

THE IMPLICATIONS OF CONCEPTIONS OF ADOLESCENCE FOR
ADOLESCENTS' PSYCHOLOGICAL ADJUSTMENT:
EXPERIMENTAL AND LONGITUDINAL NEUROIMAGING EVIDENCE

BY

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DISSERTATION

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ABSTRACT

Adolescence is often seen as a time of irresponsibility. However, prior research indicates that there is substantial variability in the extent to which youth hold irresponsibility views of adolescence, which predicts their psychological adjustment (e.g., school engagement), as they navigate the early adolescent years. Building on this research, my dissertation addressed two key questions. In Study 1a and 1b, using experimental methods with early adolescents, I demonstrated that conceptions of adolescence play a *causal* role in youth's psychological adjustment. Youth induced to see the teen years as a time of responsibility showed more responsible behavior—that is, heightened school engagement and dampened risk taking, as indicated by both reports of behavioral intentions and daily behavior – due in part to anticipating more negative consequences for irresponsible behavior. These findings highlight the key role of views about teens in shaping youth's psychological adjustment over this phase of development. They also provide a potential foundation for interventions aimed at supporting youth in constructively navigating adolescence.

Given that adolescence is a time of dramatic brain development, in Study 2, I examined how views of teens in terms of family obligation contribute to changes in youth's neural processes that accompany their psychological adjustment over adolescence. Using a three-wave longitudinal neuroimaging approach, I demonstrated that seeing the teen years as a time of ignoring family obligation during early adolescence predicted increases over later adolescence in youth's neural activation involved in cognitive control, with such neural increases related to increases in their risk taking. These findings highlight neural plasticity over adolescence and underscore the detrimental role of negative stereotype of teens in youth's neural and psychological development at this stage.

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CHAPTER 1

GENERAL INTRODUCTION

The beliefs that individuals hold play a powerful role in shaping how they navigate their lives (e.g., Banaji & Gelman, 2013; Cimpian & Salomon, 2014; Dweck, 2000; Gilbert & Malone, 1995; Olson & Dweck, 2008). Youth's beliefs often serve as a mechanism by which the environment (e.g., culture and parenting) shapes their psychological adjustment (Olson & Dweck, 2008). Almost two decades ago, Buchanan and Holmbeck (1998) suggested that beliefs about the teen years contribute to youth's psychological adjustment during this phase of development (see also Holmbeck & Hill, 1988). Laypeople (e.g., parents and youth) hold distinct ideas about what adolescents are like compared to younger children (e.g., Buchanan & Holmbeck, 1998; Hines & Paulson, 2006). Similar to other stereotypes—for example, those about being female or being African American (e.g., Ambady, Shih, Kim, & Pittinsky, 2001; Steele & Aronson, 1995)—conceptions of adolescence may guide youth's affect, cognition, and behavior. Such conceptions may be particularly powerful as youth enter adolescence given that youth may be particularly sensitive to information about teens given that they are taking on a new role of which they are uncertain and may be in active search of guiding information (Ruble, 1994; Alfieri, Ruble, & Higgins, 1996).

How youth navigate adolescence depends in part on the culture in which they reside (e.g., Arnett, 1999; Larson & Verma, 1999). For example, youth in Mainland China do not appear to experience even the mild “storm and stress” that is normative in the United States when it comes to their relationships with parents, as well as engagement in school (e.g., Pomerantz, Qin, Wang, & Chen, 2009, 2011; Wang & Pomerantz, 2009). Drawing on Buchanan's work, in my prior research, I examined the idea that American and Chinese conceptions of adolescence differ,

which contributes to differences in their psychological adjustment over this phase of development. Indeed, American and Chinese youth view teens differently. For example, whereas American youth tend to see adolescence as a time of ignoring family obligations, Chinese youth tend to see it as a time of fulfilling family obligations (Qu, Pomerantz, Wang, Cheung, & Cimpian, 2016). Notably, the idea that the teen years are a time of responsibility, as manifest in fulfilling family obligations and engaging in effortful activity in school, predicts increased engagement in school among youth over time, partially accounting for Chinese (vs. American) youth's increased engagement over early adolescence.

My research, as well as that of other investigators, rules out the possibility that potential confounds, such as youth's prior adjustment, pubertal development, and gender, as well as their mother's educational attainment, account for the role of youth's conceptions in their psychological adjustment over adolescence (Buchanan & Hughes, 2009; Qu et al., 2016). However, the correlational nature of the research raises issues about causality. Hence, a key question is whether conceptions of adolescence as a time of responsibility actually exert a causal effect on youth's psychological adjustment. In the absence of experimental studies that change such conceptions among youth, the role of youth's conceptions in their psychological adjustment is unclear. The first goal of my dissertation was to evaluate if ideas about teens as responsible play a causal role in their psychological adjustment (Study 1a and Study 1b). It is my hope that the paradigm I used to identify the causal role of such ideas will set the foundation for future interventions that promote constructive youth development via youth's beliefs about adolescence.

Adolescence is a developmental phase marked by significant neural changes (Dahl, 2004; Casey et al., 2008), which are sensitive to environmental input and attributes of youth themselves (Blakemore & Millers, 2014). Recent neuroimaging research suggests that social aspects of

youth's environment (e.g., the family context) can modulate youth's neural development over adolescence, resulting in changes in their psychological adjustment (e.g., risk taking) (McCormick, Qu, & Telzer, 2016). Given the power of youth's beliefs (Buchanan & Hughes, 2009; Blackwell, Trzesniewski & Dweck, 2007; Qu et al., 2016), youth's views of teens have the potential to be instrumental in the neural changes that youth experience over adolescence. Hence, following up on my work showing that youth's ideas about teens in regards to family obligation predict changes in their risk taking over time adjusting for their earlier risk taking as well as other potential confounds (e.g., pubertal development) (Qu, Pomerantz, Wang, & Ng, in preparation; see also Buchanan & Hughes, 2009), the second goal of my dissertation was to elucidate how conceptions of adolescence in regards to family obligations shape changes in the neural processes that accompany risk taking during adolescence (Study 2).

CHAPTER 2

STUDY 1

Changing Youth's Conceptions of Adolescence: Implications for Their Psychological Adjustment

More than a century ago, Hall (1904) proposed that adolescence is characterized by “storm and stress”. He made the case that the teen years are a time of heightened conflict with parents, mood disruption, and risk taking. The empirical work that followed indicated that indeed adolescent storm and stress exists, but is not severe (for reviews, see Arnett, 1999; Steinberg, 2001). Moreover, contemporary scholars argue that the teen years can actually be a time of flourishing given supportive environments (Dahl, 2004; Steinberg, 2014), with some evidence to support this idea (e.g., Lerner et al., 2005; Fredricks & Eccles, 2006). However, negative ideas about adolescence are widely held by American lay people, including teachers, parents, and adolescents themselves (e.g., Buchanan & Holmbeck, 1998; Hines & Paulson, 2006). There is substantial variability in the extent to which youth hold storm and stress views of the teen years, which is of importance given that it is predictive of variability in youth’s psychological adjustment—for example, how engaged they are in school—over these years (e.g., Buchanan & Hughes, 2009; Qu, Pomerantz, Wang, Cheung, & Cimpian, 2016; Qu, Pomerantz, Wang, & Ng, in preparation).

Although youth’s views of teens appear to contribute to their psychological adjustment (e.g., school engagement and risk taking behavior), the research to date has been correlational. Hence, despite the use of longitudinal designs that take into account youth’s prior adjustment, as well as a variety of potential confounds (e.g., pubertal growth and socioeconomic status), it is unclear if youths’ conceptions of adolescence play a *causal* role in their psychological

adjustment. The central goal of Study 1a and 1b of my dissertation is to address this issue. To this end, I will use experimental methods to change youth's conceptions and then evaluate the implications for their psychological adjustment in two key areas in which storm and stress is often evident during adolescence: (1) engagement in school and (2) risk-taking behavior. Elucidating the causal role of youth's views of teens will set the foundation for interventions aimed at supporting youth in constructive navigation of adolescence.

Conceptions of Adolescence

Decades of research makes it clear that both children and adults hold beliefs about the characteristics of individuals based on their membership in social categories—for example, being female (Ceci, Williams, & Barnett, 2009; Bigler, Jones, & Lobliner, 1997; Tiedemann, 2000). Although such stereotypes are often inaccurate, they often guide individuals' affect, cognition, and behavior (e.g., Ambady, Shih, Kim, & Pittinsky, 2001; Good, Rattan & Dweck, 2012; Jacobs, Davis-Kean, Bleeker, Eccles, & Malanchuk, 2005; Smith, Lewis, Hawthorne, & Hodges 2013; Steele & Aronson, 1995). Buchanan and colleagues (1998) make the case that a salient social category is the developmental phase to which children belong—for example, toddlerhood or adolescence (see also Holmbeck & Hill, 1988). These investigators find that laypeople hold distinct conceptions of adolescents compared to younger children. Although such conceptions may be based on accurate base rate information to some extent, they also may be based on exaggerated media portrayals of teens as well as extreme, but memorable, instances of teen behavior (Gilliam & Bales, 2001; Nichols & Good, 2004).

It is thus not surprising that American adults and youth tend to see adolescence in a negative light (e.g., Galván, Spatzier, & Juvonen, 2011; Hines & Paulson, 2006), despite only mild storm and stress during this phase of development (Arnett, 1999). Initial research conducted

by Buchanan and Holmbeck (1998) asked parents, teachers, and college students in the United States to rate both adolescents and elementary school children on a variety of characteristics that their pilot research indicated were seen as descriptive of adolescents. Overall, adolescents were regarded more negatively than were their elementary school counterparts. For example, teens were seen as more rebellious (e.g., testing limits) and conforming, particularly to peers (e.g., easily influenced by friends). Qu and colleagues' (2016) research indicates that early adolescents also hold storm and stress views of teens. When American youth rated the extent to which attributes characterized teens versus younger children, they indicated that teens were more likely than younger children to individuate from parents, disregard family obligations, disengage from school, and be oriented toward peers. Notably, the research to date indicates that there is substantial variability among youth, as well as adults, in the United States in the extent to which they hold storm and stress conceptions.

Arnett (1999) argues that outside the West there may be less storm and stress during adolescence, which appears to be the case in China (e.g., Pomerantz, Qin, Wang, & Chen, 2009, 2011; Wang & Pomerantz, 2009). Confucian ideas such as filial piety (i.e., children repaying their family for their efforts in raising them by bringing honor to their family and making sacrifices for their family) continue to be salient in Chinese societies despite increasing exposure to Western culture (Ikels, 2004; Wong, 2013; Sinha & Niedermeyer, 2012). Such ideas may lead youth to see the teen years as a time of fulfilling their family obligations often through engagement in school given its practical and moral importance in China (Pomerantz et al., 2011). Indeed, Qu and colleagues (2016) found that youth from a traditional area of China were more likely to see adolescence in a positive light than do American youth, particularly when it came to be responsible as manifest in fulfilling family obligations and engaging in effortful activities for

school. However, in more urban areas of China where there is more exposure to Western culture, youth may see adolescence as a time of more storm and stress similar to their Western counterparts. Indeed, this is the case in Hong Kong, which is rooted in traditional Chinese culture, but because of its history as a British colony is more Westernized than many areas in Mainland China (Tse, Belk, & Zhou, 1989). Hong Kong youth see teens (vs. younger children) as individuating from parents, disregarding family obligations, disengaging from school, and being oriented toward peers more so than their Mainland Chinese counterparts residing in less Westernized urban areas (Qu et al., in preparation).

Implications for Youth's Psychological Adjustment

Youth's conceptions of adolescence may contribute to how they navigate this phase of development (e.g., Pomerantz et al., 2011; Qu et al., 2016). Focusing on variability within the United States, Buchanan and Hughes (2009) make the case that views of teens act as self-fulfilling prophecies shaping the pathways youth take over the adolescent years. Youth's conceptions of adolescence may shape the expectations and standards they hold for themselves (for evidence that mothers' views of teens predict their expectations for their youth, see Buchanan, 2003), which ultimately guide their behavior (Buchanan & Hughes, 2009; Meece, Wigfield, & Eccles, 1990). For example, if youth see it as normative to be irresponsible—by, for example, disregarding their family obligations and disengaging from school—during adolescence, they may come to hold expectations and standards for themselves that set the stage for being irresponsible. These expectations and standards may act as self-fulfilling prophecies and guide youth toward irresponsible behavior as they navigate the early adolescent years (e.g., Buchanan & Hughes, 2009; Madon, Gyll, Spoth, Cross, & Hilbert, 2003). In addition, when youth view irresponsible behavior as normative, they may not see such behavior as leading to

negative outcomes given that it is so common among their peers. For example, disengaging from school may not be seen as creating undesirable consequences for their future academic endeavors as it is simply what teens do at this stage.

Empirical evidence is in line with these ideas. Youth's expectations for their own "storm and stress" behavior (e.g., risk taking and alienation from the family) during adolescence predicts heightened externalizing behavior among youth as well as dampened closeness with their parents one year later during early adolescence, over and above youth's prior behavior and closeness (Buchanan & Hughes, 2009; for evidence that mothers' expectations predict youth's risk taking, see Madon et al., 2003). Moreover, the more youth see teens (vs. younger children) as ignoring their family obligations and disengaged from school, the less they are engaged in school six months later over and above their earlier engagement in school as well as other potential confounds such as pubertal growth (Qu et al., 2016). Similarly, the more youth see adolescence (vs. earlier years) as a time of irresponsibility, as manifest in disregarding family obligations and disengaging from school, the more they take part in risky activities (e.g., cheating or fighting) during early adolescence, over and above their earlier antisocial tendencies and other potential confounds (e.g., gender, pubertal development, and parents' educational attainment) (Qu et al., in preparation).

