubertally mature, $F(1, 848) = 149.65$, $p<.001$, and had higher scores on measures of self-regulation, $F(1, 848) = 39.72$, $p<.001$, prosocial behavior at home at T1, $F(1, 848) = 6.35$, $p= .01$ and T2 $F(1, 848) = 12.56$, $p<.001$, and prosocial behavior with peers, $F(1, 848) = 11.55$, $p= .001$.

Relations among Self-regulation, Emotional Reactivity, Pubertal Timing and Prosocial Behavior

The main study analyses were hierarchical multiple regressions conducted concurrently and over time (from 6th to 10th grade). Full information maximum likelihood, in which substantive model parameter estimates can be computed from incomplete data, was used to handle missing data (Hofer & Hoffman, 2007). In the first step, socioeconomic status (measured by the family's income to needs ratio) was entered as a control variable along with gender, pubertal timing, and the main effects of emotional reactivity and self-regulation. The interaction between gender and pubertal timing, gender and emotional reactivity, gender and self-regulation, and self-regulation and emotional reactivity were entered in the second step; the three-way interaction between gender, self-regulation, and reactivity was entered on the third step (because it was never significant, this step is not included in the tables or discussed further); and the curvilinear effects of emotional reactivity and self-regulation, respectively, were entered on the fourth step. To reduce nonessential multicollinearity, the emotional reactivity and self-regulation variables were centered prior to creating the interaction terms (Aiken & West, 1991). For each significant interaction, simple slope analyses were conducted to determine the pattern of interaction. Several scholars suggest that relatively high tolerance levels are not uncommon when testing

higher order and nonlinear effects due to essential multicollinearity, which suggests that caution is needed when interpreting the findings (Cohen, Cohen, West, & Aiken, 2003).

For prosocial behavior at home (see Table 2), the final step of the concurrent regression resulted in significant model improvement. Self-regulation was significantly and positively related to prosocial behavior at home in all four steps, β = .41, p<.001; β = .37, p<.001; β = .36, p<.001, β = .48, p<.001, such that adolescents with higher levels of self-regulation exhibited more prosocial behavior. The main effect of pubertal timing was significant once interaction effects were included in the model, β = .16, p<.01; β = .16, p<.01; β = .16, p<.001, such that early maturers displayed higher levels of prosocial behaviors at home. However, the interaction between pubertal timing and gender was also significant, β = −.13, p<.01 in Steps 2 through 4. As shown in Figure 1, the slope of pubertal timing was steeper for boys than for girls, indicating that, particularly for boys, earlier timing of puberty was associated with higher levels of prosocial behaviors at home . Separate regressions conducted for boys and girls indicate that the effect of puberty on prosocial behaviors at home are significant for boys (β = .16, p<.01) but not for girls (β = −.02, p>.05). The curvilinear effect of self-regulation was significant in the fourth step (β = .19, p<.001), such that prosocial behavior increased at a faster rate at higher levels of self-regulation (see Figure 2). The curvilinear effect of emotional reactivity was also significant in the fourth step (β = −.12, p<.001), such that prosocial behavior was highest at medium levels of emotional reactivity (Figure 3[Jen will make]).

In the longitudinal model for prosocial behavior at home, the second and fourth steps of the regression resulted in significant model improvement. There was a positive effect of puberty in Step 1, β = .08, p<.05, but this effect was not significant in subsequent steps of the model. A negative effect of reactivity was present in all steps, (β = −.16, p<.001; β = −.20, p<.001; β = −.19, p<.001; β = −.16, p<.001), as was a positive effect of self-regulation (β = .24, p<.001; β = .23, p<.001; β = .22, p<.001; β = .28, p<.001). The curvilinear effect of emotional reactivity was also significant in the fourth step (β = −.14, p<.01), such that prosocial behavior was highest at medium levels of emotional reactivity (similar to Figure 3). There were no significant interaction effects.

For prosocial behavior with peers, none of the steps of the regression resulted in significant model improvement (Table 3). Emotional reactivity was significantly negatively related to prosocial behavior in all steps (β = −.16, p<.05, Steps 1 – 3; β = −.15, p<.05, Step 4), whereas self-regulation was significantly positively related to prosocial behavior in all steps (β = .33, p<.001, Step 1; β = .34, p<.001, Steps 2 and 3; β = .40, p<.001, Step 4). None of the interaction effects was significant in this model.

Discussion

These results provide evidence of the effects of emotional reactivity, self-regulation, and pubertal timing on adolescents' prosocial behaviors. Self-regulation was consistently and positively related to both forms of prosocial behavior (concurrently and longitudinally). Emotional reactivity showed negative concurrent relations to prosocial behavior with peers, and negative longitudinal relations (four years later) with prosocial behavior at home. Effects

of pubertal timing were found such that early maturers showed higher levels of prosocial behavior at home concurrently, particularly among boys. Overall, the findings provide evidence of pubertal and temperament-based predictors of prosocial behaviors in peer and home contexts.

