The Impact of Socio-Ecological Risk Factor Clustering on Mental, Emotional, and Behavioral Problems in Hispanic Adolescents

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THE IMPACT OF SOCIO-ECOLOGICAL RISK FACTOR CLUSTERING ON MENTAL, EMOTIONAL, AND BEHAVIORAL PROBLEMS IN HISPANIC ADOLESCENTS

By

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A DISSERTATION

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THE IMPACT OF SOCIO-ECOLOGICAL RISK FACTOR CLUSTERING ON MENTAL, EMOTIONAL, AND BEHAVIORAL PROBLEMS IN HISPANIC ADOLESCENTS

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Hispanic youth are often at greater risk for developing mental, emotional, and behavioral (MEB) problems, such as substance use, sexual risk behaviors, and internalizing and externalizing symptoms, compared to non-Hispanic white youth. Socio-ecological risk and protective factors, including family, school, peer, and acculturation factors, have been shown to be associated individually with a variety of MEB problems. This study examines the clustering of these risk and protective factors and evaluates whether there are specific subgroups of Hispanic adolescents, who are at greater risk for a variety of MEB problems.

Data come from two randomized controlled trials, and were collected at baseline, when adolescents were in eighth grade, and then 6, 18, and 30 months post-baseline. Cross-sectional analyses included 959 participants, whereas longitudinal analyses utilized the 474 control group participants to evaluate associations in the absence of intervention.

Using latent class analysis, three subgroups (Low, Medium, and High Socio-Ecological Risk) were identified based on socio-ecological risk and protective factors. Results indicated that adolescents in the higher socio-ecological risk subgroups reported significantly higher MEB problems at both baseline and 30 months post-baseline. Furthermore, the majority of adolescents remained in the same socio-ecological risk
group across time points. Those who remained in the Low Socio-Ecological Risk group reported significantly lower MEB problems at 30 months post-baseline compared to those who remained in the High or Medium Socio-Ecological Risk groups.

These results highlight the stability and impact of the clustering of socio-ecological risk and protective factors on MEB problems and support previous literature in finding the importance of these factors during early adolescence. Implications include the importance of screening youth for multiple risk and protective factors during early adolescence, as well as examining similar socio-ecological risk subgroups as potential moderators of the effects of preventive interventions.
DEDICATION

I dedicate this dissertation to my parents and grandparents for providing me with the tools I’ve needed to succeed, showing me that everything is possible, and teaching me to strike while the iron is hot. I also dedicate this to my husband, Dan, who has been there and supported me through my entire dissertation, as well as to our two furry four-legged children, Clyde and Bonnie, who happily snuggled next to each side of me while writing. I’d like to give a special dedication to my partner in crime, Emily, for always encouraging me to pursue my crazy ideas, as well as to the strong female role models I’ve had in my life, specifically Nagwa and Sarah. And finally, to my friends who have been like family to me. I can’t imagine my life without you.
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Chapter 1: Introduction

I. Overview

Mental, emotional and behavioral problems (MEB), such as substance use, sexual risk behaviors, and internalizing and externalizing symptoms are critical public health issues affecting many adolescents. These preventable and often interrelated mental, emotional, and behavioral (MEB) problems frequently start during childhood and adolescence and extend into adulthood. Although the majority of adolescents are not affected by adverse MEB problems and go on to become healthy adults, some adolescents are affected, potentially resulting in lifelong health problems, injury, or even death. MEB problems involving substance use, sexual health, and mental health are important adolescent health issues. Extensive literature has shown the need to adopt a prevention oriented approach to health care and that preventing MEB problems in adolescence can influence health outcomes across the lifespan.

Compared to non-Hispanic whites, Hispanic adolescents are more likely to report higher rates of many MEB problems. As an increasing segment of the population, it is imperative to evaluate and reduce these disparities in Hispanic adolescents. In order to address adolescent MEB problems, as well as health disparities in Hispanic adolescents, it is critical to better understand risk factors that increase the risk of MEB problems. Furthermore, this involves understanding not only individual risk factors, but also the clustering of these risk factors, given that this may impact a variety of MEB problems. It is essential to understand the manner and degree to which risk factors cluster in adolescents, the stability of this clustering across time, and the impact of this on youth
MEB problems. This understanding can help identify interventions to screen for and prevent multiple, co-occurring risk and protective factors in an adolescent’s environment through interventions.

II. Health Behavior Disparities in Hispanic Adolescents

Recent evidence suggests that Hispanic adolescents are more likely to report higher rates of many MEB problems compared to non-Hispanic whites. The Center for Disease and Prevention’s Health Disparities and Inequalities Report (2013) highlights several health disparities among ethnic minority and socioeconomically disadvantaged groups in the U.S., including substance abuse, HIV and sexually transmitted diseases, and homicides.\(^{11}\) Modifiable MEB problems, such as drug use, externalizing problems and other MEB problems, contribute to these poor health outcomes.\(^{12}\)

i. Substance Use

Tobacco and alcohol consumption are key modifiable health behaviors that are among the leading causes of mortality in the United States.\(^{5}\) They are also important factors to consider in understanding health disparities, given that differences in MEB problems such as substance use appear to underlie certain health disparities in the Hispanic population.\(^{9}\)

For example, data from Youth Risk Behavior Surveillance System, a system that tracks substance use and other health risk-behaviors trends nationally, indicates that Hispanic 8\(^{th}\) and 10\(^{th}\) grade adolescents are more likely than their non-Hispanic white and non-Hispanic black counterparts to have ever tried alcohol (73.2\% vs 71.7\%), cigarettes (48.6\% vs 44.2\%), or marijuana (42.1\% vs 37.9\%) in their lifetime.\(^{13}\) Furthermore,
Hispanic adolescents are more likely than their non-Hispanic white counterparts before the age of 13 to have used alcohol (25.2% vs 18.1%) and marijuana (9.4% vs 6.5%). Hispanic adolescents were also more likely to engage in driving while under the influence of alcohol (9.7% vs 8.0%). As adults, Hispanics continue to have higher rates of high-risk drinking, higher rates of recurrent dependence, greater social and medical consequences of drinking, and lower utilization of alcohol treatment compared to non-Hispanic whites. These health behaviors during adolescence and adulthood contribute to Hispanics being more likely than non-Hispanic whites to develop liver disease, and indeed Hispanic men having the highest mortality rates from liver cirrhosis.

**ii. Sexual Risk Behaviors**

Sexual risk behaviors among youth, such as sex without a condom and early sexual behavior, increase the risk for contracting sexually transmitted diseases and teenage pregnancy. Among sexually active youth, Hispanic adolescents (58%) have the lowest rates of condom use compared to non-Hispanic whites (60%) and non-Hispanic blacks (65%). Hispanics are also more likely to have had sex earlier in life, with 7% of Hispanic adolescents having sex before the age of thirteen compared to 4% of non-Hispanic white adolescents. Hispanic youth are also disproportionately affected by HIV, comprising 17% of new infections compared to 13% for non-Hispanic white youth. This disparity continues into adulthood with Hispanics representing 21% of new infections and accounting for 20% of those living with HIV – despite the fact that Hispanics only comprise 16% of the U.S. population. Sexual risk behaviors also increase the risk of teenage pregnancy and other sexually transmitted diseases, which are
responsible for poor health and life outcomes. Disparities in teenage pregnancy can be observed in the birth rates for Hispanic female adolescents (55.7 births per thousand females) between the ages of 15 and 19 which were more than double their non-Hispanic white counterparts (23.5 births per thousand females). Sexually transmitted diseases also disproportionately impact Hispanics, with Hispanics reporting 2.1 times the rate of chlamydia and syphilis and 1.9 times the rate of gonorrhea compared to non-Hispanic whites.

iii. Internalizing Symptoms

Internalizing symptoms in adolescence can have impacts across the life course and increase the likelihood of other adverse health outcomes. The literature on the prevalence of internalizing symptoms in Hispanic adolescents compared to non-Hispanic white adolescents has shown mixed results, with some studies showing no significant differences, other studies finding that Hispanics are at lower risk of poor mental health outcomes, and yet other studies finding Hispanic adolescents at greater risk.

In terms of internalizing symptoms, the Center for Disease Control’s Youth Risk Behavior Surveillance System shows that Hispanic adolescents reported the highest (relative to non-Hispanic white and non-Hispanic black counterparts) prevalence of “feeling sad or hopeless” (32.6% vs 27.2%), “seriously considered attempting suicide” (16.7% vs 15.5%), “attempted suicide one or more times” (10.2% vs 6.2%), or “made a plan about how they would attempt suicide” (14.3% vs 12.1%).
iv. Externalizing Symptoms

Externalizing symptoms have been found to contribute to poor health and well-being across the life course and have been related to future adverse health outcomes, such as injury and violence.\textsuperscript{6,12} For instance, externalizing symptoms have been linked to lower academic achievement, which has then been found to have cascading effects leading to increased internalizing symptoms in adulthood.\textsuperscript{21} Compared to non-Hispanic white adolescents, Hispanic adolescents have reported a higher prevalence of certain indicators of externalizing symptoms such as being “in a physical fight” (36.8\% vs 29.4\%), “injured in a physical fight” (5.5\% vs 2.8\%) and “in a physical fight on school property” (14.4\% vs 9.9\%).\textsuperscript{2}

III. Theoretical Basis of this Study

Socio-ecological theory, ecodevelopmental theory, and the transactional model of risk provide the theoretical foundations for the analyses in this study. Socio-ecological theory suggests that specific risk and protective factors at the various levels of influence impact adolescent MEB problems. As such, this study draws risk and protective factors from the socio-ecological framework. Building on the social-ecological model, ecodevelopmental theory emphasizes the importance of using a developmental framework to understand MEB problems, given that MEB problems develop and peak at different ages, and that risk and protective factors may operate differently at different ages.\textsuperscript{22} In this study, changes in risk and protective factors, as well as in MEB problems over time, will be examined. Based on the transactional model,\textsuperscript{23} which posits that risk factors can influence each other over time, this study specifically explores the clustering
of risk factors. It is expected that socio-ecological risk and protective factors will likely cluster, and that subgroups of adolescents will emerge with varying levels of risk based upon family, school, peer, and acculturation variables.

i. Socio-Ecological and Ecodevelopmental Models

Addressing health disparities experienced by Hispanic adolescents requires a more refined understanding of the risk and protective factors that influence these MEB problems. A significant amount of literature has examined the impact of individual risk and protective factors on MEB problems, and a variety of theoretical frameworks have been used to understand why adolescents engage in certain adverse health behaviors and why they are affected by MEB problems.

Socio-ecological models and extensions of these models, such as ecodevelopmental theory, propose that there are multiple factors from various social contexts influencing the development of adolescents. These models have been used as theoretical frameworks to successfully identify determinants of MEB problems and to guide the development of intervention strategies for the prevention of MEB problems. For instance, socio-ecological models have been used to understand the contexts in which adolescents engage in sexual risk behaviors, substance use, and exhibit externalizing and internalizing symptoms.

Socio-ecological risk and protective factors are conceptualized as being situated in microsystems (factors that the adolescent directly participates in such as family, peers, and school), mesosystems (interactions of microsystems like parental involvement in school), exosystems (factors that impact people in the adolescent’s life but that do not
directly impact the adolescent such as parental stress), and macrosystems (broad societal concepts like acculturation).  Ecodevelopmental theory extends this model by highlighting the importance of understanding the development of these risk and protective factors over time and suggests that there are sensitive periods when risk factors may have varying influences and when youth may be more vulnerable to MEB problems.

Social-ecological risk and protective factors have been found to be directly or indirectly associated with MEB problems. These risk and protective factors have also been shown to impact future MEB problems. In turn, interventions targeting socio-ecological risk factors, such as Familias Unidas, have been shown to be efficacious in reducing MEB problems. The socio-ecological model provides a very useful framework for this study, informing the specific risk and protective factors being evaluated at the various levels of influence.

ii. Transactional Model of Risk and Clustering of Risk Factors

While a good amount of existing research has established the importance of these risk and protective factors in influencing adolescent MEB problems, studies have often focused on the impact of single, specific risk factors on these outcomes. Examining the clustering of the risk factors within individuals, and the influence of this clustering on multiple MEB problems is an important addition to the literature. The transactional model of risk acknowledges that these socio-ecological risk factors can also influence each other over time, with higher risk in one factor having cascading, negative effects on the others. The model is “transactional” because of its emphasis on the dynamic
interactions among risk and protective factors within the child and his or her environments over time on the developmental processes and outcomes.\textsuperscript{34} Indeed, risk factors have been found to co-occur and influence each other reciprocally. For example, parenting practices have been shown to reciprocally influence peer interactions, with adolescents association with deviant peers leading to lower family functioning and thus fostering greater association with these peers as well as increased rates of future drug use.\textsuperscript{35,36} This is just one example of how adolescent development often includes many risk and protective factors that impact health outcomes.\textsuperscript{37} Given that many of these socio-ecological risk and protective factors influence each other, it is important to examine risk factors together and their impact on a variety of MEB problems.\textsuperscript{38}

IV. Socio-Ecological Risk and Protective Factors

Socio-ecological risk factors have been associated with numerous MEB problems in adolescents. Substance use, sexual risk behaviors, internalizing and externalizing symptoms each have certain unique determinants that increase risk or enhance protection for youth. Yet, these MEB problems also have common risk and protective factors at various contexts or levels of influence (e.g., family school, and peer systems) that have been found to be directly or indirectly associated with the development and intensification of MEB problems during adolescence.\textsuperscript{27,32} Particularly important are factors that characterize nurturing environments – those that promote healthy adolescent development and resilience by decreasing adversity and limiting opportunities for youth to engage in problem behaviors.\textsuperscript{39} This section summarizes the existing, relevant
literature regarding the relationship between specific risk and protective factors and MEB problems, including family, school, and peer group influences and acculturation.

i. Family Influences

Existing studies have shown that family functioning and parenting is related to substance use, sexual risk behaviors, and internalizing and externalizing symptoms, with poor family functioning increasing the risk for MEB problems. Greater parental monitoring and stronger parent adolescent communication have been associated with less substance use in adolescents. Adolescents with higher levels of parent-adolescent communication and positive parenting have also been found to be less likely to engage in sexual risk behaviors. It has been hypothesized that parents who maintain open communication with their children have opportunities to discuss sexual health with them, and these discussions may delay adolescents from having sexual intercourse or increase the likelihood of using condoms if they are engaging in this behavior. In interventions, increasing family functioning has also been shown to be effective in reducing adolescent substance use and sexual risk behavior.

Family functioning has also been associated with internalizing and externalizing symptoms. For instance, greater family conflict has been associated with both increased internalizing and externalizing symptoms among youth. This may occur because families with more positive relationships that are free of conflict and violence provide more nurturing environments for children. Several randomized controlled trials assessing interventions aimed at improving family functioning have been efficacious in
reducing internalizing\textsuperscript{49,50} and externalizing symptoms\textsuperscript{51} when compared to a control group.

ii. School Influences

School influences, such as adolescents’ school connectedness and parental involvement in school, have also been protective against MEB problems among adolescents.\textsuperscript{52-57} Parental involvement in school has been shown to be related to higher levels of a youth’s school connectedness and academic achievement.\textsuperscript{58,59} Greater school connectedness has been associated with less alcohol, cigarette and marijuana use in both observational and experimental studies.\textsuperscript{52,57,60} Adolescents who feel connected to their school are also less likely to begin sexual activity at an early age.\textsuperscript{57,61} Additionally, more limited school connectedness has been associated with current and future mental health problems in youth, including internalizing and externalizing symptoms.\textsuperscript{52,56,57} Less school connectedness could impact these MEB problems through peer groups with adolescents more likely to become involved with deviant peers and therefore more likely to engage in these behaviors.\textsuperscript{62}

iii. Peer Group Influences

Peer attitudes and behaviors have also been found to be significantly associated with adolescent outcomes such as substance use\textsuperscript{63,64} and sexual risk behaviors,\textsuperscript{65} with adolescents whose peers engage in these behaviors or whose attitudes support these behaviors being at increased risk of similarly engaging in these behaviors. Negative peer relationships, such as conflict with peers or affiliation with aggressive or anti-social peers, has also been associated longitudinally with greater externalizing\textsuperscript{66} and
internalizing symptoms. These MEB problems may impact adolescents through modeling the behaviors of their peers. Studies considering both parental and peer risk factors have found that both are influential in the development of adolescent MEB problems, with additional socio-ecological risk factors increasing the risk of the MEB problems in adolescents.

iv. Acculturation

For Hispanic youth, cultural factors are important to examine as potential risk or protective factors. Acculturation, defined as cultural change where an immigrant may adopt portions or all of a new country’s culture and retain some or all of their heritage country’s culture, may also impact MEB problems. Although acculturation can be conceptualized and measured in a multitude of ways, this study will focus on an individual’s cultural practices, such as language use, culinary practices, or media choices, often referred to as behavioral acculturation. Acculturation can directly impact MEB problems, as well as indirectly impact health behaviors, through certain socio-ecological risk factors. For instance family functioning has been shown to mediate the effect of acculturation on some MEB problems.

Although results have not always been consistent in the literature regarding the impact of acculturation on MEB problems, these inconsistencies may be due to varying definitions of acculturation and, in some cases, to the use of a unidimensional linear model of acculturation. Indeed, there is considerable literature now showing that acculturation is multidimensional and demonstrating the importance of utilizing a multidimensional model when seeking to understand the impact of acculturation on
health outcomes. The acculturation literature has shown the value of reporting on Hispanic and U.S. acculturation separately, given that adolescents may have high levels of both or “biculturalism”. Biculturalism has been shown to be protective in terms of certain health outcomes. Moreover, some research suggests that, rather than the increase in U.S. cultural practices, it is the loss of Hispanic cultural practices that intensifies health risks.

V. Dissertation Objectives

This study uses data combined from two randomized clinical trials evaluating *Familias Unidas*, a family-based preventive intervention for Hispanic adolescents. The data from these two trials contains socio-ecological risk and protective factors as well as MEB problems for Hispanic adolescents from eighth to tenth grade and provides a unique, robust dataset to evaluate the development of health outcomes in Hispanics during early adolescence. This study examines the clustering of socio-ecological risk factors in Hispanic adolescents and the association with MEB problems through the following specific aims and hypotheses:

**Specific Aim 1:** Utilizing cross-sectional analysis, identify subgroups of Hispanic adolescents based on socio-ecological risk and protective factors (e.g., positive parenting, parental monitoring of peers) and determine how MEB problems (i.e., substance use, sexual risk behavior, internalizing/externalizing symptoms) are related to higher versus lower socio-ecological risk.

H1: Socio-ecological risk group membership will be associated with a variety of MEB problems, with the high socio-ecological risk subgroup reporting the highest
levels of MEB problems over time, the medium socio-ecological risk subgroup reporting less MEB problems than the high socio-ecological risk subgroup, and the low socio-ecological risk subgroup reporting less MEB problems than the medium or high socio-ecological risk subgroup.

Specific Aim 2: Examine whether the clustering of initial levels of socio-ecological risk and protective factors predicts MEB problems over time.

H2: Socio-ecological risk group membership at baseline will predict MEB problems longitudinally, with the high socio-ecological risk subgroup experiencing the greatest increase in MEB problems over time, the medium socio-ecological risk subgroup experiencing less increase over time than the high socio-ecological risk subgroup, and the low socio-ecological risk subgroup experiencing less increase over time than the medium or high socio-ecological risk subgroup. Furthermore, differences in MEB problems by socio-ecological risk group are expected to be present at 30 months post-baseline.

Specific Aim 3: Assess different patterns of transition in adolescents’ socio-ecological risk clustering across time and the impact of this transitioning on MEB problems over time.

H3-1: The majority of adolescents will remain in the same socio-ecological risk subgroup from baseline to 30 months post-baseline, but there will be a portion of adolescents who transition across different risk subgroups over time.
**H3-2:** Adolescents who remain in lower socio-ecological risk classes over time are expected to report fewer MEB problems at 30 months compared to those who remain in higher socio-ecological risk classes over time. Adolescents transitioning from a lower socio-ecological risk subgroup to a higher risk subgroup over time will report more MEB problems compared to adolescents who remain in the lower socio-ecological risk subgroup. Adolescents transitioning from a lower socio-ecological risk subgroup to a higher risk subgroup over time will also report less MEB problems than those who remain in a higher socio-ecological risk subgroup.

Figure 1-1: Depiction of Aims

These aims are depicted in Figure 1-1. To accomplish these aims, subgroups of Hispanic adolescents will be first identified based on previously established socio-ecological risk and protective factors utilizing latent class analysis, a clustering technique
used to identify homogenous subgroups of participants. Second, differences by these socio-ecological risk subgroups in MEB problems will be examined cross-sectionally, as well as longitudinally. Finally, the degree to which adolescents shift in their socio-ecological risk subgroups over time will be assessed and whether these shifts are associated with differences in MEB problems over time.

The results of this research have the potential to enhance our understanding of the development of adverse MEB problems among Hispanic adolescents, and to provide valuable insights about which groups should be targeted by preventive interventions. First, the results of the risk factor clustering analyses may highlight the need for interventions targeting multiple potentially simultaneously occurring risk and protective factors and support theoretical frameworks that address multiple systems or context influencing adolescents to impact different MEB problems. Second, identifying specific subgroups of youth based on socio-ecological risk factor clustering may also provide information that can be used by interventions to screen and then target high risk youth in special need of intervention. Finally, evaluating the potential changes in risk factor subgroup membership over time can provide information regarding the stability of risk subgroups across adolescent development, and the impact of this stability on MEB problems. This may have consequential implications for the timing and content of preventive interventions.

VI. Summary

Youth mental, emotional, and behavioral (MEB) problems critically impact health during adolescence, as well as throughout the lifespan. Hispanic adolescents often report
higher rates of many adverse MEB problems compared to non-Hispanic whites. Research has shown that common socio-ecological risk and protective factors, including various family, school, and peer variables, can impact multiple youth MEB problems, including substance use, sexual risk behavior, and internalizing and externalizing symptoms. The transactional model of risk suggests that these socio-ecological risk factors often cluster together, intensifying the risk for adverse MEB problems. The clustering of these risk and protective factors likely influences a variety of adverse MEB problems and has implications for the content of preventive interventions; however, existing research has not examined this clustering closely. While some research has looked at multiple risk and protective factors for multiple MEB problems, the majority of existing research focuses on the influence of either single, separate risk factors or on a single MEB problem. This study extends the literature by exploring the clustering of some of these risk and protective factors in adolescents, and evaluating whether there are specific subgroups of Hispanic adolescents based on shared socio-ecological risk and protective factors, such as positive parenting and parental monitoring of peers, that are at greater risk for a variety of MEB problems (i.e., substance use, sexual risk behavior, and internalizing/externalizing symptoms).

The aims of this dissertation include: 1) using baseline data to identify subgroups of Hispanic adolescents based on the clustering of socio-ecological risk and protective factors and determining how MEB problems are related to higher versus lower socio-ecological risk clusters; 2) in the control group, examining whether levels of initial socio-ecological risk subgroups predict MEB problems over time; 3) in the control group,
assessing different patterns of transition in adolescents’ socio-ecological risk subgroup across time, and evaluating the impact of these transitions on MEB problems. Using the control group will allow for the evaluation the changes in MEB problems and socio-ecological risk group clustering in the absence of intervention. Analyses will include latent class analysis and latent transition analysis, advanced statistical methods that can strengthen our understanding of these research questions. More specifically, these person-centered clustering methods can be used to identify homogenous subgroups of participants by examining the clustering of risk and protective factors in adolescents and evaluating the impact of these clusters on multiple MEB problems. This can permit the identification of subgroups of individuals that may be more susceptible to adverse MEB problems.

Results from this dissertation are expected to enhance our understanding of how risk and protective factors cluster in adolescents, and the impact this clustering has on MEB problems. By enhancing our understanding of the manner and degree to which risk and protective factors cluster in adolescents, this can inform how and to whom interventions should be targeted. Findings can support the importance of targeting multiple risk and protective factors in an adolescent’s environment through interventions, and the impact of the stability of these risk and protective factors over time on MEB problems. Results can also help identify adolescent subgroups that should be specifically targeted by preventive interventions based on the clustering of socio-ecological risk and protective factors.
Chapter 2: Methods

I. Overview

This chapter provides a description of the methodologies used in this dissertation. It contains information on the parent study design, the participants, the measurements, and the statistical analyses. This section provides consolidated and detailed methodological information which supplements the methods sections of each of the specific aim papers described in Chapters 3 to 5.

