



# Observed Personality in Preschool: Associations with Current and Longitudinal Symptoms

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## Abstract

Personality is consistently associated with psychopathology across the lifespan. However, little is known of how observed personality dimensions in preschoolers are associated with concurrent or longitudinal symptoms across development. Spectrum, vulnerability, and pathoplasty models theorize how child personality and psychopathology are related across development. The current study tests these three models using observationally coded personality dimensions in a longitudinal sample of preschoolers. A validated ‘thin slice’ technique was used to code observed Five Factor Model (FFM) personality dimensions of extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience in a clinically enriched preschool sample oversampled for depression ( $N=299$ ). Children were followed longitudinally for 9 years while assessing dimensional psychological symptoms and global functioning. Longitudinal multilevel models testing the spectrum, or shared underlying factor model, indicated depressive symptoms in adolescence were predicted by higher preschool extraversion and lower agreeableness and conscientiousness, externalizing symptoms were predicted by lower agreeableness and higher neuroticism, and worse global functioning was predicted by higher extraversion and neuroticism, and lower agreeableness and conscientiousness. Some associations held after accounting for the influence of baseline psychological symptoms, indicating support for a vulnerability relationship between personality and later psychopathology. No support was demonstrated for pathoplasty models such that personality did not influence the developmental course or change of psychopathology over time. Findings indicate personality dimensions measured as early as the preschool period prospectively impact psychopathology and functioning across child development, demonstrating support for both a spectrum and vulnerability relationship between youth personality and psychopathology.

**Keywords** Personality development · Psychopathology · Preschool · Five factor model

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Personality traits are consistently associated with psychopathology in later childhood and adulthood as meta-analyses have linked personality with various psychiatric and personality disorders (De Pauw and Mervielde 2010; Kotov et al. 2010; Saulsman and Page 2004). Although similar relations have also been demonstrated in childhood and adolescence (De Fruyt et al. 2017), we do not yet understand how personality traits and psychopathology are etiologically associated, stemming from a lack of longitudinal data (Tackett 2006). Knowing how psychopathology and normal range personality traits are associated is especially important as novel taxonomies of psychopathology attempt to directly incorporate normative personality dimensions within a single model (e.g., HiTOP model; Kotov et al. 2017; Widiger et al. 2019). The current study tested and compared three different theoretical models concerning the overlap between personality traits exhibited in early childhood and psychopathology. Specifically, we tested how observed

personality dimensions and clinical assessments during the preschool period prospectively relate to risk and protection from psychological symptoms and impairment across child development.

## Personality and Psychopathology in Children

Temperament, defined as underlying genetic and biological predispositions to emotional reactivity and regulation (Buss and Plomin 1975; Rothbart and Bates 2006; Thomas and Chess 1977), has long been studied in early childhood and demonstrates consistent associations with psychopathology (De Pauw and Mervielde 2010; Rothbart 2007). Although the temperament literature provides great value to our understanding of the development of childhood psychopathology, recent literature has suggested a blurring of temperament and personality constructs in young children, indicating these concepts overlap, are more alike than different, and may be measuring similar underlying constructs using different terminology (Grist and McCord 2010; Zupancic et al. 2006). In fact, a ‘common taxonomy’ has been encouraged to provide consistency in temperamental/personality measurements across the lifespan, starting in preschool (Abe and Izard 1999; Asendorpf and Denissen 2006; Zupancic et al. 2006).

Assessing personality across the lifespan, the vast majority of literature has utilized the Five Factor Model (FFM), measuring personality along five dimensions: extraversion, agreeableness, conscientiousness, neuroticism, and openness to experience (aka, the “Big 5”; Caspi and Shiner 2006; Costa and McCrae 1992). The FFM has previously been successfully extended down to children as young as preschool, mainly using teachers and parents as informed raters (Caspi and Shiner 2006; De Clercq et al. 2009; Mervielde et al. 2005; Shiner and Deyoung 2013; Tackett 2006). Work from our own group has demonstrated that personality can be reliably observationally coded in children aged 3–6 (Whalen et al. [under review](#)). Although the FFM provides the most consistency when measuring personality across the lifespan, it should be noted that other models of personality in preschool-aged and young children have been theorized, including the addition of a sixth personality dimension to the FFM, ‘activity,’ to constitute the “Little Six” (Soto and Tackett 2015).

To maintain consistency with lifespan approaches to personality, we chose to utilize the FFM, of which the five dimensions have repeatedly demonstrated associations with psychopathology in children and adolescents, mirroring relationships in adulthood. Neuroticism is consistently associated with all forms of psychopathology in children and adolescents, including internalizing (e.g., depression and anxiety) as well as externalizing (e.g., aggression, conduct disorder, attention deficit hyperactivity

disorder) disorders (Barbaranelli et al. 2003; De Pauw and Mervielde 2010; Forbes et al. 2017; Tackett et al. 2017). Agreeableness and conscientiousness also demonstrate strong associations: low levels are predictive of elevated externalizing symptoms in youth (Barbaranelli et al. 2003; De Pauw and Mervielde 2010; Roberts et al. 2009; Tackett 2006; Tackett et al. 2016, 2017).

The evidence for overlap between personality and psychopathology in young children is less robust, as personality traits have been measured in preschool-aged children in only a few studies (e.g., Grist et al. 2012; Measelle et al. 2005). However, available findings indicate the nature of the relationship between personality and psychopathology in the preschool period is generally consistent with that of children and adolescents. For instance, in a sample of 5–7 year olds, low agreeableness and high extraversion were concurrently associated with externalizing behaviors (Zupancic and Kavcic 2003). Additionally, parent or teacher-reported extraversion in three year olds predicted fewer internalizing symptoms and elevated externalizing symptoms, while lower agreeableness and conscientiousness and higher neuroticism predicted more externalizing symptoms in children at age 5 (Zupancic and Podlesek 2010). Similarly, elevated extraversion (in the form of temperamental approach-sociability) in children aged 4–5 was associated with increased externalizing symptoms by age 13 (Forbes et al. 2017). It should be noted that all of these studies used parent or teacher report of child personality, and in some cases, not all dimensions of the Big Five were assessed.

The characteristic of openness has been the most difficult to operationalize in preschoolers (Grist et al. 2012), and similarly, has shown few associations with psychopathology across early child to adolescent development. Although assessment and developmental considerations may contribute to few findings, the lack of association of openness with psychopathology is consistent with adult meta-analyses indicating little overlap between this personality characteristic and psychopathology (Kotov et al. 2010; Malouff et al. 2005). Together, although initial indication that preschool personality characteristics demonstrate overlap with psychopathology in early childhood, the evidence is sparse and limited by a lack of longitudinal studies that document how these constructs are related across time.

## Models of Personality Psychopathology Etiology

To contextualize these findings relating personality and later psychopathology across development within the extant literature, three theoretical models are routinely used. First, the most supported model in adult literature is the spectrum

relationship (Clark and Watson 2008; Widiger and Smith 2008), that purports personality and psychopathology overlap due to a common, underlying, shared factor. Specifically, personality and pathology are thought to exist on a spectrum ranging from normal personality variation to more extreme forms of personality that cross the threshold into psychopathology. A spectrum relationship is thought to be the most likely model given the observed overlap between personality and psychopathology across the lifespan (Clark and Watson 2008) and the overlap of the latent structure when examining these constructs conjointly (e.g., Mike et al. 2018). However, much of the past work supporting a spectrum relationship has been from correlational studies, demonstrating cross-sectional overlap between personality and psychopathology. Although a true test of spectrum relationships would be to assess shared vulnerability factors (e.g., biological substrates), a stronger test than previous research is one in which personality and psychopathology do not occur at the same time (i.e., longitudinal versus cross-sectional), and secondly, one that assesses personality early in childhood (to safeguard against previous pathology influencing current and future personality-psychopathology relationships). A longitudinal test of the spectrum model extends previous tests by assessing the common thread between personality and pathology.