Research on temperament variables associated with prosocial behaviors has increased in recent years, though much of the research has been conducted in younger children. The present findings suggest that, as anticipated, both emotional reactivity and self-regulation were relatively consistent predictors of prosocial behaviors in adolescence. However, there were also significant curvilinear relations between each of the temperament variables and prosocial behaviors. For self-regulation, the association with prosocial behavior was strongest at higher levels. The findings for self regulation are consistent with prior research evidence that high levels of self regulation facilitate prosocial behaviors (see Eisenberg et al., 2000). For emotional reactivity, the association with prosocial behaviors was strongest at moderate levels suggesting that there may be an optimal level of emotional reactivity. Too much or too little emotional reactivity may result in either a focus on self (similar to personal distress, Eisenberg & Fabes, 1992) or insufficient emotional sensitivity to others, respectively. Moreover, the existence of curvilinear effects is compatible with the notion that there may be nonlinear interaction effects that are difficult to detect without a sufficiently large sample size and an adequate range of scores on both emotional reactivity and self-regulation. These findings add to the mounting evidence that the relations between temperament and prosocial behaviors are complex.

The study was also designed to examine previously hypothesized interactions between emotional reactivity and self-regulation on prosocial behaviors (e.g., Eisenberg & Fabes, 1992). However, in the present study, these hypothesized interactions were not significant. Perhaps the relatively strong main effects of self-regulation and emotional reactivity overwhelmed possible interaction effects. Prior research with children and adolescents shows a relatively inconsistent pattern of interaction effects of emotional reactivity and self regulation on prosocial behaviors (see Eisenberg et al., 2000; Rothbart & Bates, 1998). For example, several studies of younger children document gender-specific interaction effects of emotional reactivity and self-regulation on behavioral outcomes (see Eisenberg et al., 2000). One possibility is that the interaction effect may not be particularly robust, and/or the effect may depend upon having enough representation at the extreme ends of negative emotional reactivity or self regulation. Future research is needed to determine the conditions under which these hypothesized interaction effects might be manifested.

The present study is the first to investigate the proposed link between puberty and prosocial behaviors. The discussion of puberty in prosocial functioning (Fabes et al., 1999) has centered on whether puberty might facilitate higher levels of prosocial behaviors by enhancing emotional reactivity to needy others, or reduce prosocial behaviors by inducing emotional overarousal (e.g., anger or personal distress). The fact that earlier maturation was associated with higher levels of prosocial behaviors is consistent with the emotional reactivity hypothesis. In addition, the puberty by gender interaction in the concurrent model indicated that the positive effect of earlier maturation was stronger for boys than girls. This finding might reflect greater expectations for more physically mature early adolescent boys

to assist around the home with chores and responsibilities, though the effect might not be enduring. Although recent studies have found negative effects of early maturation on adjustment (e.g., Ge et al., 2001), early studies also showed positive effects of early pubertal maturation among boys. In these studies, early maturers were rated as more poised, good natured, popular, and attractive to peers (Jones, 1965; Jones & Bayley, 1950), perhaps owing to their more mature appearance. Similarly, a more mature appearance could affect parents' expectations regarding boys' ability to take on responsibilities at home. Coupled with the main effects of negative emotional reactivity and self-regulation, the effect of pubertal timing point to the possible role of biological-based mechanisms in the expression of prosocial behaviors (Knafo & Plomin, 2006).

Of additional interest was whether the relations would differ across prosocial behaviors in different contexts. The findings showed relatively consistent patterns across prosocial behaviors with peers and in the home. However, there were a few exceptions. As noted earlier, puberty was associated with helping in the home but not helping peers. Although other research show that early maturing adolescents may be at risk for antisocial behaviors (see Negriff & Susman, 2011), the present findings suggest that early maturity per say does not necessarily lead to negative outcomes across all contexts. This suggests that early maturers may be simultaneously at greater risk for certain outcomes but also prone to higher levels of prosocial competencies. Moreover, these findings may result from early maturing boys who recognize the need to adapt their behaviors at home and around peers (though it is uncertain why this is not the case for girls). Additionally, emotional reactivity was not significantly linked to prosocial behaviors in the home concurrently, though the effects revealed themselves four years later. In contrast, emotional reactivity was negatively associated with prosocial behaviors towards peers. These latter findings suggest that emotional reactivity may be less pertinent in predicting helping around the home perhaps because social forces (e.g., authority figure expectations and demands) influence such helping more than emotional tendencies do. In general, then, the present findings indicate that additional research on possible unique correlates of different forms of prosocial behaviors is needed.

Consistent with prior investigations, girls scored higher than boys on prosocial behaviors (both in the home and with peers) and on self-regulation. The findings yield additional evidence of gender based differences in prosociality as well as in self regulation (Eisenberg et al., 2006). The findings are consistent with theories of gender-based socialization, which posit that girls are encouraged to show concern for others and to control their behaviors more than boys (Brody, 1993; Maccoby & Jacklin, 1974). Interestingly, there were no significant gender differences in emotional reactivity. This may be due to gender differences in specific emotions. For example, although girls exhibit higher levels of sadness, boys exhibit higher levels of anger (Brody, 1993). Therefore, the lack of gender differences in emotional reactivity may be due to the fact that both boys and girls exhibit high levels of specific emotions, reducing overall gender differences.

