Cultural, Familial, and Neurobiological Correlates of Psychological Well-Being in Latinx Youth

By

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DISSERTATION

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DEDICATION

The majority of this dissertation is dedicated to the infinite universe, specifically the unique particle composition of time and space that set the stage for me to be alive right now writing this with the loving support of chosen friends and family.

The rest is dedicated to all the haters (mainly me) who didn't believe I would get this far. Who would have thought, not me!

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ABSTRACT

All youth have the capacity to thrive during adolescence by actively seeking internal and external resources to navigate the core developmental tasks characterizing this pivotal transition. Positive Youth Development (PYD) theories emphasize the role of adolescents' self-regulation and relational context in supporting this process, leading researchers to investigate which person-by-environment interactions confer optimal benefits. However, few empirical studies have explored PYD trajectories among ethnic/racial minority samples, including Latinx youth of Mexican-origin, leaving gaps in our understanding of specific individual, familial, and sociocultural factors enabling youth of color to flourish. Furthermore, research integrating cultural influences and neurobiological development within PYD trajectories in youth exposed to adversity are scarce. This dissertation aimed to address these gaps by investigating: (1) whether the Five Cs model of PYD accurately reflects PYD in Latinx youth, (2) the extent to which cultural orientation promotes Latinx PYD, (3) whether PYD factors moderate the impact of family stress on adolescent stress physiology, and (4) the moderating role of adolescent demographics within these associations. Study 1 provides robust evidence supporting the Five Cs model of PYD in Latinx youth, highlighting ethnic pride and cultural values as potent promoters of PYD for Mexican-origin youth. Study 2 reveals differential associations between family stress exposure and adrenocortical regulation based on adolescent gender and endorsement of the Five Cs, suggesting a potentially stronger biological link between the Five Cs and adrenocortical functioning in adolescent girls compared to boys. Taken together, these studies offer a culturally-sensitive and neurobiologically-informed understanding of PYD pathways and resilience processes unfolding in the lives of Mexican-origin youth, underscoring the importance of integrating across bioecological and relational systems when conducting PYD research.

CHAPTER 1: GENERAL INTRODUCTION

Adolescence is a remarkable developmental period known for its unique confluence of psychobiological maturation, social-emotional challenges, and increased opportunities for self-discovery and empowerment (Crone & Dahl, 2012; Dahl et al., 2018). Physically, young teens experience increased neural development and hormonal fluctuations resulting in significant bodily changes, including refined regulation and increased sensitivity of stress physiological systems (Berenbaum et al., 2015; Eiland & Romeo, 2013; Gunnar, Wewerka, et al., 2009). Psychologically, youth learn to balance changing autonomy and connection needs, one of the core developmental tasks of adolescence; youth must establish a strong sense of their personal and public identities, whilst managing various peer and family influences (Allen & Loeb, 2015; Bornstein et al., 2012; Bukowski et al., 2011; Collins & Laursen, 2004). As psychobiological maturation unfolds and adolescents face unique social-emotional challenges testing their self-regulatory capacities, they experience a proliferation of opportunities to discover, explore, learn from, and adapt to the world in ways that can ultimately shape their life trajectory. Thus, adolescence inherently represents a time of fluctuating risk, resilience, and flourishing (Arnett, 1999; Berenbaum et al., 2015; Eiland & Romeo, 2013; Graber, 2013; Monahan et al., 2016).

In recent years, developmental science has demonstrated a shift towards strengths-based theory and research, focusing on mechanisms fostering individual skills and abilities (Benson et al., 2006; Catalano et al., 2004; Lerner et al., 2013). This research has sought to identify sources of individual variability in social-affective engagement, self-regulation, and behavioral strategies that youth leverage to successful manage core developmental milestones associated with this time period (Crone & Dahl, 2012; Dahl et al., 2018). During adolescence, youth are rapidly learning new ways of engaging with others, exploring their personal values and goals, and

adapting their sense of identity within broader social contexts (Allen & Loeb, 2015; Bornstein et al., 2012; Crone & Dahl, 2012). Through it all, youth naturally rely on their evolving capacity to regulate their emotions and behaviors and take advantage of existing sources of support within their social circles (Geldhof & Little, 2011; Gestsdottir & Lerner, 2008). Biobehavioral models of self-regulation have been a central focus in this area because the tight coupling of neurocognitive functioning and neuroendocrine regulation underlies adolescents' developing capacity to regulate metabolic energy, attention, executive functioning, and affective arousal (Blair & Raver, 2014, 2015; Gunnar & Adam, 2012; Gunnar & Quevedo, 2007), all of which drive social-affiliative and goal-oriented behavioral patterns.

Founded on the premise that all youth seek out resources within themselves and their environment in managing the challenges of adolescence, Positive Youth Development (PYD) research proposes that the capacity to flourish is fundamentally linked to the relational context within which youth are embedded (Benson et al., 2006; Lerner, 2004; Lerner et al., 2013). PYD frameworks depict individual variability in the capacity to flourish as the extent to which youth leverage ecological assets within their immediate environment (e.g., supportive relationships with family and community members) together with their own core strengths (e.g., self-regulation and problem-solving abilities) (Lerner, 2004; Lerner et al., 2011). Lerner's Five Cs model of PYD (Lerner et al., 2005), arguably the most empirically-supported PYD framework (Heck & Subramaniam, 2009; Lerner et al., 2011, 2021; Wiium & Dimitrova, 2019), emphasizes *Caring, Character, Competence, Confidence, and Connection* as key individual strengths that enable healthy development and adolescent flourishing. The Five Cs (see *Table 1.1* for exact definitions by Lerner et al., 2005) represent strengths arising from both adolescents' personal or endogenous capabilities and their functional internalizations of positive interpersonal

experiences within their family, school, and community; collectively, the Five Cs reflect a holistic sense of well-being (operationalized as *global PYD*). This model posits that the Five Cs mediate the impact of adaptive developmental regulations by increasing the likelihood of healthy growth and mastery whilst decreasing risk of maladjustment and mental health issues.

Efforts to fully describe, explicate, and predict diverse representations of PYD could be informed by developmental regulation theories such as Bornstein's Specificity Principle (Bornstein, 2017, 2019), which emphasizes the importance of identifying coaction between proximal and distal sources of individual differences to fully understand environmental influences on health and well-being. Building on the Organismic Specificity Hypothesis (Wachs & Gruen, 1982), Bornstein's principle highlights the need to clearly articulate how specific individuals at specific time periods interact with specific contexts, settings, and cultures to better capture the spectrum of developmental cascades. As such, PYD research has increasingly prioritized integrative approaches to clarify the extent to which relational contexts and sociocultural factors contribute to individual variability in PYD (Johnson & Ettekal, 2022; Lerner & Bornstein, 2021; Yang & McGinley, 2021), particularly for adolescents coming from communities that have been historically excluded and socially marginalized due to their racial identity and ethnicity (Cabrera & The SRCD Ethnic Racial Issues Committee, 2013; Lerner et al., 2017; Marks et al., 2020). This work provides robust evidence supporting a variety of unique characteristics, opportunities, and resources that minoritized youth draw on in their pursuit of actualization. Yet, the majority of research on historically underrepresented samples has focused on maladaptation and problems despite the majority of youth traversing the adolescent transition successfully. This preponderance of risk-based and deficit-focused developmental research has been particularly true (and inherently problematic) for Latinx youth (Azmitia, 2021; Kuperminc

et al., 2009), one of the youngest and largest ethnic/racial demographic groups in the United States (Lopez et al., 2018). As PYD research increasingly recognizes and appreciates the importance of individual variability, identifying unique predictors of the Five Cs within samples of Latinx youth represents a critical step forward in the field's understanding of sociocultural nuances underlying the expression and progression of PYD within diverse settings and underserved populations (Johnson et al., 2023; Johnson & Ettekal, 2022). Empirical evidence drawn from this work has significant practical implications for public health interventions and policies targeting the health and well-being of individuals coming from socially and systemically marginalized communities (Spencer, 2006; Spencer & Spencer, 2014)

Research questions centralizing the specificity of context, developmental timing, environmental exposures, and demographic differences have also been applied to work in the areas of cultural neurobiology (Causadias et al., 2016; Doane et al., 2017; Parra & Hastings, 2018) and resilience (Masten, 2016; Masten et al., 2021; Wright et al., 2013). Research in both of these areas seeks to understand how the complete spectrum of environmental inputs, ranging from adverse to advantageous, becomes biologically-embedded in ways that meaningfully shift individuals from one life trajectory to another. Adolescence may be a particularly important developmental window for the emergence of individual differences in biological embedding, as it is a period of heightened environmental susceptibility (Del Giudice et al., 2011; Schriber & Guyer, 2016; Vijayakumar et al., 2018), including an increased biological sensitivity to sociocultural and affective cues (Blakemore & Mills, 2014; Nelson et al., 2005). Grounded in bioecological and relational systems theory, cultural neurobiology argues that investigating variation in biology as it relates to health and wellness across the lifespan necessarily requires a cultural perspective given the critical role culture plays in mental and physical health (Causadias

et al., 2016; Doane et al., 2017). Centralizing cultural neurobiology within the framework of PYD in empirical research will contribute to the developmental science of adolescence by illuminating unique pathways through which culture shapes trajectories of PYD as it is experienced by youth coming from ethnically/racially diverse backgrounds (Bornstein, 2019).

Contemporary models of resilience have similarly expanded in scope with the central goal of identifying multisystem and transdiagnostic protective factors supporting the capacity for successful adaptation in the face of emergent threats to bodily function, fitness, and development (Hostinar et al., 2023; Masten et al., 2021; Ungar, 2021). While various conditional adaptations, including the calibration of stress response systems, in the face of adverse experiences are designed to be functionally advantageous in the short-term, they may have notable downstream consequences later in life (Del Giudice et al., 2011; Ellis et al., 2011, 2017; Karatoreos & McEwen, 2013; McEwen, 2000). The unique constellation of factors making up the threat (e.g., timing, duration, and type of exposure, access to public health resources and social support networks, etc.) plays a determining role in the extent to which biobehavioral plasticity confers lifelong benefits or later risk (Ellis et al., 2011, 2017; Ellis & Boyce, 2008; Frankenhuis & de Weerth, 2013; Karatoreos & McEwen, 2013). Thus, the health, wellness, and resilience of an individual critically depends on the health, wellness, and resilience of the systems that individual interacts with (i.e., family, school, community, societal politics), and this notion is reflected in foundational theories within PYD, cultural neurobiology, and resilience (Bornstein, 2019; Bronfenbrenner & Morris, 2006; Causadias et al., 2016; Lerner et al., 2011; Masten et al., 2021).

Given the integral role of culture in bioecological systems theory, the increased focus on specificity, and the clear embeddedness of neurobiological regulation within developmental trajectories, efforts to integrate cultural and psychobiological processes have been largely absent

from PYD research. Based on these theoretical challenges and empirical limitations, I designed this dissertation to address four specific gaps in efforts to describe and predict evidence of thriving in Latinx adolescents of Mexican origin by integrating cultural and family processes within developing neurobiology.

Gap 1. What commonalities emerge in the expression and progression of PYD within samples of Latinx youth, particularly those of Mexican-origin?

While research on positive development in Latinx youth has gained traction over the past decade (Azmitia, 2021; Neblett Jr. et al., 2012), empirical studies have yet to determine the extent to which PYD frameworks effectively capture commonalities in the nature and progression of positive development within Latinx youth (Lerner et al., 2017; Spencer & Spencer, 2014). Testing the Five Cs model of PYD in samples of Latinx youth, particularly those of Mexican-origin, is important for several reasons. In California, the Latinx community represents the largest and youngest ethnic/racial demographic group, and the vast majority of these individuals (83%) are of Mexican-origin (Ahn et al., 2022). Mexican American communities are highly diverse with differences in immigration histories, language preferences, bicultural orientations, and ethnic/racial socialization practices (Safa & Umaña-Taylor, 2021; Umaña-Taylor & Fine, 2004), and this heterogeneity engenders unique cultural knowledge and personal competencies (Kuperminc et al., 2009; Yosso, 2005). Mexican American communities also face a variety of challenges related to the North American sociopolitical context, which has historically and systematically marginalized ethnically and racially diverse individuals (Kuperminc et al., 2009; Myers, 2009; Umaña-Taylor & Updegraff, 2007). This marginalization extends to academic research where Latinx youth are underrepresented in psychological and neurobiological studies (Henrich et al., 2010; Parra & Hastings, 2018). Given this community's

size, heterogeneity, and cultural capital, conducting strengths-based research articulating positive developmental pathways within samples of samples of Mexican-origin and other Latinx youth directly addresses gaps in the broader field of developmental research and fills a specific gap within PYD literature (Lerner et al., 2017). While the Five Cs theory has since been thoroughly tested in national and international samples (Bowers et al., 2010; Geldhof, Bowers, Mueller, et al., 2014; Gomez-Baya et al., 2019; Holsen et al., 2017; Lerner et al., 2005), this model was originally designed and tested in the 4-H study of PYD, which lacked a diverse or representative sample (Lerner et al., 2017; Spencer & Spencer, 2014). Thus, it is unclear whether these robust findings can be generalized to youth of color in the United States, especially Mexican-origin or other Latinx youth. Therefore, testing whether the Five Cs model of PYD appropriately captures the trajectory of PYD as it is uniquely expressed by Mexican-origin and other Latinx youth will provide valuable insights describing how positive trajectories operate in this population. Furthermore, understanding Latinx PYD trajectories will directly illuminate areas that interventions can target to promote the health and well-being of this underserved community.

Gap 2. How may cultural and familial processes promote and protect PYD for adolescents coming from historically marginalized backgrounds?

Despite the integral roles of culture and family within bioecological developmental-systems theory, researchers have yet to clarify specificities in context-driven pathways within ethnic/racial minoritized communities (Lerner & Bornstein, 2021). Considering their cultural diversity, the unique strengths and competencies that Mexican-origin and other Latinx youth draw on when facing the developmental milestones of adolescence may be qualitatively different than the skills and competencies leveraged by other youth demographics. Furthermore, the extent to which culture is embedded within family relational dynamics may be experienced more

intensely within Mexican-origin families considering the traditional Mexican family values system which prioritizes holistic family wellness, close family bonds, respect for elders, and traditional gender roles (Calderón-Tena et al., 2011; Knight et al., 2016). Recent empirical work applying the Five Cs model cross-culturally have documented cultural variation in developmental assets and ecologies differentially predicting PYD (Gomez-Baya et al., 2019; Holsen et al., 2017; Johnson & Ettekal, 2022; Yang & McGinley, 2021; Yu et al., 2021). Whereas the majority of these studies compared PYD processes between European or Asian international samples and the North American sample of the 4-H study of PYD, Yu and colleagues (2021) utilized a more diverse sample consisting of adolescents considered to be ethnic/racial minorities in the United States, specifically African American and Latinx youth. In this study, Yu and colleagues (2021) found that adolescents' ethnic/racial pride was significantly associated with four of the Five Cs (Caring, Competence, Confidence, and Connection) indicating a positive promotive link between ethnic/racial identity development and PYD. This evidence is aligned with work documenting that cultural orientation, ethnic identity, and cultural values promote multiple PYD-related domains in Latinx samples, namely prosocial and social competencies (Gonzales et al., 2008; Rew et al., 2015; Segal et al., 2011). Considering evidence that parents' ethnic/racial socialization practices predict their children's connection to their cultural history via ethnic pride and engagement with traditional cultural values (Calderón-Tena et al., 2011; Knight et al., 2016), this empirical work collectively suggests that Latinx PYD processes may be best understood from the intersection of family and culture.

Researchers have also found that psychosocial competencies and ethnic socialization processes may synergistically protect Mexican-origin and other Latinx youth from the negative effects of experiencing chronic family stressors (Lorenzo-Blanco et al., 2012; Morgan Consoli &

Llamas, 2013; Neblett Jr. et al., 2012). Considering that Latinx youth and families face systemic social and economic inequalities impacting family functioning in various ways (Gonzales et al., 2009; Myers, 2009; Parra & Hastings, 2018; Umaña-Taylor & Updegraff, 2007), it is increasingly important to understand whether PYD may act as a protective factor conferring a level of psychosocial resilience for youth coming from stressful contexts. Testing whether PYD processes may mitigate the impact of stressful family contexts on adjustment outcomes will be critical for understanding the full spectrum of possible developmental trajectories for youth exposed to varying levels of stress. This work has clear practical implications as well given literature proposing that targeting the cross-section of family and cultural processes may scaffold psychosocial and physiological health and well-being (Campos et al., 2018; Safa & Umaña-Taylor, 2021; Wakefield & Hudley, 2007; Wantchekon & Umaña-Taylor, 2021). Thus, studies designed to test specificity of PYD in Latinx samples are crucial to aid researchers, advocates, and policy makers in designing effective, impactful, and equitable policies and programs supporting the health and well-being of these youth within broader society.

Gap 3. To what extent is the positive biobehavioral cascade of PYD reflected within adolescents' regulation of stress physiology?

Although theoretical and empirical work has produced robust evidence documenting PYD as both a reflection of adaptive intentional self-regulation (Geldhof & Little, 2011; Gestsdottir & Lerner, 2008; Lerner et al., 2001; Zimmerman et al., 2007) and an antecedent of later flourishing (Geldhof et al., 2014; Johnson & Ettekal, 2022; Lerner et al., 2005), the extent to which this has been evidenced within adolescent stress physiology systems has been relatively unexplored. The Hypothalamic-Pituitary-Adrenal (HPA) axis, one of the body's primary stress response systems, coordinates the production of cortisol, a hormone responsible for mobilizing

energetic, motivational, attentional, and affective resources in the face of changing environmental demands (Gunnar & Adam, 2012; Gunnar & Quevedo, 2007). As the HPA axis displays a heightened sensitivity to social cues during adolescence (Gunnar & Quevedo, 2007; Gunnar et al., 2009), studying adrenocortical functioning during this developmental window could contribute to the field's understanding of the intrinsic link between physiological and psychological self-regulation. From this perspective of brain–body coordination and well-being, integrative models of multisystemic health and wellness are crucial for fleshing out specificities within the adaptive developmental regulations that underscore PYD trajectories. Despite increasing recognition of this (Gunnar et al., 2015; Lerner & Bornstein, 2021; Masten et al., 2021; Moore & Zaff, 2002; Vijayakumar et al., 2018), there continues to be very little empirical examination of how, or even whether, HPA activity is linked with PYD or PYD-related processes during adolescence. Research articulating associations between stress responsivity and adolescent development has been predominantly focused on understanding the psychopathology end of this spectrum rather than exploring connections with adolescent flourishing (Adam et al., 2007; Graber, 2013; Hostinar & Gunnar, 2013; Klimes-Dougan et al., 2001; Murray-Close, 2013). However, this evidence is balanced by the possibility of positive adaptations and the calibration of stress response systems to environmental opportunities to enhance growth and mastery (Del Giudice et al., 2011; Ellis et al., 2017; Lakey & Orehek, 2011; Schriber & Guyer, 2016; Shirtcliff et al., 2014). With recognition that biobehavioral PYD cascades reflect adaptive developmental regulations that are reciprocal in nature (Gestsdottir & Lerner, 2008; Lerner, 2004; Lerner et al., 2011), fully integrating HPA activity within these processes will require considerable empirical support. Yet, the first steps along this line of inquiry are to document any associations that do exist across psychological and physiological well-being domains and to

examine how positive neurodevelopmental adaptations in adolescents change under various contextual influences.

Gap 4. How may gender-identity differentiate the impact of contextual drivers of PYD?

Individual variability in PYD trajectories may depend on certain adolescent demographic differences. For example, gender differences have been documented in the expression of the Five Cs and the extent to which PYD promotes certain mental health and adjustment outcomes (Årdal et al., 2018; Gomez-Baya et al., 2019; Lewin-Bizan et al., 2010; Zimmerman et al., 2008). Women and girls have been found to display greater global PYD, Caring, Character, and Connection while men and boys report greater Competence and Confidence (Årdal et al., 2018; Gomez-Baya et al., 2019; Zimmerman et al., 2008). Research also suggests that adolescent girls are over-represented in developmental trajectories characterized by community engagement and contribution, as well as increased risk for depressive symptoms (Lewin-Bizan et al., 2010; Phelps et al., 2007; Zimmerman et al., 2008). Conversely, adolescent boys appear to have a greater risk of externalizing problems, delinquency behaviors, and substance use issues. Gender socialization within developmental contexts may explain these divergent associations (Perry & Pauletti, 2011), which perpetuate traditional gender roles, stereotypes, and inequities (Leaper & Friedman, 2007). The developmental transitions of adolescence and emerging adulthood are crucial stages for gendered differentiation in the solidification of self-concept, perceptions of personal competencies, life goals and interests (Perry & Pauletti, 2011; Shapka & Keating, 2005), which have critical implications for lifelong health and well-being. However, PYD studies have not been parsimonious in their mechanistic exploration, and the extent to which identity characteristics such as gender modify the impact of contextual influences (i.e., culture and family) on PYD has remained largely unexplored. Exploring this question in a sample of

Mexican-origin youth may be of further interest given that traditional Mexican family values emphasize gender roles as an important organizing structure for family relational dynamics (Calderón-Tena et al., 2011; Knight et al., 2016; Lorenzo-Blanco et al., 2012).

The Current Studies

Based on bioecological and relational developmental-systems theories, this dissertation was designed to explore culturally-sensitive, context-driven effects on developing PYD in a sample of Mexican-origin youth from a neurobiologically-informed perspective. The goal of this body of work is to examine trends in the positive pathways Latinx youth take throughout adolescence, and in the process, I document that the development of holistic well-being in these youth varies based on differences at the cultural-, familial-, individual-, and neurobiological-level. In doing so, I hope to contribute to the mechanistic understanding of how adolescents internalize available familial and cultural resources, both psychologically and biologically, through functional adaptations that increase their likelihood of manifesting optimal developmental outcomes. To do this, I used data collected through the California Families Project (CFP) and its neurobiology sub-study of Mexican-origin adolescents and their families[1].

The CFP is a prospective longitudinal study of Mexican-origin adolescents and their families in Northern California launched in 2006. I utilized questionnaire data collected on these adolescents over three years, from when youth were around 14 to when they were about 17 years old. A select number of these adolescents also participated in a neurobiological assessment when they were around age 17, during which data capturing physiological stress responsivity was collected. In this dissertation, I am mindful of both the commonalities and differences between the adolescent participants assessed throughout the CFP and myself as the lead researcher on

[1] For a full list of CFP publications, see the study's Open Science Framework website (https://osf.io/ky7cw/).

these studies. I grew up in suburban Pennsylvania within a working-class European American family with Polish, Dutch, and German roots. While my family's history is steeped in intergenerational conflict and economic hardship, I have been afforded many privileges that have culminated in my pursuit of a doctoral degree in Psychology. In this dissertation, I utilize strengths-based approaches to better understand effective ways to improve and support the well-being of children and families coming from marginalized backgrounds, and in service of this, I have made efforts to increase my cultural sensitivity and knowledge to accurately represent the lived experiences of the Mexican-origin adolescents assessed throughout the CFP. However, I acknowledge that my personal and educational background may have biased my interpretations of trends I identified in analyses of their data in subtle ways, and thus, I encourage readers to consider these differences in positionality when reading this dissertation.

This dissertation is composed of two empirical studies. I designed Study 1 to evaluate the applicability of the Five Cs model of PYD for defining PYD in Mexican-origin youth across ages 14 to 16 and investigate whether culturally-relevant strengths promote PYD in this sample. To do this, I conceptually replicated the bifactor model of PYD using questionnaire composites that are theoretically and empirically similar to those created by investigators of the 4-H study of PYD (Geldhof et al., 2014; Lerner et al., 2005). I tested the growth and stability of the Five Cs and global PYD across middle adolescence and examined the contemporaneous and prospective impact of cultural orientation (as indexed by adolescents' endorsements of ethnic pride, familismo, and respeto collected at age 14) on global PYD at ages 14 and 16. This study also explored individual variability in the development of PYD and the promotive impact of cultural orientation on PYD in relation to adolescents' gender-identity and nativity status. Study 1 has been accepted for publication in the peer-reviewed APA journal *Developmental Psychology*. I

designed Study 2 to investigate whether adolescents' endorsement of global PYD and the Cs (measured at age 16) modified the impact of family stress exposure (indexed using multi-informant reports of hostility, conflict, and relationship quality when youth were 16 years) on adolescents' stress responsivity (reflected by basal and reactive HPA activity assessed at age 17). This study additionally tested whether predictive relations between family stress, global PYD and the Five Cs, and adolescents' stress responsivity were differentiated by gender-identity.

This research program presents longitudinal research to understand the nature and progression of PYD in a sample of Latinx youth of Mexican origin, a historically underserved population in developmental science. This work addresses the specificity of PYD by testing whether cultural promotive factors (Study 1), parent-adolescent relationship dynamics (Study 2), adolescents' nativity status (Study 1), and gender (Studies 1 and 2) were differentially associated with PYD across mid-adolescence. Furthermore, Study 2 provides an integrative examination of the extent to which biobehavioral integration of PYD is evidenced within the regulation of stress physiology. This research adhered to the APA Style Journal Article Reporting Standards (JARS) for quantitative studies with regards to openness and transparency. All hypotheses, methods, and analytic strategies were pre-registered prior to data manipulation and analysis using the Open Science Framework (Study 1: https://osf.io/krj7x/; Study 2: https://osf.io/b6x8d/). Data and research materials are available upon request from the CFP research team, and reproducible R code for all analytic models has been uploaded to their respective OSF project pages after all analyses were finalized, ensuring that all study details are freely and publicly available. Given that very few papers have closely examined direct relations between cultural and family processes, gender-identity, and developing PYD as it becomes biologically embedded in stress physiology during adolescence, this dissertation makes novel contributions to the field.

Furthermore, each study offers a window into different developmental regulation processes (adolescents' internalizations of ethnic/racial socialization and acculturative efforts, and family relationship dynamics) for understanding psychophysiological well-being as it unfolds in the lives of Latinx youth, culminating to build on past research (Bornstein, 2019; Lerner et al., 2017; Lerner & Bornstein, 2021; Neblett Jr. et al., 2012) to offer new perspectives.

CHAPTER 2: STUDY 1

ETHNIC PRIDE AND CULTURAL VALUES PROMOTE POSITIVE YOUTH DEVELOPMENT IN A CONCEPTUAL REPLICATION OF THE FIVE CS MODEL

Abstract

The current study examined the Five Cs model of Positive Youth Development (PYD; Lerner et al., 2005) in U.S. Mexican-origin youth (N = 674, 50% female) and tested the extent to which ethnic pride, familismo, and respeto, as an index of cultural orientation, predicted PYD across mid-adolescence. PYD was modeled using a bifactor structure which defined global PYD and the Five Cs (Caring, Character, Competence, Confidence, and Connection) using theoretically similar measures matched to the conceptual definitions of the Cs. Tests of longitudinal invariance of the bifactor model at ages 14 and 16 established scalar invariance, providing support for the structure and stability of the Five Cs and global PYD using the theoretically similar measures across time. Adolescents' cultural orientation (latent factor incorporating familismo, respeto, and ethnic pride) at age 14 was positively associated with the Five Cs within and across time. Greater cultural orientation at age 14 predicted increased global PYD across ages 14 and 16. The contribution of cultural orientation to the PYD across mid-adolescence did not differ by adolescent gender or nativity. These findings demonstrate the robust nature and stability of the Five Cs model of PYD and provide novel evidence that ethnic pride, familismo, and respeto promote greater PYD in Mexican-origin youth during mid-adolescence.

Public Significance Statement: This study advances the idea that conducting strengths-based research through the lens of cultural context may deepen scientific understanding of positive development in adolescence, particularly for samples of minoritized youth. Moreover, it provides evidence that increasing ethnic pride and connection to cultural values may significantly improve psychological well-being for Mexican-origin adolescents.

Background

Positive development, healthy adjustment, and effective functioning are more the norm than the exception among youth as they traverse adolescence (Dahl et al., 2018). Despite this normative pattern, less research has explored positive development in samples of ethnic/racial minority youth compared to white samples of youth in the United States (Kuperminc et al., 2009; Lerner et al., 2017). This has been particularly true for U.S. Latinx youth (Azmitia, 2021). While the historical preponderance of research on Latinx adolescent development has focused on risks, deficits, and problematic outcomes (Kuperminc et al., 2009), the last decade of research has demonstrated a shift towards asset-based theory and research (Azmitia, 2021; Neblett Jr. et al., 2012). Positive Youth Development (PYD) is a strengths-based conceptualization of the individual traits, capacities, and strengths that enable adolescents to flourish (Benson et al., 2006). The goal of PYD-informed adolescent research is two-fold: to clarify the development of individuals' core strengths and to identify specific social, demographic, and cultural contexts intrinsic to this development. In meeting these goals, the Five Cs Model of PYD (Lerner et al., 2005) proposes that thriving can be operationalized through Caring, Character, Competence, Confidence, and Connection. However, there has been limited application of this specific model to the study of Latinx youth in the U.S. (Lerner et al., 2017), a rapidly growing demographic that has been particularly driven by those of Mexican origin. Thus, the current study was designed to assess whether the Five Cs model would demonstrate validity and stability within a sample of Mexican-origin youth in the U.S., and to examine whether cultural orientation contributes to PYD across middle adolescence.

Latinx youth development

The U.S. Latinx population encompasses all individuals with Mexican, South or Central

American, Cuban, Puerto Rican, or any other Spanish culture or origin regardless of race (Azmitia, 2021; Kuperminc et al., 2009). This within-group heterogeneity may contribute to differences in exposure to developmental risks and opportunities, accessibility of community resources and support systems, and culturally specific strengths (Kuperminc et al., 2009). This variation carries significant implications for PYD studies of Latinx youth, a group representing one of the youngest and fastest-growing ethnic/racial demographics in the U.S. generally (Lopez et al., 2018; US Census Bureau, 2021) and California specifically (Ahn et al., 2022; Department of Finance, 2019). Consistent with the growing recognition in developmental science of the need for greater representation of diverse communities within the empirical literature (Cabrera & The SRCD Ethnic Racial Issues Committee, 2013; Lerner et al., 2017), it is imperative to expand the field's understanding of what thriving looks like in U.S. Mexican-origin youth. Identifying factors supporting the development of well-being in Mexican-origin youth is essential to understanding, and being prepared to support, the positive development of these youth within broader society.

For all youth, adolescence is a time of significant development across multiple domains (Crone & Dahl, 2012; Dahl et al., 2018), with particular growth found in one's identity (Allen, 2008). For Mexican-origin and other Latinx youth, adolescence includes the added features of balancing competing cultural systems to develop, practice, and embody an ethnic-racial identity (Constantine & Sue, 2006). Despite the predominant focus on risks and deficits in studies detailing how this additional pressure may contribute to challenges and problems (Kuperminc et al., 2009), the majority of Mexican-origin youth navigate adolescence successfully and report high levels of life satisfaction, career and educational aspirations, and future-oriented optimism (Azmitia, 2021; Lawson et al., 2020). Theories incorporating broader asset- and resilience-based

frameworks have proposed that cultural orientation and ethnic/racial identity processes may intrinsically underlie the positive psychosocial adjustment demonstrated by Mexican-origin youth (Lawson et al., 2020; Rew et al., 2015). As such, the cultural context experienced by Mexican-origin youth may act as a conduit for PYD, positively influencing their developing sense of self, increasing their self-confidence, competence, and connection to others, and consequently improving their life trajectory.

The Five Cs Model of PYD

Of the existing frameworks designed to study adolescent well-being and thriving, the Five Cs model of PYD designed by Lerner and colleagues (2005), is arguably the most often studied and empirically supported (Heck & Subramaniam, 2009). The original theory outlined two foundational hypotheses conceptualizing the possibility of optimal development for all youth. Bidirectional relations between the individual and their context are inherent in the first hypothesis which posits that when individual assets are aligned with ecological assets, optimal developmental outcomes have the highest probability of occurring (Lerner et al., 2005). In other words, if the strengths of youth are aligned with strengths in the environment, then healthy development occurs most fluidly. Healthy development was operationalized as a function of youth exhibiting high levels of the Five Cs – *Caring, Character, Competence, Confidence,* and *Connection* (see *Table 1.1* for exact definitions by Lerner et al., 2005). Recognizing that each C reflects high functioning in a domain-specific area of well-being, the second hypothesis proposed that altogether, the Five Cs engender a general sense of flourishing, termed *global PYD*. These hypotheses have been largely supported by empirical tests demonstrating that cultivating the Five Cs promotes positive social-emotional and behavioral outcomes and can shift youth towards a healthier developmental trajectory (Bowers et al., 2010; Geldhof, Bowers, Mueller, et al., 2014;

Gomez-Baya et al., 2019; Holsen et al., 2017; Lerner et al., 2005).

As adolescence is a period of significant biological, psychological, and social growth (Crone & Dahl, 2012; Dahl et al., 2018), careful consideration is needed for investigating PYD across the adolescent years. With the onset of puberty and the entrance to middle school, youth must navigate increasingly complex social hierarchies with their peers, as well as develop their private and public identities in accordance with contemporary societal expectations (Allen, 2008; Arnett, 1997). Middle adolescence (ages 14 to 17) is additionally characterized by significant maturation in adolescents' capacity for effective cognitive and emotional regulation (Crone & Dahl, 2012). Previous research using the Five Cs model (Bowers et al., 2010; Geldhof, Bowers, Mueller, et al., 2014) have demonstrated that testing longitudinal measurement invariance of PYD is useful for tracking individual differences during adolescence. Establishing longitudinal invariance of PYD helps to confirm that the same constructs are being measured at each age, allowing for meaningful statistical comparisons of the stability or change in PYD across time. Earlier tests of longitudinal measurement invariance of PYD have used hierarchical confirmatory factor analysis (CFA) (Bowers et al., 2010), whereas more recent studies have favored a bifactor structure (Geldhof, Bowers, Mueller, et al., 2014). The bifactor structure arguably provides a more robust test of the PYD model (Geldhof, Bowers, Mueller, et al., 2014; Holsen et al., 2017), as it allows multiple sources of true score variance to be modeled with a global PYD factor along with individual C factors. Additionally, this structure allows for unique covariances between variables of interest (e.g., demographics) with the latent PYD factors and the individual Cs can freely covary without proportionality assumptions. Given that the Five Cs and PYD were originally measured and operationalized using a predominantly white sample, the present study was designed to determine whether the PYD constructs are defined in the same way for

Mexican-origin youth during middle adolescence. To verify this, and assess change over time, we constructed a conceptual replication of the bifactor model of PYD and tested longitudinal measurement invariance of PYD across ages 14 and 16.

