Does School Race/Ethnic Composition Impact Mental Health Outcomes?

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ABSTRACT

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This dissertation evaluated what is known from the existing literature regarding the effect of race and ethnic composition in schools on adolescent mental health outcomes as well as provided new data in this area of research. The first dissertation Chapter presents the results of a systematic literature review of the current evidence to date regarding the effect of school race/ethnic composition on mental health outcomes in school-aged youth from Kindergarten through High School. Two empirical chapters that follow the first Chapter implemented new data that filled in knowledge gaps in the current evidence base. One empirical chapter, Chapter 2, tested if the main effect of school race/ethnic composition, measured as race/ethnic density and diversity, varied by student race/ethnicity. Chapter 2 also examined the point of convergence in rates of mental health symptom for youth of different race/ethnic groups as the race and ethnic distribution in the school changed. To examine this point, the predicted counts of depressive-anxious symptoms for each race/ethnic group across changes in school race/ethnic composition were plotted and discussed. Chapter 3, the second empirical chapter, examined if the impact of school race/ethnic composition on mental health outcomes varied by acculturative stress among youth identifying as Mexican/Chicano. Both empirical analyses were informed by the knowledge gaps that were identified in the systematic literature review in Chapter 1. Public health and policy implications of this dissertation research, including its literature review and empirical findings, are discussed.

The dissertation format first consists of a publishable systematic literature review of Specific Aim #1, presented as Chapter 1, that justifies the purpose for Specific Aim #2 and #3. Following Chapter 1, the dissertation presents two publishable research articles reflecting Specific Aim #2 and #3, presented as Chapters 2 and 3, respectively. Therefore, the specific aims are to:

1. Conduct a systematic literature review of school race/ethnic composition effects on mental health outcomes;
2. Controlling for school and student covariates, test school race/ethnic composition (e.g. race/ethnic density and diversity) on student mental health outcomes;
    a. Test the interaction between school race/ethnic composition variables and student self-reported race/ethnicity;
3. Test for within Mexican/Chicano group differences of school race/ethnic composition (e.g. race/ethnic density and diversity) on student mental health outcomes by acculturative stress, controlling for school- and student-level covariates.

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Table 1. 2x2x2 Mentorship Plan

	Intervention Component		
	Bruce Link	Leslie Davidson	Jo Phelan
1	No	No	No
2	Yes	No	No
3	No	Yes	No
4	No	No	Yes
5	Yes	Yes	No
6	Yes	No	Yes
7	No	Yes	Yes
8	Yes	Yes	Yes

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Dedication

"Caminante, no hay camino, se hace camino al andar." ~ Antonio Machado

To my mother, Yolanda R. Reyes, for always believing in me and making every sacrifice necessary to provide me with the physical, mental and emotional nourishment required so that I could pursue my aspirations in life and happiness.

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I dedicate my dissertation to each of you to thank you for your unconditional love and support, for your patience throughout my doctoral journey, and, in your own unique experiences, for being the utmost inspiration for how to overcome obstacles in life.

Chapter 1: A Systematic Literature Review

"The Role of the Race and Ethnic Composition in Schools on Mental Health Outcomes: A Systematic Literature Review"

ABSTRACT

The race and ethnic composition of schools has increasingly received attention as being important for mental health outcomes among youth. This systematic literature review provides evidence concerning two separate but related constructs from the literature examining the impact of school race/ethnic composition: density and diversity. Mental health outcomes of interest included a range of symptoms (e.g. depressive, anxious, hyperactive, attention, and psychotic symptoms). The systematic literature review is the result of a search across six databases from January 1, 1990 to May 1, 2016. Eleven articles met inclusion criteria following two steps in screening: first titles and abstracts and then full-text of the articles were reviewed. Evaluating the results from the eleven articles revealed that for racial and ethnic minorities, increasing compared to decreasing proportion of same race/ethnic peers was associated with decreasing mental health symptoms. Effects among non-Hispanic whites were less clear: some studies found an increase in mental health symptoms with increasing proportion of race/ethnic minority enrollment, while other studies found that greater race/ethnic diversity (i.e. index capturing the range and size of each race/ethnic group in school) was associated with greater, fewer, or no change in symptoms. To inform policies focused in school integration, school-based health, and adolescent health, future areas of research and policy implications are discussed.

INTRODUCTION

Since the late 1960's, the demographics of the national school population in the United States have significantly changed. Enrollment in public schools has multiplied nearly four times among Hispanic/Latinos and increased among non-Hispanic blacks by 1.5 million from 1968-2012.[1] Enrollment has decreased by 9.3 million in non-Hispanic whites during that period.[1] Due to a large immigrant wave and high fertility rates among racial and ethnic minority populations, schools are projected to be more racially and ethnically diverse in the future. However, school integration has not kept pace with the change in demographics. In fact, the racial and ethnic segregation in schools, a historical problem in the United States, has widened.[1-3]

Non-Hispanic white students remain the most segregated group: in 2011, the average non-Hispanic white student attended schools that had 73% non-Hispanic white student enrollment.[1,4] In contrast, the average non-Hispanic black and Hispanic/Latino student attended schools that were about two-thirds combined non-Hispanic black and Hispanic/Latino enrollment in 2011.[1,4] Native American students also went to schools with fewer non-Hispanic whites and more racial and ethnic minorities in 2011. Essentially racial and ethnic minorities have been and continue to be funneled into highly segregated schools that are simultaneously challenged by economic deprivation and social disadvantage. Concurrently, some historically segregated schools are also enrolling more non-Hispanic whites as some neighborhoods rapidly gentrify.

To put this issue to scale, the race and ethnic minority population of children and adolescents in the United States is substantial: about half of the total United States population under the age of 18 reported their race and ethnicity as a group other than non-Hispanic white in 2014, which is projected to increase to 64.4% by 2060.[5] The Hispanic/Latino group is now the largest racial and ethnic minority group in the United States comprising a quarter of the

population under the age of 18, increasing by 43% in the past decade.[5,6] Some states are now considered a majority-minority state. For example, about 55% of the population in Texas reported their race and ethnicity as a minority group in 2010, up from 48% in 2000. The change in population also has led to dramatic shifts in racial and ethnic minority student enrollment.

Mental Health Outcomes in Youth by Race and Ethnicity

For some mental health conditions, racial and ethnic minority youth consistently report poorer outcomes compared to their non-Hispanic white counterparts.[7] From the National Comorbidity Survey–Adolescent Supplement, non-Hispanic black youth reported increased rates of anxiety disorders and Hispanic/Latino youth report increased rates of mood disorders compared to non-Hispanic white youth.[8] In the National Longitudinal Study of Adolescent Health, Hispanic/Latino youth reported the highest levels of depressive symptoms of all groups across three waves, and Asian American youth reported similarly high levels, followed by non-Hispanic black youth. Non-Hispanic white youth reported the lowest levels of depression.[9] Both Hispanic/Latino and non-Hispanic black were less likely than non-Hispanic white youth to receive services even when experiencing severe impairment.[10]

Regarding suicide-related behaviors, the Centers for Disease Control's Youth Risk Behavior Surveillance Survey has seen similar patterns since 1990 across race/ethnic groups in the five items assessing sad mood, suicide ideation, and suicide attempt.[9,11] Hispanic/Latinos have reported greater prevalence in all five items compared to non-Hispanic black and white youth. For two of the most severe items including an attempted suicide that required medical attention, prevalence was greater among non-Hispanic black and Hispanic/Latino compared to non-Hispanic white youth. Despite these patterns, however, non-Hispanic white youth between 15 to 24 years old have higher rates of completed suicide compared to Hispanic/Latino and non-

Hispanic black youth of the same ages according to the National Death Index.[12]

In addition to nationally representative studies, a systematic literature review examining community and school samples in the United States also found robust evidence of higher rates of depression and anxiety among racial and ethnic minorities compared to their non-Hispanic white peers.[13] The review identified increased prevalence of mental health problems and risk factors in the environmental, social, genetic/biological and family domains among racial and ethnic minorities suggesting that minority groups both face and respond to these factors differently.[13] Moreover racial and ethnic disparities in mental health outcomes among youth may in fact be larger than reported. Racial and ethnic minorities tend to experience physical somatization of mental health problems that are sometimes omitted from mental health surveys.[14,15] National studies have also systematically excluded non-English speaking populations; thus, immigrant and undocumented populations have been largely excluded.[16]

Race and Ethnic Composition in Schools May Contribute to Mental Health Disparities

As there is considerable variation in the race/ethnic composition in schools, the race/ethnic composition of schools may also be associated with variation in mental health outcomes. The race and ethnic make-up in schools introduces unique experiences and challenges that may influence student mental health. Two separate but related views of school race/ethnic composition as important for mental health require examination: race/ethnic diversity vs. density.

School race/ethnic diversity is an index that measures the number of different race and ethnic groups and the size of each race and ethnic group in the school. The index uses the proportion of each available race/ethnic group in the schools in its calculation. A higher index can be interpreted as having greater school race/ethnic diversity. On the other hand, race/ethnic density measures the proportion of a specific group within a local population. The specific group

can vary depending on the chosen referent. For example, the ethnic density can measure the density of the socio-political dominant group, such as the proportion of non-Hispanic white enrollment, or it can measure the density of the non-dominant group, such as the proportion of racial and ethnic minorities in the school.

While race/ethnic density and diversity use the proportion of one or more groups in the school for its measurement, the constructs are different. Diversity captures the full composition of a school by including all groups in its calculation, thus capturing whether having a range of student race/ethnic backgrounds has any impact on mental health. On the other hand, density compares groups that vary in socio-political power to capture power dynamics, susceptibility of local contexts to prejudice and discrimination, presence of social support, and development of strong ethnic identities.[17,18] It is unclear if studies using these constructs lead to similar patterns across schools or if using different constructs leads to divergent findings. As the term "diversity" is used in policies aimed at increasing inclusion and cultural exchange while "density" implies population concentrations and dynamics, the constructs have different implications in terms of the interpretation of their findings.

Though increasing racial and ethnic diversity and decreasing large proportions of non-Hispanic white enrollment in schools may be strategies towards school integration, improving academic trajectories and providing opportunities for cultural and ethnic exchange, it is unclear if increased race/ethnic diversity and density improves mental health outcomes. Further, if either school race/ethnic diversity or density improves mental health, is the improvement among all groups equally? In other words, do the benefits of increasing diversity or density vary by race/ethnic group? Identifying the optimal school race/ethnic make-up for mental health for different race/ethnic groups can distinguish between the benefits of increasing school diversity

and the harmful effects of segregation.

Needed: A Literature Review on the Role of School Race/Ethnic Composition on Mental Health

There are two scientifically meaningful reasons for conducting the current systematic literature review on the role of race/ethnic composition in schools on mental health outcomes. One is to summarize the direction and magnitude of effects in the evidence to date. The review will assess the effects of both school race/ethnic diversity and density to assess if similar patterns emerge using different constructs and vary by race and ethnicity. Studies that have examined only one or both constructs will be included to tease apart the protective effect of having density of same-ethnic peers and increasing diversity versus the harmful effects of segregation in schools. A full range and attention to the measurement of mental health outcomes will be included to compare effects for internalizing, externalizing, and psychotic symptoms and between self-report, parent report, or school/health records.

Second, conducting a literature review on the evidence to date may inform the underlying mechanisms regarding *how* race/ethnic composition impacts mental health outcomes. Understanding the underlying processes by which this may or may not occur for different race/ethnic groups may increase our understanding as to whether diversity or density has better utility for school-based research. Identifying the impact of race/ethnic density and diversity on mental health outcomes is an important pursuit as it may inform policies including school district policy focused in disparities in mental health outcomes and services among youth, improving integration efforts in schools, and addressing school climate and discrimination.

Therefore, the goals for the current systematic literature review are to report on the current evidence examining race/ethnic composition in schools as one contributing factor of racial and ethnic disparities in mental health outcomes. Additionally, this systematic literature

review aims to identify mechanisms that explain the relationship between the race/ethnic make-up in schools and mental health. With these two goals met, the review can point to knowledge gaps, provide direction for future research, and discuss implications of the evidence to date.

METHODS

The current systematic literature review examines literature from January 1, 1990 to May 1, 2016 that evaluates the effect of race and ethnic composition in the school on student mental health outcomes. A list of search keywords associated with the exposures and outcomes of interest was compiled to search six databases: PubMed, PsychINFO, Medline, Embase, SCOPUS, and ERIC (Table 1). The articles were selected for inclusion in the systematic review if they met the following specific criteria: (1) peer-reviewed published article; (2) available in English; (3) included youth samples in either elementary, middle or high school; (4) used a measure of race/ethnic school composition as the exposure of interest; and (5) had mental health as either a primary or secondary outcome (Table 2). Exclusion criteria included non-peer reviewed articles, scientific conference abstracts, and studies that were not in English. Studies outside of the United States were included to assess whether studies in other countries with racially and ethnically diverse populations assessed similar research questions. Excluded study samples and settings included those among adults or children under the age of five, and institutionalized populations of youth such as chronically ill or juvenile populations, as these populations were thought to not have a traditional or sufficient time in a school setting in which the race/ethnic composition exposure would have been meaningful.

After removing duplicate articles (n=3,459), the database searches yielded 21,971 unique articles (Figure 1). Two reviewers screened the 21,971 articles for inclusion in the final review in two steps: 1) title and abstract screening; and 2) a full-text scan. I served as one reviewer and

a post-doctoral fellow with relevant experience in this area served as second reviewer. In step one, both reviewers screened article titles and abstracts for inclusion for full-text review, resulting in 51 articles. Large amounts of articles were screened out due to the search also yielding articles that reported on the diversity of microbiota in youth samples. Full-text articles of each of the 51 articles passing title and abstract screening were added to the online database that was accessible to both reviewers.

