

Development of conscientiousness in childhood and adolescence:

Typical trajectories and associations with academic, health, and relationship changes

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Abstract

Conscientiousness is related to a range of important life outcomes, so it is important to understand its development early in life. We examined how conscientiousness changes from late childhood through middle adolescence and what other psychosocial changes it co-occurs with. We developed and validated a conscientiousness scale for use in existing data. Then in a longitudinal study of participants at ages 10, 13, and 16 ($N = 90$ at Time 1) we used growth curve modeling to examine how conscientiousness co-develops with academic, health, and relationship functioning. Mean levels of conscientiousness decreased from 10 to 13 and then increased to age 16. The later increase was stronger among females. Changes in conscientiousness were associated with adaptive changes in other variables.

Keywords: conscientiousness, childhood, adolescence, development, correlated change

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1. Introduction

Conscientiousness is increasingly being recognized as a critical dimension connecting personality to diverse socially and economically important life outcomes. This personality domain, which has emerged in the Big Five and Big Six structural models of personality (Saucier & Srivastava, 2014), is robustly linked to health and longevity (Kern & Friedman, 2008; Roberts, Kuncel, Shiner, Caspi, & Goldberg, 2007), educational and occupational attainment (Barrick, Mount, & Judge, 2001; Nettle & Robins, 2007), and relationship stability and satisfaction (Roberts et al., 2007; Solomon & Jackson, 2014). Thus, research on the development of conscientiousness – how it changes, and what those changes are linked to – may ultimately help in creating policies or interventions that promote socially desired outcomes, in addition to advancing a basic understanding of the nature of conscientiousness.

The goal of the present studies is to build on a small but growing body of research on how conscientiousness develops in childhood and adolescence. In a preliminary study, we developed a new conscientiousness scale that can be scored from an existing measure, allowing us to take advantage of an existing longitudinal dataset (and potentially facilitating similar future efforts with other datasets). We then addressed two major questions in our main study. First, what is the typical growth trajectory of conscientiousness from ages 10 to 16, and is the average trajectory different among boys than among girls? To answer this, we looked at average trajectories in growth curve models to see if we could replicate previous findings in a new sample with new measures. Second, how are changes in conscientiousness associated with changes in academic, health, and relationship variables? To answer this, we looked at correlated

growth curves to see how individual differences in the rate of change of conscientiousness were associated with changes in the other variables.

1.1. Typical development of conscientiousness in childhood and adolescence

To date, a substantial literature has focused on the development of conscientiousness in adulthood. We know that conscientiousness is one of a family of traits (along with agreeableness and emotional stability) that typically changes in the direction of greater maturity (Roberts, Walton, & Viechtbauer, 2006; Srivastava, John, Gosling, & Potter, 2003). These changes have been linked to transitions into adult roles and maturation within them (Bleidorn, Klimstra, Denissen, Rentfrow, & Potter, 2013; Roberts & Wood, 2006).

What about childhood and adolescence? Depending on one's perspective, research on conscientiousness during these age periods is either very old or very new. Temperament researchers have long been interested in constructs like ego resiliency (Block & Block, 1980) and effortful control (Rothbart & Rueda, 2005) that have theoretical overlaps with conscientiousness, though differences in specificity and level of analysis can make it hard to draw one-to-one relationships with the Big Five personality dimensions (see Shiner, 2006). More recently, research on the structure of the youth personality has begun to show that the same conscientiousness dimension that characterizes adult personality can also be explicitly identified and measured among children and adolescents (Soto & John, 2014; Tackett, Krueger, Iacono, & McGue, 2008). This work has made it possible to move past the "jangle problem" (using different names for the same traits in childhood and adulthood) and explicitly study conscientiousness in childhood and adolescence.

The present study focused on the development of conscientiousness during the transition from childhood to adolescence (specifically, ages 10 through 16), a period when there is good

reason to expect substantial changes in the average child's personality. In general terms, this is a period marked by extensive changes in many domains, including biological changes (e.g., onset of puberty), psychological changes (e.g., increases in internalizing and externalizing behavior), social changes (e.g., enhanced saliency of peers), and educational changes (e.g., transition from primary to secondary school) (Steinberg & Morris, 2001). Research has demonstrated that (some of) the Big Five personality traits also show meaningful changes during this period. Regarding conscientiousness, cross-sectional and longitudinal studies have begun to converge on a common trajectory underlying the typical development of this trait during the transition from childhood to adolescence. Denissen, van Aken, Penke, and Wood (2013) conducted a meta-analysis of 14 articles that reported age differences in mean levels of the Big Five personality traits, collectively spanning ages 10 to 20. The trajectory of conscientiousness was best described by a U-shaped pattern: Mean levels of conscientiousness decreased from age 10 to 13 and then increased from age 14 and up. That common trajectory supports the idea that factors working against conscientiousness are more prominent in earlier adolescence, and factors supporting its development are more prominent later.

Two large-scale studies not included in this meta-analysis both replicated the U-shaped average trajectory for conscientiousness but also tested for gender differences. In a large cross-sectional study, Soto and colleagues (2011) found that the positive age trend in later adolescence was more pronounced for females than for males, such that by emerging adulthood, females were slightly more conscientious than males. In a longitudinal study, Van den Akker and colleagues' (2014) did not find evidence for gender differences in the development of child-reported conscientiousness. In light of this difference between a larger cross-sectional study and a smaller

longitudinal one, the issue of gender differences remains somewhat open and would benefit from further data.

1.2. Changes in conscientiousness and changes in academic, health, and relationship variables

Moving beyond average change trajectories, a next set of questions revolves around the antecedents and consequences of change: Why does conscientiousness develop in this way and what implications do such changes have for adjustment and well-being? Experimental evidence could provide strong evidence about causality. However such studies, while not completely impossible, would be prohibitive on practical grounds at this early stage in the field.

Observational evidence may be a useful earlier step to identify promising variables to target in later intervention studies.

Therefore, as a starting point we set out to investigate correlated changes to see what variables are changing in tandem with changes in conscientiousness. Such an approach capitalizes on individual differences in the rate of change: Some individuals may be growing faster or slower than average in conscientiousness, and correlated-change analyses examine whether those same individuals are also growing faster or slower than average in other domains (Duncan, Duncan, & Strycker, 2013). Although this approach cannot directly address causality, it can be a useful initial step by indicating what other changes go hand-in-hand with changes in conscientiousness.¹

We focused our investigation on three domains: Academics, health, and relationships. Few previous studies have looked at correlated change between conscientiousness and these domains in childhood and adolescence (for exceptions, see De Bolle, Beyers, De Clercq, & De

¹ Some longitudinal analysis methods, such as lagged-effects models, are able to identify causal parameters conditional on certain assumptions. We did not pursue such a strategy because we were not confident that those assumptions would hold in the present data. For example, lagged-effects models work best when the interval between measurements is equal or less than the time course of the underlying causal process (Finkel, 1995). With a three-year interval in the present study, we were not willing to make such an assumption.

Fruyt, 2012 and Van den Akker et al., 2014). But these are domains where previous research has identified either cross-sectional associations or predictive associations between levels of conscientiousness and levels of these variables (e.g., Duckworth & Seligman, 2005; Friedman et al., 1995; Ozer & Benet-Martínez, 2006). Thus we considered them promising areas to investigate correlated change.