The current study design was derived from the foundational empirical work that validated the Five Cs model (Bowers et al., 2010; Geldhof et al., 2014; Gomez-Baya et al., 2019; Holsen et al., 2017; Lerner et al., 2005). However, the 4-H study of PYD, on which the Five Cs model was built, lacked a diverse or representative sample (Lerner et al., 2017; Spencer & Spencer, 2014). Consequently, the findings cannot be generalized to youth of color in the U.S., especially Mexican-origin and other Latinx youth. Moreover, the original tests of the Five Cs model did not consider the unique ecological factors and circumstances that impact the well-being of minoritized youth (Spencer & Spencer, 2014). Despite increasing interest in this area of research (Cabrera & The SRCD Ethnic Racial Issues Committee, 2013; Lerner et al., 2017), a limited understanding exists to date of what thriving entails for Mexican-origin youth in the U.S., due to the scarcity of culturally-informed longitudinal studies of PYD in diverse samples.

Cultural Orientation as a developmental asset

PYD theory proposes that thriving occurs when individual assets are aligned with family and community assets (Lerner et al., 2005, 2017), thus the study of adolescent thriving inherently necessitates the identification of the specific internal and external assets that are accessible to and utilized by the target sample. A key asset that may influence the psychosocial development of Mexican-origin youth is reflected in their enculturation of and orientation towards their family's ethnic and racial background (Acevedo-Polakovich et al., 2014; Gonzales et al., 2008). *Cultural Orientation*, defined herein as individuals' depth of ethnic pride and connection to their family's traditional cultural values, as a core strength promoting psychosocial health is noteworthy for its

demonstrated contribution to the Five Cs and PYD-related outcomes (Neblett Jr. et al., 2012; Yu et al., 2021). Given the need of PYD research to better account for cultural relativity, the current study aims to deepen the field's understanding of minority youth embodiment of PYD by mapping the contribution of cultural orientation onto the Five Cs model of PYD across middle adolescence in a sample of Mexican-origin youth. We examined Mexican-origin youth *ethnic pride* and endorsement of the traditional Mexican family values, *familismo* and *respeto*.

Ethnic pride. Developing an ethnic identity, or the sense of self as it connects to ethnicity, undergoes significant refinement during adolescence and typically stabilizes around high school age (Phinney, 1992). For those who have been historically excluded and systematically oppressed by the social majority, developing a positive self-concept regarding one's ethnic and racial background is challenging (Spencer et al., 2002), yet a strong ethnic identity contributes to life satisfaction, feelings of belonging, and thriving in general (Alvarado & Ricard, 2013; Constantine & Sue, 2006; Rivas-Drake et al., 2014). Ethnic pride reflects a strong, positive perception of and connection with one's cultural background (Rivas-Drake et al., 2014) and has been associated with many positive developmental assets and outcomes for minority youth, including social connectedness, coping, and four of the Five Cs (Caring, Competence, Confidence, and Connection; Rew et al., 2015; Yu et al., 2021).

Cultural family values. Aligned with cultural-ecological-transactional models of development (Coll et al., 1996), cultural values such as the traditional Mexican values of familismo and respeto represent key drivers of youth psychosocial adjustment (Constantine & Sue, 2006). By outlining acceptable standards of behavior, thoughts, and feelings within interpersonal relationships in one's community (Constantine & Sue, 2006), cultural values play a role in adolescent development by influencing identity, behavior, and decision-making.

Familismo is defined as a strong sense of connection, loyalty, identification, and solidarity with one's nuclear family and extended circle of relatives that functions to advance the health and well-being of the family as a whole (Marín & Marín, 1991). Empirical work on minority youth in general and Latinx youth specifically, demonstrates the positive role familismo plays in psychosocial development, suggesting that familismo may promote PYD, specifically through positive associations with three of the Five Cs: Caring (Calderón-Tena et al., 2011; Knight et al., 2016), Competence (Gonzales et al., 2008), and Confidence (Constantine & Blackmon, 2002).

Respeto denotes feelings and attitudes of respect and deference to elders and members of authority within the family system (Calzada et al., 2010). The values of respeto and familismo conceptually overlap; as youth recognize and calibrate their behavior to reflect their role within the family hierarchy (respeto), feelings of attachment, connection, and loyalty to the family as a whole (familismo) are created (Stein et al., 2014). Respeto has been found to have promotive effects by increasing academic engagement (Gonzales et al., 2008), suggesting positive links between respeto and the academic element of Competence. Together, familismo and respeto have been argued to increase collectivistic beliefs and social empathy in Latinx youth, which conceptually parallels elements of Caring and Character (Segal et al., 2011).

Familismo and respeto may facilitate multiple domains of PYD-related processes by instilling a deep understanding and appreciation of one's unique role within a group, promoting empathy and providing a sense of personal empowerment and agency. Moreover, familismo, respeto, and ethnic pride are each connected to ethnic identity processes that stabilize during middle adolescence (Phinney, 1992). This developmental window, when the public and private regard youth hold towards their ethnic/racial background increases in salience, may offer skill-building opportunities for Latinx youth to consciously explore ethnic identity-related beliefs and

values, foster community, and strengthen social ties. Consequently, the extent of their cultural orientation may shape the context of PYD as it is experienced by Mexican-origin youth (Alvarado & Ricard, 2013; Constantine & Sue, 2006; Rivas-Drake et al., 2014). Given the evidence for psychosocial benefits of ethnic pride, familismo, and respeto for Latinx youth, the present study investigates their cumulative influence on the global PYD of Mexican-origin youth during middle adolescence.

Gender and nativity as potential moderators

Recent research suggests that gender identity may contribute to individual variability in youths' endorsement of the Five Cs, such that on average, men score higher on Competence and Confidence, while women score higher on Caring, Character, and Connection (Gomez-Baya et al., 2019; Wiium et al., 2019). These gender differences in Caring are aligned with many studies of prosocial development indicating that women generally report more prosociality, especially sympathy-related behaviors and perspective-taking (Van der Graaff et al., 2018). Cross-sectional evidence of mean-level differences in the Five Cs is insufficient, however, for determining whether the developmental course of the Five Cs varies by gender, or whether gender moderates the extent of such factors as cultural orientation predict PYD. Potential gender differences in the predictors of the Five Cs and PYD have been relatively unexplored.

Additionally, the heterogeneity in immigration histories, acculturative status, and ethnic socialization practices of Mexican-American parents (Umaña-Taylor & Fine, 2004), collectively suggest that nativity may moderate the extent to which adolescents' cultural orientation predicts PYD. Latinx youth endorsement of traditional family values can vary by generational status (Calderón-Tena et al., 2011; Perez & Padilla, 2000), as youth born in Mexico may identify more strongly with the values and culture of Mexico compared to youth born in the U.S. with Mexican

heritage (Perez & Padilla, 2000). The Five Cs and PYD-related constructs have not been found to differ significantly by nativity (Calderón-Tena et al., 2011; Knight et al., 2016; Yu et al., 2021), but whether nativity moderates associations between cultural orientation and PYD is undetermined. Thus, the current study explores gender and nativity as moderators of the concurrent and prospective relations between adolescents' cultural orientation and PYD.

The Current Study

In a sample of Mexican-origin youth, we examined the growth and stability of the Five Cs and global PYD across middle adolescence and investigated the relative influence of cultural orientation on global PYD. We tested four main research questions matched with respective hypotheses and addressed a fifth exploratory question for which no specific hypotheses were proposed. *RQ1:* Can the Five Cs model of PYD be used to define PYD in a sample of Mexican-origin youth using novel measures? *H1:* We expected theoretically similar measures to conform to a latent bifactor structure with each measure loading onto a global PYD factor, as well as its respective C, either Caring, Character, Competence, Confidence, or Connection. *RQ2:* Does the bifactor structure of the Five Cs and global PYD remain stable across middle adolescence? *H2:* We expected to establish longitudinal scalar invariance, thus confirming the stable structure of PYD over ages 14 to 16 in our sample. *RQ3:* Do youth fluctuate in their endorsement of PYD constructs from ages 14 to 16? *H3:* We expected to find stability in individual differences in the endorsement of the Five Cs and global PYD across mid-adolescence. *RQ4:* To what extent does cultural orientation (defined as a latent composite of ethnic pride, familismo, and respeto) influence the development of PYD during mid-adolescence? *H4:* We expected youth-reported ethnic pride, familismo, and respeto to converge on a single latent factor structure and cultural orientation to predict the development of global PYD across mid-adolescence. *RQ5*: Do gender

and nativity contribute to individual differences in the extent to which cultural orientation at age 14 predicts global PYD at age 16? Moderation by gender and nativity was tested with exploratory intent that did not include *a priori* hypotheses.

Method

Participants

The current study used data from the California Families Project (CFP), an ongoing longitudinal study of 674 Mexican-origin families living in Northern California. Families with a child in the fifth grade were randomly selected from school rosters in the 2006-2007 (first cohort) and 2007-2008 (second cohort) school years, and two cohorts of fifth-graders were recruited. Assessments were completed annually in each family's home. Interviews were conducted in either English or Spanish, depending on each participant's language preference. Sociodemographic analyses indicate that 63% of mothers and 65% of fathers reported having less than a high school education (median = 9th grade for both parents). The median household yearly income was between $30,000 and $35,000 with the overall range of reported income being < $5,000 to > $95,000.

Youth were categorized as first generation if their birth country was Mexico (29%); as second generation if their birth country was the U.S., and only one of their parents was reported as being born in the U.S. (62%); and as third generation if their birth country was the U.S. and both parents were born in the U.S. (9%). Due to the low percentage of third generation youth, we created a dichotomous nativity status variable for comparing first generation (born in Mexico) to second- and third-generation (born in U.S.) youth in all analyses (0 = first-generation; 1 = second or third-generation). Of the participating families, 124 were single-parent, mother-led households, and 549 were two-parent households. This study was approved by the lead author's

university Institutional Review Board. All parents provided informed consent and adolescents provided assent, and all participants were compensated for their time and contribution.

This study utilized the full sample available in the CFP. The sample size of the CFP was determined by the original goals of the project, pertaining to risk and protective factors contributing to substance use by Mexican-origin adolescents, rather than the specific questions posed in the current report. The current analyses use data from the assessments collected when participants were in middle adolescence. 605 adolescents completed an assessment in the ninth grade (50.5% female, M_{age} = 14.75, SD = 0.49), which was in 2010-2011 or 2011-2012 for the two cohorts, and 600 adolescent participants completed the next assessment in the eleventh grade (50.2% female, M_{age} = 16.80, SD = 0.51), in 2012-2013 and 2013-2014. Of the participants used in the current analyses, 580 completed both time points, 25 completed the ninth-grade assessment only, and 20 completed just the eleventh-grade assessment (N = 625 total).

Measures

Positive Youth Development. Although the CFP was not originally designed to test the Five Cs model of PYD, the adolescent interview included multiple self-report measures of social-emotional development and academic and behavioral competence that conceptually overlapped with the PYD constructs. We operationalized PYD using a select set of scales based on the theoretical definitions of the Five Cs (Lerner et al., 2005) and prior empirical measurement (Geldhof et al., 2014) detailed in *Table 1.1*. For specific psychometric and descriptive details of all manifest items or item-composites selected for the current study, see *Supplemental Table S1.1*. A detailed comparison of the internal consistency of each measure with previous studies utilizing the same psychometric tools with samples of Latinx and other ethnic/racial minority youth can be found in *Supplemental Materials*.

Caring was defined using six items taken from the Consideration of Others subscale of the Weinberger Adjustment Inventory (WADJ; Weinberger & Schwartz, 1990). These items are scored on a scale of 1 (not at all true) to 5 (very true) with higher scores reflecting higher reported care and consideration for others' needs and feelings. An example of a Caring item is "You try very hard NOT to hurt people's feelings." Cronbach's alphas for ages 14 and 16 were .83 and .86, respectively.

Character was defined using two measures that most closely represented the Social Conscience and Personal Values subscales of the PYD-SF. We operationalized Social Conscience using the Agreeableness subscale of the Big Five Inventory (BFI; John et al., 2008), which was composed of nine items scored on a scale of 1 (strongly disagree) to 4 (strongly agree). An example item from this subscale is "Likes to cooperate with others." Cronbach's alphas for ages 14 and 16 were .68 and .64, respectively. We operationalized Personal Values using the Honesty/Trustworthiness subscale of the Self-Description Questionnaire (SDQ; Marsh et al., 2005), composed of six items scored on a scale of 1 (not at all true) to 4 (very true). An example item from this subscale is "You always tell the truth". Cronbach's alphas for ages 14 and 16 were .75 and .73, respectively.

Competence was operationalized using measures depicting Grades, Scholastic Competence, and Social Acceptance. For Grades, we included a single item asking "On average what grades do you get in school?" This item was scored on a 1 (Mostly F's) to 5 (Mostly A's) scale. For Scholastic Competence, we used all four items of the School subscale of the SDQ (Marsh et al., 2005), e.g., "You are good at most school subjects." Items are scored on the same 1-4 scale described above, and Cronbach's alphas were .77 and .76 for ages 14 and 16, respectively. Our measures of Social Acceptance include the same-sex popularity and opposite-

sex popularity subscales of the SDQ (Marsh et al., 2005). Each of these subscales includes four items that were scored on a 1 to 4 scale and averaged into two measures reflecting popularity and acceptance. For same-sex popularity, Cronbach's alphas were .68 and .67 for ages 14 and 16, respectively. For opposite-sex popularity, Cronbach's alphas were .65 and .64.

Confidence was measured with self-reports closely matching the Self-Worth, Positive Identity, and Physical Appearance subscales of the PYD-SF. For Self-Worth and Positive Identity, we used the six-item Self-Esteem subscale of the SDQ (Marsh et al., 2005), and all ten items of the Rosenberg Self-Esteem Scale (Rosenberg, 1965), respectively. While both measures of global self-esteem, the language of the items on these scales matched or closely overlapped with the delineation of Self-Worth and Positive Identity items on the PYD-SF, and thus to remain consistent, we mirrored the terminology of the PYD-SF. Both scales were scored as an average of items with responses ranging from 1-4. An example Self-Worth item is "Overall, you have a lot to be proud of.", and reliability alphas were .80 and .79 for ages 14 and 16, respectively. An example Positive Identity item is "On the whole, I am satisfied with myself.", and reliability alphas were calculated as .85 for both time points. Physical Appearance was also measured using a four-item subscale of the SDQ reflecting adolescents' positive perceptions of their appearance. The subscale includes items such as "You are good looking." Reliability for this subscale were .89 at age 14 and .88 at age 16.

Connection was defined with self-reports of adolescents' family, peer, and school social support networks. Family and Peer Connection were measured with items from the Multidimensional Scale of Perceived Support (MSPS; Zimet et al., 1988). Family Connection reflected immediate family and relatives using eight items such as "Your family really tries to help you." Peer Connection reflected adolescents' close friendships using four items such as

"You have friends with who you can share your joys and sorrows." Reliability for the MSPS was .92 and .91 for ages 14 and 16, respectively. School Connection was measured using the Child-Teacher Attachment scale, an adaptation of the parent and peer attachment scale created by Armsden and Greenberg (1987). The scale includes nine items measuring adolescents' perceptions of closeness and connection to teachers. An example item for this scale is "You could count on a teacher when you needed to talk. Items were scored on a 1 (almost never or never) to 4 (almost always or always) scale, and Cronbach's alphas were .93 and .92 for ages 14 and 16, respectively.

Cultural Orientation. At age 14, adolescents completed three questionnaire measures reflecting their endorsement of Mexican-American values and ethnic pride which together, encompassed cultural orientation as a latent construct. Adolescents' feelings of ethnic pride were captured with the Mexican-American Ethnic Pride (MAEP; Phinney, 1992) scale. This scale includes eight items scored on a 1 to 4 scale, and its Cronbach's alpha was .85. An example item from the MAEP is "You feel a strong attachment towards your own ethnic group." To capture adolescents' endorsement of familismo, the six-item Family Values (FVAL; Villarreal et al., 2005) scale and the sixteen-item Familismo subscale of the Mexican-American Cultural Values Scale (MACVS; Knight et al., 2010) were used. FVAL represents attitudinal familismo and includes items such as "You are proud of your family". FVAL items were scored on a 1 (strongly disagree) to 4 (strongly agree) scale and averaged together. The Familismo subscale of the MACVS (i.e., MACVS-F) reflects aspects of family support, obligations, and identification of the self within the family unit (e.g. family as a reflection of the self). These items were scored on a 1 (not at all) to 4 (very much) scale, and items were averaged together to create a mean familismo value. An example item from this subscale is "It is important for family members to

show their love and affection to one another." Cronbach's alphas for the familismo subscales were .75 (FVAL) and .87 (MACVS-F). Adolescents' endorsement of respeto was also measured using a subscale of the MACVS with eight items reflecting the prioritization of family hierarchy and respect for authority figures. An example item from this subscale is "Children should always be polite when speaking to any adult." Items were averaged to create a mean value of respeto. Cronbach's alpha was .77 for these items.

Transparency and Openness

Following the APA Style Journal Article Reporting Standards (JARS) for quantitative studies, data and research materials are available upon request from the CFP research team. Analysis code is available upon request from the first-author. A detailed plan of the study design, hypotheses, and analysis was uploaded to the Open Science Framework (OSF; https://osf.io/krj7x/) and linked with the official OSF page for the CFP, fulfilling pre-registration requirements. Study hypotheses were tested in R (version 4.0.3) by specifying structural equation models using the lavaan package (Rosseel, 2012). All models utilized full-information maximum likelihood and maximum likelihood estimation with robust standard errors to account for missingness and adjust for any non-normality. Model fit was evaluated with the chi-square (χ^2) goodness of fit statistic, the CFI, and the root mean square error of approximation (*RMSEA*; Browne & Cudeck, 1992). Model fit was considered excellent if the χ^2 *p*-value was non-significant (a standard that is commonly violated in large sample sizes due to the sensitivity of the test), the *CFI* was > .95, and the *RMSEA* was < .05, with a confidence interval upper-bound of < .08. Likewise, model fit was considered good or acceptable if the *CFI* was > .90, and the *RMSEA* was < .08.

Analytic Strategy

Global PYD and the Five Cs were modeled using a bifactor structure, such that manifest variables were designated to load onto a global PYD factor, as well as an individual factor representing that variable's respective C (set as orthogonal to the overarching PYD factor; see *Figure 1.1*). Our sample size met expectations for being able to achieve acceptable convergent rates and accurate parameter estimates in latent bifactor models (Bader et al., 2022). We first tested separate cross-sectional bifactor models for each measurement occasion in order to validate the Five Cs model of PYD using these data in our sample of Mexican-origin youth. A well-fitting model at this stage was seen as evidence supporting H1. Next, we tested longitudinal measurement invariance of the bifactor structure across adolescent ages 14 and 16 using standard procedures (Little, 2013). Models representing configural, metric, and scalar invariance were sequentially tested. For model comparison, we conducted a series of chi-square difference tests for nested models and evaluated change in the comparative fit index (*CFI*; Bentler, 1990) using the $\Delta CFI < .01$ criterion suggested by Cheung and Rensvold (2002). Establishing longitudinal configural, metric, and scalar invariance is required for meaningful comparisons in the factor means across time. Constraining factor loadings (i.e., metric invariance) and intercepts (i.e., scalar invariance) across measurement occasions scales the latent means and variances in a comparable metric, which then enables the identification of developmental trends. Further details concerning study-specific decisions regarding model specification, autocovariances of like items, and model fit comparisons of the measurement invariance models can be found in *Supplementary Materials.* The testing of longitudinal measurement invariance, specifically results from the scalar invariance model, will address the first three hypotheses, as establishing scalar invariance provides further theoretical support for the Five Cs structure (H1) and stability across time (H2 and H3).

We tested H4 by first specifying a CFA model defining cultural orientation as a latent factor using manifest indicators of ethnic pride, familismo, and respeto, then incorporated this CFA into the scalar invariance bifactor model of PYD. This model specified autocorrelations among the six PYD factors, correlations among the residual Cs and cultural orientation both within and across time, and predictive associations regressing global PYD onto cultural orientation at both measurement occasions (*Figure 1.2*). Lastly, we examined adolescents' gender and nativity as moderators of the associations between cultural orientation and global PYD.

Results

The first goal of the current study was to test a conceptual replication of the Five Cs model of PYD in a sample of Mexican-origin adolescents using a bifactor modeling approach. The second goal was to investigate whether longitudinal measurement invariance at the configural, metric, and scalar levels could be confirmed for the bifactor model of PYD. If scalar invariance is confirmed, results would suggest that the Five Cs structural model of PYD was measured in the same way across time. Confirmation of a scalar bifactor model would additionally inform whether youth endorsement of the Five Cs and PYD remained stable, indicating rank-order stability of the latent constructs across time. The third goal was to examine cross-sectional and longitudinal relations between youth endorsement of the Five Cs, global PYD, and cultural orientation. The last goal was to test adolescent gender and nativity as moderators of cultural orientation at age 14 predicting PYD at ages 14 and 16.

Validation of the Five Cs model of PYD

We first tested whether the theoretical concepts of the Five Cs and PYD could be conceptually replicated within these data (H1) by estimating two cross-sectional models using

the bifactor analysis structure depicted in *Figure 1.1*. For both measurement occasions, the same model described the hypothesized structure well (Age 14: $\chi^2(106) = 241.33$, $p = .000$, *CFI* = .965, *RMSEA* = .048 [.040, .056]; Age 16: $\chi^2(106) = 231.97$, $p = .000$, *CFI* = .967, *RMSEA* = .046 [.038, .054]). In both models, a residual covariance was specified between two manifest items loading onto Caring as these items shared method variance not accounted for by the bifactor model structure. See *Table S1.2* in *Supplemental Materials* for factor loadings of the Five Cs and PYD modelled separately at each age. The results of this first set of CFAs supported H1 by indicating that these data sufficiently represented adolescents' PYD by significantly loading onto latent constructs defining the Five Cs and PYD.

Testing Longitudinal Measurement Invariance of the Bifactor model of PYD

To further test the validity of the Five Cs model of PYD, we tested H2 by analyzing longitudinal measurement invariance of the bifactor model across adolescent ages 14 and 16 by specifying a series of nested CFA model structures. First, we established configural invariance by estimating a longitudinal bifactor model incorporating data from both ages, including same-item residual covariances (Model 1; $\chi^2(493) = 812.41$, $p = .000$, *CFI* = .966, *RMSEA* = .033 [.029, .037). The latent structures defining the Five Cs and global PYD were scaled using the fixed factor method, such that at both ages, factor variances were fixed to 1, and factor means were fixed to 0. Demonstrating that manifest variables loaded on the same individual C and global PYD factors over time confirmed that the hypothesized structure sufficiently represented this sample of adolescents' endorsement of the Cs and PYD across time. Next, we tested metric invariance in a two-step fashion by first constraining the factor loadings of all like manifest indicators on their respective Cs to be equal across time and releasing the factor variance constraints for the residual Cs at age 16 (Model 2; $\chi^2(506) = 816.73$, $p = .000$, *CFI* = .967,

RMSEA = .033 [.028, .037]). Second, we specified additional equality constraints for corresponding factor loadings onto global PYD across time and released the variance constraint on global PYD at age 16 (Model 3; $\chi^2(523) = 831.67$, $p = .000$, *CFI* = .967, *RMSEA* = .032 [.028, .036]). The specified constraints in Models 2 and 3 did not significantly decrease fit, therefore metric invariance was established. We next tested scalar invariance by constraining the intercepts of like manifest variables across time and freeing the age 16 factor means (Model 4; $\chi^2(535) = 886.32$, $p = .000$, *CFI* = .962, *RMSEA* = .034 [.030, .038]). This model did not significantly worsen fit in comparison to its predecessor, establishing scalar invariance of the bifactor model across ages 14 and 16, and indicating stability of like manifest intercepts across time. Model fits for all of these CFAs were in the excellent range; fit comparison tests are presented in *Supplemental Materials, Table S1.3*.

Results of the scalar invariance model supported hypotheses by evincing longitudinal validity of the bifactor model (H1) and indicating that the factor structure of the Five Cs and PYD latent constructs remain stable across time (H2). Standardized factor loadings from the scalar invariance model, displayed in *Table 1.2*, indicated that all manifest variables significantly and positively contributed to their respective latent C and to the global PYD construct, with the exception of our measures of Social Acceptance. Although Same-sex and Opposite-sex Popularity significantly contributed to the global PYD construct with positive loadings, these indicators produced negative loadings within the Competence factor structure at both measurement occasions, whereas scholastic competence produced consistent positive loadings across time. This split in loading valence indicates that the residual Competence factor is composed of both positive and negative dimensions that fluctuate in importance depending on whether the factor score increases or decreases over time. In other words, decreases in

Competence reflects an emphasis on the popularity dimension, while the scholastic dimension is emphasized when Competence increases over time (although, on average, there was not significant change in Competence from ages 14 to 16). Given that the age 14 factors were scaled as the reference group, the consistent pattern of loadings at both ages suggests a stronger emphasis on the popularity dimension of Competence within this sample.

Longitudinal stability and correlations among Global PYD and residual Cs

Establishing longitudinal scalar invariance in the current sample allows for the longitudinal comparison of factor means and the inspection of correlations among global PYD and the Five Cs (H3). Latent means and variances for the PYD constructs at each age are presented in *Table 1.3* as estimated in the scalar invariance model. Because the age 14 latent PYD factors were treated as the reference group using fixed factor scaling, any significant estimates of the age 16 factor means and variances produced by the scalar invariance model can be compared to 0 and 1, respectively. We found mean-level stability in Caring, Character, Competence, and Confidence, and decreases in Connection and global PYD across time. These mean-level changes mirror those seen in the standardized factor loadings produced by the scalar invariance model (see *Table 1.2*), as well as the raw descriptive means outlined in *Supplemental Materials, Table S1.1*. Latent correlations among the residual Cs and global PYD resulting from the scalar invariance model are displayed in *Table 1.4*. Our findings show moderate rank-order stability (*rs* .48-.64) of global PYD and the Five Cs across mid-adolescence. Cross-sectional inter-C associations were comparable at age 14 (*rs* .34-.70) and age 16 (*rs* .29-.64), with the strongest correlations at both ages between Caring and Character. Longitudinal correlations among the residual Cs ranged from small to moderate in magnitude (*rs* .19-.46). Overall, results supported H3 and suggest that adolescents' global PYD, together with their unique aspects of

PYD (i.e., value of each C, holding global PYD constant) remained relatively stable across the mid-adolescent period.

Predictive Relations between Cultural Orientation and Global PYD

We tested the extent to which cultural orientation was associated with PYD (H4) in two steps. First, we conducted a CFA using adolescent-reported ethnic pride, familismo, and respeto at age 14 to define a latent factor depicting what the current study termed cultural orientation. This model specified a residual covariance between the familismo and respeto subscales of the MACVS (Knight et al., 2010) as these indicators shared method variance not otherwise accounted for by the CFA structure defining cultural orientation. This overlap in variance was attributed to these indicators coming from the same source, and thus, including their residual covariance provided a more nuanced and accurate representation of the data. Indeed, without this specification, the cultural orientation single factor structure fit the data significantly worse (ΔCFI = -0.055; $\Delta RMSEA$ = -0.173), compared to a model including the residual covariance, which produced excellent model fit ($\chi^2(1) = 0.029$, $p = .866$, $CFI = 1.000$, $RMSEA = 0.000$ [0.000, 0.054]). As such, the CFA depicting cultural orientation accounting for one residual covariance was retained for the remaining analyses. The latent cultural orientation factor was scaled using the fixed factor method, such that its latent mean was constrained to 0, its variance constrained to 1, and all of the manifest loadings, intercepts, and variances were freely estimated. Standardized factor loadings ranged from 0.493 (respeto) to 0.682 (familismo subscale of the FVAL) and all manifest variables significantly contributed to the latent factor.

Next, we incorporated the cultural orientation CFA structure within the scalar invariance bifactor model of PYD. This model yielded excellent model fit ($\chi^2(674) = 1089.01$, $p = .000$, $CFI = 0.960$, $RMSEA = 0.032$ [0.029, 0.036]). *Table 1.4* includes correlations between cultural

orientation and the residual C constructs, as well as longitudinal predictive associations between cultural orientation and global PYD within and across time. Cultural orientation significantly and positively predicted PYD cross-sectionally and longitudinally, accounting for the stability of PYD across time. As the model accounted for the autocorrelations between PYD and residual Cs at ages 14 and 16, these findings indicate that stronger cultural orientation predicted greater PYD at age 16, after controlling for age 14 PYD. Cultural orientation was significantly associated with all residual Cs at ages 14 and 16, with the exceptions of Competence at age 14 and Confidence at age 16. Latent correlations with cultural orientation were stronger when considering cross-sectional associations (*rs* .48-.81) compared to longitudinal relations (*rs* .31-.60), and the strongest association at both ages was between cultural orientation and Connection. These findings support H4 in that all relations among latent variables were largely significant and primarily positive, suggesting that greater engagement with and pride regarding one's ethnic and racial identity and family values was related to greater embodiment of the Five Cs and PYD both cross-sectionally at age 14 and longitudinally across the mid-adolescent span.

Gender and nativity as potential moderators

Lastly, we tested a model incorporating adolescents' gender and nativity as moderators of the cross-sectional and longitudinal effects of cultural orientation on global PYD (RQ5). Latent factors representing global PYD were extracted from the scalar invariance bifactor model and the cultural orientation latent factor was extracted from its solo CFA. Factors were extracted so that moderation by gender and nativity could be tested with a simple path analysis that accounted for the complex structural nature of the bifactor model without overpowering our sample size. Global PYD at age 14 and cultural orientation were mean-centered prior to computing interaction terms so that zero represents a meaningful reference when probing significant

interactions. Two interaction terms were calculated (i.e. Gender-by-Cultural Orientation and Nativity-by-Cultural Orientation) and integrated into a simple path analysis testing whether the effects of cultural orientation on PYD within and across time differed by adolescents' gender and nativity. This model yielded null results for both moderators (model fit and parameter estimates displayed in *Supplemental Materials, Table S1.4*). Thus, in our sample, the positive impact of cultural orientation on adolescents' developing PYD across mid-adolescence was consistent across gender and nativity.

Discussion

The current study addressed a need to confirm the applicability of the Five Cs model of PYD with diverse youth, and specifically within a sample of Mexican-origin adolescents. We explored the development of PYD in relation to youth endorsement of ethnic pride, familismo, and respeto, cultural values that collectively represent a cultural strength that may promote PYD in Latinx samples. Using data from the CFP, a longitudinal study of Mexican-origin youth living in California, we first found evidence validating the Five Cs model of PYD. Next, by testing a longitudinal bifactor model of PYD, we found that adolescents' endorsement of the Five Cs and global PYD remained stable across ages 14 to 16 (i.e., scalar invariance). Aligned with our hypothesis that cultural orientation is an important contributor to PYD, we found that greater endorsements of ethnic pride, familismo, and respeto were altogether positively associated with the Five Cs and predicted global PYD within and across time. Specifically, adolescents' cultural orientation predicted growth in PYD over time, suggesting that ethnic pride, familismo, and respeto represent significant drivers of psychological well-being for Mexican-origin youth during mid-adolescence. Finally, we showed that these findings were consistent across adolescents' gender and nativity. Altogether, this study contributes to PYD research by providing novel

evidence of the structure and stability of PYD in a sample of Mexican-origin youth during mid-adolescence, identifying culturally-relevant individual strengths, and demonstrating their promotive influence on global PYD in this sample.

Theoretical implications

Testing whether long-standing theories can be empirically reproduced with alternative measures and within a range of populations is important for evaluating their continued empirical usefulness and validity. By documenting the bifactor structure of the Five Cs model of PYD in a Mexican-origin sample using independent measures, the present study contributes to replicability efforts and deepens the field's understanding of PYD in diverse populations. These findings uphold the robust nature of the Five Cs theoretical constructs by evincing that they are not inherently dependent on original measurement procedures. Furthermore, confirmation of the presence and stability of PYD in Mexican-origin youth during mid-adolescence supports prior work (Bowers et al., 2010; Geldhof et al., 2014), and positions the Five Cs theory as a viable strengths-based approach to studying healthy and adaptive development in Mexican-origin youth and, upon empirical confirmation, in other Latinx youth samples. Our findings provide novel evidence that the Five Cs model may be helpful for defining what thriving looks like for Mexican-origin youth in America, and offer a counterpoint to past research focused on risk and problematic outcomes (Kuperminc et al., 2009). As the field embraces asset-based theory and research (Azmitia, 2021; Neblett Jr. et al., 2012), efforts to conceptually replicate existing theories of positive development or design new ones within a culturally-informed framework may become increasingly prevalent. This work stands to expand the scope of PYD research by taking into account the unique ecological assets and structural factors that directly or indirectly influence the well-being of historically marginalized youth (Spencer & Spencer, 2014).

Results additionally confirmed that, excluding the residual Competence factor, all manifest variables contributed to their respective Cs and global PYD in the hypothesized manner derived from theory (Lerner et al., 2005) and psychometric testing (Bowers et al., 2010; Geldhof et al., 2014). Our study measured social acceptance using youth-reported ratings of popularity with same and opposite sex peers, and although these indicators significantly and positively loaded onto global PYD, there were significant negative loadings for both popularity indicators on the residual Competence factor. Thus, while all other latent factors defined by these data mirror those defined in the prior PYD literature, our Competence construct reflected a dynamic mix of both positive (scholastic competence) and negative (popularity) dimensions. Whether this pattern of factor loadings within the Competence structure can be strictly attributed to these data, or whether the scope of Competence is categorically different for Mexican-origin youth, warrants further investigation. We must additionally note, that aligned with Lerner and colleagues (2005), our physical appearance indicator significantly loaded on both global PYD and the residual Confidence factor, yet this runs counter to more recent studies of PYD modelled with a bifactor structure (Geldhof et al., 2014; Holsen et al., 2017).