A second round of screening consisted of a full-text scan of the 51 articles to further remove articles that did not meet the inclusion criteria. The two reviewers were assigned to each article and discrepancies were discussed until an agreement between the reviewers was met. A total of eleven articles met the criteria for final inclusion. Articles were excluded due to having the wrong exposure and/or outcome of interest (n=30) or the study population was out of the scope for this review (n=10). Data from the eleven included articles were extracted to report study design, methods, findings and conclusions according to PRISMA guidelines.[19] The review will be organized by exposure construct first describing studies that assessed school race/ethnic density and then those that assessed school race/ethnic diversity. If the study stratified by sex, results are present separately; otherwise, the study did not stratify by sex.

RESULTS

Overall the systematic review identified eleven studies eligible for inclusion. Studies were published between 2002-2015 and included eight samples in the United States and three samples in Europe (UK and Netherlands). While the majority included high school samples (n=7), one study occurred among both middle and high school students, two studies occurred among middle school students, and one study examined the kindergarten-level. About equal

numbers of studies used a convenience (n=5) and nationally representative sample (n=6). Study designs included seven longitudinal cohorts and four cross-sectional studies.

Using large nationally representative school-based populations, three studies examined the effects of race/ethnic density in the United States. Among these, two studies utilized the National Longitudinal Study of Adolescent Health (Add Health) and the third study used all available data from the Department of Education's Office for Civil Rights. Three studies in Europe also used large nationally representative school-based populations to examine the effects of race/ethnic density. Finally, five studies in the United States measured the effect of school race/ethnic diversity on mental health outcomes.

Race and Ethnic Density in Schools in Populations in the United States (n=3)

The first study to use Add Health data examined the interaction between socioeconomic status of schools and individual race/ethnicity on self-worth, negative self-image, perceived isolation, and depression (Table 3).[20] The proportion of racial/ethnic minority students in each school measured race/ethnic density. The study had a large sample of low-income high school students across 47 schools with low-income families. Low-income status for students was defined as a family income of $28,011 or less (i.e. 185% of the 1994 poverty line for household size). Three dummy variables, high, middle, and low, indicated school socioeconomic composition defined as the proportion of families in the school exceeding a threshold of: 1) at least one parent having a four-year college degree, and 2) a family income exceeding 300% of the poverty line for household size. High-socioeconomic schools had at least 40% of parents exceeding the education and income threshold, whereas low-socioeconomic schools had less than 20% and middle-socioeconomic schools had 20-40% of parents exceeding the threshold.

The study found that greater school density of racial/ethnic minorities was protective against negative self-image, perceived social isolation, and depression in high and middle compared to low socioeconomic status schools; however, only the effect on negative self-image was statistically significant.[20] In middle compared to low socioeconomic status schools, both non-Hispanic black and Hispanic/Latino compared to non-Hispanic white students had depression scores about three times greater. Then comparing high to low socioeconomic status schools, non-Hispanic black compared to white students saw increases in negative self-image and perceived social isolation scores, but not in depression scores or among Hispanic/Latinos. Taking these results into account, the study investigator concluded that both Hispanic/Latino and non-Hispanic black low-income youth saw consistent psychosocial disadvantages in middle socioeconomic status schools while non-Hispanic black low-income youth experienced psychosocial disadvantages in high socioeconomic status schools as well.

School density of racial and ethnic minorities was found to be protective against negative self-image, perceived social isolation, and depression. As higher socioeconomic status schools also are associated with increased non-Hispanic white enrollment according to national trends, low-income racial and ethnic minority youth in predominantly non-Hispanic white and higher socioeconomic status schools are vulnerable to mental health distress.[20] Non-Hispanic whites were the only group to demonstrate mental health benefit of being in a higher socioeconomic status school. In addition to the psychosocial outcomes, similar patterns were found in academic outcomes. This study demonstrates that ignoring mental health and psychosocial risks while maintaining a sole focus on achievement gains can have negative consequences for low-income and racial and ethnic minority students in middle and high socioeconomic status schools.

Another study used a larger analytic sample from Add Health to evaluate the impact of non-Hispanic white enrollment on mental health outcomes.[21] Both depression and somatic symptoms were measured. After controlling for student, family, and school characteristics including family and school socioeconomic status, non-Hispanic black compared to non-Hispanic white youth saw significant increases in predicted depressive and somatic symptoms as the percentage of non-Hispanic white youth increased.[21] Interaction terms between race/ethnic group and non-Hispanic white enrollment were not significant for Hispanic/Latino, Asian/Pacific Islander, American Indian, and other race/ethnic groups for either depressive and somatic symptoms. After controlling for perceived unfair treatment by teachers and school attachment for both outcomes, the finding among non-Hispanic black youth and proportion of non-Hispanic white enrollment was not significant. Perceived discrimination by teachers and school attachment mediated the effect between race/ethnic density and mental health outcomes, particularly among non-Hispanic black youth.[21] Of note, school socioeconomic status did not mediate these relationships.

A third study from the Department of Education Office for Civil Rights examined cross-sectional data from the National Center for Educational Statistics Common Core of Data and the Office for Civil Rights.[22] The sample included over 24 million students, about one third of the national total school districts from the 1994-1995 school year. The study tested the association between three factors with the identification of emotional disturbances: proportion of race/ethnic minority enrollment, proportion of English language learner enrollment, and the schools per pupil expenditure. Emotional disturbances were measured using the serious emotional disturbance disability category in district enrollment data. This information is required reporting

by the United States Department of Education and is used to identify students eligible for free special education and related services.

Overall the study found that the proportion of race/ethnic minority enrollment was negatively associated with the formal identification of emotional disturbance.[22] Holding all other predictors at the median value, the researchers then examined changes in odds ratios for each race/ethnic group and by gender across the distribution of race/ethnic minority enrollment. For unreported reasons, non-Hispanic white females were the chosen referent. Comparing the 10th to 90th percentiles of race/ethnic minority enrollment, non-Hispanic black males had about eleven to four times the odds and Hispanic/Latino males had about five to one and half times the odds of having an identification of emotional disturbance. In other words, in schools consisting of predominantly racial and ethnic minorities (e.g. the 90th percentile), non-Hispanic black and Hispanic/Latino males saw lower odds of being identified as emotionally disturbed. A similar pattern was found among racial and ethnic minority females and American Indian and Asian American students. Using school records for measuring mental health problems, this study supports the ethnic density hypothesis that racial/ethnic minorities do better in terms of mental health in schools with greater racial and ethnic minority enrollment.

This study also assessed language density in the school, a factor that may be important among Hispanic/Latino students. Using Department of Education data, the study found that the proportion of English language learner enrollment was also negatively associated with the identification of emotional disturbance among all students.[22] A similar analytic approach found that as the proportion of English language learner enrollment increased, emotional disturbance identification decreased for Hispanic/Latino students compared to non-Hispanic white females.

Language density was not previously assessed in either of the Add Health studies, which may partially explain some of the null findings found in the Hispanic/Latino group.

Disproportionate identification of emotional disturbance of non-Hispanic black and Hispanic/Latino youth was also found comparing the 10th and 90th percentiles of socioeconomic predictors including median housing values and household income among families, percent of children living in households below poverty level, and per pupil expenditures. Increasing per pupil expenditure increased the odds of identification of emotional disorders for non-Hispanic white, non-Hispanic black and Hispanic/Latino students, particularly for non-Hispanic black and Hispanic/Latino males. Together, the evidence from this study suggested increased emotional disturbance identification in schools with higher socioeconomic status and greater non-Hispanic white enrollment. Though cross-sectional data, the researchers suggest that the patterns that they found may stem from biases in school practices particularly in schools that are both higher socioeconomically and in non-Hispanic white enrollment.

Studies Examining Indices of Race and Ethnic Diversity in Schools (n=5)

A study combining archival data from the National Center for Educational Statistics Common Core of Data evaluated the impact of school diversity on longitudinal measures of depression and anxiety from 2005 to 2014.[23] The study included a large sample of high school students across 233 schools from a large Midwestern county. The Simpson's Index of diversity, the relative probability that two randomly selected students are from different racial/ethnic groups, was measured by computing the percentage of students in schools from three groups: non-Hispanic white, non-Hispanic black, and a multiracial category.[24] Higher scores indicated increased diversity (consequently predominantly minority groups), and lower scores indicated less diversity (consequently predominantly non-Hispanic white). A significant negative

interactive effect between school diversity and the multiracial category indicated that multiracial compared to both non-Hispanic white and black students saw a decreased risk of anxiety and depressive symptoms with increasing school diversity. The opposite was found for non-Hispanic white students who experienced a higher risk of mental health issues with increasing diversity. Even in employing a diversity index, this study's findings support the ethnic density hypothesis.

Using a convenience sample of non-Hispanic black high-school students from eight schools in a northeastern city, a cross-sectional study tested the association between diversity and depression, self-esteem, and satisfaction with life.[25] Using archival data from the school district, the Simpson's Index of diversity (described above) for both school and neighborhood diversity was measured using the percent of non-Hispanic white, non-Hispanic black, Hispanic/Latino, and Asian American students. The study also collected measures of three indicators of racial discrimination to test its role in different school contexts among the non-Hispanic black adolescent sample: individual racism, cultural racism, and collective/institutional racism. Individual racism was described as when members of the dominant group engage in behaviors that feel denigrating to minority group members. Cultural racism tapped into the perception that the cultural history and practices of the dominant group are considered superior than those of other groups. Finally, collective/institutional racism assessed the perception that dominant groups members' negative attitudes are embedded in social institutions including schools.

The investigators first modeled the relationship between school diversity as a predictor of the three indicators of racial discrimination. School diversity was significantly and positively associated with increased perceptions of cultural racism and marginally so with individual racism. Though not significant, school diversity was negatively associated with institutional racism. Next, the investigators modeled the mental health outcomes regressing on school

diversity and the indicators of racial discrimination. A significant main effect between school diversity and the mental health outcomes including self-esteem, depressive symptoms, or life satisfaction was not found. However, higher institutional racism was independently associated with lower self-esteem and increased depression scores. Thus, the study findings allude to biases in school practices towards non-Hispanic black high-school students which in turn negatively impact mental health; however, the effects were small and mostly insignificant which may be due to the lack of an adequate and meaningful comparison or control such as non-Hispanic white or students of other race/ethnic backgrounds.

Two articles examined a large longitudinal sample during the transition between middle and high school in metropolitan Los Angeles.[26,27] The studies examined the effects of the Simpson's Index on depressive symptoms, self-worth, peer victimization, and perceived school safety. The studies assessed three different school contexts: students of the more prevalent group in low diverse classrooms, students of the less prevalent group in low diverse classrooms, and highly diverse classrooms. The study found significant decreases in self-reported victimization and loneliness and increases in self-worth and perceived school safety as school diversity increased.[26] The findings suggest a benefit of increasing diversity in schools for mental health but the authors did not test if this relationship varied by race/ethnicity.

Finally, in a large sample of public school kindergarten students, the impact of the Simpson's Index of diversity and the race/ethnic match between teacher and student on externalizing behaviors and interpersonal skills was tested.[28] The study found a positive and significant interaction between proportion of same race/ethnic peers and diversity with greater parental involvement. Greater parental involvement was in turn associated with more positive

socioemotional well-being and academic outcomes. Thus, parent involvement at school may serve as a mechanism by which diversity is linked to mental health outcomes.

Studies in European Samples Examining Ethnic Density or Diversity (n=3)

Using a large longitudinal cohort of adolescents across 51 schools in London, the relationship between both same-group race/ethnic density and diversity in schools was tested on psychological well-being.[29] The Herfindahl index, the sum of the squared proportions of each race/ethnic group within a school, calculated race/ethnic diversity using census tract data of the percentages of each race/ethnic group in the school attended. After controlling for experienced racism and proportion of students eligible for free meals, both same-group race/ethnic density and diversity had no effect on psychological well-being. Experienced racism, however, was negatively associated with psychological well-being for all groups. Reports of racism were generally lower for all groups in schools with higher same-group race/ethnic density. The findings from this study do not support the ethnic density hypothesis but do confirm that racism experienced in the school context is negatively associated with psychological well-being.

Two separate studies from the Netherlands used a large nationally representative sample to assess the effect of school ethnic density on mild psychotic experiences and internalizing and externalizing symptoms.[30,31] Ethnic density was measured using the proportion of ethnic minority status students compared to Dutch native majority, measured by self-reported ethnicity and nativity. Those reporting his/her or a parent birthplace in a non-Western foreign country were coded as non-Western minorities. Internalizing problems included dimensions of withdrawn, somatic complaints, and anxious/depressed, and externalizing problems included dimensions of delinquent and aggressive behavior.

With respect to internalizing problems, the study found no effect of the density of ethnic minority students in the school, a finding that did not vary between Dutch majority and minority students.[31] However, with respect to externalizing symptoms and after controlling for age, sex, parent education, and class size, a significant negative interaction between ethnic minority status and the density of ethnic minority students was found. The interactive effect indicated that for ethnic minority students, externalizing problems increased as the density of ethnic minority status students decreased in the school. When the density of ethnic minority status students was higher, ethnic minority and Dutch majority students saw similar levels of externalizing problems. In other words, an increase in ethnic minority students in the class did not lead to more externalizing problems among Dutch majority students. Equal levels of externalizing problems are reached when about two-thirds of the class were ethnic minority and only one-third were Dutch majority students. However, with regards to psychotic experiences, as the proportion of ethnic minority students increased, Dutch majority students had a statistically significant increase in paranoia; though insignificant, ethnic minority students had a decrease in paranoia. This set of studies support the ethnic density hypothesis; however, interpretations are limited due to unmeasured confounders such as school or neighborhood level deprivation, perceived discrimination, history of family mental illness, and adolescent substance use.