II. Parent Study Design

Data for this study comes from the combination of two randomized controlled trials, evaluating Familias Unidas, a family-based intervention found to be efficacious and effective in preventing and reducing sexual risk behaviors and substance use among Hispanic adolescents.33,77 The first randomized controlled trial was an efficacy study with an indicated sample of 213 Hispanic adolescents and their primary caregivers. To be eligible adolescents had to have been identified by their school counselors as having at least “mild problems” on at least one of the following Revised Behavior Problem Checklist78 subscales: conduct disorder, socialized aggression, and attention problems. Once identified by their school counselors, parents completed the three subscales of the Behavior Problem checklist and to be included in the study adolescents had to be scored by their parents as at least one standard deviation above the mean on one of the three subscales.77 The participants were recruited from three middle schools in the Miami-Dade Public School System.
The second randomized controlled trial was an effectiveness study with a universal sample of 746 Hispanic adolescents and their primary caregivers. In the effectiveness study, school system personnel were trained by researchers to deliver the intervention. The participants were recruited from 18 middle schools in the Miami-Dade Public School System. Combining the samples from both a universal and indicated prevention studies is useful because it provides a sample that has a continuum of risk factors and levels of MEB problems.

For both trials, participants were randomized at baseline to the Familias Unidas intervention or a control condition. Participants were followed across 30 months, with measurements collected at baseline, 6 months, 18 months, and 30 months post-baseline. The University of Miami’s Institutional Review Board and the Miami-Dade County Public School System’s Research Committee approved these studies.

III. Participants

To be eligible for these studies, adolescents were required to: identify as Latino/Hispanic, attend 8th grade at baseline, live with an adult primary caregiver who was willing to participate, live within the catchment areas of the participating middle schools, and plan to live in South Florida for the duration of the study. As noted, the efficacy study had an additional inclusion criterion which was to have been identified by their school counselors as having at least “mild problems” on at least one of the following Revised Behavior Problem Checklist subscales: conduct disorder, socialized aggression, and attention problems.
As shown in Table 2.1, the efficacy study sample consisted of 213 Hispanic adolescents (36% females, n=77) with an average age of 13.8 years (SD = 0.8). A slight majority of the participants were born in the U.S. (56%, n=119) though parents of these adolescents were predominantly foreign born (96%, n=205). Foreign born adolescents (44%, n=94) were primarily born in Honduras (26.9%), Cuba (20.4%), and Nicaragua (16.1%). Adolescents were predominately from low-income families, with 87% (n=185) of participating families reporting an average household income of less than $30,000 per year. A total of 109 adolescents were randomized to the treatment group and 104 were randomized to the control group.

Table 2.1: Description of the Study Sample

<table>
<thead>
<tr>
<th>Variable</th>
<th>Combined</th>
<th>Efficacy Study</th>
<th>Effectiveness Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Size</td>
<td>959</td>
<td>213</td>
<td>746</td>
</tr>
<tr>
<td>Gender (female)</td>
<td>434 (45%)</td>
<td>77 (36%)</td>
<td>357 (48%)</td>
</tr>
<tr>
<td>Intervention Arm (treatment group)</td>
<td>485 (51%)</td>
<td>109 (51%)</td>
<td>376 (50%)</td>
</tr>
<tr>
<td>Age (years)</td>
<td>13.8 (0.7)</td>
<td>13.8 (0.8)</td>
<td>13.9 (0.7)</td>
</tr>
<tr>
<td>Household Income (&lt; $30,000/year)</td>
<td>673 (70%)</td>
<td>185 (87%)</td>
<td>488 (65%)</td>
</tr>
<tr>
<td>Nativity (U.S. born)</td>
<td>530 (55%)</td>
<td>119 (56%)</td>
<td>411 (55%)</td>
</tr>
</tbody>
</table>

The effectiveness study sample consisted of 746 Hispanic adolescents (48% females, n=357), with an average age of 13.9 years (SD = 0.7). A slight majority of the participants were born in the U.S. (55%, n=411) though parents of these adolescents were predominantly foreign born (88%, n=658). Foreign born adolescents (45%, n=335) were primarily born in Cuba (40.6%), Colombia (13.7%), Argentina (6.0%), and Nicaragua (5.7%). Adolescents were predominately from low-income families, with 65% (n=488) of participating families reporting an average household income of less than $30,000 per
year, limiting the use of income in models. A total of 376 adolescents were randomized to the treatment group and 370 were randomized to the control group.

IV. Measurements

All measures were collected via self-report surveys administered to adolescents using audio computer-assisted self-administered interview (ACASI). These surveys presented text on-screen while a pre-recorded voice reads the text to the participant. Participants had the option of selecting whether they wanted to complete the assessment battery in English or Spanish.

i. Socio-Ecological Risk and Protective Factors

The socio-ecological, ecodevelopmental, and transactional models as well as findings from the literature on the development of adolescent MEB problems guided the selection of risk and protective factors used in these analyses. Specifically, the analyses utilized risk and protective factors in the domains of family, school, peer, and acculturation that have previously shown to be associated with a variety of MEB problems. Socio-ecological risk and protective factors used in the analyses represent risk and protective factors in different systems that influence adolescent risk, and included Hispanic cultural practices, U.S. cultural practices, parental monitoring of peers, parental involvement in school, positive parenting, parental involvement, parent-adolescent communication, and perceived peer substance use.

All measures were adolescent reported. Although the family microsystem variables (i.e. positive parenting, parental involvement and parent-adolescent communication) were reported by both the parent and the adolescent, prior work has
shown that the parent and adolescent reports do not correlate strongly.\textsuperscript{27,80} As previously done in Prado et al. (2010), and given that the outcome variables as well as the other socio-ecological risk factors are adolescent reported, adolescent reports of family microsystem variables were utilized.\textsuperscript{27}

Most of the socio-ecological risk and protective factors are based on multi-item subscales with Likert scales and Cronbach’s alphas ranging from .74 to .93. The exception were parental involvement in school and perceived peer substance use, which were based on individual questions. Further description of each variable can be found in the subsections below and the information is summarized in Table 2.2.

\textit{a. Macrosystem: Hispanic and U.S. Cultural Practices}

Hispanic and U.S. cultural practices were assessed using the Bicultural Involvement Questionnaire-Revised.\textsuperscript{81} This questionnaire determines the level of U.S. and Hispanic cultural practices such as comfort and use of language, food, and traditions. Sample items include “how comfortable do you feel speaking English at home” and “how much do you enjoy Hispanic-oriented places.” Responses were on a five point Likert scale ranging from “not at all” to “very much”. Eleven items for each subscale were used with Cronbach’s $\alpha$ estimate of .92 for both Hispanic and U.S. cultural practices.

\textit{b. Mesosystem (Family-Peers): Parental Monitoring of Peers}

Parental Monitoring of Peers (Cronbach’s $\alpha = .81$) included five items from the Parent Relationship with Peer Group Scale,\textsuperscript{82} which inquires whether parents supervise adolescents’ friends, activities, and whereabouts. The responses include a five-point
Likert-type scale, ranging from “not at all” to “extremely well (often).” A sample question was “How well do your parents know your best friends?”

c. **Mesosystem (Family-School): Parental involvement in school**

Parental involvement in school was based on the answer to a question from the Parenting Practices Scale. This question asked “how often did your mom talk with you about how things are going in school?” Responses were on a three-point Likert scale. For specific aims 1 and 2, ordinal responses of “almost never”, “sometimes,” and “often” were utilized in the latent class model. For specific aim 3, responses of “almost never” and “sometimes” were combined to create a binary variable. Utilizing a binary variable instead of an ordinal variable was done in the latent transition analysis model in order to facilitate model convergence.

d. **Microsystem (Family): Positive Parenting, Parental Involvement, Parent-Adolescent Communication**

Positive parenting and parental involvement were assessed using the corresponding subscales from the Parenting Practices Scale. Positive parenting included nine items (Cronbach’s α = .82), and parental involvement included fifteen items (Cronbach’s α = .84). A sample question for the positive parenting subscale was “when you have done something that your parents like or approve of, how often does your mother say something nice about it” and for the parental involvement subscale was “how often do you and your mom do things together.” Survey responses for positive parenting were on a four-point Likert scale ranging from “never” to “always.” Parental involvement
Table 2.2: Description of Socio-Ecological Risk Factors

<table>
<thead>
<tr>
<th>System</th>
<th>Socio-Ecological Risk Factor</th>
<th># of Items / Scale Type</th>
<th>Response Range</th>
<th>Cronbach's α</th>
<th>Source</th>
<th>Sample Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Macro</td>
<td>Hispanic Cultural Practices</td>
<td>11 (5-point Likert)</td>
<td>&quot;Not at all&quot; to &quot;Very Much&quot;</td>
<td>0.92</td>
<td>Bicultural Involvement Questionnaire-Revised(^{81})</td>
<td>How much do you enjoy Hispanic-oriented places?</td>
</tr>
<tr>
<td>Macro</td>
<td>U.S. Cultural Practices</td>
<td>11 (5-point Likert)</td>
<td>&quot;Not at all&quot; to &quot;Very Much&quot;</td>
<td>0.92</td>
<td>Bicultural Involvement Questionnaire-Revised(^{81})</td>
<td>How comfortable do you feel speaking English at home?</td>
</tr>
<tr>
<td>Meso (Family-Peers)</td>
<td>Parental Monitoring of Peers</td>
<td>5 (5-point Likert)</td>
<td>&quot;Extremely well (often)&quot;</td>
<td>0.81</td>
<td>Parent Relationship with Peer Group Scale (^{82})</td>
<td>How well do your parents know your best friends?</td>
</tr>
<tr>
<td>Meso (Family-School)</td>
<td>Parental involvement in school</td>
<td>1 (3-point Likert)</td>
<td>&quot;Almost Never&quot; to &quot;Often&quot;</td>
<td>N/A</td>
<td>Parenting Practices Scale (^{83})</td>
<td>How often did your mom talk with you about how things are going in school?</td>
</tr>
<tr>
<td>Micro (Family)</td>
<td>Positive Parenting</td>
<td>9 (4-point Likert)</td>
<td>&quot;Never&quot; to &quot;Always&quot;</td>
<td>0.82</td>
<td>Parenting Practices Scale (^{83})</td>
<td>When you have done something that your parents like or approve of, how often does your mother say something nice about it?</td>
</tr>
<tr>
<td>Micro (Family)</td>
<td>Parental Involvement</td>
<td>15 (3 or 4-point Likert)</td>
<td>&quot;Never&quot; to &quot;Always&quot;</td>
<td>0.84</td>
<td>Parenting Practices Scale (^{83})</td>
<td>How often do you do and your mom do things together?</td>
</tr>
<tr>
<td>Micro (Family)</td>
<td>Parent-Adolescent Communication</td>
<td>20 (5-point Likert)</td>
<td>&quot;Strongly disagree&quot; to &quot;Strongly agree&quot;</td>
<td>0.90</td>
<td>Parent-Adolescent Communication Scale (^{86})</td>
<td>I can discuss my beliefs with my mother/father without feeling restrained or embarrassed</td>
</tr>
<tr>
<td>Micro (Peers)</td>
<td>Perceived Peer Substance Use</td>
<td>1 (Binary)</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>How many of your friends have ever smoked cigarettes?</td>
</tr>
</tbody>
</table>
included thirteen items on a three point Likert scale and two items on a four point Likert scale, ranging from “never” to “always.”

Parent-Adolescent Communication (Cronbach’s α = 0.90) was assessed using the Parent-Adolescent Communication Scale. This variable was created by summing responses to twenty items, responded to using a five-point Likert scale. A sample question is “I can discuss my beliefs with my mother/father without feeling restrained or embarrassed.” Responses ranged from “strongly disagree” to “strongly agree.”

e. Micosystem (Peers): Perceived Peer Substance Use

The Perceived Peer Substance Use variable was based on combining responses from three questions, including “How many of your friends have ever had any beer, wine, wine coolers, or liquor to drink - more than just a few sips?”, “How many of your friends have ever smoked cigarettes?”, and “Have any of your friends ever used drugs?”. If the participant responded that none of their friends had engaged in any of these activities, perceived peer substance use was coded zero. If the participant responded that very few, some, most or all of them used any of these substances, then perceived peer substance use was coded as one, indicating that their peers did use substances. This variable was made binary to facilitate model convergence in the latent class analysis.

ii. Mental, Emotional, and Behavioral (MEB) Problems

MEB problems examined in this study include adolescent substance use, sexual risk behaviors, and internalizing and externalizing symptoms. Substance use (i.e. alcohol, cigarette, and drug use) and sexual risk behaviors (i.e. lifetime and past 90 day sex, sex without a condom, multiple sexual partners, and sex under the influence) were
binary variables, indicating whether or not the adolescent engaged in the particular behavior. Internalizing symptoms (e.g., anxious/depressed, withdrawn, and somatic complaints) and externalizing symptoms (e.g., delinquent behavior, aggressive behavior) were based on questions regarding the adolescent’s psychological symptoms and behaviors, with responses on a three-point Likert scale. All MEB problems were adolescent reported. Further descriptions of each variable can be found below and the information is summarized in Table 2.3.

**a. Substance Use**

Substance use variables were measured using survey items comparable to the items from the national Monitoring the Future epidemiological study, including questions regarding alcohol, smoking, and drug use (lifetime use and/or past 90 day use). Lifetime alcohol use and alcohol use in the past 90 days were determined by the following survey questions: “Have you ever had any beer, wine, wine coolers, or liquor to drink - more than just a few sips?”, and “In the past three months, have you had any beer, wine, wine coolers, or liquor to drink - more than just a few sips?” Lifetime smoking and smoking in the previous 90 days were assessed using the survey questions: “Have you ever smoked cigarettes?”, and “Have you smoked cigarettes in the past three months?” Lifetime drug use and drug use in the preceding 90 days were determined by the survey questions which asked, “Have you ever used drugs?”, and “Have you used drugs in the past three months?” Participants responded to whether or not they had used the substance in the past three months or had ever used the substance in their lifetime for each of these items.
Responses were coded as one if adolescents indicated that they had used the substance and coded as zero if they indicated that they had not.

b. Sexual Risk Behaviors

Sexual risk behaviors were measured using the following variables: sexual contact (lifetime and/or past 90 days), unprotected sex, multiple sex partners, and sex under the influence of alcohol or drugs. Lifetime sexual contact was determined by the survey question: “Have you ever had vaginal, anal, or oral sex?” Sex in the past 90 days was based on the survey question: “In the past three months, have you had vaginal, anal, or oral sex?” Unprotected sexual behavior was determined by the survey question: “In the past three months, have you had vaginal or anal sex without using a condom?” Having multiple partners was determined by the individual’s response to the number of sexual partners in the past three months, a variable that was dichotomized into a binary variable: less than or 1 partner versus more than 1 partner. Having had sexual intercourse under the influence of alcohol or drugs was based on the question: “During the past three months, have you been under the influence of alcohol, illicit drugs, or nonmedical use medicine before (while) having sex?” Responses to all sexual risk behaviors were dichotomized and were coded as one if the participants engaged in the behavior, and zero if they had not.

c. Internalizing and Externalizing Symptoms

Internalizing and externalizing symptoms were measured using the Youth Self-Report. This measure contains 112 questions, each with a three point Likert scale, including “Not True”, “Somewhat or Sometimes True”, and “Very True or Often True”.
<table>
<thead>
<tr>
<th>MEB Problem</th>
<th>Scale Information</th>
<th>Source</th>
<th>Sample Question</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol Lifetime</td>
<td>1 item, binary</td>
<td>Monitoring the Future$^{87}$</td>
<td>Have you ever had any beer, wine, wine coolers, or liquor to drink - more than just a few sips?</td>
</tr>
<tr>
<td>Alcohol 90 Days</td>
<td>1 item, binary</td>
<td>Monitoring the Future$^{87}$</td>
<td>In the past three months, have you had any beer, wine, wine coolers, or liquor to drink - more than just a few sips?</td>
</tr>
<tr>
<td>Smoking Lifetime</td>
<td>1 item, binary</td>
<td>Monitoring the Future$^{87}$</td>
<td>Have you ever smoked cigarettes?</td>
</tr>
<tr>
<td>Smoking 90 Days</td>
<td>1 item, binary</td>
<td>Monitoring the Future$^{87}$</td>
<td>Have you smoked cigarettes in the past three months?</td>
</tr>
<tr>
<td>Drugs Lifetime</td>
<td>1 item, binary</td>
<td>Monitoring the Future$^{87}$</td>
<td>Have you ever used drugs?</td>
</tr>
<tr>
<td>Drugs 90 Days</td>
<td>1 item, binary</td>
<td>Monitoring the Future$^{87}$</td>
<td>Have you used drugs in the past three months?</td>
</tr>
<tr>
<td>Sex Lifetime</td>
<td>1 item, binary</td>
<td>Sexual Behavior Questionnaire$^{88}$</td>
<td>Have you ever had vaginal, anal, or oral sex?</td>
</tr>
<tr>
<td>Sex 90 Days</td>
<td>1 item, binary</td>
<td>Sexual Behavior Questionnaire$^{88}$</td>
<td>In the past three months, have you had vaginal, anal, or oral sex?</td>
</tr>
<tr>
<td>Unprotected Sex</td>
<td>1 item, binary</td>
<td>Sexual Behavior Questionnaire$^{88}$</td>
<td>In the past three months, have you had vaginal or anal sex without using a condom? “During the past three months, with how many men/women have you had vaginal, anal, or oral sex?”</td>
</tr>
<tr>
<td>Multiple Sex Partners</td>
<td>1 item, binary</td>
<td>Sexual Behavior Questionnaire$^{88}$</td>
<td>During the past three months, have you been under the influence of alcohol, illicit drugs, or nonmedical use medicine before (while) having sex?</td>
</tr>
<tr>
<td>Sex Under the Influence</td>
<td>1 item, binary</td>
<td>Sexual Behavior Questionnaire$^{88}$</td>
<td>I feel lonely</td>
</tr>
<tr>
<td>Internalizing Symptoms</td>
<td>30 items, 3-point Likert, $\alpha = 0.91$</td>
<td>Youth Self-Report$^{89}$</td>
<td></td>
</tr>
<tr>
<td>Externalizing Symptoms</td>
<td>32 items, 3-point Likert, $\alpha = 0.90$</td>
<td>Youth Self-Report$^{89}$</td>
<td>I break rules at home, school, or elsewhere</td>
</tr>
</tbody>
</table>
This measure includes a subscale for internalizing symptoms, which includes 30 items assessing anxious/depressed symptoms, symptoms of being withdrawn, and somatic complaints, with a Cronbach’s α of .91. Sample questions for the internalizing subscale include “I feel lonely” and “I cry a lot.” This measure also includes a 32-item subscale for externalizing symptoms, including delinquent behavior and aggressive behavior, with a Cronbach’s α of .90. Sample questions for the externalizing subscale include “I break rules at home, school, or elsewhere” and “I get in many fights.”

V. Statistical Analyses

In this section, general considerations for the statistical analyses performed are first described, while details of each analysis are provided in Chapters 3, 4, and 5 by Specific Aim / Paper. This section supplements the analysis section provided within each Specific Aim / Paper chapter.

i. Latent Class Analysis and Latent Transition Analysis

Latent class and latent transition analysis were used to address the present research questions. Latent class analysis, sometimes referred to as latent profile analysis if continuous indicators are included, is a clustering technique used to identify homogenous subgroups of participants. Using this technique, classes or subgroups based on the indicator variables are determined. Results from the latent class analysis include a probability estimate of each individual being in each of the classes. These estimates can then be utilized in other models. Extending latent class analysis, latent transition analysis identifies movement between the classes or subgroups over time, using longitudinal data. These analytic strategies that focus on identifying and analyzing data
based on classes add to typically used analytic methods in existing literature and help to inform our understanding of risk and protection for youth MEB.

**ii. Latent Class and Transition Analysis with Distal Outcomes**

Specific Aim / Paper 1\(^90\) and Specific Aim / Paper 2 examines subgroups of Hispanic adolescents based on socio-ecological risk factors (latent class analysis) and evaluates if belonging to one of these subgroups is associated with MEB problems, using cross-sectional (linear and logistic regression) and longitudinal data (growth curves) respectively. Specific Aim / Paper 3 evaluates patterns of transition in adolescent’s subgroup across time (latent transition analysis) and examines the impact of this transitioning on MEB problems at 30 months (linear or logistic regression).

Methodological challenges arise when combining latent class/transition analysis with distal outcomes, specifically regarding how to account for potential error of misclassification of individuals within each class.\(^91\) A variety of methods have been developed to account for this. The five common methods to combine a latent class analysis (a measurement model) with regression models (a structural model) are outlined below.\(^91\)\(^-\)\(^93\) Considering the advantages and disadvantages of each method was important for these analyses.

1. **Maximum Posterior Probability Assignment**: Individuals are assigned to latent classes based on their maximum posterior probabilities. Then a regression model is estimated utilizing this assignment as a predictor of an outcome. Advantages of this approach include ease of analysis as individuals are assigned to groups based on the highest probability. In addition, if the entropy is high, this indicates that the
assignment of individuals to groups was reliable and utilizing this approach tends to produce estimates similar to other methods. Among the disadvantages of this approach is that the assignment of latent classes does not take into account uncertainty of class membership, which can be problematic because the regression model will not account for potential misclassification error. This method could also attenuate the relationship between the latent class and the outcome because measurement error tends to attenuate relationships unless it is modeled.

2. **A 1-Step Approach:** In this strategy, both the latent class analysis and the regression model are included in a joint model. Advantages of this approach are that because both are included in a single model, the uncertainty of class membership is automatically accounted for in that model. Moreover, using a single analytic model is simpler than analyses using multiple steps. A disadvantage of this approach is that the outcomes may affect the latent class formation. By including the regression model with outcomes, the latent class variable is not solely impacted by the indicators and may not retain the same meaning. The distal outcome is also impacting the latent classes which poses an issue if testing whether the latent classes cause the outcome. Furthermore, the distribution of the distal outcome is assumed to be normal.

3. **A 3-Step Approach:** In step 1, the latent class analysis is estimated using only latent class indicators. In step 2, the most likely class variable is created using latent class posterior distribution, including uncertainty rates. In step 3, the most
likely class is regressed on predictor variables taking into account uncertainty rates determined in the second step. Advantages of the 3-Step Approach are that it accounts for the uncertainty of class membership, unlike in maximum posterior probability assignment, by including uncertainty rates, and it allows for the latent classes to be unaffected by distal outcome measurements, unlike in the 1-step approach. A disadvantage of this approach is that, although it can sometimes be implemented seamlessly in a statistical program like Mplus, in many cases the model must be estimated manually.

4. **Pseudo Class Draws:** After using latent class analysis to estimate class memberships, the resulting probabilities are used to multiply impute the class assignment over a given number of imputations. The resulting class membership assignments within each of these imputations are then analyzed as predictors of the outcome variable, with the significance of the relationship being assessed by combining the chi-squares across the multiple imputations. An advantage of this method is that it takes into account the uncertainty of class membership in assessing the relationship between class membership and the MEB problem outcomes. A disadvantage of this method is that, if entropy is not high, biased estimates may be produced.

5. **Lanza method:** This approach uses Bayes’s theorem to estimate the conditional distribution of the outcomes given the latent class. An advantage in the Lazna method is that it is the most robust, and will not fail due to the distal outcomes impacting the latent class formation. A disadvantage of the Lanza method is
that it assumes a multinomial regression model between the latent class variable and the distal outcome. There is also a limitation on the measurement model in that it cannot include latent class predictors.\textsuperscript{91,92}

For Specific Aim / Paper 1\textsuperscript{90} a 3-step approach was chosen as the most fitting for these particular analyses. The rationale for this decision was to allow for inclusion of uncertainty in the class assignment, as well as to ensure that the distal outcomes were not allowed to impact the latent class formation specification. Furthermore, a 3-step approach can be implemented seamlessly in the Mplus statistical software. For Specific Aim / Paper 2 analyses, the maximum posterior probability assignment was selected, given that directly combining a latent class analysis with growth curves in Mplus was not available using a 3-step approach. With high entropy, this approach should yield similar estimates as the 3-step approach.\textsuperscript{91} For Specific Aim / Paper 3 analyses, a pseudo-class draws method was chosen. This method is advantageous in that it takes into account the uncertainty in class assignment patterns.\textsuperscript{95} Additionally, combining a latent transition analysis with distal outcomes using a 3-step method was not available directly in Mplus.

iii. Missing Data

Attrition for both studies was low, with greater than 85\% of participants continuing participation throughout the study. This is considered adequate for longitudinal studies. Among those retained in the study, the missing data rate was less than 0.025\%. Data are believed to be missing at random, and as a result, missing data were handled using the full information maximum likelihood approach (FIML), which is the default in Mplus. This approach assumes that data are missing completely at random or
missing at random. Full information maximum likelihood uses all available data and estimates a likelihood function for each individual observation based on data that are available.

iv. Statistical Packages

Statistical analyses were conducted using SAS 9.3 and Mplus Version 7. An analysis plan is presented for each specific aim.

v. Analytic Approach to Specific Aims

The analytical approach differed by specific aim in order to address each objective using the most appropriate strategy. Information is provided below regarding the approach for each specific aim with further details provided in the corresponding chapters for each specific aim.