1.2.1. Conscientiousness and academics

Conscientiousness has a well-established relationship with academic performance among college students (Nofle & Robins, 2007). Among children and adolescents, conscientiousness-related traits, such as self-discipline and the ability to delay gratification, also predict academic success, including higher academic competence (Mischel, Shoda, & Peake, 1988), better grades (e.g., Duckworth & Seligman, 2005), and higher SAT scores (Shoda, Mischel, & Peake, 1990). Conscientiousness is also associated with school engagement – that is, with behaviors that tend to lead to better grades. For example, eighth-grade students high in self-discipline spend more time on their homework compared to more impulsive students (Duckworth & Seligman, 2005). Further, not only is conscientiousness positively related to the amount of time spent in class (Mehl, Gosling, & Pennebaker, 2006), but conscientious people are more likely to complete school assignments on time and come to classes prepared (bringing pens and paper) compared to their less conscientious peers (Jackson, Wood, Bogg, Walton, Harms, & Roberts, 2010). In the present study, we therefore examined whether change in conscientiousness from late childhood through middle adolescence is associated with change in grades, time spent on homework, and school engagement behaviors like coming to class prepared and demonstrating an interest in learning.

Children and adolescents spend more time in schools than in any other place outside their homes (Eccles & Roeser, 2009); therefore, it is not surprising that the educational environment has the potential to influence children's developing personalities. Changes in the supportiveness of the school environment as well as academic support from parents may be important for the development of conscientiousness. Although it is normative for such support to decrease as adolescents become more autonomous (Eccles & Roeser, 2009), a too-precipitous decline may be problematic. We therefore examined how changes in the school climate (such as the amount of encouragement from the school and the degree to which students perceive their teachers as caring) and changes in parental involvement in schooling were related to changes in conscientiousness during this period.

1.2.2. Conscientiousness and health

A growing literature shows that levels of conscientiousness in childhood predict physical health outcomes decades later (Hampson, Goldberg, Vogt, & Dubanoski, 2006) and even predict longevity (Friedman, Tucker, Tomlinson-Keasey, Schwartz, Wingard, & Criqui, 1993; Deary, Batty, Pattie, & Gale, 2008). One reason conscientiousness predicts health status and longevity is that conscientious individuals engage in healthy behaviors and avoid unhealthy ones (Bogg & Roberts, 2004). In the main study we examined whether changes in conscientiousness were related to changes in two health-related behaviors, physical activity and sleep duration. While there is an abundance of research linking conscientiousness to physical activity (e.g., Takahashi, Edmonds, Jackson, & Roberts, 2013), research on conscientiousness and sleep duration is scarce, which is surprising considering that sleep quantity is one of the leading behavioral contributors to all-cause mortality (Gallicchio & Kalesan, 2008). While some research shows that individuals higher in conscientiousness get more sleep (Randler, 2008), other research finds no association

between the two (Gray & Watson, 2002). The transition from childhood to adolescence is an especially important period to study sleep quantity since the amount of sleep that individuals get during the school week decreases across this age period (Carskadon, 2011). Adolescents who get an adequate amount of sleep may be less likely to experience a decrease in conscientiousness.

In studies of childhood psychopathology, conscientiousness is associated with both internalizing and externalizing problems (Tackett, 2006). In a study of correlated change in children and adolescents, change in conscientiousness was associated with change in externalizing problems but not change in internalizing problems (De Bolle et al., 2012). In the current study, we initially planned to examine markers of both externalizing and internalizing pathology, though because of low variances in preliminary analyses of the externalizing markers (see Method section) we report final results only for internalizing pathology.

1.2.3. Conscientiousness and relationships

For children and adolescents, an important environmental factor that may be associated with their developing personalities is changes in the parenting they experience (Shiner & Caspi, 2003). Parenting behaviors can broadly be divided into two independent dimensions of parenting: positive parenting (e.g., warmth) and negative parenting (e.g., overreactivity).

Previous research has found that changes in child-reported conscientiousness positively relates to changes in mother-reported warm parenting (Van den Akker et al., 2014). The present study examined whether changes in child-reported conscientiousness positively relate to changes in child-reported parental acceptance (separately for mothers and fathers). It also examined child-reported changes in parental monitoring – that is, how well parents know where their children are, who they are with, and what they are doing. This complements previous research since it has

been suggested that a child's perception of his or her parents' parenting behavior may contribute to the child's developing personality independent of actual parenting behavior (Schaefer, 1965).

Like changes in parental behavior, changes in friend and peer behavior may also be associated with the adolescents' developing personality. Both negative and positive peer behavior influences adolescents' behavior (Mounts & Steinberg, 1995; Urberg, Degirmencioglu, & Pilgrim, 1997). Whereas adolescents whose friends display increases in positive behaviors may be more likely to show mature changes in their personality over time (e.g., increases in conscientiousness), adolescents whose friends display increases in negative behaviors over time may be less likely to show mature changes in their personality over time (e.g., no change or decreases in conscientiousness). In the present study we examined one positive friend behavior, support, and one negative friend behavior, delinquency.

Although it is now well accepted that both parents and friends influence adolescents' development (Laursen & Collins, 2009; Brown & Larson, 2009), because adolescents spend less time with their parents and more time with their close friends and peers (Larson & Richards, 1991; Larson, Richards, Moneta, Holmbeck, & Duckett, 1996), we were especially interested in whether changes in conscientiousness may show stronger relations with changes in friend behavior than parental behavior during the transition from childhood to adolescence.

1.3. Overview of the present research

We examined change in conscientiousness in a sample of children followed longitudinally from age 10 to 16. This dataset did not include a purpose-written measure of conscientiousness, but it did include a multidimensional questionnaire with items that we identified as promising markers of conscientiousness. Thus, in a preliminary scale-development study we administered this measure alongside a standard conscientiousness measure in a separate

sample, so that we could create a conscientiousness scale with good psychometric properties for use in existing data.

In the main study, our first research goal was to replicate the U-shaped pattern of the development of conscientiousness during the transition from childhood to adolescence. We hypothesized that mean levels of conscientiousness would decrease from late childhood into early adolescence (from age 10 to 13) and increase thereafter through middle adolescence (from age 13 to 16). We also examined whether there are gender differences in change during this period, as was found in one previous cross-sectional study that looked at gender differences.

Our second goal was to examine how changes in conscientiousness relate to changes in academic, health, and relationship variables. In general, we expected to find that changes in conscientiousness would be associated with changes toward greater adaptation across these domains. In the relationships domain, we hypothesized that changes in conscientiousness would show stronger associations with changes in friend behavior than with changes in parental behavior.

2. Preliminary study

The idea to examine conscientiousness in this dataset was conceived through conversations among the authors after data collection was well under way. The purpose of the preliminary study was therefore to use an independent dataset to create a valid and reliable measure of conscientiousness from measures that participants completed at all three time points. We identified the Erikson Psychosocial Stage Inventory (EPSI; Rosenthal, Gurney, & Moore, 1981) as containing a number of good candidate items and made it the focus of further psychometric investigation. The EPSI is a self-report questionnaire with six 12-item subscales that measure respondents' resolution of the conflicts associated with the first six stages of

Erikson's psychosocial theory (e.g., stage four: industry versus inferiority). The structure of the EPSI is similar to a standard personality questionnaire; respondents indicate how true a series of statements is for them using a 5-point likert scale ranging from 1 (*hardly ever true*) to 5 (*almost always true*). For the main study, participants completed the three subscales that were age-relevant for the sample: industry (e.g., "I'm a hard worker"), identity (e.g., "I know what kind of person I am"), and intimacy (e.g., "I find it easy to make close friends").

To identify which of the 36 EPSI items were good markers of conscientiousness, two complementary approaches were taken. In the *correlational approach*, we administered the EPSI and a well-validated measure of the Big Five personality dimensions to an independent sample, and we examined the correlations between the 36 EPSI items and the Big Five. In the *expert judgment approach*, three experts familiar with the Big Five made judgments of how well each of the 36 EPSI items represented the content of each of the Big Five personality domains.

