Environmental Risks, Hypothalamic-pituitary-adrenal Axis, and Mental Health

Symptomatology in Mexican American Youth: A Two-study Approach

by

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ABSTRACT

In this dissertation Mexican American (MA) youths environmental risk contexts, HPA axis functioning and mental health symptomatology were investigated in two separate studies. In the first study, environmental risk contexts were examined utilizing a person-centered approach and focusing on MA adolescents' family, peer, and cultural risk factors in fifth grade ($N = 750$). Environmental contexts were then linked to mental health symptomatology in seventh grade. Results revealed three distinct environmental contexts: *Low risk, Moderate risk-language*, and *High risk-peer*. Youth in the *High-risk peer* context reported the highest levels of symptomatology; greater major depressive disorder (MDD), anxiety, conduct disorder (CD)/oppositional defiant disorder (ODD), and attention deficit hyperactive disorder (ADHD) symptoms than youth experiencing *Low risk* or *Moderate risk-language* context. Females, in particular, experiencing the *High risk peer context* appeared at greatest risk for MDD symptoms. Finally, adolescents in the *Moderate risk-language* context displayed similar levels of symptoms to the individuals in the *Low risk* context, with the exception of higher anxiety. This study suggested that MA youth live in unique environmental contexts and these contexts are differentially related to mental health symptomatology. In the second study, 98 MA youth participated in a three-day diurnal cortisol protocol in hopes of linking perceptions of discrimination and HPA diurnal cortisol rhythms. Results revealed that discrimination was related to greater overall cortisol output and marginally related to the cortisol awakening

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response and evening levels of cortisol. Results suggest that important

physiological processes underlie the experiences of discrimination.

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Introduction

A burgeoning body of literature has emerged in the past decade examining Latino youth's prevalence and development of mental health disorders within the U.S. (Anderson & Mayes, 2010). Latino youth generally report greater internalizing and externalizing disorders compared to other youth (e.g., Cespedes & Huey, 2008; Mikolajczyk, Bredehorst, Khelaifat, Maier, & Maxwell, 2007). Further, they face risk factors that are similar to other youth (e.g., family processes, environmental risk) and unique factors associated with their minority status in the U.S. (e.g., acculturation, discrimination; Gonzales, Knight, Morgan-Lopez, Saenz, & Sirolli, 2002; Viruell-Fuentes, 2007). Although such evidence provides us with a growing understanding of the etiological pathways through which Latino youth develop mental health disorders, there remain important gaps in the literature, including (a) an understanding of the combined or simultaneous influence of multiple risk factors on youths' disorders and (b) physiological pathways linking risk factors to disorders. The following two studies addressed these gaps in the literature by applying innovative methods and protocols to the study of Mexican American youth, a population that makes up about 60% of the Latino population in the US (U.S. Census, 2006). Specifically, Study 1 utilizes a person-centered approach to understand how familial functioning risk factors, parent-adolescent risk factors, peer relationship risk factors, and cultural risk factors work together to influence Mexican American males' and females' mental health symptomatology. In an attempt to better understand physiological pathways linking perceptions of discrimination to health outcomes, Study 2

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examined the relation between Mexican American males' and females' reports of discrimination and the main hormone of the hypothalamic-pituitary-adrenal (HPA) axis, *cortisol*. Together, these two studies add to the current literature by contributing to our understanding of environmental risk on Mexican American youths' mental health functioning and provide important new directions for researchers and prevention/interventionist.

Study 1: Environmental Risk Contexts and Mental Health Symptomatology

in Mexican American Adolescents: A Person-centered Approach

Adolescence is marked by an increase in internalizing and externalizing disorders, with estimates indicating that nearly 20% of adolescents will be diagnosed with one or more disorder before the age of 25 years old (O'Connell, Boat, & Warner, 2009). Two of the most common adolescent internalizing disorders are depression and anxiety; prevalence estimates indicate that 5-8 % of youth are diagnosed with a major depressive disorder (MDD) and 6-10 % of youth with an anxiety disorder. Disruptive disorders (i.e., conduct disorder [CD], oppositional defiant disorder (ODD)] and attention deficit hyperactivity disorder (ADHD) are considered some of the most common externalizing disorders in adolescents; nearly 6-8% of youth report CD/ODD disorders and 3-6 % of youth are diagnosed with ADHD. For both internalizing and externalizing disorders, clear gender differences have emerged. Females report greater internalizing disorders (i.e., MDD and anxiety), whereas males reporting greater externalizing disorders (i.e., CD/ODD, ADHD; Zahn-Waxler, Shirtcliff, & Marceau, 2008). Although these disorders are common among the entire U.S. adolescent population, some evidence suggests that they are especially prevalent among Latino youth. Estimates indicate that Latino youth are almost twice as likely as European American youth to report being moderately depressed (Mikolajczyk et al., 2007) and a large proportion of Latino adolescents display behaviors consistent with CD and ODD diagnoses (Yung & Hammond, 1997; Rumbaut, 2008). Latinos are considered the youngest and fastest growing minority group in

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the US and nearly 60% of this population is of Mexican origin (U.S. Census, 2006). Understanding the factors that contribute to the development of mental health disorders among adolescent-aged Mexican American males and females is clearly important.

From an ecological perspective, development occurs in an environment in which contexts, processes, and individual factors interact (Bronfenbrenner, 1979, 1986). Many of these contexts and interactions have been linked to the development of mental health disorders (e.g., Greenberg, Speltz, DeKlyen, & Jones, 2001). Further, variations in exposure and reaction to environmental factors have long been posited to play an important role in understanding gender differences in the emergence of disorders (Nolen-Hoeksema & Girgus, 1994; Zahn-Waxler et al., 2008). Most empirical work, however, has focused on the influences of risk factors from a single source or context (e.g., familial functioning) with little attention to the fact that during development, adolescents face multiple risk factors from numerous sources simultaneously. To better understand the etiological pathways to mental health disorders in Mexican American adolescents, a greater understanding is needed of (a) the environmental risk contexts that male and female Mexican American adolescents experience, and (b) how certain risk contexts might differently predict disorders in males and females (Greenberg, 1999; Pearlin, 1999). Drawing upon an ecological and person-centered framework, the current study examined profiles of environmental risk contexts for Mexican American males and females in early adolescence, and how these risk contexts related to mental health symptomatology prospectively.

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Risk Factors for Mental Health Disorders

      Ecological theory posits that individual development is driven by the interaction of multiple interrelated contexts, processes, and individual characteristics (Bronfrenbrenner, 1979, 1986). That is, individuals are situated within many contexts in which proximal processes (the enduring interaction of the individual within its environment) occur. These interactions, coupled with individual characteristics are theorized to be the driving force behind development (Bronfenbrenner & Morris, 1998). Applied to the study of mental health disorders, empirical research has identified proximal contextual factors and interactions that relate to the development of mental health symptomatology (referred to as risk factors; Kazdin, Kraemer, Kessler, Kupfer, & Offord, 1997). For early adolescents, the most influential and proximal contexts are family and peers (Greenberg et al., 2001; Larson & Richards, 1991). Some of the most empirically consistent family context risk factors include family economic hardship (e.g., Conger & Conger, 2008; Bolger, Patterson, Thompson, & Kupersmidt, 2008) parental mental health status (e.g., Cambell et al., 2009; Hammen, Brennan, & Keenan-Miller, 2008) and single parenthood (e.g., Barret & Turner, 2006; Carlson & Corcoran, 2001). Further, family interactions such as conflict between the child and parent have emerged as important predictors of mental health (e.g., Ingoldsby et al., 2006). Adolescents also experience risk factors in other proximal contexts outside of the family, particularly places in which adolescents spend significant time interacting with others. Empirically, relationships with peers (e.g., difficulties with peers; Parker, Rubin, Erath,

Wojslawowicz, & Buskrik, 2006) and contexts in which individuals associate with deviant peers have been consistently linked to the development of mental health disorders (Keenan, Loeber, Zhang, Stouthamer-Loeber, & Kammen, 1995).

In addition to family and peer domains, ethnic minority youth face risk factors that are associated with more distal level influences, but have the ability to permeate more proximal processes (Bronfenbrenner & Morris, 1998). For Mexican American youth, this includes frequent exposure to ethnic/racial discrimination (Pérez, Fortuna, & Alegría, 2008; Rosenbloom, & Way, 2004) and challenges associated with language differences from the majority culture (Gluszek & Dovidio, 2010; National Survey of Latinos, 2002). Such experiences are a product of more distal factors (e.g., social injustice, societal views) but have the potential of impacting interactions at a more proximal level, as each of these factors has been linked to greater internalizing and externalizing symptoms (e.g., Berkel et al., 2010; Yoo, Gee, & Takeuchi, 2009).

Our understanding of risk factors for mental health disorders has primarily emerged from the use of models that investigate one or a few risk factors (Lanza, Rhoades, Nix & Greenberg, 2010). Such models have provided us with an important base of knowledge about risk factors, but from an ecological perspective, they limit our understanding of how multiple risk factors across different domains simultaneously contribute to develop. One useful and informative attempt to test the influence of multiple risk factors has been the cumulative risk model (Sameroff, Bartko, Baldwin, Baldwin, & Seifer, 1998). This model posits that most individuals have resources and the ability to handle a

small number of changes in their life without serious consequences, but the accumulation of risk factors has the potential of overwhelming one's resources, disrupting development, and contributing to a greater number of problems (Sameroff & Seifer, 1990). This approach assumes that no one risk factor is more important than another and has often led researchers to examine how an index of risks from different domains (summation of all risk factors) contributes to individuals' outcomes. This method provides important information about the additive influences of multiple risk factors; however, it operates under the (not directly tested) assumption that most or all risk factors carry the same weight in individuals' lives and are somewhat interchangeable. This idea contrasts with specificity models of risk (McMahon, Grant, Compas, Thurm & Ey, 2002), namely that certain risk factors underlie the development of a particular disorder, but may not underlie another disorder (Sandin, Chorot, Santed, & Valiente, 2004; Tiet et al., 2001). Further, it masks the occurrence of unique or unusual configurations of risk contexts and their influences on adolescent disorders (Parra, Dubois, & Sher, 2006).

Person-centered Approach

An alternative approach to understanding the influence of multiple risk factors on mental health symptomatology operates out of a person-centered perspective. This approach is largely derived from holistic interactionism theory which posits that individuals function and develop within an environmental structure of social, economic, and cultural factors (Magnusson, 2001; Magnusson & Allen, 1983; Magnusson & Stattin, 1998). Uncovering this structure or gestalt

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provides insight into the processes of development (Bergman & Magnusson, 1997). In line with an ecological perspective, a person-oriented approach aims to examine patterns across individuals with special attention to how multiple components are interrelated and mutually contribute to processes (Bergman, 2001; Bergman & Trost, 2006).

Many scholars have concluded that the utilization of a person-centered approach offers a helpful perspective in understanding the multiple risk factors associated with the development of mental health disorders in adolescence (Bergman, 2001; Bergman & Magnusson, 1997; Menard, Bandeen-Roche, & Chilcoat, 2004; Vossell, 1990). Methodologically, this approach focuses on patterns in the dataset with an interest in uncovering meaning from unique patterns among risk factors (Bergman & Trost, 2006). In contrast to variable-centered strategies focused on relations across individuals, the person-centered approach draws meaning from identifying subgroups of individuals within the population that display similar patterns across variables (or indicators). Although relatively new, this approach to studying risk is promising because it can provide researchers with a more nuanced view of environmental risk contexts by identifying (a) quantitative and qualitative differences in contexts, (b) the uniqueness or commonness of particular environmental risk contexts (e.g., combinations of risk factors), and (c) the differential relations between environmental risk contexts and mental health disorder symptomatology.

The few empirical studies examining risk contexts using a person-centered approach have identified specific and unique risks contexts (i.e., combinations of

risk experiences) that differ both quantitatively and qualitatively from one another (Menard et al., 2004; Copeland, Shanahan, Costello, & Angold, 2009). For instance, both Menard et al. and Copeland et al. found a group of individuals that could be categorized as high risk (high levels on most factors) and low risk (low levels on most factors) patterns. These groups' patterns looked similar to one another, but differed drastically in the level or quantity of overall risk experienced, making them quantitatively different from one another. Other identifiable subgroups of individuals emerged that were more qualitatively different from one another. That is, groups emerged that were high on family functioning risk factors, but low in other domains, whereas other groups emerged that were high on peer risk factors, but relativity low in other domains (Menard et al., 2004; Copeland et al., 2009). Such findings demonstrate that there are risk contexts that are characterized by high and low risk, and contexts in which unique patterns of risk emerge that are qualitatively different from other contexts.

In addition to understanding quantitative and qualitative differences in risk contexts, empirical studies using the person-centered approach provide information about the *uniqueness* or *commonness* of risk contexts. For instance, Menard et al., (2004), Copeland et al., (2009) and Parra et al., (2006) found that the most common risk context could be characterized as low risk; nearly half of their samples of children or adolescents reported low levels across all examined risk factors. Less common environmental contexts were those that could be described as high risk (or high levels on most or all risk factors). Menard et al. found that only 7% of individuals reported experiencing most risk factors,

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whereas approximately 9% of adolescents in Copeland's et al. study were classified as high risk. Other groups with more qualitatively distinct patterns (high on particular risk factors and low on others) were less common than low risk groups, but slightly more common than high risk groups. Given this, we might expect that across all populations, most individuals are developing in low risk environmental contexts and small proportion of individuals develop in a high risk context.