By demonstrating that Mexican-origin youth's ethnic pride and endorsement of cultural values promotes psychosocial well-being during middle adolescence, the present study centers ethnic identity development and connection to cultural history as developmental assets for Latinx youth. This supports previous arguments proposing ethnic identity (and the processes through which this identity is developed and formalized) as a competency promoting adolescents' psychosocial adjustment for diverse youth broadly (Kuperminc et al., 2009; Neblett Jr. et al., 2012), and for Latinx youth specifically (Acevedo-Polakovich et al., 2014; Rew et al., 2015; Wantchekon & Umaña-Taylor, 2021). Youth positive socialization and internalization of their

cultural context can protect against maladjustment while promoting multiple PYD domains, namely Competence, Caring, and Connection (Gonzales et al., 2008; Rew et al., 2015; Segal et al., 2011; Yu et al., 2021). Further, there is evidence that mid- to late adolescents who report having an achieved ethnic identity may be less adversely affected by racial discrimination (Wakefield & Hudley, 2007), suggesting that those who take pride in their ethnicity may have greater self-esteem (Confidence) or adaptive coping strategies (Competence) that increase their preparedness for dealing with racialized inequity. Thus, the current findings align with past work connecting ethnic pride, familismo, and respeto with healthier psychosocial adjustment, and underscore middle adolescence as an important developmental context for deconstructing the complex connections of ethnic identity and ethnic pride with various dimensions of well-being.

When considering how cultural orientation functionally promotes PYD, the processes through which adolescents develop their ethnic pride and identify with cultural values are important to discuss. One of the core needs of adolescence, or the developmental tasks characteristic of this period that need to be safely met and surpassed (UCLA Center for the Developing Adolescent, 2022), is the exploration and definition of adolescents' self-concept. In grappling with questions such as "Who am I?" and "What do I value?", adolescents create a sense of personal meaning, belonging, and empowerment, which may culminate in a sense of psychological security and safety (Alvarado & Ricard, 2013; Constantine & Sue, 2006; Rivas-Drake et al., 2014). Increased autonomy and sense of personal agency characterizes middle adolescence in particular (Allen, 2008; Crone & Dahl, 2012), such that it is at this stage that many youth take a more active role in creating the life they want for themselves. Thus, youth may increasingly self-select into settings and experiences that build the skills underlying the Five Cs (e.g., joining the workforce or an after-school program), contributing to their PYD.

For Mexican-origin youth living in the U.S., developing positive connections to their ethnic-racial background and taking pride in their cultural community demonstrates a unique competency for grounding their self-concept in Mexican culture, despite the possibility of being stereotyped within the broader American context (Neblett Jr. et al., 2012; Safa & Umaña-Taylor, 2021). Youth who recognize the value inherent in their cultural history and draw on it as a source of inner strength may experience additional layers of psychological safety (Wakefield & Hudley, 2007) providing them with further motivation to engage positively with others in the pursuit of self-discovery and actualization. By building positive connections between their sense of self, personal values, and goals and their family's Mexican heritage and cultural traditions, youth create space for furthering their personal development, and as such, the multicultural context serves as an additional avenue supporting the universal need of self-exploration in a manner specific to Mexican-origin adolescents.

Similarly, the process of developing a personal sense of ethnic pride and connection to cultural values may additionally set the stage for PYD by factoring into Mexican-origin adolescents' decision-making. Given that healthy adolescent development requires a balancing act between increased autonomy and responsibility while maintaining connectedness (Allen, 2008), the choices and behaviors youth enact at this time are exceptionally important as they underlie trajectories of academic achievement, personal growth, and community involvement (Crone & Dahl, 2012; Dahl et al., 2018). Research exploring adolescent decision-making suggests that youth calibrate or align their behavior with their self-concept, personal attributions, beliefs, and values (Berzonsky, 1989). In choosing between peers to befriend, goals and hobbies to pursue, or different identities to embody, adolescents may seek guidance and gather relevant information from their cultural context (Berzonsky, 1989). For Mexican-origin youth, standards

of appropriate behavior and interpersonal connections are, in part, framed through the cultural values of familismo and respeto (Constantine & Sue, 2006). By emphasizing the importance of knowing one's role and position within the family dynamic as well as reinforcing prosocial, responsible, and respectful interactions with others, familismo and respeto serve as markers of culturally acceptable behavior (Constantine & Sue, 2006; Stein et al., 2014). This value system is characterized by an other-oriented approach in which a sensitivity to the needs of others is rewarded (Calderon-Tena, 2011; Knight et al., 2016). Given the bidirectional nature of relations between supportive family environments and PYD (Lerner et al., 2005), upholding an other-orientation may inspire an upward spiral of healthy decisions and psychosocial adjustment. Thus, global well-being may be optimized through a virtuous cycle characterized by positive family interactions, community engagement and school involvement increasing in parallel with adolescents' personal sense of socioemotional savviness and connection.

The present findings have important implications for programming efforts with Mexican-origin youth specifically, and Latinx youth broadly, as they suggest that positive identification with and connection to one's cultural history and values influence global well-being. Teachers, peer mentors, and other adults within the community have great capacity to model, scaffold, and foster the development of a healthy, positive, and strong connection to one's ethnic and racial community across formal education environments and informal youth development programs. The idea that adolescents' cultural orientation facilitates responsibility, prosociality, and general well-being is supported by theoretical work proposing that the community context acts as a "critical delivery system" for PYD in adolescents (Benson et al., 2006). This developmental systems-perspective proposes that the community context promotes healthy development by conveying a framework for belonging and personal empowerment, opportunities for self-

exploration, additional social support, and clear boundaries and expectations for responsible behavior. Moreover, previous intervention work within a diverse sample of adolescents has demonstrated the effectiveness of ethnic-racial identity exploration programs in promoting higher self-esteem, academic grades, and identity cohesion, and lowering depressive symptoms (Umaña-Taylor et al., 2018). The present findings lend additional empirical support for the benefits of youth engagement with their cultural community, and specifically emphasize ethnic pride and traditional Mexican family values as candidate factors engendering PYD in Mexican-origin adolescents. Since the mid-adolescent stage is characterized by increased autonomy and social responsibilities outside of the immediate family, as well as greater intrinsic motivation to discover the self (Allen, 2008; Crone & Dahl, 2012), PYD programs that youth engage with during this time may increase in impact to promote optimal trajectories of psychological health across the lifespan.

Limitations and future directions

The present study was not without limitations. Data were taken from two waves of the CFP, a study not specifically designed to test the Five Cs model of PYD. Our latent definitions of the PYD constructs were constrained to the data available, which was displayed in our measurement of the social domain of Competence. Specifically, lacking a collaborative conflict resolution scale, our measurement of social ability was restricted to popularity indices which negatively loaded onto Competence. Additionally, it should be noted that to prevent our latent structural model from producing a non-significant, but impossible estimate for the longitudinal residual covariance of our scholastic competence indicator, this residual auto-covariance was fixed at 0. This possibly contributed to the positive and negative valence of the manifest loadings for Competence. As such, our operationalization of the Five Cs may not be directly comparable

with prior literature with regard to Competence. Despite this measurement constraint, we replicated the latent bifactor structure of global PYD and residual Cs, suggesting that future work to confirm the reproducibility of our findings would be warranted. Additionally, all data were from adolescent self-reports. Further investigations of these theoretical constructs using peer-, parent-, and teacher-reports and observational data would further strengthen the reliability of the Five Cs model of PYD.

It is important to note that the present sample entirely consisted of Mexican-origin youth coming from lower socioeconomic backgrounds in California. We cannot assume generalizability of the present findings given the significant heterogeneity of the Latinx community in the United States and abroad. The specific influences of familismo, respeto, and ethnic pride, shown to be strong predictors of PYD within our unique sample, may imbue different developmental effects in other Latinx communities. Additionally, replication in other diverse samples is essential. For example, examining the Five Cs model as it relates to culturally-relevant developmental assets in African-American and other minority youth samples are needed to further test the validity of this framework for clarifying the nature of well-being and thriving for all American children and adolescents.

It is important to note that the latent associations presented in *Table 1.4* should be interpreted in the context of the Five Cs being orthogonal to global PYD except for the variance in these factors that is directly related to cultural orientation. This subtle violation of the bifactor model's orthogonality principle was unforeseen, yet perhaps demonstrates a general limitation of modelling PYD within a bifactor framework. As noted by Geldhof et al. (2014), investigating important developmental predictors of general PYD and mapping their relative contributions onto various dimensions of PYD as it is modeled with a bifactor structure represents the next

wave of PYD studies. Despite its technical drawbacks, the present model represents a step forward in our understanding of positive development in Mexican-origin youth by highlighting important cultural influences on PYD. As such, future studies designed to clarify context-driven PYD processes in diverse samples of youth may utilize this work as a reference point in the contemporary study of ethnic minority youth development.

Although our findings suggest that adolescents' ethnic pride, familismo, and respeto promote PYD and are uniquely associated with its various dimensions, further research is needed to clarify the processes as well as potential underlying mechanisms. Past work has linked dual-axis cultural adaptation and biculturalism with optimal developmental outcomes (Gonzales et al., 2009; Safa & Umaña-Taylor, 2021), pointing to individuals' proficiency and comfort within both minority and majority cultural contexts as candidate developmental assets for bicultural youth. Thus, investigations incorporating repeated-measures of bicultural adaptation, identity, and competence across adolescence stand to enrich the field's understanding of individual-and group-level variation in trajectories of psychosocial adjustment (Safa & Umaña-Taylor, 2021). In other words, future studies seeking to confirm the developmental benefits of cultural factors should consider that these youth experience two cultural worlds as they develop, and understanding their balancing of both worlds will deepen the field's understanding of PYD processes in diverse samples.

Furthermore, as PYD research evolves with greater attention to individual variability and specificity in PYD constructs in diverse samples (Johnson & Ettekal, 2022; Lerner & Bornstein, 2021), efforts to extend the Five Cs model itself, beyond replication in novel populations, may gain traction. While the present study was designed to test the extent to which positive aspects of our sample's cultural orientation promoted global PYD, future work could probe whether

sample-specific developmental assets can directly operationalize PYD concepts. For example, as a positive identity affirmation, ethnic pride may illustrate Confidence, whereas traditional cultural values such as familismo and respeto may exemplify Character in specific samples of youth. Thus, research incorporating sample-specific indicators within the Five Cs analytic structure itself stands to expand the field's operationalization of the Cs by providing a more nuanced understanding of what thriving actually looks like for youth in diverse communities.

Conclusions

The present study provided robust evidence for the Five Cs model of PYD analytically and in translation to an underrepresented sample. By clarifying the developmental nature of PYD in a Mexican-origin sample across middle adolescence, this study advances both strengths-based research and deepens the empirical basis to inform the construction and usage of developmentally-sensitive PYD programs. Investigating the cultural context in which the Five Cs develop and identifying culturally-specific developmental assets that benefit inner strengths deepens the field's understanding of PYD within diverse contexts. These findings highlight ethnic pride, familismo, and respeto as promotive factors that PYD research and programs can leverage to understand and enhance well-being in Latinx youth in general and Mexican-origin youth, in particular.

Table 1.1. The Five Cs as theoretically defined by Lerner and colleagues (2005) and empirically operationalized by the Positive Youth Development-Short Form (Geldhof et al., 2014).

Five Cs	Theoretical Definition	Empirical Operationalization
Caring	A sense of sympathy and empathy for others.	Example item: "When I see someone being picked on, I feel kind of sorry for them." Participants respond on a 1 = *not like you* to 3 = *really like you* scale.
Character	Respect for societal and cultural rules, possession of standards for correct behaviors, a sense of right and wrong (morality), and integrity.	Example item: "Helping to make the world a better place to live in." Participants respond on a 1 = *not important* to 5 = *extremely important* scale.
Competence	Positive view of one's actions in domain specific areas including social, academic, cognitive, and vocational. Social competence pertains to interpersonal skills (e.g., conflict resolution). Cognitive competence pertains to cognitive abilities (e.g., decision making). School grades, attendance, and test scores are part of academic competence. Vocational competence involves work habits and career choice explorations.	Example item: "Some teenagers are popular with others their age, BUT other teenagers are not very popular." Participants select which statement describes them more and then rates whether the statement is *really true* or *sort of true.*
Confidence	An internal sense of overall positive self-worth and self-efficacy; one's global self-regard as opposed to domain specific beliefs.	Example item: "Some kids *like* the kind of *person* they are BUT other kids often wish they were someone else." Participants select which statement describes them more and then rates whether the statement is really true or sort of true.
Connection	Positive bonds with people and institutions that are reflected in bidirectional exchanges between the individual and peers, family, school, and community in which both parties contribute to the relationship.	Example item: “In my family, I feel useful and important." Participants respond on a 1 = *strongly disagree* to 5 = *strongly agree* scale.

Figure 1.1. Bifactor model of Positive Youth Development (PYD) (Identical structures for ages 14 and 16).

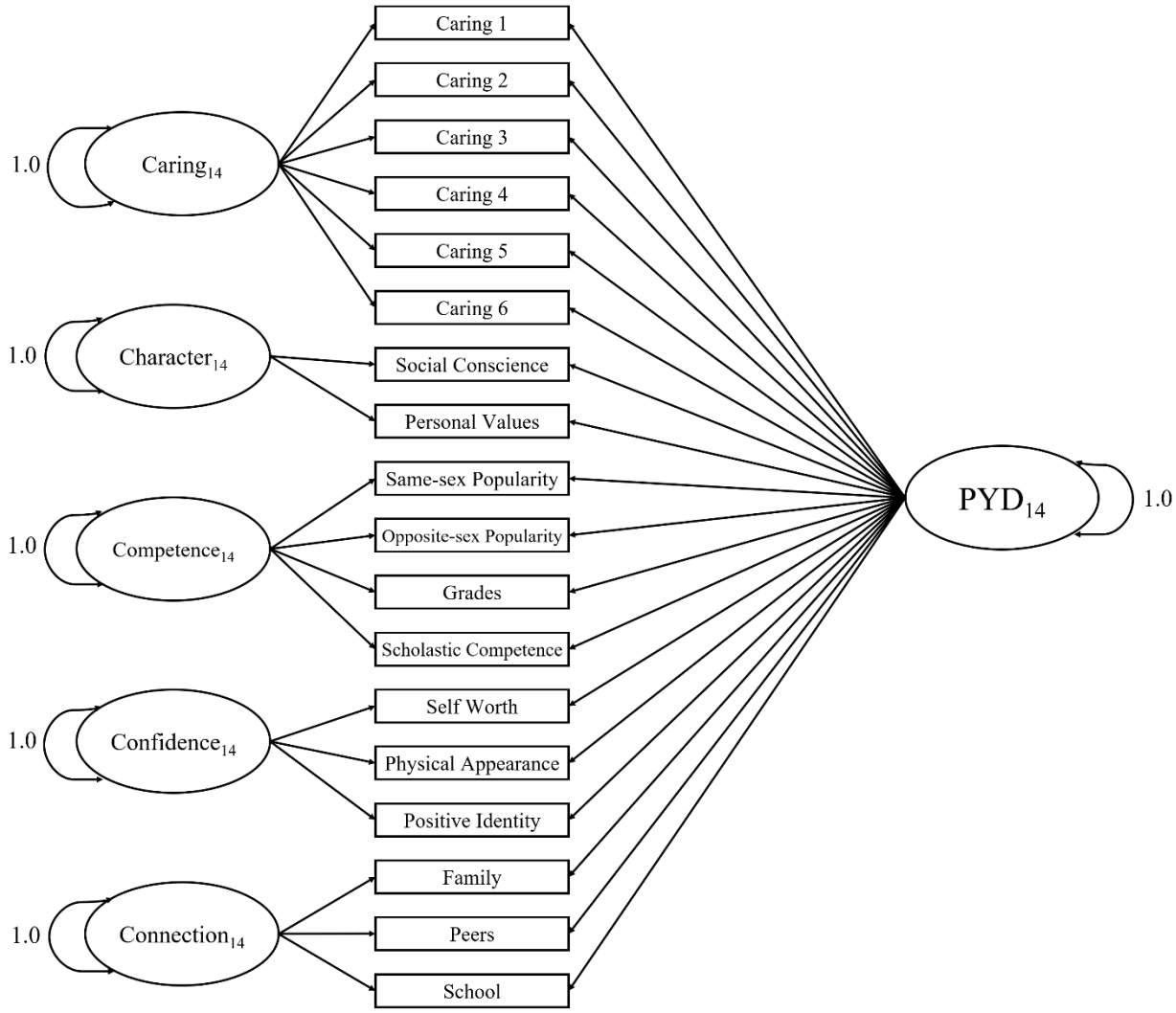


Figure 1.2. Structural equation model depicting associations between the longitudinal bifactor model of Positive Youth Development (PYD) and Cultural Orientation (CO). Participant ages are represented in subscripts.

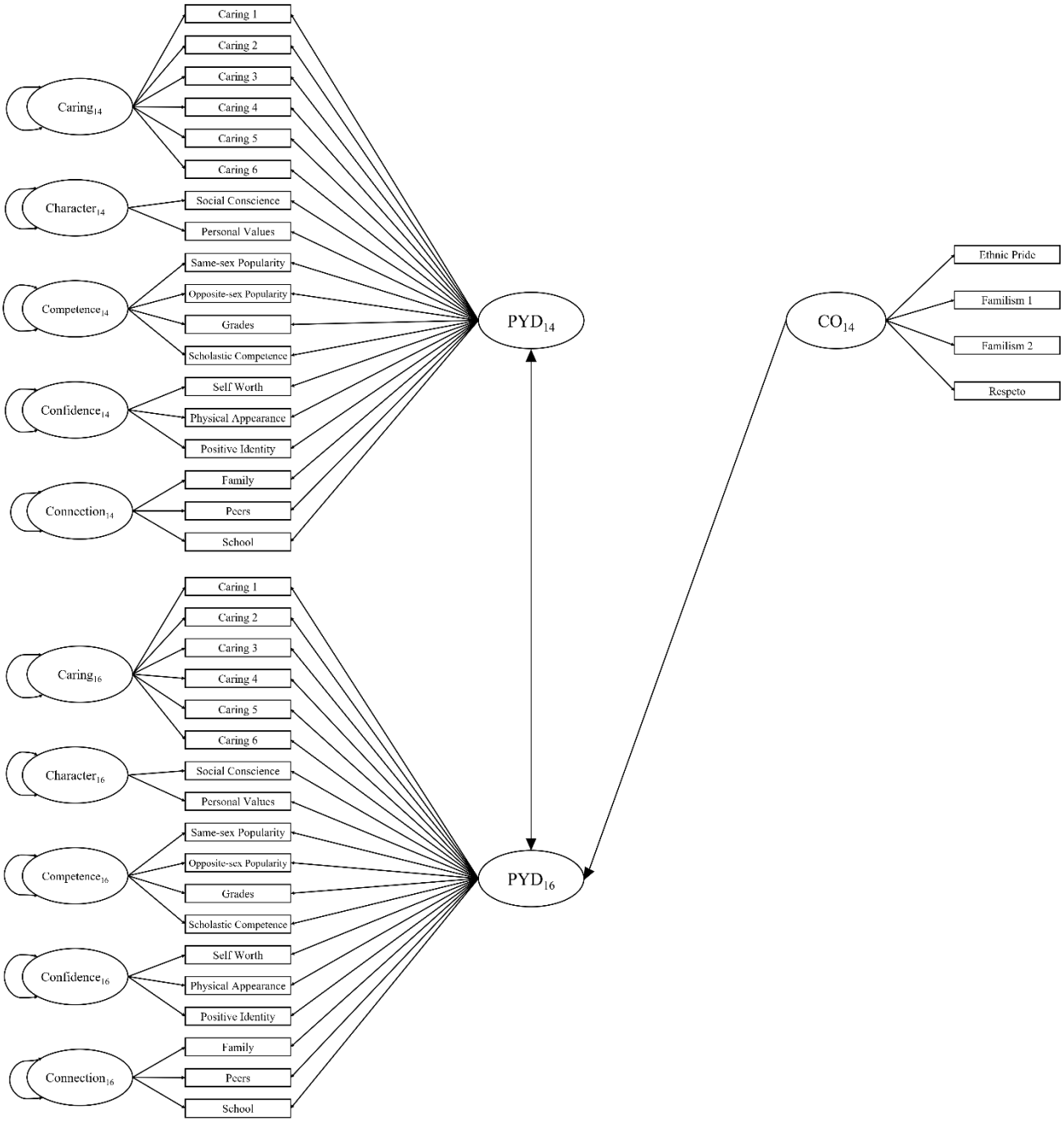


Table 1.2. Standardized factor loadings from the scalar invariance bifactor model of Positive Youth Development (PYD).

	Age 14				Age 16			
	Target C	*p*	PYD	*p*	Target C	*p*	PYD	*p*
Caring								
Caring 1	0.337	0.000	0.275	0.000	0.399	0.000	0.275	0.000
Caring 2	0.437	0.000	0.358	0.000	0.534	0.000	0.368	0.000
Caring 3	0.535	0.000	0.375	0.000	0.609	0.000	0.360	0.000
Caring 4	0.678	0.000	0.281	0.000	0.725	0.000	0.253	0.000
Caring 5	0.703	0.000	0.351	0.000	0.757	0.000	0.318	0.000
Caring 6	0.672	0.000	0.348	0.000	0.718	0.000	0.313	0.000
Character								
Social Conscience	0.636	0.000	0.409	0.000	0.671	0.000	0.415	0.000
Personal Values	0.437	0.000	0.442	0.000	0.441	0.000	0.430	0.000
Competence								
Same-Sex Popularity	-0.431	0.000	0.499	0.000	-0.360	0.000	0.511	0.000
Opposite-Sex Popularity	-0.465	0.000	0.355	0.000	-0.392	0.000	0.367	0.000
Grades	0.375	0.000	0.546	0.000	0.314	0.000	0.560	0.000
Scholastic Competence	0.274	0.015	0.871	0.000	0.217	0.015	0.846	0.000
Confidence								
Self-Worth	0.407	0.000	0.772	0.000	0.450	0.000	0.735	0.000
Physical Appearance	0.394	0.000	0.398	0.000	0.450	0.000	0.391	0.000
Positive Identity	0.534	0.000	0.619	0.000	0.577	0.000	0.576	0.000
Connection								
Family	0.694	0.000	0.454	0.000	0.656	0.000	0.419	0.000
Peers	0.525	0.000	0.391	0.000	0.518	0.000	0.376	0.000
School	0.442	0.000	0.379	0.000	0.453	0.000	0.379	0.000

Note. “Target C” refers to the residual C for a specific manifest indicator (i.e., Target C for Self-Worth refers to Confidence).

Table 1.3. Latent means (M) and standard errors (SE) of all Positive Youth Development (PYD) constructs from the scalar invariance model.

Age	14	16
Latent means		
Caring	0.000	-0.064
Character	0.000	0.070
Competence	0.000	0.004
Confidence	0.000	0.073
Connection	0.000	-0.269***
PYD	0.000	-0.142***
Latent variances		
Caring	1.000	1.275***
Character	1.000	0.972***
Competence	1.000	0.602***
Confidence	1.000	1.220***
Connection	1.000	0.948***
PYD	1.000	0.904***

Notes: ***p<.001.

Table 1.4. Target correlations among Positive Youth Development (PYD), residual Cs, and cultural orientation and predictive relations between cultural orientation and PYD.

	Target Correlations											
Concept (Age)	1	2	3	4	5	6	7	8	9	10	11	12
1. Cultural Orientation (14)	-											
2. Caring (14)	0.53***	-										
3. Character (14)	0.65***	0.70***	-									
4. Competence (14)	-0.19	-0.12	-0.28^{t}	-								
5. Confidence (14)	0.48***	0.12	0.47***	-0.46*	-							
6. Connection (14)	0.81***	0.34***	0.54***	-0.38***	0.41**	-						
7. PYD (14)	-	NA	NA	NA	NA	NA	-					
8. Caring (16)	0.31***	0.50***	0.44***	0.07	0.06	0.19**	-	-				
9. Character (16)	0.37***	0.42***	0.64***	-0.01	0.08	0.18^{t}	-	0.64***	-			
10. Competence (16)	-0.36***	-0.29***	-0.46***	0.59***	-0.45***	-0.33***	-	-0.09	-0.40*	-		
11. Confidence (16)	0.17	0.06	0.21	-0.20^{t}	0.48***	0.13	-	0.11	0.21	-0.38^{t}	-	
12. Connection (16)	0.60***	0.28**	0.43***	-0.25**	0.22	0.63***	-	0.29***	0.43***	-0.40*	0.38**	-
13. PYD (16)	-	-	-	-	-	-	0.55***	NA	NA	NA	NA	NA

	Target Regressions							
	PYD (14)				PYD (16)			
	B	*SE*	*p*	95% CI	*B*	*SE*	*p*	95% CI
Cultural Orientation (14)	0.526	0.096	0.000	0.337, 0.714	0.436	0.130	0.001	0.182, 0.690

Notes: ^{t}p<.1, *p<.05, **p<.01, ***p<.001; NA = orthogonal parameter.

CHAPTER 3: STUDY 2

PREDICTING THE IMPACT OF FAMILY STRESS ON ADOLESCENT STRESS PHYSIOLOGY: INTERACTIONS WITH POSITIVE YOUTH DEVELOPMENT CONSTRUCTS AND GENDER

Background

Developmental science is increasingly recognizing that aspects of individual resilience like psychosocial competencies can promote well-being despite experiences of stress and adversity. Yet, relatively little of this research has considered the neurobiological benefits of these individual-level resilience factors (Ellis et al., 2017). Adolescents' exposure to negative family environments, those characterized by conflict and hostile relationships, has been associated with increased psychological and physiological maladjustment (Chiang et al., 2022; Luecken et al., 2009; Repetti et al., 2002; Shaw & Starr, 2019). However, all youth may not be equally susceptible to these effects, nor are youth passive agents in the actions of their environments on their development (Cicchetti & Rogosch, 1996; Masten, 2018). Positive Youth Development (PYD) is a strengths-based framework that researchers have used to understand and identify specific facets of an individual and their environment that promote flourishing during adolescence (Benson et al., 2006). The Five Cs model of PYD (Lerner et al., 2005), one of the primary theoretical models used in PYD research, emphasizes five key individual-level capacities that are essential for the healthy development, namely Caring, Character, Competence, Confidence, and Connection, which together represent a holistic measure of social, emotional, and behavioral wellness. Given that the Five Cs have been found to protect youth from problems associated with several adverse experiences (Arbeit et al., 2014; Holsen et al., 2017; Schwartz et al., 2010), this model may point to PYD constructs as particular aspects of personal resilience

that could buffer adolescents' neurobiological well-being against the adverse impacts of negative home environments (Lerner et al., 2013).

It is particularly important to examine family processes and biobehavioral integration within diverse and underrepresented samples, specifically Mexican-origin and other Latinx samples, given the centrality of family to psychosocial and ethnic identity developmental processes (Kuperminc et al., 2009). Moreover, Mexican-origin and other Latinx samples are largely underrepresented within neurobiologically-informed developmental science (Myers, 2009; Parra & Hastings, 2018), and the preponderance of research within marginalized and minoritized communities has been focused on deficits instead of strengths (Azmitia, 2021; Lerner et al., 2017). Therefore, the current study examines the extent to which aspects of adolescents' personal resilience, operationalized herein as global PYD, moderates the neurobiological impact of hostile family dynamics during mid- to late adolescence in a sample of Mexican-origin youth.

Adrenocortical Development and the Impact of Family Stress in Adolescence

The Hypothalamic-Pituitary-Adrenal axis (HPA) is one of the body's main stress response systems that is specifically activated by uncontrollable, self-referential or social evaluative stressors (Gunnar & Quevedo, 2007). During adolescence, the HPA evolves through a dynamic maturational process, and compared to childhood and adulthood, basal and acute adrenocortical activity increases during adolescence (Dahl & Gunnar, 2009; Stroud et al., 2009). This pattern of heightened HPA sensitivity is paralleled by increased plasticity of multiple other neurobiological and hormonal systems (Eiland & Romeo, 2013). As such, the adolescent period is characterized by an increased physiological sensitivity that potentially makes the HPA more susceptible to social cues. While acute reactivity within appropriate contexts is adaptive,

repetitive activations triggered by chronic social stress can lead to dysregulated stress responses over time (Gunnar & Quevedo, 2007; Gunnar et al., 2015). Alterations to typical HPA functioning have been shown to have long-term effects on health and psychological functioning, namely mental health disturbances (Chrousos, 2009; Forbes et al., 2006; Gunnar et al., 2015).

Family social cues may increasingly impact the HPA during adolescence as it is during this time that youth begin to differentiate from the family and engage with their home environment in new ways (Ponappa et al., 2014). Positive and supportive family environments during this transition have been shown to promote adolescent mental and physical health (Chen et al., 2019; Mooney et al., 2007; Tabak & Zawadzka, 2017), including healthy HPA regulation (Marsman et al., 2012; Shirtcliff et al., 2017). Conversely, hostile family environments in which family interactions are persistently aggressive, threatening, and overtly negative are predictive of neurobiological and emotional dysregulation (Chiang et al., 2022; Lucas-Thompson & Granger, 2014), including both HPA hypoactivity (Luecken et al., 2009; Saxbe et al., 2012; Shakiba et al., 2022) and HPA hyperactivity (Essex et al., 2011; Koss et al., 2017). The extant literature on the stress responsiveness of Latinx and Mexican-origin youth has received less attention (McClure et al., 2013), however one study by Gonzales and colleagues (2018) found evidence linking family conflict to blunted HPA activity, aligned with the hypoactivity hypothesis of allostatic load theory (McEwen, 2000). Beyond this, prior work has additionally found evidence of sociocultural and economic stressors predicting HPA hypoactivity using samples of Latinx youth (Johnson et al., 2021; Mendoza et al., 2017; Ugarte and Johnson et al., 2022).

Individual variability in HPA regulation suggests that pathways of risk and resilience may diverge for youth in adverse family environments (Gunnar et al., 2009; Hostinar & Gunnar, 2013). Thus, not all adolescents experience changes in adrenocortical functioning related to

family stress exposure. The extent to which individuals display chronic, stress-induced changes to neuroendocrine functioning, and how these alterations manifest (hyper versus hypo-arousal), is a function of numerous individual, contextual, and environmental factors (Gunnar & Quevedo, 2007; Herman et al., 2016). Exploring multi-level factors that may confer resilience to the neurobiological implications of chronic stressors has increasingly become a core research goal in developmental science, particularly when studying underrepresented samples (Hostinar & Miller, 2019; Lerner et al., 2017; Masten et al., 2021). The Five Cs model of PYD (Lerner et al., 2005) mirrors a number of social, emotional, and cognitive functions that have been identified as conferring resilience and promoting positive outcomes in prior research (Arbeit et al., 2014; Årdal et al., 2018; Holsen et al., 2017; Lerner et al., 2013; Schwartz et al., 2010; Shek & Chai, 2020). Thus, we propose a test of global PYD measured in mid-adolescence to determine whether this index of psychosocial well-being supports positive adaptation for youth experiencing high family stress.

Framing PYD Constructs as a Source of Resilience

The Five Cs model of PYD asserts that adolescent flourishing is a normative developmental process that can be optimized through supportive relationships within the family, peer group, school, and community (Lerner et al., 2005). This multi-level support network creates healthy opportunities for youth to engage in a variety of social settings, where they can meaningfully contribute and engage with others while having their core needs for connection and self-exploration met (Benson et al., 2006; Dahl et al., 2018; Rivas-Drake et al., 2014). The model proposes the *global PYD* construct to operationalize flourishing, categorizing evidence of thriving into mutually influential domains of functioning, termed the Five Cs – *Caring, Character, Competence, Confidence,* and *Connection* (Lerner et al., 2005, 2013). These domains

reflect high-level social, emotional, and behavioral functioning and are considered internalizations or manifestations of the positive interpersonal interactions that youth experience in consistently supportive contexts. Given its premise that all youth flourish in ways unique to their context, research using the Five Cs model within diverse, marginalized, and traditionally-underrepresented samples is needed to support the generalizability and universality of the model, and to provide a more nuanced understanding of the factors that promote positive development in all youth. Despite being a large and growing population in the U.S., Mexican American youth are often underrepresented in research on positive development (Azmitia, 2021). Therefore, testing this model with samples of Mexican-origin youth in the U.S. specifically, may illuminate how differences in language, migration history, and cultural values influence the expression and manifestation of PYD constructs.

In the PYD literature, Global PYD and the Cs have been consistently documented to longitudinally predict increases in well-being metrics (e.g., life satisfaction, academic well-being, feelings of belonging and personal empowerment; Årdal et al., 2018; Holsen et al., 2017; Lerner et al., 2013; Shek & Chai, 2020), and decreases in maladjustment areas (e.g., internalizing/externalizing symptoms, problematic drug use and risky sexual behavior; Arbeit et al., 2014; Holsen et al., 2017; Schwartz et al., 2010). PYD research has not fully clarified whether PYD constructs have the capacity to ameliorate, protect against, or compensate youth for the adverse developmental impact of growing up within stressful life circumstances that are severe or chronic in nature (Lerner et al., 2013; Masten, 2014). Constructs that are conceptually similar to the original operationalizations of the Five Cs, such as coping strategies, peer support, and social skills, have been found to attenuate the effects of early adversity on psychological and physiological functioning as measured by externalizing and internalizing behavioral problems,

trauma-related distress, social competence, academic performance, and the regulation of multiple stress response systems including the HPA (Clarke, 2006; Hostinar & Miller, 2019; Racine et al., 2020; Wood & Bhatnagar, 2015). However, there remains both a knowledge gap and an evidence gap in understanding how PYD constructs, namely global PYD and the Cs, may moderate the impact of negative life contexts on adjustment and well-being as it manifests over time. PYD research has focused less on understanding this role (knowledge gap), and the empirical evidence linking family stress with HPA functioning is contradictory (empirical gap).

In the present study, we consider the possibility that PYD constructs contribute to adolescents' resilience by promoting efficient adrenocortical functioning and explore the extent to which PYD constructs modify the effects of family stress on individual HPA activity. Three prominent resilience models that offer unique conceptual frameworks for understanding how PYD may confer resilience are the *compensatory, protective*, and *challenge* models (Fergus & Zimmerman, 2005; Garmezy et al., 1984; Luthar & Zelazo, 2003; Luthar et al., 2000; Zimmerman & Arunkumar, 1994; Zimmerman et al., 2013). The compensatory model tests the capacity of promotive factors to directly counteract the impact of risks by explaining unique variance in adolescent health or adjustment metrics over and above the risk factor itself (Garmezy et al., 1984; Zimmerman & Arunkumar, 1994). Studies designed to test this model may, for example, examine whether parental support (promotive factor) mitigates the impact of being friends with a peer group known for their delinquency (risk factor) by predicting less personal delinquency independent of peer delinquency. Conversely, the protective factor model examines whether promotive factors moderate the detrimental effects of risk exposure on well-being (Garmezy et al., 1984; Luthar et al., 2000). Using the previous example, if the association between peer delinquency and personal delinquency is reduced for youth who report higher

parental support, relative to youth who report less parental support, this would be evidence for the protective factor model. The challenge model views average risk exposure in a manner similar to vaccines, such that moderately stressful life contexts are thought to stimulate the development of a coping "toolkit" that help youth to overcome the effects of the experience and can be useful when faced with subsequent challenges (Garmezy et al., 1984; Luthar & Zelazo, 2003). The challenge model is adaption-based and provides the foundation of the *specialization* and *sensitization* hypotheses which suggest that early stress exposure may improve certain attentional, affective, and cognitive skills that are ecologically-relevant within harsh contexts (Ellis et al., 2017). Since the challenge model and its associated hypotheses have yet to be thoroughly tested, we have focused our hypotheses on testing the role of PYD within the compensatory and protective models, yet the exploratory nature this line of inquiry may lead to results applying to one or all three theoretical approaches.