Aim 1: Utilizing cross-sectional analysis, identify subgroups of Hispanic adolescents based on socio-ecological risk and protective factors (e.g. positive parenting, parental monitoring of peers) and determine how MEB problems (i.e., substance use, sexual risk behavior, internalizing/externalizing symptoms), are related to higher versus lower socio-ecological risk.

Analysis 1: Using baseline data for all study participants, a latent class analysis was used to identify subgroups of Hispanic adolescents based on all socio-ecological risk and protective factors. Criteria to determine the best solution for the number of classes included fit criteria (i.e. AIC, BIC, adjusted BIC, Vuong-Lo-Mendell-Rubin Likelihood Ratio test, entropy) as well as number of participants in each class, clinical meaningfulness, parsimony, and power. Separate linear or
logistic regression models were used to determine whether each of the MEB problems differed by subgroup. If there was an overall difference, then individual comparisons were conducted within these regression models to analyze differences between subgroups. A 3-step estimation method was utilized to combine the latent class analysis with the regression models.

**Aim 2:** Examine whether the clustering of initial levels of socio-ecological risk and protective factors predicts MEB problems over time.

**Analysis 2:** The latent class analysis conducted in the first aim was used to identify subgroups at baseline, when adolescents were in eighth grade, based on socio-ecological risk and protective factors. Growth curves were then used to evaluate the intercept and slope of the change over time for each MEB problem separately. The intercept and slope of the growth curves were tested to determine whether these differed based on socio-ecological risk subgroup. Only control group participants were utilized for this analysis in order to evaluate changes in MEB problems in the absence of intervention. Maximum posterior probability assignment method was utilized to combine the latent class analysis with the growth curves. Differences in MEB problems at 30 months post-baseline, when adolescents were in tenth grade, by baseline socio-ecological risk factor group were also assessed using growth curves centered at that time point.

**Aim 3:** Assess different patterns of transition in adolescents’ socio-ecological risk clustering across time and the impact of this transitioning on MEB problems over time.
**Analysis 3:** A latent transition analysis was conducted to describe how adolescents transitioned across socio-ecological risk subgroups over time using data from baseline, and 18 months and 30 months post-baseline, among the control group participants in order to assess changes in risk subgroup in the absence of intervention. The impact on MEB problems at 30 months post-baseline was examined for the most common patterns of transition across socio-ecological risk subgroups using a pseudo-class draw estimation method to accurately estimate the standard errors and p-values.\textsuperscript{91}

**vi. Human Subjects Protection**

The University of Miami’s Institutional Review Board and the Miami-Dade County Public School System’s Research Committee approved all of the methods and procedures associated with the larger study. I completed the CITI course training on human subject protection and was added to the IRB. Analyses for this dissertation were conducted using de-identified data.
Chapter 3: Specific Aim / Paper #1

I. Background

Mental, emotional, and behavioral (MEB) problems, such as substance use (illicit drugs, cigarettes, and alcohol), sexual risk behaviors, and internalizing and externalizing symptoms, are critical public health issues faced by adolescents. Recent evidence suggests that Hispanic adolescents are more likely to report higher rates of certain MEB problems compared to non-Hispanic whites. For example, Hispanic eighth and tenth grade adolescents are more likely than their non-Hispanic white and non-Hispanic black counterparts to have ever tried alcohol, cigarettes, or marijuana in their lifetime. Hispanic adolescents also have the highest rates of unprotected sexual behavior compared to non-Hispanic whites and non-Hispanic blacks, and 7.1% of Hispanic adolescents have had sex before the age of thirteen compared to 3.9% of non-Hispanic white adolescents. When examining internalizing and externalizing symptoms that comprise MEB problems, Hispanic adolescents report the highest prevalence of “feeling sad or hopeless”, “attempted suicide one or more times”, or being “in a physical fight” relative to non-Hispanic white and non-Hispanic black counterparts.

Reducing these health disparities may be achieved by targeting common risk and protective factors associated with the development of multiple MEB problems, including substance use, sexual risk behaviors, and internalizing/externalizing symptoms. In fact, many preventable causes of morbidity and mortality appear to share common pathways with similar risk and protective factors impacting multiple outcomes.
Social ecological models\textsuperscript{26} of public health and extensions of those models, such as ecodevelopmental theory,\textsuperscript{27,28} propose the existence of multiple factors from various social contexts that influence adolescent development. Risk and protective factors or processes at various levels of influence (e.g., family, school, and peers) have been found to be directly or indirectly associated with multiple MEB problems.\textsuperscript{27,32} For example, extant literature has indicated that poor family functioning is related to greater substance use,\textsuperscript{40,41} sexual risk behaviors,\textsuperscript{42} and internalizing and externalizing symptoms\textsuperscript{43,44} Similarly other socio-ecological factors such as school and peer influences, and acculturation have also been found to be associated with many of these same outcomes.\textsuperscript{52,63,70}

This article examines multiple MEB problems based on the clustering of common socio-ecological risk and protective factors. Although studies have examined the influence of socioecological risk and protective factors, such as family functioning, on these MEB problems separately, more limited research has examined the impact of these factors on more than one outcome. In this study, this gap is being addressed by examining whether this clustering of risk and protective factors across various socio-contextual levels of influence is related to multiple MEB problems. Moreover, rather than considering individual risk and protective factors separately for a single outcome, this study evaluates whether specific subgroups of Hispanics adolescents based on risk factor clustering have a greater chance of engaging in a variety of MEB problems (e.g., substance use, sexual risk behavior, and internalizing/externalizing symptoms).

While a variable-centered analysis would examine the relationships between specific pathways, latent class analysis, a type of person-centered analysis, allows for the
evaluation of groups of individuals who may be more susceptible to outcomes, as well as to evaluate common developmental pathways for these outcomes. Person-centered approaches allow for the understanding of the developmental course of individuals at greater risk compared to those who are more protected and evaluate the impact of these complex processes on health outcomes. Implications for these results include enhancing our ability to tailor interventions to specifically target various subgroups and to impact these shared risk and protective factors to prevent multiple MEB problems.

In this study, subgroups of Hispanic adolescents were first identified based on socio-ecological risk and protective factors utilizing latent class analysis, a clustering technique used to identify homogenous subgroups of participants on a set of variables. Then, differences in socio-ecological risk and protective factors between these subgroups were examined to characterize these groups. Finally, analyses examined whether, and to what extent, substance use, sexual risk behaviors, and internalizing and externalizing symptoms vary as a function of subgroup.

II. Methods

i. Participants

This study uses pooled baseline data from two randomized controlled trials evaluating Familias Unidas, a family-based intervention previously found to be efficacious in preventing and reducing sexual risk behaviors and substance use among Hispanic adolescents. The first randomized controlled trial was an efficacy study with an indicated sample of 213 Hispanic adolescents and their primary caregivers. To be eligible, adolescents had to have been identified by their school counselors as having at
least “mild problems” on at least one of the following Revised Behavior Problem Checklist subscales: conduct disorder, socialized aggression, and attention problems. Parents were then asked to complete the three Behavior Problem Checklist subscales and adolescents who were scored at least one standard deviation above the mean on one of the three subscales were included in the study. Participants were recruited from three middle schools in the Miami-Dade County Public School System. The second randomized controlled trial was an effectiveness study with a universal sample of 746 Hispanic adolescents and their primary caregivers, recruited from 18 middle schools in the Miami-Dade Public School System.

To be eligible for either study, adolescents were required to identify as Latino/Hispanic, attend eighth grade at baseline, live with an adult primary caregiver who was willing to participate, live within the catchment areas of the participating middle schools, and plan to live in South Florida for the duration of the study. The University of Miami’s Institutional Review Board and the Miami-Dade County Public School System’s Research Review Committee approved all of the methods and procedures associated with these studies.

The total combined sample for the present analysis consisted of 959 Hispanic adolescents (45% female, n=434) with an average age of 13.8 years (SD = 0.7). A slight majority (55%, n=530) of the participants were born in the United States while the majority of their parents were born outside of the United States (863, 90%). Adolescents not born in the United States were predominantly from Honduras (27%), Cuba (20%), and Nicaragua (16%). Adolescents were predominately from low-income families with
70% \((n=673)\) of participating families reporting an annual household income of less than $30,000.

ii. Measures

Measures were based on responses to self-reported surveys administered to adolescents using audio computer-assisted self-administered interviewing (ACASI). These surveys have a pre-recorded voice that read text presented on screen to the participant. Participants could complete the assessment battery in English or Spanish.

iii. Socio-Ecological Risk and Protective Factors

The following socio-ecological risk and protective factors were used in the analyses: Hispanic cultural practices, U.S. cultural practices, parental monitoring of peers, positive parenting, parental involvement, parent-adolescent communication, parental involvement in school, and perceived peer substance use. All measures in these analyses were adolescent reported.

Hispanic cultural practices (Cronbach’s \(\alpha = .92\), 11 items, five-point Likert scale) and U.S. cultural practices (\(\alpha = .92\), 11 items, five-point Likert scale) were assessed using the Bicultural Involvement Questionnaire-Revised, which measures the level of Hispanic and U.S. cultural indicators such as comfort with language, food, and traditions. Sample items include “How comfortable do you feel speaking English at home?” and “How much do you enjoy Hispanic-oriented places?”

Parental monitoring of peers (\(\alpha = .81\), 5 items, five-point Likert) was measured using items from the Parent Relationship with Peer Group Scale which assesses the extent to which parents supervise adolescents’ friends, activities, and whereabouts. A sample question was, “How well do your parents know your best friends?” Positive
parenting (α = .82, 9 items, four-point Likert) and parental involvement (α = .84, 13 items on a three-point Likert scale and 2 items on a four-point Likert) were assessed using the corresponding subscales from the Parenting Practices Scale. Sample items included “When you have done something that your parents like or approve of, how often does your mother say something nice about it?” and “How often you do and your mom do things together?”. Parent-adolescent communication (α = .90, 20 items on a five-point Likert scale) was assessed using the Parent-Adolescent Communication Scale. A sample item is “I can discuss my beliefs with my mother/father without feeling restrained or embarrassed.”

Parental involvement in school is based on the answer to the question, “How often did your mom talk with you about how things are going in school” with responses on a three point Likert scale. Perceived peer substance use was assessed by combining questions regarding how many of the adolescent’s friends drank alcohol, smoked cigarettes, or used drugs. If the adolescent reported that one or more of their friends engaged in any of these activities, perceived peer substance use was coded as 1 and otherwise it was coded as 0.

iv. Mental, Emotional, and Behavioral (MEB) Problems

Outcome measures included adolescent self-reports of substance use, sexual risk behaviors, and internalizing/externalizing symptoms. Adolescent substance use was assessed using a survey comparable to the items from the national epidemiological study, Monitoring the Future. Substance use was determined from the usage of alcohol, cigarettes, and illicit drugs. The following survey questions measured lifetime and past 90 day alcohol use: “Have you ever had any beer, wine, wine coolers, or liquor to drink -
more than just a few sips?”, and “In the past 3 months, have you had any beer, wine, wine coolers, or liquor to drink - more than just a few sips?”. The following survey questions measured lifetime and past 90 day smoking: “Have you ever smoked cigarettes?”, and “Have you smoked cigarettes in the past 3 months?”. The following survey questions measured lifetime and 90 day drug use: “Have you ever used drugs?”, and “Have you used drugs in the past 3 months?”.

Sexual risk behaviors included reporting lifetime sexual behavior, as well as whether they engaged in any of the following in the past 90 days: sex, unprotected sex, multiple sex partners, and having sexual intercourse under the influence.88 The following survey questions measured lifetime and past 90 day sexual behavior: “Have you ever had vaginal, anal, or oral sex?” and “In the past 3 months, have you had vaginal, anal, or oral sex?”. The following survey questions measured unprotected sexual behavior and sex under the influence of alcohol or drugs: “In the past 3 months, have you had vaginal or anal sex without using a condom?” and “During the past 3 months, have you been under the influence of alcohol, illicit drugs, or nonmedical use medicine before (while) having sex?”. Having multiple sexual partners was determined by the individual’s response to an item about the number of sexual partners in the past 90 days and dichotomized into a binary variable one or fewer partners versus greater than one partner. All substance use indicators (alcohol, smoking, and drug use) and sexual risk behaviors were dichotomized. Responses were coded as one if the participants engaged in the behavior, and zero if they had not.

Internalizing and externalizing symptoms were measured using the Youth Self-Report.89 The total measure includes 112 questions. All questions were on a three point
Likert scale and responses included “Not True”, “Somewhat or Sometimes True”, and “Very True or Often True”. The subscale for internalizing symptoms contained 30 items ($\alpha = .91$) and the subscale for externalizing symptoms contained 32 items ($\alpha = .90$).

v. Statistical Analysis

The aims of this study are to: 1) identify subgroups of Hispanic adolescents based on socio-ecological risk and protective factors (e.g., positive parenting, parental involvement in school), and 2) determine whether MEB problems (i.e., substance use, sexual risk behavior, and internalizing/externalizing symptoms) differed by subgroup. To accomplish this, subgroups of adolescents based on socio-ecological risk and protective factors were first identified using latent class analysis. Latent class analysis, sometimes referred to as latent profile analysis if continuous indicators are included, is a clustering technique used to identify homogenous subgroups of participants.

Five criteria were used to determine the best solution for the number of classes. The first criterion included the Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and the sample-size adjusted BIC, where a better model fit is indicated by a smaller value. The second criterion used was the p-value of the Vuong-Lo-Mendell-Rubin Likelihood Ratio test which compares a model with K classes to a model with K-1 classes. The third criterion was the entropy value, where greater clarity in classification is indicated by a value closer to 1. The fourth criterion was sample size and power. The fifth criterion was the clinical meaningfulness of the classes.

The latent class analysis was conducted in Mplus version 7.11.

Second, to evaluate the differences between the subgroups in those socio-ecological factors used to create the classes, an analysis of variance (ANOVA) was used
for continuous variables and Wald chi-square test for parental involvement in school and perceived peer substance use. Separate models were conducted for each of the socio-ecological risk and protective factors and those which were statistically significantly different across the classes were further explored through pairwise comparisons with a Bonferroni correction. This analysis was used to establish an interpretation of the socio-ecological risk of adolescents in each subgroup.

Third, a 3-step method\textsuperscript{91,103} was utilized to evaluate the relationship between socio-ecological risk classes and MEB problems. In this 3-step method, first latent classes are estimated using the socio-ecological risk and protective factors, then a variable is created containing the most likely class from the posterior distribution, and finally this most likely class variable is regressed on each of the MEB outcomes.\textsuperscript{91} These 3-steps are implemented seamlessly in the Mplus statistical software. For outcomes that differed significantly across classes, individual comparisons using a Bonferroni correction were estimated to determine which subgroups of adolescents differed in the outcome.

III. Results

i. Identification and Interpretation of Classes

Table 3.1 reports the fit indices by the number of latent classes (i.e., 2, 3, 4, and 5 class solutions). While the AIC, BIC, adjusted BIC, and likelihood difference test indicated a five class solution, the four and five class solution begin to have groups with a small sample which would impact power. Looking at the interpretation of the classes, both the three, four, five class solutions were similar with the addition of the fourth and subsequently fifth class not changing the meaningfulness of the classes. Adding an additional class separated one of the classes into two without a statistically significant
distinction between the two groups created. Prioritizing parsimony and power, a three class solution was chosen based on the number of subjects within each class as well as the interpretation of the classes, with a four or five class solution not adding a significant difference in clinical meaningfulness. With the three class solution, class assignment appeared to be highly reliable with the average class probabilities of .94, .89, and .93 and entropy of .81.

Table 3.1: Fit Criteria

<table>
<thead>
<tr>
<th>Latent Classes</th>
<th>AIC</th>
<th>BIC</th>
<th>Adjusted BIC</th>
<th>Entropy</th>
<th>Likelihood Ratio Test p-value</th>
<th>Number of Subjects in Each Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>41682</td>
<td>41755</td>
<td>41707</td>
<td>-</td>
<td>-</td>
<td>959</td>
</tr>
<tr>
<td>2</td>
<td>40365</td>
<td>40487</td>
<td>40407</td>
<td>0.836</td>
<td>&lt;0.001</td>
<td>319, 640</td>
</tr>
<tr>
<td>3</td>
<td>39983</td>
<td>40153</td>
<td>40042</td>
<td>0.808</td>
<td>&lt;0.001</td>
<td>147, 386, 426</td>
</tr>
<tr>
<td>4</td>
<td>39736</td>
<td>39955</td>
<td>39812</td>
<td>0.821</td>
<td>&lt;0.001</td>
<td>77, 150, 363, 369</td>
</tr>
<tr>
<td>5</td>
<td>39638</td>
<td>39906</td>
<td>39731</td>
<td>0.849</td>
<td>&lt;0.001</td>
<td>35, 67, 144, 356, 357</td>
</tr>
</tbody>
</table>

Means and standard deviations, or frequencies and percentages, of the socio-ecological indicators by class are reported in Table 3.2. These were utilized to help evaluate the meaningfulness of the classes, and aid in the interpretation of each class. ANOVA results indicated significant differences in all of these socio-ecological risk factors by class at the p<.001 significance level except for U.S. cultural practices (F(df)=0.131(2, 956), p=.88). Individual comparisons of the remaining factors indicated that each class was significantly different from every other class at the p<.05 level on all socio-ecological factors, except between the High and Medium Socio-Ecological Risk classes, on the variables of Hispanic cultural practices classes (p=.94) and perceived peer substance use (p=.61).

As seen in Table 3.2, the Low Socio-Ecological Risk class (n=426) included 44% of the sample and had the highest levels of all the protective factors and lowest perceived
peer substance use. Compared to both the other classes, youth in the Low Socio-Ecological Risk class reported the highest average values of Hispanic cultural practices, parental monitoring of peers, positive parenting, parental involvement, parent-adolescent communication, and parental involvement in school.

The Medium Socio-Ecological Risk class (n=363) accounted for 40% of the sample. Compared to the Low Socio-Ecological Risk class, these adolescents had significantly lower average values of Hispanic cultural practices, parental monitoring of peers, positive parenting, parental involvement, parent-adolescent communication, and parental involvement in school, as well as higher reported perceived peer substance use.

Table 3.2: Means and Standard Deviations of Socio-Ecological Factors by Class

<table>
<thead>
<tr>
<th></th>
<th>Overall Sample N=959</th>
<th>High Socio-Ecological Risk N=147 (15%)</th>
<th>Medium Socio-Ecological Risk N=386 (40%)</th>
<th>Low Socio-Ecological Risk N=426 (44%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hispanic Cultural Practices</td>
<td>37.2 (10.7)</td>
<td>33.0 (10.8)</td>
<td>34.0 (10.0)</td>
<td>41.7 (9.5)</td>
</tr>
<tr>
<td>U.S. Cultural Practices</td>
<td>48 (7.6)</td>
<td>48.3 (7.1)</td>
<td>47.9 (7.3)</td>
<td>48.0 (8.1)</td>
</tr>
<tr>
<td>Parental Monitoring of Peers</td>
<td>14 (4.9)</td>
<td>10.3 (4.1)</td>
<td>12.7 (4.2)</td>
<td>16.5 (4.4)</td>
</tr>
<tr>
<td>Parental Involvement in School</td>
<td>2.7 (0.6)</td>
<td>2.0 (0.7)</td>
<td>2.7 (0.5)</td>
<td>3.0 (0.2)</td>
</tr>
<tr>
<td>Positive Parenting</td>
<td>18.9 (5.3)</td>
<td>11.2 (4.7)</td>
<td>17.8 (4.2)</td>
<td>22.4 (2.8)</td>
</tr>
<tr>
<td>Parental Involvement</td>
<td>36.9 (6.8)</td>
<td>24.9 (3.7)</td>
<td>34.9 (3.5)</td>
<td>42.4 (2.8)</td>
</tr>
<tr>
<td>Parent-Adolescent Communication</td>
<td>68.9 (14.7)</td>
<td>50.9 (12.4)</td>
<td>64.0 (9.8)</td>
<td>79.4 (10.2)</td>
</tr>
<tr>
<td>Perceived Peer Substance Use</td>
<td>406 (46%)</td>
<td>76 (56%)</td>
<td>192 (53%)</td>
<td>138 (36%)</td>
</tr>
</tbody>
</table>

*p<0.001

a indicates significant difference between the High Risk and Medium Risk class (p<0.05)
b indicates significant difference between the Medium Risk and Low Risk class (p<0.05)
c indicates significant difference between the High Risk and Low Risk class (p<0.05)

The smallest class, High Socio-Ecological Risk (n=147), included 15% of the sample and were adolescents that had a significantly lower averages on most protective factors than the other classes. Specifically, compared to the other two classes, on
average, they reported less parental monitoring of peers, positive parenting, parental involvement, parent-adolescent communication, and parental involvement in school. Compared to the Low Socio-Ecological Risk class, on average, those in the High Socio-Ecological Risk class reported less Hispanic cultural practices and greater perceived peer substance use.

**ii. Outcomes by Class**

To examine the relationships between the class membership and outcomes, the outcomes across classes were compared. This was done given the satisfactory entropy (>0.8) and classification accuracy values for the class solution. As shown in Table 3.3, there were significant associations between class membership and all of the substance use outcome variables, as well as lifetime sexual behavior, sexual behavior in the past 90 days, sex under the influence of alcohol or drugs, and internalizing and externalizing symptoms.

**a. Substance Use by Class**

Statistically significant associations were found between class membership and all substance use outcomes at the p<0.01 level. Individual comparisons revealed that the High Socio-Ecological Risk class reported greater substance use than the Low Socio-Ecological Risk class across all outcomes. The High Socio-Ecological Risk class reported greater lifetime alcohol (34%), cigarette (26%), and drug use (27%), as well as greater 90 day alcohol (20%), cigarette (13%), and drug use (21%) compared to the Low Socio-Ecological Class, with reported lifetime alcohol, cigarette, and drug use at 8%, 5%, and 4% and past 90 day alcohol, cigarette, and drug use at 3%, 3% and 2%. The Medium Socio-Ecological class also reported greater alcohol lifetime (23%), alcohol 90 days
(10%), and smoking lifetime (18%), compared to the Low Socio-Ecological Risk class (8%, 3%, and 5% respectively). Drug use in the last 90 days was significantly different between the High Socio-Ecological Risk class (21%) and the Medium Socio-Ecological Risk class (1%).

Table 3.3: MEB Problems by Class

<table>
<thead>
<tr>
<th></th>
<th>Overall Sample N=959</th>
<th>High Socio-Ecological Risk N=147 (15%)</th>
<th>Medium Socio-Ecological Risk N=386 (40%)</th>
<th>Low Socio-Ecological Risk N=426 (45%)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Substance Use</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol Lifetime**bc</td>
<td>173 (18%)</td>
<td>50 (34%)</td>
<td>87 (23%)</td>
<td>36 (8%)</td>
</tr>
<tr>
<td>Alcohol 90 Days**bc</td>
<td>81 (8%)</td>
<td>29 (20%)</td>
<td>39 (10%)</td>
<td>13 (3%)</td>
</tr>
<tr>
<td>Smoking Lifetime**bc</td>
<td>130 (14%)</td>
<td>38 (26%)</td>
<td>70 (18%)</td>
<td>22 (5%)</td>
</tr>
<tr>
<td>Smoking 90 Days***c</td>
<td>50 (5%)</td>
<td>20 (13%)</td>
<td>19 (5%)</td>
<td>11 (3%)</td>
</tr>
<tr>
<td>Drug Use Lifetime***c</td>
<td>88 (9%)</td>
<td>40 (27%)</td>
<td>32 (8%)</td>
<td>17 (4%)</td>
</tr>
<tr>
<td>Drug Use 90 Days***ac</td>
<td>44 (5%)</td>
<td>31 (21%)</td>
<td>4 (1%)</td>
<td>9 (2%)</td>
</tr>
<tr>
<td><strong>Sexual Risk Behaviors</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex Lifetime**bc</td>
<td>115 (12%)</td>
<td>27 (18%)</td>
<td>57 (15%)</td>
<td>31 (7%)</td>
</tr>
<tr>
<td>Sex in the Past 90 Days*</td>
<td>68 (7%)</td>
<td>14 (10%)</td>
<td>34 (9%)</td>
<td>20 (5%)</td>
</tr>
<tr>
<td>Unprotected Sex</td>
<td>48 (5%)</td>
<td>10 (7%)</td>
<td>21 (6%)</td>
<td>17 (4%)</td>
</tr>
<tr>
<td>Multiple Sex Partners</td>
<td>40 (4%)</td>
<td>7 (5%)</td>
<td>22 (6%)</td>
<td>10 (2%)</td>
</tr>
<tr>
<td>Sex under the Influence*</td>
<td>17 (2%)</td>
<td>7 (5%)</td>
<td>7 (2%)</td>
<td>3 (1%)</td>
</tr>
<tr>
<td><strong>Internalizing / Externalizing</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internalizing Symptoms**bc</td>
<td>10.8 (9.0)</td>
<td>14.7 (1.0)</td>
<td>12.2 (0.6)</td>
<td>8.3 (0.4)</td>
</tr>
<tr>
<td>Externalizing Symptoms**abc</td>
<td>10.8 (9.0)</td>
<td>17.3 (1.2)</td>
<td>12.5 (0.6)</td>
<td>7.0 (0.3)</td>
</tr>
</tbody>
</table>

*p<0.05, **p<0.01  
a indicates significant difference between the High Risk and Medium Risk class (p<0.05)  
b indicates significant difference between the Medium Risk and Low Risk class (p<0.05)  
c indicates significant difference between the High Risk and Low Risk class (p<0.05)

b. Sexual Risk Behaviors by Class

Significant differences across classes were found for lifetime sexual behavior at the p<0.01 level. Individual comparisons revealed that the Low Socio-Ecological Risk (7%) class reported less lifetime sex compared to both the Medium (15%) and High
Socio-Ecological Risk (18%) classes. While overall significant associations were found between class membership and both sexual behavior in the past 90 days and sexual behavior under the influence of alcohol or drugs at the \( p < 0.05 \) level, the individual comparisons were not significant.

c. Internalizing and Externalizing Symptoms by Class

Significant differences in internalizing and externalizing symptoms were found across class membership at the \( p < 0.01 \) level. Individual comparisons indicated that the Low Socio-Ecological Risk (M=8.5, SD=7.6) class reported less internalizing symptoms compared to both the Medium (M=12.0, SD=9.3) and High Socio-Ecological Risk (M=14.4, SD=10.2) classes. The High Socio-Ecological Risk (M=16.5, SD=11.3) class reported the highest levels of externalizing symptoms, the Medium Socio-Ecological Risk (M=12.5, SD=8.5) class reported lower levels of externalizing symptoms, and the Low Socio-Ecological Risk (M=7.3, SD=6.9) class reported the lowest levels of externalizing symptoms.