Changing Youth's Conceptions

Although previous longitudinal research suggests that youth's conceptions of adolescence may contribute to their psychological adjustment as they navigate the teen years, the research is correlational. Hence, it is not possible to establish the *causal* role of youth's conceptions. The key goal of the first two studies (Study 1a and Study 1b) of my dissertation was to examine if indeed youth's conceptions of adolescence play a causal role in their psychological adjustment

during this phase of development. Critical to this endeavor is changing youth's conceptions to see if this influences their adjustment. Hence, the question arises of whether it is possible to change youth's conceptions when they may already have deeply rooted ideas about what it means to be a teen, likely based on multiple experiences and observations. Although youth may have chronic ideas about what it means to be a teen, their ideas may also be sensitive to situational cues as is the case with other beliefs youth and adults hold (e.g., Cimpian & Markman, 2011; Dweck, 2000; Heyman, Dweck, & Cain, 1992; Molden & Dweck, 2000). In fact, such cues are likely to have played a role in the formation of youth's conceptions over time. As youth reach adolescence, they may be particularly sensitive to information about teens as they are taking on a new role of which they are uncertain and may be in active search of guiding information (Ruble, 1994; Alfieri, Ruble, & Higgins, 1996).

Although no extant research focuses on changing youth's conceptions of adolescence, it is clear that youth's beliefs about a variety of important issues can be changed (e.g., Cimpian & Markman, 2011; Rhodes, Leslie, & Tworek, 2012). For example, youth's gender stereotypes can be altered through a variety of methods (e.g., Bigler, 1995; Bigler & Liben, 1990; Hilliard & Liben, 2010). As demonstrated by Bigler and Liben (1992), children who receive multiple classification training (i.e., sorting people based on both gender and occupation) are less likely to hold gender stereotypes than are children who do not receive such training, but instead participate in a group discussion of specific occupations with other children. Experimental interventions to change youth's beliefs also lead to changes in their behavior (e.g., Blackwell, Trzesniewski & Dweck, 2007; Yeager, Trzesniewski, & Dweck, 2013). For example, youth who are induced to believe that intelligence is malleable show significantly greater improvement in

their motivation and achievement six month later compared to youth who are taught about study skills (Blackwell et al., 2007).

Overview of the Current Research

Using experimental methods to change youth's beliefs, the goal of Study 1a and 1b of my dissertation was to evaluate whether youth's views of teens play a causal role in their engagement in school (e.g., paying attention in class and monitoring their understanding of learning material) and risk taking behavior (e.g., alcohol use and association with risky peers), with attention to youth's expectations for the consequences of these two types of behaviors given that such expectations may be an important mechanism by which youth's beliefs shape their psychological adjustment. Prior research suggests that adolescence is often seen as a time of irresponsibility in terms of meeting societally valued standards. For example, youth see teens as disregarding family obligations, disengaging from school, and taking risks more than their younger counterparts (Buchanan & Hughes, 2009; Qu et al., 2016). Notably, these ideas about teens as irresponsible in the context of the family (i.e., fulfilling family obligations) and school (i.e., engagement in school) are predictive of children's psychological adjustment (i.e., school engagement and risk taking) (Qu et al., 2016; Qu et al., in preparation). Thus, I focused on youth's conceptions of adolescence in regards to responsibility in my dissertation research.

In designing an experimental manipulation to change children's conceptions of adolescence in regards to responsibility, I developed a paradigm that guides youth to reframe what is considered normative teen behavior. I also relied on research on brief interventions emphasizing the importance of processing information supporting new beliefs (e.g., Walton & Cohen, 2011; Yeager & Walton, 2011). In Study 1a and 1b, youth were induced to view adolescence as a time of responsibility with a focus on the family and school contexts. Other

public settings (e.g., in a store, restaurant, or at someone else's house) were also included to capture other contexts in which risk taking may be prevalent. My aim was to lead youth to hold *constructive* conceptions in the hope of setting a foundation for an intervention. Youth were first presented with information that there is an inaccurate stereotype about teens, such that people tend to think teens are irresponsible. They were then instructed to describe teen behavior that they have observed that is counter to such stereotypes. Having youth come up with their own examples is important. First, it allows thorough processing of the idea of teen responsibility with instances that are real and relevant to youth. Second, it permits youth to be the generator (i.e., the autonomous agent) rather than recipient (i.e., the controlled pawn) of the information, which may be important at this age when there is a focus on independence, particularly in regards to adult-driven standards (Steinberg & Silverberg, 1986).

The first two studies of my dissertation research focused on early adolescence, specifically the first year of middle school, because this may be a sensitive period in terms of youth's conceptions of adolescence. With the entry into adolescence, youth may be particularly sensitive to information about teens as they are taking on a new role of which they are uncertain and may be in active search of guiding information (Ruble, 1994; Alfieri, Ruble, & Higgins, 1996). Youth in one of the most urbanized regions in China—Shanghai—were studied. Although Shanghai is rooted in Chinese culture, it is also widely exposed to Western culture due to its history as the most important economic and trade center in Mainland China since the early 20th century. On one hand, youth in urban China receive information from their families, schools, and the media regarding traditional Chinese norms about teens, such as fulfilling family obligations. On the other hand, like youth in Hong Kong, they are frequently exposed to Western culture, which may lead them to hold more Westernized conceptions of adolescences compared with

their counterparts in less urban areas in China (Qu et al., in preparation). Given their exposure to both Chinese and Western cultures, youth in Shanghai may live in a bicultural society such their beliefs are flexible (Hong, Morris, Chiu, & Benet-Martinez, 2000).

Study 1a

In Study 1a, I evaluated whether manipulating youth's conceptions of adolescence as a time of responsibility (1) influences youth's views about this phase of development; (2) shapes the consequences they think school engagement and risky behavior yield; (3) contributes to their intentions in regards to school engagement and risky behavior. Mediation analyses were also conducted to identify if the effect of the conceptions manipulation on youth's school engagement and risky behavior intentions as well as anticipated consequences worked through youth's views of teens. The mediational role of youth's anticipated consequences in the link between the conceptions manipulation and youth's behavioral intentions was also examined.

Method

Participants. Participants were 124 (65 boys) Chinese youth in the seventh grade (mean age = 13.31 years, $SD = 0.36$). They were recruited from two middle schools in urban areas in Shanghai. The areas are in close proximity to a major state university, with families primarily from working- and middle-class backgrounds. One school was a lower-achieving school and the other was a higher-achieving school. Within each school, youth in two classes participated. In this area at the time of the study, almost all (99%) of residents were of Han Chinese ethnicity (World Population Review, 2015), which is the major ethnicity in China.

Procedure. Within each school, youth in one class were assigned to the responsibility conception manipulation condition and youth in the other class were assigned to the control condition. Because youth's assignment to each class within each school was random, the two

classes did not differ in terms of achievement. Youth in the two conditions received different versions of open-ended materials in which they elaborated on adolescents' behavior. To evaluate if the conception manipulation changed how youth see the teen years, youth reported on their conceptions of adolescence using the close-ended measure developed by Qu and colleagues (2016, in preparation). To evaluate whether the conception manipulation changed youth's behavioral intentions, youth reported on their intentions in terms of school engagement and risk taking. Each participating class received a total of RMB200 for their participation in the project.

In the responsibility conception condition, youth read a passage indicating that teens are often portrayed by the media (e.g., books, TV shows, and the movies) as rebellious and irresponsible (see Appendix A). Examples of such storm and stress portrayal were provided (e.g., teens in movies are often shown as being disrespectful of their parents and adults see teens as not really putting effort into school). The storm and stress stereotype was then described as incorrect. It was pointed out that a lot of teens are not rebellious and irresponsible and that sometimes the teen years are even described as a time of becoming responsible. Youth were then instructed to tell us what teens do at home when they interact with their family, at school, and somewhere else (e.g., a store, restaurant, or someone else's house) that shows they are responsible. Youth were given one box for each of the three contexts (i.e., family, school, and somewhere else).

In the control condition, youth were simply instructed to tell us about the typical teen by listing common teen behaviors (see Appendix B). The example of watching TV was provided, with detailed explanation of such behavior (i.e., "They have certain shows that they like. They might watch the shows they like during for a break from doing other things. Or maybe they watch with their friends or family"). Youth then listed three behaviors that are pretty common for teens. Youth were given one box for each of the three.

To ensure that youth in the responsibility conception condition indeed provide examples of responsible behavior, and that the two conditions did not vary on other dimensions, such as the details of the descriptions, youth's descriptions were coded by trained native Chinese coders who had spent 90% or more of their lives in China on three dimensions: (1) The extent to which the behavior described is responsible, with responses being coded as irresponsible (e.g., "Use dirty language."), neutral (e.g., "They play basketball together with friends."), or responsible (e.g., "Do homework carefully. Pay attention in class. Get along with classmates.") (Cohen's kappa = .97); (2) the number of words participants used in their descriptions, which was calculated by a word counting program; (3) how concrete the descriptions were (1 = *not concrete at all*, 2 = *a little concrete*, 3 = *very concrete*) (ICC = .95). As shown in Table 1, a Multivariate Analysis of Variance (MANOVA) indicated that youth in the two conditions differ in their descriptions of teen behavior in regards to responsibility, $F(3, 120) = 69.27, p < .001$. Youth in the responsibility conception condition listed more responsible, $F(1, 122) = 153.22, p < .001$, as well as less neutral and irresponsible, $F(1, 122)s > 29.65, p < .001$, behaviors than did youth in the control condition. However, there were no differences between the two conditions in terms of numbers of words, $F(1, 122) = 1.99, p = .16$, or concreteness, $F(1, 122) = .18, p = .67$.

Measures. The measures were initially created in English. Standard translation and back-translation procedures (Brislin, 1980) were followed to generate the Chinese versions, with repeated discussion among American and Chinese members of the research team to modify the wording of the items to ensure equivalence in meaning (Erkut, 2010). Linguistic factors were taken into account so that the measures were easily understandable to youth in China.

Conceptions of adolescence. After filling out the manipulation material, youth completed the conceptions of adolescence measure developed by Qu et al. (2016, in preparation) (see

Appendix C) to assess views of teens in regards to *family obligation* (12 items; e.g., “work hard to meet parents’ expectations”, $\alpha = .83$) and *school engagement* (6 items; e.g., “put a lot of effort into school”, $\alpha = .70$). A new scale to assess the teen years as a time of *risk taking* (e.g., 8 items; “do things that would get themselves or others hurt (e.g., race on a bike)”, $\alpha = .92$) was also used given that refraining from risky behavior may be part of acting responsibly. For each item, youth rated to what extent the behavior or attitude is more true during versus before the teen years (1 = *more true before teen years*, 4 = *equally true before and during teen years*, 7 = *more true during teen years*). The mean of the items for each dimension was taken, with lower numbers indicating that the dimension is more common *before* the teen years and higher numbers indicating it is more common *during* the teen years.

Behavioral intentions. Nine items modified from measures assessing youth’s behavioral and cognitive engagement in school (Dowson & McInerney, 2004; Skinner, Kindermann, & Furrer, 2009) were used to assess youth’s *school engagement intentions*. For each of nine items (e.g., “When I’m in class, I will listen very carefully.” and “I will try to plan out my schoolwork as best I can.”, $\alpha = .95$), youth rated how likely (1 = *not likely at all*, 7 = *extremely likely*) it would be for them to engage in the behavior in the next several days. The nine items were averaged, with higher numbers indicating greater school engagement intentions.

Youth’s *risk-taking intentions* were assessed with 11 items adopted from prior measures of risk taking (Barber, Stolz & Olsen, 2005; Stattin & Kerr, 2000). Youth indicated for each item how likely (1 = *not likely at all*, 7 = *extremely likely*) it would be that they would engage in the behavior described (e.g., “I will damage/destroy public property.” and “I will steal things from places other than home”, $\alpha = .92$) over the next several days. The mean of the items was taken, with higher numbers reflecting greater risk-taking intentions.

Anticipated consequences. Youth's evaluation of *school engagement outcomes* was measured with nine items used in the measure of school engagement intentions. However, for each item (e.g., "When I'm in class, I listen very carefully." and "I try to plan out my schoolwork as best I can.", $\alpha = .98$), youth indicated the likelihood of a positive versus negative outcome (1 = *extremely likely positive outcome*, 4 = *neither positive nor negative outcome*, 7 = *extremely likely negative outcome*). This approach has been used in previous measures to assess cognitive appraisal of specific behaviors (e.g., Cognitive Appraisal of Risky Events Questionnaire, Fromme, Katz, & Rivet, 1997). The mean of the nine items was taken and reverse scored, with higher numbers representing greater perceived positive outcomes of school engagement.

Youth's evaluation of *risk-taking outcomes* was assessed with 11 items from the risk-taking intentions measure. For each item (e.g., "I damage/destroy public property." and "I steal things from places other than home.", $\alpha = .97$), youth indicated the likelihood of a positive versus negative outcome (1 = *extremely likely positive outcome*, 4 = *neither positive nor negative outcome*, 7 = *extremely likely negative outcome*). The mean of the nine items was taken and reverse scored, with higher numbers representing greater perceived positive outcomes of risk-taking behavior.

Results

Three major sets of analyses were conducted. First, to evaluate if the responsibility conception manipulation contributes to how youth see the teen years, youth's conceptions of adolescence in the responsibility conception and control conditions were compared. Second, I examined whether the responsibility conception manipulation changes youth's intentions in terms of school engagement and risk taking as well as the anticipated consequences of such behavior. The third set of analyses examined whether youth's views of teens mediate the effect

of the responsibility conception manipulation on their intentions and anticipated consequences, with attention to whether the responsibility conception manipulation plays a role in youth's behavioral intentions via their anticipated consequences of such behaviors. The correlations between the measured variables are presented in Table 2.

Effect of the conception manipulation.

Conceptions of adolescence. A MANOVA was conducted to examine the effects of the responsibility conception manipulation on youth's views of the teen years. There was a multivariate effect of condition, Wilks' lambda = .92, $F(3, 120) = 3.66, p < .05$, with the univariate tests indicating that youth induced to see adolescence as a time of responsibility viewed the teen years in a more positive light than did their counterparts in the control condition (see Table 3). As anticipated, youth in the responsibility conception condition saw the teen (vs. earlier) years as more of a time of being responsible to the family than did youth in the control condition, $F(1, 122) = 5.30, p < .05$. Youth in the responsibility conception condition also viewed teens (vs. younger youth) as more engaged in school, $F(1, 122) = 4.25, p < .05$, and as involved in less risk taking behavior than did youth in the control condition, $F(1, 122) = 6.35, p < .05$.