There were several limitations to the present study. First, the study utilized only mother reports of emotional reactivity, self-regulation, and prosocial behaviors thereby presenting possible shared method variance and reporter bias concerns. Although there is some

evidence that parental and self reports of prosocial behaviors towards peers are strongly correlated (e.g., Carlo, Padilla-Walker, & Day, in press; Padilla-Walker, 2007), further studies to examine the convergent validity of these reports is desirable. Furthermore, the short measure of emotional reactivity had a minimally acceptable level of internal consistency, which raises concerns about the reliability of the measure. The extent to which these concerns can bias the estimates is unknown, and future research using multiple methods (including experimental manipulations, observational measures) is needed to confirm the findings. Second, the sample, although relatively large, lacks cultural and SES diversity. This issue poses a threat to the generalizability of the findings. Research is needed to examine these hypothesized links in more culturally and economically diverse samples. And third, the creation of nonlinear terms for model tests often results in collinearity problems because of essential autocorrelations. Therefore, caution is needed in interpreting the findings from the present study; indeed, this necessitates future replication studies to confirm the present findings.

Despite these limitations, the study is the first investigation of the concurrent and longitudinal links between pubertal development and adolescents' prosocial behaviors. Puberty effects on prosocial behaviors were found for boys but not girls suggesting gender-based differential relations. Furthermore, the findings suggest different relations between temperament-based predictors and prosocial behaviors across social contexts. Moreover, there were significant curvilinear effects of emotional reactivity and self- regulation on prosocial behaviors. However, there was no evidence for interactive effects of emotional reactivity and self-regulation on prosocial behaviors. These findings provide a basis for future research designed to understand the explanatory processes that link puberty and temperament to prosocial behaviors in different social contexts.

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References

Acs, G., Gallagher, M. Income inequality among American's children. New Federalism: National Survey of America's Families, B-6. 2000. Retrieved from http://www.urban.org/url.cfm?ID=309307

Aiken, L., West, S. Multiple regression: Testing and interpreting interactions. Thousand Oaks, CA US: Sage Publications, Inc; 1991.

Batson, CD. Altruism and prosocial behavior. In: Gilbert, DT.Fiske, ST., Lindzey, G., editors. The handbook of social psychology. Boston, MA: McGraw-Hill; 1998.

Baumeister, RF., Leith, KP., Muraven, M., Bratslavsky, E. Self-regulation as a key to success in life. In: Pushkar, D.Bukowski, W.Schwartzman, AE.Stack, DM., White, DR., editors. Improving competence across the lifespan: Building interventions based on theory and research. New York: Plenum; 1998. p. 117-132.

Belsky J, Steinberg L, Houts R, Friedman S, DeHart G, Cauffman E, et al. Family rearing antecedents of pubertal timing. Child Development. 2007; 78(4):1302–1321. [PubMed: 17650140]

Block JH, Gjerde PF, Block JH. Personality antecedents of depressive tendencies in 18-year-olds: A prospective study. Journal of Personality and Social Psychology. 1991; 60(5):726–738. [PubMed: 2072253]

Brody GH, Ge X. Linking parenting processes and self-regulation to psychological functioning and alcohol use during early adolescence. Journal of Family Psychology. 2001; 15:82–94. [PubMed: 11322087]

Brody, LR. On understanding gender differences in the expression of emotion: Gender roles, socialization and language. In: Ablon, SL.Brown, D.Khantzian, EJ., Mack, JE., editors. Human feelings: Explorations in affect development and meaning. Hillsdale, NJ: Analytic Press; 1993.

Calkins, S., Marcovitch, S. Child development at the intersection of emotion and cognition. Washington, DC US: American Psychological Association; 2010. Emotion regulation and executive functioning in early development: Integrated mechanisms of control supporting adaptive functioning; p. 37-57.

Carlo, G. Care-based and altruistically-based morality. In: Killen, M., Smetana, JG., editors. Handbook of moral development. Mahwah, NJ: Lawrence Erlbaum Associates; 2006. p. 551-579.

Carlo G, Crockett LJ, Randall BA, Roesch SC. Parent and peer correlates of prosocial development in rural adolescents: A longitudinal study. Journal of Research on Adolescence. 2007; 17:301–324.

Carlo G, Padilla-Walker LM, Day RD. A test of the economic strain model on adolescents' prosocial behaviors. Journal of Research on Adolescence. in press.

Carlo G, Roesch SC, Melby J. The multiplicative relations of parenting and temperament to prosocial and antisocial behaviors in adolescence. Journal of Early Adolescence. 1998; 18:266–290.

Cohen, J., Cohen, P., West, SG., Aiken, LS. Applied multiple regression/correlation analysis for the behavioral sciences. 3rd. Mahwah, NJ: Lawrence Erlbaum Associates, Publishers; 2003.

Dahl R, Gunnar M. Heightened stress responsiveness and emotional reactivity during pubertal maturation: Implications for psychopathology. Development and Psychopathology. 2009; 21(1):1–6. [PubMed: 19144219]

Derryberry D, Rothbart M. Arousal, affect, and attention as components of temperament. Journal of Personality and Social Psychology. 1988; 55(6):958–966. [PubMed: 3216290]

Dorn LD, Dahl RD, Woodward HR, Biro F. Defining the boundaries of early adolescence: A user's guide to assessing pubertal status and pubertal timing in research with adolescents. Applied Developmental Science. 2006; 10:30–56.