2.1. Method

2.1.1. Correlational approach

College students from a large university in the northwestern United States ($N = 512$; 71% female; $M_{\text{age}} = 20$ years) completed the industry, identity, and intimacy subscales of the EPSI (Rosenthal et al., 1981) and the Big Five Inventory (BFI-44; John, Naumann, & Soto, 2008). The ethnic composition of the sample was similar to the general student population at the university: < 1% American Indian/Alaskan Native, 11% Asian, 1% Native Hawaiian or other Pacific Islander, 2% Black or African American, 77% White, and 7% other (2% of participants declined to answer). In exchange for their participation, participants received credit in partial fulfillment of a course requirement. This sample was randomly split into two equally sized samples: a *training sample* that we used to select items for the EPSI conscientiousness measure, and an

independent *cross-validation sample* that we used to obtain out-of-sample estimates of reliability and validity.

2.1.2. Expert judgment approach

Three experts familiar with the Big Five personality traits independently made ratings of how strongly and in what direction they expected each of the 36 EPSI items to be correlated with each of the Big Five personality traits.² The ratings were made on a scale from 1 (*strongly negative*) to 7 (*strongly positive*), where the midpoint of the scale indicated a negligible correlation. Overall agreement among the experts was good, $\alpha = .86$ ($\alpha = .93$ for conscientiousness, $\alpha = .90$ for extraversion, $\alpha = .85$ for neuroticism, $\alpha = .83$ for agreeableness, and $\alpha = .47$ for openness).

2.2. Results

We used a two-step procedure to select items for the EPSI conscientiousness scale. We first examined the correlations in the training sample to select a set of candidate items. For those candidate items, we then examined expert ratings to further narrow the list of items. After this two-step item selection process, we examined reliability as well as convergent and discriminant validity in the cross-validation sample. Full results for all 36 EPSI items from the correlational and expert-rating analyses are reported in Supplement 1.

2.2.1. Step 1: Correlational approach

In order for an item to be identified as a potential marker of conscientiousness, the item had to meet the following criteria: (1) the item's strongest correlation had to be with conscientiousness, and (2) the difference between the correlation with conscientiousness and the next-highest correlation had to be greater than .15. For example, the industry item, "I'm a hard

² The judges were Lewis R. Goldberg, Gerard Saucier, and the second author. None of the judges saw any data or results from the correlational analyses before making their ratings.

worker,” correlated most strongly with conscientiousness at $r = .52$ (satisfying criterion one), and this correlation was .26 greater than the item’s next strongest correlation, which was with agreeableness (satisfying criterion two). Of the 36 EPSI items, 12 of these met the criteria (see bolded items in Table S1.1).

2.2.2. Step 2: Expert judgment approach

We next examined the expert ratings for the 12 items that were initially identified in the correlational analyses. In order for an item to be selected as a final marker of conscientiousness, the experts had to agree that the item’s strongest association was with conscientiousness. For eight of the 12 items, this was the case:

1. “I don’t enjoy working (r)” (industry 2)
2. “I’m a hard worker” (industry 3)
3. “I’m trying hard to achieve my goals” (industry 5)
4. “I’m good at my work” (industry 6)
5. “I waste a lot of my time messing around (r)” (industry 8)
6. “I stick with things until they’re finished” (industry 10)
7. “I don’t get things finished (r)” (industry 11)
8. “I don’t get much done (r)” (industry 12)

We initially anticipated that we might need to make further adjustments to obtain a scale with balanced keying, which is preferable when possible to reduce the influence of acquiescent responding among children (Soto, John, Gosling, & Potter, 2008). However, this did not become necessary because the eight EPSI items that resulted from our two-step selection procedure included an equal number of true and reverse-keyed items.

The final 8-item EPSI conscientiousness scale, which we call the EPSI-C, showed good psychometric properties in the training sample. Internal consistency was good, with a Cronbach's alpha of .85. This measure correlated $r = .73$ with the BFI conscientiousness scale, demonstrating good convergent validity, and had weaker correlations with the other BFI scales: with extraversion, $r = .17$; with agreeableness, $r = .37$; with neuroticism, $r = -.18$; and with openness to experience, $r = .23$, demonstrating good discriminant validity. However, results from the training sample are potentially biased because those correlations were used, in part, to select the items and therefore the results could capitalize on chance. For that reason we ran the same analyses in the cross-validation sample, to get independent estimates. Internal consistency in the cross-validation sample was nearly as good as in the training sample, with Cronbach's alpha of .82. The EPSI-C also showed good convergent and discriminant validity with the BFI. The correlation with BFI conscientiousness was $r = .76$. Correlations with other BFI scales were as follows: extraversion, $r = .21$; agreeableness, $r = .32$; neuroticism, $r = -.24$; and openness to experience, $r = .14$.

3. Main study

Using the EPSI conscientiousness measure developed in the preliminary study, we examined two research questions in the main study. First, what is the typical growth trajectory of conscientiousness from late childhood through middle adolescence, and does it differ by gender? Second, how do changes in conscientiousness relate to changes in academic, health, and relationship variables? We analyzed these research questions in a longitudinal sample of participants who were assessed at age 10, 13, and 16.

3.1. Method

3.1.1. Participants

Participants completed a packet of self-report questionnaires when they were approximately age 10 (Time 1: $N = 90$), age 13 (Time 2: $N = 56$), and age 16 (Time 3: $N = 44$). At Time 1, there was an equal number of males and females (T2: 54% female; T3: 57% female). The sample was recruited from all across the Los Angeles metropolitan area and was therefore ethnically diverse (T1: 45.6% white, 54.4% non-white or multiethnic³; T2: 47.4% white, 52.6% non-white or multiethnic⁴; T3: 47.7% white, 52.3% non-white or multiethnic⁵) and somewhat socioeconomically diverse (26% reported household income below \$55,000, which is approximately the United States median household income). Very few of the participants went to the same primary and secondary schools over the course of participation in the study. A variety of methods were used to recruit participants, such as posting fliers and making announcements at UCLA summer camps. Participants were financially compensated for their participation at each time point.

3.1.2. Measures

All items, response scales, and instructions for measures can be found in Supplement 2.

3.1.2.1. Conscientiousness

The 8-item EPSI-C, developed in the Preliminary Study, demonstrated acceptable internal consistency at all three time points: $\alpha = .70$ at T1, $.76$ at T2, and $.86$ at T3.

3.1.2.2. Academic variables

Academic variables included ratings of grades and schoolwork as well as ratings of engagement, the school environment, and parental involvement. The five academic variables are from the Profiles of Student Life: Attitudes and Behaviors (PSL-AB) survey (A&B; Search

³ 2.2% Asian or Pacific Islander, 3.3% Black or African American, 15.6% Hispanic or Latino/Latina, and 33.3% multiethnic

⁴ 1.8% Asian or Pacific Islander, 3.5% Black or African American, 12.3% Hispanic or Latino/Latina, and 35.1% multiethnic

⁵ 4.5% Black or African American, 15.9% Hispanic or Latino/Latina, and 31.8% multiethnic

Institute, 1996). This survey includes 156 items that measure eight thriving indicators, eight developmental assets (each of which includes several stand-alone measures), 14 high-risk behaviors, and five developmental deficits. Grades is one of the eight thriving indicators, time spent on homework and school engagement are two measures from the commitment to learning developmental asset, and positive school climate and parental involvement in school are two measures from the support developmental asset.

Participants indicated the grades they earned in school using a rating scale ranging from 1 (*mostly below D's*) to 8 (*mostly A's*).

Participants indicated the amount of time spent on homework outside of school on an average school day using a rating scale ranging from 1 (*none*) to 6 (*3 hours or more*).

Participants' engagement with school was measured with four items. Using a rating scale from 1 (*usually*) to 3 (*never*), participants indicated how often they (1) felt bored at school (r), (2) came to classes without bringing paper or something to write with (r), (3) came to classes without their homework finished (r), and (4) came to classes without their books (r). Alpha reliability for the school engagement composite was .42 at T1, .73 at T2, and .53 at T3.