Behavioral intentions and anticipated consequences. A MANOVA on youth's intentions yielded a multivariate effect of condition, Wilks' lambda = .89, $F(4, 113) = 3.63, p < .01$, with the univariate tests revealing a pattern consistent with the hypotheses. As shown in Table 4, youth in the responsibility conception (vs. control) condition reported greater intended engagement in school in the next several days, $F(1, 122) = 7.27, p < .01$. They also saw school engagement as more rewarding, $F(1, 117) = 7.50, p < .01$. Although youth in the two conditions did not differ in their intended risk-taking behavior, $F(1, 122) = .17, p > .68$, youth in the

responsibility conception (vs. control) condition saw risk taking as yielding greater negative outcomes, $F(1, 117) = 6.24, p = .01$.

The mediational role of conceptions. To examine if youth's conceptions mediate the effects of the responsibility conception manipulation on their behavioral intentions and anticipated consequences for such behavior, bias-corrected bootstrapping resampling techniques were used to test the indirect effect with youth's conception as mediators (Preacher & Hayes, 2008). Youth's conceptions about family obligation, school engagement, and risk taking were included in the model simultaneously. Using 1000 bootstrap resamples, results indicated that youth's conceptions account for the effect of the responsibility conception manipulation on school engagement intention: After taking into account the three conceptions, the condition difference in youth's intended school engagement was no longer significant, $\beta = .14, p = .11$, with a 42% reduction in the total effect. This was largely due to youth's conceptions about family obligation, 95% CI: [.01, .11] and risk taking, 95% CI: [.01, .15], rather than school engagement, 95% CI: [-.04, .05]. Similarly, the effect of the responsibility manipulation on youth's anticipated consequences for school engagement was partially mediated by youth's conceptions of adolescence, with the indirect path via youth's conceptions about family obligation being significant, 95% CI: [.01, .12]. The condition difference in youth's anticipated consequences for school engagement was reduced by 20%, although the difference remained significant. However, youth's conceptions did not mediate the link between the responsibility manipulation and youth's anticipated consequences for risk taking as the paths from youth's conceptions to their anticipated consequences for risk taking were not evident, $\beta s < .09, p s > .37$.

I next examined whether the effect of the manipulation on youth's school engagement intentions is mediated by their anticipated consequences of school engagement. Using 1000

bootstrap resamples, the indirect path from the responsibility conception manipulation to youth's anticipated consequences of school engagement to their school engagement intentions was significant (see Figure 1), 95% CI: [.03, .18]. The condition difference in youth's intended school engagement was reduced by 36%.

Study 1b

Study 1a demonstrated that youth's conceptions of adolescence can be changed so that they are more constructive with implications for youth's intentions for school engagement and risk taking as well as youth's anticipated consequences for such behavior. However, there are several major limitations to Study 1a. The first has to do with the control condition. Youth in the responsibility conception manipulation condition were instructed to list teens' behaviors that are inconsistent with the irresponsibility stereotype in specific contexts (i.e., home, school, and somewhere else), but youth in the control condition were instructed to simply listed attributes of teens without specific context cues. Hence, the differences between the two conditions in Study 1a could be driven by youth in the responsibility conception condition elaborating on teen behavior in specific contexts. To address this issue, the control condition in Study 1b required youth to give examples of teens' behaviors in different contexts identical to the responsibility conception manipulation condition.

Second, it is possible that the findings are simply due to experimental demand. Participants in Study 1a are told what teens are like in the manipulation materials and then immediately asked what teens are like and what they themselves are like. It is possible that the Study 1a participants were simply attempting to comply with the information provided in the manipulation when they completed the subsequent scales. To address the issue of experimental demand, in Study 1b the manipulation and survey portions were administer to youth by separate

research assistants ostensibly conducting separate studies. Third, Study 1a examined youth's behavioral *intentions*. Youth may often not follow through on their intentions for a variety of reasons (e.g., peer influence or self-control). Hence Study 1b had youth report on their behavior each day for the three days following the conceptions manipulation.

Method

Participants. Participants were 319 (160 boys) Chinese youth in the seventh grade (mean age = 13.26 years, $SD = 0.36$). They were recruited from three middle schools in urban areas in Shanghai, with four participating classes in each school. The areas are in close proximity to a major state university, with families primarily from working- and middle-class backgrounds. The schools were either below- or above-average in regards to youth's achievement. At the time of the study, almost all (99%) of residents in the areas were of Han Chinese ethnicity (World Population Review, 2015).

Procedure. Within each school, two classes were assigned to the responsibility conception condition and two to the control condition. The procedure was identical to Study 1a with a few exceptions. First, the control condition was modified to be parallel to the responsibility conception condition to a greater extent (see Appendix D). Specifically, youth in the control condition provided descriptions of typical teen behaviors in the exact same three contexts (e.g., at home when they interact with their family, in school, or somewhere else) used in the responsibility conception condition. Similar to Study 1a, I examined whether youth in the responsibility conception condition provided examples of responsible behavior (Cohen's kappa = .91), with attention as well to the length and concreteness ($ICC = .90$) of the responses. As in Study 1a, there were no differences in terms of the numbers of words (see Table 5), $F(1, 317) = .15, p = .70$, or concreteness, $F(1, 122) = 1.30, p = .25$. However, a MANOVA indicated that

youth in the two conditions differ in their descriptions of teen behavior in regards to responsibility, $F(3, 315) = 178.48, p < .001$. Youth in the responsibility conception condition listed more responsible, $F(1, 317) = 474.23, p < .001$, as well as less neutral and irresponsible behaviors, $F(1, 317)s > 104.95, p < .001$, than did youth in the control condition.

Second, to minimize experimental demand, the manipulation and assessment were described as two *separate* studies. A research assistant introduced him/herself to the class and indicated that there were two studies that youth would be helping out with today—one for him/her and one for someone else. The research assistant then distributed the materials for the conception manipulation, which were read to children with time given for them to complete the behavioral descriptions as in Study 1a. To further minimize experimental demand, the research assistant also gave youth an English word search puzzle to work on as a break for five minutes. This also served as a measure of their engagement (see below). When youth were done with the puzzle, they put the behavioral descriptions and puzzle into an envelope and handed it in to the researcher who thanked them all for their time. A second research assistant then told youth she/he had a study on youth's planning for them to do. In this context, the research assistant administered the behavioral intentions and anticipated consequence measures (see Study 1a), which youth returned to the second research assistant in a second envelope.

Third, to get closer to assessing youth's actual behavior rather than simply their intentions, youth completed a daily report (see Measures section below) each day for three days during the same class period. The second research assistant administered the daily checklist.

Measures. Children's behavioral intentions and anticipated consequences in regards to school engagement and risk taking were assessed on the day of the manipulation as in Study 1a ($\alpha > .74$). Filler items were included (e.g., "I will watch TV." and "I will read for enjoyment.")

to reduce the focus on responsible behaviors, thereby minimizing experimental demand. Given that Study 1a has already demonstrated that the responsibility conception manipulation can lead youth to see adolescence in a more positive light, youth's conceptions of adolescence was not assessed in Study 1b to ensure that the conceptions manipulation is distinct from the assessment portion of the study (see above).

When the word search puzzle following the conception manipulation was introduced, the research assistant made it clear that working on the puzzle can sharpen students' English skills, but that it was up to them whether they work on the puzzle or not; they could rest as well as read or work on something from their desk if they preferred. Youth were given five minutes for this break. The puzzle was a 15x15 letter matrix, with hidden words that were at the appropriate level for youth in 7th grade in Shanghai (e.g., "test" and "science"). The numbers of words that youth correctly found in the word-search puzzle were calculated and used as an index of *school engagement*.

At the end of school each day for three days after the day of manipulation, youth's *school engagement* was assessed using seven items modified from measures assessing school engagement (see Appendix E; Dowson & McInerney, 2004; Skinner et al., 2009). These items were selected for two reasons. First, they occur frequently on a daily basis without the constraints of class activities (e.g., participating in class discussions was excluded because teachers may not provide such opportunities on that day). Second, based on the examination of each item of school engagement intentions used in Study 1a, youth rated the selected items relatively high, indicating that they may be more likely to engage in such behavior in daily life. For each of the seven items (e.g., "Listened very carefully in class." and "Tried hard to do well in school.", $\alpha > .92$ for each day), youth rated how often (1 = *not at all*, 5 = *all of the time*) they

engaged in the behavior in school on that day. The seven items were averaged for each day, with higher numbers indicating greater school engagement for that day.

Youth's *risk-taking behavior* was assessed with daily reports using eight items adopted from prior measures of risk taking (see Appendix F; Barber et al., 2005; Stattin & Kerr, 2000). Similar to the measure for school engagement, these items were selected because they may occur relatively frequently on a daily basis (e.g., smoking cigarettes was excluded because very few youth indicated that they would engage in that in Study 1a). Youth indicated for each item how often (1 = *not at all*, 5 = *all of the time*) they engaged in the behavior described (e.g., "Cheated on an assignment or exam." and "Hung around with kids who get in trouble.", $\alpha s > .70$ for each day) on that day. The mean of the eight items was taken for each day, with higher numbers reflecting greater risk-taking behavior for that day.

Results

Three major sets of analyses were conducted. First, similar to Study 1a, I examined whether the responsibility conception manipulation influences youth's behavioral intentions in terms of school engagement and risk taking as well as the anticipated consequences of these two types of behaviors. To this end, MANOVAs were conducted to examine the effects of the responsibility conception manipulation on youth's behavioral intentions and anticipated consequences of such behavior. Second, I evaluated whether the responsibility conception manipulation contributes to youth's daily behavior. To this end, a repeated measures MANOVA was conducted on the three daily reports. Third, mediation analyses were conducted to examine whether the effects of the responsibility conception manipulation on youth's behavioral intentions and daily behavior are mediated by their anticipated consequences of such behavior. The correlations between the measured variables are presented in Table 6.

Effect of the conception manipulation.

Behavioral intentions and anticipated consequences. A MANOVA was conducted to examine the effects of the responsibility conception manipulation on youth's intentions and anticipated consequences. There was a multivariate effect of condition, Wilks' lambda = .94, $F(7, 311) = 3.10, p < .01$, with the univariate tests revealing a pattern consistent with Study 1a. As shown in Table 7, youth in the responsibility conception (vs. control) condition correctly found more words in the word search puzzle, $F(1, 317) = 6.66, p = .01$. They also reported greater intended engagement in school in the next several days, $F(1, 317) = 8.90, p < .01$, and saw school engagement as more rewarding, $F(1, 317) = 12.41, p < .001$. As anticipated, youth in the responsibility conception (vs. control) condition reported less intended risk-taking behavior, $F(1, 317) = 5.60, p < .05$, and saw risk taking as yielding greater negative outcomes, $F(1, 317) = 4.83, p < .05$. There was no condition difference in youth's responses to filler questions with regard to behavioral intentions or anticipated consequences, $F(1, 317)s < .09, ps > .77$.

Daily behavior. A MANOVA with each day of the three days of the daily reports as a repeated measured was conducted to examine the effects of the responsibility conception manipulation on youth's daily behavior. There was a main effect of condition for school engagement, $F(1, 291) = 13.63, p < .001$, without a Condition x Time interaction, $F(2, 582) = .07, p = .93$. Subsequent univariate tests indicated that youth in the responsibility conception (vs. control) condition reported greater engagement in school on each of the three days of the daily reports (see Table 8), $F(1, 291)s > 9.63, ps < .01$. For youth's daily risk-taking behavior, there was a main effect of condition, $F(1, 291) = 4.43, p < .05$, as well as a Condition x Time interaction, $F(2, 582) = 3.44, p < .05$. Subsequent univariate tests indicated that youth in the responsibility conception (vs. control) condition reported less risk-taking behavior on the first

day of the daily reports, $F(1, 291) = 8.56, p < .01$, as well as the second day, $F(1, 291) = 3.72, p = .05$, but not on the third day, $F(1, 291) = .62, p = .43$. For both youth's school engagement and risk taking, it appeared that filling out daily checklist fostered better adjustment. Engagement increased over the three days of the daily reports, $F(2, 582) = 2.97, p = .05$, with an even larger tendency for risk taking to decrease, $F(2, 582) = 23.37, p < .001$. .

The mediational role of anticipated consequences. To examine whether the effect of the manipulation on youth's behavioral intentions and daily behavior is mediated by their anticipated consequences, a set of mediation analyses were conducted. Similar to Study 1a, using 1000 bootstrap resamples, the indirect path from the responsibility conception manipulation to youth's anticipated consequences of school engagement to their school engagement intentions was significant (see Figure 2), 95% CI: [.03, .12]. The condition difference in youth's intended school engagement was reduced by 42%. The effect of the manipulation on youth's intended risk-taking behavior was mediated by their anticipated consequences of risk taking (see Figure 3), 95% CI: [.01, .08], with a reduction of 32% in the total effect.

I further examined whether the effect of the manipulation on youth's daily behavior is mediated by their anticipated consequences of such behavior. Given that the manipulation had a similar effect on youth's school engagement across all three days of the daily reports, youth's school engagement across the three days were averaged to represent their daily school engagement. Using 1000 bootstrap resamples, the indirect path from the responsibility conception manipulation to youth's anticipated consequences of school engagement to their daily school engagement was significant (see Figure 4), 95% CI: [.03, .12]. The condition difference in youth's daily school engagement was reduced by 33%, although the difference remained significant. Given that the manipulation only had significant effects on youth's risk-taking

behavior on the first and second days of the daily reports, youth's risk-taking behavior on these two days were averaged to represent their daily risk taking. The effect of the responsibility manipulation on youth's daily risk taking was mediated by youth's anticipated consequences for risk taking (see Figure 5), 95% CI: [.01, .07], with a reduction of 31% in the total effect.

Discussion

Many youth may hold negative beliefs about the teen years that contribute to the mild storm and stress that characterizes adolescence for many youth as they navigate the adolescent years (e.g., Buchanan & Hughes, 2009; Qu et al., 2016). Prior research has used longitudinal approaches to show that youth's conceptions of adolescence play a role in their psychological adjustment during this period of development (Buchanan & Hughes, 2009; Qu et al., 2016). Despite stringent analyses that take into account potential confounds (e.g., prior psychological adjustment and pubertal growth), prior research has not provided insight into whether youth's conceptions actually play a causal role in their adjustment. In Study 1a and Study 1b, I used experimental methods to change youth's conceptions, so that they see the teen years as a time of responsibility. Importantly, as revealed by both youth's behavioral intentions and daily behavior, youth's conceptions of the teen years in terms of responsibility shape their psychological adjustment as manifest in their engagement in school and risk taking behavior via their expectations for the consequences of such behavior.