Gender Differences Warrant Exploratory Moderation Analyses

There are indications that gender differences may exist between adolescent girls and boys on HPA activity, how FS affects the HPA axis, and developmental trajectories of PYD. Although less attention has been dedicated to comprehensively understanding gendered variation within associations between adolescents' FS exposure, psychosocial functioning, and stress responsivity, studies suggest that girls tend to produce stronger cortisol reactivity to interpersonal stressors than boys during adolescence (Dahl & Gunnar, 2009; Gunnar, et al., 2009). However, this may be in part dependent on the nature of the stress induction task used, as performance-based stressors appear to elicit stronger cortisol reactivity than peer rejection stressors (Gunnar & Talge, 2008; Stroud et al., 2009). Research also suggests that adolescent girls have an increased sensitivity to social influences, as stressful life events and experiences of adversity tend to

predict girls' HPA functioning more strongly than they do for boys (Essex et al., 2011; Oldehinkel & Bouma, 2011; Schriber & Guyer, 2016). Within the PYD literature, adolescent girls tend to score higher on Caring, Character, and Connection, whereas boys tend to score higher on Competence and Confidence (Gomez-Baya et al., 2019; Wiium et al., 2019); however, the extent to which certain facets of the social and environmental context predict the development of PYD more strongly for girls versus boys has been relatively unexplored. Studies have shown that gender-related socialization experiences may drive divergent patterns of adolescent physiology (Booth et al., 2008; Oldehinkel & Bouma, 2011) and psychosocial functioning (Perry & Pauletti, 2011; Wiium et al., 2019); both of which may be explained by gendered variation in how family contexts become internalized within the self-concept (Harter, 2006; Shapka & Keating, 2005). However, whether gender contributes additional variability within associations between family context, psychosocial functioning, and stress responsivity is undetermined. Hence, the present study explores adolescent gender as a possible moderator of relations between FS exposure, PYD constructs, and HPA activity.

The Present Study

The present study utilized a large sample of Mexican-origin adolescents and their parents to examine the impact of exposure to family stress (measured via a composite of adolescent- and parent-reports) on adolescents' adrenocortical functioning and investigated the extent to which adolescents' endorsement of PYD constructs attenuated any adrenocortical alterations resulting from family stress exposure. This research used a longitudinal design with two measurement occasions when adolescents were, on average, 16 and 17 years old. Based on the literature reviewed above, we addressed three main research questions matched with respective hypotheses. *RQ1:* Does adolescent exposure to family stress, reflected as family conflict,

hostility, and qualitatively negative parent-adolescent relationships, carry consequences for later adrenocortical functioning, namely a decreased capacity to mount an acute stress response? *H1:* We expected family stress to predict HPA functioning prior to and following a stress induction task simulating the experience of social exclusion. Although the directionality of specific effects is difficult to anticipate in light of contradictory evidence (Essex et al., 2011; Koss et al., 2017; Luecken et al., 2009; Saxbe et al., 2012; Shakiba et al., 2022), greater exposure to FS was expected to predict a compromised profile of HPA functioning, evidenced by a pattern of HPA hypoactivity (elevated cortisol at baseline followed by blunted reactivity). *RQ2:* To what extent does youth endorsement of global PYD and the Five Cs facilitate the underlying physiology supporting effective adrenocortical modulation in response to social stress? *H2:* In accord with the compensatory model of resilience (Garmezy et al., 1984; Zimmerman & Arunkumar, 1994; Zimmerman et al., 2013), greater endorsement of PYD/Cs was expected to predict a more typical or healthy profile of adrenocortical functioning (i.e., low afternoon cortisol and clear reactivity to stressor task), while lower endorsement was expected to predict an atypical adrenocortical profile. *RQ3:* What adolescent adrenocortical consequences of family stress exposure, if any, are moderated by youth endorsement of PYD/Cs? *H3:* In accord with the protective model of resilience (Garmezy et al., 1984; Luthar et al., 2000; Zimmerman et al., 2013), we expected global PYD and the Five Cs to moderate the effect of family stress on HPA functioning, such that youth who display greater PYD constructs will evince less evidence of neurobiological compromise in contexts of higher FS.

Finally, we explored adolescent gender as a potential moderator of associations between FS, PYD factors, and HPA activity. Although moderation by gender was tested with exploratory intent precluding specific *a priori* hypotheses, we propose the following tentative expectations

based on the extant literature for how gender-specific effects may emerge in alignment with our main research questions. First, given possible underlying gender differences in adolescents' stress susceptibility and responsivity, with girls showing heightened sensitivity to social influence and greater reactivity to social relational stressors than boys (Essex et al., 2011; Oldehinkel & Bouma, 2011; Perry & Pauletti, 2011; Schriber & Guyer, 2016; Stroud et al., 2009), it is plausible that FS will be more strongly related to HPA activity for girls compared to boys. Second, based on limited evidence of gender-specific relations between social-emotional competencies and basal cortisol (Booth et al., 2008; Catherine et al., 2012; Oberle, 2018), it is possible that some of the Five Cs, particularly Caring and Connection, will predict HPA activity to a greater degree in girls than boys. However, the degree and direction of associations of Character, Competence, and Confidence with HPA activity remain open questions, thus tests of gender-specific associations between these Cs and adrenocortical functioning were approached as exploratory. Lastly, due to a lack of empirical evidence, we refrained from speculating about the role of gender regarding RQ3, and three-way interactions with FS, PYD/Cs, and gender were tested in an entirely exploratory fashion.

Method

Participants

Participants included 229 Mexican-origin adolescents (48.7% female; M_{age} = 17.15 years, *SD* = 0.42) and their parents. This sample includes families who participated in the California Families Project (CFP) (Robins et al., 2010) and the neurobiological sub-study of the CFP (Schriber et al., 2017). The CFP is a longitudinal investigation tracking risk and resilience factors at the individual, family, and community-level in 674 Mexican-origin families who were living in Northern California and had a child in the fifth grade drawn at random from school rosters

during the 2006-2007 and 2007-2008 school years. The present study uses CFP data from the assessment when adolescents were on average, 16.8 years (*SD* = 0.51), the assessment closest in proximity to the neurobiological sub-study which was designed to examine neural, hormonal, and autonomic correlates of depression. Of the original 674 families, 82% were two-parent households, and 18% were single-parent, father-absent households. Of the current sample of 229 families, parents' educational level ranged from none to completing a 4-year college degree (median = 9th grade for both parents). Annual household income was reported to the nearest increment of $5,000 (median = $30,001 to $35,000, overall range of < $5,000 to > $95,000 per year), with 52% of families reporting < $30,001, 37.5% reporting between $30,001 and $60,001, and 10.5% reporting between $60,001 to more than $95,001 per year. Of the 229 Mexican-origin participating adolescents, 26.4% were 1st generation, 65.2% were 2nd generation, and 8.4% were 3rd generation residents of the U.S.

Procedure

CFP assessments were completed annually at home in either English or Spanish, depending on participants' language preferences. Adolescent participants and their parents individually completed structured interviews and a packet of questionnaires. For all questionnaires used in the current study, we used a multi-reporter approach when the data were available. Specific measurement details are provided below; *Table S2.1* in *Supplemental Materials* offers an overview of each measure's reports and psychometric properties.

Approximately 15.5 weeks, on average, after the age 16 assessment of the CFP was completed, adolescents were recruited for the neurobiological sub-study. This assessment was conducted at a university imaging research center and all visits were scheduled for the afternoon and early evening. The neurobiological sub-study was designed to examine mechanisms

underlying depression and thus, oversampled for adolescents from the CFP based on depressive symptom levels collected during the Computerized Diagnostic Interview Schedule for Children-IV (C-DISC; Shaffer et al., 2000), and the General Distress and Anhedonic Depression items of the Mood and Anxiety Symptom Questionnaire (MASQ; Watson et al., 1995) self-reported at age 14. Adolescents with scores above the sample median on any of these measures were designated as at risk for depression and this index was used as an inclusion criterion in the neurobiological sub-study. Despite oversampling for depressive symptoms, none of the current participants met diagnostic criteria for major depressive disorder at that time. The university's Institutional Review Board approved assessments of the CFP and the sub-study. At both time points, parents provided informed consent and adolescents provided assent, and all participants were compensated for their time and contribution.

Measures

Family Stress. A multi-informant measure of Family Stress (FS) was created using mother-, father-, and youth-reports on four instruments assessing frequency and severity of conflict and hostility as well as overall perceptions of negative relationship quality. For all instruments, youth reported on their relationship with both their mother and father, whereas for relationship-dependent instruments parents reported on either their own or their partner's relationship with their child. For conflict specifically, parents reported on both their own and their partner's conflict with their child. However, for hostility, parents reported only on their partner's hostility with their child, and negative relationship quality included parent self-reports only. The instruments were the Parent-Adolescent Conflict Scale (Gonzales et al., 2000), the Hostility sub-scale of the Behavioral Affective Rating Scale (Conger, 1989a), relevant relationship quality items of the Iowa Parenting Scale (Conger, 1989b). Additional relationship quality items were

taken from a Relationship Quality Scale developed by Rand Conger for the Iowa Youth and Families Project and the CFP (Conger & Conger, 2002; Elder & Conger, 2000). These instruments included items such as "How often have you and your mom had a serious argument or fight?", "During the past 3 months, when you and your father have spent time talking or doing things together, how often did your father criticize you or your ideas?", and "How happy are you with the way things are between you and your mother?". Each measure demonstrated high internal consistency with reliability alphas ranging from .68 to .90. Percent missing of FS variables ranged from 0 to 13% for child-reports, 2 to 18% for mother-reports, and 35 to 36% for father-reports. A missing data analysis indicated that missingness of child- and mother-reports of father behavior was related to whether or not fathers were present in the home. To account for this dependency, a dichotomous variable reflecting parenting structure was computed (1 = single parent structure, 2 = dual parent structure) and covariances between parenting structure and child- and mother-reports of father behavior were specified in all latent factor analyses depicting FS. A latent factor analysis incorporating all FS variables supported a hierarchical solution with three lower order factors defined as Hostility, Conflict, and Negative Relationship Quality loading onto a superordinate factor depicting overall FS exposure. A summary of bivariate correlations among FS variables and a fit comparison test comparing the hierarchical solution to a single-factor model and a triple-factor model separating FS by its three domains are provided in *Supplemental Materials*.

Global PYD and the Five Cs. At age 16, adolescent participants completed a series of questionnaires reflecting their academic abilities, socioemotional functioning, self-esteem, and general well-being. These specific questionnaires were used to operationalize the Five Cs (Caring, Character, Competence, Confidence, and Connection) and global PYD. Specifically,

Caring was measured with six items reflecting prosocial tendencies in considering others' needs and feelings, with individual items drawn from the Consideration of Others subscale of the Weinberger Adjustment Inventory (WADJ; Weinberger & Schwartz, 1990). *Character* reflected adolescents' views of personal integrity, honesty, and the importance of interpersonal cooperation, with summary scores drawn from the Agreeableness subscale of the Big Five Inventory (BFI; John et al., 2008) and the Honesty/Trustworthiness subscale of the Self-Description Questionnaire (SDQ; Marsh et al., 2005). *Competence* was indexed using scholastic abilities, social acceptance, and popularity, with one item reflecting average standardized grades, and summary scores capturing academic competence and social acceptance taken from the SDQ (Marsh et al., 2005). *Confidence* include measures of self-esteem and self-worth, with summary scores calculated from the Rosenberg Self-Esteem Scale (Rosenberg, 1965) as well as the Self-Esteem and Physical Appearance subscales of the SDQ (Marsh et al., 2005). Finally, *Connection* measured adolescents' family, peer, and school social support networks, with school connectedness scored using the Child-Teacher Attachment scale, a CFP-specific adaptation of the parent and peer attachment scale created by Armsden and Greenberg (1987). Average family and friend connectedness was computed from eight items of the Multidimensional Scale of Perceived Support (MSPS; Zimet et al., 1988). Item-level descriptive statistics are in *Supplemental Materials, Table S2.1*. All CFP measures used to operationalize the Five Cs and global PYD, and the bifactor model testing the PYD structure, are described at length in Johnson et al. (2023), and descriptive statistics for the Five Cs and global PYD are summarized in *Table 2.1*. Missing data for PYD variables ranged from 0 to 0.15%.

MRI including Social Exclusion Challenge

During the neurobiological sub-study assessment at age 17, adolescents completed a 60-

minute functional magnetic resonance image (fMRI) scan during which they played *Cyberball*, an interactive virtual game designed to elicit feelings of social exclusion and rejection (Williams et al., 2000). This task was chosen to represent a mild social challenge as exclusion is salient during adolescence, and prior studies using this sample have documented individual differences in HPA reactivity post-task (Johnson et al., 2021). *Cyberball* began on average 40 minutes after participants entered the scanner and ended approximately 10 minutes before the end of the scanning protocol. Participants were told they would play a simulated ball-tossing game with two computerized players and were asked to imagine, as vividly as possible, that they were playing with their peers. On a projection screen in the scanner, participants viewed three cartoon figures representing the two other players of no apparent gender or race/ethnicity and the third representing the participant. While playing the game, the ball was thrown back and forth among the players, with the participant choosing the recipient of their throws using a button, and the computer selecting the throws between the two virtual players. *Cyberball* includes both inclusion and exclusion trials. In the inclusion trials, participants had equal opportunities to toss the ball to the other two players. During exclusion trials, the virtual players included the participant by tossing the ball to them once, before excluding them for the remainder of the trial. There were 6 rounds of inclusion trials and 6 rounds of exclusion trials, each with 10-11 ball tosses of game play, presented in pseudo-random order with inclusion trials over-concentrated near the beginning, and exclusion trials over-concentrated at the end of the task. Trials ranged from 22-32 seconds, each trial was followed by a 7-8 second intervals, and in total, the task ran for approximately 9 minutes. Although *Cyberball* was administered during a neuroimaging scan, the current study examined adolescents' HPA responses, and thus, only cortisol data were included. For a visualization of the complete protocol for the MRI scanner visit, see Johnson et al. (2021);

only components relevant to the current study are reported below. Ten adolescents were ineligible for scanning; eight completed the task on a laptop computer outside of the scanner, for whom cortisol samples were used. Two participants experienced computer malfunctions with the task, therefore their cortisol samples were not used in analyses.

HPA Assessment

HPA activity was assessed via salivary cortisol output. Adolescents provided saliva samples using absorbent salivettes (Salivettes™, Salimetrics Inc., State College, PA) before and after they completed *Cyberball* within the scanner. The baseline sample (Sample 1) was collected approximately one hour after arriving at the research center, immediately prior to beginning the MRI scan preparation (M = 4:44 PM, SD = 2:20). During that first hour, adolescents acclimated to the scanning environment, were trained on scanner tasks, and completed non-evocative questionnaires. Saliva samples 2, 3, 4, 5, and 6 were collected 10, 20, 30, 40, and 50 minutes post-*Cyberball* (after the last *Cyberball* trial, corresponding to 1 to 40 minutes post-MRI scan, with sample 2 collected within a few minutes of having exited the scanner). After sample 2 was collected, adolescents returned to a comfortable waiting room where they completed questionnaires while providing the remaining saliva samples. The first 25 minutes of questionnaires included measures rating their experiences of the scanner tasks, and non-evocative questionnaires selected to minimize potential influence on cortisol output. The final 15 minutes of questionnaires included mental health assessments, administered last to avoid potential spillover of reactivity to the measures in salivary cortisol. Additional measures and tasks that were potentially more evocative were administered after the final sample was collected. The current study used samples 1-6 as they reflect the time course capturing HPA response to the *Cyberball* exclusion trials. One other salivette sample and two passive drool

samples were additionally collected from participants but excluded from analyses as they were not pertinent to the present study's research questions.

Saliva samples were assayed for cortisol at the Proteomics Core Facility at the UC Davis Genome Institute, using the standardized salivary protocol from Salimetrics Saliva Lab. All samples were assayed in duplicate using a high sensitivity enzyme immunoassay kit (Salimetrics Inc., State College, PA) that had a minimum detection ranging from 0.007 to 1.8 μg/dL; intra- and inter-assay variabilities were 5.41% and 16.59%, respectively. There was blood contamination in all 6 samples for 1 participant, and too little saliva in 1 sample from another participant for assaying; these 7 samples were discarded. Any samples (n = 17) for which the raw cortisol value was more than 3 *SD*s above or below the mean were considered outliers and removed from the data set prior to transformation. Percent of valid, usable samples for adolescents ranged from 88% (Sample 1) to 90% (Sample 3). Raw cortisol values (μg/dL) were $\log_{10}$ transformed to correct for leptokurtic and positive skews. Adolescents' HPA reactivity to the social challenge task was calculated as Area Under the Curve with respect to Increase (AUC-I; Pruessner et al., 2003).

Covariates

All prediction models included saliva sample collection time, gender, and medications (e.g., corticosteroids, birth control) as possible covariates given past work suggesting these factors contribute to individual variability in cortisol (Kudielka et al., 2009). Sample collection time was divided by 10 so that it was scaled in a comparable metric with other variables. Age was not significantly correlated with any focal variable, possible due to low variability, and thus was not controlled for. To account for bias attributed to the neurobiological sub-study oversampling for adolescents with previously elevated depressive symptoms, a recruitment

variable termed depression-risk was calculated (1 = scored above the median on any recruitment measure, $N = 175$, 0 = scored below the median on all measures, $N = 54$) and included as a covariate. We additionally controlled for family income-to-needs ratio as economic hardship has been related to increased family stress (Roy & Raver, 2014), and previous work with this sample has associated poverty exposure with youths' HPA functioning (Johnson et al., 2021).

Analytic Strategy

Bivariate associations between key study variables and covariates were first examined with zero-order correlations. Following this, path analyses were specified using Lavaan (Rosseel, 2012) in R (version 4.2.1) to test hypotheses. Family Stress (FS) was modeled as a latent hierarchical factor model and PYD was modeled using a latent bifactor structure detailed at length in Johnson et al. (2023). A descriptive summary of model specifications of the latent models for FS and PYD are presented alongside tabular summaries of latent factor loadings in *Supplemental Materials.* To pre-empt potential issues of model non-convergence due to complexity and sample size, latent factors defining FS, global PYD, and the Five Cs were extracted from these latent models and incorporated into moderation path analyses.

In testing all hypotheses and exploratory research questions, moderation models were constructed to examine whether associations between participants' adrenocortical stress physiology and prior FS exposure varied as a function of adolescents' PYD and gender. All continuous independent and control variables were mean-centered, and two-way and three-way interaction terms were created from these mean-centered variables to examine moderation effects. Baseline cortisol and cortisol reactivity were incorporated into path analyses as manifest dependent variables. Covariances between control variables were specified for those that were significant in the bivariate correlation analysis (e.g., gender with depression-risk), and residual

covariances among HPA indices were specified. Since the bifactor structure of PYD is constructed such that the Five Cs are orthogonal to global PYD, factor variances of the residual Cs are considered independent of the variance of global PYD. As such, predictive associations that emerge at the global level may diverge from predictive associations that emerge at the level of the Cs. Thus, alternative moderated moderation path analyses were conducted to test whether direct and indirect effects on HPA activity were evident for the Five Cs (i.e., Caring, Character, Competence, Confidence, and Connection), as separate, independent constructs.

We probed significant interaction effects by plotting simple slopes and examining the regions of significance (RoS) to identify the upper and lower boundary values of FS at which baseline and reactive cortisol differed significantly for youth who had higher and lower PYD (+/– 1 *SD*). Simple slopes of FS at high and low values of the PYD factors were visualized and RoS intervals were interpreted when the boundaries were within +/– 2 *SD*, as suggested by Roisman and colleagues (2012). When significant direct and indirect effects of FS exposure, PYD constructs, and gender emerged in the prediction of adolescents' HPA activity, results were interpreted as evidence for the three study hypotheses, respectively.

All models utilized full-information maximum likelihood estimation with robust (Huber-White) standard errors to account for missing data. We assessed model fit using the chi-square (χ^2) goodness of fit statistic, the comparative fit index (CFI; Bentler, 1990), and the root mean square error of approximation (RMSEA; Steiger, 1990). Model fit was considered acceptable if the χ^2 *p*-value was non-significant (a commonly-violated standard in analyses of large samples), the *CFI* was > .90, and the *RMSEA* was < .08. Model fit was considered excellent if the *CFI* was larger than .95, and the *RMSEA* was smaller than .05.

Results

The first goal of the current study was to test the extent to which adolescent exposure to FS, as indexed by hostile interpersonal dynamics, predicts decreased functioning of the HPA in a sample of Mexican-origin youth. The second and third goals were to investigate whether youth endorsement of PYD constructs is associated with regulation of the HPA and examine whether PYD constructs modify the impact of FS on HPA activity. Lastly, gender differences were explored in the aforementioned associations as a fourth and final research goal. Analyses were structured using a longitudinal design with FS and PYD measured when adolescents were age 16 and HPA physiology measured when adolescents were 17.

Descriptive Analyses

Table 2.1 displays descriptive statistics (i.e., means, standard deviations, and observed range) and bivariate correlations among the extracted latent factors representing FS, global PYD, and the Five Cs, the HPA indices, and covariates. FS was negatively associated with global PYD and four the Five Cs (Caring, Character, Confidence, Connection), but was weakly positively associated with Competence. Additionally, FS was positively associated with cortisol reactivity via AUC-I. The only significant correlation between the HPA indices and global PYD or the Cs was a positive association between baseline cortisol and Connection.

Moderation Path Analyses with FS, PYD, and Gender predicting HPA activity

To test the study's three main research questions and corresponding hypotheses, we constructed path models using extracted latent factors representing FS, global PYD, and the Five Cs to predict basal and reactive HPA activity and tested effects in a step-wise fashion. We first examined direct effects of FS and the PYD constructs predicting HPA activity to test RQ1 and RQ2, respectively. Following this, we examined the indirect effects of RQ3 and exploratory gender hypotheses by testing two- and three-way interactions among FS, PYD constructs, and

gender (e.g., FS X PYD, FS X Gender, PYD X Gender, and FS X PYD X Gender) predicting HPA activity. The effects of FS and PYD constructs on HPA activity were each uniquely qualified by interactions with gender, and as such, results of the three-way interaction models are reported herein. The three-way interaction path analysis using global PYD demonstrated excellent fit to the data ($\chi^2(29) = 42.31$, $p = .053$, *CFI* = .983; *RMSEA* = .043, 90% CI [.000, .069]). Key parameter estimates and full results of the structural equation model are shown in *Figure 2.1* and *Table 2.2*, respectively. The model revealed significant and borderline significant main and interaction effects of FS and Gender predicting basal and reactive cortisol, but no effects involving PYD.

For exploratory analyses involving gender as a moderator of FS, PYD factors, and HPA activity testing two-way and three-way interactions with the Five Cs, we computed product terms representing FS X C, FS X Gender, C X Gender, and FS X C X Gender which were incorporated into five path models testing whether the effects of FS and each of the residual Cs on HPA functioning varied by Gender. These five models produced excellent fit to the data (ranging from Competence fit: $\chi^2(30) = 41.44$, $p = .080$, *CFI* = .981; *RMSEA* = .039, 90% CI [.000, .065] to Character fit: $\chi^2(30) = 35.94$, $p = .210$, *CFI* = .990; *RMSEA* = .030, 90% CI [.000, .062]). Information on model fit and complete parameter estimates of the three-way interaction models with the Five Cs are provided in *Table 2.3a-e*. Importantly, none of the three-way interaction effects were significant in these models, however three sets of significant two-way interactions emerged between (1) FS and the Five Cs, (2) FS and Gender, and (3) the Five Cs and Gender in predicting both basal and reactive HPA activity.

We have organized the presentation of these results in the following fashion: Direct effects of key variables are presented first, followed by the first set of moderation effects (i.e., FS

X Five Cs) that were consistent across gender. The second set of moderation effects (i.e., FS X Gender) are presented next, followed by the third set of moderation effects (Five Cs X Gender).

Direct effects of key study variables predicting HPA activity

In testing Hypothesis 1, a significant negative effect of FS exposure emerged in the prediction of adolescents' baseline cortisol and a borderline positive effect of FS emerged for cortisol reactivity (see *Table 2.2*), such that as FS increased, baseline cortisol decreased and cortisol reactivity increased. These effects for basal and reactive cortisol were qualified by borderline significant interaction effects ($p < .06$ and $p < .10$, respectively) between FS exposure and Gender that are discussed in the following section. In testing Hypothesis 2, results indicated that global PYD did not directly predict HPA indices, nor did Global PYD interact with FS or Gender in the prediction of HPA activity. Results of the alternative moderation analyses with the Five Cs (see *Table 2.3a-e*) revealed that the Five Cs also were not directly related to basal or reactive cortisol, however all of the Cs significantly interacted with FS or Gender in effects that will be described in the following two sections.

Regarding covariates, a significant association between Gender and baseline cortisol emerged suggesting that adolescent boys evinced higher baseline cortisol than girls ($b = –0.128$, $p < .000$). Three additional covariate effects emerged such that participants tested earlier in the day displayed higher baseline cortisol ($b = –0.158$, $p = .017$) and higher cortisol reactivity ($b = –0.343$, $p < .000$). Youth at risk for depression (i.e., scored above the sample median on any depression measure used for inclusion) additionally tended to show lower baseline cortisol in the afternoon, though this association was not statistically significant ($b = –0.058$, $p = .074$).

FS varied by PYD factors in the prediction of HPA activity

In testing Hypothesis 3, results indicated that FS did not interact with global PYD in the

prediction of baseline cortisol, nor did FS interact with global PYD in the prediction of cortisol reactivity. At the level of the Five Cs, the association between FS and baseline cortisol was not modified by the Cs, however the effect of FS on cortisol reactivity was qualified by variation in four of the Five Cs: Character (b = 0.538, p = .053), Competence (b = –0.634, p = .013), Confidence (b = 0.711, p = .013), and Connection (b = 0.587, p = .048) (see *Figures 2.2a-2.2d*). To explore these interaction effects, we conducted simple slopes analyses of each association at different levels of the respective C and probed the RoS boundaries of FS. This revealed that the positive predictive associations observed for FS with Character, Confidence, and Connection can be interpreted in the same manner as all three effects were significant for youth who highly endorsed these Cs (+1 *SD* Character: β = 0.451, p = .019; +1 *SD* Confidence: β = 0.450, p = .005; +1 *SD* Connection: β = 0.494, p = .012) and nonsignificant for youth who scarcely endorsed them (–1 *SD* Character: β = 0.153, p = .111; –1 *SD* Confidence: β = 0.073, p = .360; –1 *SD* Connection: β = 0.171, p = .084). The RoS analysis of FS indicated that the interaction effect for Confidence became significant when FS was ≥ +.50 *SD*, while a marginal effect (p < .10) for Connection emerged when FS was ≥ +1 *SD*. In other words, for youth with moderate to high FS exposure, those who highly endorsed Confidence and Connection displayed greater cortisol reactivity compared to youth who barely endorsed these Cs. For the association with Character, the RoS analysis of FS indicated that there was no point within the observed sample range at which FS predicted different levels of cortisol reactivity. Thus, despite the positive association of FS and cortisol reactivity for youth who highly endorsed Character, youth with low versus high Character scores did not evince significantly different cortisol reactivity at any level of FS.

Lastly, and in a notably different pattern, probing the simple slopes of Competence showed that FS did not significantly predict cortisol reactivity for youth who reported higher

Competence (+1 *SD*: $\beta = 0.099$, $p = .280$), whereas it significantly and negatively predicted cortisol reactivity for youth who reported lower Competence (–1 *SD*: $\beta = 0.413$, $p = .006$). The RoS analysis of FS showed that the association approached significance ($p < .10$) when FS was either ≤ –1.28 *SD* or ≥ +1.19 *SD*, indicating that compared to those who scored highly on Competence, youth with lower scores evinced marginally divergent cortisol reactivity when coming either from homes with little to no FS or from homes with moderately high FS. Probing the upper distribution of FS further revealed that when values of FS were ≥ +2.01 *SD*, the variation in cortisol reactivity attributed to Competence became fully significant. Thus, for youth exposed to severe FS, those with lower Competence scores displayed significantly greater cortisol reactivity following the social exclusion task than those with higher Competence scores. In sum, FS exposure interacted with four of the Cs to predict cortisol reactivity in essentially the same pattern – elevated FS, in combination with higher endorsement of these Cs (excepting Competence) predicted amplified cortisol reactivity – with a somewhat less pronounced pattern for Character.

FS varied by Gender in the prediction of HPA activity

The adrenocortical impact of FS was further moderated by Gender in predicting both basal and reactive cortisol. First, a simple slopes analysis of FS and Gender revealed that the effect of FS on baseline cortisol was significant for adolescent boys ($\beta = –0.211$, $p = .017$) and nonsignificant for girls ($\beta = 0.055$, $p = .602$). The RoS analysis of FS indicated that the associations between FS and baseline cortisol became significant when values of FS were ≤ +0.73 *SD*, indicating that when FS levels were average and lower, boys were projected to have higher baseline cortisol than girls, but when the level of FS was higher, baseline cortisol levels did not vary by adolescent gender. A second simple slopes analysis of the interaction between FS

and Gender revealed that the effect of FS positively predicting cortisol reactivity was again significant only for adolescent boys (boys' $\beta = 0.234$, $p = .035$; girls' $\beta = -0.022$, $p = .832$). The RoS analysis of FS indicated that the associations between FS and cortisol reactivity became significant when values of FS were ≤ –0.27 *SD*, indicating that boys were projected to have less cortisol reactivity than girls at lower levels of FS, whereas gender did not differentiate cortisol reactivity at moderate or higher levels of FS. See *Figures 2.3a* and *2.3b* for visualizations of baseline cortisol and cortisol reactivity projected at levels of FS exposure with simple slopes plotted separately for boys and girls.

PYD factors varied by Gender in the prediction of HPA activity

At the level of the Five Cs, one significant interaction emerged for Caring and Gender ($b = 0.080$, $p = .016$, see *Figure 2.4*). This effect was positive and significant for girls ($\beta = 0.283$, $p < .000$) and nonsignificant for boys ($\beta = -0.011$, $p = .920$). The RoS analysis of Caring showed that the association between Caring and baseline cortisol became significant when values of Caring were ≤ +0.91 *SD*, indicating that adolescent girls with low to average endorsement of Caring evinced lower cortisol at baseline in comparison to boys. None of the other Cs interacted with either FS or gender in the prediction of baseline cortisol.

There were four interaction effects involving Gender and the Cs that significantly predicted cortisol reactivity, for Caring ($b = -0.183$, $p = .002$), Character ($b = -0.136$, $p = .028$), Confidence ($b = -0.159$, $p = .006$), and Connection ($b = -0.141$, $p = .023$) (see *Figures 2.5a-2.5d*). Examining the simple slopes showed that stronger endorsement of these four Cs predicted less cortisol reactivity for girls, but not for boys (Caring: girls' $\beta = -0.353$, $p = .001$, boys' $\beta = 0.144$, $p = .245$; Character: girls' $\beta = -0.238$, $p = .018$, boys' $\beta = 0.106$, $p = .385$; Confidence: girls' $\beta = -0.302$, $p = .008$, boys' $\beta = 0.082$, $p = .298$; Connection: girls' $\beta = -0.226$, $p = .043$,

boys' $\beta = 0.128$, $p = .265$). The RoS analysis showed that the relations between these Cs and cortisol reactivity was significant when values of Caring were ≤ +0.05 *SD*, when Character was ≤ –0.24 *SD*, when Confidence was ≤ –0.28 *SD*, and when Connection was ≤ –0.38 *SD*. Thus, girls who endorsed low levels of these four Cs had stronger cortisol reactivity than boys with comparably low endorsements. An upper RoS additionally emerged for both Caring and Confidence, such that girls' cortisol reactivity was significantly lower than that of boys when values of Caring were ≥ +2.10 *SD* and Confidence were ≥ +2.01 *SD*, yet these effects border the uninterpretable range and were significant only for girls who reported very high values of Caring and Confidence. In summary, while endorsement of the individual Cs did not significantly account for variability in boys' cortisol reactivity, girls' endorsement of four of the Cs predicted their stress reactivity in a consistent pattern across Cs – girls who reported lower Caring, Character, Confidence, and Connection displayed elevated cortisol reactivity following social exclusion.

Discussion

This study examined the effects of family stress (FS), including parent- and youth-reported family conflict, hostility, and poor-quality relationships at age 16, on Mexican-origin adolescents' adrenocortical functioning at age 17, and tested the extent to which adolescents' psychological well-being and gender modified the longitudinal impact of FS on HPA activity. We modelled adolescents' psychological well-being using the Five Cs theory of PYD (Lerner et al., 2005, 2013) and indexed adrenocortical functioning using basal and reactive cortisol. Notably, the multi-informant index of FS used in the present study captured low to moderate exposure levels, meaning that the present findings generally do not reflect adrenocortical functioning for youth who experienced very high FS. Contrary to expectations, FS was

negatively associated with basal cortisol and positively associated with reactive cortisol, such that as FS increased, baseline cortisol decreased and cortisol reactivity increased. However, the impact of FS on HPA activity was qualified by variability in gender and the Five Cs, and three general patterns emerged. First, the association between FS and cortisol reactivity varied by adolescents' endorsement of four of the Five Cs (i.e., Character, Competence, Confidence, and Connection). Second, the impact of FS on HPA activity was further differentiated by gender, with effects emerging specifically for adolescent boys. A third pattern emerged outside the context of FS and was significant only for adolescent girls, such that variation in girls' endorsement of four of the Five Cs (i.e., Caring, Character, Confidence, and Connection) predicted basal and reactive cortisol.