Positive school climate was assessed with three items: (1) I get a lot of encouragement at my school, (2) my teachers really care about me, and (3) students in my school care about me. Participants indicated their agreement or disagreement with each item on a rating scale from 1 (*strongly disagree*) to 5 (*strongly agree*). Alpha reliability for the positive school climate composite was .64 at T1, .81 at T2, and .81 at T3.

Parental involvement in school was measured with three items. Using a rating scale from 1 (*never*) to 5 (*very often*), participants indicated how often one of their parents (1) helped them with their school work, (2) talked to them about what they were doing in school, and (3) asked

them about their homework. Alpha reliability for the parental involvement in school composite was .63 for T1, .77 for T2, and .69 for T3.

3.1.2.3. Health variables

We initially planned analyses on mental health variables measuring externalizing and internalizing pathology. However the externalizing health variables, delinquency (four items) and substance abuse (five items), had standard deviations that were extremely small and had very poor estimates of internal consistency for the majority of the three time points. For these reasons, delinquency and substance abuse were not included in any analyses.⁶

Depression was measured with the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977). The CES-D is a 20-item self-report scale used to measure the presence of depressive symptoms in the general population. Sample items include “I felt sad,” “My sleep was restless,” and “I felt that everything I did was an effort.” Participants indicated how often they experienced each of the symptoms during the past week on a scale from 0 (*rarely or none of the time – less than 1 day*) to 3 (*most or all of the time – 5 to 7 days*). Alpha reliabilities ranged from .80 to .84 across the three time points.

Physical health variables included physical activity and sleep duration (or hours slept before an average school day), both of which were taken from the Teen Assessment Project (TAP) Survey Question Bank (Small & Rodgers, 1995), and described in Lerner and colleagues (2005).

Physical activity was measured with the question, “In the past 7 days, how often have you exercised or been physically active (e.g., rollerbladed, played basketball, done aerobics) for at least 20 minutes?” The response scale ranged from 1 (*not at all*) to 8 (*7 times or more*).

⁶ The standard deviations, on a 0-100 point scale, were as follows: For delinquency: T1 = 6.18, T2 = 4.20, and T3 = 4.66; for substance abuse: T1 = 2.51, T2 = 3.46, and T3 = 15.54. The coefficient alphas were as follows: For delinquency: T1 α = .38, T2 α = -.01, T3 α = .13; for substance abuse: T1 α = .20, T2 α = .32, T3 α = .77.

Sleep duration was calculated by taking the difference between the time participants reported usually going to sleep on a school night (i.e., sleep onset) and the time they reported usually getting up on a school morning (i.e., sleep offset). The sleep onset scale ranged from 1 (*before 9 p.m.*) to 10 (*2 a.m. or later*) and the sleep offset scale ranged from 1 (*about 4 a.m.*) to 10 (*8:30 a.m. or later*). With the exception of the ends of the sleep onset rating scale (*before 9 p.m.* and *2 a.m. or later*) and one of the ends of the sleep offset rating scale (*8:30 a.m. or later*), all other values on these two scales were exact times. In the rare occasions where participants marked one of the scale values that were not exact times, values were recorded as follows: *8:30 a.m. or later* as 8:30 a.m., *2 a.m. or later* as 2:00 a.m., and *before 9 p.m.* as 8:30 p.m. Consistent with the “Sleep in America Poll” from the National Sleep Foundation (2006), the percentage of participants in the current study who got less than an optimal amount of sleep on school nights (i.e., less than 9 hours) increased across adolescence, from 15.6% at age 10, 58.2% at age 13, and 95.3% at age 16.⁷

3.1.2.4. Relationship variables

Relationship variables included relationships with parents (i.e., mother acceptance, father acceptance, and parental monitoring) and relationships with friends (i.e., friends display delinquent behavior and friends display supportive behavior).

Parental acceptance was measured with an 8-item acceptance subscale from one of the shortened versions of Schaefer’s (1965) Children’s Reports of Parental Behavior Inventory (CRPBI; Schludermann & Schludermann, 1970). Each of the eight items describes a specific, observable child-rearing behavior (e.g., “My mother speaks to me in a warm and friendly voice”

⁷ Of the percentage of participants getting less than an optimal amount of sleep on school nights, among the 10 year olds, 3.3% got an insufficient amount (less than 8 hours) and 12.2% got a borderline amount (8 hours to less than 9 hours) of sleep on school nights. Among the 13 year olds, 20% got an insufficient amount and 38.2% got a borderline amount. Among the 16 year olds, 69.8% got an insufficient amount and 25.6% got a borderline amount.

and “My mother tells or shows me that she likes me just the way I am”), and the participants indicate how often their parent displays each behavior from 1 (*almost never*) to 5 (*almost always*). The participants completed this questionnaire separately for their mothers and fathers. Alpha reliabilities were good (mother acceptance: .91 for T1, .93 for T2, and .95 for T3; father acceptance: .94 for all three time points).

Parental monitoring was measured with the 8-item Parental Monitoring Scale (PMS; Small & Kerns, 1993). On a rating scale from 1 (*never*) to 5 (*always*), participants indicate how often their parents know where they are, who they are with, and what they are doing (e.g., “My parents know where I am after school” and “I talk to my parent(s) about the plans I have with my friends”). Alpha reliabilities ranged from .65 to .87 across the three time points.

Friends’ delinquent behavior was measured with a 4-item scale from the Profiles of Student Life: Attitudes and Behaviors (PSL-AB) survey (A&B; Search Institute, 1996). Using a rating scale from 1 (*none*) to 5 (*all*), participants indicated the number of their closest friends who (1) drink alcohol once a week or more, (2) have used drugs such as marijuana or cocaine, (3) do well in school (r), and (4) get into trouble at school. Alpha reliabilities ranged from .50 to .69 across the three time points.

Friends’ supportive behavior was measured with the 4-item Peer Support Scale (PSS; Armsden & Greenberger, 1987). The four items are as follows: (1) I trust my friends, (2) I feel my friends are good friends, (3) my friends care about me, and (4) my friends are there when I need them. Participants indicated their agreement or disagreement with each item on a rating scale from 1 (*almost never true or never true*) to 5 (*always true*). Alpha reliabilities ranged from .85 to .87 across the three time points.

To aid in interpretation, all dependent measures were rescaled with a linear transformation to Percent of Maximum Possible (POMP) scores, giving them a theoretical range from 0 to 100 (Cohen, Cohen, Aiken, & West, 1999).

3.1.3. Attrition and missing data

The self-report questionnaire data analyzed in this manuscript was originally collected as part of a neuroimaging study. A major reason for attrition was that participants who got braces after Time 1 could not be scanned and therefore were not invited back to participate in any of the study procedures (including filling out the self-report questionnaires). Another reason was that some participants had a difficult time in the scanner during the first-wave assessment (i.e., moved too much or experienced a lot of anxiety), resulting in low quality fMRI data. Because it was financially expensive to scan each child, these participants were also not contacted to participate at the follow-up times. A final reason for attrition was that some families did not respond to invitations to continue at the follow-up times.

To examine whether attrition was related to any of the study variables at Time 1 (such as conscientiousness), we ran a series of linear regression models with group as the IV (0 = participants who did not continue after T1 ($N = 33$); 1 = participants who did continue after T1 ($N = 57$ ⁸). Results revealed that there were no reliable differences between participants who did and did not continue after T1 on any of the study variables at T1 (standardized difference between the two groups ranged from $d = -.32$, 95% CI $[-.75, .12]$ to $d = .10$, 95% CI $[-.33, .53]$; absolute average $d = .12$). Missing data was handled using full information maximum likelihood (FIML), which uses all of the available data to estimate the model parameters (Enders, 2001).