Duncan P. The effects of pubertal timing on body image, school behavior, and deviance. Journal of Youth and Adolescence. 1985; 14:227–235. [PubMed: 24301178]

Eberly MB, Montemayor R. Doing good deeds: An examination of adolescent prosocial behavior in the context of parent/adolescent relationships. Journal of Adolescent Research. 1998; 13:403–432.

Eisenberg N, Cumberland A, Guthrie IK, Murphy BC, Shepard SA. Age changes in prosocial responding and moral reasoning in adolescence and early adulthood. Journal of Research on Adolescence. 2005; 15:235–260. [PubMed: 20592955]

Eisenberg, N., Fabes, RA. Emotion and its regulation in early development. San Francisco, CA: Jossey-Bass; 1992.

Eisenberg N, Fabes R, Bernzweig J, Karbon M. The relations of emotionality and regulation to preschoolers' social skills and sociometric status. Child Development. 1993; 64(5):1418–1438. [PubMed: 8222881]

Eisenberg N, Fabes R, Guthrie I, Reiser M. Dispositional emotionality and regulation: Their role in predicting quality of social functioning. Journal of Personality and Social Psychology. 2000; 78(1): 136–157. [PubMed: 10653511]

Eisenberg N, Fabes R, Murphy B. The relations of emotionality and regulation to dispositional and situational empathy-related responding. Journal of Personality and Social Psychology. 1994; 66:776–797. [PubMed: 8189352]

Eisenberg N, Fabes RA, Murphy B, Karbon M, Smith M, Maszk P. The relations of children's dispositional empathy-related responding to their emotionality, regulation, and social functioning. Developmental Psychology. 1996; 32:195–209.

Eisenberg N, Fabes R, Murphy B, Shepard S, Guthrie I, Mazsk P, et al. Prediction of elementary school children's socially appropriate and problem behavior from anger reactions at age 4–6 years. Journal of Applied Developmental Psychology. 1999; 20(1):119–142.

Eisenberg, N., Fabes, R., Spinrad, T. Handbook of Child Psychology: Vol. 3, Social, Emotional, and Personality Development. 6th. Hoboken, NJ US: John Wiley & Sons Inc; 2006. Prosocial development; p. 646-718.

Eisenberg, N., Hofer, C., Vaughan, J. Handbook of Emotion Regulation. New York, NY US: Guilford Press; 2007. Effortful control and its socioemotional consequences; p. 287-306.

Eisenberg N, Miller PA. The relation of empathy to prosocial and related behaviors. Psychological Bulletin. 1987; 101:91–119. [PubMed: 3562705]

Eisenberg, N., Smith, C., Sadovsky, A., Spinrad, T. Handbook of self-regulation: Research, theory, and applications. New York, NY US: Guilford Press; 2004. Effortful control: Relations with emotion regulation, adjustment, and socialization in childhood; p. 259-282.

Estrada P. Adolescents' self reports of prosocial responses to friends and acquaintances: The role of sympathy-related cognitive, affective, and motivational processes. Journal of Research on Adolescence. 1995; 5:173–200.

Fabes RA, Carlo G, Kupanoff K, Laible DJ. Early adolescence and prosocial/moral behavior I: The role of individual processes. Journal of Early Adolescence. 1999; 19:5–16.

Fox N. Psychophysiological correlates of emotional reactivity during the first year of life. Developmental Psychology. 1989; 25(3):364–372.

Ge X, Elder GH, Conger R. The relation between puberty and psychological distress in adolescent boys. Journal of Research on Adolescence. 2001; 11:49–70.

Graber JA, Lewisohn PM, Seely JR. Is psychopathology associated with the timing of pubertal development? Journal of the American Academy of Child & Adolescent Psychiatry. 1997; 36(12): 1768–1776. [PubMed: 9401339]

Gresham, FM., Elliott, SN. The social skills rating system. Circle Pines, MN: American Guidance Service; 1990.

Herman-Giddens, ME., Bourdony, CJ. Assessment of Sexual Maturity Stages in Girls. Elk Grove Village, IL: American Academy of Pediatrics; 1995.

Hofer, S., Hoffman, L. Modeling contextual effects in longitudinal studies. Mahwah, NJ: Lawrence Erlbaum Associates Publishers; 2007. Statistical analysis with incomplete data: A developmental perspective; p. 13-32.

Hoffman M. Developmental synthesis of affect and cognition and its implications for altruistic motivation. Developmental Psychology. 1975; 11(5):607–622.

Jones MC. Psychological correlates of somatic development. Child Development. 1965; 36:899–911. [PubMed: 5892336]

Jones JC, Bayley N. Physical maturing among boys as relates to behavior. Journal of Education Psychology. 1950; 41:129–148.

Kagan, J., Fox, N. Handbook of child psychology: Vol. 3, Social, emotional, and personality development. 6th. Hoboken, NJ US: John Wiley & Sons Inc; 2006. Biology, culture, and temperamental biases; p. 167-225.