We begin by noting two important caveats to aid readers in interpreting the complexities of the present findings. First, while many of our results were counter to initial expectations, we emphasize that hypotheses were based on studies conducted with predominantly WEIRD samples due to a lack of neurobiological studies parsing between- and within-culture variation in family processes using samples of Latinx youth (Doane et al., 2017; Parra & Hastings, 2018). Beyond sampling differences, there is considerable methodological variation across studies investigating adolescents' dysregulated stress physiology following family risk exposure regarding the risk factor measured (e.g., interparental conflict, family cohesion, emotional closeness) and stress responsivity indices used (e.g., diurnal or acute cortisol). When studies focus on acute adrenocortical activity, differences in stress-induction task or procedure used (e.g., Trier Social Stress Test [TSST], family conflict discussions, *Cyberball*) also contribute to the mixed nature of empirical evidence. Hence, the literature that motivated the present study is considerably mixed. However, it is our hope that the present findings will aid future researchers

by providing additional nuance to the field's current contextualization of developing neurobiology as it relates to family processes within samples of Latinx youth.

Second, as will become evident in the following pages, the present findings were themselves mixed, and caution is needed when interpreting emergent patterns or the lack thereof regarding the limited set of studies that are directly relevant for informing our interpretation of the findings. Additionally, we note potential qualitative differences in what is considered "expected" or "typical" HPA activity for youth in this specific sample. Diversity-sensitive research has identified racial/ethnic differences in adrenocortical functioning with robust evidence of different patterns of HPA activity becoming evident in racial/ethnic minority samples during adolescence, compared to that observed with White/European-American samples (DeSantis et al., 2007; Doane et al., 2018; Hostinar et al., 2014; Martin et al., 2012; Tackett et al., 2017). Particularly when compared to White youth, Latinx youth have been shown to have flatter diurnal cortisol slopes driven by lower morning and elevated evening levels (DeSantis et al., 2007). Doane and colleagues (2018) further differentiated Latinx adolescents' diurnal rhythms by gender, such that despite displaying steeper rates of change in the evening, boys show flatter slopes than girls overall. It is plausible that culturally-based gender differences in socialization and family processes may additionally shape Latinx adolescents' stress responsivity. For example, the extent to which Latinx youth endorse traditional cultural values (e.g., familism, respect, religiosity) has been associated with lower diurnal cortisol (Sladek et al., 2019) and stronger cortisol reactivity (Gonzales et al., 2018). However, these effects were consistent across gender, and empirical explorations of gender identity and gender socialization experiences in relation to family processes and stress responsivity in Latinx youth remain scarce. Several studies have documented that Latinx youth tend to evince reduced cortisol reactivity to

acute stress (Hostinar et al., 2014), particularly for Latinx youth coming from families with lower income and education status (Tackett et al., 2017), relative to White/European-American youth. This aligns with previous analyses of the current sample of Mexican-origin adolescents, the majority of which were coming from families living in poverty throughout adolescence. Specifically, we documented a sample-wide pattern of blunted cortisol reactivity to the acute social challenge, and cortisol suppression was more extreme for youth coming from the most impoverished families (Johnson et al., 2021). Altogether, these findings support evidence of allostatic load via hypocortisolism following chronic stress exposure (McEwen, 2000), and point to persistent economic stress as a particularly potent source of chronic stress possibly leading to trait-level HPA underarousal in the face of acute stressors (Johnson et al., 2021). As such, the physiological tendency towards hypocortisolism found in the present sample and other Latinx samples of youth should be kept in mind when considering findings of the present study.

Summary and Discussion of Main Findings

The present findings indicated that variability in FS exposure and adolescents' endorsement of the Five Cs were differentially associated with HPA activity for adolescent girls versus boys. Our three main research questions and their corresponding hypotheses were tested first, followed by exploratory analyses testing the role of gender in predictive associations between FS, PYD constructs, and HPA activity. Findings that were consistent across gender will be discussed first, followed by a synthesis of results that were qualified by gender. Our first set of moderation effects suggested that the positive association of greater FS exposure predicting increased cortisol reactivity was particularly true for youth who endorsed stronger Confidence and Connection. Although analyses controlled for family income-to-needs at age 16, prior work indicates that most of the families in this sample consistently hovered around the federal poverty

line for California across ages 10 to 16 (Johnson et al., 2021). While the current analysis did not entirely parse apart the effect of living in poverty from the impact of experiencing hostile family dynamics, these interaction effects suggest that individual variability in the *co-occurrence* of multiple sources of chronic stress may add to the field's understanding of how persistently stressful family contexts become psychobiological embedded over time. In accordance with the dimensional model of adversity posing that stress phenotypes vary as a function of threat versus neglect (McLaughlin & Sheridan, 2016), the experience of moderately hostile, poor-quality family relationships in which conflict is frequent and severe may be perceived as more acutely dangerous than the more distal (and for these youth, pre-existing) stressor of family economic hardship. Experiencing both of these stressors during mid-adolescence, a time known for its neurobiological sensitivity to social-affective stimuli (Crone & Dahl, 2012; Dahl & Gunnar, 2009), may trigger further conditional adaptations as stress response systems recalibrate according to changing selection pressures unfolding within the family context (Del Giudice et al., 2011; Ellis et al., 2017).

Probing of the interaction effects between FS and the Five Cs revealed that the moderating effects of Confidence and Connection were significant only for youth within the upper portion of the FS distribution (a lower RoS was not identified). This suggests that while the majority of the sample displayed relative hypocortisolism, in accordance with our prior findings (Johnson et al., 2021), adolescents with both high FS and high Cs evinced clear evidence of cortisol reactivity. Whether greater cortisol reactivity in this context reflects evidence of increased flexibility and sensitivity of the HPA axis rather than emerging hypercortisolism remains an open question, yet we propose several possible explanations for these findings in accordance with context-driven adaptation models (Del Giudice et al., 2011;

Ellis et al., 2017; Zimmerman et al., 2013).

First, under conditions of moderate FS, youth who prioritize social bonds with family and peers and perceive themselves as having high self-esteem, a robust self-concept, and a strong sense of personal mastery (as respectively reflected by high scores on the Connection and Confidence measures), may be more sensitive to negative family relationships. Confidence and Connection are strongly and positively correlated in this sample (Johnson et al., 2023) and others (Geldhof et al., 2014; Holsen et al., 2017) suggesting that family emotional bonds and connectedness buttress positive self-attributions surrounding one's personal competencies and self-worth. Together, Connection and Confidence reflect social-oriented and social-evaluative processes, which may increase the likelihood of youth prioritizing family cohesion. Johnson et al. (2023) documented that greater endorsement of ethnic pride and Mexican cultural values (familismo and respeto) at age 14 was highly correlated with Confidence and Connection at ages 14 and 16, indicating that ethnic identity development and family-related cultural processes are especially prioritized by Mexican-origin youth who highly endorse these residual Cs. It is possible that Latinx youth who highly endorse these family values believe that they are more responsible for ensuring a healthy family dynamic, and thus they may be highly physiologically sensitive to and provoked by experiences of FS. In this way, recent experiences of FS may have sensitized later responses to social evaluative threats, such that *Cyberball* elicited a stronger HPA response for these youth in particular. This interpretation is aligned with the vigilant phenotype posed by the Adaptive Calibration Model (Del Giudice et al., 2011) as increased cortisol reactivity emerged only in contexts of moderate FS, an environment perceived as dangerous or unpredictable. Other research has documented short-term increases in cortisol responsivity following exposure to negative parenting (Hagan et al., 2011) and recent family conflict (Koss et

al., 2017). From a sensitization perspective, a heightened sense of vigilance to social threats may be considered functionally adaptive in the context of threat or unpredictability as it may help individuals avoid fitness-damaging outcomes, compared to individuals with hypo-vigilance in the same contexts (Del Giudice et al., 2011; Ellis et al., 2017).

Considering how this pattern of findings aligns with the compensatory, challenge, and protection models of resilience (Fergus & Zimmerman, 2005; Garmezy et al., 1984; Zimmerman et al., 2013), moderation by Confidence and Connection offers clear support for the protection factor model. High scores on Confidence and Connection significantly moderated the impact of FS on HPA activity by predicting increased cortisol reactivity in the context of greater FS exposure. The protection factor framework inherently requires evidence of moderation associated with an adaptive outcome, and in the context of this sample, increased cortisol reactivity can be considered adaptive given prior evidence of a chronic stress-induced tendency towards blunted cortisol responsivity (Johnson et al., 2021). The present findings suggest that those adolescents who came from moderately stressful family contexts and who reported enhanced Confidence and Connection presented with a more robust adrenocortical response (i.e., greater cortisol reactivity), compared to youth with lower Confidence and Connection scores. Therefore, despite their moderate FS exposure, the subset of adolescents who scored Confidence and Connection highly demonstrated preserved sensitivity and flexibility of the HPA axis, compared to youth with similar FS exposure but lower scores on these aspects of PYD who did not show the capacity to mount any acute stress response. Previous studies have linked aspects of self-regulation to the development of socioemotional competences similar to those reflected by Confidence and Connection (Blair, 2010; Blair & Raver, 2015; Lerner et al., 2011; Maniar & Zaff, 2011; Murray et al., 2015). Therefore, Confidence and Connection may be biologically

grounded within systems of self-regulation, suggesting that youth high in these constructs may appraise experiences of acute stress through the lens of these psychosocial strengths. When confronted with an acute challenge such as the experience of social exclusion simulated in the current study, adolescents who have developed a positive sense of self-worth and social connectedness may be increasingly likely to view the stressor as a potentially manageable challenge rather than a threat (Blair, 2010; Chen & Miller, 2012; Lengua & Long, 2002). As such, these youth may have been more prepared to mount an acute HPA response in efforts to mobilize resources to actively cope with the challenge presented by *Cyberball*. This could explain why this sub-set of the sample displayed the expected pattern of high cortisol responsivity, typically interpreted as adaptive in the context of an acute stressor known to evoke reactivity (Gunnar & Quevedo, 2007), particularly during adolescence (Dahl & Gunnar, 2009; Stroud et al., 2009).

Alternatively, this set of effects could plausibly support the challenge model, but this is contingent on whether adolescents' heightened Confidence and Connection in the context of moderate FS exposure indeed represents functional adaptations following the need to navigate the stress of hostile and unsupportive family relationships. While it is possible that exposure to FS prompted youth to develop specialized social-emotional skills leading to an increase in Confidence and Connection, the current study measured family risk and PYD contemporaneously, precluding any conclusions regarding directionality and timing of effects. Thus, further research is needed to examine the extent to which youth develop specialized skills within the PYD domains as a function of earlier risk exposures and determine the threshold of risk severity catalyzing functional adaptations versus maladaptations. Conversely, since neither Confidence nor Connection predicted adolescents' cortisol reactivity independent of FS

exposure, youth endorsement of these Cs did not compensate for the increased risk inherent in moderate FS, therefore no conclusions can be drawn in light of the compensatory resilience model.

Overall, these findings raise important questions for future research, particularly for studies examining social and contextual factors promoting resilience within diverse samples of youth and those testing whether resilience processes unfold in alignment with existing conceptual frameworks. Our findings offer robust support for the protection factor model and tentative support for the challenge model within samples of Latinx youth, though additional empirical confirmation is warranted, particularly for the latter framework. Future longitudinal research exploring the development of associations between biobehavioral processes and adolescent resilience could speak to the continued usefulness of existing conceptual frameworks of resilience by highlighting aspects that may need revision when applying long-standing models within samples of increasingly diverse youth. Empirical work integrating cultural, familial, and biobehavioral processes across key developmental transitions are needed to increase precision regarding the timing of effects within developmental cascades and address questions of specialization, sensitization, and directionality of associations among risk and protective factors. Investigating the qualitative impact of different types of stressors experienced by Latinx youth, and how effects on stress physiology may change when multiple stress exposures overlap, would increase our understanding of emerging racial/ethnic differences in stress phenotypes and their corresponding impact on adjustment and well-being.

A significant interaction between FS and Competence also emerged in the first set of findings such that youth with low Competence scores and moderate FS exposure showed comparably strong cortisol reactivity. This finding seemingly contradicts the effects documented

for high Confidence and Connection but may be explained in light of the latent Competence factor. As described in *Supplemental Materials* and discussed in Johnson et al. (2023), the latent Competence factor was the least robust out of all the PYD factors, with indicators of Social Acceptance negatively loading onto the Competence construct. With lower Competence reflecting greater Social Acceptance, one interpretation of this finding could be that moderate FS predicted greater cortisol reactivity for youth who perceived themselves as highly accepted by their peers. If so, this would be consistent with our interpretations of the moderating effects of Confidence and Connection described above. On the one hand, recent exposure to greater FS may sensitize the HPA axis to threats of social exclusion and this may be felt most keenly by youth who strongly believe they are accepted by peers. On the other hand, youth from moderately stressful homes may have relied on their social savviness in facing the social challenge such that their robust response reflects an effective energy mobilization strategy. Both interpretations are aligned with empirical evidence linking experiences of social acceptance with the traditional pattern of strong reactivity and recovery following a social rejection/acceptance manipulation (Blackhart et al., 2007). Probing this interaction further revealed that under conditions of low to minimal FS (analyses identified a lower RoS), youth with low Competence scores (i.e., those who reported greater Social Acceptance) displayed relatively less cortisol reactivity compared to youth with high Competence scores. This may suggest that under conditions of minimal FS, Social Acceptance attenuates HPA arousal to social exclusion, but given the difficulties interpreting the Competence factor and the modest nature of this effect, further research will be needed to interpret whether this is a meaningful finding. Yet, it may be difficult for future researchers to replicate effects of Competence given the context of present study's PYD measurement model, which was restricted to measures collected as part of the CFP,

rather than the original psychometric assessments of PYD as designed for the 4-H study (Bowers et al., 2010; Geldhof et al., 2014; Lerner et al., 2005; Phelps et al., 2009). In any case, it will be important for future PYD studies to consider these alternative explanations when building their measurement models to better understand how various Competence domains relate to stress responsivity.

The second set of moderation findings revealed that FS additionally produced gender-specific effects for both basal and reactive cortisol. In a pattern significant only for adolescent boys, low to average FS was associated with a "high – flat" profile of HPA activity as indicated by elevated cortisol at the afternoon baseline followed by blunted reactivity to the social stress task. Gender differences in diurnal cortisol slopes may account for our baseline findings given that Latinx boys show flatter slopes compared to girls and this may be driven by elevated circulating cortisol across the afternoon (Doane et al., 2018). High cortisol at the afternoon baseline may be considered a conditional adaptation of the male adolescents in this sample, as we have previously documented negative associations between baseline cortisol and exposure to multiple risks using this sample. Specifically, youth coming from families with lower income-to-needs and living in neighborhoods characterized by higher unemployment and greater water toxins evinced lower cortisol at baseline (Johnson et al., 2021, Johnson & Ugarte et al., 2023). These suppression effects suggest that higher basal levels may be adaptive, yet this remains to be confirmed by other studies of Mexican-origin or Latinx youth.

Gendered variation in the pre-task saliva sample may also have been a result of boys' HPA system releasing cortisol in anticipation of the stressor. Multiple studies have shown that men produce a significant increase in cortisol in sole anticipation of an upcoming social stress task (Gaab et al., 2005; Kirschbaum et al., 1992; Kudielka et al., 2009). Specifically, Gaab and

colleagues (2005) demonstrated that anticipatory cognitive appraisal accounted for upwards of 35% of the variance in cortisol reactivity to the TSST in a sample of young adult men. Controlling for adolescent gender, Slattery et al., (2013) similarly found that anticipatory cognitive appraisal was positively associated with cortisol reactivity to the TSST, and further, self-perception of individual abilities and level of control were the main predictors of cortisol reactivity. Hence, variation in the neurocognitive abilities that shape anticipatory stress appraisal possibly underlies the gender difference we observed in basal cortisol, which was most pronounced for boys from families with lower FS. As such, these effects speak to the value of measuring psychological stress processes in addition to physiological indices to fully contextualize individual variability within psychobiological profiles of acute stress responsivity.

The flat, non-reactive profile displayed by boys who were exposed to minimal FS is also aligned with robust evidence of lower cortisol reactivity in Latinx adolescents linked to family economic hardship (Johnson et al., 2021; Tackett et al., 2017). Recognizing that, on average, the present sample displayed an overall pattern of hypocortisolism, it is possible that this HPA insensitivity is intensified in Latinx boys, yet further research exploring possible gender differences is needed. When looking at the impact of other types of stressors, the extent to which negative social dynamics in the family impact Latinx adolescents' adrenocortical activity has received less attention. However, a recent systematic review (Haft et al., 2021) documented two studies that are relevant to the current findings. Doane et al. (2018) found that adolescents who reported positive perceptions of parental support displayed greater cortisol in the morning and Gonzales and colleagues (2018) found that family conflict predicted blunted cortisol reactivity following the TSST, with lower cortisol peak and less evidence of recovery. It should be noted that our multi-informant composite operationalized FS by combining reports of high conflict and

hostility with low emotional closeness, rather than focusing on just one facet of hostile home contexts. Additional methodological differences can also be noted in our choice of stress induction task and HPA index as these are not reflected in the prior studies we referenced. Methodological differences notwithstanding, our findings are inconsistent with findings from these studies, which calls into question whether the high – flat activity pattern displayed by boys' in our sample from low FS backgrounds could be interpreted as reflecting a male-dominated yet sample-specific HPA activity profile. Future empirical work is needed to understand whether this is indeed the case and explore possible mediating influences of the stress phenotype documented in this sample.

Why we saw no evidence for suppressed reactivity in girls from low stress contexts remains less clear. One possible explanation may be reflected in our HPA reactivity index – Area Under the Curve with respect to Increase (AUCi) rather than Ground (AUCg) – as the former computes change in cortisol relative to baseline levels. The high basal cortisol shown by boys in our sample may have subverted our ability to clearly capture subsequent increases in cortisol making them appear less reactive overall. In sum, although these effects were unexpected and not fully consistent with prior literature, when contextualized within literature testing Latinx-specific and gender-specific differences, the present findings may be pointing to a distinct HPA pattern specific to Mexican-origin youth. Under conditions of low stress, high baseline cortisol and low cortisol reactivity may be typical, particularly for adolescent boys of Mexican origin, however future analyses exploring possible culture-specific and gender-specific associations between psychological and physiological stress responsivity will be crucial for clarifying variation in psychobiological processes.

Finally, the present findings show that endorsement of the Five Cs (excepting

Competence) further accounted for variation in adrenocortical functioning in a pattern significant only for adolescent girls. Compared to boys, girls who reported average and below average scores on Caring displayed lower baseline cortisol, and girls who reported below average scores on Caring, Character, Confidence, and Connection also evinced a pattern of increased cortisol reactivity. Gender differences at the high end of these factors were nonsignificant, meaning that effects were restricted to girls who endorsed lower overall functioning as reflected in these constructs (e.g., less prosocial, collaborative tendencies as captured by Caring and Character and less self-esteem and social support as captured by Confidence and Connection). Elevated afternoon cortisol may be more normative in Latinx samples (DeSantis et al., 2007; Doane et al., 2018), and prior analyses of these data have linked exposure to environmental, neighborhood, and family risks with low afternoon cortisol (Johnson et al., 2021, Johnson & Ugarte et al., 2023). Prior research on early adolescents has also linked higher afternoon cortisol with prosocial behaviors at school (Catherine et al., 2012; Oberle, 2018), with greater basal cortisol hypothesized to facilitate socioemotional competencies that youth rely on throughout day-to-day peer interactions. Further, both Catherine et al. (2012) and Oberle (2018) found that girls displayed greater prosociality and afternoon cortisol than boys which may suggest that this biobehavioral connection is stronger for girls than boys. These studies support the current finding showing that regardless of prior FS exposure, girls who report less Caring evince lower baseline, implying that having fewer prosocial tendencies may lead to alterations in daily cortisol secretion particularly for girls. Altogether, these findings emphasize the importance of understanding how neurobiological processes are embedded within socioemotional development in functionally adaptive patterns, highlighting the utility of interventions that target prosociality during early adolescence for enhancing biobehavioral and psychosocial health.

Low scores on Caring, Character, Confidence, and Connection also predicted increased cortisol reactivity in girls. Although less acute reactivity may be expected in Latinx samples (Doane et al., 2018; Johnson et al., 2021; Tackett et al., 2017), it is still considered a stress-adapted phenotype given that it appears to be driven by chronic poverty exposure. Considering that cortisol suppression in the context of an immediate social threat or challenge generally reflects the wear-and-tear of allostatic load processes unfolding (McEwen, 2000), this set of effects may suggest that girls' HPA systems have retained more acute sensitivity and flexibility than boys' HPA systems, which is somewhat aligned with the second set of findings. The fact that sensitive and flexible stress responsivity was only documented in girls when endorsement of Caring and Confidence – and to a lesser extent Character and Connection – was low is unexpected, and further research parsing the manner in which psychological and physiological self-regulation are integrated across development is warranted.

In sum, the present findings emphasize the protective capacity of the Five Cs in stressful family contexts, establish support for gender-specific variation in the extent to which family processes become biologically embedded, and provide novel evidence linking the Five Cs and adrenocortical functioning in adolescent girls, specifically. Future studies may expand on these findings to answer questions of specificity by testing stress physiology as a mediating link between PYD and adolescent adjustment outcomes with particular consideration paid to possible gender differences and family processes. By contextualizing children's and adolescents' biobehavioral integration of self-regulation within family- and individual-level processes, this line of inquiry has the potential to inform conceptual models outlining differential trajectories of adolescent thriving (Arbeit et al., 2014; Gomez-Baya et al., 2019; Lewin-Bizan et al., 2010; Schwartz et al., 2010), especially relevant for tracking positive developmental cascades within

historically underrepresented samples.

Theoretical Implications

Given that the PYD research is founded on the premise that all youth flourish in ways unique to their context, empirical studies have increasingly prioritized the study of individual variability and contextual influences in order to provide a deeper explication of the field's current understanding of positive developmental cascades. The present study explored context-driven effects on developing PYD within a sample of Mexican-origin youth with the goal of categorizing commonalities and specificities of PYD in a historically underrepresented youth sample. In accordance with this goal, the present findings highlight relations between specific family processes and later adrenocortical activity as differentiated by variation in PYD, yet effects emerged only at the level of the Five Cs, rather than at the global PYD level. This was unexpected, yet may have been due to the orthogonal partitioning of variance within the bifactor model of PYD. Past PYD studies have lauded the orthogonality principle as a strength given that it relaxes two key assumptions of the hierarchical structure that oppose underlying theoretical assumptions of the Five Cs model. Specifically, modelling PYD using a hierarchical structure assumes, first, that high PYD necessarily entails (or causes) strong correlations among all of the Five Cs, and second, that the associations between indicators and residual Cs mirror in proportion the associations between indicators and PYD (Geldhof et al., 2014; Holsen et al., 2017).

The Five Cs model itself does not propose the same assumptions as the hierarchical model approach, however. Instead, the model posits that evidence of PYD emerges when youth exhibit high-level functioning through indicators of the Five Cs (Lerner et al., 2005). Further, each C encompasses a variety of concepts (i.e., Competence includes social, academic, cognitive,

and vocational competence; Connection reflects positive bonds with both people and institutions), and it is sensible that associations between indicators and PYD may not mirror associations between the same indicators and the Cs, after controlling for PYD (Geldhof et al., 2014). Recent empirical work has preferred to model PYD with a bifactor rather than hierarchical structure since within a bifactor model, the global PYD factor provides a holistic estimate of each adolescent's level of functioning aggregated across all indicators, while the residual Cs represent the covariance among indicators respective to each C *that is not related to global PYD* (Geldhof et al., 2014; Holsen et al., 2017; von Eye et al., 2011). The bifactor structure models global PYD as one of multiple sources of true-score variance within the indicators, and since indicators can freely covary with each other in ways specific to its unique C, each item has two sources of true-score variance. The bifactor structure orthogonalizes the two sources of variance which allows global PYD and the residual Cs to freely and independently covary with important criterion measures (e.g., later adjustment metrics). However, when investigating how PYD factors independently or cumulatively predict later adjustment or when examining their capacity to moderate the influence of contextual factors on adjustment indices, completely separating variance attributed to the Cs from that which is attributed to the overarching PYD factor may not be ideal. Given that we found two sets of effects (i.e., FS X C; Gender X C) that were relatively consistent for four of the Five Cs, if we had modelled PYD using a hierarchical structure, it is possible that we would have seen significant effects at the global PYD level. In any case, these findings reiterate that PYD is multifaceted rather than unidimensional, and efforts to contextualize the nature of PYD within the lived experiences of youth will support a more detailed operationalization of thriving as it unfolds within diverse settings and contexts in the daily lives of adolescents.

The Specificity Principle, which focuses on bidirectional and multiplicative relations between specific individuals and specific contextual facets as they mutually influence each other across the lifespan (Bornstein, 2017, 2019), has become a central priority in PYD research. Questions of specificity seek to identify various constellations of lived experiences, individual characteristics, and life contexts as they cumulatively increase or decrease the likelihood of certain adjustment outcomes occurring within specific developmental time periods. Therefore, restricting PYD analyses to the bifactor structure may consequently restrict the scope of findings, leading to a skewed understanding of how sample-specific cultural, social, and environmental contexts influence PYD, thereby limiting the capacity of the Five Cs theory to appropriately define PYD in diverse settings and communities. As a result, PYD studies incorporating the hierarchical structure as an alternative modelling solution may gain traction as researchers increasingly emphasize questions of specificity.

Besides these theoretical implications, results of the present study have practical implications as well, particularly for social programming efforts with Mexican-origin and other U.S. Latinx communities. The present findings expand on empirical evidence of PYD promoting healthy adolescent adjustment outcomes (Arbeit et al., 2014; Årdal et al., 2018; Holsen et al., 2017; Lerner et al., 2013; Schwartz et al., 2010; Shek & Chai, 2020) by suggesting that fostering PYD may additionally confer physiological benefits, especially for youth exposed to low to average FS. Indeed, more research is needed to fully understand possible underlying mechanisms, including self-regulation capacities, such as anticipatory cognitive appraisal of acute stress, among others. Yet, the idea that the development of the Five Cs may intensify following moderate stress exposure is supported by theoretical models of adaptation-based resilience (Ellis et al., 2017; Fergus & Zimmerman, 2005; Zimmerman et al., 2013). Moreover,

previous interventions within minoritized youth samples have demonstrated that culturally-sensitive efforts to promote social and coping skills may provide transdiagnostic benefits as they simultaneously promote both positive adjustment and risk avoidance (Botvin et al., 1995; Zimmerman et al., 2013). The present findings lend specific support for the psychophysiological benefits of elevated social connectedness and self-confidence and highlight these strengths as multilevel resilience factors specifically for Mexican-origin youth.

Limitations and Future Directions

Several limitations of the present study should be recognized. As discussed in Johnson et al. (2023), the present study was a secondary analysis of CFP data and the specific measures we used were not originally selected by CFP investigators to test the Five Cs model of PYD. Thus, our latent definitions of the Five Cs were constrained to the data available. Although we found support for the latent bifactor structure of PYD, all latent factor definitions aligned with the theoretical constructs operationalized by Lerner and colleagues (2005) with the exception of the residual Competence C at age 16. As previously touched upon, the manifest factor loadings for Competence indicate that the latent factor was poorly defined. Thus, despite replicating four of the Five Cs and global PYD, the Competence factor was not clearly defined for Mexican-origin youth at age 16. Future studies may investigate whether this pattern holds at earlier or later ages or seek to revise how Competence is operationalized by selecting indicators that better reflect the domains of this construct at age 16 (e.g., incorporate measures for cognitive and vocational skills in addition to social and academic skills).

Hostile family environments may be expected to co-occur with multiple other stressors (e.g., economic hardship, interparental conflict, parent mental health problems), all of which may impact adolescents' developing adrenocortical system. Although the present study controlled for

each family's household composition (i.e., whether one or both parents were present) and income-to-needs at age 16, information on family social and economic circumstances prior to age 16 were not included in the present analysis. Thus, the present study did not consider how negative parent-child relationships across childhood and early adolescence may have contributed to adolescents' HPA activity at age 17. Childhood FS exposure has been linked with HPA profiles characterized by both hypo- and hyper-arousal (Essex et al., 2011), which may persist across the adolescent transition and into emerging adulthood (Luecken et al., 2009). The present study provided further evidence for long-term sensitivity of the HPA axis to harsh family dynamics in mid-adolescence, highlighting that family social adversity may continue to impact adrenocortical regulation beyond the childhood period. Future analyses tracking FS longitudinally across childhood and adolescence and examining how chronic FS intersects with co-occurring risks will build on the current findings and expand the field's understanding of equifinality and multifinality of long-term sequalae of adverse family contexts.

It must be recognized that the present study only probed for linear associations between FS, PYD, and HPA activity. Prior theoretical models have proposed curvilinear associations between developmental risks and outcomes, in which experiences of mild to moderate stress are posited as potentially more advantageous for the development of stress physiology and self-regulation than stress-free contexts (Ellis et al., 2017; Fergus & Zimmerman, 2005; Frankenhuis & de Weerth, 2013; Zimmerman et al., 2013). High stress contexts are thought to inhibit developing stress physiology and its associated psychological processes. This can lead to a breakdown of normal bodily functions in a physiological tax termed allostatic load, as evidenced by a decreased capacity of stress response systems to mount appropriate acute responses (Essex et al., 2011; McEwen, 2000). Cumulative models of risk exposure consistently find evidence of

downstream health sequalae following severe, pervasive adverse life experiences (Blair et al., 2013; Evans et al., 2013; Evans & Kim, 2007). Empirical evidence of quadratic or cubic effects have been less common in the literature, yet some studies have documented quadratic associations between interparental conflict, adolescent regulation of stress and emotion, and subsequent psychological problems (Davies et al., 2020). From a strengths-based approach, curvilinear associations may also explain how facets of PYD influence psychological processes, including the regulation of stress and emotion, across development, yet the extant empirical literature has scarcely explored this question (Busseri et al., 2006; Feinberg et al., 2001; Lerner et al., 2001). Future research may address the possibility of nonlinear associations which would contribute nuance to the field's current understanding of interpersonal relationships and contexts as "drivers" of developmental trajectories.

Notably, the extent to which low to moderate exposure of FS actively shapes variation in positive development through the Five Cs or fine-tunes existing psychosocial skills remains an open question. Measuring FS and the Five Cs contemporaneously limited our ability to draw inferences regarding directionality, and it remains plausible that the present findings, if extended longitudinally, would provide evidence supporting the conditional adaptation models of resilience, particularly the specialization and sensitization hypotheses (Ellis et al., 2017; Zimmerman et al., 2013). It is possible that for some youth, FS exposure was chronic and extended across prior childhood and adolescent years, and in coping with their prolonged stressful context, these youth developed specialized capacities underscored by the Five Cs which ultimately conferred psychophysiological benefits mediated by the HPA axis. Therefore, future studies testing whether self-regulation capacities, including PYD constructs, in part mediate the effect of family risk exposure on adolescent psychophysiological functioning would provide a

more nuanced understanding of this question, as well as elucidate possible plasticity phenotypes underlying conditional adaptation (Ellis et al., 2017).

While the present study linked indicators of family processes and adolescent well-being at age 16 to HPA activity at age 17, the present analysis did not incorporate subsequent measures of HPA regulation. Future studies incorporating multiple physiological assessments could examine whether the profiles of HPA activity we found linked to both FS and PYD persist across late adolescence and early adulthood. Findings from fully longitudinal analyses have the potential to confirm whether the cortisol reactivity pattern we found in relation to moderate FS exposure (displayed by all youth) and greater endorsement of the Five Cs (shown by girls only) were indeed the expected increase in cortisol following an acute stressor, rather than evidence of HPA hyperarousal. Alternatively, future studies may benefit from testing nonlinear associations between FS, PYD constructs, and HPA activity as this will clarify cut-off points at which the spectrum of risk becomes physiologically and psychologically detrimental.

Lastly, future work should consider how gender and cultural socialization processes may influence the extent to which adolescents internalize experiences of FS and externalize evidence of adjustment of well-being. Past work has linked biculturalism and familism with positive developmental trajectories (Gonzales et al., 2009; Safa & Umaña-Taylor, 2021), including healthy and flexible HPA reactivity (Gonzales et al., 2018) in samples of Latinx youth. Given that previous work using this sample has shown that adolescents' cultural orientation predicts increases in PYD across ages 14 to 16 (Johnson et al., 2023), it is plausible that adolescents' endorsement of cultural values and ethnic pride explains, in part, the extent to which PYD constructs modify the impact of FS on HPA activity. Research in adults also suggests that the impact of cultural socialization processes may be differentiated by gender (Fuligni & Pedersen,

2002; Nicholson et al., 2013), thus careful consideration of how these processes unfold in consistent or divergent patterns for adolescent girls versus boys is a research imperative.

Conclusions

The present study represents a significant contribution to the field's current understanding of the influence of hostile family dynamics on adolescent adrenocortical functioning. Adolescent endorsement of psychosocial and emotional well-being, operationalized using the Five Cs model of PYD, was tested in moderation with FS exposure, indexed via a multi-informant composite of hostility, conflict, and low emotional support in parent-adolescent relationships, to explore whether PYD mitigates the deleterious effects of FS. The findings support prior work documenting evidence of altered adrenocortical regulation following FS exposure in a sample of Mexican-origin youth, a demographic that is often underrepresented in psychophysiological research. The present study also provided novel evidence for the Five Cs modifying the adrenocortical impact of FS exposure, thereby emphasizing the protective nature of the Cs, in general, and suggesting that elevated social connectedness and self-confidence may act as multilevel resilience factors for Mexican-origin youth, in particular. By clarifying the extent to which PYD factors may explain individual variability in HPA activity following adverse family experiences in a sample of Mexican-origin youth across middle adolescence, this study advances a strengths-based approach to the empirical study of resilience. Importantly, gender-specific associations were found among relations between FS, PYD, and HPA activity, providing new insights into the specificities of PYD as it develops in diverse settings and communities.