When data is missing completely at random or missing at random (i.e., missingness is associated

⁸ $N = 57$ includes 13 participants who had data for T1 and T2, 43 participants who had data for T1, T2, and T3, and one participant who had data for T1 and T3.

with observed variables that are in the analysis), FIML produces unbiased and more efficient parameter estimates compared to other missing data techniques such as listwise or pairwise deletion (Enders & Bandalos, 2001). Even if there were differences between the participants who did and did not continue after T1 on the study variables at T1, FIML would account for these differences.

3.2. Results

3.2.1. Descriptive statistics

Table 1 shows means and standard deviations for all of the variables at the three time points. Table 2 shows zero-order correlations between EPSI-C and the academic, health, and relationship variables at the three time points (for all pairwise correlations, see Supplement 3). Table 3 shows rank-order stability for all of the variables. The rank-order stability correlations are similar to what is typically observed for personality traits in childhood and adolescence (Roberts & Delvecchio, 2000).

3.2.2. Univariate growth modeling of conscientiousness: Mean-level change and individual differences in change

Our main research questions were about parameters from growth curve models, not model fit per se. However, before examining parameter estimates we had to specify an overall model. Based on previous research showing curvilinear change in conscientiousness during the transition from childhood to adolescence (e.g., Van den Akker et al., 2014), we began by fitting a univariate latent growth curve model that included both a linear and quadratic slope factor in version 7 of Mplus (Muthen & Muthen, 2012) (see Figure 1). Because the study design had only three measurement occasions, fitting a quadratic model requires fixing residual variances to zero, and the model is just-identified (has zero degrees of freedom). Therefore, its fit cannot be

compared to more complex models. However, we compared the fit of the quadratic model to one with only a linear slope. A chi-square difference test indicated that the linear model was significantly worse fitting than the quadratic model, $\chi^2 (df = 1) = 6.31, p < .05$. We therefore proceeded with the quadratic model for all analyses.

3.2.2.1. Mean-level change

Results indicated that the quadratic slope growth factor was significant ($b = .55, SE = .21, p < .05$), but the linear slope growth factor (with age centered at 13) was not ($b = -.06, SE = .44, ns$). The shape of the mean growth curve, plotted as the black line in Figure 2, replicated previous research: Mean levels of EPSI-C decreased from age 10 to 13, and then increased from age 13 to 16.

3.2.2.2. Gender differences in change

In the quadratic growth curve model, there was significant variance in all three growth factors ($ps < .001$). Since previous research indicates that one source of this variability in level and change may be due to gender, we examined gender differences in the trajectory of EPSI-C from age 10 to 16 by modeling paths from a dummy-coded gender indicator (0 for boys, 1 for girls) to the growth factors. Whereas there were no significant gender differences in the intercept and quadratic slope growth factors (for the intercept growth factor: $b = 2.63, SE = 3.75, ns$; for the quadratic slope growth factor: $b = .29, SE = .42, ns$), there were significant gender differences in the linear slope growth factor ($b = 1.75, SE = .84, p < .05$). That is, females' rate of change at age 13 was more positive than that of males'. As shown in Figure 2, whereas females' and males' trajectories were similar from age 10 to 13, females increased in EPSI-C from age 13 to 16 more than males. Further, after accounting for gender differences in the three growth factors, significant variance in all of these growth factors remained ($ps < .001$).

3.2.3. Correlated change between conscientiousness and academic, health, and relationship variables

In order to examine correlated change between conscientiousness and the other variables, we specified a separate bivariate growth curve model for each of the other variables. Like the univariate model for EPSI-C, the univariate growth curve model for all of the other variables included both a linear and quadratic slope growth factor, centered in the middle of the study age range (age 13). In a bivariate model with an intercept and linear and quadratic growth factors, there are 15 covariances among the latent factors (nine of which are between the two variables). Our focal research questions were about whether children's growth rates for conscientiousness were related to their growth rates for the other variables. The model allows a participant to be growing at different rates at different ages (due to the quadratic component), and the linear term represents the age-centered rate of change – that is, a participant's typical (or expected average) rate of change over the study period. Therefore, the parameter of interest in each of these models was the covariance between the linear slopes, which we report in this section (see Table 4). A full report of the nine bivariate covariances in each model is given in Supplement 4. To aid in interpretation, in Table 5 we report linear growth components for the academic, health, and relationship variables; these showing whether participants were generally increasing or decreasing on those variables.

3.2.3.1. Academic variables

We hypothesized that changes in EPSI conscientiousness would positively correlate with changes in the academic variables. This hypothesis was supported for three of the academic variables. For grades: $r = .29$, 95% CI [.03, .56], for school engagement: $r = .35$, 95% CI [.11, .59], and for positive school climate: $r = .42$, 95% CI [.19, .65]. The more positive a participant's

growth rate on EPSI conscientiousness was, the more positive his or her growth rate on grades, school engagement, and positive school climate was. For the two other academic variables, time spent on homework and parental involvement in school, the estimated correlation was positive but the 95% confidence interval was consistent with effects ranging from a small negative correlation to a medium-large positive one (for time spent on homework: $r = .20$, 95% CI [-.06, .46], and for parental involvement in school: $r = .15$, 95% CI [-.13, .43]).

3.2.3.2. Mental and physical health variables

We hypothesized that changes in EPSI conscientiousness would negatively correlate with changes in depression. This hypothesis was supported: $r = -.30$, 95% CI [-.56, -.04], indicating that more positive change in EPSI conscientiousness was associated with less positive change in depression. We also hypothesized that changes in EPSI conscientiousness would correlate positively with changes in both of the physical health variables. This was supported for physical activity ($r = .26$, 95% CI [.003, .51]), but not for sleep duration ($r = .08$, 95% CI [-.22, .37]).

3.2.3.3. Relationship variables

We hypothesized that changes in EPSI conscientiousness would be correlated with variables assessing relationships with friends, but to have no correlation or a small correlation with changes in variables assessing relationships with parents. For parental acceptance, changes in EPSI conscientiousness were not correlated with changes in mother acceptance ($r = .06$, 95% CI [-.25, .36]) or father acceptance ($r = -.03$, 95% CI [-.33, .27]). For parental monitoring, the estimated correlation was positive, but the 95% confidence interval was consistent with an effect ranging from a very small negative correlation to a large positive one ($r = .26$, 95% CI [-.01, .52]). For the friend variables, the more positive a participant's growth rate on EPSI conscientiousness was, the more positive his or her growth rate on friend supportive behavior

was, $r = .40$, 95% CI [.19, .62]. Although the correlation with friend delinquent behavior was in the predicted direction, the 95% confidence interval was consistent with an effect ranging from a medium-large negative correlation to a very small positive one, $r = -.23$, 95% CI [-.49, .02].

4. Discussion

Using a longitudinal sample of participants assessed at the ages of 10, 13, and 16, we examined how conscientiousness changed on average during the transition from childhood to adolescence, if this average trajectory differed by gender, and the extent to which changes in conscientiousness were associated with changes in academic, health, and relationship variables. Consistent with previous cross-sectional and longitudinal research (Denissen et al., 2013; Soto et al., 2011; Van den Akker et al., 2014), the development of conscientiousness was best described by a U-shaped pattern: conscientiousness decreased from late childhood into early adolescence and increased thereafter through middle adolescence. Further, gender differences revealed that the increase in conscientiousness from early adolescence through middle adolescence was stronger for females than males. Finally, the correlated change analyses revealed that changes in conscientiousness were positively associated with changes in grades, school engagement, positive school climate, physical activity, and friend supportive behavior, and negatively associated with changes in depression. We discuss these findings in greater detail as well as their implications below.