Finally, the examination of risk environments utilizing a person-centered approach provides the opportunity for researchers to link different risk contexts to different mental health disorders. Understanding how particular risk contexts differentially relate to disorders provides us with a greater understanding of the etiological pathways linking environments and outcomes (McMachon, et al., 2002, Copeland et al., 2009). Only two studies exist that examined how person-centered risk contexts related to specific mental health outcomes. Both studies found evidence that quantitatively and qualitatively unique risk environments were differentially related to mental health outcomes. That is, both high and low risk groups had the strongest and weakest links, respectively, to mental health symptomatology (Copeland et al.); however, particular risk contexts related to specific disorders. For instance, in Copeland and colleagues' study, individuals in the moderate risk context characterized by poverty, single parent status, and parental criminal behaviors were at greater risk for disruptive disorders compared to the low risk group, whereas individuals in the moderate risk context

characterized by poverty and poor parental education were at greater risk for emotional disorders compared to the low risk group.

In summary, a person-centered approach to studying risk allows us to identify different risk contexts, how common or unique each context is, and if unique risk contexts relate to mental health disorders differently. Use of this approach, however, is in its infancy and needs to be further examined to see if particular contexts and the relations between contexts and outcomes replicate across samples. Further, for understanding risk in ethnic minority youth, attention to relevant or group specific risk factors, such as discrimination and language hassles, is greatly needed (García Coll et al., 1996). Such experiences are common among Mexican Americans and pose a risk for adolescents because they directly impact mental health functioning and indirectly contribute to a greater likelihood of experiencing other risk factors. The absence of such factors in the study of environments of risk limits our understanding of the ongoing dynamic risk contexts Mexican American youth face.

Another important consideration in understanding environments of risk that needs greater attention is gender. Clear gender differences exist in the rates of internalizing and externalizing disorders (Zahn-Waxler et al., 2008); however, the exact mechanisms or pathways contributing to these differences are still largely unknown. Theoretical explanations have focused on differences in quantities of risk and types of risk factors between males and females and/or differences in males' and females' reactions to specific risk factors (Nolen-Hoeksema & Girgus, 1994; Zahn-Waxler, et al., 2008). Some empirical evidence suggests that female

adolescents tend to report more risk factors associated with interpersonal events than males (Ge, Lorenz, Conger, Elder, & Simons, 1994; Rudolph & Hammen, 1999). Further, findings suggest that similar risk factors relate differently to internalizing and externalizing symptoms for males and females (e.g., Boyle & Pickles, 1997; McFadyen-Ketchum, Bates, Dodge, & Pettit, 1996; Cole, Teti, & Zahn-Waxler, 2003). For instance, McFadyen and colleagues (1996) found that harsh maternal parenting practices related to increased aggressive behaviors in males, but decreasing aggressive behaviors in females across childhood. Further, Boyle and Pickles (1997) found that maternal depression related to increased internalizing symptoms for females, but there was no relation for males.

    To my knowledge, however, no empirical work has examined the role of gender in identifying environmental risk contexts using a person-centered approach. Such an approach has the potential of extending our knowledge about environmental risk in adolescence beyond more commonly used variable centered approaches in the following ways. First, it can advance our understanding of gender differences in the experience of certain risk contexts. For instance, are males and females equally likely to experience each risk context? Second, males and females might experience similar risk contexts but the relations between a particular context and mental health symptomatology might differ across males and females. That is, females in a specific context might display greater disorder symptoms than males in that context. A person-centered approach has the potential of examining such questions and providing a more nuanced view of the role of gender in environmental risk and adolescent mental health. Gender may be

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especially important in understanding risk contexts among Mexican Americans because this population has been characterized as adhering to traditional gender roles in which girls may be more shielded or protected from risky environments and boys may be given more latitude or freedom to navigate these context independently (Marín & Marín, 1991; Raffaelli & Ontai, 2004).

The Current Study

To understand how multiple risk factors work together to influence Mexican American male and female adolescents' development of mental health disorders, the current study had three aims. For Aim 1, the goal was to identify Mexican American males' and females' environmental risk contexts based on adolescent gender and risk factors related to family functioning (maternal depression, family economic hardship, single parenthood), parent-child relationship (parent-child conflict), peer relations (association with deviant peers, peer conflict), and cultural stressors (discrimination, language hassles). Although there was no hypothesis about the exact number of contexts and specific patterns that would emerge, based on prior empirical evidence I did hypothesize that at least two contexts would emerge that could be characterized as *high risk* and *low risk.* Further, I expected that a majority of our Mexican American adolescents would be in the low risk context and a smaller percentage in the high risk context.

Next, for Aim 2, I examined the relations between identified environmental risk contexts (in Aim 1) and seventh grade mental health disorders symptoms (i.e., MDD, Anxiety, CD/ODD, and ADHD symptoms), controlling for fifth grade symptoms. Although I was unable to hypothesize about all potential

risk contexts links to symptoms, I did hypothesize that youth in low risk contexts would display lower seventh grade psychological symptoms than youth in high risk contexts. Finally, for Aim 3, I explored the moderating role of adolescent gender in linking environmental risk contexts to seventh grade psychological symptoms.

<center>**Method**</center>

Participants

The data for the current study comes from a longitudinal study focused on culture and context in the lives of Mexican American families in a large southwestern metropolitan area (Roosa et al., 2008). This study recruited 750 Mexican American families with students attending schools that served very diverse communities. To be eligible (a) families had to have a fifth grader attending a sampled school; (b) both mother and child had to agree to participate; (c) the mother was the child's biological mother, lived with the child, and self-identified as Mexican or Mexican American; (d) the child's biological father was of Mexican origin; (e) the child was not severely learning disabled; and (e) no step-father or mother's boyfriend was living with the child. The current study utilized data at Time 1 (T1) when the adolescents were in fifth grade and Time 2 (T2) when the adolescents were in seventh grade.

At T1, family incomes ranged from less than \$5,000 to more than \$95,000 (M_{range} = \$30,000 to \$35,000). The mean age of mothers was 35.8 years (SD = 5.77) and they averaged 10.3 years of education (SD = 3.68). The mean

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adolescent age at T1 was 10.4 years old (*SD* = .55). At T1, nearly 70% of mothers were interviewed in Spanish, whereas 82% of adolescents were interviewed in English. A majority of mothers (74.3%), but only 29.7% of adolescents, were born in Mexico. Nearly 95% (*n* = 711) of the original sample was interviewed at T2, approximately two years after T1 data collection. Families who participated in T2 interviews were compared to families who did not on several T1 demographic variables and no differences emerged on adolescent characteristics (i.e., gender, age, nativity, language of interview), mother characteristics (i.e., marital status, age, nativity) or father characteristics (i.e., age, nativity).

Procedure

The complete research procedures are described elsewhere (Roosa et al., 2008); only key features are summarized here. The original research team identified communities served by 47 public, religious, and charter schools chosen to represent the metropolitan area's cultural, economic, and social diversity. Recruitment materials that explained the project and asked parents to provide contact information if interested in participating in the study were sent home with all fifth grade children in these schools. Nearly 85% of those who returned contact information were eligible for screening (e.g., Latino) and 1,028 met eligibility criteria. Computer Assisted Personal Interviews, lasting about 2.5 hours, were then conducted in the homes with 750 families, 73% of those eligible. These interviews were conducted by interviewers who had received 40 hours of training which included information on project goals and characteristics of the target

population. Questions and response options were read aloud in the participants'

preferred language. Participants were paid $45 at T1 and $50 at T2.

Measures

Family functioning risk. To assess family functioning risk the current

study focused on three factors found to relate to adolescent psychological

functioning: maternal depression, family economic hardship, and single

parenthood. Maternal depression was examined utilizing the Center for

Epidemiological Depression Scale (CES-D; Radloff, 1977). This scale measures

depressive symptomatology in the general population utilizing 20 items (e.g.,

"You felt that that everything you did was an effort", "You thought your life had

been a failure"). Mothers responded to items using a Likert-type scale ranging

from 1 (*Rarely or none of the time)* to 4 (*Most of the time*). The scale

demonstrated high reliability for the current study (α = .91).

For economic hardship, Conger and colleagues' Economic Hardship scale

was utilized (Conger & Elder, 1994). Using 11 items, three scales assess families'

inability to make ends meet, not enough money for necessities, and financial

strains. The mean of the three scales was computed for mothers and fathers, and

their scores averaged in two parent families (mother and father reports were

highly correlated, r = .54, p < .001), with higher scores representing greater

economic hardship. Mothers' scores alone were used for single-parent families.

The measure was reliable for both mother and father reports (α = .92 for both).

For family structure, mothers were asked about their current marital status.

Mothers who identified their marital status as (1) *Never married and not living*

with partner (*n*= 59), (2) *Married but not living together* (*n*= 40) and (3) *Divorced* (*n*= 61), were treated as single-parents, whereas mothers who reported (4) *Living with a partner but not legally married* (*n* = 79; Note that the partner had to be the biological father of the study child according to selection criteria) or (5) *Married and living together* (*n* = 499) were treated as two-parent families.

Parent-adolescent relationship risk. To examine risk associated with the parent-adolescent relationship, the current study examined parent-child conflict. Utilizing 10 items, the Parent-Adolescent Conflict Scale (PACS; Ruiz & Gonzales, 1998) assesses adolescents' reports of minor disagreements as well as serious arguments with their mothers and fathers in the past three months. Adolescents responded to items (e.g., "You and your mom/dad had a serious argument or fight", "You and your mom/dad yelled or raised your voices at each other") using a 5-point Likert scale ranging from 1 (*Almost never or never*) to 5 (*Almost always or always*). Given that adolescents reports for mom and dad were highly correlated ($r = .68$, $p < .001$), a mean was taken for adolescent in two-parent families. Only reports on conflict with mothers were used for adolescents in single-parent homes. The measure was reliable for adolescent reports for mother and father (αs = .72 and .74 respectively).

Peer relationship risk. To assess risk associated with peer relationships, the current study examined conflict/hassles with peers and association with deviant peers. Conflict and hassles with peers were assessed utilizing the peer hassles subscale of the Multicultural Events Scale for Adolescents (MESA; Gonzales, Tein, Sandler, & Friedman, 2001). The MESA is a life events index

used to assess events for adolescents that specifically fit the lifestyle and experiences of culturally diverse, urban adolescents. Adolescents reported which of 14 items have happened or not in the previous three months (e.g., "Other kids told mean stories or lies about you", "You had a disagreement with a close friend"). For association with deviant peers, a 13-item Peer Delinquent Behavior scale (Barrera et al., 2002) was utilized. Adolescents responded to statements like "How many of your friends have sold drugs?" on a 5-point Likert-type scale ranging from 1 (*None of them*) to 5 (*All of them*). Cronbach's alpha was .79.

  Cultural risk. Two cultural risk factors were assessed: language conflicts/hassles and discrimination. Language conflicts/hassles were assessed using the language hassles subscale for the MESA. Seven items ask about the problems adolescents face that are related to either their inability to speak English (e.g., "Other kids put you down for not speaking English or not speaking it well") or Spanish well (e.g., "Other kids put you down for not speaking Spanish or not speaking it well"). Adolescents reported if the event happened or did not happen in the past three months. For discrimination, adolescents responded to nine items designed to assess discriminatory experiences from peers and teachers (Berkel et al., 2010). The four peer items (e.g., "Kids at school have negative beliefs about Mexicans or Mexican Americans") and five teacher items (e.g., "You have heard your teachers at school making jokes or saying bad things about Mexicans or Mexican Americans") relied upon a Likert-type response scale ranging from 1 (*Not at all true*) to 5 (*Very true*). Cronbach's alpha was .74.

Adolescent mental health symptoms. The Diagnostic Interview Schedule for Children (DISC-IV; Shaffer, Fisher, Lucas, Dulcan, & Schwab-Stone, 2000), a structured diagnostic interview instrument for use by nonclinicians was used to assess adolescents' MDD, Anxiety (generalized), CD/ODD, and ADHD symptoms at T1 (fifth grade) and T2 (seventh grade). This interview provides symptom counts as continuous measures of mental health (higher scores reflecting more symptoms). Consistent with prior research (Shaffer et al., 1996) a combined report that reflects the mean of adolescent and mother report of symptoms was used.

Results

To analytically test the aims of the current study, a series of latent profile analyses (LPA) were run utilizing Mplus Version 4 (Muthén & Muthén, 1998-2007). All missing data were accounted for using maximum likelihood (ML) estimation via the EM algorithm (Enders, 2010). LPA is a technique used to identify patterns of continuous and dichotomous variables under the assumption that latent, unobserved subgroups with similar associations between variables exist in a given population (Geiser, Lehmann, & Eid, 2006; Pastor, Barron, Miller, & Davis, 2007). These groups are referred to as latent profiles because an individual's class membership is considered unobserved but identified based on the pattern of the variables. *Within* each profile, individuals show similar response patterns, whereas *between* profiles patterns can be markedly different, indicating unique environmental risk contexts. In most cases, the number of profiles that will emerge in an LPA is unknown beforehand; therefore, LPA models proceed in a

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series of steps starting with a one-profile model solution and increasing in number of profiles. The best fitting model can be determined by a number of indices of which the most reliable are information criteria (IC) and likelihood ratio (LR) tests (Nylund, 2007; Tofighi & Enders, 2006). For ICs, researchers have recommended the Akaike's information criterion (AIC), Bayesian information criteria (BIC) and the adjusted Bayesian information criteria (ABIC); a decrease in these indices when an additional profile has been estimated indicates an improvement in model fit (Lubke & Muthén, 2005). In addition, researchers also use likelihood ratio tests. The Lo-Mendell-Rubin (LMR) log likelihood test can be used to determine whether a model with a given number (k) of profiles significantly fits the data better than a simpler model with one fewer profiles [$k -$ 1; (Tofighi & Enders, 2006)]. A significant LMR test value indicates that the model in which k profiles are specified is a better fitting than the k-1 profile model. Finally, researchers also evaluate each solution from a content-oriented or substantive viewpoint (e.g., examining the patterns of the means for each profile in the solution) in helping identify the best fitting model.