Table 2.1. Descriptive statistics and bivariate correlations among key study variables.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1. Family Stress	-													
2. Global PYD	-.28***	-												
3. Caring	-.20**	NA	-											
4. Character	-.26***	NA	.76***	-										
5. Competence	.14*	NA	-.22***	-.62***	-									
6. Confidence	-.13^{t}	NA	.19**	.42***	-.64***	-								
7. Connection	-.22***	NA	.36***	.59***	-.68***	.56***	-							
8. Baseline Cortisol	-.07	-.06	.05	.08	-.10	.10	.14*	-						
9. Cortisol Reactivity	.16*	-.06	-.07	-.08	.02	-.08	-.06	-.44***	-					
10. Gender	.03	.04	.18*	.21***	.01	-.09	.11	-.24***	.15*	-				
11. Medication use	.02	-.08	.01	.01	-.03	-.05	.08	.08	.10	.14*	-			
12. Depression risk	.16*	-.22***	-.06	-.14*	-.19**	-.22***	-.14*	-.13*	.11	.16*	0.12^{t}	-		
13. Sample Time	-.05	.04	.06	.02	.06	.02	-.03	-.14*	-.26***	-.07	-.08	.05	-	
14. Income-to-Needs	.14*	.17*	.11	.07	.02	.08	.04	-.07	.08	.01	-.07	-.10	.05	-
Mean	0.00	0.00	0.00	0.00	0.00	0.00	0.00	-0.98	-0.10	0.49	0.12	0.76	1.67	1.28
SD	0.11	0.92	0.88	0.82	0.73	0.78	0.82	0.24	0.32	0.50	0.33	0.43	0.23	0.81
Min	-0.17	-2.33	-2.84	-2.89	-1.95	-2.49	-2.03	-1.62	-0.70	0.00	0.00	0.00	1.19	0.14
Max	0.33	2.11	2.18	2.37	2.24	2.23	2.24	-0.27	1.60	1.00	1.00	1.00	1.96	4.25

Note. NA = Orthogonal parameter as per bivariate structure of Global Positive Youth Development (PYD).

Figure 2.1. Moderation path model testing a three-way interaction for Family Stress, Global Positive Youth Development (PYD), and Gender predicting Adrenocortical activity.

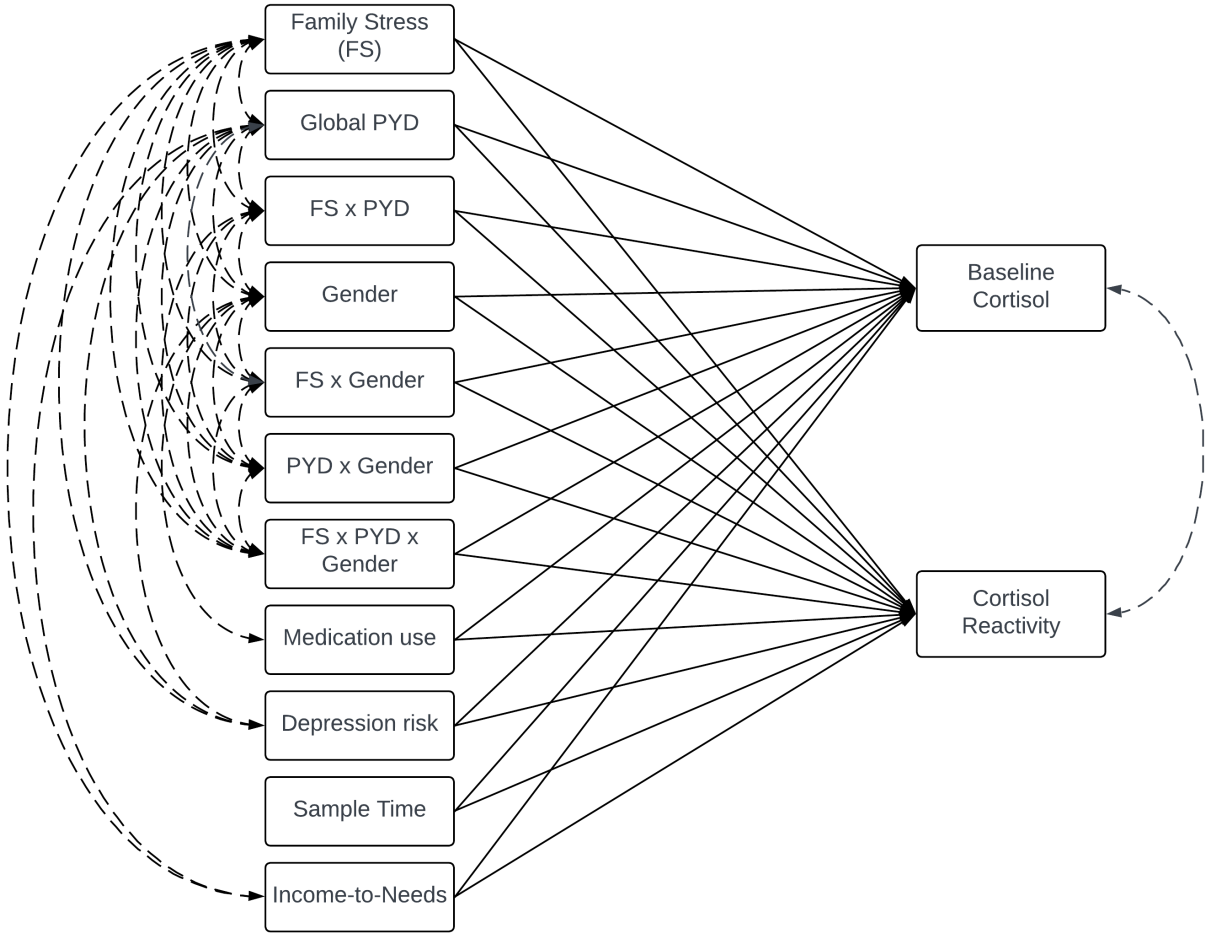


Table 2.2. Model of Family Stress, Global Positive Youth Development (PYD), and Gender predicting Adrenocortical activity.

	Baseline Cortisol					Cortisol Reactivity				
	B	*(SE)*	*p*	95% CI		*B*	*(SE)*	*p*	95% CI	
Family Stress (FS)	**-0.463**	**0.195**	**0.017**	**-0.845**	**-0.082**	*0.632*	*0.330*	*0.056*	*-0.015*	*1.279*
Global PYD	-0.019	0.031	0.536	-0.081	0.042	0.012	0.055	0.833	-0.096	0.120
Gender	**-0.128**	**0.032**	**0.000**	**-0.191**	**-0.064**	0.068	0.045	0.129	-0.020	0.156
FS X PYD	-0.010	0.225	0.963	-0.452	0.431	0.007	0.327	0.983	-0.634	0.648
FS X Gender	*0.583*	*0.305*	*0.056*	*-0.015*	*1.181*	*-0.745*	*0.442*	*0.092*	*-1.611*	*0.121*
PYD X Gender	0.003	0.037	0.935	-0.070	0.076	-0.028	0.058	0.631	-0.140	0.085
FS X PYD X Gender	-0.352	0.292	0.229	-0.925	0.222	-0.014	0.377	0.970	-0.754	0.726
Medication use	0.071	0.048	0.142	-0.024	0.165	0.049	0.080	0.540	-0.108	0.205
Depression risk	*-0.058*	*0.033*	*0.074*	*-0.122*	*0.006*	0.070	0.045	0.123	-0.019	0.158
Sample Time	**-0.158**	**0.066**	**0.017**	**-0.288**	**-0.028**	**-0.343**	**0.096**	**0.000**	**-0.532**	**-0.154**
Income-to-Needs	-0.011	0.025	0.659	-0.061	0.038	0.045	0.046	0.330	-0.046	0.136
Fit Statistics	$\chi^2(29) = 42.31$, $p = .053$; *CFI* = 0.983; *RMSEA* = 0.043 [.000, .069]									

Note. **Bold font** indicates significant effects ($p < .05$). *Italicized font* indicates borderline effects ($.05 < p < .10$).

Table 2.3a. Family Stress, Caring, and Gender predict Adrenocortical activity.

	Baseline Cortisol					Cortisol Reactivity				
	B	*(SE)*	*p*	95% CI		*B*	*(SE)*	*p*	95% CI	
Family Stress (FS)	**-0.426**	**0.192**	**0.026**	**-0.802**	**-0.050**	**0.712**	**0.316**	**0.024**	**0.093**	**1.332**
Caring	-0.003	0.027	0.920	-0.056	0.050	0.053	0.046	0.245	-0.037	0.143
Gender	**-0.149**	**0.032**	**0.000**	**-0.211**	**-0.086**	**0.105**	**0.050**	**0.035**	**0.007**	**0.202**
FS X Caring	-0.113	0.270	0.674	-0.642	0.415	0.536	0.458	0.242	-0.362	1.433
FS X Gender	**0.885**	**0.308**	**0.004**	**0.281**	**1.489**	**-1.026**	**0.441**	**0.020**	**-1.891**	**-0.162**
Caring X Gender	**0.080**	**0.033**	**0.016**	**0.015**	**0.146**	**-0.183**	**0.059**	**0.002**	**-0.300**	**-0.067**
FS X Caring X Gender	-0.161	0.330	0.627	-0.808	0.487	-0.116	0.544	0.832	-1.182	0.950
Medication use	*0.074*	*0.044*	*0.095*	*-0.013*	*0.160*	0.051	0.067	0.450	-0.081	0.182
Depression risk	-0.046	0.032	0.153	-0.109	0.017	0.036	0.044	0.408	-0.050	0.122
Sample Time	-0.013	0.021	0.538	-0.055	0.029	0.017	0.033	0.611	-0.049	0.083
Income-to-Needs	**-0.165**	**0.063**	**0.009**	**-0.288**	**-0.041**	**-0.332**	**0.087**	**0.000**	**-0.502**	**-0.162**
Fit Statistics	$\chi^2(30) = 40.80$, $p = .090$; *CFI* = 0.982; *RMSEA* = 0.040 [.000, .069]									

Note. **Bold font** indicates significant effects ($p < .05$). *Italicized font* indicates borderline effects ($.05 < p < .10$).

Table 2.3b. Family Stress, Character, and Gender predict Adrenocortical activity.

	Baseline Cortisol					Cortisol Reactivity				
	B	*(SE)*	*p*	95% CI		*B*	*(SE)*	*p*	95% CI	
Family Stress (FS)	*-0.411*	*0.222*	*0.065*	*-0.846*	*0.025*	**0.896**	**0.388**	**0.021**	**0.135**	**1.656**
Character	0.022	0.030	0.476	-0.038	0.081	0.042	0.049	0.385	-0.053	0.138
Gender	**-0.144**	**0.034**	**0.000**	**-0.210**	**-0.078**	0.076	0.053	0.153	-0.028	0.179
FS X Character	-0.146	0.219	0.504	-0.575	0.283	*0.538*	*0.278*	*0.053*	*-0.007*	*1.083*
FS X Gender	**0.808**	**0.329**	**0.014**	**0.163**	**1.453**	**-1.111**	**0.517**	**0.032**	**-2.125**	**-0.098**
Character X Gender	0.033	0.036	0.348	-0.036	0.103	**-0.136**	**0.062**	**0.028**	**-0.257**	**-0.015**
FS X Character X Gender	-0.356	0.334	0.287	-1.012	0.299	-0.049	0.390	0.899	-0.813	0.714
Medication use	0.072	0.045	0.111	-0.017	0.162	0.062	0.072	0.390	-0.079	0.203
Depression risk	-0.041	0.033	0.210	-0.105	0.023	0.041	0.046	0.374	-0.050	0.132
Sample Time	-0.018	0.022	0.409	-0.061	0.025	0.024	0.035	0.493	-0.045	0.092
Income-to-Needs	**-0.156**	**0.064**	**0.014**	**-0.281**	**-0.031**	**-0.333**	**0.091**	**0.000**	**-0.510**	**-0.155**
Fit Statistics	$\chi^2(30) = 35.94$, $p = .210$; *CFI* = 0.990; *RMSEA* = 0.030 [.000, .062]									

Note. **Bold font** indicates significant effects ($p < .05$). *Italicized font* indicates borderline effects ($.05 < p < .10$).

Table 2.3c. Family Stress, Competence, and Gender predict Adrenocortical activity.

	Baseline Cortisol					Cortisol Reactivity				
	B	*(SE)*	*p*	95% CI		*B*	*(SE)*	*p*	95% CI	
Family Stress (FS)	**-0.396**	**0.188**	**0.035**	**-0.765**	**-0.028**	**0.759**	**0.321**	**0.018**	**0.130**	**1.387**
Competence	-0.032	0.030	0.276	-0.090	0.026	-0.019	0.040	0.637	-0.097	0.059
Gender	**-0.121**	**0.031**	**0.000**	**-0.181**	**-0.060**	0.056	0.045	0.211	-0.032	0.144
FS X Competence	0.201	0.193	0.297	-0.177	0.580	**-0.634**	**0.254**	**0.013**	**-1.133**	**-0.135**
FS X Gender	**0.701**	**0.312**	**0.024**	**0.091**	**1.312**	*-0.854*	*0.456*	*0.061*	*-1.749*	*0.041*
Competence X Gender	0.019	0.039	0.631	-0.057	0.095	0.042	0.052	0.419	-0.060	0.144
FS X Competence X Gender	0.192	0.329	0.560	-0.452	0.836	0.330	0.334	0.324	-0.325	0.985
Medication use	0.064	0.049	0.193	-0.032	0.160	0.074	0.080	0.355	-0.083	0.231
Depression risk	-0.050	0.034	0.143	-0.116	0.017	0.070	0.051	0.174	-0.031	0.171
Sample Time	-0.022	0.023	0.340	-0.067	0.023	0.039	0.041	0.338	-0.041	0.119
Income-to-Needs	**-0.148**	**0.066**	**0.026**	**-0.278**	**-0.018**	**-0.336**	**0.092**	**0.000**	**-0.517**	**-0.154**
Fit Statistics	$\chi^2(30) = 41.44$, $p = .080$; *CFI* = 0.981; *RMSEA* = 0.039 [.000, .065]									

Note. **Bold font** indicates significant effects ($p < .05$). *Italicized font* indicates borderline effects ($.05 < p < .10$).

Table 2.3d. Family Stress, Confidence, and Gender predict Adrenocortical activity.

	Baseline Cortisol					Cortisol Reactivity				
	B	*(SE)*	*p*	95% CI		*B*	*(SE)*	*p*	95% CI	
Family Stress (FS)	**-0.425**	**0.182**	**0.019**	**-0.782**	**-0.069**	**0.775**	**0.297**	**0.009**	**0.193**	**1.357**
Confidence	0.030	0.027	0.266	-0.023	0.082	0.034	0.033	0.298	-0.030	0.098
Gender	**-0.120**	**0.031**	**0.000**	**-0.180**	**-0.060**	0.052	0.043	0.219	-0.031	0.136
FS X Confidence	-0.231	0.190	0.225	-0.604	0.142	**0.711**	**0.287**	**0.013**	**0.148**	**1.274**
FS X Gender	**0.671**	**0.299**	**0.025**	**0.085**	**1.256**	**-0.909**	**0.419**	**0.030**	**-1.730**	**-0.088**
Confidence X Gender	0.003	0.038	0.933	-0.071	0.077	**-0.159**	**0.057**	**0.006**	**-0.271**	**-0.046**
FS X Confidence X Gender	-0.065	0.306	0.833	-0.665	0.535	-0.419	0.447	0.349	-1.296	0.457
Medication use	0.065	0.048	0.179	-0.030	0.160	0.060	0.074	0.413	-0.084	0.205
Depression risk	-0.046	0.033	0.170	-0.111	0.020	0.066	0.050	0.186	-0.032	0.165
Sample Time	-0.021	0.023	0.362	-0.065	0.024	0.044	0.041	0.280	-0.036	0.123
Income-to-Needs	**-0.162**	**0.065**	**0.013**	**-0.290**	**-0.034**	**-0.305**	**0.089**	**0.001**	**-0.480**	**-0.130**
Fit Statistics	$\chi^2(30) = 36.18$, $p = .202$; *CFI* = 0.989; *RMSEA* = 0.030 [.000, .060]									

Note. **Bold font** indicates significant effects ($p < .05$). *Italicized font* indicates borderline effects ($.05 < p < .10$).

Table 2.3e. Family Stress, Connection, and Gender predict Adrenocortical activity.

	Baseline Cortisol					Cortisol Reactivity				
	B	*(SE)*	*p*	95% CI		*B*	*(SE)*	*p*	95% CI	
Family Stress (FS)	*-0.410*	*0.236*	*0.083*	*-0.873*	*0.054*	**0.985**	**0.390**	**0.012**	**0.220**	**1.750**
Connection	0.034	0.031	0.261	-0.026	0.095	0.051	0.045	0.265	-0.038	0.139
Gender	**-0.137**	**0.033**	**0.000**	**-0.202**	**-0.072**	0.058	0.052	0.260	-0.043	0.159
FS X Connection	-0.175	0.217	0.419	-0.600	0.249	**0.587**	**0.297**	**0.048**	**0.004**	**1.169**
FS X Gender	**0.824**	**0.332**	**0.013**	**0.173**	**1.475**	**-1.203**	**0.527**	**0.022**	**-2.235**	**-0.170**
Connection X Gender	0.025	0.036	0.476	-0.044	0.095	**-0.141**	**0.062**	**0.023**	**-0.262**	**-0.019**
FS X Connection X Gender	-0.490	0.313	0.118	-1.103	0.124	0.026	0.430	0.953	-0.817	0.868
Medication use	0.067	0.044	0.131	-0.020	0.154	0.063	0.068	0.360	-0.071	0.197
Depression risk	-0.042	0.033	0.205	-0.108	0.023	0.050	0.049	0.304	-0.045	0.145
Sample Time	-0.020	0.021	0.360	-0.062	0.022	0.029	0.037	0.431	-0.044	0.103
Income-to-Needs	**-0.141**	**0.063**	**0.024**	**-0.263**	**-0.018**	**-0.370**	**0.086**	**0.000**	**-0.539**	**-0.202**
Fit Statistics	$\chi^2(30) = 40.39$, $p = .098$; *CFI* = 0.984; *RMSEA* = 0.039 [.000, .067]									

Note. **Bold font** indicates significant effects ($p < .05$). *Italicized font* indicates borderline effects ($.05 < p < .10$).

Figure 2.2a. Family Stress predicted Cortisol Reactivity at various levels of Character.

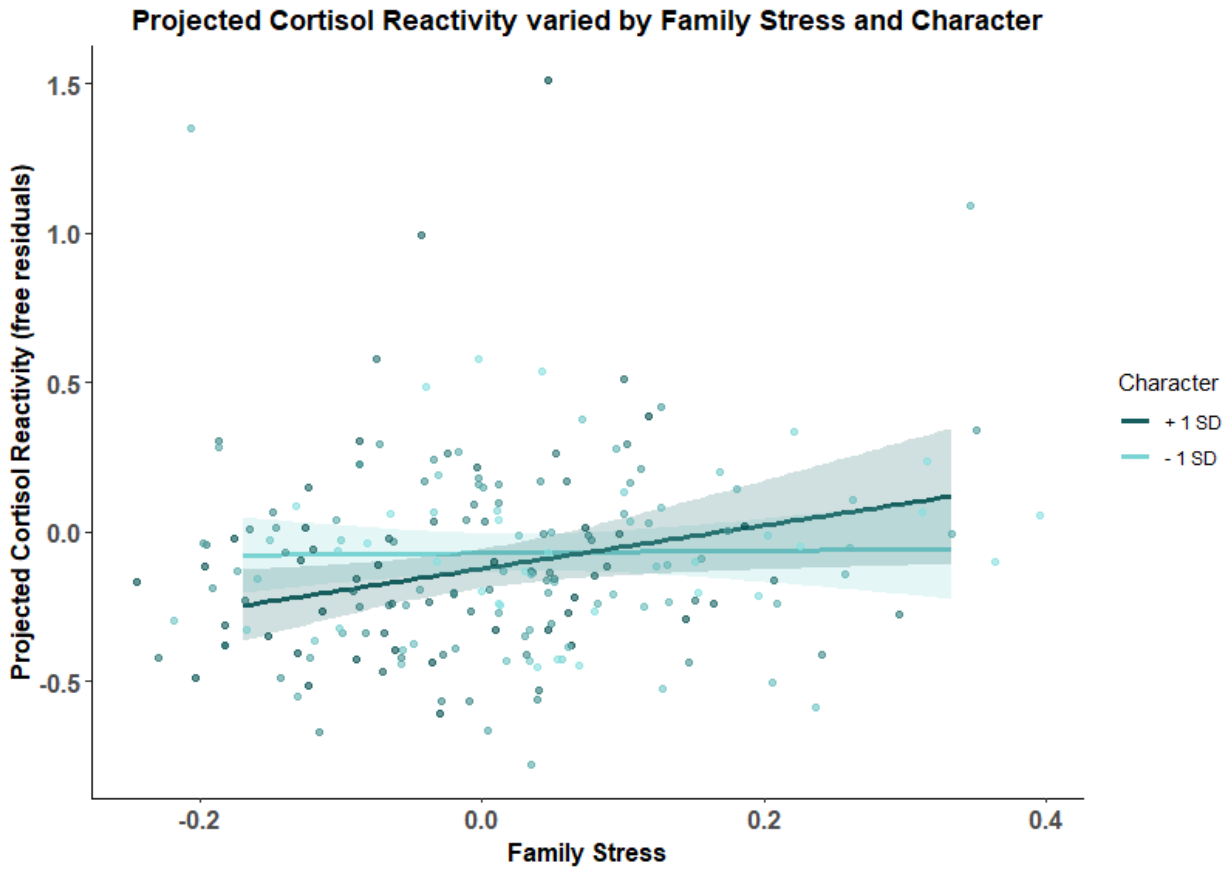
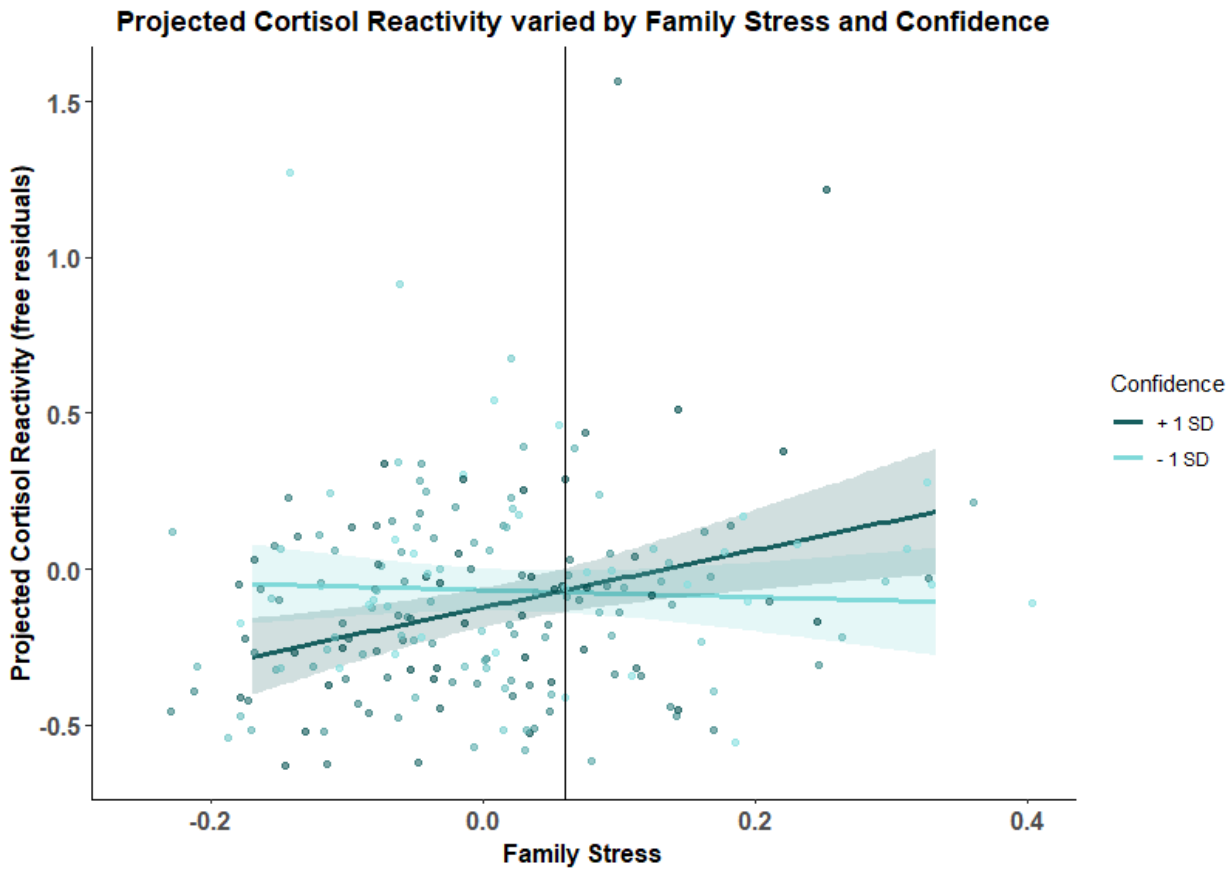
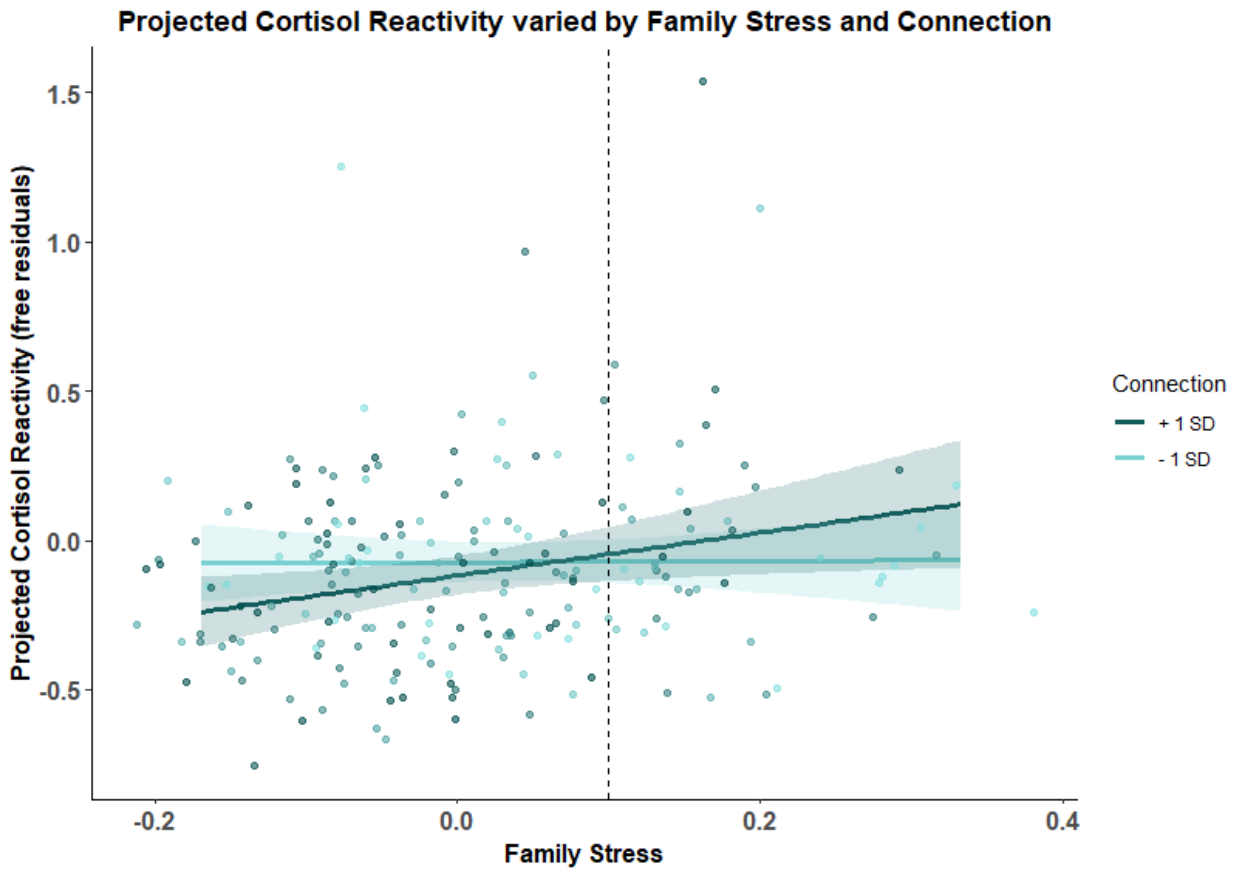


Figure 2.2b. Family Stress predicted Cortisol Reactivity at various levels of Confidence.



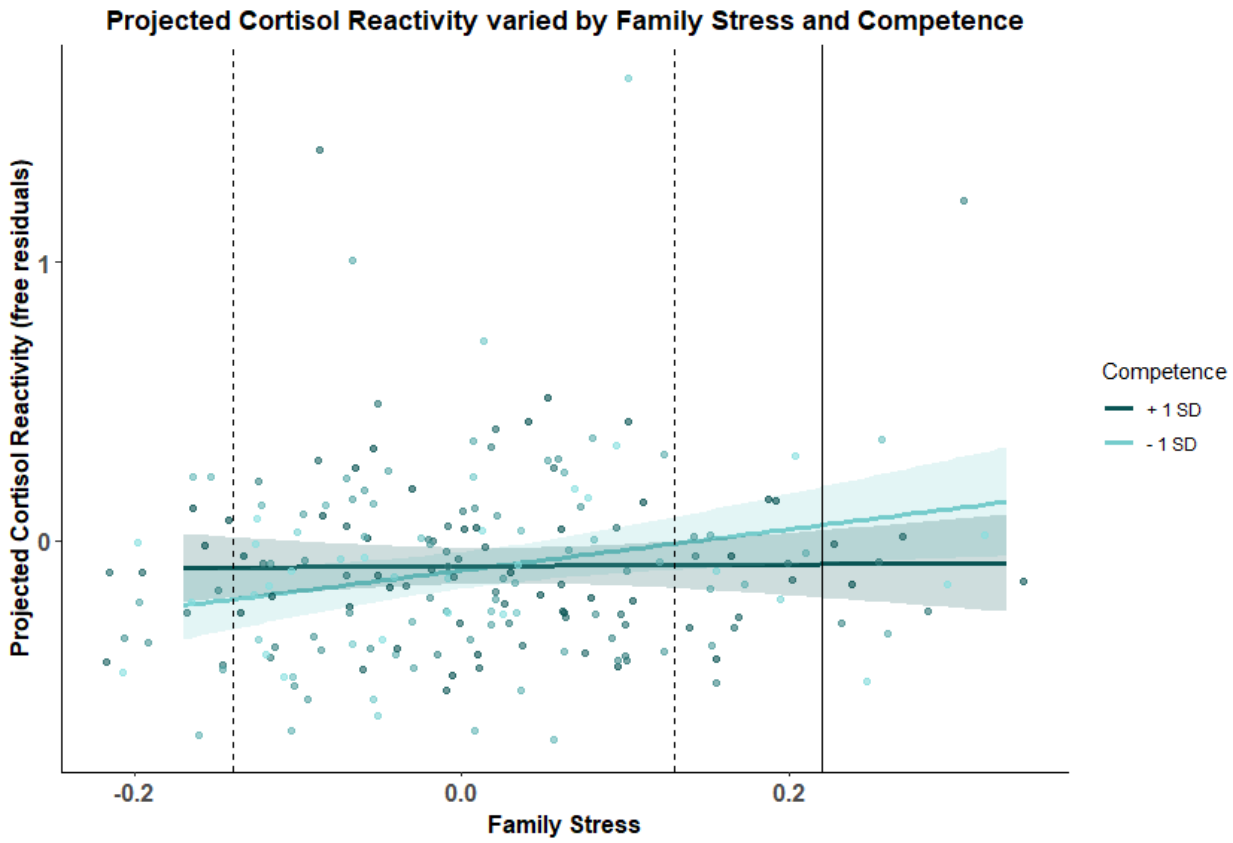
Note. Regions of significance (RoS) denoted by vertical bar; simple slopes are significantly different from each other at values of Family Stress that fall to the right of RoS boundary.

Figure 2.2c. Family Stress predicted Cortisol Reactivity at various levels of Connection.



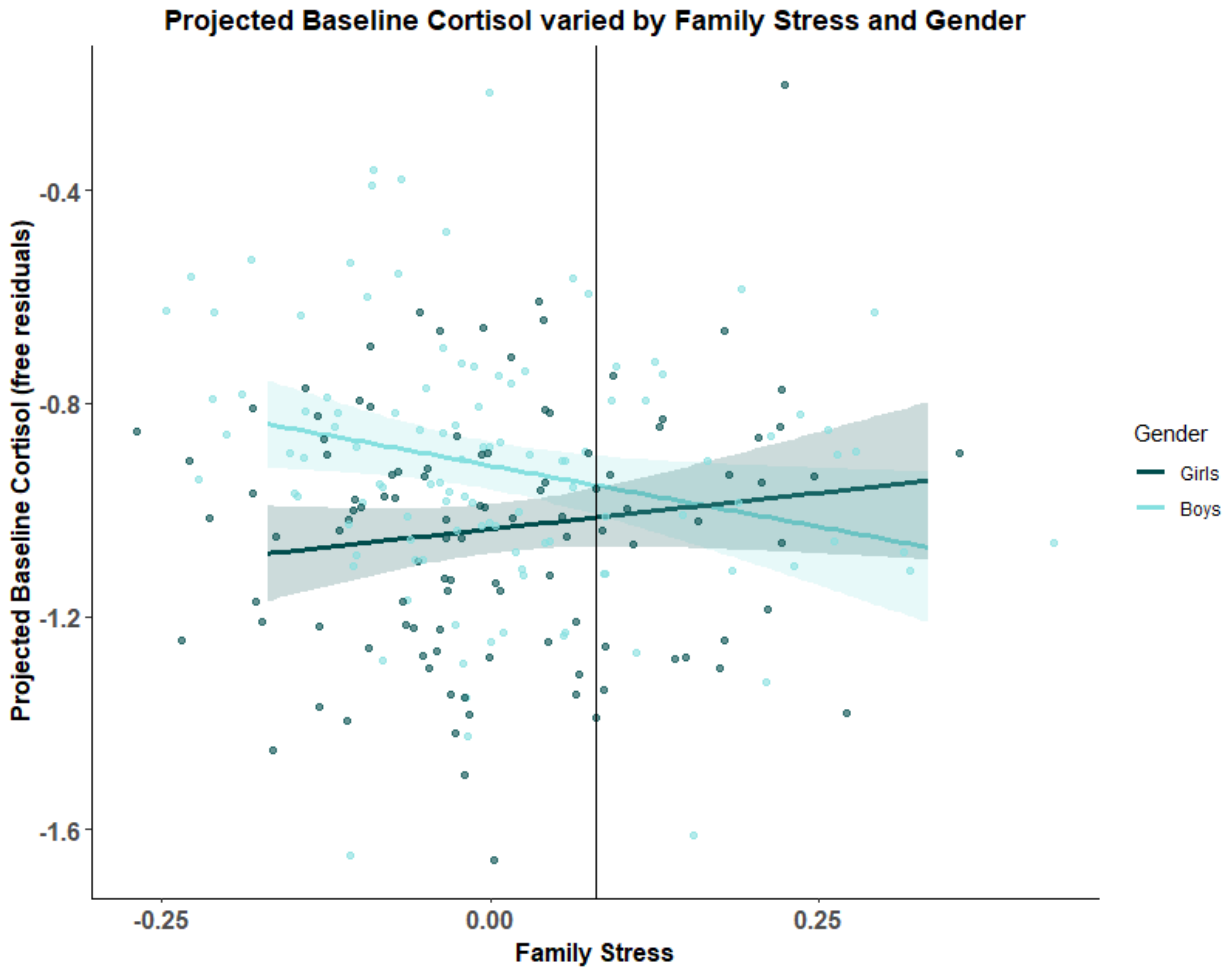
Note. Dashed vertical bar denotes trending Regions of significance (RoS) boundary; simple slopes are marginally different from each other at values of Family Stress that fall to the right of dashed line.