4.1. Mean-level change and gender differences in change

Like previous research, our research shows that the average development of personality during the transition from childhood to adolescence (around ages 10 to 13) is characterized by a decrease in conscientiousness, which later is reversed. Van den Akker et al. (2014) characterized this as a “temporary defiance of the maturity principle.” The reasons for this change are probably

multiple and complex. Just as personality change in young adulthood is associated with investing in new social roles such as entering the job force or getting married (Roberts & Wood, 2006), we suggest that the role transitions and other social changes that are typical of the transition from childhood to adolescence may be implicated as well. During this period, there are new roles that accompany the transition from primary to secondary school (Eccles & Roeser, 2009). For example, students must adjust to an increased school work load and make new friends, which requires good self-regulatory abilities and a stable sense of identity. At the same time, children are becoming increasingly independent and relying less on parents. This shift from scaffolded co-regulation to self-regulation may result in a temporary decrease in conscientiousness. However, as these skills develop later in adolescence, children may be more successful at investing in the new roles, which would be accompanied by an increase in conscientiousness. This is consistent with research showing that among high school students, investment in school work was associated with increases in conscientiousness (Bleidorn, 2012).

What about gender differences? Research among adults in the United States and around the world reveals a small gender difference: women tend to be somewhat more conscientiousness than men over much of the adult lifespan (e.g., Schmitt, Realo, Voracek, & Allik, 2008; Srivastava et al., 2003). This raises the question of whether gender differences in conscientiousness are present early in life or emerge sometime before young adulthood. In the present research, males and females did not differ in levels of conscientiousness at age 10 or 13; but from age 13 to 16 females increased more than males, resulting in a gender difference that emerged by age 16. The reasons for the emergence of this gender difference are not clear. One possibility is gender-based socialization. In addition to conscientiousness, there are gender differences in agreeableness and neuroticism that emerge in childhood and persist in adulthood

(Soto et al., 2013; Srivastava et al., 2003). These traits fall under a higher-order factor of social self-regulation, encompassing traits related to following social norms and promoting the interests of a larger community (Saucier & Srivastava, 2014). It is possible that the emergence of these differences in mid to late adolescence reflects gender-based socialization processes during this period.

4.2. Correlated change between conscientiousness and academic, health, and relationship variables

For the correlated change analyses, we hypothesized that changes in conscientiousness would be positively associated with changes in adaptive variables (e.g., school engagement) and negatively associated with changes in maladaptive variables (e.g., depression). For three of the academic variables (i.e., grades, school engagement, and positive school climate), two of the health variables (i.e., depression and physical activity), and one of the relationship variables (i.e., friend supportive behavior), this hypothesis was supported. Although changes in conscientiousness were associated with changes in time spent on homework, parental involvement in school, parental monitoring, and friend delinquent behavior in the predicted direction, the confidence intervals around these correlated change results were consistent with effects ranging from a small negative association to a medium-large positive one (and for friend delinquent behavior, from a small positive association to a medium-large negative one).

Changes in conscientiousness were unrelated to changes in sleep duration. This finding is not inconsistent with past research: While some research shows that individuals higher in conscientiousness get more sleep (i.e., Randler, 2008), other research shows no relation between conscientiousness and sleep quantity (Gray & Watson, 2002). One reason why changes in conscientiousness may have been unrelated to changes in sleep duration is that adolescents high

in conscientiousness may stay up late to finish homework and study, and as a result they may get a similar amount of sleep as those lower in conscientiousness (who stay up late for other reasons). Although research on the relationships between the Big Five personality traits and sleep quantity (and quality) is scarce and therefore ambiguous, the relationships between the Big Five personality traits and sleep schedule is well documented. The most robust finding to emerge from this literature is that conscientious individuals are more likely to be morning types than evening types, that is, their peak alertness for performing mental and physical tasks is earlier in the day (e.g., Randler, 2008; Tonetti, Fabbri, & Natale, 2009). Our main study did not include a measure of morning-evening preference, but since there is a normative shift towards an evening preference in early adolescence (Kim, Dueker, Hasher, & Goldstein, 2002), it may be promising for future research to examine how changes in morning-evening preference relate to changes in conscientiousness.

Changes in conscientiousness were also unrelated to changes in parental acceptance, both in terms of father and mother acceptance. Previous research examining a similar construct found that changes in conscientiousness were positively related to changes in mother warmth (Van den Akker et al., 2014). Our results may differ because we measured the adolescents' perception of their parents' parenting behavior while the previous research had mothers report on their own parenting behaviors.

In addition to our hypothesis that changes in conscientiousness would be associated with changes towards greater adaptation across the academic, health, and relationship domains, we also hypothesized that changes in conscientiousness would correlate more strongly with changes in friend behaviors than with changes in parent behaviors. For the most part, the magnitude of the correlated change results were larger for the friend behaviors (i.e., delinquency and

supportiveness) than the parent behaviors (i.e., acceptance and monitoring). At first this seems at odd with the research literature demonstrating that both parents and friends matter in adolescents' development, but very little if any of this research focuses on adolescent personality trait development (Laursen & Collins, 2009; Brown & Larson, 2009). While our results suggest that friends may be more influential, additional research with larger samples and a greater variety of parent and friend behaviors is required before drawing any conclusions. It is possible that parents and friends matter equally, but that some behaviors (e.g., parental monitoring) matter more than others (e.g., parental acceptance) in shaping personality trait development during the adolescent years.

With an increased sample size, the correlated change estimates would become more precise and if there are differences in the magnitude of the results they would become more apparent, allowing us to better distinguish between which domains matter most for the adolescents' developing personality. Although these results tell us nothing about the direction of the effects, they help to identify promising variables that could be targeted in future experimental research on interventions to promote increases in conscientiousness among the youth. For example, increasing the supportiveness of the school environment or creating more after school athletic programs by means of providing more resources to teachers and schools may be a promising candidate for eliciting changes in students' conscientiousness. Future work in this area could also help elucidate the complex relationship between socioeconomic status and conscientiousness. A number of the academic and health variables studied here are associated with socioeconomic status (e.g., Caldas & Bankston, 1997; Giles-Corti & Donovan, 2002), raising the possibility that policy interventions addressed at social inequality might also have individual-level consequences for personality development.

4.3. Limitations and future directions

Conscientiousness is a broad personality trait that is made up of several lower-order personality traits, or facets. The number of facets proposed to underlie conscientiousness ranges from two to six (e.g., DeYoung et al., 2007; Soto & John, in press; Saucier & Ostendorf, 1999; Roberts et al., 2004; Costa & McCrae, 1992). Research examining the development of the conscientiousness facets in adulthood is beginning to show that not all facets of conscientiousness change similarly (Terracciano, McCrae, Brant, Costa, 2005; Jackson et al., 2009); however, this research is sparse in childhood and adolescence (for an exception see Soto et al., 2011). Although research has yet to explore the lower-order structure of conscientiousness in childhood and adolescence, of the facets proposed to underlie conscientiousness in adulthood, our measure of conscientiousness is most similar to the industriousness (working hard vs. laziness) facet. Therefore, the limitation of our EPSI conscientiousness measure is that we cannot say with certainty if our findings speak to the full domain of conscientiousness or just to one or a few facets of conscientiousness. It is possible that other facets might change in different ways, or correlate with other kinds of changes than those observed here. Moving forward, our research should be evaluated alongside future research examining changes in a full range of facets of conscientiousness during childhood and adolescence, to see if other facets produce similar results. Our study and future studies may together paint a picture of the development of the lower-order structure of conscientiousness during the transition from childhood to adolescence.

Another limitation of the present research is our reliance on self-reports. Future research will benefit most from using multiple perspectives, for example comparing self-reports to reports from parents, teachers, and peers. In addition to it being generally good measurement practice to measure personality with multiple methods, in some cases self-reports may reflect substantively

different processes than other-reports and therefore self- and other-reports may provide complementary information. For example, children's perspectives on parental monitoring may have different effects than actual monitoring (Schaefer, 1965). Thus, areas of discrepancy as well as agreement could be important to examine.