DISCUSSION

Overall Patterns in the Evidence to Date

This systematic literature review describes the observational studies that have examined the impact of race and ethnic composition in schools on mental health outcomes when measured as race/ethnic density or diversity. Only eleven studies resulted from the review, an indication that more research in this area is needed particularly as schools are increasingly changing

demographically, becoming more diverse and yet segregated over time. The evidence thus far supports the protective effect of having sufficient same-group density in schools particularly for racial and ethnic minority youth. All three nationally representative studies examining race/ethnic density supported the protective effect of the ethnic density hypothesis among non-Hispanic black youth while two of these studies supported the hypothesis among Hispanic/Latino youth. Further, two of three European studies examining ethnic density found similar patterns between the socio-political majority and minority groups and mental health outcomes. From the five studies that employed a diversity index, racial and ethnic minority youth saw fewer mental health symptoms in schools with increased diversity. The similarity in patterns is surprising given the differences in study designs, populations, and measures. To my knowledge, no other review has been conducted that recognizes this consistency across studies; thus, this current review is a contribution in the knowledge base as it shows the consensus provided among these studies. Among the studies in the United States, the samples encompass large nationally representative samples in addition to convenience samples of both urban, suburban, and rural populations; thus, findings are generalizable to similar race/ethnic students in the United States.

For non-Hispanic white students, the impact of race and ethnic composition in schools on mental health is less clear. One study identified that low-income non-Hispanic whites were the only group compared to non-Hispanic black and Hispanic/Latino youth to have academic and psychosocial benefits in middle and high as opposed to low socioeconomic status schools.[20] In terms of diversity, non-Hispanic and Dutch white youth were shown to have increased mental health symptoms with increasing school race/ethnic diversity.[23,30,31] Further evidence examining the impact of school race/ethnic composition on mental health outcomes among non-Hispanic white students in varying school contexts may resolve some of the discrepancy in the literature.

Attention to these findings may be informative for policies aimed at increasing the racial and ethnic diversity of schools. Efforts to improve integration (e.g. bussing programs) and redistricting of school districts may also introduce challenges for racial and ethnic minorities in terms of their mental health. Programs that bring low-income and race/ethnic minority youth to higher socioeconomic schools with higher proportions of non-Hispanic white enrollment simultaneously cause a loss of same-ethnic peers that is protective of mental health distress. While mental health is one of many important outcomes to consider along with physical health and academic achievements, this review demonstrates that ignoring mental health and psychosocial risks can have negative consequences for racial and ethnic minority students. National policy in education must not maintain a sole focus on achievement gains.

Increasing race/ethnic diversity in schools to improve integration does, however, provide an opportunity for cultural and ethnic exchange that better prepares youth for a more diverse and global society. Though not clearly identified across the literature, knowledge regarding what kind of racial and ethnic make-up of a school results in protection or risk in terms of mental health for each race/ethnic group, particularly for racial and ethnic minorities, would be useful. One Dutch study suggested that risk for ethnic minorities occurs when schools were about a third of the Dutch white group.[34] One study using Add Health data suggested that risk for racial and ethnic minorities occurred in schools with 15% or greater non-Hispanic white enrollment.[21,31] Identifying the ideal race/ethnic make-up of a school for each racial and ethnic group may be important for school policy and for our understanding of mental health disparities among youth.

Potential Underlying Mechanisms between School Race/Ethnic Composition and Mental Health

School race/ethnic composition may operate through several different pathways. Racially and ethnically diverse schools are hypothesized to be advantageous for mental health as

they may also promote equity and cultural awareness in school programming.[26,32] This, in turn, may develop strong ethnic identities that are protective against feelings of vulnerability and isolation.[33-36] Additionally due to the range and even distribution of race/ethnic groups in diverse schools, such schools may have a balanced power dynamic and more opportunities for any student, regardless of race/ethnic background, to socially fit-in.[26,32,37]

However, racially and ethnically diverse schools may also face several challenges. From research in neighborhoods, the ethnic density hypothesis posits that members of ethnic minority groups may have better mental health in areas with higher proportion of people of the same ethnicity in the local population.[17] The hypothesis predicts that the reverse is true for the majority group where risk increases with a high density of race/ethnic minorities in the local population.[17] This suggests that the risk of negative mental health outcomes in racial and ethnic minorities depends on the degree to which they are a minority or not in their local context.[38,39] In fact, youth in schools with higher compared to less same group density (i.e. many peers of the same race/ethnicity) have been found to experience improved well-being and school connectedness, increased ethnic-specific support and programming, and less peer victimization, discrimination, and alcohol use.[31,33-36,40-44] For example, in historically segregated schools with higher same-group densities, there may exist a strong identity and legacy of the school with the broader community; thus, increased feelings of school connectedness coupled with reduced social isolation and perceived discrimination may be synergistically improving mental health.

In racially and ethnically diverse schools, youth may experience less school connectedness as the mass of same-ethnic group peers may not be sufficient to ward off feelings of isolation and vulnerability. There may be less ethnic-specific support and programming built into the school curriculum and culture. Increased chances of negative interactions between

different racial/ethnic groups may exist, which in turn may increase exposure to discrimination, stereotyping, and/or cultural appropriation as more groups are present and forced to interact. Increased experiences of discrimination may be reported in diverse schools or schools with greater non-Hispanic white enrollment as there is more opportunity for racial and ethnic minority youth to assess fairness or equality in their school compared to students of other race/ethnic backgrounds. These potential mediating factors including the occurrence of school-based discrimination may vary by school context.

Remaining Gaps in Knowledge

Knowledge gaps that remain following review of the literature to date serve as a compelling call for further research to inform school-based policy decisions particularly surrounding integration, equity, and mental health. School socioeconomic status as a potential confounder of the relationship between the race/ethnic composition of schools and mental health outcomes needs further and consistent examination. School socioeconomic status is another important characteristic of a youth's school experience. Often school socioeconomic status is measured as an aggregate of family income and parent education, or with school-level indicators such as the proportion of students eligible for free or reduced price lunch. School socioeconomic status is strongly linked to the race/ethnic composition of schools where schools predominantly of race/ethnic minorities compared to non-Hispanic whites have greater deprivation in terms of social capital and per pupil expenditures, which are, in turn, negatively associated with mental health. Individual socioeconomic variables such as family income and parent education should be tested for confounding. As only one study examined the interaction between race/ethnicity and school socioeconomic status,[20,21,25,29] future research should include measures of school and individual socioeconomic status.

A second area for future investigation is within race/ethnic group analyses. The density of other factors among students in the school such as immigration status, years lived in the United States, and language preferences may be particularly important to immigrant groups and among youth of color such as Hispanic/Latino and Asian American groups. Only one study conducted a within group analysis among Hispanic/Latino youth and found a negative association between the proportion of English language learners in the school and identification of emotional disturbance.[22] There is an urgent need to test the application of the ethnic density hypothesis to understand the effects of language density in schools among Hispanic/Latino youth. Hispanic/Latino youth represent a significant population in public schools and have unique migration experiences including a significant undocumented population in the United States. Hispanic/Latino youth may be simultaneously learning English and/or Spanish proficiency and enroll in schools that vary in bilingual learning or support for English language learners. As Hispanic/Latino youth comprise a quarter of public school enrollment and over 75% of English language learner enrollment, and are much more likely to attempt suicide compared to their non-Hispanic white and black peers,[16,45] examining stressors in the school context may further our understanding of their mental health outcomes.

Finally, important mediating and modifiable factors to consider in future research are school connectedness, social isolation, school-based discrimination, ethnic-specific programming, parental involvement, and race/ethnic make-up of teachers and staff.[21,25,29,46] School-based discrimination has been shown to be negatively associated with mental health and its prevalence may vary by school race/ethnic composition. As only three studies examined school-based discrimination,[36,40,43] future research should further test perceived discrimination as it relates to the association between school race/ethnic composition and mental health. Similarly,

the proportion of racial/ethnic minority teachers and staff at the school represents a modifiable factor that may buffer effects between race/ethnic composition and mental health outcomes. Increasing diversity in teachers and staff may enhance the benefits of increasing student diversity in terms of academic gains but also deter the occurrence of school-based discrimination. Only one study examined race/ethnic match of teachers in a kindergarten sample limiting its generalizability to older youth.[28] Further research is needed to test these potential mechanisms.

Implications for Policy

Aiming to balance resources and providing opportunities across schools towards achieving full integration, as well as consideration of unequal treatment of students within schools should be considered for improving mental health outcomes. Efforts to increase racial and ethnic diversity must simultaneously evaluate and address interpersonal and institutional discrimination. Strategies to address discrimination may include ensuring social and academic integration, increasing race/ethnic diversity of teachers and staff, and introducing school-wide anti-bullying policies that can address a range of mistreatment including race/ethnic prejudice. As evidenced by current news articles and special reports,[47-49] there is an urgent need to: 1) increase the evidence base for understanding mechanisms and testing potential interventions, and 2) consider policies that address inequities both across and within schools.

Future research

Rigorous epidemiological research that captures the changing landscape of schools in terms of race/ethnic composition is needed to provide evidence-based recommendations. Race/ethnic composition should be tested using measures of both race/ethnic density and diversity to examine if similar patterns are found across multiple measures. Across all studies, race/ethnic composition at the school level utilized aggregated self-reported race and ethnicity at

a single point in time shortly after the school year began. Longitudinal measures of the exposure would allow for measurement of changes of school race/ethnic composition from year to year or when students change schools (e.g. moving). Further no study conducted a thorough within race/ethnic group examination perhaps because measures of meaningful within group variation did not exist. For example, measures of immigration status, number of years in the United States, language preferences or having an accent may be important predictors of Hispanic/Latino mental health outcomes. Research that examines race/ethnic composition effects could utilize a majority/minority framework as well as assess different race/ethnic groups to identify specific differences between and within race/ethnic groups.

Other indices used to measure segregation in neighborhood research such as dissimilarity and isolation may be informative for understanding mechanisms.[50] Dissimilarity is commonly used in residential segregation research and can be interpreted as the proportion of ethnic groups of interest that would need to move across schools in order to achieve an even distribution.[50] An isolation index is interpreted as the extent to which a member of a racial/ethnic group is likely to be in contact with members of this same group (as opposed to members of other groups).[50] The isolation index captures the degree of isolation felt in the local context because of its surrounding race/ethnic composition. Each index is formula-based and can be calculated using school race/ethnic compositions and school size.

Most studies used validated measures of mental health outcomes. Only one study used school records for measuring the outcome while all other studies included self-reported measures by youth participants and no study included a parent or peer report regarding mental health.[22] Comprehensive measurement should include a combination of reports from self, peer, parent, and school records noting that discrepancies may elucidate the biases in identifying mental

health problems by teachers and parents and detect unknown cases using self and peer reports. Further about half of studies focused on depression as the mental health outcome.[20,21,25,26,51] Examining symptoms of anxiety, depression, and attention and hyperactive, and distinguishing between type and number of mental health problems, may be necessary as youth often experience a range of concurrent symptoms and symptom expression may be patterned by gender. Although seven studies included samples from longitudinal cohorts, longitudinal measures of mental health were not always available and assessed. Finally, all studies included a self-report of mental health symptoms and do not tap into a subjective assessment about whether reported symptoms constitute a mental health problem. Future research could employ a comprehensive measurement of mental health status among youth using multiple reports to include number of mental health problems, type of symptoms, and a perceived problem.

One study provided a critical exploration of the potential biases occurring at the school-level in terms of identifying an emotional problem in youth.[22] As schools decreased in proportion of racial/ethnic minority enrollment, racial/ethnic minority students, particularly males, had increased odds of being identified as having an emotional disturbance. The agreement between school records and individual and parent report of classifying students as having emotional disturbance is unknown. While disproportionate identification occurred in schools with fewer racial/ethnic minority students, racial/ethnic minority students also had better mental health in schools with greater proportion of racial/ethnic minorities. Thus, this issue of biased problem identification in schools that are higher socioeconomically and with a higher proportion on non-Hispanic white enrollment is critical and should be further examined. Potential negative consequences of biased problem identification among youth of color are important. Providing unnecessary medical treatment to youth who may not need mental health

services creates distrust in the school and mental health service system, potentially exposes youth to dangerous side effects of medication, and occupies already limited services and treatments from youth in need of them. As stigma of mental illness is still a problem in our society, biased problem identification may create a false label increasing suffering from academic and social consequences of stigma. This issue of biased problem identification must be further explored to understand the drivers of the phenomena and ways to intervene.

Comprehensive data in this area of research may be scarce as these studies usually are conducted using secondary data sources with available mental health measures. In order to increase the capacity to examine factors regarding the school context on mental health outcomes, school-based studies should aim to collect school-level data on the schools that comprise the sample in addition to a range of mental health outcomes collected from student, parent, teacher and/or peer report. Longitudinal cohorts that collect mental health data among adolescents should also measure school factors such as school climate, connectivity or inclusivity, the race and ethnic make-up of friends or peers at school, and race and ethnicity of teachers and staff. Such efforts may allow for studying mediation and period effects particularly when changes in education policy occur. Capitalizing on existing studies among youth and adding a few measures regarding the school context can increase the evidence base by creating readily available data.

Ongoing challenges to this area of research include the inability to conduct randomized controlled experiments of school assignment. School assignment is non-random in nature largely due to families having a choice in school assignment that is shaped by the neighborhoods in which families choose to live. These choices in neighborhoods and schools are also shaped by historical and current discriminatory and economic policies. There may exist opportunities for

natural experiments that make use of lotteries in bussing or school choice programs in select states and cities that may allow for a naturally occurring random assignment of school.