Figure 2.2d. Family Stress predicted Cortisol Reactivity at various levels of Competence.



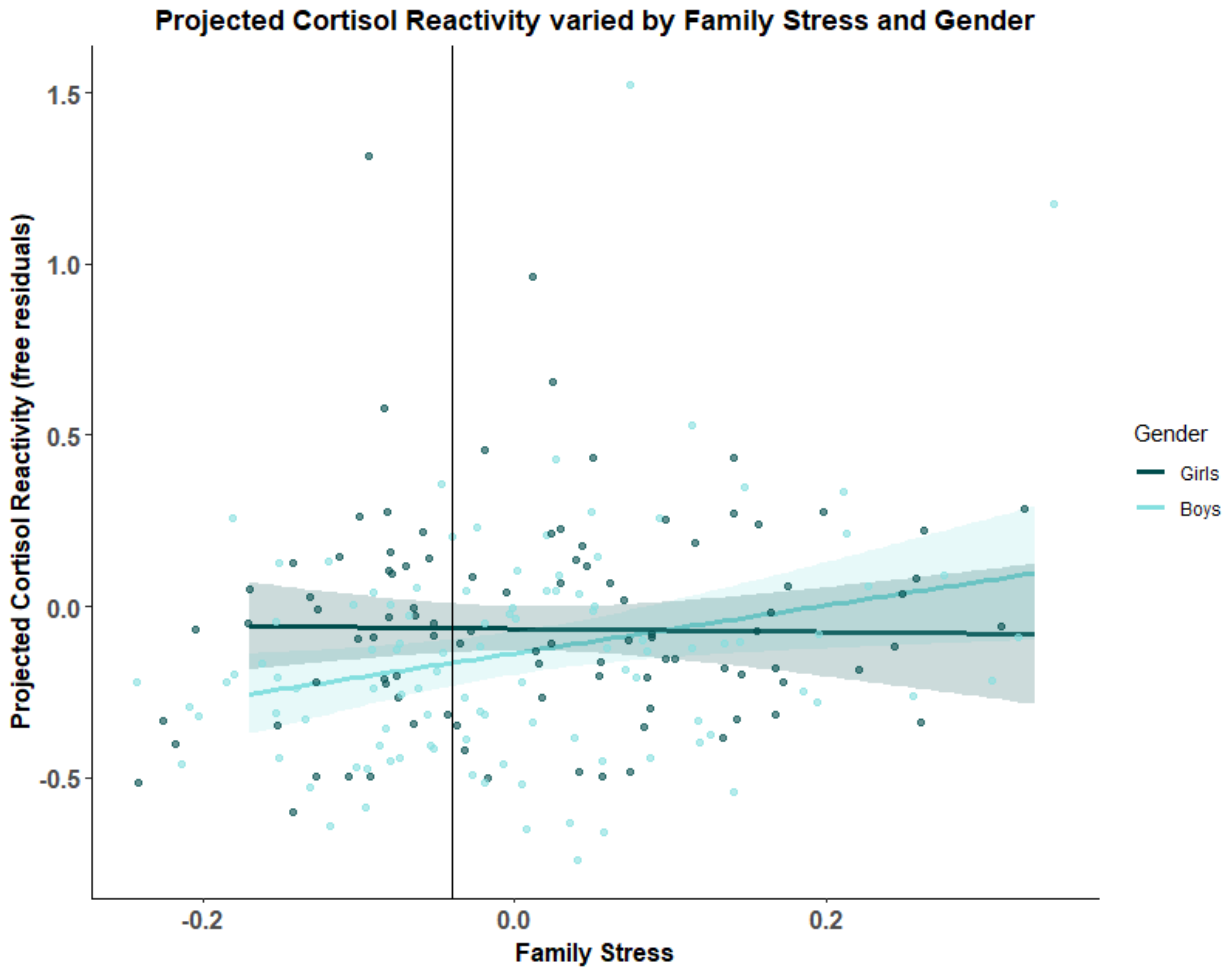
Note. Dashed vertical bars denote trending Regions of significance (RoS), solid vertical lines denote significant RoS; simple slopes are significantly different from each other at values of Family Stress that fall to the left of the lower RoS boundary and to the right of the upper RoS boundaries.

Figure 2.3a. Family Stress interacted with Gender to predict Baseline Cortisol.



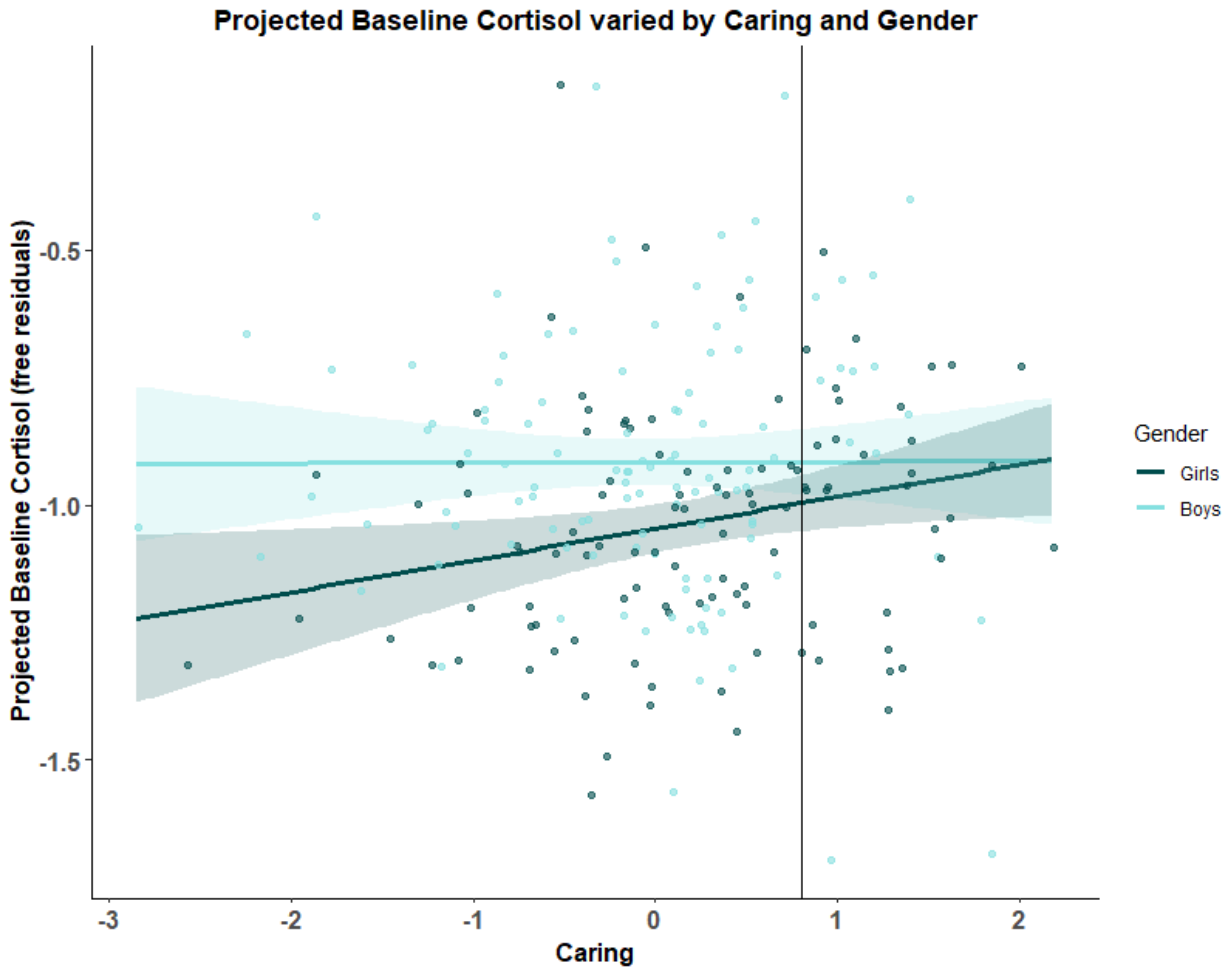
Note. Regions of significance (RoS) denoted by vertical bar; simple slopes are significantly different from each other at values of Family Stress that fall to the left of RoS boundary.

Figure 2.3b. Family Stress interacted with Gender to predict Cortisol Reactivity.



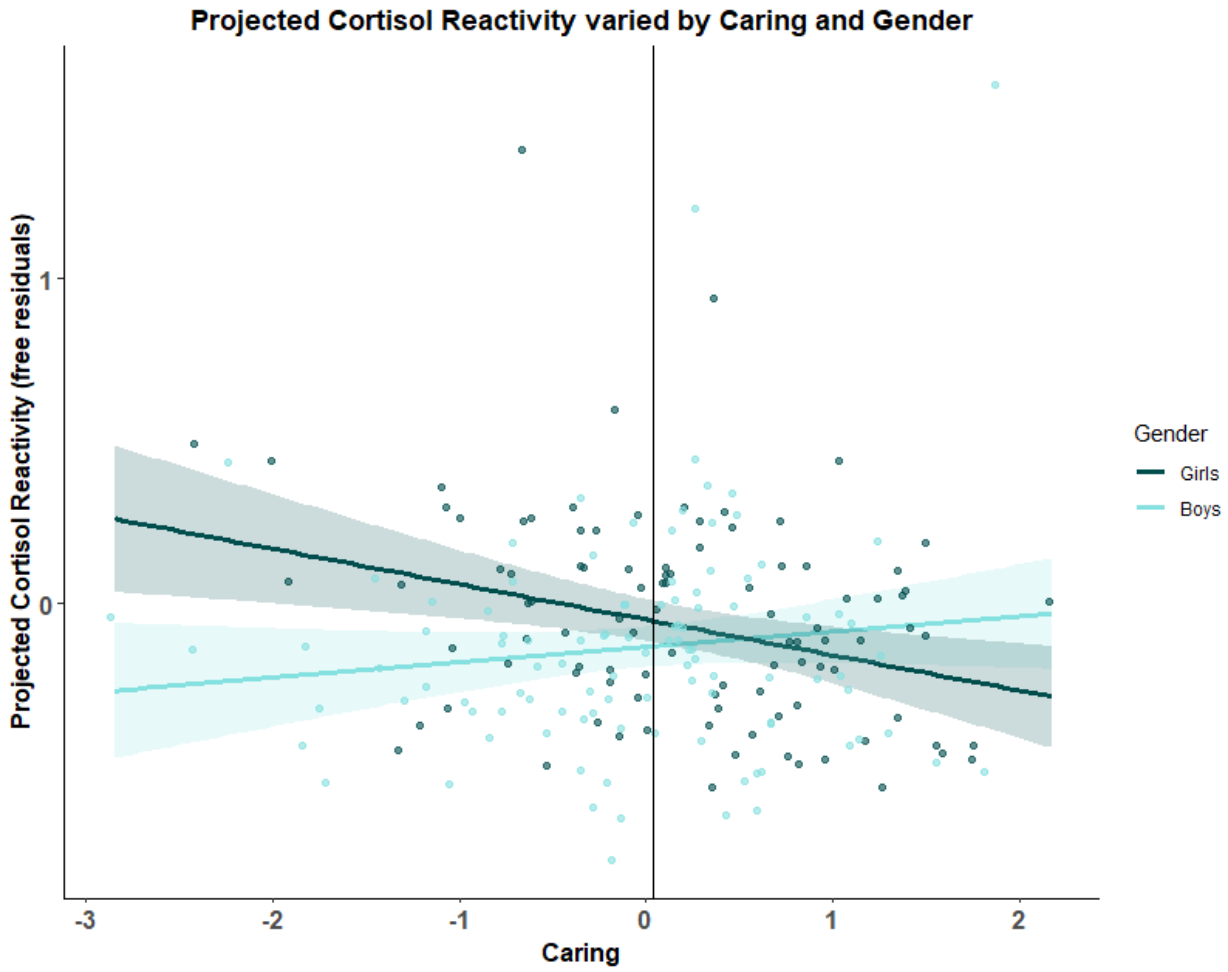
Note. Regions of significance (RoS) denoted by vertical bar; simple slopes are significantly different from each other at values of Family Stress that fall to the left of RoS boundary.

Figure 2.4. Caring interacted with Gender to predict Baseline Cortisol.



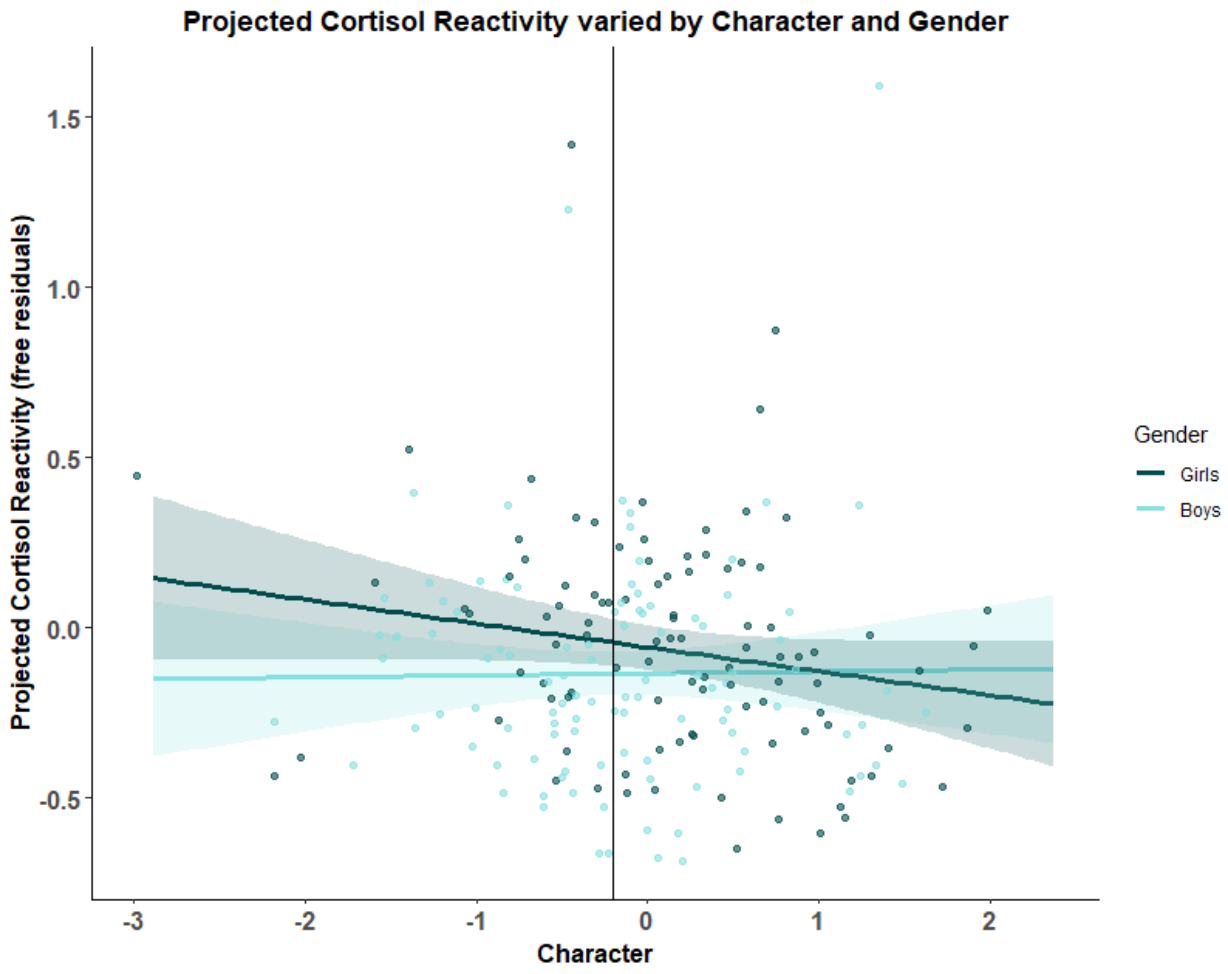
Note. Regions of significance (RoS) denoted by vertical bar; simple slopes are significantly different from each other at values of Caring that fall to the left of RoS boundary.

Figure 2.5a. Gender differences in projected Cortisol Reactivity as a function of Caring.



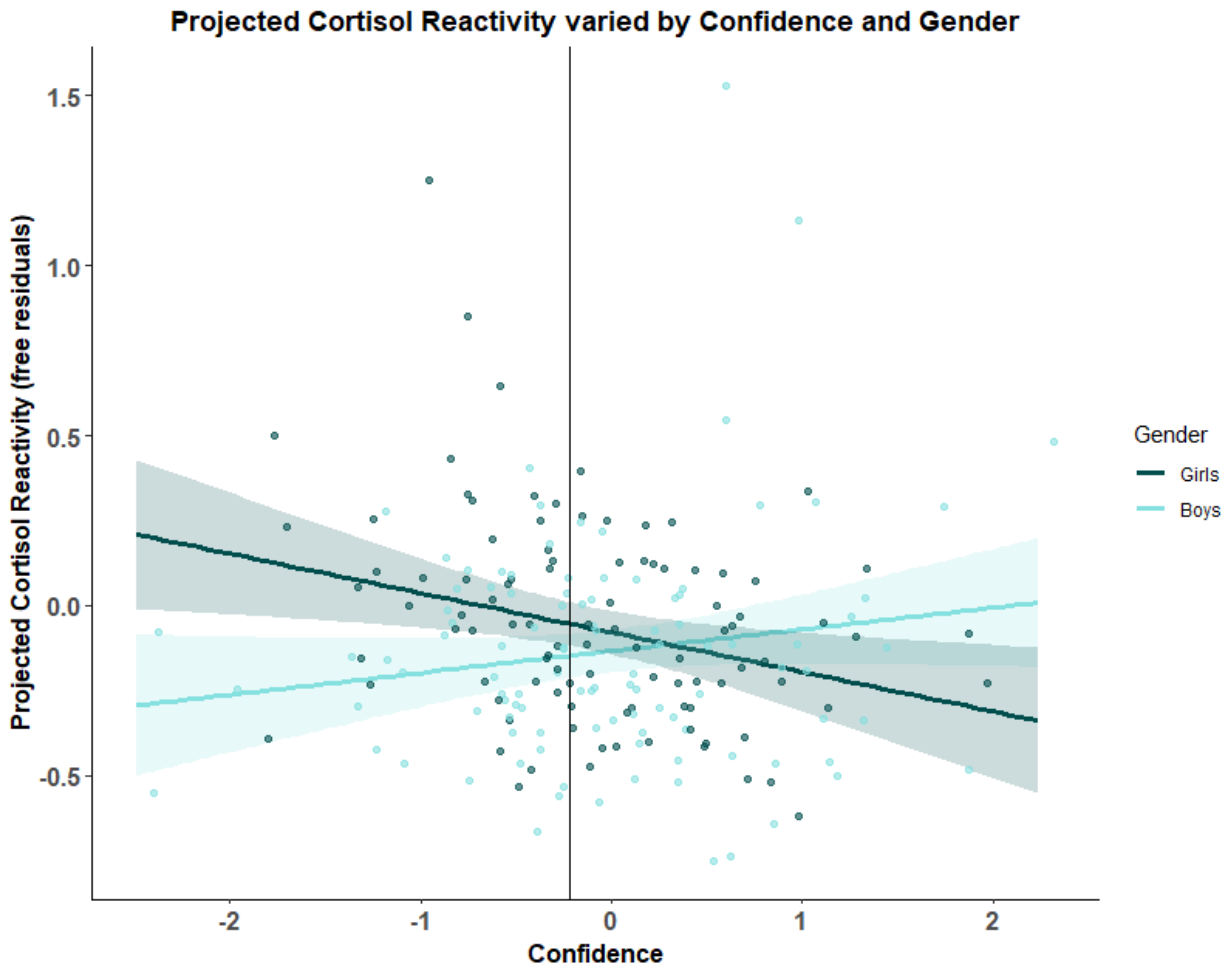
Note. Regions of significance (RoS) denoted by vertical bar; simple slopes are significantly different from each other at values of Caring that fall to the left of RoS boundary.

Figure 2.5b. Gender differences in projected Cortisol Reactivity as a function of Character.



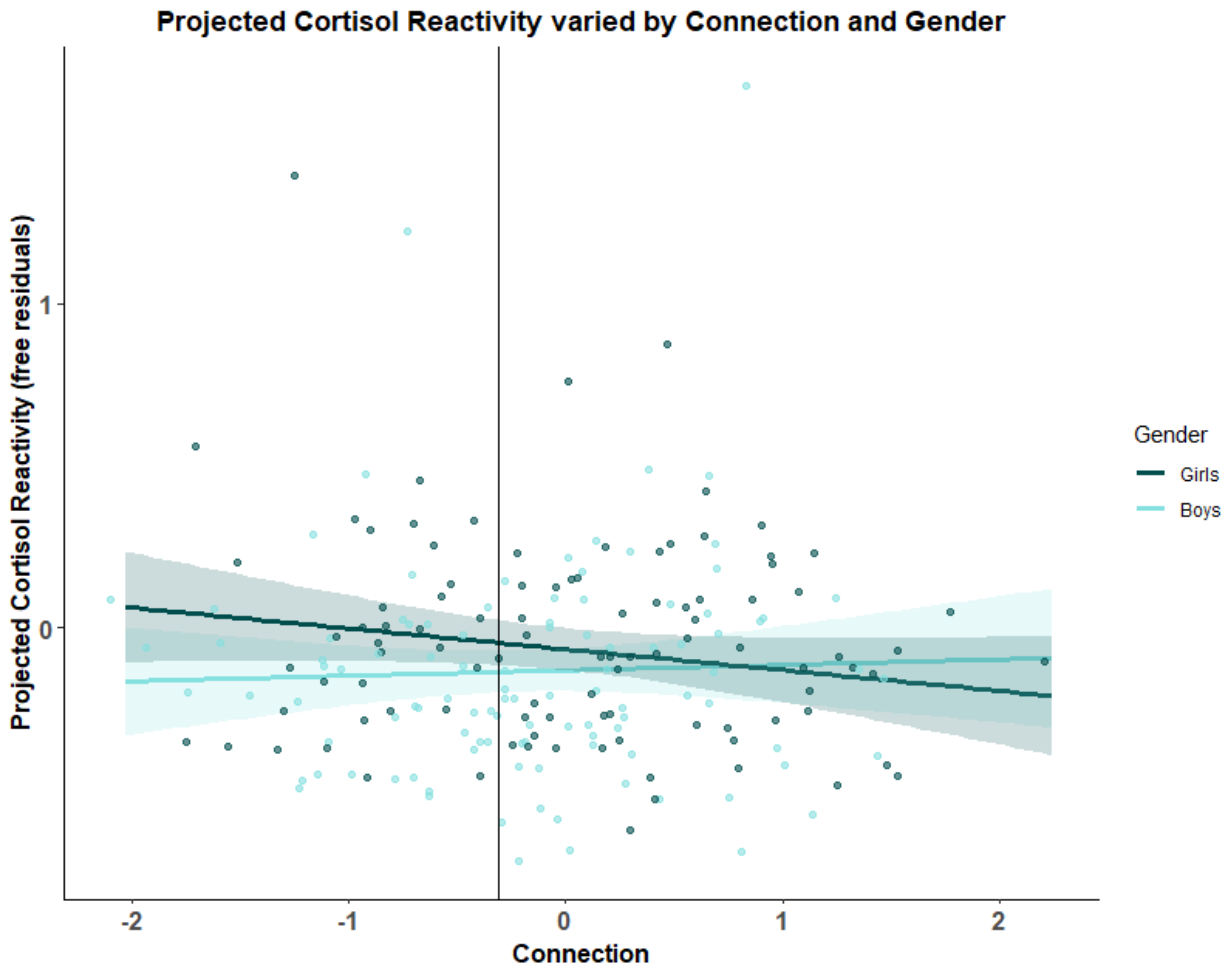
Note. Regions of significance (RoS) denoted by vertical bar; simple slopes are significantly different from each other at values of Character that fall to the left of RoS boundary.

Figure 2.5c. Gender differences in projected Cortisol Reactivity as a function of Confidence.



Note. Regions of significance (RoS) denoted by vertical bar; simple slopes are significantly different from each other at values of Confidence that fall to the left of RoS boundary.

Figure 2.5d. Gender differences in projected Cortisol Reactivity as a function of Connection.



Note. Regions of significance (RoS) denoted by vertical bar; simple slopes are significantly different from each other at values of Connection that fall to the left of RoS boundary.

CHAPTER 4: GENERAL DISCUSSION

During adolescence, youth experience significant psychobiological maturation and shifts in autonomy and connection needs, which create pivotal opportunities for self-discovery and actualization (Crone & Dahl, 2012; Dahl et al., 2018). Although PYD research has shown that adolescent thriving is a normative developmental process that is highly context-dependent (Lerner et al., 2005; Lerner et al., 2011; Wiium & Dimitrova, 2019), there has been limited empirical examination of specific positive trajectories experienced by Latinx youth, particularly those of Mexican origin (Azmitia, 2021; Lerner et al., 2017). Furthermore, interactions between biobehavioral PYD processes and various facets of the sociocultural and familial context within which Latinx youth are embedded have yet to be fully investigated. Given the crucial role culture plays in shaping development and the intrinsic link between psychological and physiological self-regulatory capacities, integrating neurobiological mechanisms within culturally-informed, person-centered studies of PYD is essential for building a nuanced understanding of the various paths youth take when traversing adolescence. In two comprehensive studies, this dissertation investigated multi-level influences of Latinx adolescents' PYD trajectories. In Study 1, I documented the characterization of PYD pathways in Mexican-origin youth using the Five Cs model and provided evidence of cultural orientation acting as a developmental asset leading to improved psychological well-being across mid-adolescence. In Study 2, I investigated the extent to which biobehavioral integration of PYD is evidenced within regulation of the Hypothalamic-Pituitary-Adrenal (HPA) axis and documented gender-specific associations between PYD and psychophysiology differentiated by family relational context. Altogether, the findings of these studies expand our current understanding of Mexican-origin adolescents' thriving by supporting four main conclusions with implications for future research, policy, and PYD program design.

Study 1, Conclusion 1: PYD trajectories displayed by Mexican-origin adolescents adhere to the Five Cs model of PYD.

In Study 1, I evaluated the validity of the Five Cs model of PYD for describing Latinx PYD and documented evidence of the bifactor structure of PYD, which was conceptually replicated using independent measures. These findings confirmed the presence and stability of the Five Cs as key dimensions of PYD for Mexican-origin youth and offer a counterpoint to deficit- and risk-based perspectives focused on problematic outcomes. By documenting robust evidence of the Five Cs and global PYD in a historically under-represented sample, these findings speak to the continued usefulness of the Five Cs theory of PYD as a viable strengths-based approach for investigating healthy and adaptive adolescent development in a variety of diverse populations and settings. Furthermore, confirmation of the bifactor analytic structure of global PYD and the residual Cs modelled with novel measures provides further evidence that the bifactor model is effective for mapping the influence of important developmental predictors onto multiple dimensions of PYD.

Implications and Future Directions

As the field of developmental science increasingly embraces asset-based theory and research, there is a growing need for efforts to conceptually replicate existing theories of positive development within a culturally-informed framework (or, to develop new ones). Evidence of successful conceptual replications such as that described in Study 1 suggests that innovative secondary data analyses of publicly-available datasets or existing longitudinal studies may be leveraged to provide the empirical confirmation needed to enact real change in the lives of American adolescents through social policy and programming. This research can be directly applied in the design and implementation of school-, technology-, or community-based programs

which are uniquely situated to support the holistic well-being of youth coming from historically underserved and marginalized communities.

Given that PYD research utilizing ethnic/racial minoritized samples is still in its infancy, further empirical investigations will be needed to expand on current strengths-based perspectives and address the complex sociocultural and structural-level factors influencing the daily lives of Latinx youth. As PYD research continues to advance the central aim of understanding specific sources of individual variability underlying diverse representations of PYD (Lerner & Bornstein, 2021), future investigations may consider extending the Five Cs model beyond replication in new populations. For example, empirical efforts to incorporate culturally-sensitive and sample-specific indicators within the analytical structure of the Five Cs model itself may gain traction in the next decade of PYD research. This work has the potential to expand our broader understanding of the Five Cs and PYD by offering a more nuanced perspective on what thriving truly means for youth in diverse communities.

Study 1, Conclusion 2: Cultural orientation and its correlate, ethnic identity development, are core developmental assets uniquely supporting PYD trajectories for Latinx youth.

Study 1 further tested whether adolescents' cultural orientation promoted PYD. Indeed, youth who reported a greater sense of ethnic pride and connection to cultural values had greater global PYD at ages 14 and 16, and this association was consistent across adolescent gender and nativity. This study highlighted the specific role of the adolescents' cultural context in promoting PYD. Mexican-origin youth who recognized the value of their cultural heritage and drew on it as a source of strength were more likely to engage positively with others, develop advantageous psychosocial competencies, and experience higher levels of overall well-being. Moreover, youth who highly endorsed familismo and respeto may have used these cultural values as a guiding

framework for appropriate behavior, social boundaries, and interpersonal connections, creating more opportunities for positive interactions and supportive connections within their family and broader community. These findings are aligned with previous research documenting the psychosocial benefits of ethnic/racial identity processes and suggest that all Latinx youth have the ability to manifest psychological benefits by positively internalizing their cultural context as an empowering facet of their identity (Neblett Jr. et al., 2012; Rivas-Drake et al., 2014; Umaña-Taylor et al., 2018). By articulating positive links between ethnic pride, familismo, respeto and global PYD with similar effects displayed by both adolescent girls and boys, Study 1 highlights cultural orientation as a potent promotive factor that PYD programs can leverage to enhance holistic well-being in Latinx youth.

Implications and Future Directions

Given evidence that youth with an achieved ethnic identity appear to use their ethnic pride and its associated improvements to self-esteem as a protective shield in the face of racial discrimination (Rivas-Drake et al., 2014; Umaña-Taylor & Updegraff, 2007; Wakefield & Hudley, 2007), scaffolding positive ethnic identity development in minoritized youth is crucial for bolstering their capacity to cope with systemic racism and inequity and enabling them to thrive. From a developmental-systems perspective, teachers, peer mentors, and other supportive adults within adolescents' physical and virtual community have a specialized capacity to model, scaffold, and encourage the development of a healthy, strong, and empowering connection to one's ethnic and racial community. These practical applications span formal education environments and informal youth development programs which have the infrastructure to convey critical opportunities for identity exploration, personal empowerment, and communal coping and support. Considering the success of previous ethnic-racial identity interventions for enhancing

psychosocial competencies and academic achievements and decreasing symptoms of psychopathology in diverse samples of youth (Umaña-Taylor et al., 2018; Wantchekon & Umaña-Taylor, 2021), PYD programs informed by empirical investigations such as Study 1 may be increasingly impactful for optimizing psychological health during the adolescent transition.

Research programs designed to improve the practical impact of PYD research must consider the unique ecological assets and structural factors that directly or indirectly influence the well-being of historically marginalized youth (Spencer & Spencer, 2014). While our findings indicate that Latinx adolescents' ethnic pride and endorsement of familismo and respeto positively influence their holistic well-being and are uniquely associated with a number of PYD domains, future research is required to illuminate possible mechanisms underlying this process. Previous studies linking biculturalism with favorable adjustment outcomes suggest that individual's proficiency and comfort managing the competing demands of minority and majority cultural contexts may act as another core developmental asset for multicultural youth (Acevedo-Polakovich et al., 2014; Safa & Umaña-Taylor, 2021). Therefore, further empirical efforts measuring the contemporaneous and longitudinal impacts of various bicultural competencies and adaptations on development will greatly enhance the field's comprehension of PYD trajectories from an intersectional perspective.

Study 2, Conclusion 3: The extent to which PYD processes become embedded within adolescents' stress physiology may depend on the quality of their relationships with their parents.

In Study 2, I investigated the extent to which PYD factors moderated the impact of family stress (indexed with mother-, father-, and youth-reports of hostility, conflict, and poor-quality relational dynamics) on adolescents' stress physiology (measured through basal and

reactive adrenocortical functioning). Our findings build on prior evidence that family stress influences the regulation of the HPA axis, with results indicating that the impact of family stress on HPA activity varied according to youth endorsement of the Five Cs. Specifically, moderate family stress exposure predicted elevated cortisol reactivity particularly for youth who reported high levels of Confidence, Connection, and the social domain of Competence. When interpreting these findings, it is important to acknowledge possible qualitative differences in what is considered an expected, healthy, or advantageous adrenocortical response to an acute stressor. Previous analyses of the adolescents in the present sample have documented a general physiological tendency towards hypocortisolism in a stress-adapted pattern that is driven by chronic poverty exposure and aligned with prior empirical work (Johnson et al., 2021). Despite research indicating HPA suppression may be more typical for Latinx youth (DeSantis et al., 2007; Doane et al., 2018; Hostinar et al., 2014; Tackett et al., 2017), trait-like under-arousal generally reflects the emergence of allostatic load processes (Hastings et al., 2023), suggesting that increased cortisol reactivity displayed by these youth is evidence of enhanced physiological flexibility and threat sensitivity. From an adaptation perspective, this intensified state of alertness towards social threats could be functional in the context of environmental threat or uncertainty. This heightened vigilance may aid individuals in evading outcomes that could compromise their well-being, compared to those who exhibit reduced physiological sensitivity under similar conditions. Alternatively, these findings may reflect Confidence, Connection, and to a lesser extent the social component of Competence as protective factors conferring resilience for youth exposed to moderately stressful family contexts, such that highly confident and socially connected adolescents leverage their psychosocial strengths as coping mechanisms when managing social stressors, resulting in a more robust acute cortisol response. Overall, these

findings raise important questions for future research.