Changing Conceptions of Adolescence

A key aim of Study 1a was to examine if it is possible to change youth's conceptions of adolescence. Although youth's beliefs may be rooted in their experiences and observations over the course of their lives, such beliefs may also be sensitive to situational cues (e.g., Cimpian & Markman, 2011; Dweck, 2000). Using a closed-ended measure of conceptions, Study 1a

demonstrated that youth who are induced to see adolescence as a time of responsibility tend to view the teen years in a positive light. As anticipated, youth in the responsibility conception condition saw the teen (vs. earlier) years as more of a time of being responsible, as manifest in fulfilling family obligations, engaging in school, and refraining from risk taking, than did youth in the control condition. It is possible that early adolescence is a sensitive period in terms of youth's conceptions of adolescence. As youth enter adolescence, they may be particularly sensitive to information about teens as they are taking on a new role of which they are uncertain and may be in active search of guiding information (Ruble, 1994; Alfieri et al., 1996). By presenting information that highlights the inaccurate negative stereotypes about teens, the manipulation provides youth with situational information about teens, which they may search for during this stage.

The Role of Conceptions of Adolescence in Youth's Psychological Adjustment

A key goal of the current research was to examine whether conceptions of adolescence play a causal role in youth's psychological adjustment. Consistent with hypotheses, both Study 1a and Study 1b indicate that guiding youth to see adolescence as a time of responsibility can change their behavioral intentions. Specifically, youth in the responsibility conception condition reported greater intentions to be engaged in school in the next several days than did youth in the control condition. Although there was no effect of the responsibility conception manipulation on youth's intentions with regard to risk taking in Study 1a due to low rate of occurrence, there was such an effect in Study 1b in which care was taken to ask about risk taking that may occur relatively frequently on a day-to-day basis.

Study 1b moves a step further and demonstrates that the manipulation can lead to change in youth's daily behavior. Using a behavioral assessment of school engagement (i.e., the word

search puzzle), youth in the responsibility conception (vs. control) condition found more correct words, suggesting that they spent more effort working on the puzzle. Moreover, the effect of the manipulation on youth's daily school engagement lasts across three days after the manipulation. However, the effect of manipulation on youth's risk taking becomes weakened over time. Youth in the responsibility conception condition reported less risk taking behavior on the first and second days of the daily reports, but not on the third day, than did their counterparts in the control condition. These findings suggest that risk taking may be less likely to change over the longer term compared to school engagement among youth. Given that school engagement can lead to positive outcomes to youth (e.g., getting good grades in school or being praised by teachers), it may have a cascade effect and youth are motivated to maintain their engagement in school. However, less involvement in risk taking activities may not result in obvious positive consequences to youth, and sometimes it may even have negative consequences (e.g., being perceived as less cool by peers), which makes youth less likely to maintain low risk taking behavior. Moreover, filling out the daily checklist seems to draw youth's attention about their own behavior and promote better adjustment over time. Although it remains unclear if this effect is driven by changes in youth's actual behavior or just self-presentational bias, it seems that youth in the control condition reported less risk taking over time because daily checklist draws attention about their own behavior.

A key question is why conceptions of adolescence shape youth's psychological adjustment. One potential mechanism examined in the current research is youth's expectations for the consequences of their behavior. When youth view responsible behavior as normative, they may tend to see such behavior as leading to more positive outcomes and less negative outcomes given that it is common for teens. Such expectations for outcomes may further guide

youth to engage in such behavior. Indeed, as shown in Study 1a and Study 1b, the effect of manipulation on youth's behavioral intentions and daily behavior is mediated by their anticipated consequences of such behavior. Youth who are induced to see the teen years as a time of responsibility view school engagement as more rewarding, and thus they tend to report greater intended school engagement and work hard in school in the following days. Similarly, these youth see risk taking as yielding greater negative outcomes, leading them to report less intended risk taking behavior and be involved in less risky activities on a daily basis. Therefore, the responsibility conception manipulation plays a role in youth's behavioral intentions and daily behavior via their anticipated consequences of such behaviors. In some cases, youth's anticipated consequences only partially mediated the link between condition and behavioral outcomes. For example, the effect of manipulation on youth's daily school engagement is partially mediated by their anticipated consequences of school engagement. This may be because other mechanisms, such as self-fulfilling prophecies, also play a role in the link between conceptions of adolescence and youth's psychological adjustment. It is possible that youth are influenced by the manipulation and put effort into school, but they are not consciously aware of the positive outcomes of school engagement. Although it is hypothesized that youth's anticipated consequences of behavior play a mediational role in the link between manipulation and youth's behavior, it is also possible that youth change their anticipated consequences due to cognitive dissonance. For example, to justify their greater intentions for school engagement, youth are more likely to report that they see school engagement as rewarding.

Notably, as expected, the effect of the responsibility conception manipulation on youth's intentions and daily behavior is mediated by youth's views of teens. For example, in Study 1a, inclusion of youth's three conceptions of adolescence—seeing the teen years as a time of

increased family obligation and school engagement as well as dampened risk taking—account for the effect of the manipulation on school engagement intention. This suggests that the manipulation leads to changes in youth’s behavioral intentions via changing their conceptions of adolescence. Youth’s conceptions of adolescence only partially mediated the effect of manipulation on some outcomes (e.g., anticipated consequences for school engagement). It may be because youth are not aware of their conceptions, so they cannot fully report their conceptions. Or the closed-ended measures of conceptions may not have comprehensively what it means for teens to be responsible.

Limitations and Future Directions

The current research has several limitations, pointing to directions for future research. First, the current research examines the causal role of conceptions of adolescence in youth’s psychological adjustment using a sample of Chinese youth who reside in urban regions of China. It is possible that these youth are exposed to both Chinese and Western cultures, so their beliefs are flexible to change. Future research is needed to evaluate whether the experimental paradigm used in the current research is also effective in changing American youth’s conception of adolescence and promoting their responsible behavior. As revealed by prior research, American youth also showed substantial variation in their conceptions of adolescence (Qu et al., 2016). Moreover, for both American and Chinese youth, ideas about being responsible in the family and school during the teen years predict their actual responsible behavior over time (e.g., greater engagement in school). Given that the experimental paradigm in the current research focuses on promoting responsibility conceptions, it may be also effective in changing American youth’s beliefs and subsequent behavior.

Second, the current research focused on guiding youth to see adolescence as a time of responsibility and did not look at conceptions in terms of irresponsibility. Therefore, it is still unknown if irresponsibility conceptions play a causal role in youth's storm and stress behavior. Prior longitudinal research suggests that youth who hold a storm and stress view of teens may show greater risk taking over time (Buchanan & Hughes, 2009). Future research can use experimental methods to guide youth to see teens as irresponsible, and elucidate if such views lead to more storm and stress in youth's daily life (e.g., dampened school engagement and heightened risk taking).

Third, the experimental paradigm has the potential to be developed as formal interventions to promote constructive youth development. Such interventions can be easily implemented in school settings, such as class discussion and activity. For example, together with their peers, youth can reflect on the how the media portrays teens in a stereotypical way and what teens' daily behavior is inconsistent with such stereotypes. Communication with their peers in a supportive environment can facilitate youth's processing of the information and help them reframe the teen years in a positive light. It will also be useful to examine if these interventions can lead to improvement in other types of psychological adjustment (e.g., parent-child relationships and prosocial behavior). Based on findings of the current research, it is highly possible that such interventions can create long-lasting effects on youth's responsible behavior via changing their beliefs about teens.

Fourth, although the current research uses experimental methods to change youth's conceptions of adolescence and their psychological adjustment, it is unclear where and how youth get these views about teens in daily life. Given that there is substantial variation in the extent to which youth hold negative views of the teen years (e.g., Buchanan & Hughes, 2009; Qu

et al., 2016), it is important to examine the origin of such views. Given developmental research suggesting that parents are often central in transmitting cultural ideas to youth, they may play a role in the development of youth's conceptions of adolescence, thereby shaping youth's adjustment over this phase. Therefore, research is needed to examine whether and how parents transmit their conceptions of adolescence to youth. Moreover, future research can examine if it is possible to change parents' conceptions of adolescence, which lead to change in their parenting practices when they interact with their youth, and ultimately promote youth's psychological adjustment.

Conclusions

Using an experimental paradigm, the current research demonstrates that conceptions of adolescence play a causal role in youth's psychological adjustment. In two studies, youth who were induced to see the teen years as a time of responsibility showed more responsible behavior—that is, heightened school engagement and dampened risk taking, as indicated by both behavioral intentions and daily behavior. Moreover, the effect of the manipulation on youth's behavioral intentions and daily behavior is mediated by their anticipated consequences of such behavior. These findings highlight the key role of views about teens in shaping youth's psychological adjustment, and provide a valuable foundation for large-scale interventions aimed at supporting youth in constructive navigation of adolescence.

CHAPTER 3

STUDY 2

Conceptions of Adolescence Predict Changes Over Adolescence in the Prefrontal Cortex and Risk Taking

Adolescence in the United States is often portrayed in a negative light. A classic example is the “storm and stress” view of this phase of development (Hall, 1904). Although research reveals only mild storm and stress during adolescence (Arnett, 1999; Larson & Ham, 1993), American youth and adults tend to hold negative views of the teen years (e.g., Buchanan & Holmbeck, 1998; Hines & Paulson, 2006). However, there is substantial variability in both youth’s and adults’ conceptions of adolescence, which is of significance as it appears to modulate youth’s psychological adjustment over the teen years (e.g., Buchanan & Hughes, 2009; Qu, Pomerantz, Wang, Cheung, & Cimpian, 2016). For example, the more youth see the teen years as a time of shirking family obligations, the less responsibly they navigate the initial years of adolescence in that they are less likely to maintain their engagement in school and more likely to become involved in risk taking activities (Qu et al., 2016; Qu, Pomerantz, Wang, & Ng, in preparation).

Youth’s conceptions of adolescence may also modulate the neural processes that accompany their psychological adjustment over this phase of development. Recent neuroimaging studies suggest dramatic changes in the brain during adolescence, which are sensitive to the environment, as well as attributes of youth themselves (for reviews, see Blakemore & Mills, 2014; Crone & Dahl, 2012). Study 2 of my dissertation examined the role of youth’s conceptions of adolescence as a time of shirking family obligations in the development of neural processes that accompany risk taking among youth over adolescence. I focused on the cognitive control

system of the brain given its importance to risk taking (e.g., Steinberg, 2008). With the aim of providing new insights into neuroplasticity during adolescence, I used a longitudinal neuroimaging approach to investigate if youth's views of teens as disregarding their obligations to the family predict changes in their neural activation when they engage in cognitive control, with attention to links to youth's risk taking.

Conceptions of Adolescence as a Time of Shirking Family Obligations

Decades of theory and research make it clear that both youth and adults hold beliefs about the characteristics of individuals based on their membership in social categories—for example, being female (Ceci, Williams, & Barnett, 2009; Bigler, Jones, & Lobliner, 1997; Tiedemann, 2000). Although such stereotypes are often inaccurate, they often guide individuals' affect, cognition, and behavior (e.g., Ambady, Shih, Kim, & Pittinsky, 2001; Good, Rattan & Dweck, 2012; Jacobs, Davis-Kean, Bleeker, Eccles, & Malanchuk, 2005; Smith, Lewis, Hawthorne, & Hodges 2013; Steele & Aronson, 1995). Buchanan and colleagues (1998) make the case that a salient social category is developmental phase (see also Holmbeck & Hill, 1988). These investigators find that laypeople in the United States hold distinct conceptions of adolescents compared to younger children. American youth and adults tend to see adolescence in a negative light compared to earlier phases of development (e.g., Buchanan & Holmbeck, 1998; Hines & Paulson, 2006; Qu et al., 2016) despite the fact that there is only mild storm and stress during this phase (Arnett, 1999; Larson & Ham, 1993).

The view that the teen years are a time in which youth are relatively irresponsible when it comes to the family appears to be particularly instrumental in shaping how youth navigate the initial adolescent years (Qu et al., 2016; Qu et al., in preparation). Perhaps as part of the idea that adolescence is a time of individuating from parents (e.g., Collins & Steinberg, 2006; Grotevant

& Cooper, 1986; Tsai, Telzer, & Fuligni, 2013; Youniss & Smollar, 1985), American youth see adolescence (vs. the earlier years) as a time of shirking family obligations in that youth are less respectful of their parents, feel less compelled to help out around the house, and are less concerned with their parents' approval (Qu et al., 2016). Buchanan and Hughes (2009) argue that youth's views of teens act as self-fulfilling prophecies in shaping their psychological adjustment over adolescence. For example, if youth see it as normative to ignore family obligations during adolescence, they may come to hold expectations and standards for themselves that set the stage for disregarding such obligations. As a consequence, they may not attempt to exert the self-control necessary to regulate their behavior in a manner that meets with their parents' approval, leading to difficulties in inhibiting irresponsible behavior, such as risk taking.

Indeed, the more youth view teens as shirking family obligation, the less they are able to maintain their engagement in school over early adolescence (e.g., monitoring their understanding of the material they are learning at school and planning out their schoolwork) and the more their risk taking (e.g., using alcohol and hanging around with kids who get in trouble) increases over this phase of development, over and above their earlier school engagement and risk taking, as well as other potential confounds such as pubertal development and maternal education (Qu et al., 2016; Qu et al., in preparation). Given the importance of self-control in inhibiting the heightened reward seeking that can increase risk taking during adolescence (e.g., Duell et al., in press; Romer, Duckworth, Sznitman, & Park, 2010; Steinberg et al., 2008), a key question is whether youth's conceptions of adolescence as a time of dampened family obligation undermine the development of self-control over this phase of development.

Neural Development of Self-Control During Adolescence

As youth enter adolescence, their self-control is still developing, with protracted maturation over the course of this phase and even into early adulthood (Steinberg et al., 2008). Such protracted maturation is accompanied by neural changes (for a review, see Bunge & Wright, 2007). A key brain region involved in self-control is the lateral prefrontal cortex (PFC) (Miller & Cohen, 2001). The PFC begins to develop in early childhood, continuing to mature over the course of adolescence. During this phase and into young adulthood, there are significant structural and functional changes in the PFC (Steinberg, 2008). Sizeable evidence indicates that the PFC is involved in cognitive control (Levy & Wagner, 2011; Wessel et al., 2013). Given that effective cognitive control is needed to inhibit risky behavior (Steinberg, 2008), it is not surprising that PFC activation is linked to risk taking among youth during adolescence (e.g., Fecteau et al., 2007; Schonberg et al., 2012).