Using a mixed methods model of research including both qualitative inquiry that explores a student's experience of the race and ethnic composition of their school and quantitative data would help validate the finding that racial and ethnic minorities have improved mental health in schools with greater proportions of race/ethnic minorities. Photo voice and other forms of sharing narrative experiences that engage youth are opportunities for qualitative study. In schools where increasing diversity is already a key goal and a part of school recruitment efforts, programming and efforts to improve inclusivity, tolerance, and equity should be offered; school-wide anti-discrimination policy should exist. To better enable the dissemination of school-based mental health research, knowledge translation experts including communication specialists, and use of policy briefs and lay reports should be involved in both study design and interpretation to better enable integration of epidemiological research into school policy and practice.

In conclusion, the current systematic literature review raises an awareness of how race/ethnic composition impacts mental health outcomes based on the published evidence to date. An understanding of this body of literature should be a core competency for school-based mental health researchers and should be applied in educational policy. This article provides greater depth of discussion of these studies as a collection, such that researchers, mental health providers, school stakeholders, and families can begin the process of addressing the mental health crisis in schools and the large inequities across and within schools patterned along racial, ethnic, and socioeconomic divides.

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TABLES

Table 1. Database search terms.

School context	(school OR middle school OR middle-school OR high school OR high-school OR elementary school OR education OR educational setting OR academic OR academic setting OR college OR university OR universities OR class OR classroom OR student)
Exposure of interest	(race composition OR racial composition OR racial make-up OR racial make up OR ethnic composition OR ethnic make-up OR ethnic make up OR race/ethnicity composition OR racial/ethnic composition OR races/ethnicities OR diverse OR diversity OR diverse composition OR ethnic density OR ethnic densities)
Outcome of interest	MESH (PUBMED), EMTREE (MEDLINE and EMBASE), MAP (PSYCHINFO) terms for mental health outcomes; (Mental Health OR Psychological OR Psychological problem OR psychological disorder OR mental disorder OR mental health OR mental health problem OR Emotion OR mental illness OR internalizing behavior OR internalizing symptom OR externalizing behavior OR externalizing symptom OR problem behavior) OR (ADHD OR attention OR attention deficit disorder OR attention deficit hyperactive disorder OR attention deficit hyperactivity disorder OR attention-deficit hyperactivity disorder OR attention-deficit/hyperactivity disorder OR hyperactivity OR impulsivity) OR (Depression OR depressive OR Depressive Disorder OR unipolar depression OR Depressive OR major depressive disorder OR major depression OR depressive symptom OR emotional depression OR emotional) OR (Mood Disorder OR mood OR Bipolar OR Affective Disorder OR Psychotic OR Affective Symptom OR Irritable Mood OR irritability OR mood change OR mood swing OR mood disturbance) OR (Nervousness OR Anxiety OR anxiety disorder OR anxiety state OR anxious state OR anxiety symptom) OR (Agoraphobia OR Panic Disorder OR panic OR Obsessive Compulsive Disorder OR OCD OR conduct OR conduct disorder) OR (Post-Traumatic Stress Disorder OR psychological distress OR stress disorder OR post traumatic stress disorder OR PTSD OR hyper-vigilance)

Table 2. Inclusion and exclusion criteria.

INCLUSION CRITERIA		
Report characteristics	Publication dates	January 1, 1990 – May 1, 2016
	Language	English only
	Publication status	published, in-press, and online only peer-reviewed articles; book chapters; dissertations
Study characteristics	Population	school-aged youth ages 5-18 (include elementary, middle and high school populations)
	Intervention/Exposure	a school-level measure of race/ethnic density, diversity, or composition; school-level measures in relation to race and ethnic groups such as school-socioeconomic status
	Comparison	given the exposure requirement, the study should include a high vs. low density or diversity groups to compare effect estimates between groups and not merely present a case study
	Outcomes	must include a mental health or behavior outcome; this can be broad to include self-esteem or well-being, or specific such as depression or suicide-behaviors
	Setting	sample is not required to be school-based though likely given the exposure requirement
	Study designs	observational and experimental designs, quantitative and qualitative analyses
EXCLUSION CRITERIA		
Report characteristics	Publication dates	publications outside of date range January 1, 1990 – April 26, 2016
	Language	Non-English language
	Publication status	abstracts, conference presentations, non-peer-review, unpublished articles; commentaries
Study characteristics	Population	children under 5 (pre-school, infants, toddlers, etc.), college, graduate and doctoral populations, adults 18+ not in school
	Intervention/Exposure	neighborhood-level measures measure of race/ethnic density, diversity, or composition only
	Comparison	no exclusions
	Outcomes	exclude substance use disorders
	Setting	exclude institutionalized populations (e.g. chronically ill or incarcerated youth)
	Study designs	anything other than included study design criteria

Table 3. Summary of included articles.

Basic Study Information			Participants		Exposure and Outcome Measurement		Study Findings	Overall Conclusion
Author, Year	Country; Setting (Study)	Study Design; Years	Total Sample Size	Sample Characteristics	Specific Exposure(s); Measure(s) Used	Primary Outcome(s); Measure(s) Used		
Astell-Burt, T; 2012[29]	United Kingdom; school-based (DASH)	Longit-udinal cohort; 2003-2006	N=6,645 students	Adolescents from 51 schools in London; compared racial and ethnic minorities including Indian, Pakistani, Bangladeshi, Black Caribbean, Nigerian, Ghanaian, and Other African to white	Own-group ethnic density and diversity; school census data and Herfindahl index	Psychological well-being; Goodman's 25-item Strengths and Difficulties Questionnaire	Adjusting for racism and proportion of students eligible for free meals, ethnic density and diversity had no direct effect on psychological well-being. Racism was negatively associated with psychological well-being in schools with greater compared to lower same-group ethnic densities.	Indirect effect of race/ethnic density on race/ethnic minorities' mental health. Racism may be the mechanism between race/ethnic density and mental health.
Benner, A; 2015[28]	United States; school-based (ECLS-K)	Longit-udinal cohort; 1998-1999 academic year	N=13,970 students	Public school kindergarten students; compared racial and ethnic minorities including NH black, Hispanic/Latino, Asian American, and other to NH white	Classroom race/ethnic diversity, proportion of same-race/ethnic peers, and race/ethnic teacher and student match; Simpson's index	Socioemotional adjustment (externalizing behaviors & interpersonal skills); Social Ratings Scale	Classrooms with greater compared to less same-group ethnic peers and diversity had increased parent involvement. Communicati on quality and parent involvement increased socioemotion al well-being and academic achievement.	Indirect effect of race/ethnic density and diversity on race/ethnic minorities' mental health. Parent involvement may be the mechanism between race/ethnic density/ diversity and mental health.
Coutinho, M; 2002[22]	United States; Department of Education	Cross-sectional; 1994-1995 academic year	M=4,151 school districts; N=over 24 million students	About one third of school districts across 50 states and District of Columbia; compared racial and ethnic minorities including American Indian, Asian/Pacific Islander, NH black, and Hispanic/Latino to NH white female	Proportion of NH white and English language learner enrollees; school district data	Proportion of students identified with emotional disturbances; the emotional disturbances disability category in district data	The proportion of race/ethnic minorities enrolled at school was negatively associated with emotional disturbance identification among NH black and Hispanic/Lati no youth compared to	Direct effect of ethnic density on identification of emotional disturbance in schools among race/ethnic minorities.

							NH white females. Similar patterns were found examining the proportion of English language learners and emotional disturbance identification in Hispanic/Latino youth.	
Crosnoe, R; 2009[20]	United States; school-based (Add Health)	Longit-udinal cohort; 1995-2002.	M=47 schools; N=1,119 students	Low-income public high school students; compared racial and ethnic minorities including NH black, Hispanic/Latino, and other race/ethnic group to NH white	Proportion of non-white racial/ethnic students in each school	Psychosocial indicators; CES-D	Low-income Hispanic/ Latinos demonstrated disadvantages across most psychosocial outcomes in medium versus low income schools. NH blacks demonstrated disadvantages in about half of psychosocial outcomes in medium and high versus low family income schools. NH low-income whites were the only group to demonstrate psychosocial advantages in medium and high income schools. Overall low-income students received less advanced coursework in medium and high income schools and greater perceptions of social isolation in high income schools.	Direct effect of school ethnic and socioeconomic density on race/ethnic minorities' mental health. Social isolation may be the mechanism between race/ethnic density and mental health.

Eilbracht, E; 2014[30]	Netherlands; school-based (HBSC)	Cross-sectional; fall 2005	M=21 schools; N=4,375 students	High school students from 47% of a random sample of 137 schools; compared racial and ethnic minorities including Moroccan, Turkish, Surinamese, Antillean, and other non-Western group to Dutch white	Ethnic density; percentage of non-Western students per class	Mild psychotic experiences; Community Assessment of Psychotic Experiences scale	The proportion of ethnic minorities was significantly and positively associated with hallucination, paranoia, grandiosity, and paranormal beliefs with small to moderate effect sizes. As the proportion of ethnic minority students increased, a significant increase in paranoia was found among ethnic majority students while ethnic minority students had a decrease in mild psychotic experiences though not significant.	Direct effect of school ethnic density on ethnic minority and Dutch majority mental health.
Fisher, S; 2014[23]	United States; school-based	Longit-udinal cohort; 2005-2014	M=233 schools (21 school districts); N=4,766 students	High school students in a large Midwestern county with a mix of cities, suburbs, and rural areas; compared multiracial students to NH black and NH white	Ethnic diversity; Simpson's index	Anxiety and depression; modified 10-item state-trait anxiety and 13-item CES-D scales	Increased diversity was significantly and moderately positively associated with depression and anxiety. A significant negative interaction between school diversity and ethnicity was found indicating that multiracial students in schools with greater diversity had lower risk of mental health issues. NH whites in	Direct effect of diversity on race/ethnic minorities' mental health.

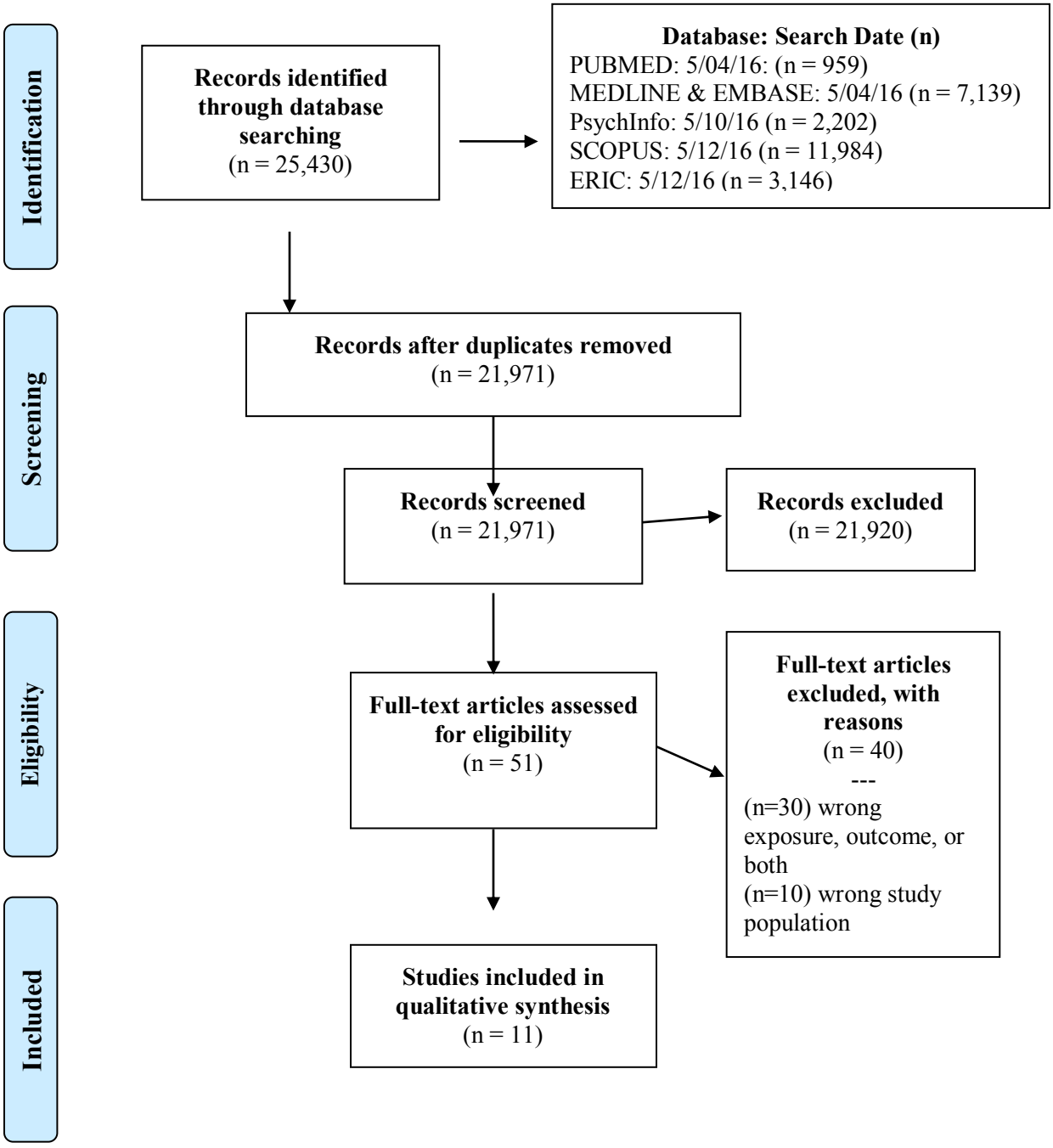
							greater diversity schools had higher risk of mental health issues.	
Gieling, M; 2010[31]	Netherlands; school-based (HBSC)	Cross-sectional; fall 2001-2002	N=5,730 students	High school students from 47% of a random sample of 137 schools; compared racial and ethnic minorities including Moroccan, Turkish, Surinamese, Antillean, and other non-Western group to Dutch white	Ethnic density; proportion of pupils in class with ethnic minority status	Internalizing and externalizing problems; 101-item Youth Self-Report scale	No differences between Dutch majority and minority students and no moderating effects of ethnic composition in the classroom were found in internalizing problems. As the proportion of minorities in the classroom increased, externalizing problems decreased for ethnic minority group students but not for ethnic majority group students.	Direct effect of school ethnic density on externalizing but not internalizing symptoms among ethnic minority and Dutch majority.
Juvonen, J; 2006[26]	United States; school-based	Longit-udinal cohort; 2000-2003	N=2,003 students	Sixth-graders from 99 classrooms in 11 different middle schools in Los Angeles; included Hispanic/Latino, NH black, NH white, Persian or Middle Eastern, Asian or Pacific Islander, and other race/ethnic group of mainly biracial students	Ethnic diversity; Simpson's index	Depression and self-worth; 10-item Children's Depression Inventory and 6-items of self-worth from Harter' Self-Perception Profile for Children	Greater versus lower ethnic diversity in the classroom was associated with moderately lower levels of perceived peer victimization and loneliness and increased perception of school safety and self-worth.	Direct effect of diversity on race/ethnic minorities' mental health. Perceived peer victimization and school safety may be factors related to diversity and mental health.
Graham, S; 2009[51]	United States; school-based	Longit-udinal cohort; 2000-2003	N=2,003 students	Sixth-graders from 99 classrooms in 11 different middle schools in Los Angeles; included Hispanic/Latino, NH black, NH white, Persian or Middle Eastern, Asian or Pacific Islander, and other race/ethnic	Ethnic diversity, proportion of same-ethnicity peers in the classroom; Simpson's index	Depressive symptoms and self-worth; 10-item Children's Depression Inventory and 6-item global self-worth subscale of Harter' Self-Perception Profile for Children	For numerical minorities in low diverse classrooms, victimization was related to psychological maladjust-ment but not mediated by	Indirect effect of diversity on race/ethnic minorities' mental health. Perceived peer victimization and self-blame may be the mechanism between