IV. Discussion

The aim of this study was to identify subgroups of Hispanic adolescents based on socio-ecological risk and protective factors, as well as to determine whether and to what extent substance use, sexual risk behaviors, and internalizing and externalizing symptoms would differ by these subgroups. To the best of our knowledge, this is the first study to use a person-centered approach in evaluating the impact of socio-ecological risk factors across multiple levels of influence on a broad set of outcomes in Hispanic adolescents, including substance use, sexual risk behavior and internalizing/externalizing symptoms. Results indicate that there were subgroups of Hispanic adolescents which significantly
differed in terms of socio-ecological risk, and that MEB problems varied among these groups. Adolescents in higher socio-ecological risk groups reported significantly greater substance use, sexual risk behaviors, and internalizing and externalizing symptoms. The findings were consistent across a majority of outcomes, lending support to the common pathways to multiple MEB problems concept.99

Among the socio-ecological factors included in our analysis, U.S. cultural practices was the only indicator found to not differ significantly among the risk groups. Although the measure used in these analyses focused on U.S. and Hispanic cultural practices (e.g., preferences regarding language or media), and does not include measures of cultural values (e.g. individualism and collectivism) or cultural identification (e.g., ethnic and national identity),73,106 our findings support the notion that U.S. practices may not contribute significantly to risk, as long as Hispanic cultural practices are retained.76,107 In our results, the Low Socio-Ecological Risk group had significantly higher Hispanic cultural practices than both the Medium and High Socio-Ecological Risk groups. In many studies, acculturation is measured as a unidimensional construct ranging from high heritage-cultural orientation to high U.S.-cultural orientation. However, a bidimensional approach appears to be preferable, as U.S. and Hispanic cultural orientations can contribute separately to psychosocial and health outcomes. In past research, integrated adolescents (i.e., those with high levels of both U.S. and Hispanic cultural practices) have been found to report the highest levels of positive family functioning indicators, whereas assimilated adolescents (i.e., those with high U.S. orientation but low heritage orientation) have been most likely to report aggressive behavior.71,76 This may suggest
that retention of Hispanic culture is the more important aspect of acculturation in the context of family relationships and adolescent risk behavior.

Adopting a person-centered approach allowed for the identification of homogenous groups of adolescents based on risk and protective characteristics across multiple levels of socioecological influence. With risk and protective factors across family, peer and school, often impacting each other to affect outcomes, examining these factors together allowed for the assessment of individuals in a more comprehensive manner. These findings add to our understanding of shared risk and protective factors, suggesting that several MEB problems may be influenced by common developmental pathways. The person-centered approach used in these analyses also highlighted groups of Hispanic adolescents with higher or lower socio-ecological risks and demonstrated that those with higher risks were more likely to have poorer MEB outcomes.

i. Limitations

Results from this study should be considered in light of several limitations. First, the use of a single data collection time point and cross-sectional analyses indicates that causality between socio-ecological risk and health outcomes cannot be inferred. Further research using longitudinal data would aid in our understanding of how socio-ecological risk impacts these outcomes over time. It would also provide information about risk trajectories across time, which has important developmental and intervention implications. Second, the Hispanic adolescents used in this analysis were drawn only from Miami and are not representative of the U.S. Hispanic population. While, the sample includes Hispanics from a wide range of countries and backgrounds, Miami has strong and well-established Hispanic social, cultural and political structures in place,
which may differentially impact the acculturation process relative to Hispanics living in other parts of the United States. Third, while the three class solution was chosen based on parsimony and power considerations, a larger sample size may have allowed for the utilization of a larger number of classes. Fourth, the socio-ecological factors and MEB outcomes were all measured through self-reports and adolescents may have under or over reported some or all of these variables.

ii. Conclusions

Overall, our findings suggest common pathways with individuals who share similar risk and protective factors being more likely to engage in a variety of mental, emotional and behavioral problem outcomes. Our results highlight the benefit of adopting a person-centered approach to holistically evaluate socio-ecological risks, rather than linking specific risk factors with separate outcomes. Implications for interventions include the potential importance of screening and identifying adolescents by common risk factor clustering to improve intervention efficacy. In particular, it may be important to direct interventions towards indicated groups showing higher risk profiles based on socioecological factors. Furthermore, findings suggest the value of targeting shared risk and protective factors that influence multiple MEB problems rather than unique factors that may influence a specific MEB outcome, as this could yield benefits spanning multiple health areas with a single intervention.
Chapter 4: Specific Aim / Paper #2

I. Background

Substance use, sexual risk behaviors and internalizing and externalizing symptoms, referred to as mental, emotional, and behavioral (MEB) problems, frequently arise or intensify during adolescence.\textsuperscript{12} Hispanic adolescents are often at higher risk for many of these problems. According to Centers for Disease Control & Prevention (CDC), compared to non-Hispanic whites and non-Hispanic blacks, Hispanic adolescents report greater rates of alcohol, cigarettes, and marijuana use, as well as unprotected sex.\textsuperscript{13} In terms of internalizing and externalizing symptoms, they also report higher levels of “feeling sad or hopeless,” “attempted suicide one or more time,” being “in a physical fight”, and “injured in a physical fight” compared to non-Hispanic whites.\textsuperscript{2,13} It is important to further investigate and address these evident health disparities.

MEB problems have been shown to be associated with common risk and protective factors.\textsuperscript{26} Socio-ecological models posit that adolescent MEB problems are impacted by risk and protective factors found in different systems within the adolescent’s environment, including family, school, and peer groups.\textsuperscript{27,32} Socio-ecological risk and protective factors, such as family functioning,\textsuperscript{33,41} school involvement,\textsuperscript{108} peer group risk behaviors,\textsuperscript{63} and acculturation\textsuperscript{70} have been found separately to impact the development of MEB problems.

Previous work has shown that specific socio-ecological risk factors are associated with MEB problems.\textsuperscript{33,41,63,70,108} In Chapter 3: Specific Aim / Paper #1,\textsuperscript{90} the clustering of socio-ecological risk and protective factors was shown to be associated with MEB
problems using cross-sectional data analysis. While this previous analysis showed this association at the single, baseline time-point, the current paper expands upon Specific Aim / Paper 1’s\textsuperscript{90} research by examining the impact of the clustering of socio-ecological risk factors in eighth grade on the change of MEB problems over time. The control group participants was focused on exclusively in order to understand how these socio-ecological factors impact the change in youth MEB problems over time in the absence of intervention. This is important because this analysis will aid in understanding directionality of the relationship between socio-ecological risk factor clusters at baseline and the change of MEB problems over time. Furthermore, this critical period of adolescence from eighth to tenth grade is when many MEB problems often begin or increase,\textsuperscript{12} and so the findings can capture valuable information from an adolescent development perspective.

In this study, the subgroups of Hispanic adolescents were utilized based on the socio-ecological risk and protective factors (e.g., positive parenting, parental involvement in school), as found in Chapter 3: Specific Aim / Paper #1.\textsuperscript{90} In this previous analysis, adolescents with average age 13.8 were found to cluster into three groups: Low, Medium, and High Socio-Ecological Risk. In this paper, these group assignments were used for the control group participants to determine if there are significant differences by group in how MEB problems change over time, as well as examine differences in MEB problems by subgroup at 30 months following baseline when adolescents are approximately 16.3 years old. It is hypothesized that the low socio-ecological risk group will report the lowest levels of MEB problems at baseline and this will continue through
30 months post-baseline. The medium socio-ecological risk group will report greater MEB problems and the high socio-ecological risk group will report the greatest MEB problems. Implications for this study include determining the potential longer term impact of socio-ecological risk and protective factors in eighth grade on multiple future MEB problems.

II. Methods

i. Participants

Data for this study were collected as part of two randomized controlled trials assessing a family based preventive intervention, Familias Unidas, that has been found to reduce substance use and sexual risk behaviors in Hispanic adolescents. The first randomized controlled trial included 213 Hispanic adolescents. To be included in the study, adolescents had to first be identified by their school counselors as having at least “mild problems” on at least one of the following Revised Behavior Problem Checklist subscales: conduct disorder, socialized aggression, and attention problems. Parents were then asked to complete these three subscales and adolescents with scores greater than one standard deviation above the mean on at least one of the three subscales were included in the study. The second randomized controlled trial included a universal sample of 746 Hispanic adolescents from 18 middle schools.

Eligibility criteria for both studies included: (1) identification as Latino/Hispanic, (2) attend eighth grade at baseline, (3) live with an adult primary caregiver who was willing to participate, (4) live within the catchment areas of the participating Miami-Dade County middle schools, and (5) plan to live in South Florida for the duration of the study.
All methods and procedures for these randomized controlled trials were approved by the University of Miami’s Institutional Review Board and the Miami-Dade County Public School System’s Research Committee.

The total number of participants from both studies consisted of 959 Hispanic adolescents, but for these longitudinal data analysis in this study only the 474 control group participants were included. Of these control group participants, 104 (22%) were from the efficacy study and 370 (78%) were from the effectiveness study. This total control group sample was 45% (n=212) female, with 56% (n=264) born in the U.S., 71% (n=338) reporting household income less than $30,000 per year, and an average age of 13.8 (0.7) years at baseline. The majority of parents were foreign born (90%) and adolescents born outside of the United States were primarily from Honduras (27%), Cuba (21%), and Nicaragua (16%). Correspondingly, at the 30-month follow-up, the mean age was 16.3 (0.7). Table 4.1 displays the description of the sample used these analyses as well as a breakdown of these demographics by study.

Table 4.1: Description of the Sample

<table>
<thead>
<tr>
<th></th>
<th>Combined</th>
<th>Efficacy Study</th>
<th>Effectiveness Study</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Size</td>
<td>474</td>
<td>104 (22%)</td>
<td>370 (78%)</td>
</tr>
<tr>
<td>Gender (female)</td>
<td>212 (45%)</td>
<td>36 (35%)</td>
<td>176 (48%)</td>
</tr>
<tr>
<td>Age at Baseline (years)</td>
<td>13.8 (0.7)</td>
<td>13.9 (0.7)</td>
<td>13.8 (0.7)</td>
</tr>
<tr>
<td>Age at 30-Months Post-Baseline (years)</td>
<td>16.3 (0.7)</td>
<td>16.4 (0.7)</td>
<td>16.3 (0.7)</td>
</tr>
<tr>
<td>Household Income (&lt; $30,000/year)</td>
<td>338 (71%)</td>
<td>91 (88%)</td>
<td>247 (67%)</td>
</tr>
<tr>
<td>Nativity (U.S. born)</td>
<td>264 (56%)</td>
<td>54 (52%)</td>
<td>210 (57%)</td>
</tr>
</tbody>
</table>

### ii. Measures

All measures were self-reported by the adolescent using audio computer-assisted self-administered interview (ACASI), which presents text on screen with a pre-recorded
 Participants could choose to complete the survey in English or Spanish. All measures were collected at baseline as well as 6, 18, and 30 months post-baseline.

iii. Socio-Ecological Risk and Protective Factors

The following socio-ecological risk and protective factors were assessed in this study: Hispanic cultural practices, U.S. cultural practices, parental monitoring of peers, positive parenting, parental involvement, parent-adolescent communication, parental involvement in school, and perceived peer substance use.

The Bicultural Involvement Questionnaire-Revised\textsuperscript{81} was utilized to assess Hispanic cultural practices and U.S. cultural practices. Each of these scales contained eleven items on a five point Likert scale with Cronbach’s $\alpha = 0.92$. Sample items such as “how much do you enjoy Hispanic-oriented places” and “how comfortable do you feel speaking English at home” determined the comfort with cultural indicators such as food, traditions, and language. Response choices range from “not at all” to “very much.”

Several measures were used to assess family variables. The Parent Relationship with Peer Group Scale\textsuperscript{82} was used to assess parental monitoring of peers. This measure included five items on a five point Likert with Cronbach’s $\alpha = 0.81$, that ask questions such as “How well do your parents know your best friends?” Responses ranged from "not at all" to "extremely well (often).” Positive parenting and parental involvement were measured using subscales from the Parenting Practices Scale.\textsuperscript{83} Positive parenting was comprised of nine items on a four point Likert with Cronbach’s $\alpha = 0.82$ and included questions such as “When you have done something that your parents like or approve of,
how often does your mother say something nice about it.” Parental involvement was comprised of thirteen items on a three point Likert scale and two items on a four point Likert scale with Cronbach’s α = 0.84, and included questions such as “How often you do and your mom do things together.” Responses for both positive parenting and parental involvement ranged from “never” to “always.” The Parent-Adolescent Communication Scale86 was used to assess parent-adolescent communication with twenty items on a five point Likert scale and Cronbach’s α = 0.90. This scale included questions such as “I can discuss my beliefs with my mother/father without feeling restrained or embarrassed.” Responses ranged from “strongly disagree” to “strongly agree.”

The question “How often did your mom talk with you about how things are going in school” was used to measure parental involvement in school. Responses were on a three point Likert scale ranging from “almost never” to “often.”

To measure perceived peer substance use, questions regarding how many of the participant’s friends drank alcohol, smoked cigarettes, or used drugs were used. Perceived peer substance use was coded as 1 for participants that reported one or more of their friends had engaged in any of these activities and coded as 0 otherwise.

iv. Mental, Emotional, and Behavioral (MEB) Problems

MEB problems included adolescent substance use, sexual risk behaviors, and internalizing/externalizing symptoms. Substance use was determined based on reported past 90 day usage of alcohol, cigarettes, and illicit drugs and used items similar to Monitoring the Future,109 an ongoing national study of adolescent behaviors funded by the National Institute on Drug Abuse. Survey items included “In the past 3 months, have
you had any beer, wine, wine coolers, or liquor to drink - more than just a few sips?,” “Have you smoked cigarettes in the past 3 months?,” and “Have you used drugs in the past 3 months.” The sexual risk behaviors variables were based on survey questions asking whether the adolescent had participated in any of the following in the past 90 days: sexual behavior, unprotected sexual behavior, multiple sex partners, and having sex under the influence of alcohol or drugs. Survey questions for sexual behavior in the past 90 days, unprotected sexual behavior, and sex under the influence of alcohol of drugs included “in the past 3 months, have you had vaginal, anal, or oral sex,” “in the past 3 months, have you had vaginal or anal sex without using a condom,” and “during the past 3 months, have you been under the influence of alcohol, illicit drugs, or nonmedical use medicine before (while) having sex.” To determine whether the adolescent had multiple partners, their response to the number of partners was dichotomized based on whether they indicated they had greater than one partner. For all substance use and sexual risk behavior questions, if the adolescent reported engaging in the behavior, their response was coded as one and if they had reported they had not engaged in the behavior their response were coded as zero.

The Youth Self-Report was used to calculate internalizing and externalizing symptoms. Responses to questions were on a three point Likert scale and included “Not True”, “Somewhat or Sometimes True”, and “Very True or Often True.” The subscale for internalizing symptoms included 30 items measuring anxious/depressed, withdrawn and somatic complaints and had a Cronbach’s $\alpha = 0.91$. The subscale for externalizing symptoms included 32 items measuring delinquent behavior and aggressive behavior, and
had a Cronbach’s $\alpha = 0.90$. Sample items included “I feel lonely” for internalizing symptoms and “I break rules at home, school, or elsewhere” for externalizing symptoms.

v. Statistical Analysis

The aim of this study was to determine whether MEB problems (e.g., substance use, sexual risk behavior, and internalizing/externalizing symptoms) over time differed by subgroups of Hispanic adolescents characterized by socio-ecological risk and protective factors (e.g., positive parenting, parental involvement in school).

To accomplish this, first the latent class analysis (LCA) performed in Chapter 3: Specific Aim / Paper #1 was utilized. While new classes could have been created by using control youth only for the LCA, utilizing the previous LCA results with the entire sample was chosen for additional power. This LCA had identified 3 subgroups of adolescents based on socio-ecological risk and protective factors. Given high entropy (.81) and reliability (average class probabilities of .94, .89, and .93), maximum posterior probability was used to identify participants as belonging to a specific socio-ecological risk class. In order to determine the impact of these subgroups on MEB problems over time in the absence of intervention, only control group participants were utilized for this analysis.

Next, growth curves were used to evaluate the intercept and slope of MEB problems across four time points, baseline, 6 months, 18 months, and 30 months. Using the socio-ecological risk classes previously identified, the intercept and slope of each growth curve was tested to determine if these differed by socio-ecological risk class.
Finally, to further examine whether differences found by growth curves were remained significant at 30 months post-baseline, the means/standard deviations or frequencies/percentages of each outcome by class at this specific time point were calculated. A multivariate analysis of variance test was then used to determine if there were significant differences in MEB problems at 30 months by socio-ecological risk group. Given a significant multivariate test, separate growth curves for each outcome centered at 30 months were conducted to evaluate whether differences between socio-ecological risk classes were significant at this time point. All models were run in Mplus version 7.11.98

III. Results

i. Identification and Interpretation of Classes

This study utilized the latent class analysis results from Chapter 3: Specific Aim / Paper #1.90 Table 4.2 shows the fit indices as previously reported. Although the AIC, BIC, adjusted BIC, and likelihood difference test indicated a five class solution, the three class solution was selected prioritizing parsimony, power, and meaningfulness of each class. Furthermore the three class solution was reliable with entropy of .808 and average class probabilities of .94, .89, and .93.

<table>
<thead>
<tr>
<th>Latent Classes</th>
<th>AIC</th>
<th>BIC</th>
<th>Adjusted BIC</th>
<th>Entropy</th>
<th>Likelihood Ratio Test p-value</th>
<th>Number of Subjects in Each Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>41682</td>
<td>41755</td>
<td>41707</td>
<td>-</td>
<td>-</td>
<td>959</td>
</tr>
<tr>
<td>2</td>
<td>40365</td>
<td>40487</td>
<td>40407</td>
<td>0.836</td>
<td>&lt;0.001</td>
<td>319, 640</td>
</tr>
<tr>
<td>3</td>
<td>39983</td>
<td>40153</td>
<td>40042</td>
<td>0.808</td>
<td>&lt;0.001</td>
<td>147, 386, 426</td>
</tr>
<tr>
<td>4</td>
<td>39736</td>
<td>39955</td>
<td>39812</td>
<td>0.821</td>
<td>&lt;0.001</td>
<td>77, 150, 363, 369</td>
</tr>
<tr>
<td>5</td>
<td>39638</td>
<td>39906</td>
<td>39731</td>
<td>0.849</td>
<td>&lt;0.001</td>
<td>35, 67, 144, 356, 357</td>
</tr>
</tbody>
</table>
The results from the three class solution included High, Medium and Low Socio-Ecological Risk classes. To aid in the interpretation of these classes, Table 4.3 displays the mean and standard deviation or frequency and percent of the socio-ecological risk and protective factors by class in the control group participants. All of the factors except for U.S. cultural practices (F(df)=0.24(2, 471), p=0.79) were significantly different by class. Pairwise comparisons of the socio-ecological risk classes revealed significant differences in the remaining factors except for the Medium and High Socio-Ecological Risk classes in Hispanic cultural practices (p=0.97) and perceived peer substance use (p=0.36).

### Table 4.3: Means and Standard Deviations of Latent Classes

<table>
<thead>
<tr>
<th>Factor</th>
<th>Overall N=474</th>
<th>High Socio-Ecological Risk N=69 (15%)</th>
<th>Medium Socio-Ecological Risk N=188 (40%)</th>
<th>Low Socio-Ecological Risk N=217 (45%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hispanic Cultural Practices*bc</td>
<td>37.5 (10.6)</td>
<td>33.7 (10.4)</td>
<td>34 (10.4)</td>
<td>41.8 (9.2)</td>
</tr>
<tr>
<td>U.S. Cultural Practices</td>
<td>48.1 (7.7)</td>
<td>48.7 (6.1)</td>
<td>47.9 (7.6)</td>
<td>48.1 (8.2)</td>
</tr>
<tr>
<td>Parental Monitoring of Peers*abc</td>
<td>14 (4.9)</td>
<td>10.5 (4.3)</td>
<td>12.5 (4.3)</td>
<td>16.5 (4.4)</td>
</tr>
<tr>
<td>Parental Involvement in School*abc</td>
<td>2.7 (0.5)</td>
<td>2 (0.7)</td>
<td>2.7 (0.5)</td>
<td>3 (0.2)</td>
</tr>
<tr>
<td>Positive Parenting*abc</td>
<td>18.9 (5.5)</td>
<td>11 (4.9)</td>
<td>17.7 (4.5)</td>
<td>22.4 (2.7)</td>
</tr>
<tr>
<td>Parental Involvement*abc</td>
<td>37.2 (6.9)</td>
<td>24.5 (4.1)</td>
<td>35.3 (3.5)</td>
<td>42.4 (2.8)</td>
</tr>
<tr>
<td>Parent-Adolescent Communication*abc</td>
<td>69.4 (15.1)</td>
<td>49.6 (13.7)</td>
<td>64.7 (9.7)</td>
<td>80 (10.1)</td>
</tr>
<tr>
<td>Perceived Peer Substance Use*bc</td>
<td>200 (46%)</td>
<td>39 (60%)</td>
<td>94 (53%)</td>
<td>67 (34%)</td>
</tr>
</tbody>
</table>

*p<0.001

a indicates significant difference between the High Risk and Medium Risk class (p<0.05)
b indicates significant difference between the Medium Risk and Low Risk class (p<0.05)
c indicates significant difference between the High Risk and Low Risk class (p<0.05)

Compared to both the Medium (n=188, 40%) and High (n=69, 15%) Socio-Ecological Risk classes, the Low (n=217, 45%) Socio-Ecological Risk class had the highest levels of Hispanic cultural practices, parental monitoring of peers, parental
involvement in school, positive parenting, parental involvement, and parent-adolescent communication, as well as the lowest levels of perceived peer substance use. Compared to the High Socio-Ecological Risk class, the Medium Socio-Ecological Risk class had greater levels of parental monitoring of peers, parental involvement in school, positive parenting, parental involvement, and parent-adolescent communication, but differences in levels of Hispanic cultural practices and perceived peer substance use were not statistically significant.

ii. MEB Problems Growth Curves by Class

To evaluate the impact of class membership at baseline on the trajectory of MEB problems across 30 months, the association of class membership on the intercept and slope of the growth curves for each of the MEB problem outcomes was examined. Table 4.4 shows the standardized estimates of the relationship of class membership on intercept and slope comparing High to Medium, High to Low, and Medium to Low Socio-Ecological Risk classes.