Youth's views of teens as disregarding family obligations may contribute to the development of the PFC during adolescence. The more youth see adolescence as a time of dampened family obligation, the less often they may exert self-control to regulate their behavior in an effort to act responsibly. As a consequence, exerting self-control may become a more effortful process, which may be reflected in an increase over time in PFC activation during cognitive control as youth need to recruit more neural resources. Although prior research using cross-sectional designs is mixed in terms of what constitutes mature self-control related activation (for a review, see Crone & Dahl, 2012), recent research using longitudinal designs suggests that increases over time in PFC activation are an indicator of poor self-control and associated with increases in risk taking over adolescence (McCormick et al., 2016; Qu et al., 2015). Thus, viewing teens as disregarding family obligation may foster changes in prefrontal

cortex activation when youth engage in cognitive control over adolescence, which are related to increases in their risk taking.

Overview of the Current Research

The goal of Study 2 of my dissertation is to examine role of youth's conceptions of adolescence as a time of dampened family obligation in the development of youth's neural processes that accompany changes in their risk taking over adolescence. To this end, I used a three-wave longitudinal neuroimaging design. Youth reported on their views of teens as shirking family obligation in early adolescence (i.e., 7th grade) at which time they may be particularly sensitive to information about teens as they are taking on a new role of which they are uncertain (Ruble, 1994; Alfieri et al., 1996). To ensure the unique role of such views, data on potential confounds were also obtained. Namely, because youth who view adolescence as a time of dampened family obligation may have poor relationships with parents, mother-child relationship quality was assessed during a 15-min interaction between the two. Youth also reported on their pubertal development as such development is linked to conceptions of family obligation (Qu et al., 2016) and risk taking (Icenogle et al., in press). To examine changes over time in neural activation in the context of cognitive control, youth were scanned as they completed a cognitive control task (i.e., the Go/Nogo task) one year following the conceptions assessment (i.e., 8th grade) and then a year later in the first year of high school (i.e., 9th grade). At both of these time points, youth reported on their risk taking. I focused on the transition from middle to high school, because there is a significant drop in school attendance over this transition (Benner & Wang, 2014), providing more opportunities for risk taking.

I tested three key hypotheses. First, I examined whether youth's conceptions of adolescence as a time of dampened family obligation during middle school predict changes in

their risk taking as they move from middle to high school. Replicating prior research (Buchanan & Hughes, 2009; Qu et al., in preparation), it was anticipated that the more youth see adolescence as a time of shirking family obligations, the more their risk taking would increase over the transition to high school. Second, and most centrally, I evaluated if a parallel trend would exist for changes in neural activation in the PFC during cognitive control. I hypothesized that the more youth view teens as disregarding family obligations, the more effort they exert to recruit neural resources when they engage in cognitive control, as reflected in increases over the transition to high school in PFC activation during the Go/Nogo task. Third, I examined how such neural changes are related to changes in risk taking over the transition to high school. Given recent evidence from longitudinal neuroimaging research (McCormick et al., 2016; Qu et al., 2015), increases in prefrontal cortex activation were expected to be associated with increases in youth risk taking over time.

Method

Participants

This research was part of the University of Illinois Middle School Motivation Project in which youth were studied beginning in the seventh grade in the United States (see Cheung, Pomerantz, Qu, & Wang, in press; Qu et al., 2016). In the spring of seventh grade (T1), 203 (110 boys) youth (mean age = 13.26 years) participated. One year later, a small subset of the original sample was contacted to participate in a follow-up study. Twenty-three (13 boys) youth (mean age = 13.08 years at T1) underwent a functional MRI scan in the spring of eighth (T2; mean age = 14.39 years) and then again in the spring of ninth grade (T3; mean age = 15.20). Youth who showed excessive inter-slice head movement (> 2.0 mm), or did not provide self-report data were excluded from the analyses, yielding a final sample of 20 youth. These youth were primarily

(65%) European American, with 22% being African American, and 7% other races (e.g., Asian American). A majority of American mothers reported that their highest educational degree was a college degree or greater (62%); 38% reported their highest degree as a high school diploma.

Survey Measures

Conceptions of adolescence. At T1, youth reported on their conceptions of adolescence as a time of family obligation with Qu and colleagues' (2016) measure. Youth rated to what extent six behaviors or attitudes reflecting family obligation (e.g., "work hard to meet parents' expectations" and "care little about fulfilling family obligations" [reverse-scored], $\alpha = .80$) is true during the teen years versus before the teen years (1 = *more true before teen years*, 5 = *equally true before and during teen years*, 9 = *more true during teen years*). The items were modified from Fuligni's (1999) and Ng, Loong, Liu, and Weatherall's (2000) scales of family obligation. The mean of the six items was taken, with lower numbers indicating that fulfilling family obligation was more common *before* the teen years and higher numbers indicating that it was more common *during* the teen years.

Mother-child relationship quality. At T1, mothers visited the laboratory with youth. The two took part in a 15-min. video-recorded session in which youth were give a challenging set of cognitive problems, the Raven's Progressive Matrices (Raven, Court, & Raven, 1977), to solve (for a more detailed description, see Cheung et al., in press). Mothers were told that they could provide as little or as much help as they wanted. The quality of the relationship between mothers and youth over the course of the interaction was coded (1 = *negative*, 5 = *positive*) by three coders using a coding system adapted from the Iowa Family Interaction Rating Scales (IFIRS; Melby et al., 1998). With visibly unhappy, conflicted, and brittle (e.g., mother is unresponsive to the needs of child) interactions indicating negative relationships and visibly open,

satisfying, pleasing, communicative, and warm (e.g., mother and child respond appropriately to each other's needs) interactions indicating positive relationships. Inter-rater reliability between the three coders was acceptable (ICCs = .68 to .91 among the coders, with an average of .83).

Pubertal development. At T1, youth completed Petersen, Crockett, Richards, and Boxer's (1988) Pubertal Development Scale (PDS). The scale is comprised of five items (1 = *no development*, 4 = *development is complete*). Both boys and girls reported on growth spurt, hair growth, and skin changes; boys also reported on voice change and facial hair and girls on breast development and menarche status (1 = *no*, 4 = *yes*). The mean was taken with higher numbers indicating more advanced pubertal development ($\alpha = .79$).

Youth risk taking. At T2 and T3, youth reported on their risk-taking behavior using the externalizing subscale from the Brief Problem Monitor Scale (Achenbach & Rescorla, 2001). Youth completed 13 items indicating to what extent (1 = *not all true*, 5 = *very true*) they engage in a variety of risky behaviors (e.g., "I stole things." and "I hung around with peers who got in trouble."); $\alpha s = .92$). The mean was taken with higher numbers indicating more risk taking. To examine changes over time, difference scores between T1 and T2 (i.e., T2 minus T1 scores) were calculated, with greater scores indicating greater increases in risk taking.

fMRI Task

At T2 and T3, during the fMRI scans, youth completed a Go/NoGo task (see Figure 6). The Go/Nogo task has been widely used in fMRI studies to measure neural reactivity underlying cognitive control; the PFC is reliably recruited in the task (e.g., Liddle, Kiehl, & Smith, 2001; Menon, Adleman, White, Glover, & Reiss, 2001). Youth were presented with brief (500 ms) trials in which they saw a single letter. They were instructed to press a button to all letters (go trials) with the exception of X (no-go trials). Xs were presented on 25% of the trials. Thus, youth

developed a pre-potent response to press during go trials but had to inhibit during no-go trials. Each trial was separated by a fixation period that is jittered with a gamma distribution ($M = 1000$ ms). Youth completed the task four times across 4 separate blocks. Each block of the task consisted of 80-trials, comprising 20 nogo and 60 go trials. Each block was separated by a 60s rest period. Following previous studies using the Go/Nogo task (Liddle et al., 2001; Menon et al., 2001), behavioral performance on the task was the false alarm rate, an index of how often youth pressed the button on no-go trials.

fMRI Data Acquisition

Imaging data were collected using a 3 Tesla Siemens Trio MRI scanner. The Go/NoGo task included T2*-weighted echoplanar images (EPI) [slice thickness = 3mm; 38 slices; TR = 2s; matrix = 92x92; FOV = 230 mm; voxel size 2.5x2.5x3mm³]. Structural scans consisted of a T2 weighted, matched-bandwidth (MBW), high-resolution, anatomical scan (TR = 4s; TE = 64ms; FOV = 230; matrix = 192x192; slice thickness = 3mm; 38 slices) and a T1* magnetization-prepared rapid acquisition gradient echo (MPRAGE; TR = 1.9sec; TE = 2.3ms; FOV = 230; matrix = 256x256; sagittal plane; slice thickness = 1mm; 192 slices). The orientation for the MBW and EPI scans was oblique axial in order to maximize brain coverage.

fMRI Data Preprocessing and Analysis

Data were preprocessed and analyzed using Statistical Parametric Mapping (SPM8; Wellcome Department of Cognitive Neurology, Institute of Neurology, London, UK) software package. Preprocessing was conducted separately for the T2 and T3 scans. Preprocessing included spatial realignment to correct for head motion, and coregistration with the high-resolution T1* MPRAGE structural scan, which was subsequently segmented into grey matter, white matter, and cerebrospinal fluid. The transformation matrix used to normalize the

MPRAGE images was applied to the MBW and functional images to transform them into the standard stereotactic space defined by the Montreal Neurological Institute and the International Consortium for Brain Mapping. Normalized functional images were smoothed using an 8mm Gaussian kernel, full-width-at-half maximum, to increase the signal-to-noise-ratio. The general linear model in SPM8 was used to perform statistical analyses, convolving each trial with a canonical hemodynamic response function. High-pass temporal filtering (cutoff 128s) was applied to remove low-frequency drift across the time series. Serial autocorrelations were estimated with a restricted maximum likelihood algorithm using an autoregressive model order of 1.

In each participant's fixed-effects model, a general linear model (GLM) was created for each regressor of interest to separate the different events, including successful go trials, successful no-go trials, false alarms (i.e., pressing on no-go trials), and misses (i.e., inhibiting the button response on go trials). These regressors were modeled separately for T2 and T3. Null events consisted of the jittered inter-trial fixation periods plus the one minute rest period between blocks and were not explicitly modeled therefore constituting the implicit baseline. To examine longitudinal changes in neural reactivity, contrasts between T2 and T3 were computed at the individual level.

Random effects, group-level analyses were performed on all individual subject contrasts using GLMFlex. GLMFlex corrects for variance-covariance inequality, partitions error terms, removes outliers and sudden activation changes in the brain, and analyzes all voxels containing data (http://mrtools.mgh.harvard.edu/index.php/GLM_Flex). Given that the primary goal of Study 2 of my dissertation is to examine neural activation supporting effective cognitive control, the group-level analyses focused on trials where youth successfully inhibited their responses (no-

go). To examine how youth's conceptions of adolescence (i.e., seeing the teen years as a time of shirking family obligation) are associated with changes in neural activation, whole-brain regression analyses were conducted by entering conceptions as a regressor on the contrast Nogo T2 > Nogo T1.

Correction for multiple comparisons was conducted using a Monte Carlo simulation through 3dClustSim from the AFNI software package (Ward, 2000) using the group-level brain mask. The simulation resulted in a voxel-wise threshold of $p < .005$ and a minimum cluster size of 42 voxels for the whole brain, corresponding to $p < .05$ corrected. To plot significant effects, parameter estimates of signal intensity were extracted from the clusters using the MarsBar toolbox in SPM. For visualization, statistical maps of all analyses were projected onto a T2 template.

Results

Preliminary Analyses

Preliminary analyses using a dependent t-test indicated that youth's risk taking did not differ from T2 ($M = 1.51$, $SD = .64$) to T3 ($M = 1.57$, $SD = .63$), $t(19) = -.70$, $p > .49$. Moreover, there was no significant change in youth's behavioral performance on the cognitive control task from T2 ($M = 8.51\%$, $SD = .04$) to T3 ($M = 8.47\%$, $SD = .05$), $t(19) = .06$, $p > .95$. The correlations between all variables are shown in Table 9.

Do Conceptions of Adolescence Predict Changes in Risk Taking?

The first set of central analyses examined whether youth's conceptions of adolescence in regards to family obligation during middle school (i.e., 7th grade) predict changes in their risk taking over the transition from middle (i.e., 8th grade) to high (i.e., 9th grade) school. Consistent with prior research, the more youth saw the teen years as a time of ignoring family obligations,

the more their risk taking increased over the transition from middle to high school (see Figure 7), $r = .64, p < .01$. This association remained after controlling for risk taking at T2, $pr = .62, p < .01$, suggesting that youth's views of teens regarding family obligation are associated with changes in their risk taking, above and beyond their risk taking at T2. Moreover, the association remained when analyses controlled for the quality of relationships between mothers and youth, youth's pubertal status, youth's gender, and mothers' educational attainment, $pr = .68, p < .01$.

Do Conceptions of Adolescence Predict Changes in Neural Reactivity During Cognitive Control?

In the second set of central analyses, I examined if youth's conceptions of adolescence predict changes in their neural responses on the cognitive control task. Preliminary analyses indicated that conceptions of adolescence were not predictive of changes in behavioral performance on the Go/Nogo task from T2 to T3, $r = .34, p > .14$. To evaluate if youth's conceptions of adolescence predict changes in their neural reactivity during cognitive control, whole brain regression analyses were conducted with conceptions regressed onto changes in neural activation during successful Nogo trials (T3 scan – T2 scan). As shown in Figure 8, the more youth viewed teens as ignoring family obligation, the more there was an increase over time in their bilateral ventrolateral prefrontal cortex (VLPFC) activation over time. To test whether this association holds after accounting for baseline VLPFC activation, I extracted parameter estimates of signal intensity from the same VLPFC region at T2. After controlling for T2 VLPFC activation, youth's conceptions at T1 were still predictive of increases in VLPFC activation over time. Moreover, the predictive effect of conceptions remained significant after controlling for

mother-child relationship quality, youth pubertal status, youth gender, or mothers' educational attainment¹.

Do Changes in Youth's Neural Reactivity Predict Changes in Their Risk Taking?