Implications and Future Directions

To our knowledge, Study 2 represents the first empirical examination of the extent to which PYD factors may be embedded in adolescents' psychophysiology and whether the neurobiological impact of family relational context varies as a function of PYD. Findings of Study 2 emphasize the protective capacity of the Five Cs for youth faced with stressful family dynamics and establish support for divergent biobehavioral patterns for adolescent girls versus boys both inside and outside the context of family stress. Future research is needed to understand the qualitative impact of various chronic stressors that Latinx youth must manage and consider how multiple stress exposures may interact to mutually influence psychosocial well-being and stress response profiles. Empirical confirmation of the present findings using Latinx and other diverse samples is crucial as this line of inquiry could inform youth programming efforts designed to improve resilience in adolescents exposed to harsh and unsupportive home environments. Furthermore, Study 2 findings highlight gendered variation in the extent to which adolescents' family dynamics and psychosocial functioning impact stress responsivity, thereby emphasizing a need for program designers to carefully consider how gender identity and gender socialization history may impact adolescent resilience.

Study 2, Conclusion 4: Psychological and physiological well-being may be increasingly entwined for adolescent girls and the strength of this integration may have implications for later adjustment outcomes

Findings of Study 2 also suggest that adolescents' endorsement of the Five Cs accounted for further variation in girls' adrenocortical functioning, regardless of their level of family stress exposure. Results indicated that these effects were significant only for girls who endorsed less

prosocial, collaborative tendencies as captured by low Caring and Character and less self-esteem and social support as reflected in low Confidence and Connection. Compared to adolescent boys with comparable scores, girls who reported lower Caring scores evinced reduced basal cortisol in the afternoon and girls who had low endorsement of Caring, Character, Confidence, and Connection showed increased cortisol reactivity. Our basal cortisol findings are aligned with previous studies which consistently suggest that basal cortisol in the afternoon appears to be highest among adolescent girls who display greater prosocial tendencies (Booth et al., 2008; Catherine et al., 2012; Oberle, 2018). With acknowledgement of cross-cultural differences in the expected pattern of acute adrenocortical responses, the significant associations we found among the Five Cs and Latinx girls' adrenocortical regulation may reflect evidence of the Five Cs becoming biologically embedded in functionally adaptive ways for girls in particular. However, it was surprising that greater cortisol reactivity was only displayed by girls who endorsed lower Caring and Confidence (and to a lesser extent Character and Connection). Low scores on the Cs may imply greater trait-like distress in response to social exclusion including a tendency towards rumination which has been linked with augmented acute cortisol reactivity (Vrshek-Schallhorn et al., 2018; Zoccola et al., 2010). Considering these results alongside emerging evidence of differential stress phenotypes, our findings may suggest that, even outside contexts of family stress, girls in this sample with low endorsement of the Five Cs showed a unique profile of stress responses characterized by blunted social-emotional functioning and greater physiological arousal and sensitivity to social exclusion. This stress phenotype aligns with prior work documenting a heightened neurobiological sensitivity to social influence in adolescent girls (Dahl & Gunnar, 2009; Schriber & Guyer, 2016; Stroud et al., 2009) which may have consequences for girls' psychological health and adjustment in the transition to adulthood

(Oldehinkel & Bouma, 2011). However further research is needed to fully parse the manner in which psychological and physiological self-regulation processes are integrated across the lifespan and the extent to which biobehavioral self-regulation confers psychosocial benefits across adolescence.

Implications and Future Directions

Study 2 contributes new evidence of PYD being a component of whole-body well-being for girls in particular, suggesting that the psychophysiological integration of the Five Cs and stress responsivity may be more strongly entwined for girls. Given that the adolescents in this sample show a tendency towards physiological under-arousal in the face of acute social stressors, which is a stress-adapted pattern implicated in allostatic disease processes, these findings may suggest additional gender differences in the calibration of stress response systems with girls possibly retaining more physiological sensitivity and flexibility than boys. For example, it is plausible that girls' HPA axis may be increasingly attuned to social-emotional cues in their environment allowing them to flexibly modulate their adrenocortical arousal in accord with varying levels of social-emotional engagement demands. However, as evidence of this was only displayed by girls with low endorsement of the Five Cs, future studies may expand on whether or not this biopsychosocial stress phenotype is advantageous across various contexts. Additionally, future empirical work should consider testing stress physiology as a partial mediator of the associations between adolescent PYD and later adjustment. By investigating how and in what contexts adolescents' self-regulatory capacities are integrated within and supported by neurobiology, future empirical studies may contribute a deeper understanding of differential trajectories of adolescent thriving across numerous diverse populations and settings.

General Theoretical Implications, Limitations, and Strengths

This program of research was designed to address gaps in the literature on PYD, specifically the lack of attention to the critical role of cultural processes and the need to integrate neurobiological regulation within PYD pathways for youth exposed to stressful family environments. Study 1 emphasized the robust nature of the Five Cs model for articulating PYD in a Latinx sample, and described the promotive power of adolescents' cultural orientation for increasing PYD across mid-adolescence. Study 2 demonstrated the protective capacity of the Five Cs in stressful family contexts and provided novel evidence linking the Five Cs and adrenocortical functioning in adolescent girls, specifically. Synthesizing across the findings of both studies highlights two major theoretical implications that future research can investigate.

First, both studies speak to the statistical and theoretical limitations of the bifactor structure of PYD. In Study 1, we demonstrated that the significant associations between cultural orientation and the six PYD factors (Five Cs and global PYD) that we documented must be interpreted in the context of setting the Five Cs to be orthogonal to global PYD, except for the shared variance in these factors that was directly related to adolescents' cultural orientation. Through that exception, we showed that the orthogonality principle of the bifactor structure can be unintentionally violated when testing the bifactor structure within larger structural equation models, a subtle limitation that future researchers must carefully consider when deciding on an analytic strategy. Findings of Study 2 were consistently significant at the level of the Five Cs rather than the global PYD level. This could suggest that modelling PYD using a hierarchical structure, which would not impose the assumption of orthogonality between the global PYD and residual Cs, possibly would have revealed significant effects at the global PYD level. Furthermore, both studies demonstrate the difficulties of conceptual replications using existing datasets, which are most clearly evident in the weak latent definitions for Competence. In any

case, both studies reiterate the multifaceted nature of PYD and suggest that future investigations may benefit from a more detailed operationalization, as well as corresponding statistical modeling, of thriving as it unfolds in the daily lives of youth.

Second, each of these studies provide valuable insight that cultural neurobiology research can explore further with regards to possible gender and ethnic/racial socialization processes underlying the variation in developmental pathways documented in this dissertation. Findings of Study 1 indicate that PYD and the Five Cs are buttressed by adolescents' endorsement of ethnic pride, familismo, and respeto. Furthermore, Study 2 revealed that Confidence, Connection, and the social domain of Competence moderate the adrenocortical consequences of harsh family relationships. Altogether, this dissertation highlights the capacity of cultural processes to serve both as promotive factors and stress buffers in Latinx youth. Familismo, as a value system characterized by a sensitivity to and prioritization of the family and its needs, has been noted as a resilience factor protecting adolescents following social threats such as discrimination (Germán et al., 2009; Morgan Consoli & Llamas, 2013; Neblett Jr. et al., 2012; Rivas-Drake et al., 2014). This aligns with theoretical work by Campos and colleagues (2018) who proposed that the interdependent construal of the self as documented by Latinx youth who strongly endorse familismo has biological implications, such that familismo may confer stress buffering effects specifically in the context of high family support. Taken together, this work suggests that cultural processes may contribute to individual differences in how adolescents respond to and cope with stressors (Santiago et al., 2016), leading to subsequent variability in how youth internalize and attribute meaning to prior stressful life events. With recognition that this is a Latinx sample of predominantly first- and second-generation parents, it is possible that the Latinx values of familismo, in addition to marianismo, machismo, and respeto, may result in different

socialization pressures on daughters compared to sons (Umaña-Taylor et al., 2009). This may explain some of the gender differences found in Study 2. Furthermore, in light of prior evidence that gender differentiates self-construals (Cross & Madson, 1997) and the extent to which facets of cultural orientation confer long-term psychological benefits (Fuligni & Pedersen, 2002), additional research is needed to better understand how gender-identity establishes personal contexts for positive developmental trajectories.

Despite their contributions to the field, several limitations should be considered when interpreting the findings discussed in this dissertation. Both Study 1 and Study 2 used a sample that entirely consisted of Mexican-origin youth coming from lower socioeconomic backgrounds in California. Given the significant within-group diversity of the Latinx community in the United States and abroad, we cannot assume generalizability of any one specific finding presented within this dissertation. Therefore, replication in other Latinx communities, as well as other diverse samples, is essential. Both studies also utilized a secondary data analysis approach to measuring the Five Cs and PYD using questionnaire assessments completed as part of the CFP, a study which was not originally designed to test the Five Cs model of PYD. Although the full set of adolescent questionnaires included many self-report measures of social-emotional competencies and behavioral adjustment that conceptually paralleled the domains of well-being making up the Five Cs, our latent definitions of the PYD factors were constrained to the available data. This may reduce the generalizability of the present findings, particularly with regard to the Competence factor which was poorly defined at age 16. Future efforts to replicate the Five Cs model of PYD using independent measures should be mindful of the many sub-domains included within some of the Cs (i.e., Competence and Connection) to increase the likelihood of replication of the theoretical findings, in general, and the findings of the present

studies, in particular.

Furthermore, both Study 1 and Study 2 utilized just two measurement occasions limiting generalizations to the mid-adolescent period. Addressing this limitation will be important for future research given that these findings represent a small snapshot of a larger developmental cascade unfolding from late childhood to early adulthood. To fully understand the extent to which stress physiology may underlie PYD trajectories, it is essential to incorporate multiple neurobiological assessments collected in tandem with PYD at various time points across the adolescent transition and beyond. Efforts to replicate the current findings and address these limitations will provide a more comprehensive understanding of how PYD processes are supported by physiological self-regulation and how this psychophysiological integration may be optimized within certain sociocultural and familial contexts for Latinx youth.

These limitations are balanced by certain strengths in the design of Study 1 and Study 2 that speak to the value of the present findings with regards to replicability efforts within psychological science and the increasing need in developmental research for empirical examinations that integrate across multiple developmental systems, respectively. In Study 1, the conceptual replication of the Five Cs model of PYD in a sample of Mexican-origin adolescents contributes to broader replicability efforts and diversity, equity, and inclusion initiatives within developmental science. Additionally, the central aim of Study 1 to identify the unique cultural strengths that youth coming from minoritized communities utilize in manifesting PYD outcomes for themselves is directly aligned with the increasing prioritization of cross-cultural examinations within PYD research. The findings of Study 1 represent a step forward in this respect, as results contribute additional nuance to our understanding of the specific strengths underscoring adolescents' capacity to flourish within diverse populations and multicultural contexts. The

findings of Study 2 offer significant contributions to the field of PYD by contextualizing PYD trajectories within parent-adolescent relational dynamics and adolescents' peripheral stress physiology. This work demonstrates that integrating neurobiological regulation within PYD pathways may critically inform the extent to which PYD may be biologically embedded within stress physiology and how this process may be functionally adaptive for youth exposed to varying levels of family risk.

Conclusions

By taking an integrative approach to explicating commonalities and specificities of Latinx PYD, findings of this dissertation reflect an expanding understanding of PYD that is culturally-sensitive and neurobiologically-informed. Study 1 provides robust evidence of the validity and reliability of the Five Cs model of PYD statistically and in translation to an underrepresented sample of Latinx youth of Mexican origin. We identified cultural orientation as an important developmental asset uniquely strengthening PYD across mid-adolescence, highlighting the importance of encouraging Latinx youth to take pride in their ethnic/racial identity and to derive a sense of meaning and empowerment from their cultural values for promoting holistic well-being and its various psychosocial dimensions. Study 2 integrated Latinx PYD processes within family relational dynamics and adolescents' regulation of stress physiology and tested PYD factors as possible moderators of the adrenocortical consequences of adverse family relationships. We provide novel evidence of variable associations between family stress exposure and adrenocortical functioning in accordance with endorsement of the Five Cs and emphasize the protective nature of self-confidence and social connectedness, in particular. Findings also suggest that the integration of psychological and physiological well-being may be more synchronized in adolescent girls than boys. Altogether, this dissertation contributes to the

science of adolescence by advancing a multisystem characterization of various PYD trajectories and resilience processes unfolding across adolescence for Latinx youth. By exploring the extent to which sociocultural processes shape Latinx PYD and psychobiological functioning in unique ways, these findings have theoretical and practical implications for future research, social policy, and PYD programming efforts designed to understand and support the holistic well-being of youth coming from historically marginalized communities.

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STUDY 1 SUPPLEMENTAL MATERIALS

Internal consistency of the psychometric tools used to operationalize Positive Youth Development (PYD) in the present study as it compares to prior work

The internal consistency of Caring items, measured with the WADJ (Weinberger & Schwartz, 1990), was comparable to that reported by Weinberger and Schwartz (1990), in a sample that was 16-18% ethnic minority, and by Farrell and Sullivan (2000), in a sample ofAfrican American adolescents. Similarly, the internal consistency of the BFI (John et al., 2008), used to measure Social Conscience, was comparable to the Spanish undergraduate and bilingual Hispanic samples (50% Mexican, 3% Peruvian, 2% Chilean, 2% Panamanian, 2% Argentinian, 1% Cuban, 1% Puerto Rican, 1% other) tested by Benet-Martinez and John (1998). Two large reviews of adolescent self-esteem and self-concept measures reported high internal consistency of both the SDQ (Marsh et al., 2005) and ROSE (Rosenberg, 1965) scales in diverse, non-white samples (Donnellan et al., 2015; Orth et al., 2018). Our study used various subscales of the SDQ as manifest indicators of Character, Competence, and Confidence, while the ROSE contributed to Confidence. The internal consistency of the SDQ and ROSE reported by Donnellan et al., (2015), and Orth et al., (2018) were comparable to those computed with our sample. Likewise, the internal consistency of the Parent and Peer Connection items taken from the MSPS (Zimet et al., 1998) in our sample were comparable to the coefficients reported in a study of predominantly African American adolescents (Canty-Mitchell & Zimet, 2000). Finally, our measure of School Connection (Child-Teacher Attachment) was developed specifically for the CFP study based on the Inventory of Parent and Peer Attachment (Armsden & Greenberg, 1987). The internal consistency reported for the current study is as high as that reported by Murray and Zvoch (2011), who used a similar teacher-focused adaption of the IPPA in a sample

of African American youth.

Analytic strategy for testing measurement invariance of the Positive Youth Development (PYD) bifactor model

The configural invariance model was constructed by combining data from the two assessments into one longitudinal model depicting the same bifactor structure at each time point. This model specified autocovariances between the residual errors of like manifest variables across the two measurement occasions to account for the unique measurement variance of each manifest variable that was correlated over time. The configural invariance model tests whether the same pattern of fixed and free factor loadings was specified for each measurement occasion. For each time point, the factor loadings, covariances, and means were allowed to freely vary. A well-fitting configural model suggests that a similar measurement model is plausible across our two study time points. In other words, this suggests that the relations or associations between our observed indicators and their corresponding latent constructs are similar across ages 14 and 16. Establishing configural invariance confirms that the bifactor structure sufficiently represented adolescents' endorsement of the Cs and PYD across time.

After establishing longitudinal configural invariance of the bifactor model, we tested longitudinal metric invariance using a two-step process. We first constrained the factor loadings of all like manifest indicators on their respective Cs to be equal (e.g., the factor loading of Grades on Competence were set to be equal across time). This step tests whether each observed indicator loads onto their respective C at a similar level across time. We then constrained corresponding factor loadings onto the global PYD factor to be equal across both ages (e.g., the factor loading of Grades on PYD were set to be equal across time). Establishing longitudinal metric invariance confirms that each observed indicator contributes to its respective latent C

construct, as well as the global PYD construct, at the same level across time.

Next, we tested scalar invariance by constraining corresponding manifest intercepts to be equal across time (e.g., the manifest intercept of Grades at age 14 was set to be equal to the manifest intercept of Grades at age 16). Establishing scalar invariance implies stability of like manifest intercepts over time and therefore allows for the comparison of the means, variances, and correlations among the global PYD construct and individual Cs across time.

Post-hoc tests of structural variance at the latent variance level

Results of the scalar invariance model indicated that compared to the age 14 PYD constructs, all age 16 latent factors demonstrated significant variances, suggesting increased structural variability over time. To probe further, we compared the scalar model to a fifth bifactor structure that re-constrained the age 16 factor variances to 1, thereby testing structural invariance of the bifactor model at the factor variance level. A model fit comparison test indicated that the added constraints did not significantly worsen fit when this model was compared to the scalar structure (ΔCFI = -0.003) and the configural structure (ΔCFI = -0.007). Despite this technical confirmation of structural invariance, in alignment with study hypotheses, we retained the scalar structure of the bifactor for the remaining analyses.

Table S1.1. Descriptive statistics of manifest items and item composites chosen to operationalize the Five Cs and Cultural Orientation.

Latent Construct	Current Study Operationalization	Age 14				Age 16			
		N	*M*	*SD*	Range	N	*M*	*SD*	Range
Caring	Caring 1	604	3.01	1.06	1-5	599	3.50	1.03	1-5
	Caring 2	604	3.38	1.13	1-5	600	3.44	1.04	1-5
	Caring 3	604	3.32	1.04	1-5	599	3.27	1.04	1-5
	Caring 4	604	3.88	1.04	1-5	598	3.71	1.07	1-5
	Caring 5	602	3.70	0.98	1-5	599	3.58	1.05	1-5
	Caring 6	603	3.77	0.99	1-5	600	3.65	1.04	1-5
Character	Social Conscience	604	3.05	0.34	1.78-4	600	3.01	0.32	1.78-4
	Personal Values	604	3.36	0.43	1.67-4	600	3.40	0.42	1.50-4
Competence	Same-sex Popularity	604	3.30	0.50	1-4	600	3.27	0.47	1.40-4
	Opposite-sex Popularity	604	3.34	0.51	1-4	600	3.30	0.47	1.75-4
	Grades	590	3.88	0.90	1-5	574	3.86	0.80	1-5
	Scholastic Competence	604	2.99	0.58	1-4	598	2.90	0.57	1.25-4
Confidence	Self-Worth	604	3.18	0.48	1.50-4	600	3.14	0.46	1.50-4
	Physical Appearance	595	2.39	0.67	1-4	593	2.37	0.65	1-4
	Positive Identity	604	3.13	0.42	1.70-4	600	3.11	0.43	1.40-4
Connection	Family	604	3.01	0.68	1-4	600	2.80	0.69	1-4
	Peers	604	3.22	0.72	1-4	600	3.11	0.72	1-4
	School	602	2.48	0.80	1-4	586	2.43	0.77	1-4
Cultural Orientation	Ethnic Pride	605	3.39	0.50	1.38-4	-	-	-	-
	Familismo 1	605	3.34	0.40	2-4	-	-	-	-
	Familismo 2	604	3.52	0.36	1.88-4	-	-	-	-
	Respeto	604	3.42	0.41	1.88-4	-	-	-	-

Table S1.2. Standardized factor loadings of the Positive Youth Development (PYD) bifactor structure as modelled separately at ages 14 and 16.

	Age 14				Age 16			
	Target C	*p*	PYD	*p*	Target C	*p*	PYD	*p*
Caring								
Caring 1	0.325	0.000	0.286	0.000	0.431	0.000	0.261	0.000
Caring 2	0.482	0.000	0.317	0.000	0.550	0.000	0.349	0.000
Caring 3	0.615	0.000	0.246	0.000	0.600	0.000	0.385	0.000
Caring 4	0.707	0.000	0.208	0.000	0.719	0.000	0.236	0.000
Caring 5	0.742	0.000	0.263	0.000	0.784	0.000	0.283	0.000
Caring 6	0.717	0.000	0.248	0.000	0.745	0.000	0.258	0.002
Character								
Social Conscience	0.598	0.000	0.422	0.000	0.726	0.000	0.354	0.035
Personal Values	0.484	0.000	0.431	0.000	0.463	0.000	0.413	0.001
Competence								
Same-Sex Popularity	-0.044	0.627	0.725	0.000	-0.548	0.071	0.443	0.073
Opposite-Sex Popularity	-0.083	0.221	0.55	0.000	-0.419	0.003	0.346	0.072
Grades	0.516	0.000	0.248	0.009	0.125	0.654	0.548	0.000
Scholastic Competence	0.939	0.000	0.488	0.000	0.123	0.786	0.934	0.000
Confidence								
Self-Worth	0.818	0.000	0.592	0.000	0.537	0.000	0.661	0.000
Physical Appearance	0.330	0.000	0.394	0.000	0.479	0.000	0.332	0.000
Positive Identity	0.380	0.002	0.654	0.000	0.662	0.000	0.488	0.004
Connection								
Family	0.652	0.000	0.478	0.000	0.678	0.000	0.355	0.029
Peers	0.479	0.000	0.439	0.000	0.586	0.000	0.339	0.031
School	0.550	0.000	0.319	0.000	0.480	0.000	0.382	0.000

Note. “Target C” refers to the residual C for a specific manifest indicator (i.e., Target C for Self-Worth refers to Confidence).

Table S1.3. Fit indices and fit change for measurement models 1 through 4.

	χ^2	*df*	*p*	$\Delta\chi^2$	Δdf	**RMSEA [90% CI]**	*CFI*	*ΔCFI*	**Pass?**
Model 1: Correlated errors of same-items	812.41	493	0.000	---	---	0.033 [.029, .037]	0.966	---	---
Model 2: Individual C loading invariant	816.73	506	0.000	4.32	13	0.033 [.028, .037]	0.967	0.001	Yes
Model 3: General PYD loading invariant	831.67	523	0.000	14.93	17	0.032 [.028, .036]	0.967	0.000	Yes
Model 4: Manifest intercept invariant	886.32	535	0.000	54.65	12	0.034 [.030, .038]	0.962	-0.005	Yes

Table S1.4. Model fit and parameter estimates for target regressions moderated by gender and nativity.

	PYD (14)				PYD (16)			
	B	*SE*	*p*	95% CI	*B*	*SE*	*p*	95% CI
Cultural Orientation (14)	0.448	0.086	0.000	0.280, 0.616	0.358	0.083	0.000	0.196, 0.521
Gender	-0.055	0.066	0.404	-0.185, 0.075	0.024	0.065	0.714	-0.104, 0.152
Nativity Status	0.065	0.073	0.376	-0.079, 0.208	0.051	0.073	0.486	-0.092, 0.194
Gender Interaction	-0.056	0.085	0.508	-0.222, 0.110	0.054	0.092	0.559	-0.127, 0.234
Nativity Interaction	0.154	0.095	0.105	-0.032, 0.340	-0.006	0.098	0.955	-0.198, 0.187
Model Fit Statistics: $\chi 2(6) = 12.75$, $p = 0.047$; *CFI* = 0.997; *RMSEA* = 0.038 [0.000, 0.067]								

STUDY 2 SUPPLEMENTAL MATERIALS

Family Stress Preliminary Analyses: Correlations and Fit Comparison of Single, Triple, and Hierarchical Factor Structures

To determine the appropriate approach to structuring a latent model depicting adolescents' exposure to Family Stress (FS), we conducted a two-step preliminary analysis. In step 1, we examined patterns of significant relations between conflict, hostility, and negative relationship quality within mother-adolescent and father-adolescent dyads using bivariate correlations. Bivariate correlations are displayed in *Table S2.2*. All reports of conflict and hostility were significantly and positively correlated with each other, demonstrating a robust pattern of co-occurrence (within-dyad *rs* = .15–.76; between-dyad *rs.* = .11–.44). Despite some associations between reports of negative relationship quality and the other FS domains not quite reaching significance, correlations revealed a similarly consistent pattern of poor relationship quality being associated with greater conflict (within-dyad *rs* = .11–.33; between-dyad *rs.* = .12–.28) and greater hostility (within-dyad *rs* = .11–.42; between-dyad *rs* = .16–.27). Within each FS domain, correlations between child- and parent-reports were all significant and positive with coefficients that ranged from .13 to .64.

In step 2, we conducted a model comparison testing the fit of a single-factor solution in which all FS indices loaded on a latent construct representing overall FS exposure against a triple-factor solution that separated manifest items by FS domains and a hierarchical solution that specified three lower-order factors for the 3 FS domains loading onto a superordinate latent factor. Residual covariances among like reporters were specified in all three models to account for reporter-specific method variance. Covariances among latent FS domains were additionally specified in the triple-factor solution. Latent factors were scaled using the fixed marker method

which restricts the first manifest indicator of each latent factor to 1. All three models demonstrated acceptable model fit, and the triple-factor and hierarchical solutions fit the data equally and demonstrating better fit ($\chi^2(52) = 203.65$, $p = .000$, *CFI* = .946, *RMSEA* = .069 [.059, .079]) compared to the single-factor solution ($\chi^2(54) = 271.75$, $p = .000$, *CFI* = .925, *RMSEA* = .080 [.071, .090]). To confirm the best fitting model, we conducted a chi-square difference test and assessed adequate fit via change in the Confirmatory Factor Index (CFI; Bentler, 1990) of less than or equal to .01 (Cheung & Rensvold, 2002). The fit comparison test (provided in *Table S2.3*) indicated the triple-factor and hierarchical solutions had better fit than the single-factor model. Given that the domain-specific approach and the hierarchical model did not differ in fit and bivariate correlations demonstrated significant and theoretically-meaningful patterns of FS domain relations, the hierarchical solution was retained. Standardized factor loadings of the FS hierarchical model are provided in *Table S2.4*.

PYD Preliminary Analyses: Manifest Correlations and Model Specifications of the Bifactor Model

As detailed in Johnson et al., (in press), the bifactor model of PYD was structured such that all manifest indicators loaded onto a latent factor depicting global PYD and a residual factor representing that variable's respective C. While the residual Cs were allowed to freely covary, the global PYD factor was set as orthogonal to the Cs as the bifactor structure allows multiple sources of true score variance to be accounted for. Thus, the variance within the residual Cs reflects the variance of the manifest variables that is remaining after accounting for the variance attributed to the overarching PYD factor. One residual covariance was also specified between two manifest items loading onto Caring as these items shared method variance not accounted for by the bifactor model structure. The bifactor structure modeled at age 16 produced excellent

model fit ($\chi^2(106) = 231.97$, $p = .000$, *CFI* = .967, *RMSEA* = .046 [.038, .054]). Standardized factor loadings, displayed in *Table S2.5*, indicated that all manifest variables significantly and positively contributed to their respective latent C and to the global PYD construct, with the exception of our manifest indicators for Competence. Although Same-sex and Opposite-sex Popularity marginally contributed to the global PYD construct with positive loadings ($p < .08$), these indicators produced negative loadings within the Competence factor structure, whereas Grades and Scholastic Competence produced significant positive loadings for global PYD but did not load onto Competence itself. This split in loading valence indicates that the residual Competence factor is composed of both positive and negative dimensions that may fluctuate in importance depending on whether the factor score increases or decreases over time. Since we only modeled PYD at one time-point in this study, Competence at age 16 was restricted to Social Acceptance only as these were the only indicators with significant loadings.

Table S2.1. Summary and descriptive information of manifest independent variables.

			Descriptive Information				
Family Stress Domain	**Rater**	**Dyad**	***N***	***M***	***SD***	**Min**	**Max**
Conflict	Child	Mother-Child	598	1.66	0.44	1	3.80
	Child	Father-Child	529	1.56	0.49	1	4
	Mother	Mother-Child	586	1.52	0.35	1	2.90
	Mother	Father-Child	502	1.52	0.45	1	4
	Father	Father-Child	371	1.37	0.38	1	3.70
	Father	Mother-Child	365	1.44	0.41	1	3.60
Hostility	Child	Mother-Child	598	1.53	0.39	1	3.31
	Child	Father-Child	529	1.47	0.43	1	3.46
	Mother	Father-Child	504	1.48	0.33	1	3.08
	Father	Mother-Child	364	1.55	0.29	1	2.77
Negative Relationship Quality	Child	Mother-Child	598	2.14	0.57	1	4
	Child	Father-Child	534	2.43	0.64	1	4
	Mother	Mother-Child	586	1.78	0.41	1	3
	Father	Father-Child	371	1.85	0.42	1	3.25
Positive Youth Development Domain	**Manifest Variable**		***N***	***M***	***SD***	**Min**	**Max**
Caring	Caring 1		599	3.50	1.03	1	5
	Caring 2		600	3.44	1.04	1	5
	Caring 3		599	3.27	1.04	1	5
	Caring 4		598	3.71	1.07	1	5
	Caring 5		599	3.58	1.05	1	5
	Caring 6		600	3.65	1.04	1	5
Character	Social Conscience		600	3.01	0.32	1.78	4
	Personal Values		600	3.40	0.42	1.50	4
Competence	Social Competence 1		600	3.27	0.47	1.40	4
	Social Competence 2		600	3.30	0.47	1.75	4
	Grades		574	3.86	0.80	1	5
	Scholastic Competence		598	2.90	0.57	1.25	4
Confidence	Self-Worth		600	3.14	0.46	1.50	4
	Physical Appearance		593	2.37	0.65	1	4
	Positive Identity		600	3.11	0.43	1.40	4
Connection	Family network		600	2.80	0.69	1	4
	Peer network		600	3.11	0.72	1	4
	School network		586	2.43	0.77	1	4

Table S2.2. Bivariate correlations among manifest Family Stress indicators.

	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Mother-Child Hostility (CR)	--												
2. Father-Child Hostility (CR)	.50***	--											
3. Father-Child Hostility (MR)	.14**	.39***	--										
4. Mother-Child Hostility (FR)	.24***	.13*	.18***	--									
5. Mother-Child Conflict (CR)	.71***	.38***	.11*	.21***	--								
6. Father-Child Conflict (CR)	.44***	.76***	.36***	.16**	.50***	--							
7. Mother-Child Conflict (MR)	.26***	.12**	.35***	.15**	.35***	.21***	--						
8. Father-Child Conflict (MR)	.14**	.34***	.69***	.16**	.17***	.41***	0.53***	--					
9. Father-Child Conflict (FR)	.18***	.22***	.30***	.36***	.23***	.28***	.28***	.44***	--				
10. Mother-Child Conflict (FR)	.23***	.14**	.18***	.51***	.28***	.20***	.34***	.32***	.64***	--			
11. Mother-Child Negative RQ (CR)	.42***	.16***	-0.03	.13*	.32***	0.07	.10**	0.03	0.06	.13*	--		
12. Father-Child Negative RQ (CR)	.27***	.39***	.11*	0.04	.22***	.32***	.16***	.18***	0.08	.09^{t}	.54***	--	
13. Mother-Child Negative RQ (MR)	.20***	.08^{t}	.21***	.11*	.20***	.12**	.28***	.22***	0.09^{t}	.11*	.31***	.26***	--
14. Father-Child Negative RQ (FR)	.21***	.23***	.23***	.18***	.18***	.22***	.13*	.25***	.33***	.28***	.22***	.32***	.26***

Note. CR, MR, and FR refer to child-report, mother-report, and father-report, respectively.

Table S2.3. Fit comparison test of latent structures depicting Family Stress.

Family Stress Latent Structures	χ^2	***df***	***p***	$\Delta\chi^2$	Δdf	**RMSEA [90% CI]**	***CFI***	ΔCFI
Single-factor solution	241.75	54	0.000	---	---	0.080 [.071, .090]	0.925	---
Triple-factor solution	203.65	52	0.000	-38.10	-2	0.069 [.059, .079]	0.946	0.021
Hierarchical solution	203.65	52	0.000	0.00	0	0.069 [.059, .079]	0.946	0.000

Table S2.4. Standardized loadings produced by the Family Stress hierarchical model.

Latent Factor	Rater	Dyad	Loading	*p*
Hostility	Child	Mother-Child	0.410	–
	Child	Father-Child	0.495	0.005
	Mother	Father-Child	0.601	0.040
	Father	Mother-Child	0.335	0.000
Conflict	Child	Mother-Child	0.433	–
	Child	Father-Child	0.502	0.002
	Mother	Mother-Child	0.561	0.000
	Mother	Father-Child	0.700	0.013
	Father	Father-Child	0.601	0.001
	Father	Mother-Child	0.518	0.000
Negative Relationship Quality	Child	Mother-Child	0.387	–
	Child	Father-Child	0.504	0.000
	Mother	Mother-Child	0.540	0.000
	Father	Father-Child	0.603	0.004
Family Stress		Hostility	1.000	0.903
		Conflict	1.215	0.922
		Neg RQ	0.854	0.563

Note. Neg RQ stands for Negative Relationship Quality.

Table S2.5. Standardized loadings produced by the bifactor model of Positive Youth Development (PYD).

The Five Cs	Manifest Indicator	Target C	*p*	PYD	*p*
Caring	Caring 1	0.431	0.000	0.261	0.000
	Caring 2	0.550	0.000	0.349	0.000
	Caring 3	0.600	0.000	0.385	0.000
	Caring 4	0.719	0.000	0.236	0.000
	Caring 5	0.784	0.000	0.283	0.000
	Caring 6	0.745	0.000	0.258	0.002
Character	Social Conscience	0.726	0.000	0.354	0.035
	Personal Values	0.463	0.000	0.413	0.001
Competence	Same-Sex Popularity	-0.548	0.071	0.443	0.073
	Opposite-Sex Popularity	-0.419	0.003	0.346	0.072
	Grades	0.125	0.654	0.548	0.000
	Scholastic Competence	0.123	0.786	0.934	0.000
Confidence	Self-Worth	0.537	0.000	0.661	0.000
	Physical Appearance	0.479	0.000	0.332	0.000
	Positive Identity	0.662	0.000	0.488	0.004
Connection	Family	0.678	0.000	0.355	0.029
	Peers	0.586	0.000	0.339	0.031
	School	0.480	0.000	0.382	0.000

Note. "Target C" refers to the residual C for a specific manifest indicator (i.e., Target C for Self-Worth refers to Confidence).