Differences in the intercepts, but not the slopes, were significant across all outcomes when comparing the High to Low Socio-Ecological Risk class. Comparing the High to the Medium Socio-Ecological Risk class, the differences in intercepts but not slopes were significant for alcohol, smoking, drug use, unprotected sex, sex under the influence, and externalizing symptoms. Comparing the Medium to the Low Socio-Ecological Risk class, the differences in the intercepts but not the slopes were significant for alcohol, internalizing symptoms, and externalizing symptoms. There were also
significant differences in slopes but not intercepts for drug use and sex under the influence.

Table 4.4: Class on the Intercepts and Slopes of Substance Use, Sexual Risk Behaviors, and Internalizing/Externalizing Symptoms Growth Curves

<table>
<thead>
<tr>
<th></th>
<th>High vs Medium Socio-Ecological Risk Class</th>
<th>High vs Low Socio-Ecological Risk Class</th>
<th>Medium vs Low Socio-Ecological Risk Class</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Intercept</td>
<td>Slope</td>
<td>Intercept</td>
</tr>
<tr>
<td>Substance Use</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol</td>
<td>0.270*</td>
<td>-0.304</td>
<td>0.611*</td>
</tr>
<tr>
<td>Smoking</td>
<td>0.350*</td>
<td>-0.621</td>
<td>0.409*</td>
</tr>
<tr>
<td>Drug Use</td>
<td>0.498*</td>
<td>-0.069</td>
<td>0.498*</td>
</tr>
<tr>
<td>Sexual Risk Behaviors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex in the Past</td>
<td>0.134</td>
<td>0.156</td>
<td>0.240*</td>
</tr>
<tr>
<td>Unprotected Sex</td>
<td>0.214*</td>
<td>0.244</td>
<td>0.313*</td>
</tr>
<tr>
<td>Multiple Sex Partners</td>
<td>0.197</td>
<td>-0.040</td>
<td>0.218*</td>
</tr>
<tr>
<td>Sex under the Influence</td>
<td>0.250*</td>
<td>-0.084</td>
<td>0.352*</td>
</tr>
<tr>
<td>Internalizing / Externalizing</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internalizing Symptoms</td>
<td>0.122</td>
<td>0.004</td>
<td>0.327*</td>
</tr>
<tr>
<td>Externalizing Symptoms</td>
<td>0.266*</td>
<td>-0.035</td>
<td>0.518*</td>
</tr>
</tbody>
</table>

*p<0.05

In order to visually depict the differences in these growth curves of MEB problems by class, model estimated means over time by class are shown in Figure 4-1. These graphs display the differences in intercepts, with classes differing in MEB problems at baseline as well as displaying that the majority of slopes were not significantly different from each other. For alcohol, smoking, internalizing symptoms, and externalizing symptoms, it appears that there were differences between each of the three classes at baseline and that these differences continued at the 30 months follow up. For drug use, sexual behavior, unprotected sexual behavior, and multiple partners, it
appears that the High Socio-Ecological Risk class reported greater problems at baseline and continued to report greater problems at the 30 month follow up compared to both the Medium and Low Socio-Ecological Risk classes.

Figure 4-1: Graphs of Model Estimated MEB Outcomes over Time by Class

To evaluate these differences further, means/standard deviations and frequencies/percentages of MEB problems by class at 30 months were evaluated and whether these differences were statistically significant. If the differences in MEB problems by class remained significant at 30 months, this would indicate that socio-ecological risk factor clustering in eighth grade continues to be associated with MEB problems 30 months later.
iii. MEB Problems at 30 Months by Class

Differences in MEB problems at 30 months by class membership are shown in Table 4.5 along with MEB problems for the overall sample at both baseline and 30 months post-baseline. Separate univariate tests were run for each MEB problem given that the multivariate analysis of variance test was significant (p<.01). There were statistically significant associations (p<.01) found between class membership and all substance use outcomes at 30 months. Individual comparisons revealed that the Low Socio-Ecological Risk class reported less alcohol (13%), smoking (4%), and drug use (3%) compared to both the High (30%, 20%, and 26%, respectively) and Medium (23%, 10%, and 10%, respectively) Socio-Ecological Risk classes. The Medium Socio-Ecological Risk class also reported less drug use (10%) compared to the High (26%) Socio-Ecological Risk class.

Significant associations were also found between class membership and sexual behavior and unprotected sexual behavior at the p<0.01 level, as well as between class membership and sex under the influence of alcohol or drugs at the p<0.05 level. Individual comparisons revealed that the High Socio-Ecological Risk class had higher reported sexual behavior (38%) and unprotected sexual behavior (28%) compared to both the Medium (19% and 12%, respectively) and Low (13% and 10%, respectively) Socio-Ecological Risk classes. The Medium (6%) Socio-Ecological Risk class reported higher levels of sex under the influence of alcohol or drugs than the Low (1%) Socio-Ecological Risk class.
Both internalizing and externalizing symptoms at 30-months post-baseline significantly differed (p<0.01) by class membership. Individual comparisons revealed that the Low Socio-Ecological Risk (M=6.4, STD=8.3) class reported lower levels of internalizing symptoms compared to both the Medium (M=9.3, STD=8.3) and High (M=11.9, STD=11.6) Socio-Ecological Risk classes. Externalizing symptoms were lowest among the Low (M=7.0, STD=7.9) Socio-Ecological Risk class, higher among the Medium (M=10.3, STD=8.3) Socio-Ecological Risk class, and highest among the High (M=14.0, STD=12.1) Socio-Ecological Risk class.

Table 4.5: MEB Problems by Class at 30 Months

<table>
<thead>
<tr>
<th></th>
<th>Overall Sample at Baseline</th>
<th>Overall Sample at 30 Months Post-Baseline</th>
<th>High Socio-Ecological Risk (N=58)</th>
<th>Medium Socio-Ecological Risk (N=159)</th>
<th>Low Socio-Ecological Risk (N=163)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Substance Use</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Alcohol <strong>abc</strong></td>
<td>39 (8%)</td>
<td>73 (19%)</td>
<td>15 (30%)</td>
<td>34 (23%)</td>
<td>24 (13%)</td>
</tr>
<tr>
<td>Smoking <strong>abc</strong></td>
<td>26 (5%)</td>
<td>31 (8%)</td>
<td>10 (20%)</td>
<td>14 (10%)</td>
<td>7 (4%)</td>
</tr>
<tr>
<td>Drug Use <strong>abc</strong></td>
<td>29 (6%)</td>
<td>32 (8%)</td>
<td>13 (26%)</td>
<td>14 (10%)</td>
<td>5 (3%)</td>
</tr>
<tr>
<td>Sexual Risk Behaviors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex <strong>ac</strong></td>
<td>42 (9%)</td>
<td>71 (19%)</td>
<td>19 (38%)</td>
<td>28 (19%)</td>
<td>24 (13%)</td>
</tr>
<tr>
<td>Unprotected Sex <strong>ac</strong></td>
<td>30 (6%)</td>
<td>50 (13%)</td>
<td>14 (28%)</td>
<td>17 (12%)</td>
<td>19 (10%)</td>
</tr>
<tr>
<td>Multiple Sex Partners</td>
<td>24 (5%)</td>
<td>43 (11%)</td>
<td>8 (17%)</td>
<td>19 (13%)</td>
<td>16 (9%)</td>
</tr>
<tr>
<td>Sex under the Influence <strong>b</strong></td>
<td>13 (3%)</td>
<td>14 (4%)</td>
<td>3 (6%)</td>
<td>9 (6%)</td>
<td>2 (1%)</td>
</tr>
<tr>
<td>Internalizing / Externalizing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internalizing</td>
<td>10.9</td>
<td>8.3</td>
<td>11.9</td>
<td>9.3</td>
<td>6.4</td>
</tr>
<tr>
<td>Symptoms <strong>abc</strong></td>
<td>(9.0)</td>
<td>(9.0)</td>
<td>(11.6)</td>
<td>(8.3)</td>
<td>(8.3)</td>
</tr>
<tr>
<td>Externalizing</td>
<td>10.8</td>
<td>9.2</td>
<td>14.0</td>
<td>10.3</td>
<td>7.0</td>
</tr>
<tr>
<td>Symptoms <strong>abc</strong></td>
<td>(9.3)</td>
<td>(9.0)</td>
<td>(12.1)</td>
<td>(8.3)</td>
<td>(7.9)</td>
</tr>
</tbody>
</table>

*p<0.05, **p<0.01

a indicates significant difference between the High Risk and Medium Risk class (p<0.05)

b indicates significant difference between the Medium Risk and Low Risk class (p<0.05)

c indicates significant difference between the High Risk and Low Risk class (p<0.05)
IV. Discussion

This study examined whether the clustering of socio-ecological risk and protective factors in eighth grade impacted the change in MEB problems (e.g., substance use, sexual risk behavior, and internalizing/externalizing symptoms) over 30 months and whether there were significant differences by socio-ecological risk cluster groups in MEB problems 30 months post-baseline when adolescents were in tenth grade. Focusing these analyses exclusively on the control group helps identify the impact of these risk factor clusters on mental, emotional and behavioral problems in the absence of intervention. This study builds upon prior research that has assessed the impact of socio-ecological risk factors on MEB problems at a single time point. This previous work has shown that individual socio-ecological risk and protective factors are associated with a variety of MEB problems. Specifically, in Chapter 3: Specific Aim / Paper 1, these same risk and protective factors clustered together, with the exception of U.S. cultural practices. The loss of Hispanic cultural practices clustered with greater socio-ecological risk factors, while U.S. cultural practices was not significantly different across socio-ecological risk groups. This highlighted the importance of the loss of Hispanic cultural practices as a risk factor rather than the increase in U.S. cultural practices. This clustering was associated cross-sectionally with a variety of MEB problems when youth were in the eighth grade. Yet, this existing work left several gaps and research questions unanswered, including the influence of the clustering of socio-ecological risk factors on MEB problems over time, as youth become older adolescents and are more likely to show certain MEB, such as substance use, sexual risk behavior and internalizing symptoms.
The present study uses longitudinal data to evaluate the impact that this risk factor clustering during eighth grade has on the change in MEB problems across the subsequent two years, a sensitive developmental period in adolescence.

The overall patterns of MEB problems across time for the entire sample are consistent with what is expected developmentally, with adolescents increasing substance use and sexual risk behaviors between eighth and tenth grade.\textsuperscript{109,110} The growth curves showed most slopes were not significantly different by class indicating that adolescents in higher risk subgroups were not increasing MEB problems across time compared to those in lower risk subgroups. However, results did show that these MEB problems varied by socio-ecological risk group at baseline when the adolescents were in eighth grade, and that these subgroup differences continued to be present at 30 months post-baseline when the adolescents were 16 years old. Significant differences by socio-ecological risk subgroup were found at 30 months post-baseline for all substance use outcomes, sex, unprotected sex, and sex under the influence as well as internalizing and externalizing symptoms. Previous literature has shown the associations of individual socio-ecological risk and protective factors on MEB problems.\textsuperscript{33,41,63,70,108} These results are consistent and add to this literature by showing that the clustering of these socio-ecological risk and protective factors is also associated with a variety of MEB problems.

These results indicate that without intervention, socio-ecological risk class when adolescents are 13 to 14 years of age is associated with MEB outcomes 30 months later when adolescents are 16 years old. This demonstrates the importance of the combination of these risk and protective variables on a variety of MEB problems, and the influence of
the clustering of these socio-ecological risk and protective factors on MEB problems throughout adolescence. With adolescents in the Low Socio-Ecological Risk group at baseline displaying less alcohol, smoking, drug, sex, unprotected sex and internalizing and externalizing symptoms compared to the High Socio-Ecological Risk group, results further indicates that being in the Low Socio-Ecological Risk group at baseline was protective over time across a range of MEB outcomes. The consistency with which risk class influenced a variety of MEB problems lends support to the idea of common pathways in the development of mental and behavioral health outcomes.26

i. Limitations

The sample for this study came from the Miami-Dade County Hispanic population. With its unique cultural and social heritage, Hispanics in Miami may not be representative of the U.S. Hispanic population. The sample does, however, include Hispanics from a diverse set of countries and experiences. Another limitation of this study is that given the limited sample size the three class solution was utilized for greater power when a greater number of classes could have been used. A third limitation is that all measures were self-reported. While utilization of audio computer-assisted self-administered interview may mitigate some inaccuracies,79 adolescents could have under or over reported some measures. Furthermore, this study utilized socio-ecological risk factors clustered in eighth grade and did not examine how sustained risk clustering or changes in risk group over time might impact outcomes. Future research could examine the impact of changes in socio-ecological risk group on MEB problems.
ii. Conclusions

This study suggests the importance of socio-ecological risk factor clustering in Hispanic eighth grade adolescents and the association of this clustering on MEB problems throughout adolescence. Targeting socio-ecological risk factors during early adolescence may impact a variety of poor health outcomes. These results support the importance of implementing interventions aimed at improving socio-ecological risk factors for Hispanics in early adolescence.

While this study focused on control group participants in order to examine the relationship of clustering of socio-ecological risk factors on MEB problems in the absence of intervention, these results suggest latent class analysis could also be used to identify risk groups that may benefit in different ways from various preventive interventions. Specifically, interventions could examine socio-ecological risk group as a potential moderator of intervention effects. This information could then be utilized to target risk groups for whom the intervention has the highest probability of being efficacious/effective or for scaling the strength of the intervention based on the level of risk.111
Chapter 5: Specific Aim / Paper #3

I. Background

Mental, emotional, and behavioral (MEB) problems (e.g. substance use, sexual risk behaviors, and internalizing and externalizing symptoms) often develop during adolescence, with Hispanic adolescents often reporting higher levels of these MEB problems compared to non-Hispanic whites.\(^{12}\) For instance, Hispanic eighth and tenth graders are more likely to have tried alcohol, cigarettes, or marijuana compared to non-Hispanic whites and non-Hispanic blacks.\(^{13}\) Hispanic adolescents also report higher levels of unprotected sex and sex before the age of 13 compared to non-Hispanic whites.\(^{13}\) Additionally, compared to non-Hispanic whites, Hispanic adolescents report greater levels of “feeling sad or hopeless,” having “seriously considered attempting suicide,” being “in a physical fight”, and “injured in a physical fight.”\(^{2,13}\)

Common risk and protective factors have been associated with a variety of different MEB problems.\(^{12}\) Models, such as the socio-ecological model,\(^{26}\) propose that risk and protective factors in the adolescent’s environment (e.g. family, school, and peer groups) impact a variety of these MEB problems.\(^{27,32}\) Greater risk of MEB problems has been shown to be associated separately with various socio-ecological risk and protective factors occurring in these environments or systems, such as poorer family functioning,\(^{33,41}\) lower school involvement,\(^{108}\) riskier behaviors among peers,\(^{63}\) and loss of Hispanic cultural practices and values.\(^{70}\)

This paper builds on this previous work, including analyses regarding the clustering of socio-ecological risk and protective factors and the cross-sectional...
association of this clustering on MEB problems among eighth grade Hispanic adolescents (Chapter 3: Specific Aim / Paper #1), as well as the impact of this risk and protective factor clustering in eighth grade on changes in MEB problems over the following 30 months until adolescents were approximately 16 years old (Chapter 4: Specific Aim / Paper #2). These previous analyses indicated that socio-ecological risk and protective factors in eighth grade clustered together, and that this clustering was associated with MEB problems in eighth grade, as well as 30 months later when adolescents were in tenth grade. These analyses, however, did not examine potential transitions in risk and protective factor cluster group membership over time, or the impact of these transitions on MEB problems.

In this study, latent transition analysis (LTA) was used to assess different patterns of transition in adolescents’ socio-ecological risk clustering beginning in eighth grade at baseline, including 18 months post-baseline, and ending 30 months post-baseline when adolescents were in tenth grade. This LTA analysis will help elucidate the degree to which adolescents remain in, or transition across, socio-ecological risk groups over time, as well as examining the impact of these patterns of transition on MEB problems at 30 months post-baseline. This analysis is important because it allows for evaluation of the stability of socio-ecological risk cluster groups, as well as for evaluation of the impact that stability or transition in risk group may have on MEB problems. Although previous research has evaluated change in specific socio-ecological risk factors (e.g., parent-adolescent communication) and the impact this has on certain MEB problems, to our knowledge the literature has not looked at changes in the clustering of socio-ecological
risk factors in Hispanic adolescents and how these transitions in socio-ecological risk
group impact MEB problems. These analyses are conducted using control group
participants’ data only in order to evaluate transition patterns in the absence of
intervention.

Given that risk and protective factors have been previously shown to influence
one another across time, and thus impact subsequent levels of risk and protective
factors, it is hypothesized that the majority of adolescents will remain in the same
socio-ecological risk subgroup from baseline to 30 months post-baseline, but there will
be a small proportion of adolescents who transition across different risk subgroups over
time. Given literature and the previous findings indicating an association between greater
socio-ecological risk and higher MEB problems, adolescents who remain in lower
socio-ecological risk classes over time are expected to report fewer MEB problems at 30
months post-baseline compared to those who remain in higher socio-ecological risk
classes over time. Furthermore, given that higher levels of risk and protective factors are
associated with greater risk for MEB problems, and that these factors tend to have
cumulative effects across time, adolescents transitioning from a lower socio-ecological
risk subgroup to a higher risk subgroup over time are expected to report less MEB
problems at 30 months than those who remain in a higher socio-ecological risk subgroup
over time. Likewise, adolescents transitioning from a lower socio-ecological risk
subgroup to a higher risk subgroup over time are expected to report more MEB problems
at 30 months compared to adolescents who remain in the lower socio-ecological risk
subgroup over time. In summary, this paper investigates whether, in the absence of
intervention, the clustering of risk and protective factors during early adolescence remains stable into later adolescence, and whether this stability or transition influences youth MEB problems across development.

II. Methods

i. Participants

Data for this study came from control group participants from two randomized controlled trials assessing a preventive intervention for Hispanic adolescents called Familias Unidas. Eligibility criteria for both studies included: identifying as Latino/Hispanic, attending eighth grade at baseline, living with an adult primary caregiver who was willing to participate, living within the catchment areas of the participating middle schools, and planning to live in South Florida for the duration of the study. All methods and procedures were approved by the University of Miami’s Institutional Review Board and the Miami-Dade County Public School System’s Research Committee.

The participants from the first study included a total of 213 Hispanic adolescents from an indicated sample, in which school counselors had identified adolescents as having at least “mild problems” on at least one of the following Revised Behavior Problem Checklist subscales: conduct disorder, socialized aggression, and attention problems. Parents were asked to complete these three subscales and adolescents to be eligible adolescents had to be scored at least one standard deviation above the mean on at least one of these subscales.
The second study included a total of 746 Hispanic adolescents from a universal sample, and was an effectiveness trial. Of the total participants from the two studies (n=959), only the 474 control group participants were included in the analyses reported in this paper. For the combined sample, the average age was 13.8 (SD=.7) at baseline and 16.3 (SD=.7) at 30 months post-baseline. A slight majority of the participants were male (55%, n=262) and a slight majority were born in the U.S. (55%, n=259) though the majority of parents of these adolescents were foreign born (90%, n=863). Adolescents who were foreign born predominantly originated from Honduras (27%), Cuba (20%), and Nicaragua (16%). The majority of adolescents came from low income families, with 71% (n=338) of caregivers reporting an average household income of less than $30,000 per year.

ii. Measures

All measures for this study were self-reported using audio computer assisted self-administered interview (ACASI). All within this system, a pre-recorded voice reads the text of the questions presented on the screen to the participant. The surveys could be completed in English or Spanish, depending on the participant’s preference.

iii. Socio-Ecological Risk and Protective Factors

Socio-ecological risk and protective factors examined in this study included: Hispanic cultural practices, U.S. cultural practices, parental monitoring of peers, positive parenting, parental involvement, parent-adolescent communication, parental involvement in school, and perceived peer substance use. All socio-ecological risk and protective factors used in this analysis were reported by the adolescent at baseline, 6-, 18-, and 30-
months post-baseline. For this analysis, only data from baseline, 18- and 30- months post-baseline were utilized. Data from 6 months post-baseline was excluded since shifts in socio-ecological risk subgroups would likely take longer than 6 months to occur as well as to simplify the LTA analysis to three time points.

Hispanic and U.S. cultural practices were assessed using the Bicultural Involvement Questionnaire-Revised,\textsuperscript{81} which measures the adolescent’s comfort with items such as language, food, and traditions of each culture. These scales included items such as “how much do you enjoy Hispanic-oriented places?” and “how comfortable do you feel speaking English at home?” Cronbach’s $\alpha$ was .92 for both of these scales. Each scale contained eleven items, each rated on a five point Likert scale ranging from “not at all” to “very much.”

Items from the Parent Relationship with Peer Group Scale\textsuperscript{82} were used to measure parental monitoring of peers. “How well do your parents know your best friends?” is a sample item from this scale, which includes five items rated on a five point Likert scale with responses ranging from "not at all" to "extremely well (often).” Cronbach’s $\alpha$ for scores on this scale in the present dataset was .81.

Family functioning variables included in this analysis were positive parenting, parental involvement, and parent-adolescent communication. Positive parenting and parental involvement were assessed using the subscales from the Parenting Practices Scale\textsuperscript{83} and parent-adolescent communication was assessed using the Parent-Adolescent Communication Scale.\textsuperscript{86} Sample items for each of these scales include: “when you have done something that your parents like or approve of, how often does your mother say
something nice about it,” “how often do you and your mom do things together,” and “I can discuss my beliefs with my mother/father without feeling restrained or embarrassed.”

In the present dataset the Cronbach’s alpha coefficient for scores on the positive parenting scale was .82, on the parental involvement scale was .84, and on the parent-adolescent communication scale was .90. The positive parenting scale included nine items rated on a four point Likert scale with responses ranging from “never” to “always.” Parental involvement included thirteen items rated on a three point Likert scale and two items on a four point Likert scale with responses ranging from “never” to “always.” Parent-adolescent communication included twenty items on a five point Likert scale with responses ranging from “strongly disagree” to “strongly agree.”

Parental involvement in school was assessed using the question “How often did you mom talk with you about how things are going in school.” Responses to this question included “almost never,” “sometimes,” and “often.” For this analysis, the response was dichotomized and participants who responded “often” were coded as one, whereas participants who responded “almost never” or “sometimes” were coded as zero.

Questions regarding how many of the adolescent’s friends drank alcohol, smoked cigarettes, or used drugs were utilized to measure perceived peer substance use. For this measure, participants were separated into (a) those indicating that none of their friends engaged in any of these substance use activities (coded as 0) and (b) those indicating that their friends engaged in any of these substance use activities (coded as 1).
iv. Mental, Emotional, and Behavioral (MEB) Problems

Substance use, sexual risk behaviors, and internalizing/externalizing symptoms were examined as the MEB problem outcome variables. The MEB problems used in this analysis were reported by the adolescent at 30 months post-baseline.

Using items comparable to the Monitoring the Future survey, a national ongoing study of adolescent behaviors, substance use was determined from past 90-day usage of alcohol, cigarettes, and illicit drugs. Alcohol use in the past 90 days was measured using the survey question “In the past 3 months, have you had any beer, wine, wine coolers, or liquor to drink - more than just a few sips?” Smoking in the past 90 days was measured using the survey question “Have you smoked cigarettes in the past 3 months?” Drug use in the preceding 90 days was measured using the survey question “Have you used drugs in the past 3 months?”

Sexual risk behaviors included having engaged in sexual behavior, unprotected sexual behavior, multiple sex partners, and having sex under the influence of alcohol or drugs in the preceding 90 days. Sexual behavior in the past 90 days was measured using the question “In the past 3 months, have you had vaginal, anal, or oral sex?” Unprotected sexual behavior was measured with the question “In the past 3 months, have you had vaginal or anal sex without using a condom?” Having multiple sex partners was measured by the participant’s response to a question about the number of sex partners in the past 90 days, and dichotomized depending on whether participants indicated they had more than one partner versus zero or one partner. Sexual behavior under the influence of alcohol or drugs was measured using the question “during the past 3 months, have you
been under the influence of alcohol, illicit drugs, or nonmedical use medicine before (while) having sex.” Response choices to all substance use and sexual risk behavior questions were either “yes” or “no”, except for number of sexual partners. For dichotomous variables, the participant’s response was coded as 1 if they had engaged in the behavior and 0 if not.

Internalizing and externalizing symptoms were assessed using the Youth Self-Report, which contains 112 questions rated on a three point Likert scale. The internalizing symptoms subscale includes 30 items and included items such as “I feel lonely.” The subscale for externalizing symptoms included 32 items and included items such as “I break rules at home, school, or elsewhere.” The Cronbach’s alpha coefficient for scores on the internalizing symptoms scale was .91 and on the externalizing symptoms scale was .90 in the present dataset. Responses for all questions ranged from “not true” to “very true or often true.”

v. Statistical Analysis

In this study, different patterns of transition in adolescents’ socio-ecological risk/protective (e.g., positive parenting, parental involvement in school) clustering across time were assessed. The impact of the most common transition patterns on MEB problems (i.e., substance use, sexual risk behavior, and internalizing and externalizing symptoms) across time was then evaluated.