A second way that personality may influence later psychopathology is via the course or manifestation of psychopathology. The pathoplastic model suggests that personality influences the way psychopathology emerges and manifests across time. Currently there is little support either for or against this model (Tackett 2006). Among the models, this is the most difficult to test as it requires repeated assessments of psychopathology to examine whether personality is associated with decreasing or increasing symptoms across development. One instance of support for this model was from Forbes et al. (2017) who found preschool neuroticism predicted changes in internalizing and externalizing disorder trajectories (not only influencing overall symptoms, but the shape of change of symptoms) from early childhood (ages 4–5) to early adolescence. Specifically, preschool emotional reactivity (neuroticism) predicted increasing symptom trajectories of depression, anxiety, conduct disorder and attention-deficit hyperactivity disorder, while higher approach-sociability (extraversion) predicted increasing trajectories of externalizing presentations and decreasing trajectories of anxiety (Forbes et al. 2017).

A third, widely studied model is the vulnerability model, which theorizes that personality is a risk factor for later psychopathology (De Bolle et al. 2012; Tackett 2006). Although past literature has aimed to support this model, many of these studies did not begin to assess personality or psychopathology until later childhood or adolescence, raising the question of whether earlier assessments, such as in the preschool age,

would provide similar associations. It is possible that personality assessed in adolescence already shares overlap with psychopathology or is influenced by prior psychopathology, leading to decreased utility of personality as a vulnerability factor. Although a true test of the vulnerability model would include a healthy sample to test precursor or predisposition models, a more rigorous test of the vulnerability model than the current literature provides would be to use very early childhood assessments of personality and later assessments of psychopathology to separate the time between assessments. Secondly, an improvement on past tests of the vulnerability model would also account for early symptoms, to understand how personality can be informative of later psychopathology above and beyond concurrent psychological symptoms. Although both a vulnerability and spectrum model could be occurring simultaneously and there is not an ideal method to tease the models apart, these are not necessarily competing hypotheses. What differentiates the models is that a true vulnerability model would demonstrate how normal ranges of personality provide *additional* information (above shared symptom presentation) about the likelihood of developing later psychopathology, hence implying a temporal relationship. Conversely, spectrum processes are not inherently temporal, but rather, purport covariation between personality and psychopathology that is due to shared etiological (and/or neurological, biological) factors.

## The Current Study

It is clear that the development of personality and psychopathology are associated in youth (e.g., Caspi and Shiner 2006; De Clercq et al. 2009; Soto and Tackett 2015). Yet it is unknown how to best theoretically conceptualize these relationships, especially very early in development. The current study aimed to provide tests of each of these models with preschool aged children followed longitudinally for up to 9 years.

We assessed these aims using unbiased behaviorally coded FFM personality dimensions. Given that obtaining self-reports from preschoolers about their own personalities is not feasible due to cognitive and self-reflective limitations, and parent or teacher informants of preschool personality introduce biases based on the distortion of adult perception (De Pauw 2017), we chose to observationally code child personality using the ‘thin slice’ method. ‘Thin slice’ coding involves naïve observers viewing short clips of individuals across contexts and making ‘snap judgments’ about the individual (Ambady et al. 2000). In both older child and adult samples, thin slice methods demonstrate that untrained individuals can quickly and accurately rate personality, as indexed by good agreement within raters, with self-reports of personality by the individual, and consistency across situations (Ambady et al. 2000; Tackett et al. 2016). We have validated this approach in preschoolers demonstrating

within and across task consistency, comparable or better to, estimates in adults (Whalen et al. [under review](#)). This method provides a non-biased index of early child personality measured via observed behaviors.

We utilized this observed measure of preschool personality to first investigate FFM personality dimensions with concurrent clinical symptoms of psychopathology in preschool. We then tested three models of personality/psychopathology development, starting with the notion that underlying etiological factors contribute to personality and psychopathology in the spectrum model by examining whether personality in the preschool period predicts symptoms of depression, anxiety, and externalizing disorders and global functioning across child development. Given it has the greatest theoretical support in adults, we hypothesized the spectrum model to demonstrate similar patterns seen in older childhood and adult samples: neuroticism would predict more internalizing and externalizing symptoms, agreeableness and conscientiousness would predict low externalizing symptoms, extraversion would predict elevated externalizing symptoms, and openness would not show associations. Second, to test whether personality influences the course of psychopathology (pathoplasty model), we examined whether preschool personality predicts different trajectories of psychological symptoms and global functioning across development. Given the lack of previous support of this model, we did not expect to see support for this model. Third, to test a vulnerability model where personality is a risk factor for later pathology, we investigated associations between preschool personality and symptoms, above and beyond the influence of baseline dimensional psychopathology. As less literature supports a direct causal relationship between personality and psychopathology, we hypothesized that some of the above-mentioned, but not all, associations demonstrated in the spectrum model would survive in vulnerability models. Although the spectrum and vulnerability models cannot be completely disentangled, the current study provides unique and more stringent tests of both models than past research. The spectrum model provides a starting point to assess shared associations between personality and psychopathology (possibly due to underlying etiological factors), while the vulnerability model goes one step further by asking whether there are explicit temporal relationships between personality and psychopathology over and above shared concurrent associations.

## Methods

### Participants

Children from the Preschool Depression Study (PDS) (Luby et al. [2009](#)), an ongoing longitudinal study conducted at the Washington University School of Medicine in St. Louis

(WUSM) who had usable observational data ( $N = 299$ ) during the preschool waves participated. Children aged 3.0- to 5.11-year-old children and their primary caregivers were initially recruited from daycares, preschools, and primary care sites in the St. Louis area, using the Preschool Feelings Checklist (PFC; Luby et al. [2004](#)) to oversample for depression. The PFC shows high sensitivity for preschool depressive symptoms, but also identifies children with other mood and/or disruptive disorders (Belden et al. [2008](#)). Children with scores  $\geq 3$  (81% of sample; elevated depressive and possible mood/disruptive symptoms) and scores of 0 (presumed healthy) were sought for participation and children were not excluded based on psychiatric diagnoses except Autism Spectrum disorder. Additional exclusion criteria included chronic illness, neurological disorders and speech, language, or cognitive delays. Of the 416 invited for study participation, 305 participated. Children underwent approximately annual diagnostic assessments over 9 years. Informed consent was obtained from all parents in the study. Child verbal assent was also obtained before study participation. The Institutional Review Board at WUSM approved all procedures in accordance with institutional ethical guidelines. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

To obtain the best approximation of preschool personality traits, observational data assessed across the first three preschool-aged assessments were combined (however, longitudinal modeling analyses were also completed using only the initial preschool-aged assessment and is provided in supplemental tables; overall findings remain similar). Baseline age was the mean age at the first three assessments used for personality assessment ( $M = 5.36$ ,  $SD = 0.86$ ,  $Min = 3.13$ ,  $Max = 6.99$ ); each assessment was spaced approximately one year apart. The sample included slightly more males (51.8% male) and Caucasian (53.8%) participants compared with African American (32.8%) or other (13.4%) ethnicities. In total, children were followed for approximately 9 years. Following the three baseline assessments, subjects completed on average 3.41(1.12) longitudinal follow-up assessments, with the final assessments occurring between the average ages of 9.05(0.82) and 12.04 (1.46). Subjects completed mean 86.6% ( $SD = 20.0$ ) longitudinal follow-up assessments they were offered. For those participants who completed at least one follow-up assessment, 200 (76%) completed their final offered assessment while 64 (24%) did not. Children who did and did not complete follow-up assessments did not differ on preschool personality variables or symptoms/functioning, except depressive symptoms: children who completed a final

assessment had lower preschool depressive symptoms ( $M = 2.16$ ,  $SD = 1.37$ ) than those who did not ( $M = 2.67$ ;  $SD = 1.81$ ;  $t = 2.05$ ,  $p = 0.04$ ).