The third set of analyses was conducted to examine if changes in youth's neural reactivity are associated with changes in their risk-taking behavior over the transition to high school. To this end, the parameter estimates of signal intensity from the VLPFC cluster that showed significant changes as a function of family obligation conceptions were extracted. Correlation analyses using this functional ROI were conducted in SPSS. Consistent with prior research, youth who showed a greater increases in the VLPFC over time also showed greater increases in risk taking (see Figure 9), $r = .47, p < .05$. To eliminate the possibility that this association was driven by youth's initial level of risk taking, I further controlled for their risk-taking behavior at T2. The association between changes in the VLPFC activation and changes in risk taking remained significant, $pr = .50, p < .05$. Other covariates (i.e., mother-child relationship quality, youth pubertal status, youth gender, and mothers' educational attainment) did not account for this association, $pr = .51, p < .05$.

Discussion

Although there is only mild storm and stress during adolescence among American youth (Arnett, 1999; Larson & Ham, 1993), lay people often view teens in a negative light (e.g.,

¹ To evaluate if youth conceptions of adolescence predict neural reactivity during cognitive control at each time point, whole-brain regression analyses were conducted with conceptions of adolescence regressed onto neural activation during successful Nogo trials at T2 and T3 scans separately. Youth's conceptions of adolescence were not associated with any neural region at T2 or T3.

Buchanan & Holmbeck, 1998; Hines & Paulson, 2006). Such views about teens play an important role in shaping youth's psychological adjustment as they navigate the teen years (e.g., Buchanan & Hughes, 2009; Qu et al., 2016). Given that adolescence is a time of dramatic brain development (e.g., Blakemore & Mills, 2014; Crone & Dahl, 2012), a key question is whether conceptions of adolescence contribute to youth's neural development. Using a unique longitudinal fMRI approach, the current study examined how views of teens in terms of family obligation contribute to changes in youth's neural processes that accompany their risk taking. Consistent with prior research (Qu et al., in preparation), youth who saw the teen years as a time of ignoring family obligation showed longitudinal increases in risk taking over the transition from middle to high school. Notably, views of adolescence as a time of ignoring family obligation were also predictive of increases over time in the VLPFC activation during cognitive control. Such changes in youth's neural processing were related to increases in their risk taking. Taken together, the findings suggest that seeing the teen years as a time of ignoring family obligation may undermine the neural basis underlying cognitive control, which accompanies increases in risk taking over adolescence.

Building on previous studies on conceptions of adolescence (Buchanan & Hughes, 2009; Qu et al., 2016), the current research focused on the role of such conceptions in youth's transition from middle to high school, because such a transition can be stressful and incur more opportunities for risk taking due to a decline in school attendance (Benner & Wang, 2014). Consistent with prior findings, the more youth saw teens as ignoring family obligations, the more their risk taking increased over the transition to high school. Importantly, the predictive effects of conceptions of adolescence on changes in youth's risk taking remained significant, above and beyond youth's prior risk taking as well as other covariates (i.e., mother-child relationship

quality, youth pubertal status, youth gender, and mothers' educational attainment). Hence, our findings are not driven by initial level of risk taking or potential confounds, highlighting the unique role of conceptions in youth's psychological adjustment.

A key goal of the current research was to examine whether conceptions of adolescence in terms of family obligation contribute to youth's neural development. To this end, I used a unique longitudinal fMRI approach to capture youth's neural changes over adolescence. Although concurrent designs can provide insights into the association between youth's conceptions and their neural activation at a single time point, such conceptions may play a role in youth's neural development over time, which cannot be elucidated by concurrent designs. In contrast, longitudinal designs allowed us to examine the role of conceptions in neural changes, with links to individual differences in adolescent adjustment over time. Recent neuroimaging evidence suggests that youth's social context can modulate their neural development over adolescence. For example, a negative family environment (e.g., high family conflict) predicts increases in youth's neural activation involved in cognitive control (e.g., the VLPFC), which are associated with increases in risk taking over adolescence (McCormick et al., 2016). However, little is known about whether the beliefs that youth hold play a role in their neural development.

In the current research, youth who saw the teen years as a time of ignoring the obligation to the family showed increases over time in their VLPFC activation during cognitive control. This association remained significant after taking into account youth's prior VLPFC activation. It is important to note that youth with different views about teens do not differ in their behavioral performance on the Go/Nogo task from T2 to T3. This suggests that the changes in the VLPFC are driven by differences in how youth complete the task, but not by differences in youth's ability to succeed in the task when they are instructed to do so. The VLPFC is a relatively late

developing neural region and open to change during adolescence (Steinberg, 2008). Prior research has shown that the VLPFC is consistently involved in behavioral inhibition and impulse control (Levy & Wagner, 2011; Wessel et al., 2013). The findings suggest that youth who see the teen years as a time of ignoring family obligation may be less likely to exhibit self-control in daily life, and thus need to recruit more neural resources over time to inhibit their behavior. Moreover, recent evidence suggests that the normative neural change over adolescence is a decline in the VLPFC activation, with variation in such decline related to change in youth's risk taking (Qu et al., 2015). The change in VLPFC activation, which was predicted by how youth see teens in terms of family obligation, may be related to changes in youth's psychological adjustment. Indeed, consistent with prior research (Qu et al., 2015), longitudinal increases in the prefrontal cortex activation during cognitive control were related to increases in youth's risk taking over the transition to high school. Therefore, youth's views about teens as ignoring family obligation undermine their neural development of self-control as they navigate the teen years.

Study 2 of my dissertation research highlights the role of conceptions of adolescence—beliefs that youth hold about teens—in modulating youth's neural development and psychological adjustment. By seeing the teen years as a time of ignoring family obligation, youth may become less likely to exhibit self-control in daily life, resulting in a diminished ability in their neural process of self-control over time. Such dampened neural process may incur more risk taking. However, it is also possible that consistent involvement in risk taking over time may dampen the neural process of self-control. Therefore, the significant association between neural changes and behavioral changes may reflect reciprocal relationships between the two.

Moreover, additional analyses suggest that after controlling for conceptions of adolescence, the association between neural changes and behavioral changes was no longer

significant. This could be due to the high correlation between youth's conceptions and VLPFC changes. Statistically, conceptions of adolescence may account for most variance in the neural changes, with little variance left that are meaningful and predictive of risk taking. It may be also due to the fact that although youth's conceptions play a role in their neural and behavioral processes, these are two separate processes, during the transition from middle to high school. Perhaps in the long run, due to the potential reciprocal relationships between the two, youth neural changes and risk taking may become more closely related, over and above their views about teens.

Limitations and Future Directions

The current research has several limitations that point to directions for future research. First, given the small sample size in the current research, caution should be taken when interpreting the findings. Future studies are needed to examine the role of views about teens in youth's neurodevelopmental process in a larger sample size. Second, we examined the role of conceptions of adolescence in youth's neural development of self-control and did not investigate neural development of other processes (e.g., reward seeking). Using a cognitive control task (i.e., the Go/Nogo task), it is not surprising that regions in the prefrontal cortex showed significant association with youth's conceptions. Although the prefrontal cortex is still developing and open to change during adolescence (Steinberg, 2008), other neural regions may be also influenced by how youth see the teen years. For example, recent evidence suggests that youth's social contexts (e.g., the presence of peers or parents) can modulate neural reactivity in the reward-related regions (e.g., the ventral striatum), which are involved in sensation seeking and risk taking (e.g., Chein et al., 2011; Telzer, Ichien, & Qu, 2015). Therefore, to obtain a comprehensive picture of how conceptions of adolescence contribute to youth' neural functioning, future studies are

needed to examine how views about teens play in role in youth's neural development of reward-related regions, using tasks that are involved in reward seeking.

Third, although the present study takes into account several important covariates (e.g., youth's pubertal status, gender, mother-child relationship quality, and mothers' educational attainment), causal conclusions cannot be made. By taking into account youth's risk taking and VLPFC activation at T2, we ruled out the possibility that youth's conceptions of adolescence predict changes in their neural and psychological adjustment simply because they reflect youth's earlier adjustment. It will be still useful to elucidate the causal role of conceptions of adolescence in youth's neural development. Given that conceptions may contribute to changes in youth's neural functioning in the long run, future interventions can use experimental methods to guide youth to see the teen years as a time of fulfilling family obligation, and examine whether such interventions lead to changes in youth's neural development over time. Moreover, although the current research highlights the importance of how youth see the teen years, such views are not the only mechanism that contributes to individual differences in neural and psychological development. For example, factors in social contexts (e.g., parental depression) may also shape youth's neural process and risk taking (Qu et al., 2016). Hence, it will be useful to examine how the views about teens interact with other factors in modulating youth's navigation of the teen years.

Fourth, the current research focuses on the implications of youth's conceptions of adolescence for their risk taking, a key dimension of storm and stress (Arnett, 1999). However, such conceptions may also play an important role in shaping other dimensions of youth's psychological adjustment, such as school engagement and family relationships. Indeed, prior research suggests that the less youth see teens as ignoring family obligation, the more they are

engaged in school over time (Qu et al., 2016). Therefore, to better understand how views about teens contribute to changes in such psychological adjustment, it is important to examine the neural processes that accompany different dimensions of psychological adjustment over adolescence.

Conclusions

The current study provides novel evidence that conceptions of adolescence contribute to change in youth's neural processes that accompany their risk taking during adolescence. By using a unique longitudinal neuroimaging approach, we demonstrated that ideas that the teen years are a time of ignoring family obligation predict increases over time in youth's neural activation involved in cognitive control, with such neural increases related to increases in their risk taking. These findings highlight neural plasticity over adolescence and underscore the detrimental role of negative stereotype of teens in youth's neural and psychological development at this stage.

CHAPTER 4

GENERAL DISCUSSION

Although adolescence is not a time of severe storm and stress, many youth experience mild storm and stress during this important phase of development (Arnett, 1999). Therefore, decades of research has been devoted to examining what contributes to mild storm and stress. Although changes in biological underpinnings appear to be important (e.g., Casey, Getz, & Galvan, 2008; Steinberg, 2008), my earlier work on conceptions of adolescence across cultures suggests that youth's navigation of the teen years is also socially constructed—for example, via their views about teens (Qu et al., 2016; Qu et al., in preparation). Importantly, there is substantial variation in the extent to which youth hold these societally constructed views, which predicts youth's psychological adjustment, such as school engagement and risk taking, during the initial adolescent years, over and above their prior adjustment and potential confounds.

In my dissertation, I moved beyond prior research and demonstrated that conceptions of adolescence play a causal role in youth's psychological adjustment (Study 1a and 1b). Guiding youth to see adolescence as a time of responsibility leads them to be more responsible in terms of their engaging in school and refraining from risk taking. Moreover, conceptions of adolescence play a role not only in youth's psychological adjustment, but also in their neural development (Study 2). Findings from the two studies highlight that how youth view teens can shape their navigation over the adolescent years. Therefore, it is important to re-evaluate the messages about teens that youth receive in daily life (e.g., how teens are portrayed in movies and books) and reframe what is considered normative teen behavior as American teens are often portrayed as irresponsible, which may guide youth to hold negative views about teens and contribute to more storm and stress. Findings of my dissertation suggest that such effort is promising in terms of

promoting positive psychological adjustment and adaptive neural development during adolescence.

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TABLES

Table 1

Study 1a: Youth's descriptions of teens in the responsibility conception and control condition

	Responsibility Conception Condition	Control Condition	Effect Size (Cohen's d)
Conceptions	<i>M (SD)</i>	<i>M (SD)</i>	
Number of words	40.68 (19.90)	47.19 (30.41)	0.25
Concreteness	2.09 (0.65)	2.04 (0.63)	0.08
Number of responsible behavior	2.63 (0.89)	0.68 (0.86)	2.22
Number of irresponsible behavior	0.00 (0.00)	0.63 (0.91)	0.98
Number of neutral behavior	0.11 (0.32)	1.39 (1.09)	1.58

Note. Effect size (Cohen's d) is presented for the difference between the two conditions.

Table 2

Study 1a: Correlations between the variables

	1	2	3	4	5	6	7
1.Family obligation conceptions	--	--	--	--	--	--	--
2.School engagement conceptions	.34***	--	--	--	--	--	--
3.Risk taking conceptions	-.17 [†]	-.30**	--	--	--	--	--
4.School engagement intentions	.25**	.18*	-.32***	--	--	--	--
5.Risk taking intentions	-.09	-.09	.16 [†]	-.42***	--	--	--
6.Anticipated consequences of school engagement	.25**	.10	-.03	.40***	-.39***	--	--
7.Anticipated consequences of risk taking	-.14	-.11	.15 [†]	-.34***	.54***	-.42***	--

[†] $p < .1$. * $p < .05$. ** $p < .01$. *** $p < .001$.

Table 3

Study 1a: Effect of conception manipulation on conceptions of adolescence

Conceptions	Responsibility Conception Condition	Control Condition	Effect Size (Cohen's d)
	<i>M (SD)</i>	<i>M (SD)</i>	
Family obligation	4.65 (1.20)	4.17 (1.10)	0.41
School engagement	4.45 (1.52)	3.94 (1.21)	0.37
Risk taking	3.30 (1.79)	4.10 (1.73)	0.45

Note. The conceptions of adolescence measure uses a 7-point scale with 1 = *more true before teen years*, 4 = *equally true before and during teen years*, 7 = *more true during teen years*. Effect size (Cohen's d) is presented for the difference between the two conditions.

Table 4

Study 1a: Effect of conception manipulation on youth's behavioral intentions and anticipated consequences

	Responsibility Conception Condition	Control Condition	Effect Size (Cohen's d)
	<i>M (SD)</i>	<i>M (SD)</i>	
School engagement intentions	5.70 (1.29)	5.06 (1.21)	0.50
Risk taking intentions	1.41 (0.66)	1.51 (0.78)	0.13
Anticipated consequences of school engagement	6.41 (0.99)	5.83 (1.32)	0.50
Anticipated consequences of risk taking	1.36 (0.66)	1.79 (1.17)	0.45

Note. Effect size (Cohen's d) is presented for the difference between the two conditions.

Table 5

Study 1b: Youth's descriptions of teens in the responsibility conception and control condition

Conceptions	Responsibility Conception Condition	Control Condition	Effect Size (Cohen's d)
	<i>M (SD)</i>	<i>M (SD)</i>	
Number of words	94.27 (52.54)	91.81 (59.18)	0.04
Concreteness	2.20 (0.54)	2.13 (0.50)	0.13
Number of responsible behavior	2.90 (0.34)	0.96 (1.07)	2.44
Number of irresponsible behavior	0.00 (0.00)	0.81 (0.99)	1.15
Number of neutral behavior	0.04 (0.21)	1.21 (0.98)	1.63

Note. Effect size (Cohen's d) is presented for the difference between the two conditions.