To accomplish this, a latent transition analysis (LTA) was conducted to describe how adolescents transitioned across socio-ecological risk classes. The latent class analysis described in Chapter 3 and Chapter 4 allowed for the identification of
homogenous subgroups of Hispanic adolescents based on socio-ecological risk and protective factors reported at baseline and examine their relationship to MEB problems cross-sectionally and longitudinally. Extending these analyses, the LTA in the present study allowed for the evaluation of how individuals changed in their risk subgroup membership over time, and the influence of risk group stability versus transition on MEB problems across time. To evaluate the clinical meaningfulness of subgroup assignment, means and standard deviations or frequencies and percentages for the socio-ecological risk and protective factors by class were calculated. Then, separate analyses of variance (for continuous variables) or logistic regression analyses (for binary variables) were conducted for each socio-ecological risk and protective factor to evaluate differences by class. For those socio-ecological risk/protective factors which were significant, pairwise comparisons were then conducted. These results were utilized to help evaluate the meaningfulness of the classes and aid in their substantive interpretation. It is also important to note that, when estimating the LTA, within each subgroup, the means and frequencies of each socio-ecological risk factor are held constant across time so that the clinical meaning of the classes remains the same across time after testing whether this assumption can be made. Therefore, only a single mean or frequency is shown for each socio-ecological risk and protective factor by subgroup, and thus, these means and frequencies may differ slightly from those using only baseline data in Chapter 3: Specific Aim / Paper #1 and Chapter 4: Specific Aim / Paper #2.

Based on the LTA, prevalence of each socio-ecological risk class at each time point and transition probabilities were calculated. Common patterns of risk class changes
over time were also reported. For the most common patterns, means and standard deviations, or frequencies and percentages, for each MEB problem outcome at 30 months were calculated for participants using maximum posterior probability. To determine whether there was a significant difference across class patterns, the pseudo class method was utilized. This method takes into account uncertainty of class membership in assessing the relationship between class membership and MEB problem outcomes. With this method, after estimating the LTA model, the resulting probabilities were used to multiply impute the LTA transition pattern variable with 20 imputations. These LTA transition pattern variables were then analyzed with the outcome variables for each of the 20 multiple imputations. Statistical tests were conducted by combining the chi-squares from each of these imputations using the procedure described in Schafer et al,94 whether there were significant differences in a given outcome across LTA transition patterns. The pseudo class method was utilized to test for overall differences among the three groups, as well as pairwise comparisons between pairs of groups. A multivariate analysis of variance test was first run to check if there were significant differences in the MEB problem outcomes by socio-ecological risk group. With a significant multivariate analysis of variance test, separate analysis of variance models were used for the continuous outcome variables and logistic regression analyses were utilized for the binary outcomes. The LTA model was analyzed using Mplus version 7.1198 and the pseudo-class method was analyzed using SAS 9.3.97
III. Results

i. Identification and Interpretation of Classes

To determine the number of latent classes, fit indices as presented in Table 5.1 were utilized. A three class solution was used for this study for parsimony, power, and meaningfulness of the classes even though the AIC, BIC, adjusted BIC, and likelihood difference test indicated a five class solution. The three class solution was also highly reliable with entropy greater than .80 and class average class probabilities of .94, .89, and .93.

Table 5.1: Fit Criteria

<table>
<thead>
<tr>
<th>Latent Classes</th>
<th>AIC</th>
<th>BIC</th>
<th>Adjusted BIC</th>
<th>Entropy</th>
<th>Likelihood Ratio Test p-value</th>
<th>Number of Subjects in Each Class</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>41682</td>
<td>41755</td>
<td>41707</td>
<td>-</td>
<td>-</td>
<td>959</td>
</tr>
<tr>
<td>2</td>
<td>40365</td>
<td>40487</td>
<td>40407</td>
<td>0.836</td>
<td>&lt;0.001</td>
<td>319, 640</td>
</tr>
<tr>
<td>3</td>
<td>39983</td>
<td>40153</td>
<td>40042</td>
<td>0.808</td>
<td>&lt;0.001</td>
<td>147, 386, 426</td>
</tr>
<tr>
<td>4</td>
<td>39736</td>
<td>39955</td>
<td>39812</td>
<td>0.821</td>
<td>&lt;0.001</td>
<td>77, 150, 363, 369</td>
</tr>
<tr>
<td>5</td>
<td>39638</td>
<td>39906</td>
<td>39731</td>
<td>0.849</td>
<td>&lt;0.001</td>
<td>35, 67, 144, 356, 357</td>
</tr>
</tbody>
</table>

Table 5.2 displays the means/standard deviations or frequencies/percentages for the socio-ecological risk and protective factors by class. There were significant differences (p<.001) in all of these individual risk and protective factors by class except for U.S. cultural practices (F(df)=1.2(2, 471), p=.31). Pairwise comparisons for the factors that were significantly different indicated that the individual classes were significantly different (p<.05) from each other across all measures except for Hispanic cultural practices (p=.75) and perceived peer substance use (p=.24), when comparing the High and Medium Socio-Ecological Risk classes.
The Low (n=188, 40%) Socio-Ecological Risk class had the least perceived peer substance use and highest levels of Hispanic cultural practices, parental monitoring of peers, parental involvement in school, positive parenting, parental involvement, and parent-adolescent communication compared to both the High (n=94, 20%) and Medium (n=192, 40%) Socio-Ecological Risk classes. Compared to the High Socio-Ecological Risk class, the Medium Socio-Ecological Risk class had greater parental monitoring of peers, parental involvement in school, positive parenting, parental involvement, and parent-adolescent communication, though no significant difference in perceived peer substance use or Hispanic cultural practices.

Table 5.2: Means and Standard Deviations of Socio-Ecological Factors by Class

<table>
<thead>
<tr>
<th></th>
<th>Overall Sample (N=474)</th>
<th>High Socio-Ecological Risk (N=94) (20%)</th>
<th>Medium Socio-Ecological Risk (N=192) (40%)</th>
<th>Low Socio-Ecological Risk (N=188) (40%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hispanic Cultural Practices</td>
<td>37.5 (10.6)</td>
<td>33.6 (10.9)</td>
<td>35.0 (9.9)</td>
<td>42.1 (9.4)</td>
</tr>
<tr>
<td>U.S. Cultural Practices</td>
<td>48.1 (7.7)</td>
<td>48.7 (6.2)</td>
<td>47.4 (7.9)</td>
<td>48.5 (8.1)</td>
</tr>
<tr>
<td>Parental Monitoring of Peers</td>
<td>14.0 (4.9)</td>
<td>11.2 (4.3)</td>
<td>12.1 (4.3)</td>
<td>17.3 (3.9)</td>
</tr>
<tr>
<td>Parental Involvement in School</td>
<td>2.7 (0.5)</td>
<td>2.1 (0.7)</td>
<td>2.8 (0.4)</td>
<td>3.0 (0.2)</td>
</tr>
<tr>
<td>Positive Parenting</td>
<td>18.9 (5.5)</td>
<td>11.0 (4.6)</td>
<td>18.8 (3.6)</td>
<td>22.8 (2.5)</td>
</tr>
<tr>
<td>Parental Involvement</td>
<td>37.2 (6.9)</td>
<td>26.8 (5.4)</td>
<td>36.6 (4.0)</td>
<td>42.5 (2.9)</td>
</tr>
<tr>
<td>Parent-Adolescent Communication</td>
<td>69.4 (15.1)</td>
<td>51.4 (12.8)</td>
<td>67.5 (10.0)</td>
<td>80.5 (10.3)</td>
</tr>
<tr>
<td>Perceived Peer Substance Use</td>
<td>200 (46%)</td>
<td>52 (59%)</td>
<td>92 (51%)</td>
<td>56 (33%)</td>
</tr>
</tbody>
</table>

*p<0.001

a indicates significant difference between the High Risk and Medium Risk class (p<0.05)
b indicates significant difference between the Medium Risk and Low Risk class (p<0.05)
c indicates significant difference between the High Risk and Low Risk class (p<0.05)
ii. Prevalence of Classes and Transition Probabilities

Based on the results from the latent transition analysis, the prevalence of each socio-ecological risk class at each time point is presented in Table 5.3. The probabilities of transitioning from one class to another from baseline to 18 months follow-up, as well as from 18 months to 30 months follow-up, are shown in the table as well.

<table>
<thead>
<tr>
<th>Time 1 – Baseline</th>
<th>Time 2 – 18 Months</th>
<th>Time 3 – 30 Months</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Risk</td>
<td>.198</td>
<td>.120</td>
</tr>
<tr>
<td>Medium Risk</td>
<td>.405</td>
<td>.475</td>
</tr>
<tr>
<td>Low Risk</td>
<td>.397</td>
<td>.405</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transitions from Time 1 (rows) to Time 2 (columns)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Socio-Ecological Risk</td>
</tr>
<tr>
<td>.483</td>
</tr>
<tr>
<td>Medium Socio-Ecological Risk</td>
</tr>
<tr>
<td>.133</td>
</tr>
<tr>
<td>Low Socio-Ecological Risk</td>
</tr>
<tr>
<td>.000</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Transitions from Time 2 (rows) to Time 3 (columns)</th>
</tr>
</thead>
<tbody>
<tr>
<td>High Socio-Ecological Risk</td>
</tr>
<tr>
<td>.683</td>
</tr>
<tr>
<td>Medium Socio-Ecological Risk</td>
</tr>
<tr>
<td>.081</td>
</tr>
<tr>
<td>Low Socio-Ecological Risk</td>
</tr>
<tr>
<td>.000</td>
</tr>
</tbody>
</table>

From the prevalence results, the highest prevalence of participants were in the Medium Socio-Ecological Risk class at every time point, followed closely by the Low Socio-Ecological Risk class. Furthermore, the High Socio-Ecological Risk class had less than half the prevalence of participants than either the Medium and Low Socio-Ecological Risk classes at all time points. Over time, the prevalence of the High Socio-Ecological Risk class decreased with .198 at baseline, .120 at 18 months, and .108 at 30
months follow-up. During this same period, the prevalence of the Medium Socio-Ecological Risk class increased over time with .405 at baseline, .475 at 18 months, and .479 at 30 months. The prevalence of the Low Socio-Ecological Risk class increased slightly over time with .397 at baseline, .405 at 18 months, and .414 at 30 months.

Based on the transition probabilities, the majority of participants remained in the same class from baseline to 18 months, with .483 of the High Socio-Ecological Risk class remaining in that class, .667 of the Medium Socio-Ecological Risk class remaining in that class, and .780 of the Low Socio-Ecological Risk Class remaining in that class. Transition probabilities from High to the Low Socio-Ecological Risk (.082) or from Low to High Socio-Ecological Risk (.000) were extremely small. Transition probabilities of going from the High to the Medium Socio-Ecological Risk class or going from the Medium to the Low Socio-Ecological Risk class were .435 and .201, respectively. Transition probabilities of going from the Low to the Medium Socio-Ecological Risk class or going from the Medium to the High Socio-Ecological Risk class were .220 and .133 respectively.

Compared to those who remained in the same class from baseline to 18 months, an even greater number of participants remained in the same class from 18 to 30 months, with .683 remaining in the High Socio-Ecological Risk class, .832 remaining in the Medium Socio-Ecological Risk class, and .935 remaining in the Low Socio-Ecological Risk Class. Transition probabilities from High to Low Socio-Ecological Risk (.027) or from Low to High Socio-Ecological Risk (.000) were again extremely small. Transition probabilities of going from the High to Medium Socio-Ecological Risk class or going
from the Medium to the Low Socio-Ecological Risk class were .290 and .086 respectively. Transition probabilities of going from the Low to the Medium Socio-Ecological Risk class or going from the Medium to the High Socio-Ecological Risk class were .065 and .081 respectively.

Table 5.4: Socio-Ecological Risk Class Patterns

<table>
<thead>
<tr>
<th>Pattern #</th>
<th>Class at Time 1</th>
<th>Class at Time 2</th>
<th>Class at Time 3</th>
<th>Number</th>
<th>Percentage</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Low</td>
<td>Low</td>
<td>Low</td>
<td>156</td>
<td>33%</td>
</tr>
<tr>
<td>2</td>
<td>Medium</td>
<td>Medium</td>
<td>Medium</td>
<td>128</td>
<td>27%</td>
</tr>
<tr>
<td>3</td>
<td>High</td>
<td>Medium</td>
<td>Medium</td>
<td>50</td>
<td>11%</td>
</tr>
<tr>
<td>4</td>
<td>Low</td>
<td>Medium</td>
<td>Medium</td>
<td>29</td>
<td>6%</td>
</tr>
<tr>
<td>5</td>
<td>Medium</td>
<td>Low</td>
<td>Low</td>
<td>26</td>
<td>5%</td>
</tr>
<tr>
<td>6</td>
<td>High</td>
<td>High</td>
<td>High</td>
<td>25</td>
<td>5%</td>
</tr>
<tr>
<td>7</td>
<td>Medium</td>
<td>High</td>
<td>High</td>
<td>16</td>
<td>3%</td>
</tr>
<tr>
<td>8</td>
<td>High</td>
<td>High</td>
<td>Medium</td>
<td>9</td>
<td>2%</td>
</tr>
<tr>
<td>9</td>
<td>Medium</td>
<td>High</td>
<td>Medium</td>
<td>6</td>
<td>1%</td>
</tr>
<tr>
<td>10</td>
<td>Medium</td>
<td>Medium</td>
<td>High</td>
<td>6</td>
<td>1%</td>
</tr>
<tr>
<td>11</td>
<td>High</td>
<td>Low</td>
<td>Low</td>
<td>5</td>
<td>1%</td>
</tr>
<tr>
<td>12</td>
<td>Medium</td>
<td>Medium</td>
<td>Low</td>
<td>5</td>
<td>1%</td>
</tr>
<tr>
<td>13</td>
<td>Medium</td>
<td>Low</td>
<td>Medium</td>
<td>5</td>
<td>1%</td>
</tr>
<tr>
<td>14</td>
<td>High</td>
<td>Medium</td>
<td>High</td>
<td>3</td>
<td>1%</td>
</tr>
<tr>
<td>15</td>
<td>Low</td>
<td>Medium</td>
<td>Low</td>
<td>2</td>
<td>0.4%</td>
</tr>
<tr>
<td>16</td>
<td>High</td>
<td>High</td>
<td>Low</td>
<td>2</td>
<td>0.2%</td>
</tr>
<tr>
<td>17</td>
<td>High</td>
<td>Medium</td>
<td>Low</td>
<td>1</td>
<td>0.2%</td>
</tr>
<tr>
<td>18</td>
<td>Low</td>
<td>Medium</td>
<td>High</td>
<td>1</td>
<td>0.2%</td>
</tr>
</tbody>
</table>

iii. Patterns of Transition

Based on the same results of the latent transition analysis, patterns of change in socio-ecological risk class over time are displayed in Table 5.4. The majority of participants (65%) stayed in the same class across all three time points. The greatest number of participants were identified as being in the Low Socio-Ecological Risk class throughout all time points (33%) followed closely by participants who were identified as
being in the Medium Socio-Ecological Risk class throughout all time points (27%). A small proportion of participants (5%) were also identified as being in the High Socio-Ecological Risk class throughout all time points.

Only a small number of participants (1.6%) were identified being in the High Socio-Ecological Risk class at one time point and the Low Socio-Ecological Risk class at another time point. Other common patterns included High Socio-Ecological Risk at baseline with Medium Socio-Ecological Risk at 18 and 30 months (11%), Low Socio-Ecological Risk at baseline with Medium Socio-Ecological Risk at 18 and 30 months (6%), and Medium Socio-Ecological Risk at baseline with Low Socio-Ecological Risk at 18 and 30 months (5%).

iv. MEB Problems by Common Transition Patterns

Means/standard deviations or frequencies/percentages of each MEB problem outcome at 30 months are presented by class in Table 5.5 for the most common transition patterns. Differences between those who remained in the Low Socio-Ecological Risk class (LLL) at all time points, those who remained in the Medium Socio-Ecological Risk class (MMM) at all time points, and those who remained in the High Socio-Ecological Risk class (HHH) at all time points were examined. The multivariate analysis of variance test was significant with p<.01, so univariate tests were run on each MEB problem.

Significant associations were found between pattern group and all substance use outcomes at the p<0.01 level. Individual comparisons revealed the LLL pattern reported significantly less past 90-day alcohol (11% vs 33%), smoking (3% vs 25%), and drug use (1% vs 29%) as compared to from the HHH pattern. The LLL pattern also reported less
Table 5.5: Outcomes at 30 Months for the Most Common Socio-Ecological Risk Class Patterns

<table>
<thead>
<tr>
<th>Substance Use</th>
<th>LLL (n=156)</th>
<th>MLL (n=26)</th>
<th>LMM (n=29)</th>
<th>MMM (n=128)</th>
<th>HMM (n=50)</th>
<th>MHH (n=16)</th>
<th>HHH (n=25)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Alcohol 90 Days**bc</td>
<td>11%</td>
<td>4%</td>
<td>29%</td>
<td>27%</td>
<td>19%</td>
<td>25%</td>
<td>33%</td>
</tr>
<tr>
<td>Smoking 90 Days**ac</td>
<td>3%</td>
<td>13%</td>
<td>7%</td>
<td>6%</td>
<td>8%</td>
<td>13%</td>
<td>25%</td>
</tr>
<tr>
<td>Drug Use 90 Days**abc</td>
<td>1%</td>
<td>0%</td>
<td>11%</td>
<td>13%</td>
<td>15%</td>
<td>13%</td>
<td>29%</td>
</tr>
<tr>
<td>Sexual Risk Behaviors</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sex in the Past 90 Days**c</td>
<td>13%</td>
<td>9%</td>
<td>14%</td>
<td>23%</td>
<td>35%</td>
<td>19%</td>
<td>33%</td>
</tr>
<tr>
<td>Unprotected Sex</td>
<td>11%</td>
<td>4%</td>
<td>7%</td>
<td>17%</td>
<td>15%</td>
<td>13%</td>
<td>25%</td>
</tr>
<tr>
<td>Multiple Sex Partners</td>
<td>9%</td>
<td>4%</td>
<td>14%</td>
<td>14%</td>
<td>12%</td>
<td>6%</td>
<td>22%</td>
</tr>
<tr>
<td>Sex under the Influence*</td>
<td>2%</td>
<td>0%</td>
<td>0%</td>
<td>9%</td>
<td>0%</td>
<td>6%</td>
<td>8%</td>
</tr>
<tr>
<td>Internalizing / Externalizing</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Internalizing Symptoms**bc</td>
<td>4.5 (5.2)</td>
<td>7.2 (7.5)</td>
<td>13.3 (13.9)</td>
<td>9.0 (8.5)</td>
<td>13.4 (9.6)</td>
<td>14.2 (6.3)</td>
<td>12.8 (10.8)</td>
</tr>
<tr>
<td>Externalizing Symptoms**bc</td>
<td>5.2 (5.2)</td>
<td>6.8 (6.8)</td>
<td>13.9 (12.5)</td>
<td>11.1 (9.1)</td>
<td>13.7 (9.4)</td>
<td>15.5 (7.5)</td>
<td>12.8 (9.0)</td>
</tr>
</tbody>
</table>

*p<0.05, **p<0.01

a indicates that the HHH was statistically significantly different from the MMM class at p<0.05 -
b indicates that the MMM was statistically significantly different from the LLL class at p<0.05

c indicates that the HHH was statistically significantly different from the LLL class at p<0.05

Note: L indicates the Low, M indicates the Medium, and H indicates the High Socio-Ecological Risk class. The position indicates the time point (baseline, 18 months, or 30 months)
past 90-day alcohol (11% vs 27%) and drug use (1% vs 13%) as compared to the MMM pattern. The MMM pattern reported significantly less past 90-day smoking (6% vs 25%) as compared to the HHH pattern.

Both internalizing and externalizing symptoms were found to be significantly different by pattern group at the p<0.01 level. Individual comparisons revealed that the LLL pattern group reported significantly less internalizing (4.5 vs 12.8) and externalizing (5.2 vs 12.8) symptoms than the HHH pattern. The LLL pattern also reported significantly less internalizing (4.5 vs 9.0) and externalizing (5.2 vs 11.1) symptoms compared to the MMM pattern. Differences between the MMM and HHH were not significant for either internalizing or externalizing symptoms.

Significant associations were also found between pattern group and sexual behavior in the past 90 days at the p<0.05 level. Individual comparisons revealed that the LLL pattern reported significantly less likelihood of sexual behavior in the past 90 days (13% vs 33%) compared to the HHH pattern. A significant association was found between pattern group and sex under the influence of alcohol or drugs at the p<0.05 level. However, individual group comparisons were not significant.

Patterns groups made up of youth who remained in one socio-ecological risk group level at all time points were compared to patterns groups comprised of youth who transitioned to another socio-ecological risk group at 18 months to assess differences in MEB problems. The majority of these differences were not significant. The only significant differences found were for internalizing and externalizing symptoms when comparing the LLL pattern group to those who were in the Low Socio-Ecological Risk
class at baseline and increased to Medium Socio-Ecological Risk class at 18 and 30 months (LMM). The LLL pattern group reported significantly less internalizing (4.5 vs 13.3) and externalizing (5.2 vs 13.9) symptoms compared to the LMM pattern.

IV. Discussion

This study evaluated patterns of transition in socio-ecological risk factor clustering among Hispanic adolescents between baseline when adolescents were in eighth grade, 18 months post-baseline, and then 30 months post-baseline when adolescents were in tenth grade. It further assessed the impact of these patterns of transition on MEB problems at 30 months post-baseline. Previous studies have found that socio-ecological risk and protective factors in the family, school, peer and acculturation contexts have been individually associated with MEB problems, with risk and protective factors influencing each other over time.\textsuperscript{38}

The findings from Chapter 3: Specific Aim / Paper #1\textsuperscript{90} and Chapter 4: Specific Aim / Paper #2 indicated that socio-ecological risk and protective factors clustered together when adolescents were in eighth grade, with groups identified based on low, medium and high risks. In addition, these cluster groups were associated with MEB problems in eighth grade, as well as 30 months later when adolescents were in tenth grade. This present paper is important because it assesses whether, in the absence of intervention, the clustering of socio-ecological risk and protective factors changes across adolescence and whether those cluster patterns involving stability or transition across time are associated with subsequent MEB problems. Considering these factors and
changes across development is important because the risk of developing MEB problems increases during adolescence.³

Results indicated that, in the absence of intervention, most adolescents are likely to continue in the same socio-ecological risk group based on factors, such as parent-adolescent communication and parental monitoring of peers, throughout the time period between eighth to tenth grade. Some adolescents showed slight changes in socio-ecological risk group, but very few experienced dramatic changes in socio-ecological risk group. The highest transition probability for those who transitioned classes was from the High Risk group at baseline to the Medium Risk group at 18 months post-baseline. This indicates that in the absence of intervention a portion of these adolescents may slightly reduce risk over time though drastic shifts in socio-ecological risk group is unlikely. The overall stability in risk group indicates that without intervention, those at higher risk appear to remain at higher risk across development. This demonstrates the importance of preventive interventions, especially selective or indicated interventions, for samples that are identified as being at high risk. Several preventive interventions aimed at socioecological risk and protective factors including *Familias Unidas* and *Bridges*, have been found to be efficacious at reducing MEB problems among these youth.⁴⁵,¹¹⁴

It is important to note the relative frequency with which the risk clustering occurred in this study’s combined-trial sample, which included a continuum of youth risk levels given that the trials included (a) a large universal sample and (b) a selected sample of youth evidencing behavior problems. The majority of adolescents remained in the Low or Medium Socio-Ecological risk classes across time all time points with only a small
amount remaining in the High Socio-Ecological Risk class throughout all time points. Given the poor MEB outcomes associated with the high risk class, it is fortunate that a comparatively smaller proportion of youth experience this clustering of adverse risk factors.

Compared to those who remained in the High Socio-Ecological Risk class, those remaining in the Low Socio-Ecological Risk class from eighth through tenth grade demonstrated lower risk of MEB problems for the majority of outcomes, including past 90-day alcohol, smoking, drug use, and sexual behavior, as well as internalizing and externalizing symptoms. Moreover, compared to those who remained in the Medium Socio-Ecological Risk class, those remaining in the Low Socio-Ecological Risk class from eighth to tenth grade also reported lower past 90-day alcohol and drug use, as well as fewer internalizing and externalizing symptoms. Compared to those who remained in the High Socio-Ecological Risk class, remaining in the Medium Socio-Ecological Risk class was associated with lower likelihood of smoking and drug use. These results highlight the importance of ensuring that adolescents begin and sustain low levels of socio-ecological risk throughout this critical developmental period.