## Measures

**DSM-IV Psychiatric Diagnoses** Trained staff conducted in-person diagnostic interviews with children and their primary caregivers from the baseline to the final follow-up assessment. The Preschool-Age Psychiatric Assessment (PAPA; Egger et al. 2006) was used with primary caregivers from baseline through age 7, and the Childhood and Adolescent Psychiatric Assessment (CAPA; Angold and Costello 2000) was administered to caregivers at age 8. At age 9 to the final assessment the CAPA was administered to child and caregiver. As is standard with and recommended by the authors of the PAPA and CAPA (Angold and Costello 2000; Egger et al. 2006), raters were first trained to reliability. All diagnostic assessments were audiotaped and 20% of tapes were reviewed by a master coder for reliability and discrepancies were resolved in consultation with a senior child psychiatrist (J.L.L.) as previously described (Luby et al. 2009). Preschool diagnoses assessed included major depressive disorder (MDD), separation anxiety disorder (SAD), generalized anxiety disorder (GAD), social phobia, conduct disorder (CD), attention deficit hyperactivity disorder (ADHD) and oppositional defiant disorder (ODD).

### Depression, Anxiety, and Externalizing Severity Scores

Dimensional depression, anxiety, and externalizing severity scores (i.e., the total number of core DSM based symptoms endorsed) were created at preschool assessments using the PAPA and at school-age assessments using the CAPA. The depression severity score was the sum of 9 core depression symptoms from DSM-IV Major Depressive Disorder (MDD) criteria (Baseline:  $M = 2.27$ ;  $SD = 1.48$ ; Range = 0–8). The anxiety severity score combined sum scores of symptoms from the SAD and GAD modules (Baseline:  $M = 2.03$ ;  $SD = 2.22$ ; Range = 0–11). The externalizing severity score was the combined sum scores of core symptoms from the ADHD, ODD, and CD modules (Baseline:  $M = 6.62$ ;  $SD = 6.37$ ; Range = 0–34). Baseline assessments were the average scores across the three baseline assessments (baseline  $\alpha$ 's = 0.62, 0.69, and 0.92 for depression, anxiety and externalizing, respectively) while longitudinal severity scores were sum scores at each individual assessment (average  $\alpha$ 's across longitudinal assessment = 0.63, 0.64, and 0.90 for depression, anxiety and externalizing, respectively). Baseline depressive symptoms were associated with anxiety ( $r = 0.62$ ,  $p < 0.001$ ) and externalizing ( $r = 0.67$ ,  $p < 0.001$ ) symptoms, and anxiety and externalizing symptoms were associated with each other ( $r = 0.46$ ,  $p < 0.001$ ).

**Child Functional Assessment** Child functioning was measured at school-age follow-up assessments using the Child and Adolescent Functional Assessment Scale (CAFAS; Hodges 2000). The CAFAS is a semi-structured rater administered interview that assesses psychosocial functioning and impairment across a variety of functioning domains, such as home, school, and behavior toward others. The total score was used; higher scores indicate more impairment (Baseline:  $M = 25.13$ ;  $SD = 25.60$ ; Range = 0–120). Worse functioning was associated with higher depressive ( $r = 0.55$ ,  $p < 0.001$ ), anxiety ( $r = 0.41$ ,  $p < 0.001$ ) and externalizing ( $r = 0.61$ ,  $p < 0.001$ ) symptoms.

**Five Factor Model Personality Traits** 7820 unique ratings of children during ages 3–6 years were included in observed thin slice personality measurements. Children were video recorded during structured Laboratory Temperament Assessment Battery (LABTAB) tasks and unacquainted observers rated each FFM personality dimension after watching approximately 60 s (taken from the middle) of each structured observational task (observational tasks included: Box Empty, Impossibly Perfect Circles, Popping Bubbles, Picture Tearing, Snack Delay, Storytelling, Transparent Box and Tea Cups, and were chosen to elicit observable personality differences, such as negative and positive affectivity). Of note, micro-analytic coding of temperament in the current sample was begun using the LABTAB tasks initially, however was not completed due to the immense time investment necessary for multiple tasks across multiple ages. Given there is already a large body of literature assessing observed temperament in early childhood (Gagne et al. 2011), and emerging consensus indicates that temperament and personality are more alike than different (Grist and McCord 2010), we believed the LABTAB provided an interesting opportunity to observationally code personality in very young children.

Unacquainted observers included 27 undergraduate students and staff of the Early Emotional Development Program, all of whom were blind to child diagnostic and demographic characteristics. Each observer was oriented to the thin slice procedure by being given brief definitions of each personality dimension and asked to provide a 'snap judgement' of the child's personality using the entire video clip. Descriptions for each dimension included extraverted: "talkative, assertive, active, excitement-seeking, and fun-loving;" agreeableness: "trusting, straightforward, helpful, easy going and modest;" conscientiousness: "deliberate, orderly, competent, dutiful and achievement-striving;" neuroticism: "anxious, depressed, self-conscious, impulsive and vulnerable;" and openness: "non-conforming, seeks novelty and fantasy, and open to new ideas and values." Observers rated each FFM personality trait on a 1 (not at all) to 5 (extremely) scale. For example, for the Popping Bubbles task, children are instructed to pop bubbles blown by the

experimenter, and a child might be rated as less ‘agreeable’ if the child took the bubbles wand from the experimenters’ hand and played by him/herself. In a different task where children are repeatedly criticized for their drawing abilities (Impossibly Perfect Circles), a child’s agreeableness might be rated lower if the child stopped complying with the drawing task following correction or started drawing something other than asked. Each child’s personality trait was rated by 8–18 unique observers across 4–8 structured experimenter/child observation tasks, with an average of 25.7 (SD 5.13; Min = 10, Max = 33) ratings for each FFM dimension. These ratings were averaged across observers and across tasks for each personality dimension (e.g., extraversion). Intraclass correlation coefficients (ICC) for single raters for one task ranged from ICC = 0.24 (openness) to ICC = 0.53 (extraversion), which is similar to agreement levels for thin slice technique in adults (Connelly and Ones 2010). The average agreement of the composite score across tasks and raters for the five dimensions was ICC = 0.46, 0.48, 0.56, 0.60, and 0.77 for openness, neuroticism, agreeableness, conscientiousness, and extraversion, respectively. Again, estimates demonstrated equivalent or better magnitudes when compared with adult and child thin slice papers (Borkenau et al. 2004; Tackett et al. 2016), indicating that meaningful individual differences were obtained and agreed upon by raters. ICCs for cross-situational consistency (cross rater/cross task) had a mean of 0.82, notably higher than those derived from previous work with adults (Borkenau et al. 2004) and consistent with previous estimates using older children (Tackett et al. 2016, 2017). At individual preschool timepoints, ICC’s ranged from 0.40–0.74 (T1), 0.46–0.76 (T2), and 0.49–0.85 (T3). Thin slice observations also demonstrated preliminary divergent and convergent validity with temperament (see Whalen et al. [under review](#), for further details on validation).