Knafo A, Plomin R. Prosocial behavior from early to middle childhood: Genetic and environmental influences on stability and change. Developmental Psychology. 2006; 42(5):771–786. [PubMed: 16953685]

Ladd GW, Profilet SM. The Child Behavior Scale: A teacher-report measure of young children's aggressive, withdrawn, and prosocial behaviors. Developmental Psychology. 1996; 32(6):1008–1024.

Laible D, Carlo G, Panfile T, Eye J, Parker J. Negative emotionality and emotion regulation: A person-centered approach to predicting socioemotional adjustment in young adolescents. Journal of Research in Personality. 2010; 44:621–629.

Laible D, Eye J, Carlo G. Dimensions of conscience in mid-adolescence: Links with social behavior, parenting, and temperament. Journal of Youth and Adolescence. 2008; 37:875–887.

Lytton H, Romney DM. Parents' differential socialization of boys and girls: A metaanalysis. Psychological Bulletin. 1991; 109:267–296.

Maccoby, EE., Jacklin, CN. The psychology of sex differences. Stanford: Stanford University Press; 1974.

Miller PA, Jansen op de Haar MA. Emotional, cognitive, behavioral, and temperament characteristics of high empathy children. Motivation and Emotion. 1997; 21(1):109–215.

Murphy B, Shepard S, Eisenberg N, Fabes R, Guthrie I. Contemporaneous and longitudinal relations of dispositional sympathy to emotionality, regulation, and social functioning. The Journal of Early Adolescence. 1999; 19(1):66–97.

Murphy B, Shepard S, Eisenberg N, Fabes R. Concurrent and across time prediction of young adolescents' social functioning: The role of emotionality and regulation. Social Development. 2004; 13(1):56–86.

Negriff S, Susman EJ. Pubertal timing, depression, and externalizing problems: A framework, review, and examination of gender differences. Journal Of Research On Adolescence. 2011; 21(3):717–746.

NICHD Early Child Care Research Network. Child care and children's peer interaction at age 24 and 36 months: The NICHD study of early child care. Child Development. 2001; 72(5):1478–1500. [PubMed: 11699683]

Padilla-Walker LM. Characteristics of mother-child interactions related to adolescents' positive values and behaviors. Journal of Marriage and Family. 2007; 69(3):675–686.

Pelham WE, Gnagny E, Greenslade KE, Milich R. Teacher ratings of DSM-III-R symptoms for the disruptive behavior disorders. Journal of the American Academy of Child and Adolescent Psychiatry. 1992; 31:210–218. [PubMed: 1564021]

Putnam S, Rothbart M. Development of Short and Very Short Forms of the Children's Behavior Questionnaire. Journal of Personality Assessment. 2006; 87:102–112. [PubMed: 16856791]

Raffaelli M, Crockett LJ. Sexual risk-taking in adolescence: The role of self-regulation and risk-proneness. Developmental Psychology. 2003; 39:1036–1046. [PubMed: 14584983]

Rothbart M. Temperament, development, and personality. Current Directions in Psychological Science. 2007; 16:207–212.

Rothbart M, Ahadi S, Evans D. Temperament and personality: Origins and outcomes. Journal of Personality and Social Psychology. 2000; 78:122–135. [PubMed: 10653510]

Rothbart M, Ahadi S, Hershey K. Temperament and social behavior in childhood. Merrill-Palmer Quarterly: Journal of Developmental Psychology. 1994; 40:21–39.

Rothbart, M., Bates, J. Handbook of child psychology, 5th ed.: Vol 3. Social, emotional, and personality development. Hoboken, NJ US: John Wiley & Sons Inc; 1998. Temperament; p. 105-176.

Rothbart, MK., Hwang, J. Temperament and the development of competence and motivation. In: Elliot, AJ., Dweck, CS., editors. Handbook of Competence and Motivation. New York: Guilford Publications; 2005. p. 167-184.

Spinrad T, Eisenberg N, Gaertner B. Measures of effortful regulation for young children. Infant Mental Health Journal. 2007; 28:606–626. [PubMed: 18066395]

Susman, E., Dorn, L. Handbook of adolescent psychology, Vol 1: Individual bases of adolescent development. 3rd. Hoboken, NJ US: John Wiley & Sons Inc; 2009. Puberty: Its role in development; p. 116-151.

Susman, E., Rogol, A. Handbook of adolescent psychology. 2nd. Hoboken, NJ: John Wiley & Sons; 2004. Puberty and psychological development; p. 15-44.

Tanner, JM. Growth at Adolescence. 2nd. Springfield, IL: Thomas; 1962.

Thompson, R., Meyer, S., McGinley, M. Understanding values in relationships: The development of conscience. In: Killen, M., Smetana, J., editors. Handbook of moral development. Mahwah, NJ: Lawrence Erlbaum Associates; 2006. p. 267-297.

Tisak M, Holub S, Tisak J. What nice things do boys and girls do? Preschoolers' perspectives of peers' behaviors at school and at home. Early Education and Development. 2007; 18:183–199.

Walker EF, Sabuwalla Z, Huot R. Pubertal neuromaturation, stress sensitivity, and psychopathology. Development and Psychopathology. 2004; 16:807–824. [PubMed: 15704816]

Wichstrøm L. The impact of pubertal timing on adolescents' alcohol use. Journal of Research on Adolescence. 2001; 11:131–150.