				group of mainly biracial students			self-blaming. Numerical majority youth in low diverse classrooms are more likely to experience victimization which in turn explained depression and self-worth, and this relationship was mediated by self-blame. A similar pattern was found among youth in high ethnic diversity classrooms.	diversity and mental health.
Seaton, S; 2009[25]	United States; school-based	Cross-sectional	N=252 students	NH black high school students across 51 public high schools in a large northeastern city	Neighborhood and school diversity; Simpson's index	Depression, self-esteem, and satisfaction with life; 20-item CES-D, 10-item Rosenberg Self-Esteem, and 5-item Satisfaction with Life scales	School diversity was positively associated with perceived cultural racism. Perceived collective/ institutional racism was negatively associated with self-esteem and depressive symptoms. A significant negative interaction between collective/ institutional racism and diversity was found for self-esteem and life satisfaction, and was strongest for students in high diversity contexts, weaker for students in low diversity contexts and weakest for students in moderately diverse	Indirect effect of diversity on NH black mental health. Cultural and institutional racism may be the mechanism between diversity and mental health.

							settings.	
Walsemann, K; 2011[21]	United States; school-based (Add Health)	Longit-udinal cohort; 1994	M=132 junior and senior high schools; N=18,419 students	Nationally representative sample of adolescents in grades 7-12; compared NH black, Hispanic/Latino, Asian/Pacific Islander, American Indian and other ace/ethnic group to NH white	School racial composition; percentage of NH white students at each school from self-report survey which was then aggregated to the school level using probability weights	Depression and somatic symptoms; 19-item CES-D and 12-item physical symptom scale	Adjusting for student, family, and school character-ristics, NH black compared to white youth saw significant moderate increases in depressive and somatic symptoms as the percentage of NH white enrollment increased. Perceived discrimin-ation and school attachment attenuated this interactive effect. School-level socio-economic status did not mediate these relationships.	Direct effect of race/ethnic density on mental health outcomes of NH black compared to white youth only. Perceived discrimination and not socioeconomic status in school may be the mechanism between race/ethnic density and mental health among NH black youth.
Abbreviations: "Add Health" denotes "National Longitudinal Study of Adolescent Health"; "CES-D" denotes "Center for Epidemiological Studies Depression scale"; "DASH" denotes "Determinants of Adolescent Social well-being and Health study"; "ECLS-K" denotes "Early Childhood Longitudinal Study-Kindergarten Cohort"; "HBSC" denotes "Health Behaviour in School-aged Children study"; "NH" denotes "Non-Hispanic".								

FIGURES

Figure 1. PRISMA flow diagram of database search.



Chapter 2: An Empirical Analysis across Race/Ethnic Groups

"Race/ethnic Composition in Schools and Mental Health:

A Risk or Protective Factor for All Students?"

Abstract

Objectives: Existing literature has shown how racial and ethnic minority youth benefit in some domains but are harmed in others with increasing non-Hispanic white enrollment in their school. Improved academic and economic trajectories for race/ethnic minorities have been found in schools that are predominantly non-Hispanic white and higher in socioeconomic status. However, these same schools introduce mental health risks to racial and ethnic minority students. This pattern may in part be due to increased experiences of discrimination that occurs in the school. This analysis aims to identify the optimal levels of race/ethnic density and diversity in schools where risk of mental health symptoms is lowest for each race/ethnic group and differences between groups are reduced. New evidence relevant to these issues is provided by examining patterns in mental health symptoms by school race/ethnic density and diversity according to race/ethnic group.

Methods: Data for analyses link an existing diverse sample of sixth-graders (N=484) across 14 schools in Texas who participated in an anti-stigma intervention to publically available data about the race/ethnic composition of the participating schools. A longitudinal self-administered survey assessed mental health symptoms over five time points over 24 months. Generalized estimating equations tested if the mental health impact of school race/ethnic composition varied by race/ethnicity. Finally, plots of predicted mental health symptoms counts display the point of convergence for each race/ethnic group across changes in race/ethnic composition.

Results: Non-Hispanic black compared to white youth had about twice the rate of depressive-anxious symptoms for every one-unit increase in non-Hispanic white enrollment during the 24-month study period. A significant interaction between self-reported race/ethnicity and non-Hispanic white enrollment was found such that below 25% non-Hispanic white enrollment, non-Hispanic white students had more symptoms, but above 25%, non-Hispanic black students had more symptoms. Although school diversity had a significant positive association with mental health symptoms as a main effect, it was significantly protective for Hispanic/Latino youth: compared to non-Hispanic white, Hispanic/Latino youth had about a quarter of the rate of depressive-anxious symptoms for every one-unit increase in school diversity.

Conclusions: This study highlights how mental health symptoms can increase for non-Hispanic black youth when non-Hispanic white enrollment exceeds about a quarter of the total school make-up. Increased diversity leads to fewer mental health symptoms for Hispanic/Latino youth compared to their non-Hispanic peers. While many outcomes are considered for adolescent health and well-being, these findings point to the importance of considering the mental health impact of the race/ethnic context surrounding youth in schools.

INTRODUCTION

Although schools are projected to be more racially and ethnically diverse over the next century,[1] schools have and will likely always vary considerably in terms of their race and ethnic composition. At the same time, segregated schools predominantly enrolling racial and ethnic minority students are often economically disadvantaged in terms of per pupil expenditure, proportion of students eligible for free or reduced priced lunch, and average family socioeconomic status of the school.[2] This chapter explores the possibility that the considerable dissimilarity in school race/ethnic composition introduces unique experiences and challenges that may be associated with variation in adolescent mental health outcomes. This conjecture is supported by a small body of evidence suggesting a significant effect of school race/ethnic composition on adolescent mental health, particularly for racial/ethnic minorities.[3-8] Overall for race/ethnic minorities, schools with larger proportions of same-ethnic peers are associated with fewer mental health symptoms; alternatively, mental health symptoms increase for minorities with increasing non-Hispanic white enrollment.[4-9] For non-Hispanic white youth, studies have demonstrated either increased or no change in risk with increasing density of minorities.[3-6]

Previous studies have employed one of two measures of school race/ethnic composition to examine its relationship to mental health. The first measure uses an ethnic density of a race/ethnic group to compare a sociopolitical majority versus minority group in a local population.[4,6] The percent of non-Hispanic white enrollment in a school is commonly used to measure ethnic density, though sometimes the proportion of enrolled racial and ethnic minority students is used instead.[3,8,9] A second measure of race/ethnic composition uses a diversity index,[5,7,10,11] such as the Simpson's Index, to account for the range and size of all available race/ethnic groups within a school. A diversity index captures the full composition of a school

as all race/ethnic groups are included in its calculation rather than one group. A diversity index reflects the public's aim to integrate schools and increase the representation of race/ethnic minorities in educational institutions.

Both race/ethnic density, measured as proportion of non-Hispanic white enrollment, and diversity, measured using an index, are related in that they each can quantify how the race/ethnic make-up in schools may influence mental health outcomes. Both measures should also be tested for their influence on a range of important outcomes for adolescents including academic achievement, college readiness, long-term economic trajectories, and physical health. Using both race/ethnic density and diversity, the empirical aim of this Chapter is to add knowledge by identifying the optimal levels of race/ethnic density and diversity in schools where differences in mental health risk between race/ethnic groups are reduced. Effects of race/ethnic density and diversity on mental health outcomes that vary by race/ethnic groups could signal an underlying mechanism of potential inequality, discrimination, or challenges between multi-ethnic relationships in the school setting.

Though my empirical aim will test direct effects of race/ethnic density and diversity, there are three potential mechanistic explanations why I might expect to find an association between race/ethnic composition and mental health symptoms. One mechanism is through socioeconomic status of the schools which includes per pupil expenditure, proportion of students eligible for free or reduced priced lunch, and average family socioeconomic status in the school.[3] Generally schools with greater non-Hispanic white enrollment also have higher socioeconomic status.[2] These schools tend to be wealthier including having higher per pupil expenditure and higher family incomes, have increased extracurricular programming and resources, and better overall academic achievement and success than schools with fewer non-Hispanic white

students.[12] On the other hand, students in schools with lower socioeconomic status tend to experience greater adversity than those in higher socioeconomic schools, which subsequently increases risk for mental health symptoms.[a]

A second potential explanatory mechanism is through presence of racism in the school, measured using self-reported perceived discrimination. Perceived discrimination and lack of equality in the school setting can lead to feelings of marginalization and isolation that are associated with negative mental health.[10,11] In fact, incidents of institutional and interpersonal discrimination may occur more often for racial and ethnic minorities in schools enrolling predominantly non-Hispanic white rather than minority students, which in turn has been linked to psychological distress.[11] Due to a range of race/ethnic groups, diverse schools may have a more balanced power dynamic and culture of tolerance of differences, which may decrease experiences of discrimination.[7] On the other hand, increasing diversity in schools may present challenges to students of any background as students try to engage and form relationships with students of different race/ethnic backgrounds. Increased proportions of teachers and staff from racial/ethnic minority backgrounds may be able to reduce school-based discrimination.

A final mechanism by which school race/ethnic composition may influence mental health is through school attachment.[8] Race/ethnic minority students in predominantly minority schools experience increased connectedness to their schools as more ethnic-specific support and programming are integrated into the school curriculum and culture.[7,13,14] An ethnic-specific supportive education may provide psychosocial benefit to youth as it may develop strong ethnic

[a] A caveat to these assumptions regarding low versus high socioeconomic schools is the existing adversity faced by students in predominantly non-Hispanic white schools due to, for example, school shootings and the opioid epidemic. Literature to date has yet to compare the mental health impact of experiences of adversity such as gun violence, ongoing fear of potential violent events, and substance use problems between schools predominantly of racial and ethnic minority versus non-Hispanic white enrollment.

identities that protect students from feelings of vulnerability and isolation. It also may contribute to increased parent involvement and parent-school communication.[15] Due to a range of race/ethnic groups, diverse schools may also provide increased chances for youth of any background to socially fit-in.[7] This mechanism is also supported by the ethnic density hypothesis which posits that members of ethnic minority groups have better mental health in local contexts with high same-ethnic density.[16] Ethnic density has been associated with improved well-being at school, less peer victimization, fewer externalizing problems, and less alcohol use.[17-21] School attachment has also been associated with less alcohol tobacco, and marijuana use, fewer suicide-related behaviors, later initiation of sex, and less frequent engagement in violence using a weapon.[22,23]

More research is needed to understand these mechanisms further, ensuring that improvements to health are balanced by not ignoring the detrimental effects of discrimination and segregation. A critical first step to further knowledge in this area is to first determine which measure of race/ethnic composition, density or diversity, matters more for mental health outcomes. Perhaps each measure leads to different findings for different race/ethnic groups. Thus, the current empirical longitudinal analysis asks whether increasing the density of non-Hispanic white enrollment and/or school race/ethnic diversity improves mental health outcomes for each race/ethnic group. The analysis also aims to identify if there is a point of convergence where no differences in mental health outcomes exist between race/ethnic groups.