### Statistical Analysis

We first examined demographic differences, including sex, age and a measure of socioeconomic status (income to needs ratio) with baseline FFM dimensions. Significant differences in demographic variables were used as covariates in all longitudinal analyses. We then examined concurrent baseline dimensional depressive, anxiety and externalizing symptoms and preschool psychiatric disorder status differences (Y/N) with individual personality dimensions.

To test separate models relating personality to psychopathology we completed two sets of multilevel linear models including random intercept and slope components with an unstructured covariance structure. Time was defined as age at assessment, which varied across subjects within each wave, and all models controlled for sex, mean baseline age, and Time 1 (T1) income-to-needs. All models were centered at age 11, which was the nearest integer to the mean age of

10.7 across subjects and waves. These multilevel models allowed us to examine whether early assessments of personality were associated with assessments of psychopathology across development. We simultaneously tested spectrum and pathoplasty theory in the same set of multilevel models. To examine the spectrum theory we examined the main effect of the association between FFM dimensions and longitudinal depressive, anxiety and externalizing symptoms, and global functioning. To test the pathoplasty theory, we examined the personality by time interaction, allowing us to test slope differences, or differences in trajectories, of symptoms and functioning across time, as predicted by personality. To test a pure vulnerability model, we then completed a second set of identical models (without the interaction), with the addition of baseline dimensional depressive, anxiety and externalizing symptoms as covariates. These models assessed the role of personality above and beyond baseline symptoms to understand whether personality provides additional risk for psychopathology. Statistical software utilized for longitudinal models was SAS v9.4.

## Results

### Demographics Differences

Older participants exhibited elevated conscientiousness and agreeableness and lower openness (see Table 1). Females were significantly higher on conscientiousness and agreeableness and significantly lower on neuroticism while children from higher income-to-needs families exhibited elevated conscientiousness and agreeableness. Due to demographic differences in personality, all analyses controlled for mean baseline age, sex, and T1 income-to-needs. See Whalen et al. ([under review](#)) for correlations of personality dimensions.

### Spectrum Models

The spectrum model suggests that personality and psychopathology lay on a single spectrum that influences each other. Consistent with this spectrum model, concurrent preschool associations between personality and baseline externalizing symptoms indicated that elevated extraversion, openness and neuroticism were associated with higher externalizing symptoms while lower conscientiousness and agreeableness were associated with fewer externalizing symptoms (see Table 1). However, there was a lack of overlap for depressive and anxiety symptoms with preschool personality. The only evidence for internalizing symptom associations with personality was for a concurrent baseline diagnosis of separation anxiety disorder. Those that met diagnosis ( $n = 73$ ;  $M = 2.84$ ;  $SD = 0.59$ ) exhibited lower extraversion ( $t(297) = 2.13$ ,  $p = 0.03$ ,  $d =$

**Table 1** Demographic and clinical associations with FFM personality dimensions ( $n = 299$ )

	Personality Dimensions				
	Extraversion	Agreeableness	Conscientiousness	Neuroticism	Openness to Experience
Average Rating Across Sample	2.96(0.54) (1.45–4.33)	3.39(0.40) (2.16–4.31)	3.09(0.43) (1.77–4.29)	2.14(.29) (1.42–3.40)	2.79(0.35) (1.84–3.87)
Mean Age	$r = -0.10$	$r = 0.25^{**}$	$r = 0.33^{**}$	$r = -0.09$	$r = -0.19^{**}$
Sex	$t(297) = -0.06$	$t(297) = -3.26$	$t(297) = -3.65$	$t(297) = 3.70$	$t(297) = 0.91$
Females	2.96(0.54)	3.46(0.40)	3.18(0.45)	2.07(0.28)	2.77(0.31)
Males	2.96(0.55)	3.32(0.38)	3.00(0.39)	2.19(0.28)	2.80(0.38)
Baseline Income to needs	$r = -0.10$	$r = 0.22^{**}$	$r = 0.37^{**}$	$r = 0.06$	$r = -0.01$
Average Symptoms at Baseline					
Baseline Depressive Symptoms	$r = 0.06$	$r = -0.05$	$r = -0.04$	$r = 0.08$	$r = 0.07$
Baseline Externalizing Symptoms	$r = 0.16^{**}$	$r = -0.21^{**}$	$r = -0.20^{**}$	$r = 0.17^*$	$r = 0.12^*$
Baseline Anxiety Symptoms	$r = 0.04$	$r = 0.02$	$r = -0.03$	$r = 0.07$	$r = 0.06$

Mean(Standard deviation)(Range); Mean age from baseline T1-T3 preschool period; Baseline income to needs from T1. Average symptoms at baseline include T1-T3 period. \*  $p < 0.05$ ; \*\* $p < 0.01$

0.30) than those without ( $n = 226$ ;  $M = 3.00$ ;  $SD = 0.52$ ) and lower openness ( $M = 2.72$ ;  $SD = 0.35$ ;  $t(297) = 2.06$ ,  $p = 0.04$ ,  $d = 0.28$ ) compared with those without ( $M = 2.84$ ;  $SD = 0.34$ ; for full baseline diagnostic difference findings, see Supplemental Table 1). Results indicate that evidence for some overlap between normal range personality and psychopathology in preschoolers. However, the extent of the overlap is less than in older children and adults for internalizing or depression.

The spectrum model was examined longitudinally in multilevel models of depression, externalizing, and anxiety symptom trajectories and global functioning trajectories (see Table 2). In accordance with the spectrum model, elevated extraversion and lower agreeableness and conscientiousness were significantly associated with higher depressive symptoms over development. Higher levels of neuroticism and lower agreeableness predicted higher externalizing symptoms. A similar pattern emerged for global functioning where higher levels of extraversion and neuroticism and lower agreeableness and conscientiousness in early childhood were associated with worse global functioning. No personality dimensions were longitudinally associated with later anxiety symptoms (Table 2).

### Pathoplasty Models

Examining the interaction between time and personality (e.g., neuroticism) in the above models, to assess whether early personality influenced trajectories of psychopathology across childhood, we found no significant interactions. Findings indicated no evidence that early child personality is shaping the linear trajectory of pathology across time (see Table 2). As a secondary analysis given some literature indicates non-linear models explain symptom trajectories in childhood (e.g.,

Forbes et al. 2017), we completed a set of models by adding a squared interaction to assess curvilinear trajectories. Findings indicated significant non-linear trajectories between agreeableness and depression and anxiety symptoms and conscientiousness and depression. Findings were similar across the three findings: elevated agreeableness/conscientiousness (1SD above mean) demonstrated consistently elevated symptoms across development, while low (1SD below mean) agreeableness/conscientiousness demonstrated an inverted-U pattern such that at young and older ages, personality was associated with fewer internalizing symptoms, but around ages 9–13, personality was associated with higher internalizing symptoms. Full results in supplemental Tables 2–5 and supplemental Figs. 1, 2, 3. Results using only initial assessment of personality in supplemental Tables 6–7.