Finally, the correlated change analyses we report here can tell us about what other changes co-occur with changes in conscientiousness, but they cannot tell us about the direction of effects. It is likely that some of the correlated changes we observed are antecedents of conscientiousness (such as changes in parental monitoring), some are consequences (such as changes in grades), and some may be reciprocally related. (And in other instances, correlated changes may result from changes in unmeasured third variables, such as biological changes associated with pubertal maturation.) A promising next step for future research would be to design longitudinal studies with more closely spaced assessments, to make it possible to fit lagged-effects models to look at the direction of effects. Ultimately, randomized intervention studies will provide the strongest evidence of causation. We hope that the present study, by identifying other variables that change in tandem with conscientiousness, will be useful in designing such future studies.

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Table 1

Means and Standard Deviations for the Study Variables at Each Time Point

Dependent Variable	Age 10 (T1)	Age 13 (T2)	Age 16 (T3)
	<i>M (SD)</i>	<i>M (SD)</i>	<i>M (SD)</i>
EPSI conscientiousness	74.33 (15.30)	68.92 (14.66)	73.86 (16.30)
Academic Variables			
Grades ^a	88.40 (11.56)	90.43 (14.17)	87.01 (19.44)
Time spent on HW ^b	48.75 (24.30)	58.36 (26.37)	69.77 (29.72)
School engagement	71.46 (16.07)	64.73 (23.97)	71.31 (17.17)
Positive school climate	77.27 (17.59)	68.90 (20.26)	68.56 (20.08)
Parental involvement in school	77.43 (21.51)	66.37 (24.41)	57.01 (22.66)
Health Variables			
Depression	15.94 (12.47)	15.49 (10.67)	23.29 (12.64)
Physical activity	65.49 (34.18)	64.80 (27.91)	55.19 (32.98)
Sleep duration ^c	83.52 (12.80)	67.12 (15.91)	43.99 (17.85)
Relationship Variables			
Mother acceptance	79.92 (18.63)	72.82 (22.09)	61.12 (26.85)
Father acceptance	72.23 (24.69)	69.13 (22.71)	60.31 (24.16)
Parental monitoring	92.09 (10.26)	87.89 (12.82)	77.34 (16.41)
Friend delinquent behavior	10.90 (10.79)	14.17 (10.08)	21.83 (16.31)
Friend supportive behavior	86.04 (16.81)	84.71 (15.40)	79.69 (17.79)

Note. Means and standard deviations for the 14 dependent variables have a theoretical range from 0 to 100.

^aMeans and standard deviations (in parentheses) for grades on the original rating scale (see Supplement 2) are as follows: T1 = 7.19 (0.81), T2 = 7.33 (0.99), and T3 = 7.09 (1.36). On the

original rating scale, a value of 7 indicates *about half A's and half B's* and a value of 8 indicates *mostly A's*.

^bMeans and standard deviations (in parentheses) for time spent on homework on the original rating scale (see Supplement 2) are as follows: T1 = 3.44 (1.21), T2 = 3.92 (1.32), and T3 = 4.49 (1.49). On the original rating scale, a value of 3 indicates *between half an hour and an hour*, a value of 4 indicates *1 hour*, and a value of 5 indicates *2 hours*.

^cIn hours and minutes, the means and standard deviations (in parentheses) for sleep duration are as follows: T1 = 9 hr, 31 min (46 min), T2 = 8 hr, 32 min (57 min), and T3 = 7 hr, 8 min (1 hr, 4 min).

Table 2

Correlations between EPSI Conscientiousness and the Academic, Health, and Relationship Variables at Each Time Point

Zero-Order Correlation	Age 10 (T1)		Age 13 (T2)		Age 16 (T3)	
	<i>r</i>	95% CI	<i>r</i>	95% CI	<i>r</i>	95% CI
EPSI-C with academic variables						
Grades	.34	[.15, .53]	.46	[.26, .67]	.49	[.27, .72]
Time spent on HW	.04	[-.17, .25]	.26	[.02, .51]	.43	[.19, .68]
School engagement	.24	[.04, .43]	.51	[.32, .70]	.60	[.40, .79]
Positive school climate	.30	[.11, .49]	.43	[.22, .65]	.30	[.03, .57]
Parental involvement in school	.15	[-.05, .35]	.18	[-.08, .43]	.05	[-.24, .35]
EPSI-C with health variables						
Depression	-.34	[-.52, -.15]	-.38	[-.60, -.16]	-.18	[-.46, .11]
Physical activity	.17	[-.03, .37]	.35	[.12, .58]	.24	[-.04, .52]
Sleep duration	.15	[-.06, .35]	-.06	[-.32, .21]	.05	[-.25, .34]
EPSI-C with relationship variables						
Mother acceptance	.18	[-.02, .38]	.50	[.30, .70]	.34	[.07, .61]
Father acceptance	.18	[-.03, .38]	.32	[.07, .56]	.37	[.11, .63]
Parental monitoring	.39	[.21, .56]	.36	[.13, .59]	.18	[-.10, .47]

Friend delinquent behavior	-.35	[-.53, -.17]	-.37	[-.60, -.14]	-.15	[-.44, .14]
Friend supportive behavior	.32	[.14, .51]	.09	[-.17, .35]	.41	[.17, .66]

Note. EPSI-C = The 8-item EPSI conscientiousness measure; 95% CI = The 95% confidence interval of *r*.

Table 3

Rank-Order Stability for the Study Variables

Dependent Variable	Age 10 with Age 13		Age 13 with Age 16		Age 10 with Age 16	
	<i>r</i>	95% CI	<i>r</i>	95% CI	<i>r</i>	95% CI
EPSI conscientiousness	.35	[.13, .56]	.38	[.13, .63]	.25	[-.01, .51]
Academic Variables						
Grades	.27	[.04, .49]	.40	[.15, .65]	.33	[.10, .56]
Time spent on HW	.21	[-.04, .45]	.26	[-.02, .53]	-.05	[-.33, .22]
School engagement	.32	[.08, .56]	.33	[.07, .59]	-.13	[-.43, .18]
Positive school climate	.30	[.07, .52]	.51	[.30, .72]	.22	[-.06, .49]
Parental involvement in school	.23	[-.02, .48]	.57	[.38, .77]	.39	[.13, .65]
Health Variables						
Depression	.38	[.15, .60]	.27	[.01, .53]	.06	[-.24, .37]
Physical activity	.27	[.04, .49]	.42	[.18, .67]	.11	[-.17, .38]
Sleep duration	.39	[.16, .62]	.44	[.20, .68]	.06	[-.27, .39]
Relationship Variables						
Mother acceptance	.46	[.24, .68]	.42	[.17, .66]	.32	[.04, .60]
Father acceptance	.33	[.08, .59]	.52	[.29, .75]	.40	[.13, .67]

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Parental monitoring	.25	[.02, .49]	.55	[.36, .74]	.04	[-.26, .34]
Friend delinquent behavior	.33	[.12, .53]	.61	[.42, .79]	.03	[-.22, .28]
Friend supportive behavior	-.05	[-.31, .20]	.34	[.09, .60]	-.31	[-.56, -.07]

Note. 95% CI = The 95% confidence interval of *r*.

Table 4

Correlations between Linear Change in EPSI Conscientiousness and Linear Change in Academic, Health, and Relationship Variables

	Linear Δ in EPSI conscientiousness	
	<i>r</i>	95% CI
Linear Δ in academic variables		
Grades	.29	[.03, .56]
Time spent on HW	.20	[-.06, .46]
School engagement	.35	[.11, .59]
Positive school climate	.42	[.19, .65]
Parental involvement in school	.15	[-.13, .43]
Linear Δ in health variables		
Depression	-.30	[-.56, -.04]
Physical activity	.26	[.003, .51]
Sleep duration	.08	[-.22, .37]
Linear Δ in relationship variables		
Mother acceptance	.06	[-.25, .36]
Father acceptance	-.03	[-.33, .27]
Parental monitoring	.26	[-.01, .52]
Friend delinquent behavior	-.23	[-.49, .02]
Friend supportive behavior	.40	[.19, .62]

Note. 95% CI = The 95% confidence interval of *r*.