Wiesner M, Ittel A. Relations of pubertal timing and depressive symptoms to substance use in early adolescence. The Journal of Early Adolescence. 2002; 22:5–23.

Wentzel KR, McNamara CC. Interpersonal relationships, emotional distress, and prosocial behavior in middle school. Journal of Early Adolescence. 1999; 19:114–125.

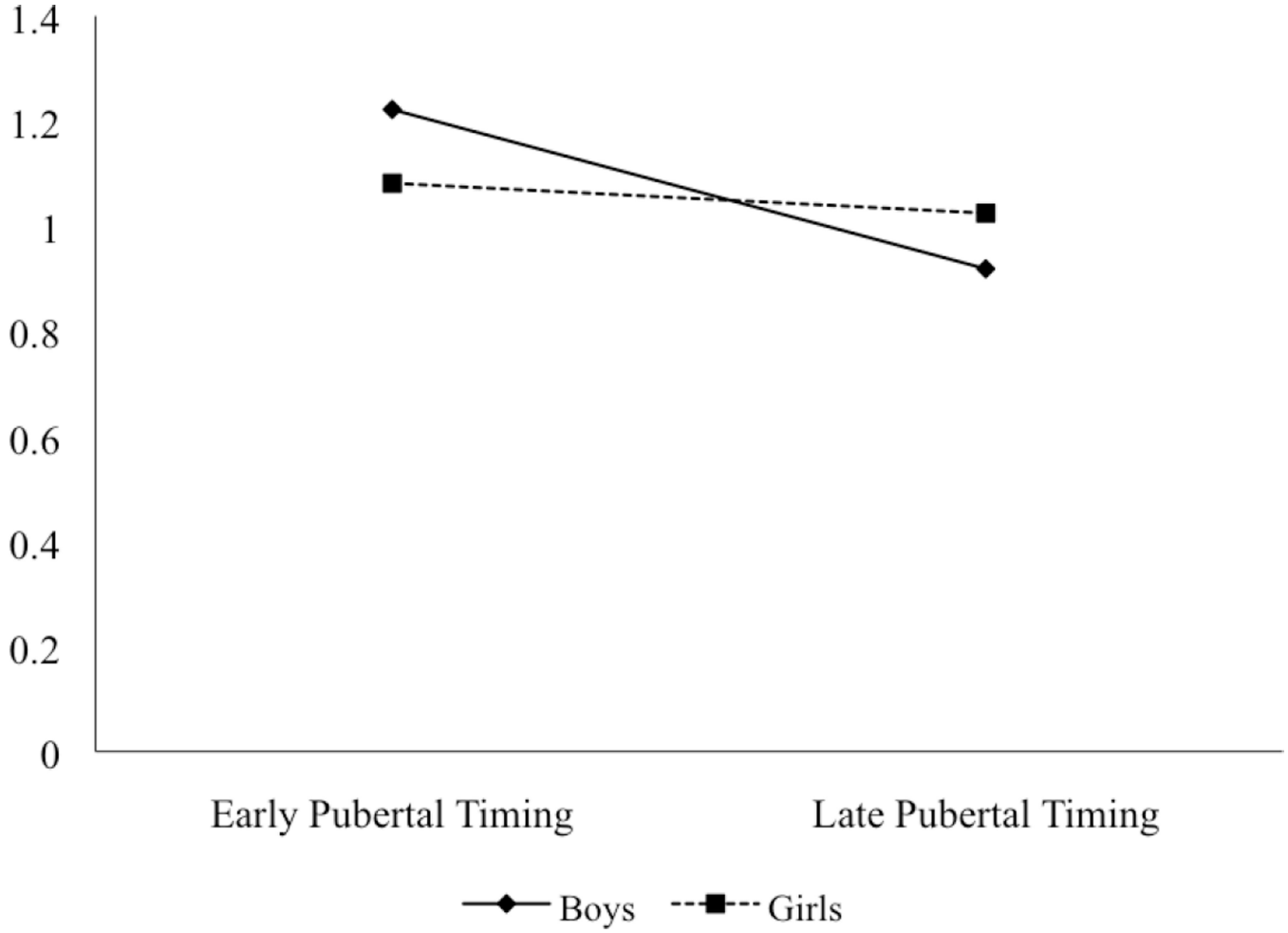

Figure 1.
Interaction Between Pubertal Timing and Gender Predicting Concurrent Prosocial Behaviors at Home.