Table 6

Study 1b: Correlations between the variables

	1	2	3	4	5	6	7
1. Correct words in the puzzle	--	--	--	--	--	--	--
2. School engagement intentions	.29***	--	--	--	--	--	--
3. Risk taking intentions	-.02	-.36***	--	--	--	--	--
4. Anticipated consequences of school engagement	.25***	.38***	-.08	--	--	--	--
5. Anticipated consequences of risk taking	-.07	-.20***	.35***	-.38***	--	--	--
6. Daily school engagement	.23***	.70***	-.31***	.36***	-.29***	--	--
7. Daily risk taking	-.05	-.29***	.51***	-.22***	.34***	-.37***	--

Note. Daily school engagement and daily risk taking are averaged behavior across three days.

*** $p < .001$.

Table 7

Study 1b: Effect of conception manipulation on youth's behavioral intentions and anticipated consequences

	Responsibility Conception Condition	Control Condition	Effect Size (Cohen's d)
	<i>M (SD)</i>	<i>M (SD)</i>	
Correct words in the puzzle	6.41 (4.99)	5.14 (3.75)	0.29
School engagement intentions	5.57 (1.08)	5.19 (1.20)	0.34
Risk taking intentions	2.31 (0.83)	2.55 (1.01)	0.27
Anticipated consequences of school engagement	6.43 (0.75)	6.10 (0.94)	0.40
Anticipated consequences of risk taking	2.04 (0.87)	2.31 (1.26)	0.25

Note. Effect size (Cohen's d) is presented for the difference between the two conditions.

Table 8

Study 1b: Effect of conception manipulation on youth's daily behavior

	Responsibility Conception Condition	Control Condition	Effect Size (Cohen's d)
	<i>M (SD)</i>	<i>M (SD)</i>	
Day 2 school engagement	4.03 (0.79)	3.69 (0.80)	0.42
Day 3 school engagement	4.10 (0.79)	3.75 (0.95)	0.41
Day 4 school engagement	4.11 (0.87)	3.78 (0.96)	0.36
Day 2 risk taking	1.32 (0.33)	1.46 (0.45)	0.34
Day 3 risk taking	1.25 (0.33)	1.33 (0.41)	0.23
Day 4 risk taking	1.26 (0.40)	1.30 (0.43)	0.09

Note. Effect size (Cohen's d) is presented for the difference between the two conditions.

Table 9

Study 2: Correlations Between the Variables

	1	2	3	4	5	6	7	8	9
1. Family obligation conceptions T1	--	--	--	--	--	--	--	--	--
2. Mother-child relationship quality T1	.12	--	--	--	--	--	--	--	--
3. Youth pubertal status T1	.05	.23	--	--	--	--	--	--	--
4. Risk taking T2	-.20	.10	.59**	--	--	--	--	--	--
5. Risk taking T3	-.04	.08	.50*	.78***	--	--	--	--	--
6. False alarms T2	-.08	-.22	.08	.12	-.06	--	--	--	--
7. False alarms T3	.19	-.03	.01	.09	-.31	.68**	--	--	--
8. Maternal education	-.07	.08	.20	.09	.03	.29	.11	--	--
9. Youth gender	.12	.21	.27	.32	.33	.06	-.16	-.19	--
<i>Mean</i>	4.06	3.18	2.50	1.51	1.57	.09	.08	1.60	--
<i>SD</i>	1.49	.54	.62	.64	.63	.04	.05	.50	--

Note. The family obligation conceptions measure uses a 9-point scale with 1 = *more true before teen years*, 4 = *equally true before and during teen years*, 9 = *more true during teen years*. For mothers' education, -1 = less than a college degree and 1 = college degree or higher; for youth's gender, -1 = male and 1 = female.

** $p < .01$. *** $p < .001$.

FIGURES

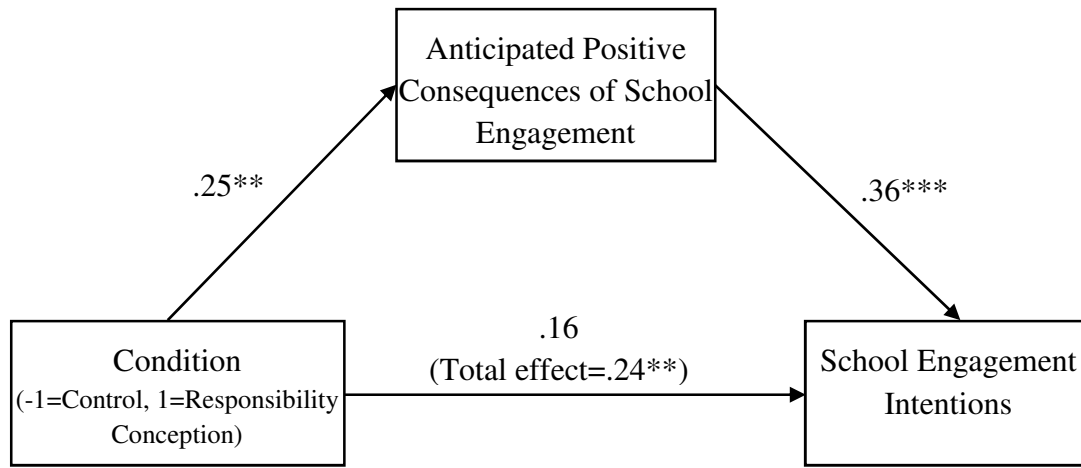


Figure 1. Study 1a: Youth's anticipated consequences of school engagement mediate the effect of the conception manipulation on school engagement intentions. *Note.* Mediation was evaluated in the context of multiple regression analyses. The standardized coefficients yielded by these analyses are presented.

** $p < .01$. *** $p < .001$.

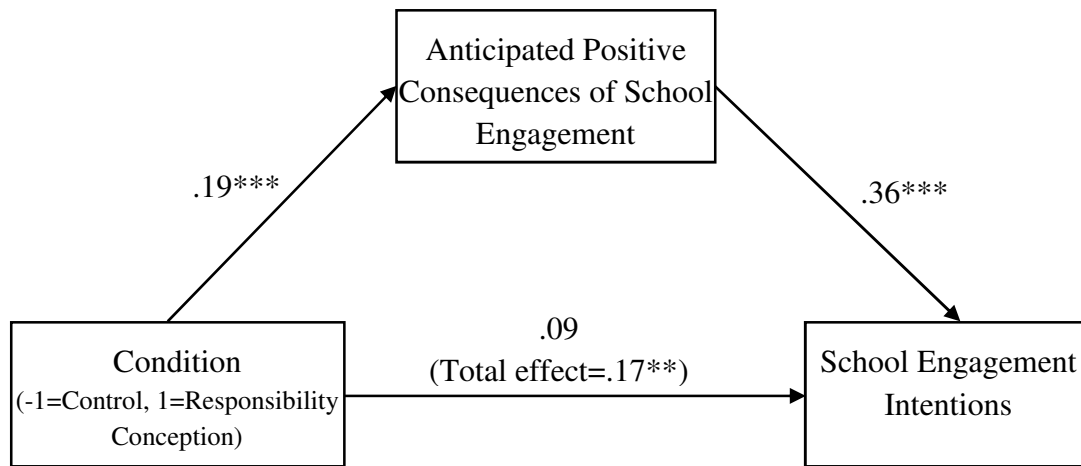


Figure 2. Study 1b: Youth’s anticipated consequences of school engagement mediate the effect of the conception manipulation on school engagement intentions. *Note.* Mediation was evaluated in the context of multiple regression analyses. The standardized coefficients yielded by these analyses are presented.

** $p < .01$. *** $p < .001$.

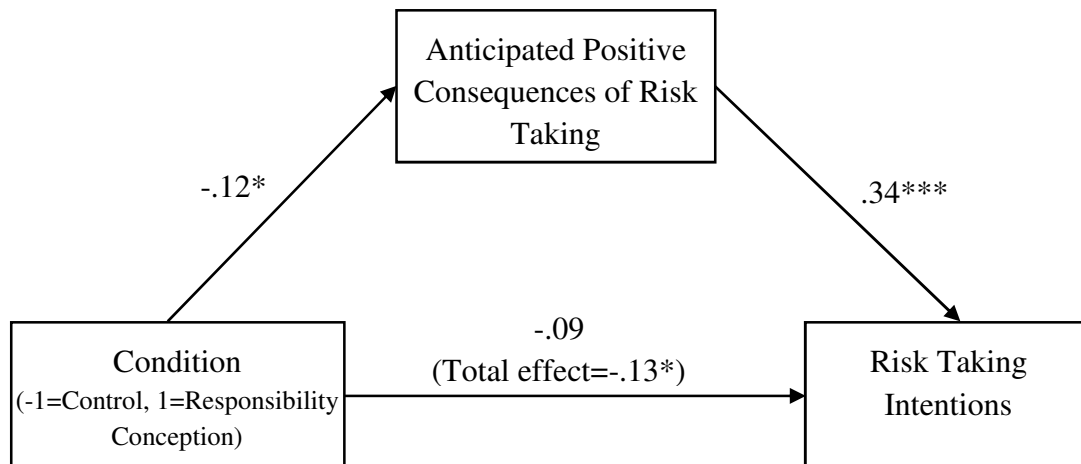


Figure 3. Study 1b: Youth’s anticipated consequences of risk taking mediate the effect of the conception manipulation on risk taking intentions. *Note.* Mediation was evaluated in the context of multiple regression analyses. The standardized coefficients yielded by these analyses are presented.

* $p < .05$. *** $p < .001$.

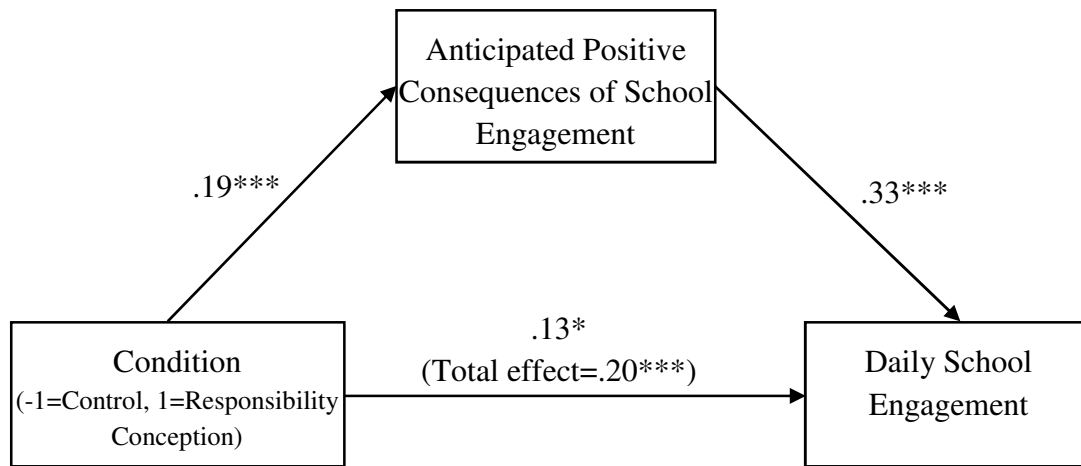


Figure 4. Study 1b: Youth’s anticipated consequences of school engagement partially mediate the effect of the conception manipulation on daily school engagement. *Note.* Daily school engagement was the averaged school engagement from day 2 to day 4. Mediation was evaluated in the context of multiple regression analyses. The standardized coefficients yielded by these analyses are presented.

* $p < .05$. *** $p < .001$.

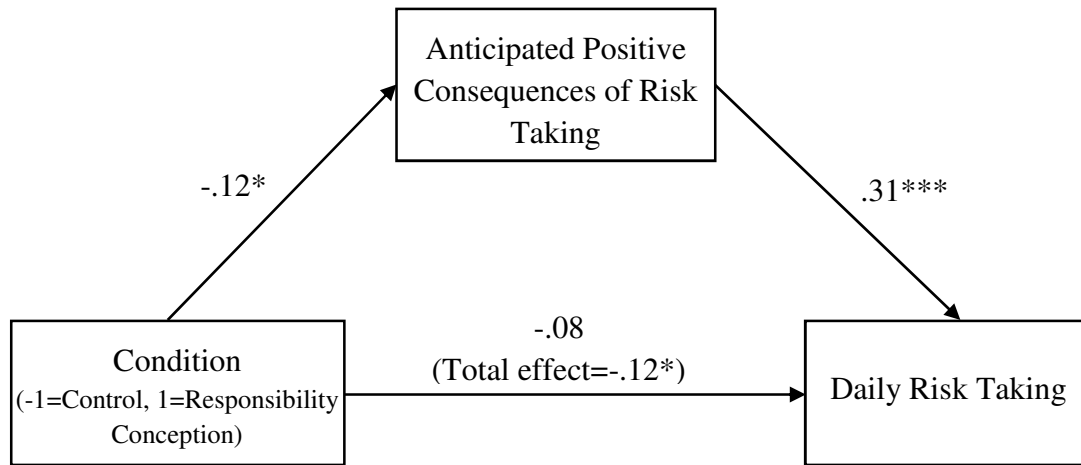


Figure 5. Study 1b: Youth’s anticipated consequences of risk taking mediate the effect of the conception manipulation on daily risk taking. *Note.* Daily risk taking was the averaged risk taking on day 2 and day 3. Mediation was evaluated in the context of multiple regression analyses. The standardized coefficients yielded by these analyses are presented.

* $p < .05$. *** $p < .001$.