For *Aim 1*, a series of five LPAs were run that included eight risk factors and adolescent gender as observed indicators. All continuous risk factors were allowed to correlate, but variances and covariances were constrained to be equal

across profiles.[1] To avoid convergence on a local maximum, 200 random sets of

starting values were used (Pastor et al., 2007). Table 2 presents ICs and LMR

results for each analysis. Results revealed that the 2-profile solution AIC, BIC,

and ABIC decreased from the 1-profile solution. Further, the LMR test was

marginally significant ($p = .07$). The 3-profile solution AIC, BIC and ABIC

continued to decrease from the 2-profile solution and the LMR test was

significant ($p < .001$). The 4-profile and 5-profile solutions decreased significantly

in AIC, BIC, and ABIC values; however, these models were considered unstable

given that the log likelihood value was not replicated. Thus, it appeared that the 3-

profile solution was the best fitting model. Further, the 3-profile solution made

sense substantively, as discussed subsequently. Table 2 presents the 3-profile

solution means for each group and sample means. Because the continuous risk

factor indicators were on different metrics, sample means (not profile-estimate

means) were standardized and graphed in Figure 1. This allows for an

understanding of the magnitude of difference across each profile on risk

indicators. First, a majority of Mexican American adolescents (84.4%)

demonstrated low levels across all risk factors; thus, this group was categorized as

Low Risk. Next, 11.3% of adolescents fell into a group that was characterized by

the highest levels (relative to the other profiles) of maternal depression (.25

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[1] All models were run allowing covariances and variances to vary across models;

however, this contributed to unstable models (e.g., logliklihood values that would

not replicate). Therefore, these parameters were fixed for the final models.

standard deviations (SD) above the mean), moderate levels of peer conflict (.5 SD above the mean), deviant peers (.5 SD above the mean), peer conflict (about 1 SD above the mean), and discrimination (.75 SD above the mean). In addition, they showed the highest levels of language hassles (almost 2.5 SD above the mean). Given, this, they were categorized as *Moderate risk-language*. Finally, the smallest group to emerge (4.3%) was characterized by the highest levels of parent-child conflict (.75 SD above the mean), association with deviant peers (3.5 SDs above the mean), peer conflict (1.25 SD above the mean), and discrimination (1.5 SD above the mean). Because they were at least 1 SD above the mean on three risk factors and because two of those risk factors were in the peer domain, they were categorized as *High risk-peer*. Table 3 presents the effects size (Cohen's *d*) differences between profile means.

From a substantive point of view, the two "risky" environments appeared to represent substantively unique environments; the *High risk-peer* profile tapping into environments characterized by risky peer processes and the *Moderate risk-language* profile tapping into environments characterized by cultural struggles, especially with language. Given that the profiles did not include indicators of cultural demographics, post-hoc analyses were conducted examining if in fact individuals in the *Moderate risk-language* profile differed from individuals in other profiles on adolescent place of birth and interview language. Results revealed that individuals in the *Moderate risk-language* profile were more likely to be interviewed in Spanish [$\chi^2 (2) = 5.96$, $p = .05$] and be born in Mexico [$\chi^2 (2) = 10.98$, $p < .01$], than individuals in *Low risk* or *High risk-peer* contexts.

To examine *Aim 2*, MDD, Anxiety, CD/ODD and ADHD symptoms T2 were added to the 3-profile solution. Latent profiles were regressed on T1 symptoms to allow symptoms to influence group membership. Further, T2 symptoms were regressed on T1 symptoms to control for baseline symptoms. This model allowed for the emergence of T2 symptom means for each profile (i.e., *Low risk; Moderate risk-language; High risk-peer*), controlling for T1 symptom means. It should be noted that when additional variables are added to LPA models (as was done here), the original profile solution can change in either the patterns of the means and/or the proportion of individuals who fall into each profile (C. Enders, personal communication, December 28, 2010). Significant changes in either can indicate an unstable model and possibly, that a simpler profile solution (e.g., 2-profile solution vs. 3-profile solution) would be a more appropriate solution. For the current study, the 3-profile solution remained a stable model (both means and proportion of sample in each profile remained very similar to Figure 1) with the inclusion of T1 and T2 symptoms.

Table 4 presents T2 symptom means for each profile group and Figure 2 presents the results in bar-graph form. To examine if the T2 symptom means significantly differed across profiles a series of analyses were conducted. First, an omnibus logliklihood (LR) test $[LR = 2(\log L_{Full} - \log L_{Restricted})]$ was examined: an analysis in which all means of a particular symptom (e.g., MDD symptoms) were constrained to be equal across all three profiles was run followed by an analysis in which all means of that particular symptom were allowed to freely estimate. The LR test follows a chi-square distribution with degrees of freedom equal to the

number of parameter constraints in the restricted model (Enders, 2010). A significant LR test indicates that the free model is a significantly better fitting model compared to the restricted model, suggesting that one should retain the more complex model (and reject the more parsimonious model). Each significant omnibus LR test was followed up with a series of tests in which each profile symptom mean was constrained and freed to determine which symptom means significantly differed from one another.

For MDD symptoms, a significant omnibus LR test emerged ($\chi^2\Delta[2] = 30.48$, $p < .001$). Follow up analyses revealed that the *High risk- peer* profile had significantly higher symptoms than the other two profiles ($\chi^2\Delta[1] = 7.05$, $p < .01$), but that *Low risk* and *Moderate risk-language* profiles did not significantly differ from one another. For anxiety symptoms, a significant omnibus LR test also emerged ($\chi^2\Delta[2] = 23.81$, $p < .001$). Follow up analyses revealed that the *High risk- peer* profile had significantly higher anxiety symptoms than the other two profiles ($\chi^2\Delta[1] = 23.67$, $p < .001$). Further, the *Moderate risk-language* profile had significantly higher anxiety symptoms than the *Low Risk* profile ($\chi^2\Delta[1] = 5.02$, $p < .05$). For CD/ODD symptoms, a significant omnibus LR test emerged ($\chi^2\Delta[2] = 9.06$, $p < .01$). Follow up analyses revealed that the *High risk-peer* profile had significantly higher CD/ODD symptoms than the other two profiles ($\chi^2\Delta[1] = 6.67$, $p < .01$), but that the *Low Risk* and *Moderate risk-language* profiles did not differ from one another. Finally, for ADHD symptoms, a significant omnibus LR test emerged ($\chi^2\Delta[2] = 9.62$, $p < .01$). Similar to prior analyses, follow up analyses revealed that the *High risk-peer* profile demonstrated

significantly higher ADHD symptoms than the other two profiles ($\chi^2\Delta$[1] = 10.22, $p < .01$), but *Low risk* and *Moderate risk-language* did not differ from one another.

Finally, to test Aim 3 a similar model to Aim 2 analysis was run; however, gender was excluded as an indicator and added as a *known class* (Mplus command: KNOWNCLASS = gender). Profile means based on results in Aim 1 were used as starting values for each class. This analysis estimated the 3-profile solution with T2 mental health symptoms separately by adolescent gender, allowing me to examine if environmental risk profiles related to T2 mental health symptoms similarly for males and females. Table 5 presents males' and females' profile means. Utilizing LR tests, results revealed that the only profile that demonstrated significant differences across gender was the *High risk-peer* profiles' MDD symptoms ($\chi^2\Delta$[1] = 9.29, $p < .01$). Specifically, females in the *High risk-peer* profile demonstrated significantly higher levels of MDD symptoms ($M = 5.91$) than males in that profile ($M = 3.14$).

Discussion

Guided by an ecological framework and a person-centered approach, the current study used latent profile analysis to identify Mexican American youths' environmental risk contexts and how these contexts shape mental health symptomatology over time. Risk factors, which emerge from a number of contexts and interactions, are theorized to work together to influence development over time (Bronfenbrenner, 1979, 1986). Our understanding of adolescent risk, however, has primarily emerged from empirical studies examining risk factors

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individually or a few at a time, leaving us with little information about the co-occurrence of multiple risk factors simultaneously. As numerous variable-centered studies have suggested, risk factors originating from family and peer contexts predict greater mental health symptomatology in adolescence (e.g,. Conger & Conger, 2008; Ingoldsby et al., 2006; Keenan, et al. 2006). Further, for racial and ethnic minorities in the U.S., youth face salient cultural risk factors like discrimination and language hassles (Williams & Mohammed, 2009). To advance our understanding of the etiological pathways linking environments and mental health, a greater understanding of how multiple risk factors simultaneously co-occur in adolescence and how such configurations relate to youths' mental health functioning is needed, especially among a rapidly growing, relatively young population like Mexican Americans (Fry, 2008).

The person-centered perspective offers a theoretical and methodological way of doing this. Specifically, the person-centered framework posits that individuals live within a context in which numerous factors are at play (Magnusson, 2001). Understanding the pattern or structure of these risk factors provides a more complete and nuanced view of how environments influence individuals (Bergman, 2001; Bergman & Magnusson, 1997). Guided by a person-centered framework, the current study examined Mexican American adolescents' environmental risk contexts based on family, peer, and cultural risk factors and adolescent gender. Three distinct risk environments emerged: *Low risk, Moderate risk-language*, and *High risk-peers*. The *Low risk* context was characterized by low levels of family, peer, and cultural risk and emerged as the most common

context with nearly 84% of Mexican American youth experiencing this environment. The *Moderate risk-language* context, characterized by the highest levels of language hassles was the next most common context with 11% of Mexican American youth experiencing in this environment. Finally, the *High Risk-peers* context, characterized by the highest levels of deviant peer associations, peer conflict, and perceived discrimination was the least common context with only 5% of Mexican American youth. Notably, gender differences were not seen across profiles; that is, the same proportion of males and females emerged within each of the three risk environments (discussed in more detail subsequently).

Quantitative and Qualitative Differences in Risk Contexts

The current study's findings suggest that Mexican American adolescents' environmental risk contexts differ both quantitatively and qualitatively. Three contexts emerged that differed in the level of risk – low, medium and high risk. However, within the medium and high risk contexts, specific patterns emerged suggesting that characterizing environmental risk contexts strictly based on quantitative differences may not be adequate. For instance, while individuals in the *Moderate risk-language* context demonstrated lower risk levels than those in the *High risk-peer* context on most factors, they did emerge with strikingly high levels of language hassles (large effect size). Most noticeable about the *High risk-peer context* was the high levels of deviant peers, peer conflict, and discrimination. These differences suggest that environmental risk factors do tend to congregate or co-occur to some extent (high risk in multiple domains), but that

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there are important differences that paint a picture of unique and different risk processes occurring in Mexican American youths' lives.

Low risk context. As hypothesized an environment characterized by low levels of risk across family, peer and cultural domains emerged. In fact, compared to the other two "risky" profiles, the individuals in the *Low risk* context demonstrated significantly lower levels on all risk factors except maternal depression. This context was expected because prior person-centered work has found that the most common environment among other adolescents was a low risk environment (e.g., Menard et al., 2004; Copeland et al., 2009). In addition to low risk, two "risky" contexts emerged characterized by higher levels of risk compared to the *Low risk* context in family, peer and cultural domains. I now turn to describing the two higher risk contexts in relation to one another.

High risk-peer context. Mexican American youth in the *High risk-peer* context appeared to be having the most difficulties in regards to their peers. They reported associating with friends that were participating in deviant acts (e.g., stealing, selling drugs, and fighting) and having high levels of peer conflict. As developmental theories suggests, early adolescence is a time in which involvement with peers dramatically increases and peer group associations are formed (Larson & Richards, 1991; Sullivan, 1953). Youth tend to pick their friends based on similarities in race/ethnicity, socioeconomic status, and behaviors (Brown & Klute, 2003; Ennett & Bauman, 1996). Youth in deviant peer groups are no exception; they engage in similar deviant behaviors and many of them have histories of such behaviors in early childhood (Dishion, Patterson,

Stoolmiller, & Skinner, 1991). Further unifying deviant peers are the experiences of conflict and rejection from other peers (Dishion et al., 1991; Patterson & Dishion, 1985). These experiences often leave youth feeling excluded and marginalized, propelling them to further their involvement in their deviant peer group. Consistent with this idea, youth in the *High risk-peer* context may have been rejected or excluded by other peers and their participation in maladaptive behaviors as part of a deviant peer association resulted in more problems with peers (evidenced by high levels of peer conflict).

Youth in the *High risk-peer* context also exhibited high levels of discrimination. Although limited, empirical findings suggest that racial minorities involved in deviant peer groups tend to perceive greater levels of discrimination (Reed et al., 2010). It is theorized that discriminatory experiences leave individuals feeling powerless and marginalized and, in turn, individuals engage in deviance as a way of coping and restoring their identity. However, it should be noted that the discrimination measure used in the current study focused on discrimination from individuals in the school context that included peers; high levels of discrimination could then further reflect the strain in peer relationships characteristic of this risk environment.