Two data sources were linked to conduct these empirical analyses: (1) a school-based randomized controlled intervention funded by the National Institute of Mental Health (NIMH) that aimed to reduce stigma and promote help-seeking for mental illness;[24] (2) public data from the Texas Education Agency from the 14 participating schools in Texas that comprised the

study.[25] The NIMH-study contains comprehensive and longitudinal data regarding the social and mental conditions for 751 sixth-graders and 482 parent-student dyads. Notable strengths of this study are the collection of rich data over six waves in multiple schools that vary with respect to race/ethnic composition. Studying sixth-graders is also of developmental importance; mental health symptoms emerge at this age and yet issues of truancy and drop-out are not prevalent as they are in high-school samples.

Pin-pointing what school race/ethnic landscapes impose risk for mental health symptoms particularly for different race/ethnic groups may be useful for policies in school-based mental health, mental health disparities among adolescents, and race/ethnic integration in schools. Identifying if different patterns emerge by using race/ethnic density or diversity can inform how school race/ethnic composition may impact mental health outcomes uniquely for each race/ethnic group. Plotting the predicted mental health symptoms by race/ethnic group across the distribution of school race/ethnic composition may help identify where mental health disparities emerge and are reduced.

METHODS

Data for analysis came from a school-based experiment that evaluated the effectiveness of three anti-stigma interventions aimed at improving knowledge and attitudes about mental illness. The selection of participants, design, and procedures of the intervention are described in detail elsewhere.[24] Briefly, the study was conducted in two phases. Phase I included a pre-posttest that assessed knowledge acquisition and attitudinal change in sixth grade students comparing them before an intervention (i.e. pre-test) to three weeks after its conclusion (i.e. post-test). The intervention tested singly and combinations of an anti-stigma curriculum and a contact intervention with two persons with mental illness. Phase II was a longitudinal study of Phase I

participants at 6-, 12-, 18- and 24- months post intervention. The final follow-up survey was completed in the spring of 2015; thus, both phases of the study have been completed.

Both parents/guardians and students gave active assent and consent for participation after being given information about the study. Study packets with invitations to participate went home to 1,260 students. A total of 882 (70%) returned a packet with signed consent/assent forms, of which 751 (85%) consented to and 131 (15%) declined participation. Students were not included in the study without signed forms (i.e. parental consent). Students and parents/guardians received a modest monetary incentive for returning the signed forms and completing the study questionnaires. The study was approved by the Institutional Review Boards of MHMR of Tarrant County, the primary mental health community center of this county, and Columbia University Medical Center.

Study Sample

Drawn from 14 schools in an urban setting in Texas during 2011 and 2012, 484 of 751 consenting sixth-grade students completed a pre-posttest survey on laptop computers in either English or Spanish and agreed to participate in the longitudinal study (response rate=60%). More than half were female; the mean age was 11.5 years at baseline (Table 1). The sample consisted of 23% non-Hispanic white, 49% Hispanic/Latino, 21% non-Hispanic black, and 10% other race/ethnic group. Among all students, 67% preferred using English at home. Of the 49% who self-reported as Hispanic/Latino, 91% self-reported as ethnically Mexican/Chicano. About 61% came from homes with an annual income of less than $40,000 and about 45% had parents with less than or equal to high school education. Out of the 751 consenting in Phase I, 484 (64%) agreed to participate in Phase II. Table 1 summarizes the significant differences between Phase I and Phase II samples on key demographic factors. Notably the longitudinal sample had

significantly greater Hispanic/Latino participation and more youth with a family history of mental illness. The samples were not significantly different in mental health variables, intervention assignment, gender, family income, parent education, past mental health service use, and non-Hispanic white and economically disadvantaged student enrollment.

Texas Education Agency School Data

In order to obtain school data that was not collected by the NIMH-study, the NIMH-study data were linked to publicly available data on each of the participating schools that comprised this study. The Texas Education Agency (TEA) evaluates and publishes a School Report Card on each public school in the state and provides a glossary for each variable detailing how the data were collected.[25,26] The publically available data was linked to each student in the NIMH-study by matching the student school assignment to the TEA school data, allowing for the analysis of school contextual factors. The current analysis used baseline (i.e. sixth-grade) proportions of each race/ethnic group in each participating school to create measures of race/ethnic density and diversity, as well as variables that measured school socioeconomic status.

Measures

Dependent variables. A self-reported mental health symptoms checklist was administered to youth at pre-posttest, 12-, 18-, and 24-month interviews. The mental health checklist provided a compact screen that drew on items from the National Institute of Mental Health Diagnostic Interview Schedule for Children, Version IV.[27] Exploratory factor analysis of youth self-reported symptoms suggested one factor and that using the full 23-item scale fit the data better than reduced scales (alpha = 0.90; see Appendix Table 1). However, factor analysis of the parent reports of symptoms pertaining to their child suggested a two-factor specification: 1) symptoms of depression and anxiety; and 2) symptoms of hyperactivity and attention issues.

As race/ethnic composition was expected to evoke a specific effect on depressive and anxious symptoms and not hyperactivity, youth self-reported items were summed to create three count variables to explore patterns by symptom type and examine hyperactivity as a negative control: 1) all items combined to create a global mental health score; 2) depressive-anxious symptoms only; and 3) hyperactive-attention symptoms only.

School race/ethnic density. Modeling the operationalization of race/ethnic density in previous studies,[8,19] the proportion of enrolled non-Hispanic white students at each school in sixth-grade available in the TEA data measured race/ethnic density. The proportion of non-Hispanic white enrollment ranged from 3-68% in the participating schools. The schools collected race and ethnicity from the parent/guardian who enrolled the student in public school. In the rare event that a parent/guardian declined to provide this information, the United States Department of Education required that the school district employ observer identification as a last report to gather this information for federal reporting.[26] This same procedure was used across all schools in the NIMH-study. The race and ethnicity codes were then reported to the TEA by school districts. Other specifications of school race/ethnic density were explored including quartiles of school proportions of non-Hispanic white and racial and ethnic minority enrollment. Analyses with these different specifications resulted in similar patterns as those presented.

School race/ethnic diversity. The Simpson diversity index,[28] a measure of school diversity, was adapted as a measure of biological diversity and previously validated for use in demography, education, and social science research.[14,29-32] The diversity index measures richness, or the range of different race/ethnic groups in a school, and evenness, or the general representation of each race/ethnic group in a school. Diversity, ranging from 0 to 1, equals the probability that two youth taken at random from the sample represent the same race/ethnicity.

Using the percentages of non-Hispanic white, non-Hispanic black, Hispanic/Latino, and other race/ethnic group in school from the TEA data, the diversity index was calculated using the following formula, $D = 1 - \sum(n^2)$, where 'n' represents the proportion of each race/ethnic group. A higher index was interpreted as greater race/ethnic diversity in the school.

Covariates. The analyses controlled for several covariates; some were common causes of the exposure and outcome of interest, while others were included due to having theoretical and statistical importance. Two theoretically important covariates included gender (male—referent category) and self-reported race/ethnicity (non-Hispanic white—referent, Hispanic/Latino, non-Hispanic Black, and other race/ethnic group). To control for and examine the potential modifying influence of the NIMH-study intervention, dummy variables indexed the intervention cell the youth was assigned to: curriculum, contact, curriculum/contact combination, and control—referent. Study wave was used to index time, with the pre-test interview serving as the referent. Family socioeconomic status, a common cause of school race/ethnic composition and mental health outcomes, was controlled using caregiver reports of family income (0 "<$40,000", 1 "$40K-$75K", 2 ">$75K") and the education level of the parent (0 "High school diploma or less", 1 "Some college or greater") with the highest income and education levels serving as the referents. Finally, to control for history of mental illness that may be associated with the outcome, I controlled for family history of mental illness (0 "None/Don't Know" —referent, 1 "Yes") and past formal mental health service use including a doctor, therapist or school counselor (0 "None/Don't Know" —referent, 1 "Yes") as reported at baseline.

School socioeconomic status, also a common cause of school race/ethnic composition and mental health outcomes, was measured using the percentage of economically disadvantaged students and per pupil expenditure in the TEA data. The percent of economically disadvantaged

students in the school was calculated by the TEA as the sum of students coded as eligible for free or reduced-price lunch or eligible for other public assistance, divided by the total number of students in the school. Total operating expenditures per student was also calculated by the TEA taking the annual school expenditures and dividing it by the total number of students enrolled in the school that year. The total operating expenditures per student was not the amount actually spent on each and every student, but rather a per pupil average of the total.

Data Analysis

Generalized estimating equations (GEE) were used to analyze the correlated longitudinal data with the three mental health count variables summed over five time points as the outcomes.[33,34] All youth who completed the longitudinal component of the study were included in the model. In order to use a GEE model, first the distribution of the outcome was assessed overall and by study assessment (see Appendix Figure 1). Based on the histograms of the count outcome with a limited range and some excess zeros in three study assessments, the distribution suggested a Poisson or Negative Binomial Family. After comparing each family specification in a GEE model with the main variables of interest, the Poisson family was selected for multivariate regression modeling (see Appendix Table 2). In addition to comparing the family specification of the GEE model, a log link was selected to appropriately model the Poisson distribution.

After the family and link were determined, the correlation structures were compared across GEE models (see Appendix Table 2). An autoregressive correlation was tested as the data reflects a repeated measure design and an exchangeable correlation structure was tested to account for clustering at the student and school levels. Robust standard errors (e.g. Huber/White Sandwich Estimators) were used to allow the estimates to be valid in the event of a misspecification of correlation structure. Though GEE models are robust to misspecification of

the correlation structure, the QIC statistic and consistency across coefficients and standard errors suggested that the exchangeable correlation was the optimal choice.[33,34]

For multivariate GEE modeling, the association between school race/ethnic density (i.e. percent non-Hispanic white enrollment) and global mental health adjusted for time and self-reported race/ethnicity were modeled (Model 1). Next, to investigate whether the relationship between race/ethnic density and mental health varied by self-reported race/ethnicity, an interaction term was included of self-reported race/ethnicity by the percent non-Hispanic white students in Model 2, and in all subsequent Models. Models 3 examined whether the effects of race/ethnic density in Model 2 were attenuated after adjusting for family socioeconomic status, intervention assignment, history of family mental illness, and past mental health service use, respectively. The final Model 4 added a school socioeconomic indicator of proportion of economically disadvantaged students. Additionally, I tested for potential interactions with all covariates (n=56 tests) and found only one to be marginally significant (gender, P = 0.051 for joint interaction effect). I found no statistically significant associations with per pupil expenditure in the data; thus, percentage of economically disadvantaged students is the single school socioeconomic covariate.

Using the same model building process, four models were estimated to test the effect specifically in depressive-anxious symptoms and then separately in hyperactive-attention symptoms as a negative control. Lastly, in addition to regressing on proportion of non-Hispanic white enrollment, a separate series of GEE models were built using the same step-wise model building process to test the association between the diversity index and mental health. Stata SE 14 was used to estimate descriptive sample statistics and GEE models.[35]

Sensitivity Analysis

Several sensitivity analyses were used to test whether findings from alternative GEE regression models were robust to changes in model specification and missing data in the sample. To address missing data in the longitudinal sample, models were run using, 1) Phase I and Phase II samples, 2) a complete case of the Phase II sample, and 3) multiple imputation strategy in the Phase II sample (see Appendix Table 5). The following variables required imputation: mental health checklist items, family income, and parent education (see % Missing in Table 2). To fill in missing values of these variables, the multiple imputation analysis used other available variables that were found to be correlated with the missing variables which included student characteristics, bullying behaviors, and familiarity with mental illness. All available covariate and outcome data to be used in GEE models were also used to impute the missing values. GEE analyses were conducted for each of 20 imputed data sets as the largest 'Fraction of Missing Information' was about 20% for family income. The results were combined according to Rubin's rules leaving the estimated effective amount of missing data to be approximately less than 3% based on the variations between the 20 imputation analyses. Therefore, the overall analytic sample size improved from n=466 in complete case to n=471. The size and direction of the effect of the covariates were similar when using different specifications of the sample. However, the statistical significance of the interaction terms between the measures of race/ethnic composition and self-reported race/ethnicity were attenuated using the imputed dataset. Thus, I present the results from the multiple imputation analysis of the longitudinal sample.

Stratified analyses were used to test whether findings varied by gender. Because results were similar, the combined findings are presented. Also, 49% or more youth responded "yes" to six of the mental health checklist items. To account for these items that were commonly endorsed by youth, I ran the final models with outcome variables that removed these six items.

Results were similar but attenuated when including all items compared to excluding those that were common. Finally, a three-level multi-level model approach with time nested in students that were nested in schools was considered for analysis. However, the calculated Intraclass Correlation Coefficient in the crude model was less than 1% indicating that the observations within schools are no more similar than observations from different schools. Thus, GEE modeling was sufficient to test the research questions.

Results

Table 1 presents the distribution of sample characteristics at baseline. In the longitudinal sample, the mean score on the mental health checklist was nine (range 0-23) while 39% of youth believed that they had a mental health problem. About 46% had a family history of mental illness and just under a quarter received mental health services in the past. Statistically significant differences by race/ethnicity were found for mental health symptoms, language preference, family income, parent education, intervention assignment, family history of mental illness, and past mental health service use (indicated by '*' in Table 1). Summarized in Table 2, about 5% were missing the following variables, either singly or in combination: race/ethnicity, gender, the mental health checklist, perceived mental health problem, family income and parent education. Multiple imputation resulted in no imputes for those missing on race/ethnicity and gender, as they were previously imputed using logical imputation during data collection and cleaning. Thus, missing values were imputed for the following variables: the mental health checklist, perceived mental health problem, family income, and parent education.