Given the stability of socio-ecological risk groups, with the majority of adolescents remaining in the same group throughout this time period, these results indicate the importance of intervening early, especially with the high and medium risk groups. Previous literature has shown that transition periods, such as entrance into middle school during early adolescence, can be an critical intervention period given that
many risk behaviors are initiated during this time. Preventive interventions delivered to adolescents during middle school have shown success in reducing MEB problems.

Although the majority of comparisons between adolescents who had transitioned across classes to those who had remained in one class throughout the study were not significant, possibly due to low power, it is interesting to note that those who had transitioned from the Low to the Medium Socio-Ecological Risk class at 18 months reported significantly higher internalizing and externalizing symptoms compared to those who remained in the Low Socio-Ecological Risk class for the duration of the study. This suggests that transitioning from a low risk group, when adolescents are on average 13.8 years old, to medium risk, when adolescents are on average 15.3 years old, can increase internalizing and externalizing symptoms. This time period has previously been shown to be a critical time for the development of MEB problems. These results further support the notion that keeping adolescents in a low socio-ecological risk class, with lower levels of risk factors and higher levels of protective factors, is important in preventing MEB problems.

i. Limitations

One limitation of this study is that, although Hispanics in this sample are from a variety of countries and circumstances, the sample may not be representative of the U.S. Hispanic population. Mexican Americans and Puerto Ricans, the two largest national-origin groups in the U.S. Hispanic population, were not well represented in the sample. Indeed, Miami, where the present sample was recruited, is predominantly home to Cuban, Central American, and South American Hispanics. A second limitation is that the self-
reported measures utilized in this analysis may have been susceptible to inaccuracies and biases, although the use of audio computer-assisted self-administered interview may have helped alleviate some of these.79 A third limitation is that the three class solution was chosen given the limited sample size and power considerations. However, with a larger sample size, a potentially greater number of classes may have been chosen and the results may have shown more transitions between classes. A fourth limitation is that certain transition patterns were comprised of small numbers of participants. Therefore, when conducting comparisons of MEB problem outcomes by transition pattern, clinically meaningful differences may not have reached statistical significance. Future research should be conducted with larger sample sizes to evaluate effects of different transition patterns on MEB problems.

ii. Conclusions

Results from this study suggest the importance of adolescents being in and remaining in a low socio-ecological risk class during the critical period from eighth grade to tenth grade. Specifically, it is essential for youth to be exposed to a combination of low levels of risk factors with high levels of protective factors. Findings support prior research indicating the importance of targeting influential risk and protective factors in the adolescent’s environment (e.g. family, school, and peer groups) and promoting nurturing environments that can reduce the risk of MEB problems.26,115

Implications for intervention include the value of early screening to identify youth who have risk profiles that involve the clustering of risk and protective factors in the family, school and peer systems that intensify MEB problems. Among Hispanic
adolescents, screening for level of acculturation, in particular the loss of Hispanic cultural practices, is important. It is interesting to note that Hispanic cultural practices were significantly different between these cluster groups, with lower Hispanic cultural practices found in the higher socio-ecological risk group, while U.S. cultural practices were not significantly different. As discussed in Chapter 3: Specific Aim / Paper #1, findings highlight the importance of the loss of Hispanic cultural practices on MEB problems. Utilizing these socio-ecological risk and protective factors, screening can help identify youth in higher socioecological risk groups who are unlikely to transition to a lower risk group without targeted preventive interventions. This comparatively small group of youth may require more intensive, selective, or indicated interventions that can strengthen protective factors and promote behavioral health. The type of latent class analysis used here can also be used to identify adolescents prior to and in eighth grade who are not currently in a low socio-ecological risk class and offer selective interventions to these adolescents.

Interventions that focus on influencing a variety of socio-ecological risk and protective factors in early adolescence can potentially improve multiple MEB problem outcomes. In particular, the literature suggests that family-based interventions are effective in reducing socioecological risks during adolescence, including family, school and peer risks. Utilizing a latent class approach, rather than focusing on a particular risk or protective factor in isolation, would help identify adolescents in high risk subgroups across socio-ecological domains, as well as those at highest risk for developing a variety of MEB problems. Future research would also benefit from
examining how preventive interventions impact participants’ transition patterns across socio-ecological risk classes and the influence that these transition patterns may have on MEB problems.
Chapter 6: Discussion and Conclusions

I. Overview

Using the socio-ecological, ecodevelopmental and transactional models as guiding frameworks for understanding the development of mental, emotional and behavioral problems in youth, this study evaluated the impact of the clustering of socio-ecological risk and protective factors such as family, school, peer, and acculturation variables on MEB problems in Hispanic adolescents, including substance use, sexual risk behavior, and internalizing and externalizing symptoms. Analyses performed in this research utilized a person-centered approach to evaluate the clustering of these socio-ecological risk and protective factors and then used these cluster groups to examine their impact on MEB problems. These novel methodological approaches can bolster our understanding of the development of MEB problems in Hispanic youth, given that existing analyses have often focused on the influence of separate risk and protective factors on single MEB outcomes. In reality, risk factors often cluster and operate together to impact these health outcomes across development. First, the association between risk factor cluster group and MEB problems was assessed using cross-sectional baseline data when adolescents were in eighth grade. Second, the impact of these socio-ecological risk factor groups was evaluated on changes in MEB problems over time from baseline to 30 months post-baseline when adolescents were in tenth grade. Finally, the potential transitioning across socio-ecological risk group from baseline to 30 months post-baseline was explored along with the association of various transition patterns on MEB problems at 30 months post-baseline.
Results showed that the socio-ecological risk and protective factors clustered together and represent Low, Medium, and High Socio-Ecological Risk groups. These socio-ecological risk cluster groups at baseline were associated with MEB problems at baseline, as well as MEB problems 30 months following baseline. The impact of these risk clusters in eighth grade on MEB well into the tenth grade demonstrates the influential nature of these risk groups. Indeed, in the absence of intervention, the majority of adolescents in one socio-ecological risk group at baseline were likely to continue in that same group at both 18 and 30 months post-baseline. Adolescents who were in the Low Socio-Ecological Risk group at all time points reported significantly less MEB problems at 30 months post-baseline on most of the measures compared to both the High and Medium Socio-Ecological Risk groups.

These results suggest the importance of targeting interventions aimed at improving socio-ecological risk factors in early adolescence in order to impact a variety of MEB problems across time. These interventions can begin by screening youth early to determine their socio-ecological risk profiles in order to identify adolescents at highest risk for MEB problems. The goal should be to ensure that adolescents remain in these low risk groups that are characterized by nurturing environments in families, peers and schools. Intervention research could also benefit from examining socio-ecological risk groups as potential moderators of an intervention’s effects.

II. The Clustering of Socio-Ecological Risk Factors among Adolescents

The results for all specific aims were based on latent class analysis evaluating homogenous groups of adolescents based on socio-ecological risk and protective factors.
The selection of socio-ecological risk and protective factors is based on findings from the existing literature for understanding the development of youth MEB problems.\textsuperscript{26,27} It is extremely important that risk and protective factors assessed and analyzed included among the most influential factors that exist in the systems that are most proximal to adolescents, including family, peers and schools. These factors are reflective of nurturing environments that build protection and resilience in youth, such as positive parenting practices and parental involvement in the child’s school.\textsuperscript{39} Furthermore, for Hispanic adolescents acculturation has been shown to be a critical factor, impacting MEB problems directly as well as indirectly through other socio-ecological factors.\textsuperscript{69,70}

Considerable literature has examined the impact of individual socio-ecological risk and protective factors separately on MEB problems such as substance use, sexual risk behavior, and internalizing and externalizing symptoms.\textsuperscript{3,25} This previous research has shown that socio-ecological risk factors can influence each other over time.\textsuperscript{3,27,38} In the current study, socio-ecological risk and protective factors across family, peer, school, and acculturation were evaluated together, allowing the assessment of overall risk for individuals, as well as the impact of combinations of risk and protective processes. This is a strength of the study, given that risk factors often co-occur and influence each other.\textsuperscript{3}

Utilizing this person-centered methodological approach provided a unique analysis of Hispanic adolescents grouped by level of socio-ecological risk that contributes to our understanding of adolescent risk and protection for mental, emotional and behavioral problems. The latent class analysis identified subgroups of youth based on varying risk levels, high, medium, and low, with significantly different socio-ecological
risk and protective factors between the subgroups. These results aid in our understanding of shared socio-ecological risk and protective factors.99

It is noteworthy that among all the socio-ecological risk and protective factors included in the latent class analysis, the only indicator not found to be significantly different across the groups was U.S. cultural practices. Level of U.S. cultural practices was similar across the three groups, whereas level of Hispanic cultural practices was significantly different between the low risk group and both the medium and high risk groups. It is important to note that the measure utilized in this study focused on U.S. and Hispanic cultural practices, such as preferences regarding language, food, and media and that this measure does not include cultural values, such as individualism and collectivism, or cultural identification, such as ethnic and national identity.73,106 The latter variables represent very important cultural constructs that are worthy of attention and investigation in future research. These findings suggest that as long as Hispanic cultural practices are retained, differences in U.S. cultural practices may not significantly contribute to adolescent risk.76,107 Other studies have documented the importance of retaining Hispanic cultural practices and values in terms of protection from mental, emotional and behavioral problems.73,76 These results also highlight the importance of using a bi-dimensional approach to characterizing acculturation, in which U.S. and Hispanic culture are assessed on a separate continuum, as these cultural factors can have distinct impact on outcomes.76 This is consistent with previous literature which has shown for example that integrated adolescents, those with high levels of both U.S. and Hispanic cultural practices, report the highest levels of family functioning, whereas assimilated
adolescents, those with high U.S. orientation but low Hispanic orientation, reported highest aggressive behaviors.\textsuperscript{71,76} Overall, this supports that for Hispanic adolescents, it is the Hispanic cultural retention that may be the more important aspect of acculturation than U.S. cultural practices. Future studies would benefit from similarly utilizing a model of acculturation that includes acculturation as measured by both U.S. and Hispanic cultural factors.

III. Cross-sectional Association of Socio-Ecological Risk Cluster Groups with MEB Problems - Specific Aim #1

In this specific aim, the subgroups of Hispanic adolescents that were identified by using a latent class analysis on socio-ecological risk and protective factors, were tested to determine whether there were differences in MEB problems between these subgroups. This analysis utilized cross-sectional baseline data, when adolescents were in eighth grade.

For hypothesis H$_1$, it had been hypothesized that there would be differences in MEB problems across socio-ecological risk group membership. Specifically, the High Socio-Ecological Risk group would report the highest levels of MEB problems over time, the Medium Socio-Ecological Risk group would report less MEB compared to the High Socio-Ecological Risk group and the Low Socio-Ecological Risk groups would report the least MEB problems compared to both the Medium and High Socio-Ecological Risk groups.

Results indicated that there were differences in MEB problems by socio-ecological risk group for all substance use outcomes, lifetime sexual behavior, and
internalizing and externalizing symptoms. Specifically, the High Socio-Ecological Risk group reported higher levels of all of these MEB problems compared to the Low-Socio-Ecological Risk group. Furthermore, the Medium Socio-Ecological Risk group reported higher lifetime alcohol, past 90 day alcohol use, lifetime smoking, and internalizing and externalizing symptoms compared to the Low Socio-Ecological Risk group. The High Socio-Ecological Risk group reported higher past 90 day drug use and externalizing symptoms compared to the Medium Socio-Ecological Risk group.

Overall, these results demonstrate that adolescents in higher socio-ecological risk subgroups were more likely to report greater MEB problems than those in the lower risk groups when these students were in the eighth grade. This person-centered approach allowed for the evaluation of socio-ecological risk holistically and supports the notion of common pathways to multiple mental, emotional and behavioral problems. Building upon previous research findings regarding associations of separate, individual risk factors with MEB problems, this research suggests that the clustering of socio-ecological risk factors are associated with these different outcomes. The findings speak to the value of understanding individual risk factors within the context of other risk and protective factors that adolescents may have and that these risk factors may influence each other.

IV. Socio-Ecological Cluster Groups Impact on MEB Problems Over Time – Specific Aim #2

In this specific aim, the cluster groups based on risk that were previously identified by the latent class analysis were tested to see if risk group membership at baseline was associated with change in MEB problems over time. This builds upon the
results of the previous specific aim by using longitudinal data to evaluate the impact of socio-ecological risk factor groups at baseline, when adolescents are in eighth grade, on the change of MEB problems over the following 30 months in the absence of intervention. This is important because the cross-sectional analyses do not permit an understanding of the causal direction of the associations. Indeed, mental emotional and behavioral problems, such as substance use and sexual risk behavior, can reciprocally influence some of the risk factors such as peer substance use and family relations. Furthermore, risk for certain mental, emotional and behavioral problems intensifies across adolescence, in particular internalizing symptoms and disorders such as depression. Longitudinal analyses can potentially capture the influence of early risk factor clustering on these increasingly prevalent outcomes across development.

For hypothesis H2-1, it had been hypothesized that socio-ecological risk group membership at baseline will be associated with change in MEB problems over the following 30 months. Particularly, the High Socio-Ecological Risk subgroup was hypothesized to experience the greatest increase in MEB problems over time, with the Medium Socio-Ecological Risk group experiencing less increase over time comparatively, and the Low Socio-Ecological Risk group experiencing the least increase over time. Differences in MEB problems by socio-ecological risk group were expected to be present at 30 months post-baseline with higher baseline socio-ecological risk group associated with greater MEB problems.

Results from these analyses indicated that for the majority of MEB problems, there were differences in reported baseline outcomes, when adolescents were an average
of 13.8 years old, and that these differences continued to be significant at 30 months post-baseline, when adolescents were on average 16.3 years old. Over this time period, adolescents generally increased substance use and sexual risk behaviors, which is consistent developmentally with the literature on the prevalence of these problem behaviors. However, the rate of change in MEB problems over time, as indicated by the slopes, was not significantly different by socio-ecological risk group for the majority of outcomes. This indicates that being in a higher socio-ecological risk group at baseline does not indicate that MEB problems will increase at a faster rate over time.

The associations found between socio-ecological risk group in eighth grade and MEB problems 30 months later are consistent with literature showing associations in analyses of individual socio-ecological risk and protective factors on MEB problems. These results strengthen the existing literature by showing that the clustering of these socio-ecological risk and protective factors in eighth grade has an impact on MEB problems more than two years later.

When compared to the High Socio-Ecological Risk group, the Low Socio-Ecological Risk group reported fewer MEB problems at baseline, as well as 30 month-post-baseline for all past 90-day substance use outcomes, sex and unprotected sex in the past 90 days, as well as internalizing and externalizing symptoms. The Low Socio-Ecological Risk group also reported less past 90-day substance use, sex under the influence, and internalizing and externalizing symptoms as compared to the Medium Socio-Ecological group. These expected results indicate that being in the Low-Socio-Ecological Risk group at baseline, when adolescents are in eighth grade, is protective.
across a range of MEB problems at baseline, as well as 30 months post-baseline when adolescents are in tenth grade. Having a profile that shows low risk factors can continue to protect youth from MEB problems across time, despite the increasing likelihood of showing these MEB problems as adolescents age.

Overall, these results show the importance of socio-ecological risk and protective factor clustering in eighth grade Hispanic adolescents and the continued impact of this clustering on MEB problems throughout adolescence. Interventions that target risk and protective processes early on (e.g., in early childhood) can prevention MEBs later in life (e.g., adolescents). The consistency of the results of this specific aim once again supports the existence of common risk and protective pathways in the development of health outcomes. Targeting these shared socio-ecological risk and protective factors early in adolescence may impact a variety of MEB problems across time.

V. Transition of Socio-Ecological Cluster Groups Over Time and Impact on MEB Problems – Specific Aim #3

In this specific aim, adolescents were identified as belonging to a specific socio-ecological risk subgroup at baseline, 18 months post-baseline, and 30 months post-baseline. The patterns of transitions in subgroups were found across this critical time period from eighth to tenth grade. The association of these patterns of transition was evaluated in terms of the relationship to MEB problems at 30 months post-baseline. These analyses build upon the previous two specific aims which showed that the clustering of socio-ecological risk factors at baseline was associated with MEB problems both at baseline and 30 months post-baseline. This analysis extends these previous
specific aims by first evaluating whether in the absence of intervention, the clustering of socio-ecological risk and protective factors is maintained across time or the degree to which there are transitions of adolescents between these cluster groups. These analyses then investigated the impact of this transitioning on MEB problems over time. Understanding how adolescents’ progress in these consequential risk groups is important, especially in the absence of intervention, as this highlights the need for interventions for these youth.  

For hypothesis H3-1, it had been hypothesized that the majority of adolescents would remain in the same socio-ecological risk subgroup across these time points (baseline and 18 months and 30 months post-baseline), but a portion of adolescents would transition across different risk subgroups over time. Results indicated that in the absence of intervention, as hypothesized, the majority of adolescents remained in the same socio-ecological risk subgroup across this time period. While some adolescents made slight changes in subgroup, for example going from medium to high socio-ecological risk, very few made dramatic changes in subgroup, such as transitioning from low to high socio-ecological risk. These results are consistent with previous literature examining socio-ecological risk and protective factors that has shown these factors tend to influence each other over time, and it would therefore be expected for these cluster groups to remain fairly stable in the absence of intervention.  

The findings do highlight the need for selective and indicated prevention interventions that screen for youth at high risk for mental emotional and behavioral problems, and provide interventions intended to place them on a healthier
developmental trajectory. For example, the Positive Parenting Program offers levels of intervention with increasing strength for those in a selective or indicated sample in order to provide the minimum which would be sufficient in allowing youth to maintain a healthy trajectory.\textsuperscript{111}

Another important result from this analysis is that the majority of adolescents remained in the Low or Medium Socio-Ecological Risk group across this time period, and only a small portion remained in the High Socio-Ecological Risk group across time. The sample for these analyses included both a large universal sample and a selected sample of adolescents identified as experiencing behavior problems. These results on the distribution of youth in terms of risk group indicate that there is likely a small subset of the population that are at the highest risk and could potentially benefit most from targeted interventions to strengthen protective factors and reduce risk factors, including family school, peer, and acculturation.\textsuperscript{12}

For hypothesis H\textsubscript{3.2}, it had been hypothesized that compared to adolescents remaining in higher socio-ecological risk subgroups, those remaining in lower socio-ecological risk subgroups were expected to report less MEB problems at 30 months post-baseline. Furthermore, those remaining in a lower socio-ecological risk subgroup are expected to report less MEB problems than those who transition from a lower to a higher risk subgroup. Adolescents remaining in a higher socio-ecological risk subgroup are also expected to report greater MEB problems than those who transition from a lower to a higher subgroup.
Results from these analyses indicated that being and remaining in the Low Socio-Ecological Risk group across this time period during adolescence was protective against the development of MEB problems by the tenth grade. These adolescents reported lower levels of past 90-day alcohol, smoking, drug use, and sexual behavior, as well as fewer internalizing and externalizing symptoms compared to adolescents who remained in the High Socio-Ecological Risk class across time. Those who stayed in the Low Socio-Ecological Risk class also reported less past 90-day alcohol and drug use, as well as internalizing and externalizing symptoms, compared to those who remained in the Medium Socio-Ecological Risk group. Adolescents who remained in the Medium Socio-Ecological Risk class reported less smoking and drug use compared to those who remained in the High Socio-Ecological Risk class. Once again, these results add to the consistency of the previous findings, highlighting the importance of adolescents beginning and remaining in lower socio-ecological risk groups during this period of development.

Comparing MEB problems between adolescents whose patterns of socio-ecological risk group showed transitions to adolescents whose patterns remained similar within the same socio-ecological risk group across these time points, it was found that most of these comparisons were not significant. The only significant differences in these comparisons were found for internalizing and externalizing symptoms when comparing adolescents who had transitioned from the Low to Medium Socio-Ecological Risk class at 18 months to those who had remained in the Low Socio-Ecological Risk class. Transitioning from the Low Socio-Ecological Risk, when adolescents are an average of
13.8 years old, to the Medium Socio-Ecological Risk group, when adolescents are an average of 15.3 years old, was associated with greater internalizing and externalizing symptoms. These results are consistent with the literature which indicates that this time period is critical to the development of internalizing and externalizing symptoms, and that higher levels of risk factors contribute to poorer mental health outcomes for youth.3

Overall, the results from this specific aim highlight the importance of socio-ecological risk group clustering in Hispanic adolescents from eighth to tenth grade and the impact of this clustering on MEB problems. These findings suggest the importance of adolescents beginning and remaining in a low socio-ecological risk group throughout this time period to reduce MEB problems.

VI. Conceptual Model Revisited

This study was based on socio-ecological theory,26 ecodevelopmental theory,27,28 and the transactional model of risk.23 Based on these theoretical models, it was expected that socio-ecological risk and protective factors at various levels of influence would cluster together and that these subgroups of adolescents would be associated with varying levels of MEB problems.

The results from this study indicated that risk and protective factors, based on the socio-ecological model, cluster together in eighth grade Hispanic adolescents. These cluster groups were associated with a variety of MEB problems at both baseline and 30 months post-baseline, when adolescents were in tenth grade. Adolescents in lower socio-ecological risk group often reported less MEB problems than those in higher socio-ecological risk groups at both of these time points. These results further support the
socio-ecological model and the importance of impacting the risk and protective factors identified by this model.

In examining how adolescents transitioned between cluster groups, it was found that in the absence of intervention the majority of adolescents remained in the same group. Those adolescents who remained in lower socio-ecological risk groups across this time period reported less MEB problems at 30 months post-baseline. This indicates the need to intervene in early adolescence (or earlier) in order to allow youth to start in and remain in a lower risk group during this critical time period. This further supports ecodevelopmental theory and the need to understand these risk and protective factors across time and look for sensitive periods of development. The clustering of these risk and protective factors suggests that they may influence one another as the transactional model posits. 23

Overall, these findings further support the theoretical frameworks and indicate the importance of impacting socio-ecological risk and protective factors (e.g. family, school, peer groups, and acculturation) and providing a nurturing context to reduce the risk of MEB problems.26,115

VII. Strengths and Limitations

i. Limitations

There are several limitations of this study to consider. First, the sample for these analyses included Hispanic adolescents drawn from Miami, Florida and thus may not represent the U.S. Hispanic population generally. With its well established social, cultural and political structures, Hispanics from Miami may have a different acculturation process.
and characteristics relative to Hispanics in other parts of the U.S. This sample did, however, include Hispanics from a variety of countries and backgrounds.

Second, all the measures utilized in these analyses were self-reported and are thus prone to misclassification with adolescents potentially under or over reporting. In order to help mitigate some of these potential misclassifications, audio computer-assisted self-administered interview were used where a pre-recorded voice reads the on-screen text to the participant.79

Third, risk factors were limited to specific socio-ecological risk and protective factors including family, peer, school, and acculturation measures and did not include other potentially influential variables. In previous research, biological and genetic risk factors have been shown to impact MEB problems as well.3 While this research did not include these and other consequential measures of risk and protection, the findings still suggest that the socio-ecological risk and protective factors influence MEB problems during this critical period in adolescence.

Fourth, the use of single items to describe each of the socio-ecological risk and protective factors is a limitation. While the measures utilized in this study have been previously validated and had high Cronbach’s alpha’s indicating high reliability, they may reflect only a single dimension of a particular system. For instance, perceived peer substance use was the only measure that reflected the peer microsystem. However, there are many other factors involving peers that could and have been shown to impact MEB problems such as conflict with peers or having aggressive or antisocial peers.66,67
Fifth, the determination to use a three class solution for the latent class model was made based on prioritizing a parsimonious solution given power considerations. Had a larger sample size been utilized, a four or five class solution may have emerged and resulted in greater distinction between adolescent groups and greater transitions between these groups may have been seen in the latent transition model.

Sixth, a limitation of specific aim #3 is that due to the sample size, certain transition patterns only had a small number of participants. Therefore, associations of these various patterns with MEB problems may have been not significant though there may have been differences between certain pattern groups. A larger sample size would be needed to evaluate the impact of some transition patterns on MEB problems in greater depth.117

ii. Strengths

Despite these limitations, the study has numerous strengths and provides significant contribution to the literature. First, this study examines a crucial time period in adolescence for the development of MEB problems and does so for a population at higher risk for developing these adverse health outcomes.1,9 As a rapidly growing segment of the population, addressing the health disparities in Hispanic adolescents is critical.10

Second, the data and analyses utilized in this study provide a unique perspective on socio-ecological risk and protective factors in Hispanic adolescents. Utilizing innovative statistical methods, such as latent class analysis, provided a way to show the clustering of these risk factors and extend beyond the findings of previous literature.
This person-centered approach allowed for the identification of subgroups of Hispanic adolescents at varying levels of socio-ecological risk.