Altogether, the *High risk-peer* context paints a picture of a troublesome environment in which Mexican American adolescents are significantly struggling in the peer domain. Given the salience of peers for all adolescents, not just Mexican Americans, we might expect that a similar risk context emerges in other ethnicities/races. Indeed, one study examining primarily European American and

African American adolescents' risk environments from a person-centered approach found a similar context (Parra et al., 2006); nearly 9% of early adolescents reported living in an environment characterized by high levels of substance using peers (almost 2.5 standard deviations above sample means). Replication of this risk environment with Mexican American adolescents suggests that this peer dominated context of risk is an important environmental context to consider and from a prevention/intervention perspective, identifies salient context of risk across multiple groups of adolescents.

Moderate risk-language. In contrast to the *High risk-peer* context, the *Moderate risk-language* context appeared to be considerably less risky. Only moderate levels of risk emerged in maternal depression, peer conflict and discrimination; however, considerable risk was seen in language hassles. Instead of reflecting a peer context of risk identifiable across multiple races and ethnicities, this profile might be reflecting cultural risk environments unique to acculturating youth such as Mexican Americans or other immigrating groups. That is, adolescents might be facing challenges associated with adapting to mainstream culture, with the most noticeable difficulty demonstrated in the challenges to learning a new language. Indeed, these individuals were more likely to be born in Mexico, and more likely to complete the interview in Spanish, compared to families in the *High-risk peer* or *Low risk* contexts. Further, language difficulties might have implications for the formation of peer relationships. Youth might struggle with forming friends or fitting into peer groups because of language differences/difficulties.

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Overall, this study provided evidence of unique profiles of risk for three groups of Mexican American youth that reflect differences in developmentally salient domains and cultural processes. One important factor that did not distinguish the formation of risk contexts was adolescent gender. Across all three contexts, the gender distribution (or the proportion of males and females in each context) did not differ, suggesting that males and females shared similar risk contexts and no particular context was more common to one gender than the other. Prior variable-centered work has suggested that males and females tend to differ in their experiences of risk factors (e.g., Ge et al., 1994; Rudolph & Hammen, 1999). While this could still be the case, a person-centered approach considers the occurrence of multiple risk factors simultaneously. Thus, the likelihood of both males and females experiencing a particular configuration of risk factors is similar.

Uniqueness and Commonness of Risk Contexts

In addition to describing patterns of risk, the person-centered approach allows us to understand the commonness or uniqueness of particular risk contexts. Prior person-centered studies have found that a majority of youth (primarily European American or African American) live within contexts of low risk while a small portion of youth experience higher levels of risk (Copeland et al., 2009; Menard et al., 2004, Parra et al., 2006). In line with these findings and consistent with the current study's hypothesis, a majority of Mexican American youth in the current study reported experiencing contexts characterized by low family, peer, and cultural risk, while small groups of youth reported higher levels of risk.

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Together, this suggests that despite the numerous changes during adolescence, most youth progress through this developmental time experiencing relativity low levels of difficulties and exposure to risk (Steinberg & Morris, 2001). It should be noted, however, that in prior studies low risk groups ranged from 50-60% of youth, while the current study found that 84% of Mexican American youth fell into this context. Such findings come at a time when a great deal of attention has been placed on the underachievement and risk status of Mexican American youth, often highlighting negative aspects of development including higher dropout rates and poorer academic functioning than their peers from other racial and ethnic groups (e.g., Arellano & Padilla, 1996; Carvajal, Hanson, Romero, & Coyle, 2002). While Mexican American youth might disproportionally be at a greater risk compared to other adolescents, these results suggest that *normative* environments for Mexican American youth in early adolescence are *not* characterized by high risk in family, peer and cultural domains.

The small minority of Mexican American youth identified as at risk, however, should not be overlooked. The current study found that 11% of youth were experiencing moderate risk and 5% experiencing high levels of risk. These groups align with prior work that has suggested less than 10% of youth experience disproportionally high levels of risk while a greater percentage of youth (usually between 15 – 30%) fall into contexts characteristic of more moderate levels of risk (Copeland et al., 2009; Menard et al., 2004;). Albeit a small percentage of youth, these two "risky" environments represent important

contexts when understanding how risk factors simultaneously work together to affect youths' mental health development (discussed below).

Risk Contexts and Mental Health Disorder Symptomatology

Finally, the person-centered approach to understanding risk allowed us to link unique contexts of risk to different mental health symptomatology over time. Overall, the *High risk-peer* context emerged with the strongest links to all symptomatology. Males and females within the *High risk-peer* contexts in fifth grade had the highest MDD, anxiety, CD/ODD, and ADHD symptoms at seventh grade compared to individuals within the *Low risk* and *Moderate risk-language* contexts. Only in the case of MDD symptoms within the *High risk-peer* context was there any gender difference in the link between risk profile and symptomatology; females in this context displayed higher MDD symptoms than did males. Adolescents in *Moderate risk-language* contexts only appeared to be at risk for anxiety symptoms; their anxiety symptoms were significantly higher than individuals' symptom in the *Low risk* context, but lower than individuals in the *High risk-peer* context.

As hypothesized, individuals in the highest risk context demonstrated the highest levels of the mental health symptoms. This is consistent with prior work utilizing a person-centered approach (Copeland et al., 2009; Parra et al., 2006), and suggests that there is a cumulative component to risk. That is, individuals who display the most risk, regardless of patterns or co-occurrence of risk, tend to exhibit the most mental health problems (Rutter, 1981; Sameroff & Seifer, 1990). Our findings are also consistent with empirical work suggesting that deviant peer

affiliations relate to higher externalizing and internalizing symptoms (for review see Vermeiren, 2003). Not surprisingly, for MDD symptoms, females in the *High risk-peer* context appeared to be at the greatest risk, suggesting there is something unique about a context characterized by peer difficulties for females' depressive symptomatology.

A theoretical explanation that sheds light on this finding is the interactionist perspective on delinquency (Heimer, 1996; Heimer & Matsueda, 1994). Largely derived from symbolic interactionism, this perspective suggests that individuals tend to view their contexts based on what they anticipate others' reactions might be (Heimer, 1996; Heimer & Matsueda, 1994). During adolescence the most likely reaction to deviant acts comes from individuals' parents and peers. Given that aggressive and assertive characteristics (traits often associated with deviant peer groups) are typically viewed as more appropriately male characteristics and that females tend to place greater importance on peer and family relationships, the theory proposes that females in deviant peer groups should anticipate greater consequences associated with their involvement. These consequences are theorized to manifest in greater vulnerability in affective disorders, like depression (Chodorow, 1999; Heimer, 1996). This explanation also aligns with gender theories of depressive symptoms suggesting that reaction from others have greater consequences for females' depressive symptoms compared to males (Rudolph & Hammen, 1999) and with other empirical findings suggesting a stronger association between deviant peer groups and depressive symptoms in females compared to males (e.g., Ulzen & Hamilton, 1998). Further, from a

cultural perspective, Mexican American females might be especially prone to depressive consequences of parent and peer reactions given traditional gender roles often characteristic in Latino culture. That is, adolescent females are socialized on the importance of interpersonal relations, especially in the family, and expected to adhere to more feminine traits (Raffaelli & Ontai, 2004). In turn, letting down both family and friends might be especially disappointing to the female adolescent, eventually leading to greater depressive feelings.

Following a cumulative logic, we might expect that individuals in the *Moderate risk–language* context would be at greater risk for all mental health disorder symptomatology than individuals in the *Low risk* context. However, this was not the case. In fact, individuals in the *Moderate risk-language* context reported similar levels to individuals in the *Low risk* context on all mental health symptoms except anxiety. As described above, the *Moderate risk-language* context could be representing a cultural risk environment in which adolescents are struggling with the acculturative process, especially in regards to language. Acculturative stressors have been linked to greater internalizing in adolescents (Varela & Hensley-Maloney, 2009). Further, there is some evidence that aspects of acculturative stress, specifically stressors related to being an immigrant, might be especially predictive of anxiety symptoms (Suarez-Morales & Lopez, 2009). Suarez-Morales and Lopez theorized that difficulties in either learning the new language or using the language in contexts where they might not feel comfortable might be especially anxiety provoking. Given that Mexican American youth in the *Moderate risk-language* context were more likely to be interviewed in Spanish

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than the adolescents in other contexts, we might be capturing an environmental context characterized by cultural language risk that is especially relevant in predicting anxiety.

Contributions, Future Directions and Limitations

The current study contributes to our understanding of the development of mental health symptomatology in Mexican American youth in a number of ways. First, the identification of distinct risk contexts characterized by differences in quantity of risk and processes of risk can inform prevention and intervention efforts aimed at deceasing youths' risk. While most Mexican American youth develop within contexts of low risk, there remained a small, yet significant, number of youth who faced substantial troubles. The identification of this group could allow prevention efforts to shift from *universal prevention strategies*, approaches designed to address risk factors in entire populations of youth, to more *selective prevention*, approaches designed to target groups who show significant risk (Weisz, Sandler, Durlak, & Anton, 2005). Further, the linking of contexts to mental health symptomatology over time revealed that certain risk environments, namely environments of cultural risk, may relate to only one specific disorder. From a prevention perspective, this information could be used to develop outcome specific preventions focused on anxiety symptoms. Finally, the current study contributes to the scholarly debate of specificity and cumulative characteristics of risk (McMahon et al., 2002), suggesting that there are both cumulative components of risky environments and some specificity linking particular contexts of risk to mental health symptomatology.

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Despite our contributions, there are important limitations to consider. First, to determine environments of risk, our study relied upon a relatively small number of family, peer and cultural risk factors in order to maintain a parsimonious model. These domains were chosen based on theoretical notions of salient and proximal environmental influences in adolescence and because they reflect more normative risk factors experienced in individuals' micro and macro contexts. Thus, some important indicators (or risk factors) were not considered. Prior work has determined that childhood abuse (physical, sexual, and emotional) is an important risk factor for mental health disorders (MacMillan et al., 2001). This risk factor was not assessed in the current study and therefore, not included as an indicator. To extend our knowledge of how abuse plays into the risk environment, it is important for future work to consider the role of these risk factors in shaping youths' environmental contexts.

In addition, the current study focused on early adolescence, assessing risk environments in fifth grade only. As individuals progress through adolescence, certain risk factors become more common or change in importance (e.g., parent-child conflict intensifies, greater difficulties in romantic relationships; Laursen, Coy, & Collins, 1998; Connolly, Craig, Goldberg & Pepler, 1999). Understanding the risk environments in different stages of adolescence and how these contexts are linked to the development of mental health outcomes could greatly inform our understanding of adolescent mental health disorders. In a similar line, it would be important to understand how risk environments change within individuals across time and what predicts changes in or out of a particular risk context. Recent

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advances in statistical modeling make this possible (e.g., latent transition analyses; Bray, Lanza, & Collins, 2010), and would provide a person-centered perspective across development.

Conclusion

Findings from this study suggest that a majority of Mexican American males and females develop within contexts of low risk. A small and important minority, however, are developing within environments in which many risk factors are at play. These environments predict changes in both internalizing and externalizing disorder symptoms over time, with gender being an important risk factor for internalizing symptoms. Despite its limitations, the current study contributes significantly to our understanding of Mexican American psychological functioning by identifying prospective links between environmental contexts of risk and mental health symptomatology in early adolescence.

Study 2: Perceived Discrimination, Diurnal Cortisol Profiles, and Gender:

Examining Relations among Mexican American Adolescents

Discrimination is a commonly experienced stressor among ethnic and racial minority individuals in the U.S. (Williams & Mohammed, 2009). Nearly 30% of Mexican American adults and 50% of Mexican American adolescents report experiences of discrimination on a daily basis (Pérez, Fortuna, & Alegría, 2008). This frequency is alarming given that perceived discrimination has been consistently linked to a variety of physical and mental health outcomes that include hypertension, self-reported poor health, breast cancer, depression, and anxiety (for review see Pascoe & Richman, 2009; Williams & Mohammed, 2009). Numerous theories posit that there are physiological pathways through which perceptions of discrimination affect health (Beauchaine, Neuhaus, Brenner, & Gatzke-Kopp, 2008; Cicchetti, & Gunnar 2008; Clark, Anderson, Clark & Williams, 1999; Meyers, 2009; Pascoe & Richman, 2009). Specifically, such experiences set in motion a process of physiological responses that include cardiovascular activity and greater stress response, which over time, are theorized to lead to deleterious health outcomes. Empirically, perceived discrimination has been found to predict greater cardiovascular reactivity, which includes higher nocturnal blood pressure (Brondolo et al., 2008), and higher systolic and diastolic blood pressure throughout the day (Steffen, McNeilly, Anderson, & Sherwood, 2003); however, the link between perceived discrimination and other major stress response systems remains relatively unexplored.