Overall schools in the longitudinal sample had an average non-Hispanic white enrollment of 24% and economically disadvantaged enrollment of 71%. The mean diversity index across all schools was 0.55. Non-Hispanic white and economically disadvantaged enrollment, as well as

the diversity index, were found to be significantly different across race/ethnic groups. Figure 1 displays the average percent of non-Hispanic white enrollment overall and for each race/ethnic group. Nearly 70% of non-Hispanic white youth went to schools that had 40% or more non-Hispanic white enrollment. In contrast, less than 10% of non-Hispanic black and Hispanic/Latino and about 18% other race/ethnic group students went to schools that were 40% or more non-Hispanic white enrollment. For non-Hispanic black and Hispanic/Latino students, 45% and 55% went to schools that were less than 10% non-Hispanic white students, respectively. The majority of the other race/ethnic group students attended schools that were between 10-39% non-Hispanic white. These patterns in school race/ethnic composition according to individual race/ethnicity are consistent with national trends in school segregation.[36]

Density of non-Hispanic white enrollment and mental health symptoms

Table 3 presents the resulting incidence rate ratios from the GEE model building process for global mental health, depressive-anxious symptoms, and hyperactive-attention symptoms. These dependent variables regressed on the proportion of non-Hispanic white students at school. Table 3 of the Appendix details the model building process for the models presented below. Model 1 examined the main effect of race/ethnicity and the proportion of non-Hispanic white enrollment, adjusting for time. A statistically significant main effect was found for the proportion of non-Hispanic white enrollment ($P<0.05$). To test if this main effect varied by race/ethnicity, Model 2 added an interaction term between self-reported race/ethnicity and the proportion of non-Hispanic white enrollment. A statistically significant interaction was found for non-Hispanic black but not for Hispanic/Latino or other race/ethnic group compared to non-Hispanic white students ($P<0.05$). After adjusting for gender, family income, parent education, intervention assignment, family history of mental illness, and past mental health service use, the

interactive effect between non-Hispanic black race/ethnicity and percent non-Hispanic white enrollment remained significant. Finally, after adjusting for school percent of economically disadvantaged students in Model 4, the interaction attenuated: non-Hispanic black compared to white students had about twice the rate of mental health symptoms for every one-unit increase in non-Hispanic white enrollment in school during a 24-month period ($P<0.10$).

The sensitivity of these findings to alternate specifications was tested by examining if differences existed by depressive-anxious and hyperactive-attention symptoms (Table 3). The interactive effect between non-Hispanic white enrollment and non-Hispanic black compared to white students was found to be statistically significant for depressive-anxious symptoms only (Incident Rate Ratio (IRR) = 2.31; 95% Confidence Interval (CI): 1.13, 4.73); thus, no interaction effects are shown for hyperactive-attention symptoms in Table 3. A similar series of models was tested in a complete case analysis of the Phase I and Phase II sample (N=635) and longitudinal only sample (N=429) and similar results were found (see Appendix Table 4).

School race/ethnic diversity and mental health symptoms

Using the same model building process for understanding the effect of school race/ethnic density, Table 4 presents the resulting incidence rate ratios of mental health symptoms from the GEE models regressing on school diversity. Model 1 examined the main effect of the diversity index adjusting for self-reported race/ethnicity and time. School diversity was found to be positively associated with mental health symptoms ($P < 0.01$). After adjusting for time, gender, family income, parent education, intervention assignment, family history of mental illness, past mental health service use, and percent of economically disadvantaged enrollees, the main effect of school diversity was attenuated in Model 4: youth had about 1.43 times the rate of mental health symptoms for every one-unit increase in school diversity over a 24-month period (95%

CI: 0.95, 2.17). Though not significant, after covariate adjustment, the interaction effect for non-Hispanic black, Hispanic/Latino, and other race/ethnic group compared to non-Hispanic white youth indicated lower of rates of mental health symptoms for racial and ethnic minority students as school diversity increased (results not shown). These results were replicated though attenuated in analyses that compared the results of the imputed data set to the complete case analyses (see Appendix Table 4).

Effects in depressive-anxious compared to hyperactive-attention symptoms were tested (Table 4). After adjusting for gender, family income, parent education, intervention assignment, family history of mental illness, past mental health service use, and percent of economically disadvantaged enrollees, the interaction effect between Hispanic/Latino race/ethnicity and school diversity was significant only for depressive-anxious symptoms. Hispanic/Latino compared to non-Hispanic white youth had about a quarter of the rate of depressive-anxious symptoms for every one-unit increase in diversity over a 24-month period (IRR=0.27; 95%CI: 0.08, 0.92). School diversity also retained a significant direct effect where overall youth saw 3.5 times the rate of depressive-anxious symptoms for every one-unit increase in diversity.

When do depressive-anxious symptoms vary by race/ethnicity in terms of density and diversity?

To better understand the direction and magnitude of the interactive effects found between non-Hispanic black and proportion of non-Hispanic white enrollment and Hispanic/Latino and school race/ethnic diversity, post-estimates with respect to number of depressive-anxious symptoms were obtained.[37] The post-estimation tests were based on the values of race/ethnic composition found in the data. Post-estimated predicted symptoms were plotted to examine at what point in school race/ethnic composition do rates of depressive-anxious symptoms converge for each race/ethnic group. Figure 2 displays the predicted depressive-anxious symptoms after

adjustments for covariates by race/ethnic group as the proportion of non-Hispanic white enrollment increases along the x-axis. The curves in the figure show that the number of symptoms increased for non-Hispanic black but remain flat for Hispanic/Latino and other race/ethnic group students as the percent of non-Hispanic white youth increased. The number of depressive-anxious symptoms increased for non-Hispanic black students as the percent of non-Hispanic white youth increased where the inverse is true for non-Hispanic white youth (see Figure 2). From the figure, non-Hispanic black youth had fewer depressive-anxious symptoms than non-Hispanic white students up to 25% of non-Hispanic white enrollment in school. Above that point, depressive-anxious symptoms were higher for non-Hispanic blacks.

Net of covariates, the post-estimated counts of depressive-anxious symptoms as school diversity increases by race/ethnic group are plotted in Figure 3. While overall school diversity had a significant positive association with depressive-anxious symptoms, this effect was mostly driven by the non-Hispanic white group. The plot shows the accelerated rate of depressive-anxious symptoms among non-Hispanic white youth with increasing diversity. Because of this trend, Hispanic/Latino relative to non-Hispanic white youth saw fewer symptoms with increasing school diversity though their predicted counts of symptoms remain steady across the diversity spectrum. When diversity was equal to about 0.52, Hispanic/Latinos saw similar depressive-anxious symptoms compared to their non-Hispanic white peers. There were few differences in depressive-anxious symptom counts between non-Hispanic white, non-Hispanic black, and Hispanic/Latino youth. In terms of reducing race/ethnic disparities in depressive-anxious symptoms, together these findings showed an ideal school race/ethnic composition as having a diversity index of about 0.50 and a proportion of non-Hispanic white enrollment of 25%.

DISCUSSION

To measure the impact of race/ethnic composition of schools on student mental health, the current study examined whether race/ethnic density using proportion of non-Hispanic white enrollment and/or diversity using Simpson's Index were associated with mental health symptoms and whether this relationship varied according to individual race/ethnicity or by symptom type. Net of covariates, a statistically significantly positive interaction was found between non-Hispanic black compared to white youth with respect to race/ethnic density and depressive-anxious symptoms. Non-Hispanic black compared to white youth were found to have twice the rate of depressive-anxious symptoms for every one-unit increase in non-Hispanic white enrollment during the 24-month study period. Estimates were adjusted for time, gender, family income, parent education, intervention assignment, history of family mental illness, past mental health service use, and percent of economically disadvantaged enrollees. Predicted depressive-anxious symptoms were greater for non-Hispanic black compared to white youth when non-Hispanic white enrollment was greater than 25% of the school.

Analyses examining the effects of race/ethnic diversity on mental health symptoms supported these findings as well. While school diversity significantly increased rates of depressive-anxious symptoms as a main effect for all youth, it seems to be largely driven by the accelerated rates of depressive-anxious symptoms among non-Hispanic white students with increasing school diversity. Generally, race/ethnic diversity in school was in a protective direction for racial and ethnic minority compared to non-Hispanic white students. Specifically, Hispanic/Latino compared to non-Hispanic white youth saw about a quarter of the rate of depressive-anxious symptoms for every one-unit increase in school diversity.

It is likely that the race/ethnic make-up of a school impacts depressive-anxious symptoms rather than hyperactive-attention issues. I found no evidence of school race/ethnic composition

effects on hyperactive-attention symptoms and prior research has shown similar patterns in depressive-anxious symptoms. A possible explanation for these observed effects in depressive-anxious only may be that depressive-anxious symptoms are associated with the hypothesized pathways for how race/ethnic composition of a school impacts mental health such as through perceived discrimination, school attachment, or feelings of loneliness and isolation. These findings were also consistent for males and females and robust to complete case analyses.

Little evidence was found to suggest that non-Hispanic black, Hispanic/Latino, or other race/ethnic group youth have *fewer* mental health symptoms in schools with greater proportions of non-Hispanic white enrollees. Instead race/ethnic minority youth, particularly non-Hispanic black compared to white youth, have increased rates of depressive-anxious symptoms in school contexts that have greater proportions of non-Hispanic white enrollees. Non-Hispanic white enrollment measures the sociopolitical dominant group and taps into differential power dynamics in the school context. Thus, it may be serving as an indicator of potential unfair treatment for non-Hispanic black youth occurring at school. For non-Hispanic black compared to white students, rates of depressive-anxious symptoms became higher when the percent of non-Hispanic white enrollment exceeded about a quarter of the total student body. Rates of depressive-anxious symptoms also increased for non-Hispanic white students with increasing race/ethnic diversity in school. If policies focused in race/ethnic integration are valued, these findings are informative as they point to where differences between race/ethnic groups emerge and are minimized with respect to race/ethnic composition and depressive-anxious symptoms.

If school socioeconomic status explained the relationship between school race/ethnic composition and mental health, and if schools with high proportions of non-Hispanic white enrollment were akin to having higher socioeconomic status, I would have found that non-

Hispanic black and white youth had similar rates of depressive-anxious symptoms, or at least that non-Hispanic black youth would have fewer symptoms in schools with greater rather than smaller proportions of non-Hispanic white enrollment. However, I did not find that non-Hispanic black youth had improvement in rates of depressive-anxious symptoms in school contexts with greater non-Hispanic white enrollment, i.e. schools higher in socioeconomic status. Though there is potential for misclassification due to measurement error of the percent of economically disadvantaged enrollees, I also examined per pupil expenditure in school and found that it had no impact on mental health outcomes. This suggests other underlying mechanisms of the patterns found among non-Hispanic black compared to white students such as school-based discrimination or poor school attachment.

Several limitations require discussion. First, the current study used measures of race/ethnicity in the school context at one point in time, the beginning of sixth grade. To adequately address causality and the impact of school contexts for youth requires a dynamic measure of race/ethnic composition in the school. Such a dynamic measure should be collected over time to capture changes in school race/ethnic composition for individual students (e.g. moves to another school) and schools (e.g. gentrification or flight of a population) in addition to identifying if sixth grade is the correct window for these effects or if studies should focus on younger or older populations. Studies that exploit school lotteries or vouchers as a natural experiment may best infer causality. Second, the study aimed to test the main effect of race/ethnic composition on mental health outcomes. However, indirect effects that can explain underlying mechanisms were not examined such as school attachment and perceived discrimination. Other factors also related to both the race/ethnic composition of schools and student mental health that were not measured in this study should be explored such as presence

of a school police officer, ethnic-specific support and curriculum, and diversity among teachers and staff. Future analyses should examine these mechanisms.

Interpretations of the "other race/ethnic" group are limited as it is smaller and heterogeneous including Asian American, Pacific Islander, and Native American groups. Graphically, the patterns in predicted depressive-anxious symptoms in the "other race/ethnic" group tended to resemble the Hispanic/Latino group; however, these estimates were insignificant and of lesser magnitude due to lack of power from the small size of the group. Nevertheless, a common linkage between other race/ethnic groups with non-Hispanic black and Hispanic/Latino youth are not belonging to the sociohistorical dominant group (i.e. non-Hispanic white) of the United States. Studying racial and ethnic identity as well as self-reported race/ethnicity could be important particularly in assessing interracial and multi-ethnic individuals that represent an emerging and understudied group. Interpretations of the Hispanic/Latino group are also limited to youth identifying as Mexican/Chicano, as they comprised 91% of the Hispanic/Latino sample. Future research should explore these effects in other Hispanic/Latino populations.

Despite these limitations, these findings make an important contribution to the understanding of the role of the race/ethnic make-up of a school across a range of mental health symptoms during a 24-month period. The study sample included an ethnically and socioeconomically diverse school-based sample of sixth-graders where this area of research is most appropriate— mental health symptoms begin to emerge and drop-out and truancy are not yet prevalent as in high school samples. Using reliable and validated measures of mental health symptoms in youth recommended for research[27], new data were offered on the impact of non-Hispanic white enrollment and school race/ethnic composition on mental health symptoms by race/ethnic groups. In addition to using the validated mental health symptoms checklist, the type

of symptoms was explored; the patterns in the data applied primarily to depressive-anxious symptoms. These findings replicate prior research that find that non-Hispanic black compared to white youth have increasing rates of mental health symptoms with increasing non-Hispanic white enrollment, and increasing school diversity is overall protective of mental health for Hispanic/Latino youth.[3-8,10,11,14,15] However, our study adds to the current literature base by being one of the few to examine mental health symptoms over approximately two and half years of middle school (sixth to eighth grade) with the exposure captured at baseline. Thus, temporal order was established in which baseline school race/ethnic composition in sixth grade was used to measure the rates of mental health symptoms over the length of a middle school period. Finally, results may be applicable to other non-Hispanic black and Mexican/Chicano youth in the United States given the socioeconomically diverse sample.