### Vulnerability Models

The vulnerability model states that personality constitutes a risk or vulnerability early in childhood in and of itself for later psychopathology. To test a vulnerability model and investigate temporal precedence of personality predicting psychopathology, we added baseline dimensional symptoms of externalizing, anxiety and depressive symptoms to all longitudinal models, as a way to examine whether there is additional information early personality provides about later psychopathology above baseline associations (see Table 3). Above and beyond demographic covariates and the addition of baseline symptoms to all models, findings indicated lower conscientiousness predicted higher depressive symptoms and elevated neuroticism predicted increased externalizing symptoms. Lower conscientiousness and lower agreeableness predicted worse functioning. No personality dimensions predicted

**Table 2** Spectrum and pathoplasty multilevel models of depression core severity, externalizing dimensional, internalizing dimensional, and global functioning by FFM dimensions

Independent Variable	DV: Depression Severity Score			DV: Externalizing Severity Score			DV: Anxiety Severity Score			DV: Global Functioning Score		
	<i>Estimate (SE)</i>	<i>t</i>	<i>p</i>	<i>Estimate (SE)</i>	<i>t</i>	<i>p</i>	<i>Estimate (SE)</i>	<i>t</i>	<i>p</i>	<i>Estimate (SE)</i>	<i>t</i>	<i>p</i>
<b>Extraversion</b>												
Intercept	2.82(0.14)	20.2	0.00	5.74(0.47)	12.0	0.00	0.65(.11)	5.9	0.00	21.19(1.82)	11.6	0.00
Female gender	-0.44(.20)	-2.2	0.03	-2.07(0.69)	-3.0	0.00	0.13(0.16)	0.8	0.43	-6.50(2.65)	-2.5	0.02
Mean Baseline age	0.58(.13)	4.5	0.00	0.99(0.44)	2.2	0.03	0.11(0.10)	1.1	0.28	2.38(1.69)	1.4	0.16
T1 Income-to-needs ratio	-0.28(.09)	-3.1	0.00	-0.60(.29)	-2.0	0.04	-0.12(.07)	-1.7	0.08	-2.77(1.14)	-2.4	0.01
Time	-0.12(.04)	-2.9	0.00	-0.76(0.10)	-7.5	0.09	-0.13(0.03)	-4.1	0.00	0.37(0.49)	0.8	0.45
Extraversion (Spectrum)	0.46(0.19)	2.5	0.02	1.08(0.64)	1.7	0.00	0.14(0.15)	0.9	.36	5.31(2.42)	2.2	0.03
Extraversion x Time (Pathoplasty)	0.05(0.07)	0.7	.46	-0.18(.18)	-1.0	0.32	0.02(0.05)	0.3	0.75	0.43(0.87)	0.9	0.62
<b>Agreeableness</b>												
Intercept	2.78(0.14)	19.4	0.00	5.57(0.48)	11.6	0.00	0.66(0.11)	5.9	0.00	20.12(1.83)	11.0	0.00
Female gender	-0.34(0.21)	-1.6	0.12	-1.71(0.71)	-2.4	0.02	0.10(0.16)	0.6	0.53	-4.27(2.72)	-1.6	0.12
Mean Baseline age	0.66(0.14)	4.8	0.00	1.16(0.45)	2.6	.01	0.10(0.11)	0.9	0.36	3.67(1.73)	2.1	0.04
T1 Income-to-needs ratio	-0.25(0.09)	-2.8	0.01	-0.51(0.30)	-1.7	0.09	-0.14(0.07)	-2.0	0.05	-2.14(1.16)	-1.9	0.06
Time	-0.11(0.04)	-2.8	0.01	-0.76(0.10)	-7.5	0.00	-0.13(0.03)	-4.1	0.00	0.42(0.49)	0.9	0.39
Agreeableness (Spectrum)	-0.59(0.30)	-2.0	0.05	-2.18(1.0)	-2.2	0.03	0.10(0.23)	0.4	0.67	-12.12(3.80)	-3.2	0.00
Agreeableness x Time (Pathoplasty)	0.06(0.10)	0.6	0.53	0.17(0.26)	0.7	0.51	0.11(0.08)	1.4	.17	0.12(1.23)	0.1	0.93
<b>Conscientiousness</b>												
Intercept	2.76(0.14)	19.2	0.00	5.56(0.49)	11.4	0.00	0.65(0.11)	5.7	0.00	20.21(1.85)	10.9	0.00
Female gender	-0.30(.21)	-1.4	0.16	-1.70(0.72)	-2.4	0.02	0.13(0.17)	0.8	0.43	-4.32(2.78)	-1.6	0.12
Mean Baseline age	0.68(0.14)	4.9	0.00	1.19(0.47)	2.6	0.01	0.11(0.11)	1.1	0.30	3.70(1.79)	2.1	0.04
T1 Income-to-needs ratio	-0.21(0.10)	-2.2	0.13	-0.43(0.32)	-1.4	0.18	-0.13(0.07)	-1.7	0.08	-1.79(1.23)	-1.5	0.15
Time	-0.11(0.04)	-2.8	0.01	-0.76(0.10)	-7.5	0.00	-0.13(0.03)	-4.0	0.00	0.36(0.49)	0.7	0.46
Conscientiousness (Spectrum)	-0.68(0.30)	-2.2	0.03	-1.86(1.0)	-1.8	0.07	-0.06(0.24)	-0.2	0.81	-10.08(3.92)	-2.6	0.01
Conscientiousness x Time (Pathoplasty)	-0.01(0.09)	-0.1	0.93	0.13(0.25)	0.5	0.60	0.08(0.07)	1.1	0.26	-1.17(1.16)	-1.0	0.31
<b>Neuroticism</b>												
Intercept	2.82(0.14)	19.7	0.00	5.56(0.48)	11.7	0.00	0.67(0.11)	6.0	0.00	20.72(1.84)	11.3	0.00
Female gender	-0.42(0.21)	-2.0	0.05	-1.59(0.70)	-2.3	0.02	0.10(0.17)	0.6	0.54	-5.34(2.73)	-2.0	0.05
Mean Baseline age	0.58(0.58)	4.4	0.00	0.945(0.44)	2.2	0.03	0.14(0.10)	1.4	0.17	2.42(1.69)	1.4	0.15
T1 Income-to-needs ratio	-0.30(0.09)	-3.3	0.00	-0.69(0.29)	-2.4	0.02	-0.15(0.07)	-2.2	0.03	-3.18(1.14)	-2.8	0.01
Time	-0.11(0.04)	-2.8	0.01	-0.75(0.10)	-7.5	0.00	-0.13(0.03)	-4.1	0.00	0.40(0.49)	0.8	0.41
Neuroticism (Spectrum)	0.18(0.38)	0.5	0.64	2.97(1.3)	2.3	0.03	0.06(0.31)	0.2	0.86	10.08(4.90)	2.1	0.04
Neuroticism x Time (Pathoplasty)	-0.13(0.14)	-1.0	0.35	0.53(0.36)	1.5	0.14	-0.17(0.11)	-1.6	0.11	-1.86(1.71)	-1.1	0.28
<b>Openness</b>												
Intercept	2.82(0.14)	20.1	0.00	5.74(0.48)	12.0	0.00	0.65(0.11)	5.9	0.00	21.16(1.83)	11.6	0.00
Female gender	-0.43(0.20)	-2.1	0.04	-2.06(0.69)	-3.0	0.00	0.13(0.16)	0.9	0.40	-6.41(2.67)	-2.4	0.02
Mean Baseline age	0.59(.13)	4.5	0.00	0.97(0.445)	2.2	0.03	0.12(0.10)	1.2	0.25	2.41(1.70)	1.4	0.16
T1 Income-to-needs ratio	-0.30(0.09)	-3.4	0.00	-0.65(0.29)	-2.2	0.03	-0.13(0.07)	-1.9	0.06	-3.03(1.15)	-2.7	0.02
Time	-0.11(0.04)	-2.9	0.04	-0.76(0.10)	-7.5	0.00	-0.13(0.03)	-4.1	0.00	0.40(0.49)	0.8	0.41
Openness (Spectrum)	0.65(0.31)	2.1	0.00	1.00(1.1)	0.9	0.35	0.24(0.25)	1.0	0.33	6.13(4.03)	1.5	0.13
Openness x Time (Pathoplasty)	0.15(0.12)	1.3	0.19	-0.24(0.31)	-0.8	0.43	0.03(0.09)	0.3	0.77	-0.08(1.45)	-0.1	0.95

Separate models were conducted for each FFM dimension and each symptom and functioning outcome variable

anxiety symptoms. Overall, childhood personality predicted some later psychopathology after accounting for early

psychopathology, indicating the utility of early personality assessments from a vulnerability perspective.