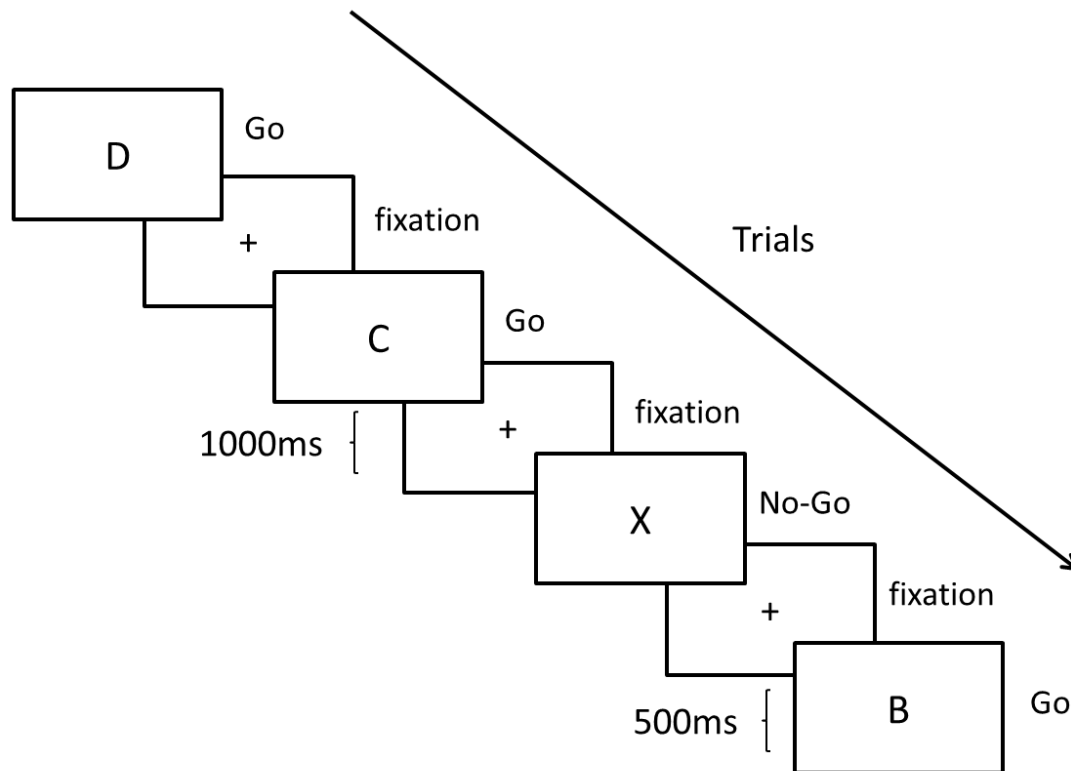


Figure 6. The Go/NoGo task used in Study 2.

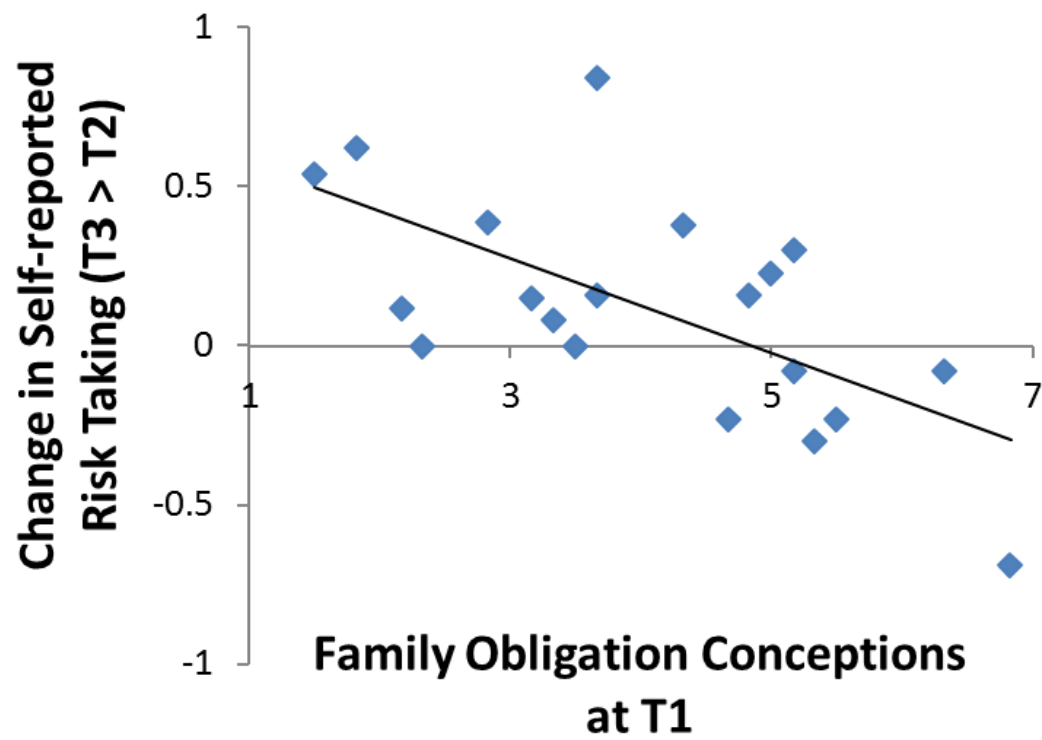


Figure 7. Study 2: The more youth see teens as ignoring family obligation (T1), the more their risk taking increase over time (T2 to T3).

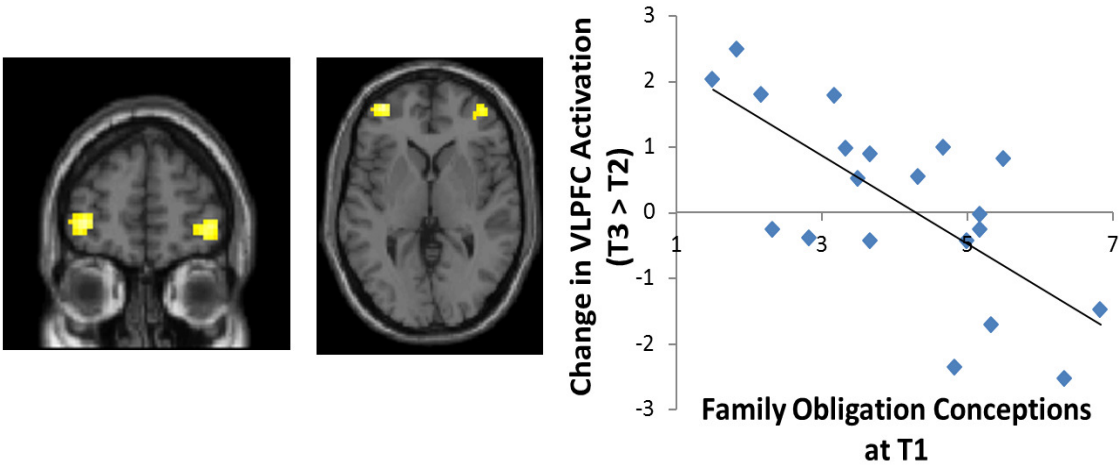


Figure 8. Study 2: The more youth see teens as ignoring family obligation (T1), the more their bilateral VLPFC activation increased over time (T2 to T3).

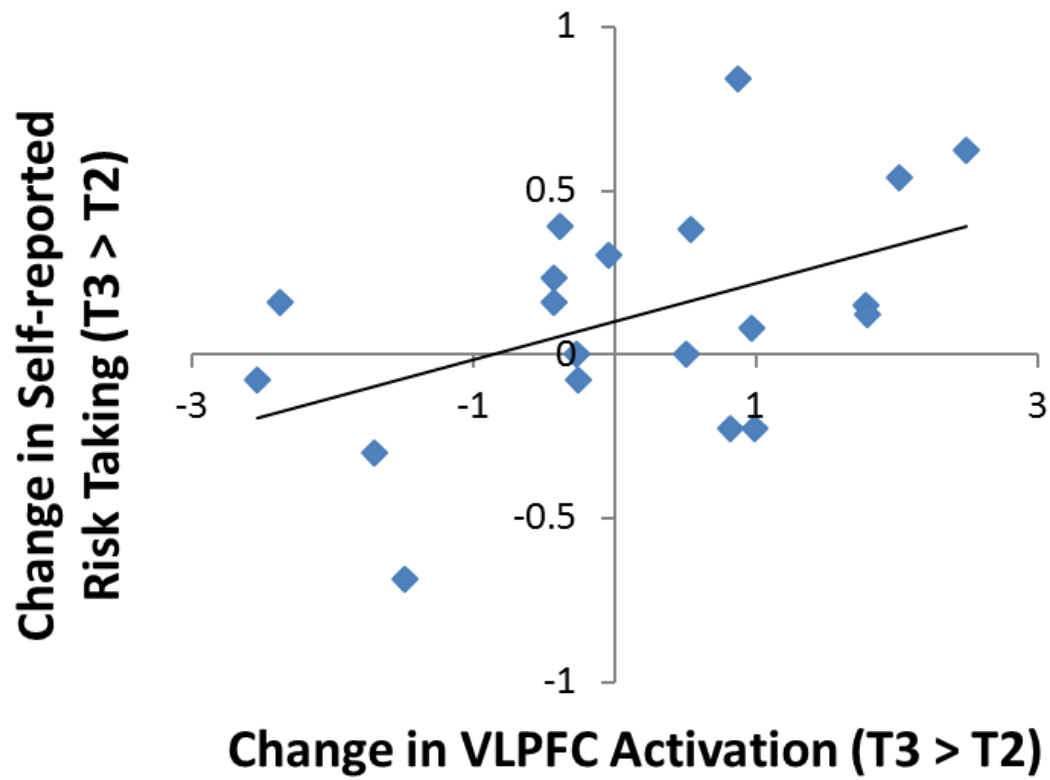


Figure 9. Study 2: The greater the increase in the VLPFC over time (T2 to T3), the greater risk taking over time (T2 to T3).

APPENDIX A

Conception Manipulation in Study 1a

WHAT ARE TEENS LIKE?

Teens are often rebellious and irresponsible in books, TV shows, movies, and music. For example, teens in movies are often shown as being disrespectful of their parents – that is, talking to them rudely or ignoring what they have to say. Adults, like teachers and parents, often think of teens as rebellious and irresponsible too. To them, teens just don't care about anything important. They see teens as not really putting in the effort that they need to put in when it comes to school, chores, and other things.

However, these ideas about teens are quite frequently incorrect. There are a lot of teens who are **not** rebellious and irresponsible. Sometimes the teen years are even described as the time of becoming responsible. Tell us what teens do in their day-to-day life that demonstrates that they are responsible. Try to be as detailed as possible, so we can really get a good picture of how teens are responsible.

Tell us what teens do **at home when they interact with their family** that shows they are responsible:

Tell us what teens do **in school** that shows they are responsible:

Tell us what teens do when they are **somewhere else** (for example, in a store, restaurant, or at someone else' house) that shows they are responsible:

APPENDIX B

Control Condition in Study 1a

WHAT ARE TEENS LIKE?

Tell us about the **typical teen**. For each box below, think of a behavior that is pretty common for teens. Once you come up with one, think of what teens do in their day-to-day life. Then, tell us about it in the box below where you wrote the behavior. Try to be as detailed as possible, so we can really get a good picture of what teens are like. Let's try one together.

EXAMPLE. Behavior pretty common for teens: Watch TV.

Tell us how teens watch TV. Tell us about what they do in two to four sentences.

They have certain shows that they like. They might watch the shows they like during for a break from doing other things. Or maybe they watch with their friends or family.

Behavior pretty common for teens:

Tell us how teens _____. Tell us about what they do in two to four sentences.

Behavior pretty common for teens:

Tell us how teens _____. Tell us about what they do in two to four sentences.

Behavior pretty common for teens:

Tell us how teens _____. Tell us about what they do in two to four sentences.

APPENDIX C

Conceptions of Adolescence Measure

Instructions: To what extent do you think each of the descriptions below is true of TEENS MORE than younger children. For each item, shade in the circle that shows how much you think it is more true of teens (right side of the scale), more true of younger children (left side of the scale), or equally true of the two (mid-point of the scale).

Family obligation

1. Work hard to meet parents' expectations.
2. Be disrespectful of parents. (reverse-scored)
3. Care little about fulfilling family obligations. (reverse-scored)
4. Be responsible members of the family.
5. Treat parents with respect.
6. Follow parents' advice.
7. Do well for the sake of parents.
8. Make sacrifices for family.
9. Be concerned with meeting obligations to parents.
10. Do their part around the house.
11. Not make sacrifices for parents. (reverse-scored)
12. Not care much about being responsible members of family. (reverse-scored)

School engagement

1. Uninterested in schoolwork. (reverse-scored)
2. Don't care very much about school. (reverse-scored)
3. Excited about what they are learning in school.
4. Pay little attention in class. (reverse-scored)
5. See schoolwork as important.
6. Put a lot of effort into school.

Risk taking

1. Swear or use dirty language.
2. Lie or cheat.
3. Fight with other people.
4. Bully someone or together with others bully other students.
5. Do things that would get themselves or others hurt (e.g., race on a bike).
6. Steal or shoplift.
7. Deface public property.
8. Do things that would make themselves in danger (e.g., cross a busy street when the light is red).

APPENDIX D

Control Condition in Study 1b

WHAT ARE TEENS LIKE?

Tell us about the **typical teen**. For each box below, think of a behavior or attitude that is pretty common for teens. Once you come up with one, think of what teens do in their day-to-day life. Then, tell us about it in the box below where you wrote the behavior or attitude. Try to be as detailed as possible, so we can really get a good picture of what teens are like.

Tell us what teens do **at home when they interact with their family**:

Tell us what teens do **in school**:

Tell us what teens do when they are **somewhere else** (for example, in a store, restaurant, or at someone else' house):

APPENDIX E

School Engagement Checklist in Study 1b

Think back over your day. While you were in class today, how much did you do the following behavior?

(1= Not at all, 2= A little bit, 3= Some of the time, 4= Much of the time, 5= All of the time)

1. Listened very carefully in class.
2. Paid attention in class.
3. Did not think about other things (that is, things that are not relevant to school).
4. Worked as hard as I could.
5. Tried hard to do well in school.
6. Tried to make sure that I understood what I was learning about in class.
7. Checked to see if I understood the things we learned about in school today.

APPENDIX F

Risk Taking Checklist in Study 1b

Think back over your day. How much did you do the following behavior today?

(1= Not at all, 2= A little bit, 3= Some of the time, 4= Much of the time, 5= All of the time)

1. Used bad or dirty language.
2. Lied to an adult (e.g., teacher or parent).
3. Cheated on assignment or exam.
4. Made fun of other kids.
5. Called someone a name.
6. Was mean to other kids in other ways.
7. Disobeyed adults (that is, did not do what teachers or parents told me to do).
8. Hung around with kids who get in trouble.