Third, data utilized in this analyses combined two randomized controlled trials, including both a universal and indicated sample. This provided a robust dataset with adolescents at varying risk levels. This increased variability allowed for the assessment of the association between socio-ecological risk clustering and MEB problems for adolescents at a continuum of youth risk levels.

Fourth, this study adds to the literature by evaluating the impact of this clustering of socio-ecological risk and protective factors on a variety of MEB problems in Hispanic adolescents. Rather than focusing on a specific health outcome, the analyses were performed on multiple outcomes including substance use, sexual risk behaviors, and internalizing and externalizing symptoms. The associations found between the socio-ecological risk subgroups and a variety of outcomes support the importance of targeting these types of socio-ecological risk and protective factors. This is also important because these outcomes can co-occur, and are worth targeting simultaneously through interventions.3,27

Fifth, the analyses performed for the second and third specific aims use longitudinal data. The use of this data allowed for the evaluation of the impact of socio-ecological risk factors on future MEB problems. Using longitudinal data with the socio-ecological risk factor exposure occurring when the adolescents were in eighth grade, and the MEB problem outcomes occurring 30 months later when the adolescents were in
tenth grade, bolsters the evidence for a potential causal relationship between these measures.

**VIII. Implications for Interventions**

The results from this study have significant implications for interventions. In designing interventions, these results highlight the importance of targeting shared and frequently co-occurring socio-ecological risk and protective factors. Rather than targeting specific health outcomes, interventions that target shared socio-ecological risk and protective factors could improve outcomes across multiple MEB problems through a single intervention.

Another implication for interventions is utilizing a latent class approach to help screen for and identify adolescents in high risk subgroups across a variety of risk and protective factors. These classes could be used to help identify adolescents who are at the highest risk for developing MEB problems and who will require more intensive selective or indicated interventions that can strengthen protective factors and promote behavioral health. Given the stability in socio-ecological risk groups in the absence of intervention, using this type of latent class analysis to help identify adolescents prior to and during eighth grade is important. Identifying youth who are not currently in the Low Socio-Ecological Risk group could improve outcomes for these adolescents across a variety of MEB problems. The cost-effectiveness of an intervention could also be improved by directing it at this indicated sample. Understanding these types of moderators of intervention effects has been critical in directing interventions to where it will benefit the most and even scaling the strength of an intervention to meet the needs of
individual youth, such as in the Positive Parenting Program. Similarly the Adolescent Transition Program is a tiered intervention which varies the support provided based on whether the participants are a universal, selected or indicated sample.

These results also indicate that early adolescence is a critical time for preventive interventions that reduce risk factors and promote protective factors and youth resilience to MEB problems. It has been previously shown that the transition into middle school can be a crucial period for intervention and previous interventions during this time period have shown success in reducing MEB problems. Results from this study emphasize the importance of this time period, and showed that in the absence of intervention the majority of adolescents remained in the same class from baseline, when adolescents were on average 13.8 years old, to 30 months post-baseline, when adolescents were on average 16.3 years old. This stability of socio-ecological risk group further supports the need to intervene early. Being and remaining in the Low Socio-Ecological Risk group during this time period was associated with less MEB problems compared to adolescents who were in the Medium or High Socio-Ecological Risk groups during this same time period.

Future intervention research could utilize this type of latent class analysis in a multitude of ways. Socio-ecological risk factor subgroups could be utilized as a potential moderator of an intervention answering for whom this intervention works. As a moderator of intervention effects, adolescents in higher risk subgroups may respond differently to an intervention compared to those in lower risk subgroups. Analyses that yield this type of information can then be used to target adolescents in specific risk groups where the intervention is likely to have the greatest effect. Interventions could
also target these socio-ecological risk and protective factors simultaneously, recognizing their individual importance as well as the manner in which they cluster in adolescents. In fact, interventions for adolescents, such as *Familias Unidas* and *Bridges*, will often aim to influence several of these risk and protective factors in order to impact MEB problems.45,114 These results suggest the clustering of these risk factors and the importance of targeting multiple risk and protective factors in an intervention.
References


15. CDC. *HIV Surveillance in Adolescents and Young Adults*. 2011.


95. Clark SL, Muthén B. Relating latent class analysis results to variables not included in the analysis. 2009; Submitted for Publication.


105. Muthén L. Mplus discussion.


Appendix: Mplus and SAS Code

MPLUS: Specific Aim 1

TITLE: LCA Analysis

DATA: File is DataPaper1.csv;

VARIABLE:
NAMES ARE
ID school cond gender age usborn household
Hisp1 Hisp2 Hisp3 Hisp4 Amer1 Amer2 Amer3 Amer4
school1 school2 school3 school4 peer1 peer2 peer3 peer4
patom1 patom2 patom3 patom4 pospar1 pospar2 pospar3 pospar4
involve1 involve2 involve3 involve4 peersub1 peersub2 peersub3 peersub4
alclif1 alclif2 alclif3 alclif4 alc901 alc902 alc903 alc904
smklif1 smklif2 smklif3 smklif4 smk901 smk902 smk903 smk904
druglif1 druglif2 druglif3 druglif4 drug901 drug902 drug903 drug904
sexlif1 sexlif2 sexlif3 sexlif4 sex901 sex902 sex903 sex904
cond901 cond902 cond903 cond904 sxpar901 sxpar902 sxpar903 sxpar904
high901 high902 high903 high904 intern1 intern2 intern3 intern4
extern1 extern2 extern3 extern4 HEPI2;

USEVARIABLES ARE Hisp1 Amer1 school1 peer1 patom1 pospar1 involve1 peersub1;

IDVARIABLE IS ID;

CLASSES= c(3);

MISSING ARE ALL (-99);

CATEGORICAL ARE school1 peersub1;

ANALYSIS: TYPE =MIXTURE;

OUTPUT: TECH1 TECH8;

SAVEDATA: FILE is 3Class_Solution.sav; SAVE=CPROBABILITIES ;
TITLE: LCA Analysis with Outcomes

DATA: File is DataPaper1.csv;

VARIABLE:
NAMES ARE
ID school cond gender age usborn household
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school1 school2 school3 school4 peer1 peer2 peer3 peer4
patom1 patom2 patom3 patom4 pospar1 pospar2 pospar3 pospar4
involve1 involve2 involve3 involve4 peersub1 peersub2 peersub3 peersub4
alclif1 alclif2 alclif3 alclif4 alc901 alc902 alc903 alc904
smklif1 smklif2 smklif3 smklif4 smk901 smk902 smk903 smk904
druglif1 druglif2 druglif3 druglif4 drug901 drug902 drug903 drug904
sexlif1 sexlif2 sexlif3 sexlif4 sex901 sex902 sex903 sex904
cond901 cond902 cond903 cond904 sxpar901 sxpar902 sxpar903 sxpar904
high901 high902 high903 high904 intern1 intern2 intern3 intern4
extern1 extern2 extern3 extern4 HEPI2;

USEVARIABLES ARE Hisp1 Amer1 school1 peer1 patom1 pospar1 involve1 peersub1;

IDVARIABLE is ID;

CLASSES= c(3);

AUXILIARY = alclif1(DE3STEP) alc901(DE3STEP) smklif1(DE3STEP)
smk901(DE3STEP) druglif1(DE3STEP) drug901(DE3STEP) sexlif1(DE3STEP)
sex901(DE3STEP) cond901(DE3STEP) sxpar901(DE3STEP) high901(DE3STEP)
intern1(DE3STEP) extern1(DE3STEP);

MISSING ARE ALL (-99);

CATEGORICAL ARE school1 peersub1 ;

ANALYSIS: TYPE =MIXTURE;

OUTPUT: TECH1 TECH8 TECH10;
MPLUS: Specific Aim 2

TITLE: Growth Curves

DATA:  FILE IS DataPaper2.csv;

VARIABLE: NAMES ARE
ID Class Class21 Class31 Class32
school cond gender age usborn household
Hisp1 Hisp2 Hisp3 Hisp4 Amer1 Amer2 Amer3 Amer4
school1 school2 school3 school4 peer1 peer2 peer3 peer4
patom1 patom2 patom3 patom4 pospar1 pospar2 pospar3 pospar4
involve1 involve2 involve3 involve4 peersub1 peersub2 peersub3 peersub4
alc1f1 alc1f2 alc1f3 alc1f4 alc01 alc02 alc03 alc04
smk1f1 smk1f2 smk1f3 smk1f4 smk01 smk02 smk03 smk04
drug1f1 drug1f2 drug1f3 drug1f4 drug01 drug02 drug03 drug04
sex1f1 sex1f2 sex1f3 sex1f4 sex01 sex02 sex03 sex04
c0d101 c0d102 c0d103 c0d104 sxpar01 sxpar02 sxpar03 sxpar04
high01 high02 high03 high04 intern1 intern2 intern3 intern4
extern1 extern2 extern3 extern4 HEPI2;

USEVARIABLES are
Class21
!Class31
!Class32

alc01 alc02 alc03 alc04;
!smk01 smk02 smk03 smk04;
!drug01 drug02 drug03 drug04;
!sex01 sex02 sex03 sex04;
!cond01 cond02 cond03 cond04;
!sxpar01 sxpar02 sxpar03 sxpar04;
!high01 high02 high03 high04;
!intern1 intern2 intern3 intern4;
!extern1 extern2 extern3 extern4;

categorical ARE alc01 alc02 alc03 alc04;
!categorical are smk01 smk02 smk03 smk04;
!categorical are drug01 drug02 drug03 drug04;
!categorical are sex01 sex02 sex03 sex04;
!categorical are cond01 cond02 cond03 cond04;
!categorical are sxpar01 sxpar02 sxpar03 sxpar04;
!categorical are high01 high02 high03 high04;

MISSING ARE ALL (-99);
ANALYSIS: TYPE IS MISSING; PROCESSORS=2; ALGORITHM=INTEGRATION;

MODEL:
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   !i s | smk901@0 smk902@1 smk903@3 smk904@5;
   !i s | drug901@0 drug902@1 drug903@3 drug904@5;
   !i s | sex901@0 sex902@1 sex903@3 sex904@5;
   !i s | cond901@0 cond902@1 cond903@3 cond904@5;
   !i s | sxpar901@0 sxpar902@1 sxpar903@3 sxpar904@5;
   !i s | high901@0 high902@1 high903@3 high904@5;
   !i s | intern1@0 intern2@1 intern3@3 intern4@5;
   !i s | extern1@0 extern2@1 extern3@3 extern4@5;

   s on i;

   i s on class21;
   !i s on class31;
   !i s on class32;

OUTPUT: STANDARDIZED TECH4;
TITLE: T4 Centered Growth Curves

DATA: FILE IS DataPaper2.csv;

VARIABLE: NAMES ARE
ID Class Class21 Class31 Class32
school cond gender age usborn household
Hisp1 Hisp2 Hisp3 Hisp4 Amer1 Amer2 Amer3 Amer4
school1 school2 school3 school4 peer1 peer2 peer3 peer4
patom1 patom2 patom3 patom4 pospar1 pospar2 pospar3 pospar4
involve1 involve2 involve3 involve4 peersub1 peersub2 peersub3 peersub4
alclif1 alclif2 alclif3 alclif4 alc901 alc902 alc903 alc904
smklif1 smklif2 smklif3 smklif4 smk901 smk902 smk903 smk904
druglif1 druglif2 druglif3 druglif4 drug901 drug902 drug903 drug904
sexlif1 sexlif2 sexlif3 sexlif4 sex901 sex902 sex903 sex904
cond901 cond902 cond903 cond904 sxpar901 sxpar902 sxpar903 sxpar904
high901 high902 high903 high904 intern1 intern2 intern3 intern4
extern1 extern2 extern3 extern4 HEPI2;

USEVARIABLES are
Class21
!Class31
!Class32
alc901 alc902 alc903 alc904;
!smk901 smk902 smk903 smk904;
!drug901 drug902 drug903 drug904;
!sex901 sex902 sex903 sex904;
!cond901 cond902 cond903 cond904;
!sxpar901 sxpar902 sxpar903 sxpar904;
!high901 high902 high903 high904;
!intern1 intern2 intern3 intern4;
!extern1 extern2 extern3 extern4;

categorical are alc901 alc902 alc903 alc904;
!categorical are smk901 smk902 smk903 smk904;
!categorical are drug901 drug902 drug903 drug904;
!categorical are sex901 sex902 sex903 sex904;
!categorical are cond901 cond902 cond903 cond904;
!categorical are sxpar901 sxpar902 sxpar903 sxpar904;
!categorical are high901 high902 high903 high904;

MISSING are all (-99);
MODEL:
   i s | alc901@-5 alc902@-3 alc903@-1 alc904@0;
   !i s | smk901@-5 smk902@-3 smk903@-1 smk904@0;
   !i s | drug901@-5 drug902@-3 drug903@-1 drug904@0;
   !i s | sex901@-5 sex902@-3 sex903@-1 sex904@0;
   !i s | cond901@-5 cond902@-3 cond903@-1 cond904@0;
   !i s | sxpar901@-5 sxpar902@-3 sxpar903@-1 sxpar904@0;
   !i s | high901@-5 high902@-3 high903@-1 high904@0;
   !i s | intern1@-5 intern2@-3 intern3@-1 intern4@0;
   !i s | extern1@-5 extern2@-3 extern3@-1 extern4@0;

   s on i;

   s on class21;
   !i s on class31;
   !i s on class32;

OUTPUT: STANDARDIZED TECH4;
MPLUS: Specific Aim 3

TITLE: LTA ANALYSIS

DATA: File is DataPaper3.csv;

VARIABLE: NAMES ARE
ID Class Class21 Class31 Class32 school cond gender age usborn household
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patom1 patom2 patom3 patom4 pospar1 pospar2 pospar3 pospar4 involve1 involve2 involve3 involve4 peersub1 peersub2 peersub3 peersub4
alc1 alc12 alc13 alc14 alc901 alc902 alc903 alc904
smk1 smk12 smk13 smk14 smk901 smk902 smk903 smk904
drug1 drug12 drug13 drug14 drug901 drug902 drug903 drug904
sex1 sex12 sex13 sex14 sex901 sex902 sex903 sex904
cond1 cond2 cond3 cond4 cond901 cond902 cond903 cond904 sxp901 sxp902 sxp903 sxp904
high1 high2 high3 high4 intern1 intern2 intern3 intern4 extern1 extern2 extern3 extern4 HEPI2;

USEVARIABLES ARE
hisp1 amer1 school1 peer1 patom1 pospar1 involve1 peersub1
hisp3 amer3 school3 peer3 patom3 pospar3 involve3 peersub3
hisp4 amer4 school4 peer4 patom4 pospar4 involve4 peersub4;

IDVARIABLE is ID;

MISSING ARE ALL (-99);

CATEGORICAL are school1 peersub1 school3 peersub3 school4 peersub4;

CLASSES = c(2) c1(3) c2(3) c3(3);

ANALYSIS: TYPE = MIXTURE; PARAMETERIZATION = PROBABILITY;
STARTS = 100 20; PROCESSORS = 2;

MODEL: %OVERALL% c1 ON c;
MODEL c: %c#1% c2 ON c1; c3 ON c2; %c#2%
c2#1 ON c1#1@1; c2#2 ON c1#1@0;
c2#1 ON c1#2@0; c2#2 ON c1#2@1;
c2#1 ON c1#3@0; c2#2 ON c1#3@0;
c3#1 ON c2#1@1; c3#2 ON c2#1@0;
c3#1 ON c2#2@0; c3#2 ON c2#2@1;
c3#1 ON c2#3@0; c3#2 ON c2#3@0;
MODEL c1:
  %c1#1%
  [hisp1] (1); [amer1] (2); [school1$1] (3); [peer1] (4);
  [patom1] (5); [pospar1] (6); [involve1] (7); [peersub1$1] (8);

  %c1#2%
  [hisp1] (9); [amer1] (10); [school1$1] (11); [peer1] (12); 
  [patom1] (13); [pospar1] (14); [involve1] (15); [peersub1$1] (16);

  %c1#3%
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  [patom1] (21); [pospar1] (22); [involve1] (23); [peersub1$1] (24);

MODEL c2:
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  [patom3] (5); [pospar3] (6); [involve3] (7); [peersub3$1] (8);

  %c2#2%
  [hisp3] (9); [amer3] (10); [school3$1] (11); [peer3] (12); 
  [patom3] (13); [pospar3] (14); [involve3] (15); [peersub3$1] (16);

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  [hisp3] (17); [amer3] (18); [school3$1] (19); [peer3] (20); 
  [patom3] (21); [pospar3] (22); [involve3] (23); [peersub3$1] (24);

MODEL c3:
  %c3#1%
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  [patom4] (5); [pospar4] (6); [involve4] (7); [peersub4$1] (8);

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  [patom4] (13); [pospar4] (14); [involve4] (15); [peersub4$1] (16);

  %c3#3%
  [hisp4] (17); [amer4] (18); [school4$1] (19); [peer4] (20); 
  [patom4] (21); [pospar4] (22); [involve4] (23); [peersub4$1] (24);

OUTPUT: TECH1 TECH8 TECH15;

SAVEDATA: FILE IS 3Class_Solution_LTA.sav; SAVE=CPROBABILITIES;
SAS Code for Pseudo Class

*Import Datafile;
PROC IMPORT DATAFILE="C:\...\Data.xlsx" OUT=a replace; RUN;

*Run 20 Imputations;
DATA b; SET a; ARRAY m20impute(20) m20imp1-m20imp20;
CALL STREAMINIT(841525);
DO i = 1 to 20;

*Transpose the Data;
DATA c; SET b; ARRAY imp{20} m20imp1-m20imp20;
DO time=1 to 20;
imputation= imp{time}; OUTPUT; END; DROP i m20imp1-m20imp20; RUN;

*Sort Data by Time;
PROC SORT DATA=c OUT=d;BY time; RUN;

*Macro for Binary Outcomes (Substance Use/Sexual Risk)
Runs a Proc Genmod to Test Differences Between LLL, MMM, and HHH participants
Uses ODS Output to Create SAS Datasets
Then Cleans Those Datasets to Include Only Chi-Square Values for each of the 20 Imputations
Proc IML then Helps Calculate the P-Value which is Then Printed to the Log;
%MACRO probs(outcome, df,chi,data,Label);
DATA e; SET d; IF &outcome=-99 THEN &outcome=.; ELSE &outcome=&outcome; RUN;

PROC GENMOD DATA=e; WHERE imputation in (1, 14, 54); CLASS imputation;
BY time; MODEL &outcome=imputation/ type3; LSMEANS imputation/PDIFF;
ODS OUTPUT TYPE3=t3 DIFFS=lsm; RUN;

DATA t31; SET t3; KEEP ChiSq; RUN;

DATA lsm_1_14; SET lsm; KEEP ChiSq; ChiSq=zValue*zValue;
IF imputation=1 AND _imputation=14; RUN;

DATA lsm_1_54; SET lsm; KEEP ChiSq; ChiSq=zValue*zValue;
IF imputation=1 AND _imputation=54; RUN;

DATA lsm_14_54; SET lsm; KEEP ChiSq; ChiSq=zValue*zValue;
IF imputation=14 AND _imputation=54; RUN;
PROC IML; DF=&df; %IF &chi ^= and &data ^= %THEN %DO;
   print, "Error: Can't specify both CHI= and DATA="; abort; %END;
%IF &chi ^= %THEN %DO; g2={&chi}; %END;
%IF &data ^= %THEN %DO;
   use &data; read all into g1; g2=g1`; %END;
   m=ncol(g2); g=sqrt(g2); mg2=sum(g2)/m;
   r=(1+1/m)*(ssq(g)-(sum(g)**2)/m)/(m-1);
   F=(mg2/df - r*(m+1)/(m-1))/(1+r);
   DDF=(m-1)*(1+1/r)**2/df**(3/m);
   P=1-probf(f,df,ddf);
   PRINT &label f df ddf p; QUIT;
%MEND;

*Calling the Macro Created Above. Each Outcome Variable is run for Overall of the 3 Groups and Then Pairwise Comparisons;
%probs(alc904,1 ,t31,'alc904_overall');
%probs(alc904,1 ,lsm_1_54,'alc904_1_54');
%probs(alc904,1 ,lsm_1_14,'alc904_1_14');
%probs(alc904,1 ,lsm_14_54,'alc904_14_54');

%probs(smk904,1 ,t31,'smk904_overall');
%probs(smk904,1 ,lsm_1_54,'smk904_1_54');
%probs(smk904,1 ,lsm_1_14,'smk904_1_14');
%probs(smk904,1 ,lsm_14_54,'smk904_14_54');

%probs(drug904,1 ,t31,'drug904_overall');
%probs(drug904,1 ,lsm_1_54,'drug904_1_54');
%probs(drug904,1 ,lsm_1_14,'drug904_1_14');
%probs(drug904,1 ,lsm_14_54,'drug904_14_54');

%probs(sex904,1 ,t31,'sex904_overall');
%probs(sex904,1 ,lsm_1_54,'sex904_1_54');
%probs(sex904,1 ,lsm_1_14,'sex904_1_14');
%probs(sex904,1 ,lsm_14_54,'sex904_14_54');

%probs(cond904,1 ,t31,'cond904_overall');
%probs(cond904,1 ,lsm_1_54,'cond904_1_54');
%probs(cond904,1 ,lsm_1_14,'cond904_1_14');
%probs(cond904,1 ,lsm_14_54,'cond904_14_54');

%probs(sxpar904,1 ,t31,'sxpar904_overall');
%probs(sxpar904,1 ,lsm_1_54,'sxpar904_1_54');
%probs(sxpar904,1 ,lsm_1_14,'sxpar904_1_14');
%probs(sxpar904,1 ,lsm_14_54,'sxpar904_14_54');
*Macro for Continuous Outcomes (Internalizing/Externalizing)*

Runs a Proc GLM to Test Differences Between LLL, MMM, and HHH participants
Uses ODS Output to Create SAS Datasets
Then Cleans Those Datasets to Include Only Chi-Square Values for each of the 20 Imputations
Proc IML then Helps Calculate the P-Value which is Then Printed to the Log;

```sas
%MACRO probs2(outcome, df, chi, data, label);
DATA e; SET d; IF &outcome=-99 THEN &outcome=.;
ELSE &outcome=&outcome; RUN;

PROC GLM DATA=e; WHERE imputation in (1, 14, 54); CLASS imputation;
BY time; MODEL &outcome=imputation/ss3; LSMEANS imputation/pdiff;
CONTRAST "hm" imputation 1 -1 0;
CONTRAST "hl" imputation 1 0 -1;
CONTRAST "ml" imputation 0 1 -1;
ODS OUTPUT OVERALLANOVA=t3cont CONTRASTS=lsmcont; RUN;

DATA t31cont; SET t3cont; KEEP ChiSq; ChiSq=2*FValue;
IF Source='Model'; RUN;

DATA lsm_1_14; SET lsmcont; KEEP ChiSq; ChiSq=FValue;
IF Source="hm"; RUN;

DATA lsm_1_54; SET lsmcont; KEEP ChiSq; ChiSq=FValue;
IF Source="hl"; RUN;

DATA lsm_14_54; SET lsmcont; KEEP ChiSq; ChiSq=FValue;
IF Source="ml"; RUN;

PROC IML; DF=&df; %IF &chi ^= and &data ^= %THEN %DO;
print, "Error: Can't specify both CHI= and DATA="; abort; %END;
%IF &chi ^= %THEN %DO; g2={&chi}; %END;
%IF &data ^= %THEN %DO;
use &data; read all into g1; g2=g1`; %END;
m=ncol(g2); g=sqrt(g2); mg2=sum(g2)/m;
r=(1+1/m)*(ssq(g)-(sum(g)**2)/m)/(m-1);
F=(mg2/df - r*(m+1)/(m-1))/(1+r);
DDF=(m-1)*(1+1/r)**2/df**(3/m);
P=1-probdf(f,df,ddf);
PRINT &label f df ddf p; QUIT;
%MEND;
```

%probs(high904,1,'t31','high904_overall');
%probs(high904,1,'lsm_1_54','high904_1_54');
%probs(high904,1,'lsm_1_14','high904_1_14');
%probs(high904,1,'lsm_14_54','high904_14_54');
*Calling the Macro Created Above. Each Outcome Variable is run for Overall of the 3 Groups and then Pairwise Comparisons;
%probs2(intern4,1,t31cont,'intern4_overall');
%probs2(intern4,1, lsm_1_54,'int4_1_54');
%probs2(intern4,1, lsm_1_14,'int4_1_14');
%probs2(intern4,1, lsm_14_54,'int4_14_54');

%probs2(extern4,1, ,t31cont,'extern4_overall');
%probs2(extern4,1, ,lsm_1_54,'exter4_1_54');
%probs2(extern4,1, ,lsm_1_14,'exter4_1_14');
%probs2(extern4,1, ,lsm_14_54,'exter4_14_54');