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One of those systems is the hypothalamic-pituitary-adrenal (HPA) axis; as one of the body's major stress responding systems, the HPA axis reacts to environmental stressors or threats by activating a complex cascading of events, eventually resulting in the release of the stress hormone, *cortisol* (Johnson, Kamilaris, Chrousos, & Gold, 1992). Cortisol levels have been linked to day-to-day variation in daily stressors (Adam, 2006) and more persistent, chronic life stressors (Miller, Chen & Zhou, 2007), but its link to perceptions of discrimination has yet to be examined. The HPA axis appears to be particularly sensitive to environmental stressors that are uncontrollable or relate to individuals' social standing (Dickerson & McKemeny, 2004), both of which are characteristic of discrimination; therefore, we might expect a strong relation. Further, prior work has found that ethnic and racial minorities (i.e., African Americans, Latinos) differ from majority individuals in their basal cortisol levels (DeSantis et al., 2007; Gallager-Thompson, et al., 2006; McCallum, Sorocco, & Fritsch, 2006), prompting scholars to theorize that discrimination plays an important role in these differences (Miller et al., 2007; Pachter & García Coll, 2010). To gain a better understanding of the physiological processes activated by discrimination, the current study examined the link between perceptions of discrimination and diurnal cortisol levels among Mexican American adolescents. As members of the youngest and fastest growing ethnic minority populations in the U.S. (U.S. Census, 2006), understanding the physiological correlates of these adolescents' experiences has implications for our understanding of health

disparities among the Mexican American population and other racial/ethnic minorities within the U.S.

Perceived Discrimination as a Stressor

Discrimination is a reality for ethnic and racial minority individuals living within the U.S with estimates that nearly half of African American, Latino, and Asian American adolescents report such experiences on a regular basis (Fisher, Wallace, & Fenton, 2000). For Latinos, recent political attention to immigration in the U.S. has increased perceptions of such experiences with nearly 61% of Latino adults describing discrimination as a "major problem" in 2010 compared to 50% in 2004 (Lopez, Morin, & Taylor, 2010). Empirical evidence of the deleterious effects of perceived discrimination is mounting. In a recent meta-analysis of 134 studies, a robust and strong relation emerged between perceptions of discrimination and physical health outcomes that included cardiovascular disease, hypertension, diabetes, and respiratory conditions (Pascoe & Richman, 2010). An equally strong relation emerged between discrimination and mental health conditions (e.g., depression, anxiety, posttraumatic stress disorder, and perceived quality of life).

Although most of this work has focused on adult populations, researchers have also begun to examine the effects of discrimination on adolescents' development. Cross-sectional studies have consistently found that adolescents' perceptions of discrimination relate to mental (e.g., Simons, Murray, McLoyd, Lin, Cutrona, & Conger, 2002) and physical health outcomes (e.g., Clark, 2006). More recently, longitudinal studies have emerged revealing that perceptions of

discrimination relate to changes over time in internalizing symptoms (e.g., Berkel, et al., 2010; Greene, Way, & Pahl, 2006), externalizing symptoms (e.g., Galliher, Jones, & Dahl, 2011), and academic functioning (e.g., Berkel et al., 2010). Together, such evidence underscores the seriousness of perceived discrimination in adolescents' development.

Adolescence is a particularly compelling period of development to understand the impact of discrimination. Due to increased cognitive functioning and a greater sense of self-identity, theorists have posited that this developmental stage brings an increased understanding that societal attitudes of racial/ethnic biases are based upon opinion and perspectives of its majority members (Selman, 1976). Adolescents, in turn, develop a greater awareness of biases and discrimination at an interpersonal level, leading to increased perceptions of discrimination (Brown & Bigler, 2005). Understanding the pathways linking discrimination to adolescents' outcomes during a developmental period in which such events gain salience could provide researchers clues into the impact of discrimination over the life course.

Hypothalamic-pituitary-adrenal Axis Response to Stressors

The biopsychosocial model of minority health (Meyers, 2009) and other theoretical frameworks (Pascoe & Richman, 2009) posit that there are physiological pathways and mechanisms linking perceptions of discrimination and health. One of those mechanisms is the HPA axis. As one of the bodies' major stress-response systems, the HPA axis reacts to both physical and psychological environmental stressors and includes complex interactions between

the hypothalamus, the pituitary gland, and the adrenal cortex (Johnson et al., 1992). Stated simply, when stressors arise, the limbic system activates the release of corticotropin-releasing hormone (CRH) and arginine vasopressin (AVP) from the hypothalamus. CRH and AVP then interact with receptors of the anterior pituitary, which in turn stimulates the release of adrenocorticotropin hormone (ACTH) into general circulation (Herman & Cullinan, 1997). ACTH circulates in the blood and binds to the receptors of the adrenal cortex, stimulating the release of cortisol. About 95% of cortisol is biologically inactive (unable to be accessed) because it is immediately bound to corticosteroid binding globulin and albumin; the remaining cortisol, however, is active in the body, affecting a wide range of processes (de Kloet & Derijk 2004). During the process of cortisol secretion, there are important feedback mechanisms to the hippocampus, hypothalamus, pituitary, and the prefrontal cortex that help to self-contain the activation of the HPA axis (Chrousos & Gold, 1992). When signaled, the feedbacks inhibit the further production of CRH and AVP from the hypothalamus and ACTH from the pituitary, effectively turning off the HPA axis when individuals have recovered from the environmental stressor.

The entire process of the HPA axis responding to immediate stressors is often referred to as *cortisol reactivity*. Most of the early work on cortisol has focused on this area; researchers have used laboratory stressor tasks to elicit a cortisol response (for review see Dickerson & Kemeny, 2004) and more recently examined reactivity in naturalistic settings (Adam, 2006). Researchers have also begun to understand the importance of examining cortisol outside of the reactivity

framework, focusing on the basal activity of the HPA axis (e.g., Adam, Doane, Zinbarg, Mineka, Craske, & Griffth, 2010; Shirtcliff & Essex, 2008). The HPA axis produces levels of cortisol that follow a strong diurnal rhythm; cortisol levels are high upon waking, increase by 50-60% in the first 30-40 minutes [known as cortisol awakening response (CAR)], and then rapidly drop off throughout the day, reaching nadir around midnight (Kirschbaum & Hellhammer, 2000; Pruessner, et al., 1997). Although the relation between cortisol reactivity and basal diurnal levels is not completely understood, theories of HPA axis activity posit that the periodic activation of the HPA axis and the release of cortisol are necessary to cope with acute stress; when the HPA axis response is frequent or persistent, however, chronically low or chronically high levels of cortisol can emerge, leading to changes in basal cortisol levels and possibly, damaging effects that include receptor desensitization and tissue damage (McEwen, 1998). This process is often referred to as *allostatic load* (McEwen, 1998, 2002)

Although empirical studies have lagged behind theory, emerging research into diurnal cortisol rhythms suggests that flattened diurnal slopes, increased CAR, and/or low or high levels of overall cortisol output [typically referred to as area under the curve (AUC)] might be an indication of such changes and even allostatic load (McEwen, 2002). For instance, prolonged or cumulative stressors have related to decreased morning cortisol levels and a higher afternoon/evening cortisol levels, which results in a flatter slope or a less steep decline in cortisol across the day (for review see Miller et al., 2007; Michaud, Mathenson, Kelly, &Anisman, 2008). Further, persistent environmental stressors have been linked to

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a greater CAR (Schulz, Kirshbaum, Prubner, & Hellhammer, 1998; Pruessner, Hellhammer, & Kirschbaum, 1999; Pruessner, Hellhammer, Pruessner, & Lupien, 2003) and a greater AUC (Gustafsson, Gustafsson, & Nelson, 2006; Kirschbaum et al., 1995). Together, such evidence suggests that persistent or chronic environmental stressors have the potential of influencing diurnal cortisol patterns.

Although no empirical studies have specifically examined the relation between perceptions of discrimination and HPA axis functioning, studies suggest that activation of the HPA axis is sensitive and more prone to react to stressors that are *socially evaluative* and *uncontrollable*. In a meta-analysis of 208 adult laboratory studies, Dickerson and Kemeny (2004) found that adults had a strong cortisol response to stressors when exposed to threats in which an aspect of the self (e.g., trait, ability) could be negatively judged by others or when stressors were deemed uncontrollable. Stressors with both characteristics evoked the strongest cortisol response. Naturalistic studies corroborate these findings such that uncontrollable stressors and/or stressors that pose a threat to the individual's social standing were related to flattened diurnal slopes (lower morning values, higher afternoon values; Michaud, et al., 2008, Miller et al., 2007). Experiences of discrimination could be considered both socially evaluative and uncontrollable; socially evaluative because such experiences threaten individuals' social standing in their peer group and their immediate context (e.g., school) and uncontrollable because discrimination has nothing to do with individuals' actions, but rather their ethnic appearance or national origin. Guided by previous findings, we might

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expect perceptions of discrimination to be a particularly important stressor in activating the HPA axis.

An important consideration in linking environmental stressors like discrimination and physiological response is gender. First, prior work has found that males report more frequent exposure to discrimination than females (Alfaro et al., 2009) and some evidence suggests that males might display poorer psychosocial outcomes in response to discrimination than their female counterparts (e.g., Delgado, Updegraff, Roosa & Umana-Taylor, 2009; Wiehe, Aalsma, Liu, &Fortenberry, 2010). In terms of cortisol, some literature suggests that females display greater overall levels of cortisol output and CARs than males (Kunz-Ebrecht, Kirschbaum, Marmot, & Steptoe, 2004); however studies among children find no differences (Knutsson et al., 1997). Although some studies have examined gender differences in HPA axis reactivity in the laboratory setting, no study has examined how environmental stressors impact adolescent males' and females' cortisol differently in the naturalistic setting. Examining gender differences in adolescence appears especially important given that the divergence between males and females on challenges, stressors, and outcomes manifest during this developmental period. To increase our understanding of the role of gender in HPA axis activity, a closer look is warranted.

The Current Study

To address prior limitations in the literature and to advance our understanding of physiological processes underlying perceptions of discrimination, the current study examined the relation between Mexican

American adolescents' diurnal cortisol levels and self-reported perceptions of discrimination in the naturalistic setting. We focused on three commonly used parameters in cortisol research, CAR, diurnal slopes, and AUC, hypothesizing that greater perceptions of discrimination would relate to greater CARs, flatter diurnal slopes and greater AUCs, controlling for individuals' socioeconomic status, life stressors, and depressive symptomatology. We also explored the role of adolescent gender in moderating the relation between perceptions of discrimination and diurnal cortisol parameters, but made no hypotheses given the inconsistencies in prior work. This study contributed to the existing literature by being the first empirical study to examine the relation of discrimination and HPA axis diurnal functioning among male and female adolescents. Although focused on Mexican American adolescents, it has the potential of contributing to our understanding of the physiological processes of discrimination in ethnic and racial minority males and females at large.

Method

Participants and Procedure

Data for the current study came from a longitudinal study of 750 Mexican-origin families focused on culture and context (Roosa et al., 2008). A subsample of these families ($N = 131$) were asked to participate in a cortisol sampling protocol during the third wave of data collection when adolescents were in tenth grade. To be eligible to participate, the families must have been scheduled for

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interviews in the larger project between February, 2010 and December, 2011.[2]

The selected families were contacted to schedule the in-home interview and asked

if their adolescent was interested in participating in a 3-day cortisol sampling

protocol. At the home, bilingual (Spanish and English) trained interviewers

obtained informed consent from the mother and/or father and assent from the

adolescent, and distributed the cortisol "spit kit" to the adolescent. Interviewers

briefed the adolescent on the materials contained in the kit and the sampling

protocol and asked participants to start the sampling protocol the next day (if

interviewed Sunday – Tuesday) or to start the following Monday to ensure

sampling on three consecutive weekdays. Study personnel contacted participants

each night of the sampling protocol to ensure proper cortisol sampling techniques

and answer participants' questions. Adolescents were also asked to respond to a

series of questions about their daily behaviors/activities that included medication

use (including depression or asthma related medication), hours of exercise,

alcohol consumption, cigarette use, caffeine consumption, and stress level. After

completion of the third day, study personnel picked up cortisol samples from each

adolescent's home.[3] Samples were stored in a -20 degrees Celsius freezer until

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[2] For the start of the study, only English speaking families (mother or father and

adolescent) were selected ($n = 28$). English or Spanish speaking families were

selected for the reminder 103 families.

[3] During the start of the study, 28 participants were given prepaid envelopes to

ship the samples back to the project and 23 participants complied. To increase

being assayed. Adolescents were paid $55 for the larger in-home interview and $15 for their completion of the salivary cortisol protocol.

Of the 131 families targeted, 113 adolescents (86.2%) agreed to participate. Fifteen adolescents were excluded from the current analyses because they did not complete the cortisol protocol ($n = 5$), did not label cortisol samples ($n = 1$), reported that they were on corticosteroid medication ($n = 4$), or had missing data on variables of interest across all 3-day sampling protocol ($n = 5$), resulting in a final sample of 98 adolescents. Participants (51% female) were approximately 15 years old ($M = 15.3$, $SD = 0.50$) and 85.7% reported being born in the U.S. Adolescents came from families in which 36 % of fathers and 48% of mothers reported being born in the U.S. Family income ranged from $5,000 to $99,000 with a mean range of $40,000 to $45,000. All adolescents completed the interview and cortisol materials in English, whereas 52% of father and 46% of mothers completed interviews in Spanish. Adolescents excluded from the current analyses ($n = 15$) did not differ from participating adolescents ($n = 98$) on age, gender, nativity (adolescent and parent), family income, interview language use (adolescent and parent); however, those in the current sample ($n = 98$) differed from the larger longitudinal study sample ($N = 652$) on adolescent nativity ($\chi^2[1] = 12.88$, $p < .001$), maternal nativity ($\chi^2[1] = 29.14$, $p < .001$), paternal nativity ($\chi^2[1] = 11.94$, $p < .001$), family income ($t [731] = 3.64$, $p < .001$), mothers'

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completion rates, we changed the protocol for the reminder of participants ($n = 85$) by having study personnel pick up samples from participants' homes.

interview language ($\chi^2[1] = 66.83$, $p < .001$) and fathers' interview language ($\chi^2[1] = 41.22$, $p < .001$). That is, family members in the larger study were more likely to be born in Mexico, have lower family income, and more likely to complete the interview in Spanish.