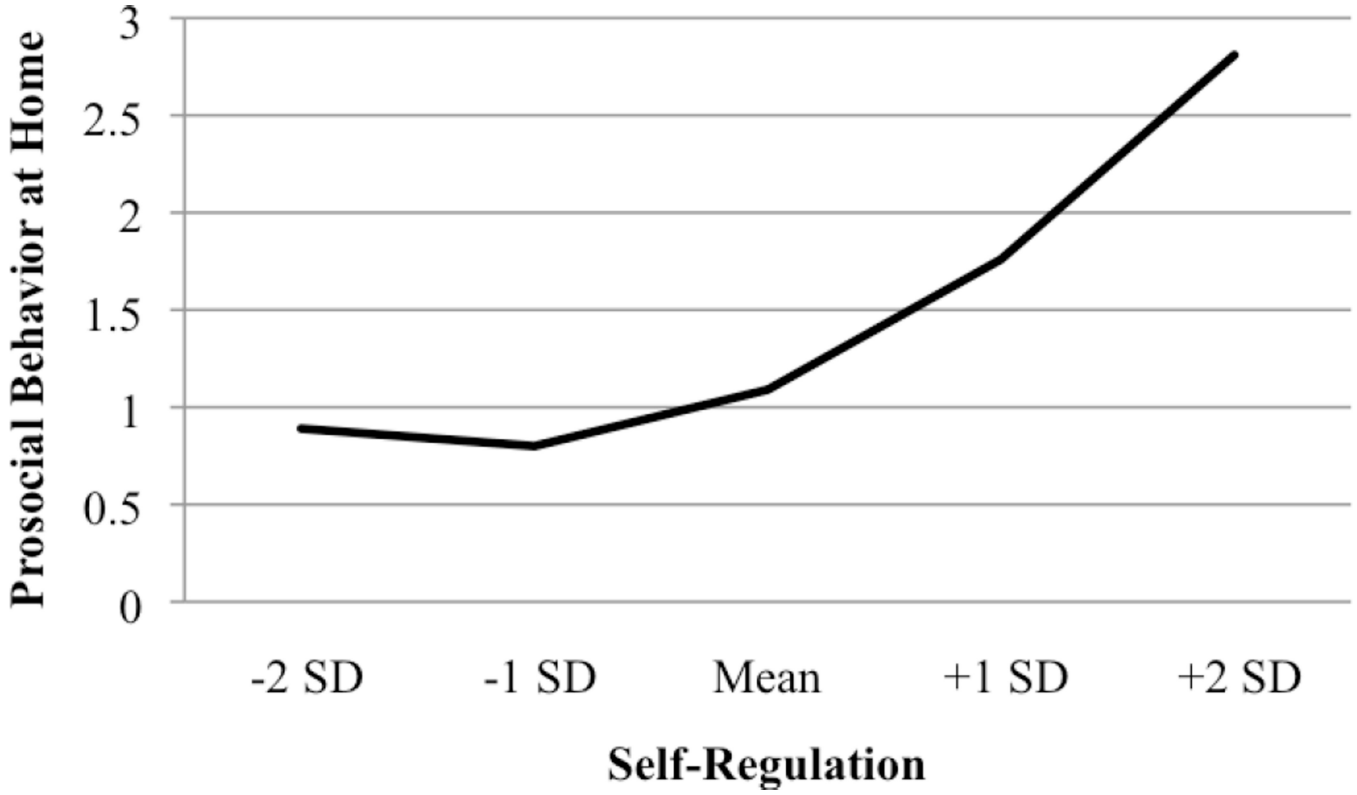

Figure 2.
Curvilinear Effect of Self-Regulation Predicting Prosocial Behaviors at Home Concurrently.