Table 5

Parameter Estimates for the Linear Slope Factor in the Univariate Growth Curve Models

	Mean of Linear Slope		Variance of Linear Slope	
	Estimate	95% CI	Estimate	95% CI
EPSI conscientiousness	-0.06	[-0.92, 0.79]	10.38	[6.29, 14.47]
Academic Variables				
Grades	-0.19	[-1.09, 0.71]	9.75	[5.70, 13.79]
Time spent on HW	3.54	[1.84, 5.23]	41.91	[25.84, 57.97]
School engagement	-0.07	[-1.09, 0.96]	16.74	[10.19, 23.29]
Positive school climate	-1.35	[-2.38, -0.32]	15.18	[9.18, 21.17]
Parental involvement in school	-3.21	[-4.30, -2.12]	16.54	[9.72, 23.36]
Health Variables				
Depression	1.20	[0.48, 1.93]	7.94	[4.78, 11.10]
Physical activity	-1.74	[-3.64, 0.17]	55.21	[34.34, 76.09]
Sleep duration	-6.51	[-7.46, -5.56]	12.66	[7.24, 18.07]
Relationship Variables				
Mother acceptance	-3.25	[-4.55, -1.96]	20.62	[11.86, 29.38]
Father acceptance	-2.01	[-3.26, -0.75]	20.79	[11.53, 30.05]
Parental monitoring	-2.35	[-3.19, -1.52]	9.80	[5.91, 13.70]
Friend delinquent behavior	1.96	[1.14, 2.78]	9.62	[6.09, 13.15]
Friend supportive behavior	-1.14	[-2.25, -0.03]	21.14	[13.73, 28.55]

Note. 95% CI = The 95% confidence interval of the mean and variance estimates.

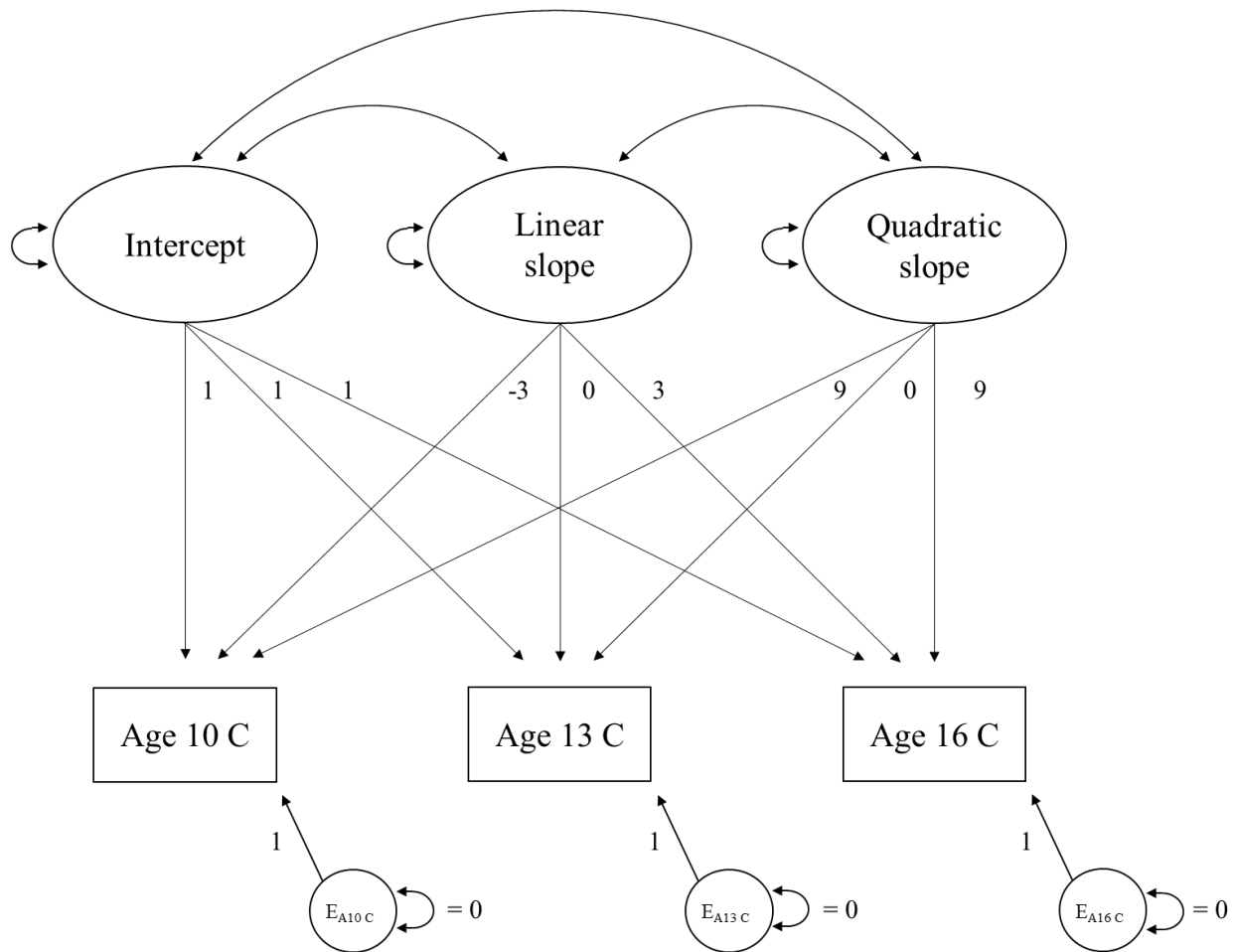


Figure 1. Univariate growth curve model for change in EPSI conscientiousness from late-childhood (age 10) through middle adolescence (age 16). To attain a just-identified model, residual variances for the outcomes were fixed at zero. The mean intercept indicates the average level of EPSI conscientiousness at age 13, the mean linear slope indicates the average rate of change in EPSI conscientiousness at age 13, and the mean quadratic slope indicates the average acceleration/deceleration in EPSI conscientiousness over time. C = EPSI conscientiousness; E = Error or residual variance.

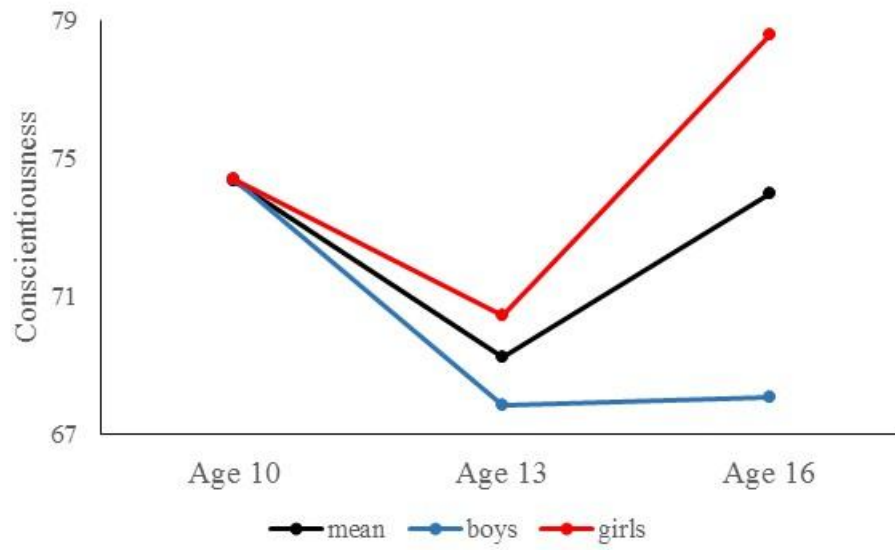


Figure 2. Mean-level change of EPSI conscientiousness moderated by gender