Measures

Salivary cortisol. Salivary samples were gathered each day for three consecutive weekdays at wake up, 30 minutes after waking, and bedtime. Adolescents were given a preset 30-minute timer to aid in compliance with the second sample. Participants expelled saliva through a small straw into a 2-mL polypropylene tube and labeled tubes with the time and date. Participants were instructed not to eat, drink, or brush their teeth 30 minutes before sampling. Samples were picked up from participants' homes, refrigerated at -20 degrees Celsius, and then sent on dry ice by courier to Biochemisches Labor, Trier, Germany to be assayed for cortisol. Cortisol levels are stable at room temperature for several weeks and are unaffected by shipping (Clements & Parker, 1998). Assays were conducted using a time-resolved immunoassay with fluorometric detection (DELFIA; see Dressendorfer et al., 1992 for greater assay description). Intra-assay coefficients of variation (CVs) were between 4.0% and 6.7%, and inter-assay CVs ranged from 7.1% to 9.0%.

To compute the CAR, the difference between the waking cortisol level and the 30 min after waking cortisol level was calculated for each day ([wakeup +30 min cortisol] – [wakeup cortisol level; Adam & Kumari, 2009]). Daily diurnal slope was computed by taking the difference between waking cortisol level and

bedtime cortisol level and dividing by the time between the samples ([bedtime cortisol] – [wakeup cortisol]/time between waking and bedtime sample). Finally, daily AUC (with respect to ground) was calculated using the trapezoid formula (Pruessner, Kirschbaum, Meinlschmid, & Hellhammer, 2003).

Perceived discrimination. Adolescents' perceptions of discrimination were assessed during the in-home interview using the Brief Perceived Ethnic Discrimination Questionnaire (Brief PEDQ; Brondolo et al., 2005). The original scale utilizes 16 items that assess experiences of ethnic discrimination within social or interpersonal contexts. Each item begins with the phrase: "Because of your race or ethnicity . . . " followed by a description of exposure in the following subscales Exclusion/Rejection (3 items; e.g. "others ignored you or not paid attention to you"), Stigmatization (4 items; e.g., "others hinted that you are dishonest or can't be trusted"), Threat/Aggression (4 items; e.g., "others threatened to hurt you"), Discrimination at School (4 items; e.g., "been treated unfairly by teachers or other staff") and Police attitudes (1 item; "policemen or security guards been unfair to you"). An additional item was added to assess opinions of intelligence (e.g., "hinted that you are not very smart"). Participants were asked how often each of these experiences happened during the past 12 months and responded using a Likert scale, ranging from 1 (*never happened*) to 5 (*happened very often*). The scale demonstrated good reliability for the current study ($\alpha = .93$).

Day-level control variables. To account for the many daily behaviors known to be associated with diurnal cortisol, adolescents reported their waking

time, previous night's hours of sleep, daily consumption of caffeinated drinks, cigarettes, alcohol, their daily hours of exercise and current medication.

Individual-level control variables. To account for individual-level factors that have been found to relate to cortisol levels, the current study controlled for family income, adolescents' overall stressors, and adolescents' major depressive disorder (MDD) symptoms. For family income, mothers and fathers were asked to provide their annual income. For two parent families, the mean of mothers and fathers' reports were used. For single parent families, mothers' reports were used. Adolescent overall stressors were examined using the Multicultural Events Scale for Adolescents (MESA; Gonzales, Tein, Sandler, & Friedman, 2001). The MESA is a life events scale used to assess stressors for adolescents that specifically fit the lifestyle and experiences of culturally diverse adolescents. Adolescents responded to items assessing family economic hassles (10 items; e.g, "Your parent lost a job"), peer conflict (14 items; e.g., "You had a disagreement or fight with a close friend.), family conflict (e.g., "You had a serious disagreement or fight with a parent") and language hassles (e.g., "A teacher put you down for not speaking English or not speaking it well"). Adolescents responded to each item by indicating if the event *happened* or *did not happen* in the past three months. For the current study, a sum of all events experienced except the language hassles subscale, which might overlap with discriminatory experiences, were used. Finally for MDD symptoms, parent and adolescents completed the Diagnostic Interview Schedule for Children (DISC-IV; Shaffer et al., 1996), a structured diagnostic instrument for use by nonclinicians,

to assess indicators mental health symptomatology. The mean of both parent and adolescent report was used.

Results

Descriptive statistics and correlations among study variables are presented in Table 6. To examine the research questions, a series of regressions were run in a multilevel modeling (MLM) framework. MLM was an appropriate analytic technique to account for the daily cortisol samples (Level 1) nested within individuals (Level 2; Raudenbush & Bryk, 2002). First, to determine the amount of variability across individuals on cortisol parameters (i.e., CAR, Diurnal Slope, and CAR) a series of unconditional models were run and intraclass correlations (ICC) were computed. If significant variability existed, perceived discrimination and adolescent gender (both at Level 2) were added as predictors of each cortisol parameter along with a series of Level 1 and Level 2 control variables.[4] Finally,

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[4] MLM equations are as follows: *Level 1*: $Cortisol_{ij} = \beta_{0j} + \beta_{1j}$ (Caffeine) $+ \beta_{2j}$ (Exercise) $+ \beta_{3j}$ (Wake time) $+ \beta_{4j}$ (Hours of sleep) $+ \beta_{5j}$ (Stress level) $+ r_{ij}$
Level 2: $\beta_{0j} = \gamma_{00} + \gamma_{01}$ (Discrimination)$+ \gamma_{02}$ (Gender)$+ \gamma_{03}$ (Life stressors)$+ \gamma_{04}$ (Family income)$+ \gamma_{05}$ (MDD symptoms)$+ \gamma_{06}$ (Birth control) $= u_{ij} + r_{ij}$
$\beta_{1-5j} = \gamma_{10-50}$. Alcohol consumption, cigarette consumption, and medication use were excluded from models because of the lack of variability. Only one participant reported drinking one alcohol beverage and only two adolescents reported smoking cigarettes. Less than 7% of adolescents reported medication use across the three days of sampling.

an interaction between perceived discrimination and adolescent gender was added

(at Level 2). In line with recommendations, all Level 1 and Level 2 predictors

were grand mean centered (Enders & Tofighi, 2007).

Unconditional models for the cortisol parameters revealed that 29% [τ_{00}=

.025 (standard error [SE] = .007), $p < .001$] of the variation in the CAR, and 34%

(τ_{00} = 2.57 [SE = .64], $p < .001$) of the variation in AUC was attributed to

differences across individuals; for diurnal slopes, however, the variation across

individuals was not significant (τ_{00} = .001 [SE = .001], p = .71) meaning we could

not continue examining variation in diurnal slopes. Given that the diurnal slopes

were computed using both waking levels of cortisol and bedtime levels of

cortisol, we examined these two cortisol parameters separately to see if significant

variability across individuals existed. Results revealed that 30% (τ_{00}= .013 [SE =

.003], $p < .001$) of the variation in waking cortisol and 33% (τ_{00}= .003 [SE =

.002], $p < .05$) of the variation in bedtime cortisol was attributed to differences

across individuals. We proceeded by treating the following cortisol parameters as

our dependent variables: CAR, AUC, waking cortisol and bedtime cortisol.

Next, discrimination, gender and control variables were added into the

regressions to predict individuals' CAR, AUC, waking and evening cortisol levels

(Table 7). For the CAR, discrimination emerged as a marginally significant

predictor (p = .06), revealing that greater perceptions of discrimination were

related to a more pronounced CAR (greater increase in cortisol from waking to 30

minutes after waking). Gender was also a significant predictor; females reported a

more pronounced CAR than males. For the AUC, both discrimination and gender

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emerged as significant predictors, revealing that greater perceptions of discrimination were related to a greater AUC cortisol levels and females reported a greater AUC than males. For morning cortisol, discrimination and gender were not significant. For bedtime cortisol, discrimination was marginally significant (p = .08) suggesting that greater perceptions of discrimination related to greater bedtime levels of cortisol. Next, an interaction term between discrimination and adolescent gender was added to each model, but did not emerge as significant. To understand what the entire cortisol pattern might look like for adolescents perceiving high and low perceptions of discrimination, a mean of each cortisol sample across the three days of sampling for each individual was computed. Using these means, Figure 3 presents the diurnal cortisol pattern for individuals who reported below the perceived discrimination mean (low discrimination) and individuals who reported above the discrimination mean (high discrimination). Although descriptive, this figure demonstrates that individuals with high discrimination exhibited greater overall cortisol, partially driven by greater CARs, than individuals with low discrimination.

Discussion

The current study contributed to the extant literature by being the first empirical study to examine the relation between perceived discrimination and diurnal cortisol rhythms among adolescents. Although perceived discrimination has been consistently linked to physical and mental health outcomes cross-sectionally and longitudinally (Williams & Mohammed, 2009), the pathways and processes underlying the relation remain relatively unexplored. Numerous

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theories suggest that physiological processes mediate the link (Meyers, 2009; Pascoe & Richman, 2009); however, most empirical examinations have focused on cardiovascular reactivity, with little attention given to the stress response. Uncovering stress response processes underlying experiences of discrimination can start to provide researchers with a clearer understanding into physiological mediators linking discriminatory experiences and health outcomes among ethnic and racial minorities in the U.S and abroad. The current study focused on Mexican American adolescents, one of the largest and fastest growing ethnic minority groups in the U.S. (U.S. Census, 2006) and examined the relation between diurnal cortisol and perceived discrimination. This examination appears especially relevant at a time when Mexican Americans perceive greater discrimination given the recent political focus on immigration in the U.S. (Lopez et al., 2010). My findings suggest that there are aspects of HPA axis functioning that are related to Mexican American adolescents' perceptions of discrimination.

First, Mexican American youth who perceived greater discrimination reported greater AUCs. The AUC is a measure of overall cortisol output across the sampling protocol, which for the current study was from wakeup to bedtime. The findings align with prior work that has demonstrated that increased levels of environmental stressors relate to greater overall cortisol output (e.g., Gustaffson et al., 2006). Further, the findings suggest that discrimination serves as a strong correlate for Mexican American adolescents; nearly a 40% increase in AUC was associated with a one unit increase in perceived discrimination. From a physiological perspective, when adolescents experience discrimination, the HPA

axis is set in motion, eventually resulting in the release of cortisol. Repeated

exposure to discrimination leads to heightened levels of cortisol circulating in the

body. Given that the HPA axis is particularly sensitive to stressors that are

uncontrollable and socially evaluative (Dickerson & Kemeny, 2004) experiences

of discrimination are acting as potent activators of the HPA axis. The current

study aligns with numerous theories (Pachter & García Coll, 2010; Pascoe &

Richman, 2009) by linking perceived discrimination to greater cortisol output

even after controlling for individuals daily behaviors, economic standing, life

stressors, and depressive symptomatology.

The current study's results also suggest that perceived discrimination was

related to greater CARs and bedtime cortisol levels; however, these findings

should be interpreted with caution given that they were only marginally

significant ($p = .06$, $p = .08$, respectively). Lack of significance could be due to

the study's limited sample size and power. Even so, to place the current study's

findings in context, the CAR, defined as the increase in cortisol from waking to

30 minutes post-awakening, typically reflects a 50-60% change in cortisol levels

(e.g., Kirschbaum & Hellhammer, 2000; Adam, 2006). For the current study,

Mexican American youth demonstrated a similar increase (i.e., a 57% increase

from waking to 30 minutes post-waking). Results revealed that the inclusion of

discrimination further increased the CAR; for every one unit increase in

discrimination, the CAR increased by nearly 55% above the average CAR of the

sample. Greater perceptions of discrimination being related to greater CARs is

consistent with prior work examining other environmental stressors (Schulz et al.,

1998). Similar to the AUC, a greater CAR could reflect an individuals' overall greater activation of the HPA axis; however, it could also reflect an individuals' preparation for such experience. Recent work has demonstrated that the CAR might be a unique component of the diurnal rhythm that is controlled by slightly different neurological processes (Clow, Hucklebridge, Stalder, Evans & Thorn, 2010). Further, the CAR might have an anticipatory mechanism activated by individuals' preparing for an upcoming challenge (Fries, Dettenborn, & Kirschbaum, 2009). For instance, prior work has demonstrated that individuals facing social evaluative challenges the upcoming day, awake with a greater CAR than on days where challenges were not expected (Rohleder, Beulen, Chen, Wolf & Kirschbaum, 2007). As such, adolescents who anticipate experiences of discrimination could tend to prepare by exhibiting a boost in their morning cortisol levels as a way to prepare for the upcoming challenge. Over time, this preparation takes a toll on their HPA diurnal functioning resulting in more lasting alteration of the CAR. Answering this question is beyond the scope of the current paper; however, future research focused on linking day-to-day experiences of discrimination to day-to-day fluctuations in CAR could start to uncover the anticipatory function. Further, longitudinal work examining the HPA response to perceived discrimination over time could uncover long term alteration in the CAR.