**Table 3** Vulnerability multilevel models of depression core severity, externalizing dimensional, internalizing dimensional, and global functioning by FFM dimensions

Independent Variable	DV: Depression Severity Score			DV: Externalizing Severity Score			DV: Anxiety Severity Score			DV: Global Functioning Score		
	<i>Est. (SE)</i>	<i>t</i>	<i>p</i>	<i>Est. (SE)</i>	<i>t</i>	<i>p</i>	<i>Est. (SE)</i>	<i>t</i>	<i>p</i>	<i>Est. (SE)</i>	<i>t</i>	<i>p</i>
<b>Extraversion</b>												
Intercept	2.74 (0.11)	24.4	0.00	5.45 (0.31)	17.4	0.00	0.67 (0.10)	6.8	0.00	19.22 (1.27)	15.1	0.00
Female gender	-0.19 (0.16)	-1.2	0.24	-1.13 (0.46)	-2.5	0.01	0.13 (0.14)	0.9	0.39	-1.61 (1.88)	-0.9	0.39
Mean Baseline age	0.49 (0.11)	4.6	0.00	0.65 (0.30)	2.2	0.03	0.05 (0.10)	0.5	0.59	1.29 (1.21)	1.1	0.29
T1 Income-to-needs ratio	-0.07 (0.07)	-1.0	0.33	0.21 (0.20)	1.0	0.30	-0.05 (0.06)	-0.8	0.46	0.22 (0.82)	0.3	0.79
Baseline Externalizing severity	0.08 (0.02)	4.4	0.00	0.56 (0.05)	10.7	0.00	-0.00 (0.02)	-0.2	0.81	2.11 (0.21)	10.0	0.00
Baseline Depression severity	0.40 (0.09)	4.6	0.00	0.33 (0.25)	1.3	0.19	0.18 (0.08)	2.3	0.02	2.11 (0.97)	2.2	0.03
Baseline Anxiety severity	0.02 (0.05)	0.4	0.66	0.18 (0.14)	1.3	0.19	0.16 (0.04)	3.8	0.00	-0.08 (0.53)	-0.2	0.88
Time	-0.11 (0.04)	-2.9	0.00	-0.75 (0.10)	-7.7	0.00	-0.12 (0.03)	-3.8	0.00	0.45 (0.49)	0.9	0.36
Extraversion (Vulnerability)	0.28 (0.15)	1.9	0.06	0.36 (0.42)	0.9	0.39	0.13 (0.13)	1.0	0.33	1.76 (1.70)	1.0	0.30
<b>Agreeableness</b>												
Intercept	2.71 (0.11)	23.7	0.00	5.35 (0.32)	16.9	0.00	0.68 (0.10)	6.8	0.00	18.65 (1.28)	14.6	0.00
Female gender	-0.13 (0.17)	-0.8	0.45	-0.90 (0.47)	-1.9	0.05	0.11 (0.15)	0.7	0.47	-2.42 (1.91)	-0.2	0.83
Mean Baseline age	0.53 (0.11)	4.8	0.00	0.78 (0.30)	2.6	0.01	0.03 (0.10)	0.3	0.76	2.03 (1.24)	1.6	0.10
T1 Income-to-needs ratio	-0.05 (0.07)	-0.7	0.47	0.27 (0.20)	1.4	0.18	-0.06 (0.06)	-1.0	0.34	0.58 (0.82)	0.7	0.48
Baseline Externalizing severity	0.08 (0.02)	4.4	0.00	0.55 (0.05)	10.7	0.00	-0.00 (0.02)	-0.1	0.92	2.06 (0.21)	9.8	0.00
Baseline Depression severity	0.40 (0.09)	4.7	0.00	0.33 (0.25)	1.3	0.18	0.18 (0.08)	2.3	0.02	2.15 (0.96)	2.2	0.03
Baseline Anxiety severity	0.02 (0.05)	0.4	0.67	0.19 (0.13)	1.4	0.17	0.16 (0.04)	3.7	0.00	-0.03 (0.52)	-0.1	0.96
Time	-0.11 (0.04)	-2.8	0.01	-0.75 (0.10)	-7.7	0.00	-0.12 (0.03)	-3.8	0.00	0.46 (0.49)	0.9	0.35
Agreeableness (Vulnerability)	-0.40 (0.24)	-1.7	0.09	-1.26 (0.66)	-1.9	0.06	0.16 (0.21)	0.8	0.44	-6.77 (2.67)	-2.5	0.01
<b>Conscientiousness</b>												
Intercept	2.68 (0.11)	23.5	0.00	5.32 (0.32)	16.7	0.00	0.67 (0.10)	6.6	0.00	18.50 (1.29)	14.4	0.00
Female gender	-0.08 (0.17)	-0.5	0.65	-0.85 (0.47)	-1.8	0.08	0.13 (0.15)	0.9	0.38	-0.13 (1.94)	-0.1	0.95
Mean Baseline age	0.57 (0.11)	5.0	0.00	0.82 (0.31)	2.7	0.01	0.05 (0.10)	0.5	0.61	2.29 (1.27)	1.8	0.07
T1 Income-to-needs ratio	-0.01 (0.08)	-0.2	0.87	0.35 (0.21)	1.6	0.11	-0.05 (0.07)	-0.7	0.46	0.92 (0.86)	1.1	0.29
Baseline Externalizing severity	0.08 (0.02)	4.5	0.00	0.56 (0.05)	10.8	0.00	-0.00 (0.02)	-0.2	0.88	2.09 (0.21)	10.0	0.00
Baseline Depression severity	0.40 (0.09)	4.7	0.00	0.32 (0.25)	1.3	0.20	0.18 (0.08)	2.3	0.02	2.14 (0.96)	2.2	0.03
Baseline Anxiety severity	0.02 (0.05)	0.4	0.68	0.19 (0.13)	1.4	0.17	0.16 (0.04)	3.8	0.00	-0.06 (0.52)	-0.1	0.90
Time	-0.11 (0.04)	-2.9	0.00	-0.75 (0.10)	-7.8	0.00	-0.12 (0.03)	-3.8	0.00	0.44 (0.49)	0.9	0.37
Conscientiousness (Vulnerability)	-0.56 (0.24)	-2.4	0.02	-1.28 (0.66)	-1.9	0.05	-0.01 (0.21)	-0.1	0.96	-6.72 (2.71)	-2.5	0.01
<b>Neuroticism</b>												
Intercept	2.74 (0.11)	24.0	0.00	5.36 (0.31)	17.0	0.00	0.69 (0.10)	6.9	0.00	18.92 (1.28)	14.8	0.00
Female gender	-0.20 (0.17)	-1.2	0.23	-0.88 (0.47)	-1.9	0.06	0.08 (0.15)	0.5	0.59	-0.84 (1.91)	-0.4	0.66
Mean Baseline age	0.47 (0.11)	4.4	0.00	0.65 (0.29)	2.2	0.03	0.04 (0.10)	0.4	0.71	1.34 (1.20)	1.1	0.27
T1 Income-to-needs ratio	-0.08 (0.07)	-1.0	0.30	0.16 (0.20)	0.8	0.42	-0.04 (0.06)	-0.7	0.50	0.02 (0.81)	0.0	0.98
Baseline Externalizing severity	0.09 (0.02)	4.6	0.00	0.56 (0.05)	10.8	0.00	-0.00 (0.02)	-0.2	0.83	2.12 (0.21)	10.1	0.00
Baseline Depression severity	0.40 (0.09)	4.6	0.00	0.31 (0.25)	1.2	0.22	0.18 (0.08)	2.3	0.02	2.08 (0.97)	2.2	0.03
Baseline Anxiety severity	0.02 (0.05)	0.4	0.71	0.17 (0.13)	1.3	0.21	0.16 (0.04)	3.9	0.00	-0.13 (0.53)	-0.3	0.80
Time	-0.11 (0.04)	-2.8	0.01	-0.75 (0.10)	-7.7	0.00	-0.12 (0.03)	-3.9	0.00	0.47 (0.49)	1.0	0.34
Neuroticism (Vulnerability)	-0.10 (0.30)	-0.3	0.73	1.78 (0.85)	2.1	0.04	-0.44 (0.27)	-1.6	0.11	5.90 (3.42)	1.7	0.09
<b>Openness</b>												
Intercept	2.73 (0.11)	24.3	0.00	5.45 (0.31)	17.3	0.00	0.67 (0.10)	6.8	0.00	19.20 (1.28)	15.1	0.00
Female gender	-0.18 (0.17)	-1.1	0.27	-1.12 (0.46)	-2.4	0.02	0.13 (0.14)	0.9	0.36	-1.56 (1.88)	-0.8	0.41
Mean Baseline age	0.49 (0.11)	4.6	0.00	0.65 (0.30)	2.2	0.03	0.06 (0.10)	0.6	0.55	1.28 (1.21)	1.1	0.29
T1 Income-to-needs ratio	-0.08 (0.07)	-1.2	0.25	0.19 (0.20)	1.0	0.34	-0.05 (0.06)	-0.9	0.39	0.15 (0.82)	0.2	0.86
Time	0.08 (0.02)	4.6	0.00	0.56 (0.05)	10.8	0.00	-0.00 (0.02)	-0.2	0.86	2.12 (0.21)	10.1	0.00
Baseline Externalizing severity	0.39 (0.09)	4.5	0.00	0.32 (0.25)	1.3	0.20	0.17 (0.08)	2.2	0.03	2.09 (0.98)	2.1	0.03
Baseline Depression severity	0.02 (0.05)	0.4	0.68	0.18 (0.14)	1.3	0.19	0.16 (0.04)	3.8	0.00	-0.09 (0.53)	-0.2	0.86
Baseline Anxiety severity	-0.11 (0.04)	-2.9	0.00	-0.75 (0.10)	-7.7	0.00	-0.12 (0.03)	-3.8	0.00	0.46 (0.49)	0.9	0.35
Openness (Vulnerability)	0.38 (0.25)	1.5	0.13	0.40 (0.70)	0.6	0.57	0.22 (0.22)	1.0	0.33	1.81 (2.81)	0.6	0.52