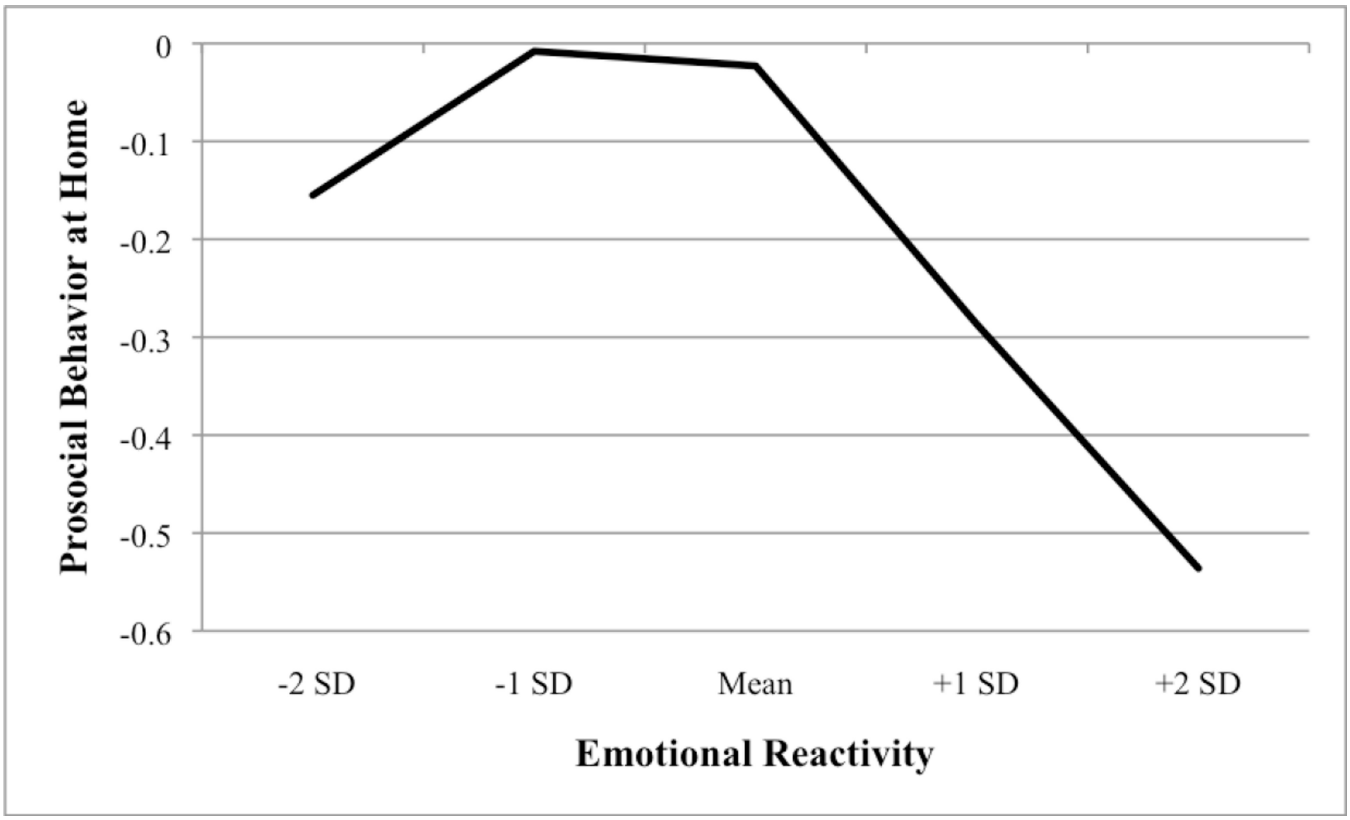

Figure 3.
Curvilinear Effect of Emotional Reactivity Predicting Prosocial Behaviors at Home Concurrently.

Table 1

Descriptives and Bivariate Correlations for Main Effect Variables

Variable	1	2	3	4	5	6
1. Pubertal Timing	-	.01	−.06	−.08	−.12*	.02
2. Emotional Reactivity		−	−.49**	−.22**	−.32**	−.31**
3. Self-Regulation			-	.39**	.37**	.33**
4. Prosocial Behavior in the Home (6th)				-	.18**	.49**
5. Prosocial Behavior with peers (6th)					-	.20**
6. Prosocial Behavior in the home (10th)						-
Mean (SD)	2.74 (.92)	3.05 (.82)	2.35 (.49)	1.01 (.41)	1.69 (.33)	1.14 (.38)

Note:

* $p < .05$

** $p < .001$

Table 2

Standardized Regression Results Predicting Prosocial Behaviors in the Home (n=1,096)

	Concurrent				Longitudinal			
Variable	**Step 1**	**Step 2**	**Step 3**	**Step 4**	**Step 1**	**Step 2**	**Step 3**	**Step 4**
Income to Needs	−0.03	−0.04	−0.04	−0.03	−0.01	−0.01	−0.01	−0.01
Gender	−0.01	−0.03	−0.05	−0.04	0.04	0.03	0.02	0.02
Pubertal timing	0.05	0.16*	0.16*	0.16**	0.08*	0.11	0.11	0.11
Reactivity	−0.01	0.01	0.01	0.05	−0.16**	−.20**	−0.19**	−0.16**
Self-Regulation	0.41**	0.37**	0.36**	0.48**	0.24**	0.23**	0.22**	0.28**
Gender X Pubertal timing		−0.13*	−0.13*	−0.13*		−0.03	−0.03	−0.03
Gender X Reactivity		−0.01	0.01	−0.01		0.07	0.07	0.07
Gender X Self-Reg		0.08	0.10	0.04		0.05	0.07	0.05
Self-Reg X Reactivity		−0.03	0.01	0.05		−0.07	−0.04	−0.07
Gender X Self-Reg X React			−0.05	−0.06			−0.04	−0.05
Curvilinear Reactivity				−0.12**				−0.14*
Curvilinear Self-Reg				0.19**				0.08
R^2	.17**	.18**	.18**	.20**	.13**	.14**	.14**	.15**
ΔF		4.42	0.00	13.55**		3.16*	0.00	6.37*

* $p < .05$,

** $p < .001$

Table 3

Standardized Regression Results Predicting Prosocial Behaviors with Peers Concurrently (n=1096)

Variable	Step 1	Step 2	Step 3	Step 4
Income to Needs	0.14**	0.14**	0.14**	0.14**
Gender	0.03	0.03	0.04	0.05
Pubertal timing	−0.03	−0.02	−0.02	−0.03
Reactivity	−0.16**	−0.16*	−0.16*	−0.15*
Self-Regulation	0.33**	0.34**	0.34**	0.40**
Gender X Pubertal timing		−0.01	−0.01	−0.01
Gender X Reactivity		−0.01	−0.01	−0.02
Gender X Self-Regulation		−0.02	−0.03	−0.06
Self-Regulation X Reactivity		0.01	−0.01	0.05
Gender X Self-Reg X Reactivity			0.02	0.02
Curvilinear Reactivity				−0.01
Curvilinear Self-Regulation				0.10
R^2	.23**	.23**	.23**	.23**
ΔF		.00	.00	.00

** $p<.001$,

* $p<.05$