Before discussing bedtime cortisol, it should be noted that the current study did not examine diurnal slopes (the rate of decline from waking to bedtime cortisol) because of the lack of variability across individuals. Prior work has

demonstrated significant variability in slopes across individuals (e.g., DeSantis et al., 2007), but these studies tend to be with older individuals. Very few studies examining this age group have examined slopes and/or provided information about the degree to which diurnal declines varied across individuals. The current study's lack of variability could be due to the developmental stages of the current study and/or the limited cortisol samples across the day. Experiences of environmental risks across an extended period of time are theorized to be a key factor in changing diurnal slopes (McEwen, 2000). Thus, our lack of slope variability across individuals could be due to the fact that our sample is young and fluctuations in diurnal slopes are not yet evident. Further, prior work predicting variability in slopes among older adolescents has tended to collect more than one evening sample (e.g., Adam et al., 2006; Doane & Adam, 2010) which could allow for more variability across the day.

The current study, however, did find some evidence that perceived discrimination related to elevated bedtime cortisol. Similar to the AUC, higher bedtime cortisol could reflect an HPA axis that is generally working harder and the exhibiting greater cortisol output; again, the result for bedtime cortisol was marginally significant and should be taken with caution. Bedtime cortisol is a component of the diurnal slope and prior work has characterized flatter diurnal slopes as lower morning levels and higher evening levels (Adam & Kumari, 2009); however, for the current study, no differences were seen in waking levels of cortisol, suggesting that evening levels might be more of an indicator of greater cortisol output than flatter diurnal slopes.

Together, the results suggests that, indeed, perceptions of discrimination in Mexican American youth are associated with greater cortisol output even after accounting for adolescents' economic conditions, other stressors, and depressive symptoms. Although cross sectional, it provides an important first step in understanding the physiological mechanisms that might relate experiences of discrimination with mental health symptoms and has the potential of propelling researchers into identifying the mechanisms underlying health disparities in the U.S. These findings come as no surprise given that discrimination has long been theorized as a salient and impactful stressor for ethnic and racial minority youth living within the U.S (Pachter & García Coll, 2010).

Limitations and Directions for Future Research

Despite the study's contributions, there are important limitations to consider. First, the current study utilized cross-sectional data, limiting our understanding of the direction of effects. Although theory suggests that environmental stressors activate the HPA axis and that chronic exposure can result in diurnal changes in cortisol secretion, it could also be that individuals with specific diurnal cortisol profiles share certain characteristics that relate to greater perceptions of discrimination. Prior work has found that individuals who experience severe adverse conditions in early life tend to have distinct diurnal cortisol rhythms that are related to psychopathology (Gunnar, Morison, Chisholm & Schuder, 2001). The current study did control for adolescents' depressive symptoms, but did not account for early childhood trauma or stress. Future longitudinal work uncovering how early life stress and perceptions of

discrimination interact to influence diurnal cortisol could inform this area. An additional consideration that could be answered with longitudinal data is the unique role of particular cortisol parameters across time. Recent work has suggested that the CAR and diurnal slopes act in different ways in relation to depression; the CAR prospectively predicted depression, whereas flatter diurnal slopes were characteristic of depressed individuals (Adam et al., 2010). For discrimination, it could be that a greater AUC is related to concurrent reports of these experiences, but over time, perceptions of discrimination contribute to and predict changes in diurnal slopes or CARs.

Second, the study's sample is limited in the representation of the larger Mexican American population. Compared to the larger longitudinal study from which the current sample was drawn (see Roosa et al., 2008), this sample contained Mexican American youth who were more likely to U.S. born, English speaking, and come from families where parents were more likely to be born in the U.S. Prior work has suggested that individuals born in Mexico report greater levels of discrimination than those born in the U.S. (e.g., Pérez et al., 2008). Thus, our sample could have been slightly restricted in its range in discriminatory experiences which could have implications for power, or the likelihood of detecting significant findings. Further, as many researchers have pointed out (Knight, Roosa, & Umaña-Taylor, 2009), the Mexican American population varies in not only place of birth, but in cultural values and acculturation experiences that have been found to be important in linking environment stressors and outcomes. A recent study suggests that acculturation has implications for

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Mexican American adults' CAR, such that greater Anglo orientation related to dysregulated CARs (Mangold, Wand, Javors & Mintz, 2010). Future work focused on the intersection of culture, discriminatory experiences, and diurnal cortisol in Mexican American youth is greatly needed.

Finally, the study's protocol instructed adolescents to follow a strict schedule for salivary samples. Although nightly calls were made to remind participants, electronic monitoring devices to track exact timing of cortisol samples were not used; failure to time samples appropriately, however, would most likely lead to fewer significant findings, rather than generating more significant results. Even so, future studies with compliance checks could contribute to greater power in detection of the relation between discrimination and cortisol.

Despite these limitations, the current study takes an important first step in understanding the physiological stress response in adolescents in general and, particularly, that underlying experiences of discrimination in Mexican American youth. These findings are important given the growth of the Mexican American population and the salience of discriminatory experiences to this population. Further, our study provides a starting point for researchers interested in further investigating the physiological mechanisms underlying perceptions of discrimination and larger health disparities.

Dissertation Conclusion

My dissertation focused on salient environmental factors for Mexican American youth. Drawing from three theoretical frameworks (i.e., ecological, person-centered, and biopsychosocial model of minority health), I identified salient environmental contexts important for Mexican American youths' adjustment and began the investigation of the physiological processes underlying important cultural risks. These studies add to the current literature by providing examples of innovative methodological tools to increase our understanding Mexican American youth development. Further, these studies contribute to our understanding of environmental risk in adolescents functioning and provide directions and possibilities for prevention/intervention efforts aimed at decreasing Mexican American youth's mental health problems.

My dissertation used innovative analytic techniques and methodology in trying to understand Mexican American youth development. The majority of prior empirical work has focused on environmental risk utilizing variable-centered designs. Study 1, however, used a person-centered analytic strategy and was able to identify unique patterns of risk in Mexican American youth and how these patterns related to mental health symptomatology prospectively. In Study 2, a protocol assessing physiological functioning was implemented in the naturalistic setting. While this protocol has been used with European American, African American, and Latino youth (DeSantis et al., 2007), no study to date has focused on exclusively on Mexican American early adolescents from both English and Spanish speaking families. Study 2 demonstrates Mexican Americans youths'

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willingness to participate in protocol with biological components and suggests that such protocols are viewed as relatively easy and nonintrusive to this population.

Finally, these two studies contribute to our understanding of how environmental risks act in complex ways. There are cumulative components (individuals with the greatest overall risk are experiencing the most mental health problems) and there are components of specificity (certain contexts of risk are uniquely related to specific disorder symptoms). Further, as Study 2 suggests, there are physiological processes that likely mediate the relation of environmental risk and adolescent adjustment. Together, these studies push researchers to begin to understand risk from a more holistic approach and start to identify physiological processes underlying risk, as very few studies exists examining both of these things among the Mexican American population. Further, the two studies bring information for preventionist and interventionist by identifying unique environments of risk that predict mental health disorder symptoms.

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Table 1

Model Fit Indices for Latent Profile Analyses

	AIC	BIC	ABIC	*p* LMR
1 profile	12565.74	12736.69	12619.20	—
2 profiles	12203.34	12420.48	12271.24	.07[†]
3 profiles	**11908.27**	**12171.61**	**11990.61**	**.001**[**]
4 profiles	11039.75±	11349.29±	11136.54	.46
5 profiles	10977.47±	11333.21±	11088.71	.21

Note. *N* = 750. AIC = Akaike information criterion; BIC = Bayesian information criterion; ABIC adjusted Bayesian information criterion; LMR = Lo-Mendell-Rubin. ± The solution loglikelihood did not replicate; [†]*p* < .10, [**]*p* < .01. Bolded text indicates the best-fitting solution.

Table 2

Sample Descriptive and Latent Profile Analysis Indicator Means on Risk Factors across Profile Solutions

Risk factor	Total Sample ($N = 750$)		Profiles		
	M (SD)	Range	*Low risk M*s (n = 633)	*Moderate risk-language M*s (n = 85)	*High risk-peer M*s (n = 32)
Maternal depression	1.78 (0.53)	1.00 – 03.65	1.76$_a$	1.94$_b$	1.73$_{ab}$
Economic hardship	2.58 (0.82)	1.00 – 04.82	2.55$_a$	2.78$_a$	2.68$_a$
Single-Parent (%)	22.9 %		22.3% $_a$	24.7% $_a$	31.3% $_a$
Parent-child conflict	1.95 (0.53)	1.00 – 05.00	1.90$_a$	2.18$_b$	2.33$_b$
Deviant friends associations	1.22 (0.31)	1.00 – 03.71	1.16$_a$	1.32$_b$	2.29$_c$
Peer conflict	3.13 (2.85)	0.00 – 13.00	2.62$_a$	5.68$_b$	6.77$_c$
Discrimination	1.80 (0.62)	1.00 – 05.00	1.71$_a$	2.24$_b$	2.59$_c$
Language hassles	0.57 (0.90)	0.00 – 05.00	0.27$_a$	2.60$_b$	1.13$_c$
Female adolescent	48.8%		48.8% $_a$	49.4% $_a$	46.9% $_a$

Note. Means in the same row that do not share subscripts are significantly different from one another at $p < .05$.

Table 3

Mean Differences and Cohen's d*s for Profiles*

Risk factor	*Low risk* vs. *Moderate risk-language*		*Low risk* vs. *High risk-peer*		*Moderate risk-language* vs. *High risk-peer*	
	Mean difference	Cohen's *d*	Mean difference	Cohen's *d*	Mean difference	Cohen's *d*
Maternal depression	-0.18	0.34[*]	*ns*	—	*ns*	—
Economic hardship	*ns*	—	*ns*	—	*ns*	—
Parent-child conflict	-0.28	0.53[**]	0.43	0.81[***]	*ns*	—
Deviant friends associations	-0.16	0.52[**]	1.13	> 1.00[***]	-0.97	> 1.00[***]
Peer conflict	-3.06	> 1.00[***]	4.15	> 1.00[***]	-1.09	0.38[*]
Discrimination	-0.53	0.85[***]	0.88	> 1.00[***]	-0.35	0.56[**]
Language hassles	-2.33	> 1.00[***]	0.86	0.96[***]	1.47	> 1.00[***]

Note. [*]small effect size, [**]medium effect size, [***]large effect size; *ns* indicates that mean differences between these groups were not significant.

Table 4

Sample Descriptive and Latent Profile Analysis Profile Means on Time 2 Psychological Symptoms, Controlling for Time 1

Symptoms

Psychological symptoms	Total Sample (*N* = 750)		Profiles		
	M (*SD*)	Range	*Low risk M*s (*n* = 633)	*Moderate risk-language M*s (*n* = 85)	*High risk-peer M*s (*n* = 32)
MDD symptoms (T2)	3.03 (2.57)	0.00 – 15.50	2.96$_a$	3.01$_a$	4.28$_b$
Anxiety symptoms (T2)	2.17 (1.61)	0.00 – 09.50	2.08$_a$	2.28$_b$	3.62$_c$
CD/ODD symptoms (T2)	2.46 (2.42)	0.00 – 13.00	2.35$_a$	2.73$_a$	3.49$_b$
ADHD symptoms (T2)	3.34 (3.08)	0.00 – 17.50	3.26$_a$	3.24$_a$	5.19$_b$

Note. Means in the same row that do not share subscripts are significantly different from one another at *p* < .05. ADHD = attention deficit hyperactive disorder; CD/ODD = conduct disorder/oppositional defiant disorder; MDD = major depressive disorder; T2 = Time 2.

Table 5

Latent Profile Analysis Profile Means on Time 2 Psychological Symptoms by Gender, Controlling for Time 1 Symptoms

Psychological symptoms	Low Risk (n= 633)			Moderate risk-language (n= 85)			High risk-peer (n = 32)		
	Females	*Males*		*Females*	*Males*		*Females*	*Males*	
MDD symptoms (T2)	3.00	2.93	*ns*	3.10	2.91	*ns*	5.91	3.14	**
Anxiety symptoms (T2)	2.08	2.09	*ns*	2.24	2.32	*ns*	4.23	3.15	*ns*
CD/ODD symptoms (T2)	2.35	2.34	*ns*	2.55	2.92	*ns*	4.27	2.83	*ns*
ADHD symptoms (T2)	3.06	3.26	*ns*	2.80	3.72	*ns*	6.34	4.29	*ns*

Note. ADHD = attention deficit hyperactive disorder; CD/ODD = conduct disorder/oppositional defiant disorder; MDD = major depressive disorder; T2 = Time 2. **$p < .001$.