Separate models were conducted for each FFM dimension and each symptom and functioning outcome variable

### Discussion

The current study demonstrated that observed FFM personality dimensions in a preschool-aged sample are associated with concurrent psychological symptoms and prospectively predict psychological symptoms and global functioning. In particular,

we demonstrated support for both spectrum and vulnerability models of personality and psychopathology relationships across child development; however, we found little support for the pathoplasty model. These findings suggest that individual observed personality dimensions in children as young as preschool demonstrate concurrent associations as well as

prospective relationships with psychopathology, possibly indicating possible shared underlying etiological factors contributing to both (spectrum). Moreover, some of this risk is above and beyond baseline relationships, demonstrating personality to partly play a causal role in predicting longitudinal psychiatric developmental outcomes (vulnerability).

Our first set of models demonstrated support for the spectrum models of personality and psychopathology relationships, such that certain personality traits were prospectively associated with increased likelihood of clinical psychopathology and impairment across child development. Specifically, high neuroticism and low agreeableness predicted longitudinal externalizing symptoms while high extraversion, low conscientiousness, and low agreeableness predicted longitudinal depressive symptoms. In a similar pattern, these four personality dimensions also predicted global impairment across development. Together, observed extraversion and neuroticism demonstrated predictive associations with psychopathology and impairment while elevated agreeableness and conscientiousness acted as protective factors. These findings are mostly consistent with relationships evidenced in childhood and adolescence, however, neuroticism is often linked with both externalizing presentations, as we demonstrated, as well as internalizing presentations, which we did not find (Barbaranelli et al. 2003; De Pauw and Mervielde 2010; Tackett 2006; Tackett et al. 2017). Moreover, extraversion has previously demonstrated links with *fewer* depressive symptoms in preschoolers (Zupancic and Podlesek 2010) and generally shows stronger associations with externalizing presentations (e.g., Forbes et al. 2017; Zupancic and Kavcic 2003). Extraversion in early childhood has been thought to tap sociability and activity (the latter which has been separated into its own facet in the Little Six) (De Pauw 2017; Soto and John 2014), and as such, our observed measure of extraversion might be picking up on increased motor activity often seen in developmental manifestations of activity. This motor activity could be assessing early externalizing presentations that transition into elevated depressive symptoms across childhood. These contrary findings using preschool thin slice assessments warrant future study to better understand developmental course.

Findings are in line with much of the past literature in older children and adults indicating support for the spectrum model of personality and psychopathology relationships (e.g., Clark and Watson 2008; De Bolle et al. 2012). Spectrum relationships were further validated in concurrent findings: all five personality dimensions uniquely related to preschool externalizing symptoms and the presence or absence of preschool psychiatric disorders. Previous literature examining spectrum models utilizes a cross-sectional approach to examining overlap, and our concurrent findings add to this literature while our longitudinal models indicate this overlapping relationship persists across childhood development. Together, findings

indicate the possibility of a shared underlying factor contributing to a spectrum of personality and psychopathology relationships in children as young as preschool, from general traits to subclinical symptoms to full-blown psychopathology across concurrent and prospective child development. However, it should be noted that in order to truly test a spectrum model, shared underlying factors, such as neurobiological substrates, would need to be assessed.

When testing the pathoplasty model, we found no support that observed preschool personality predicted linear symptom or functioning trajectories across development. However, we did find some secondary non-linear relationships indicating low agreeableness and conscientiousness were associated with elevated internalizing (depression and anxiety) symptoms only between roughly ages 9–13, while elevated agreeableness and conscientiousness appeared to increase risk for symptoms at younger and older ages. Findings could indicate that the pubertal ages of 9–13, which is often an elevated time of risk for onset of internalizing symptoms (Cyranowski et al. 2000), is an especially sensitive time to personality/psychopathology relationships. In general the pathoplasty model has little previous support (Tackett 2006) as is difficult to test due to it requiring repeated assessments of symptoms across development. We know of only one study finding support for this model in preschoolers, using temperamental assessments akin to a measure of neuroticism to predict internalizing trajectories across childhood (Forbes et al. 2017). Our study was not able to replicate the Forbes and colleagues (2017) paper, however our study differed in several key ways, including being clinically enriched for depression, a smaller sample size, the use of personality versus temperamental measures, observed measures versus informant report, and diagnostic clinical symptoms rather than parent-reported psychological symptoms. All of these factors might have influenced findings.

Although a good deal of literature takes the third, vulnerability, approach to testing personality and psychopathology (Nigg 2006; Tackett 2006), most literature does not control for baseline psychopathology, so is not testing a pure vulnerability model. Likewise, vulnerability models are commonly examined later in child development, at which point personality might already demonstrate overlap with psychopathology. As such, we next tested the vulnerability model at one of the earliest feasible time points to assess temporal precedence of personality/psychopathology relationships in childhood.