Table 6

Descriptive Statistics and Zero-order Correlations for Study Variables

Measure	1	2	3	4	5	6	7	8	9	10
1 Discrimination	—									
2 CAR	.12[*]	—								
3 Waking cortisol	.09	-.20[***]	—							
4 Bedtime cortisol	.10	-.05	.20[**]	—						
5 Diurnal slope	-.02	.16[*]	-.78[***]	.44[***]	—					
6 Cortisol AUC	.20[**]	.58[***]	.42[***]	.48[***]	-.06	—				
7 Family income	.01	.09	-.02	-.08	-.01	.03	—			
8 Life stressors	.43[***]	.12[*]	.01	.02	-.01	.09	-.05	—		
9 Daily life stress	.20[**]	.11[†]	-.01	-.01	.02	.06	.03	.19[**]	—	
10 MDD symptoms	.07	.03	-.09	.01	.08	-.03	.01	.36[***]	.28[***]	—
M	1.22	0.21	0.28	0.08	-0.20	4.50	8.33	7.00	1.83	3.34
SD	0.36	0.30	0.21	0.15	0.24	2.72	5.41	4.68	0.91	2.97

Note. All cortisol levels reflect μg/dL. AUC = Area under the curve; CAR = Cortisol awakening response; MDD = major depressive disorder. [†]$p < .10$, [*]$p < .05$, [**]$p < .01$, [***]$p < .001$.

Table 7

Unstandardized Parameter Estimates (Standard Errors) for Multilevel Model Regressions Predicting Cortisol Parameters

	CAR	Cortisol AUC	Waking Cortisol	Bedtime Cortisol
Intercept	0.204 (.018)***	4.514 (0.197)***	0.279 (.016)***	0.084 (.010)***
Discrimination (γ_{01})	0.113 (.060)†	1.806 (0.646)**	0.072 (.053)	0.062 (.036)†
Gender (γ_{02})	0.193 (.039)***	1.577 (0.429)***	-0.001 (.035)	-0.025 (.023)
Control Variables				
Life stressors (γ_{03})	-0.001 (.004)	-0.036 (0.049)	-0.001 (.004)	-0.001 (.002)
Family income (γ_{04})	0.002 (.003)	-0.011 (0.037)	-0.001 (.003)	-0.002 (.002)
MDD symptoms (γ_{05})	-0.001 (.001)	-0.045 (0.077)	-0.005 (.006)	0.001 (.004)
Oral contraceptives (γ_{06})	-0.133 (.096)	-0.274 (1.089)	0.029 (.087)	0.052 (.061)
Daily caffeine use (γ_{10})	0.046 (.019)*	0.319 (0.200)	-0.017 (.017)	0.015 (.012)
Daily hrs. of exercise (γ_{20})	-0.006 (.019)	0.025 (0.199)	0.019 (.017)	-0.009 (.012)
Daily wake time (γ_{30})	-0.045 (.019)*	-0.376 (0.205)†	0.032 (.017)†	0.006 (.012)
Daily hours of sleep (γ_{40})	-0.033 (.016)*	-0.322 (0.163)†	-0.017 (.014)	-0.003 (.009)
Daily stress level (γ_{50})	-0.006 (.019)	-0.226 (0.197)	-0.001 (.016)	-0.005 (.012)
Variances				
Level 2 variance (τ_{00})	0.014 (.005)**	2.090 (0.613)**	0.013 (.004)**	0.021 (.002)***
Level 1 variance (σ^2)	0.043 (.005)***	4.144 (0.479)***	0.034 (.003)***	0.003 (.002)

Note. $N = 98$. AUC= Area under the curve; CAR = Cortisol awakening response. Gender coded $0 = male$, $1 = female$; Oral contraceptives coded $0 = no$, $1 = yes$. †$p \leq .10$, *$p < .05$, **$p < .01$, ***$p < .001$. All cortisol levels reflect μg/dL.
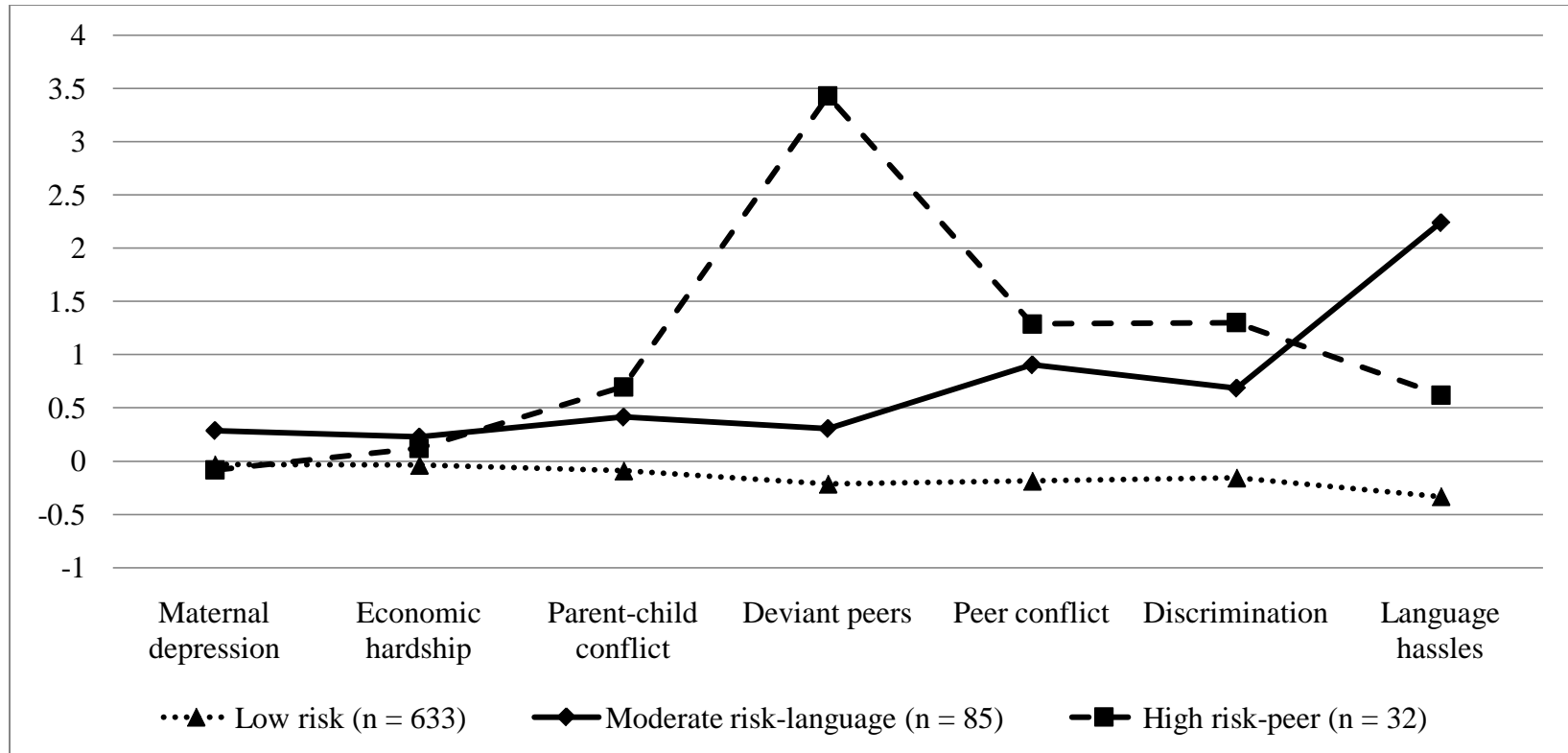
Figure 1. (*N* = 750). Latent profile means on indicators for the 3-profile solution. All variables were standardized across the

sample; means reflect how much each profile differed by standard deviation compared to overall sample mean.
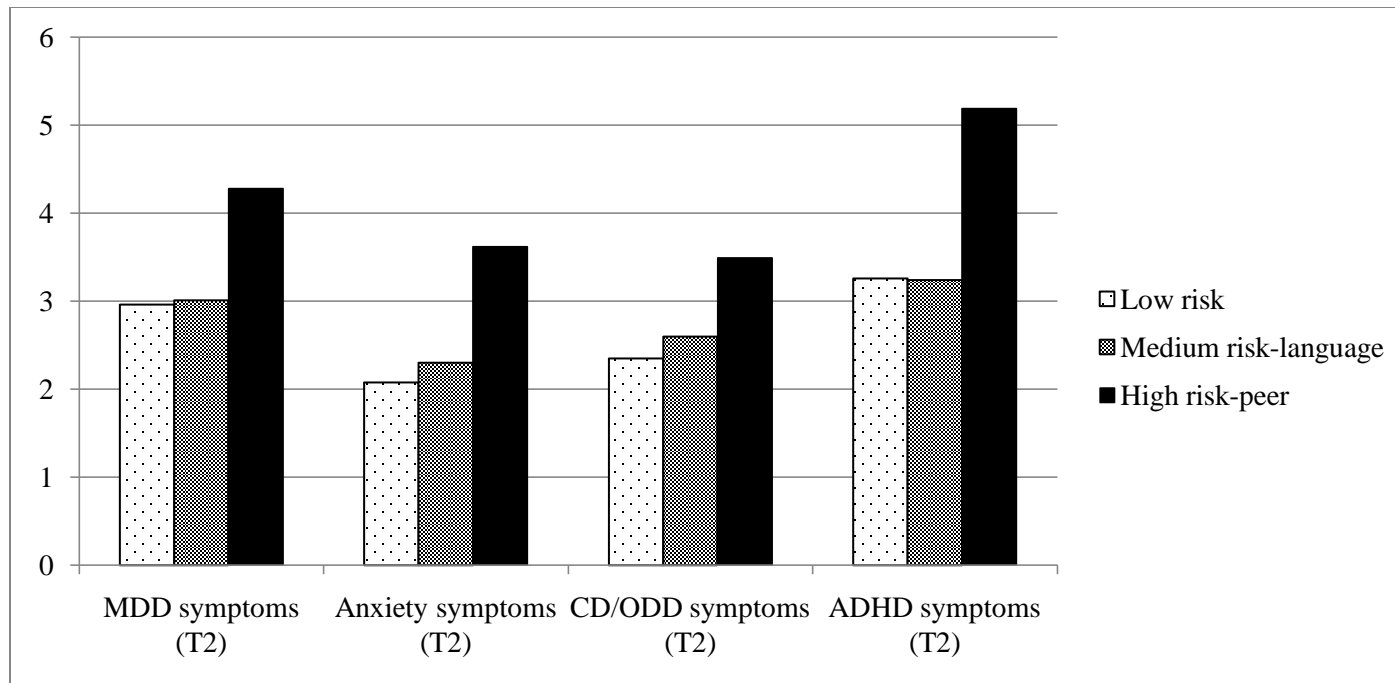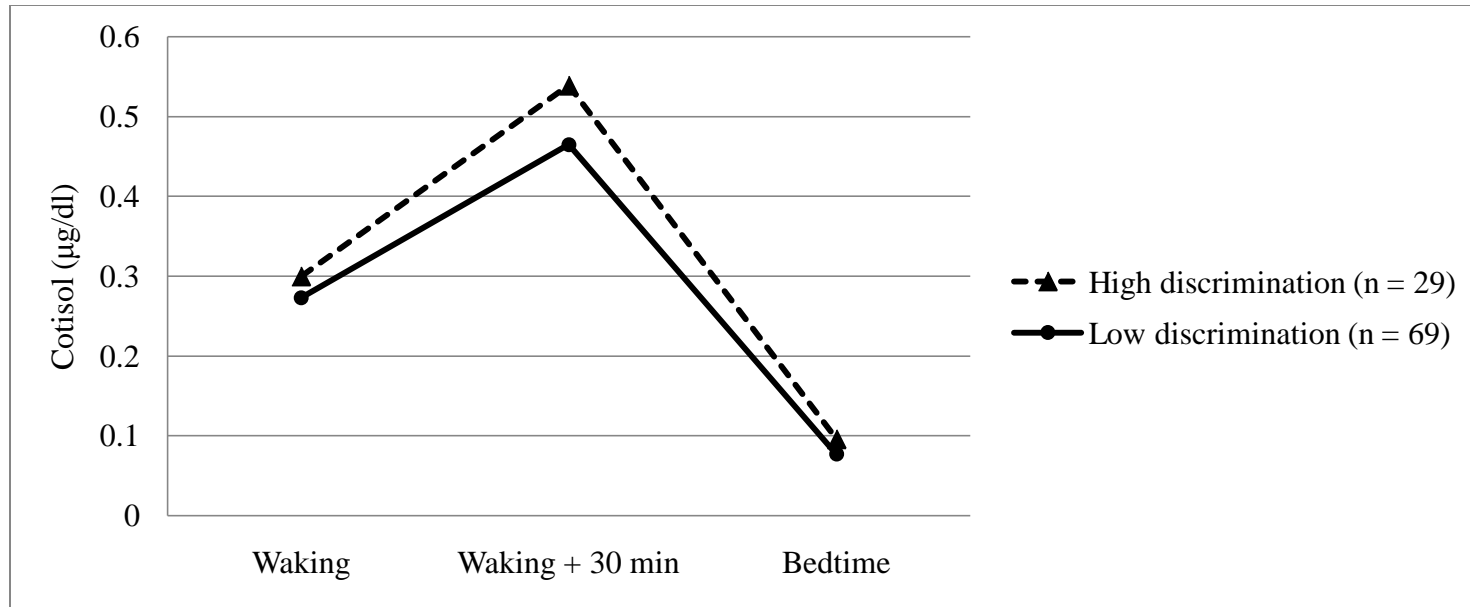
Figure 2. (*N* = 750). Latent profile means on Time 2 psychological symptoms, controlling Time 1 symptoms. T2 = Time 2.

Figure 3. Diurnal cortisol for individuals with high perceptions of discrimination (> 1.22) and low perceptions of discrimination (< 1.22).