To do this, we tested whether above and beyond concurrent symptoms, personality demonstrated longitudinal relationships with psychological symptoms. Because our sample was clinically enriched for depression and already showing associations with symptoms at baseline, findings demonstrate that above initial psychopathological symptoms, observed preschool personality exhibits associations with symptoms across child development. Specifically, lower conscientiousness continued to predict elevated depressive symptoms and

worse impairment, higher neuroticism continued to predict elevated externalizing symptoms, and lower agreeableness continued to predict worse impairment. Findings indicate increased utility of personality as a predispositional risk factor for some psychopathology and likely plays a causal temporal role in the development of symptoms. It should be noted that the spectrum and vulnerability models are not competing hypotheses, indicating evidence for both is not contradictory, and need not be mutually exclusive. Both are plausible hypotheses that warrant testing, as even if personality and psychopathology constructs overlap somewhat (spectrum), it is still important to ask whether one predicts the other as this tests whether there is additional novel information in the former (vulnerability). As noted though, we weren't able to truly test a vulnerability model due to the current sample exhibiting baseline psychopathology.

The preschool personality traits that related the most to adolescent psychopathology were high neuroticism and extraversion, and low agreeableness and conscientiousness. These findings replicate previous work in children and adolescents (De Pauw 2017; De Pauw and Mervielde 2010) and are similar to previous work using adult informants in preschoolers (Barbaranelli et al. 2003; Forbes et al. 2017; Zupancic and Kavcic 2003). Conscientiousness and agreeableness showed similar patterns across outcomes, consistent with the notion that these two personality traits covary highly in childhood compared with adulthood (Soto and Tackett 2015). Multiple studies in childhood demonstrate that conscientiousness is a robust and central personality trait at early ages that has life-long consequences, due to its indication of high self-regulation, responsibility and persistence (De Pauw 2017; Jackson and Hill *in press*). Agreeableness in young children encompasses some of these same features, though typically exhibits in interpersonal settings such as with authority figures and peers (De Pauw 2017; Shiner and Deyoung 2013). In early childhood there are fewer settings to demonstrate self-regulation and responsibility outside of interpersonal settings, possibly leading to the overlap of these two constructs during this developmental period.

Neuroticism demonstrates some of the strongest associations with psychopathology in adults (Griffith et al. 2009; Kotov et al. 2010) and although neuroticism predicted externalizing symptoms in the current sample, we were surprised to find few associations between observed preschool neuroticism and baseline diagnostic differences or with depressive and anxiety outcomes. The lack of baseline psychopathology differences could be due to the clinical heterogeneity and comorbidity of the sample. Youth without the target disorder in analysis (i.e., no ODD) commonly exhibited other forms of psychopathology (i.e., MDD, GAD) and as such, other psychopathologies could have led to null results. Second, neuroticism is generally thought to be less directly observable compared with other personality dimensions (Hampson and

Goldberg 2006), and has been suggested to be the most difficult FFM trait to measure using thin slice observational codes (Widiger and Costa Jr 1994), especially in children (Borkenau et al. 2004). Related, tasks used may not have evoked neuroticism or our observational measure of neuroticism may have only captured outwardly apparent aspects of neuroticism, and likewise, childhood neuroticism primarily taps lower self-worth and anxious distress (De Pauw 2017). Therefore, this methodology might have contributed to an inability to quantify more inward presentations, or the wide lens of emotional instability and negative affectivity common in early childhood. Moreover, the definition provided to raters taps into the various presentations of the trait, and raters may not have used valid clues to assess neuroticism. As such, observed neuroticism may have been more difficult to detect and isolate in preschool-aged children.

Additionally, as hypothesized and previous work indicates, openness demonstrated few associations with outcomes. There were no longitudinal associations, only with baseline separation anxiety disorder. Openness is the most heterogeneous FFM dimension in adults and is also the most controversial factor in children (John et al. 2008; Herzhoff & Tackett 2012). Openness in childhood overlaps greatly with an intellect dimension and there is little consensus on when openness first emerges in childhood, as even utilizing parent report, openness demonstrates poor psychometric properties in preschool (Grist et al. 2012). Consistent with this, openness also indicated the poorest psychometric properties of the Big Five from our sample (Whalen et al. *under review*).

Lastly, we also found no support of observed preschool personality predicting symptoms of anxiety for any models (albeit secondary findings in non-linear models). Past research has often examined childhood personality with broad externalizing and internalizing presentations (De Bolle et al. 2012; Tackett 2006) rather than anxiety per se. We parsed internalizing symptoms into separate depressive and anxiety symptom presentations (due to oversampling children with depression). Given the current samples elevated depression, it is not surprising that within internalizing presentations, most of the outcomes were associated with continued depressive symptoms. Moreover, temperamental dimensions (i.e., behavioral inhibition) most commonly linked with anxiety are most salient in the context of novelty. Given the breadth of situations used (many of which did not assess response to novelty), and that the dimensions assessed do not tap temperaments specifically associated with anxiety, these non-specific assessments might have contributed to a lack of personality/anxiety associations.

Limitations of the current study include that many preschoolers had clinical disorders at baseline and the sample was enriched for preschool depression. The severity of the sample may indicate findings are not generalizable to community preschool samples. Related, given many of the children

had baseline diagnoses, causal relationships between preschool personality dimensions contributing to onset of psychopathology cannot be determined. Observed personality might be a scar of concurrent mental disorder, or, early psychopathology may contribute to subsequent personality change. Related, personality was not assessed across development and so we were unable to assess change in personality over time. Further research would benefit by mapping the developmental course of observed personality starting in the preschool age to better understand temporal relationships between personality and symptoms. Third, we did not assess ‘activity,’ which many have deemed a sixth childhood personality dimension (aka, “The Little Six”) (De Pauw et al. 2009). Fourth, our assessment utilized observed measures of personality, and as such the behaviors indexed might have tapped into both traits and symptoms, though this is an issue across the lifespan and whenever observational methods identifying personality are employed. Related, although we have validated this approach (Whalen et al. [under review](#)), and in many ways the thin-slice approach represents a strength as does not use biased raters, interrater reliability of observed personality traits ranged from moderate to adequate and we were not able to compare observed personality with parent-reported child personality. The thin slice method should be further validated in this age range. Fifth, although theoretically orthogonal, personality dimensions were not independent from each other and as such, some findings may be due to overlap among variables. Lastly, we are unable to determine what might be the shared underlying etiological factors contributing to both preschool personality and concurrent and longitudinal psychological symptoms.

## Conclusions

The current study illustrated that observed FFM personality dimensions in children as young as preschool are associated with concurrent and longitudinal psychological symptoms and functioning across child development. From this work we demonstrated support for the spectrum and vulnerability models, yet found little indication of pathoplasty model. Observed personality dimensions appear to inform the etiology of childhood psychopathology and highlight the importance of early measurements of personality in preschool. The FFM model of personality in very young children is under-utilized as conferring risk or resilience for future psychopathology and impairment across development and could be better incorporated into models of developmental psychopathology. Future research would benefit from ongoing assessments of observed personality from the preschool age through adolescence to causally evaluate temporal relationships between the development of personality and psychological symptoms.

## Compliance with Ethical Standards

**Conflict of Interest** All authors declare no conflict of interest.

**Ethical Approval** The Institutional Review Board at WUSM approved all procedures in accordance with institutional ethical guidelines. All procedures performed in studies involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki declaration and its later amendments or comparable ethical standards.

**Informed Consent** Informed consent was obtained from all parents.

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