For race/ethnic minority students, segregated schools may protect against discrimination but disadvantage students in many other ways including academic, economic, and physical health outcomes. Future research is needed that tests the underlying mechanisms that cause or prevent depressive-anxious symptoms for race/ethnic minorities particularly in schools with greater than 25% non-Hispanic white enrollment. Previous studies suggest that mechanisms include school attachment, experiences of discrimination, and lack of ethnic-specific support and programming that is embedded in the school curriculum and culture.[8,11] For example, in schools with high non-Hispanic white enrollment, do school-wide anti-discrimination or anti-bullying policies buffer any negative mental health effects particularly for racial/ethnic minority youth in school contexts with greater than 25% non-Hispanic white enrollment? Perhaps increasing the racial/ethnic diversity of teachers and staff may reduce discrimination and increase ethnic-specific curriculum and school attachment for students.[38,39] Does the presence of a multi-ethnic

curriculum and culture in schools with high non-Hispanic white enrollment improve mental health outcomes for students of varying race/ethnic backgrounds? Future research should explore these remaining questions as they present opportunities for intervention that can alleviate our national problem of segregation and prepare students of all backgrounds for a globalized multi-cultural and multi-ethnic world. Finally, using a mixed methods approach to include qualitative inquiry among students regarding their school race/ethnic make-up as well as their racial/ethnic identity may help our understanding of mechanisms and strategies for intervention.

This area of research has never been more pressing due to the intersection of several phenomena. The projection of a more racially and ethnically diverse national school-aged population is also coupled with that fact that there is no immediate expected change to the trends of increasing segregation of schools in the United States. The school race/ethnic landscape is shifting dramatically and rapidly too as non-Hispanic white populations have saturated cities while race/ethnic minorities have increasingly moved to suburban neighborhoods. Second, understanding adolescent mental health in the school setting and identifying high-risk groups is of public health importance. Mental health among youth is important in itself in that it is related to well-being, academic success, and school retention[22] and to prevent chronic stress from childhood and adolescent psychological trauma. Mental health research in school contexts can help us understand how race/ethnic disparities in mental health outcomes emerge and the ways to best intervene to reduce those disparities. Finally, while a constant underlying issue of racism exists in the United States, tensions between race and ethnic groups have recently been more heated.[40-42] Understanding the dynamics between race and ethnic groups in schools is of social importance. Together these reasons require further public health research concerning how the school race/ethnic composition can impact mental health.

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Tables

Table 1. Baseline sample characteristics by student race/ethnicity; School-based stigma intervention study, Texas, 2011-2012 (N=751)

Characteristic	Pre-post Test Only Sample (N=267)	Longitudinal Sample (N=484)				
	Overall	Overall	Non-Hispanic White (22.85%)	Non-Hispanic Black (20.96%)	Hispanic/ Latino (49.06%)	Other Race/ Ethnic Group (7.13%)
Mental health outcomes						
Global mental health score (0-23)*	8.49 (5.54)	8.99 (5.78)	9.77 (5.80)	10.14 (5.81)	8.55 (5.69)	6.11 (5.60)
Depressive-anxious symptoms (0-17)*	5.70 (3.97)	6.08 (4.12)	6.59 (4.28)	6.87 (4.19)	5.74 (4.01)	4.38 (3.76)
Hyperactive-attention symptoms (0-6)*	2.70 (1.84)	2.81 (1.82)	3.07 (1.92)	3.01 (1.71)	2.74 (1.78)	1.84 (1.76)
Student covariates						
Female	52.29	55.39	54.13	55.00	55.79	61.76
English language preference*	73.28	67.59	99.07	96.94	41.38	62.50
Family income < $40K*	60.78	58.89	25.00	69.89	72.33	50.00
Parent education ≤ H.S. diploma*	44.88	42.08	11.43	25.26	65.40	38.71
Intervention assignment*						
Curriculum	29.12	27.71	48.62	31.00	16.24	29.41
Contact	24.71	30.09	13.76	31.00	37.18	41.18
Curriculum and Contact	18.01	17.70	27.52	11.00	17.09	8.82
Control	28.16	24.50	10.09	27.00	29.49	20.59
Family history of mental illness*	32.95	45.91	67.89	60.00	33.76	23.53
Past mental health service use*	25.67	23.96	23.85	36.00	20.94	11.76
School covariates						
% Non-Hispanic white enrollment*	22.28 (21.93)	24.24 (23.93)	50.35 (24.69)	16.93 (17.26)	14.87 (16.48)	24.87 (20.06)
Diversity index*	0.58 (0.13)	0.55 (0.14)	0.54 (0.11)	0.57 (0.15)	0.53 (0.15)	0.64 (0.11)
% Economically disadvantaged*	71.41 (25.55)	71.04 (26.24)	45.78 (25.12)	76.41 (23.09)	81.43 (19.46)	67.90 (23.28)

Notes: Baseline mean and standard deviations are shown for continuous and count variables and percentages are shown for categorical variables, presented as "Mean (SD)" or "%". Chi-square, one-way ANOVA, and Kruskal-Wallis were used to test differences in categorical, continuous, and count variables across race/ethnic groups. "<$40K" denotes "Less than $40,000 annual income", "≤H.S." denotes "Less than or equal to High School diploma", and "*" denotes $P < 0.05$ for significant differences across race/ethnic groups.

Table 2. % Missing in variables in longitudinal sample; School-based stigma intervention study, Texas, 2011-2012 (N=484)

Variable	N	%
Mental health symptom checklist	10	2.07
Race/ethnicity	7	1.45
Gender	2	0.41
Language preference	15	3.10
Family income	51	10.54
Parent education	42	8.68
Intervention assignment	0	0.00
Family history of mental illness	0	0.00
Past mental health service use	0	0.00
% Non-Hispanic white enrollment	0	0.00
Diversity index	0	0.00
% Economically disadvantaged in school	0	0.00

Table 3. Generalized estimating equations predicting incidence rate ratios of mental health symptoms and regressing on race/ethnic density using school proportion of non-Hispanic white enrollment; School-based stigma intervention study, Texas, 2011-2012 (N=484)

	Global Mental Health IRR (95%CI)	Depressive-Anxious Symptoms IRR (95%CI)	Hyperactive-Attention Symptoms IRR (95%CI)
Intercept	8.19 (4.48, 14.64) ***	6.50 (3.58, 11.82) ***	1.61 (0.86, 3.03)
Study wave			
Post-test	0.82 (0.77, 0.87) ***	0.80 (0.75, 0.86) ***	0.85 (0.80, 0.91) ***
12-Month	0.98 (0.96, 1.00) *	0.99 (0.97, 1.01)	0.99 (0.97, 1.01)
18-Month	0.76 (0.69, 0.84) ***	0.75 (0.67, 0.84) ***	0.81 (0.73, 0.90) ***
24-Month	0.78 (0.72, 0.86) ***	0.77 (0.70, 0.86) ***	0.83 (0.76, 0.92) ***
Student covariates			
Race/ethnicity (ref = NH White)			
NH black	0.88 (0.69, 1.15)	0.81 (0.61, 1.07)	1.04 (0.88, 1.23)
Hispanic/Latino	0.86 (0.66, 1.10)	0.80 (0.61, 1.05) [a]	1.09 (0.91, 1.31)
Other race/ethnic group	0.62 (0.39, 0.98) *	0.53 (0.33, 0.87) *	0.68 (0.50, 0.93) *
Gender			
Female	1.10 (0.99, 1.22) [a]	1.16 (1.04, 1.30) **	1.05 (0.95, 1.17)
Family income			
< $40K	1.09 (0.93, 1.28)	1.11 (0.94, 1.31)	1.04 (0.89, 1.22)
$40-75K	1.12 (0.95, 1.32)	1.11 (0.93, 1.31)	1.13 (0.97, 1.33)
Parent education			
≤ H.S. diploma	0.96 (0.84, 1.09)	0.93 (0.80, 1.07)	1.00 (0.88, 1.14)
Intervention assignment			
Curriculum	1.27 (1.08, 1.48) **	1.29 (1.09, 1.53) **	1.30 (1.10, 1.54) **
Contact	1.21 (1.04, 1.40) *	1.16 (0.99, 1.37) [a]	1.31 (1.12, 1.54) ***
Curriculum/contact	1.18 (0.98, 1.42) [a]	1.20 (0.98, 1.47) [a]	1.11 (0.91, 1.36)
Family history of mental illness			
Yes	1.14 (1.02, 1.27) *	1.13 (1.00, 1.27) *	1.17 (1.05, 1.31) **
Past mental health service use			
Yes	1.20 (1.07, 1.34) **	1.22 (1.08, 1.38) **	1.18 (1.06, 1.31) **
School covariates			
% NH white enrollment	0.78 (0.39, 1.54)	0.56 (0.28, 1.15)	1.58 (0.78, 3.17)
% Economically disadvantaged	0.85 (0.50, 1.43)	0.75 (0.44, 1.30)	1.06 (0.60, 1.88)
School by Student Interaction			
NH Black X % NH White	1.86 (0.95, 3.64) [a]	2.31 (1.13, 4.73) *	N.S.
Hispanic/Latino X % NH White	1.37 (0.79, 2.39)	1.45 (0.78, 2.68)	N.S.
Other X % NH White	1.13 (0.37, 3.43)	1.67 (0.54, 5.15)	N.S.

Notes: All models adjust for time, gender, family income, parent education, intervention assignment, family history of mental illness, history of receiving mental health services, and percent economically disadvantaged students in school. Referent groups include: NH white race/ethnicity, pre-test time point, male gender, >$75K family income, some college or more parent education, control assignment, and no family history or past mental health service use.
Abbreviations: "NH": Non-Hispanic, "K": thousand in annual income, "H.S.": high school, and "N.S.": not significant.
[a] $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 4. Generalized estimating equations predicting incidence rate ratios of mental health symptoms and regressing on school race/ethnic diversity; School-based stigma intervention study, Texas, 2011-2012 (N=484)

	Global Mental Health IRR (95%CI)	Depressive-Anxious Symptoms IRR (95%CI)	Hyperactive-Attention Symptoms IRR (95%CI)
Intercept	5.87 (4.29, 8.02) ***	2.35 (1.29, 4.30) **	2.01 (1.45, 2.79) *
Study wave			
Post-test	0.82 (0.77, 0.87) ***	0.80 (0.75, 0.86) ***	0.85 (0.80, 0.92) ***
12-Month	0.99 (0.97, 1.01)	0.99 (0.97, 1.01)	0.99 (0.97, 1.01)
18-Month	0.76 (0.69, 0.84) ***	0.75 (0.68, 0.83) ***	0.81 (0.73, 0.90) ***
24-Month	0.79 (0.72, 0.86) ***	0.78 (0.70, 0.86) ***	0.83 (0.76, 0.92) ***
Student covariates			
Race/ethnicity (ref = NH White)			
NH black	1.05 (0.89, 1.24)	1.44 (0.65, 3.18)	1.03 (0.87, 1.22)
Hispanic/Latino	0.97 (0.83, 1.14)	2.00 (0.98, 4.05) *	1.00 (0.85, 1.18)
Other race/ethnic group	0.66 (0.50, 0.87)	1.63 (0.40, 6.70)	0.65 (0.48, 0.88) **
Gender			
Female	1.10 (1.00, 1.22) [a]	1.14 (1.02, 1.27) *	1.05 (0.95, 1.17)
Family income			
< $40K	1.10 (0.94, 1.28)	1.13 (0.96, 1.33)	1.05 (0.90, 1.23)
$40-75K	1.11 (0.95, 1.30)	1.13 (0.95, 1.33)	1.12 (0.95, 1.32)
Parent education			
≤ H.S. diploma	0.97 (0.85, 1.11)	0.94 (0.81, 1.10)	1.00 (0.87, 1.15)
Intervention assignment			
Curriculum	1.23 (1.05, 1.45) *	1.25 (1.05, 1.49) *	1.30 (1.10, 1.54) **
Contact	1.18 (1.01, 1.37) *	1.15 (0.97, 1.35) [a]	1.27 (1.08, 1.49) **
Curriculum/contact	1.17 (0.98, 1.40) [a]	1.19 (0.99, 1.44) [a]	1.18 (0.98, 1.42) [a]
Family history of mental illness			
Yes	1.16 (1.04, 1.29) *	1.14 (1.02, 1.29) *	1.17 (1.05, 1.30) **
Past mental health service use			
Yes	1.22 (1.10, 1.36) ***	1.23 (1.09, 1.39) **	1.20 (1.08, 1.34) **
School covariates			
Diversity Index	1.43 (0.95, 2.17) [a]	3.48 (1.26, 9.63) *	1.30 (0.84, 1.99)
% Economically disadvantaged	0.85 (0.67, 1.08)	0.83 (0.64, 1.08)	0.77 (0.60, 0.97) *
School by Student Interaction			
NH Black X Diversity Index	N.S.	0.57 (0.15, 2.16)	N.S.
Hispanic/Latino X Diversity Index	N.S.	0.27 (0.08, 0.92) *	N.S.
Other X Diversity Index	N.S.	0.21 (0.02, 2.13)	N.S.

Notes: All models adjust for time, gender, family income, parent education, intervention assignment, family history of mental illness, history of receiving mental health services, and percent economically disadvantaged students in school. Referent groups include: NH white race/ethnicity, pre-test time point, male gender, >$75K family income, some college or more parent education, control assignment, and no family history or past mental health service use.
Abbreviations: "NH": Non-Hispanic, "K": thousand in annual income, "H.S.": high school, and "N.S.": not significant.
[a] $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Figures

Figure 1. School non-Hispanic white enrollment overall and by student race/ethnicity.

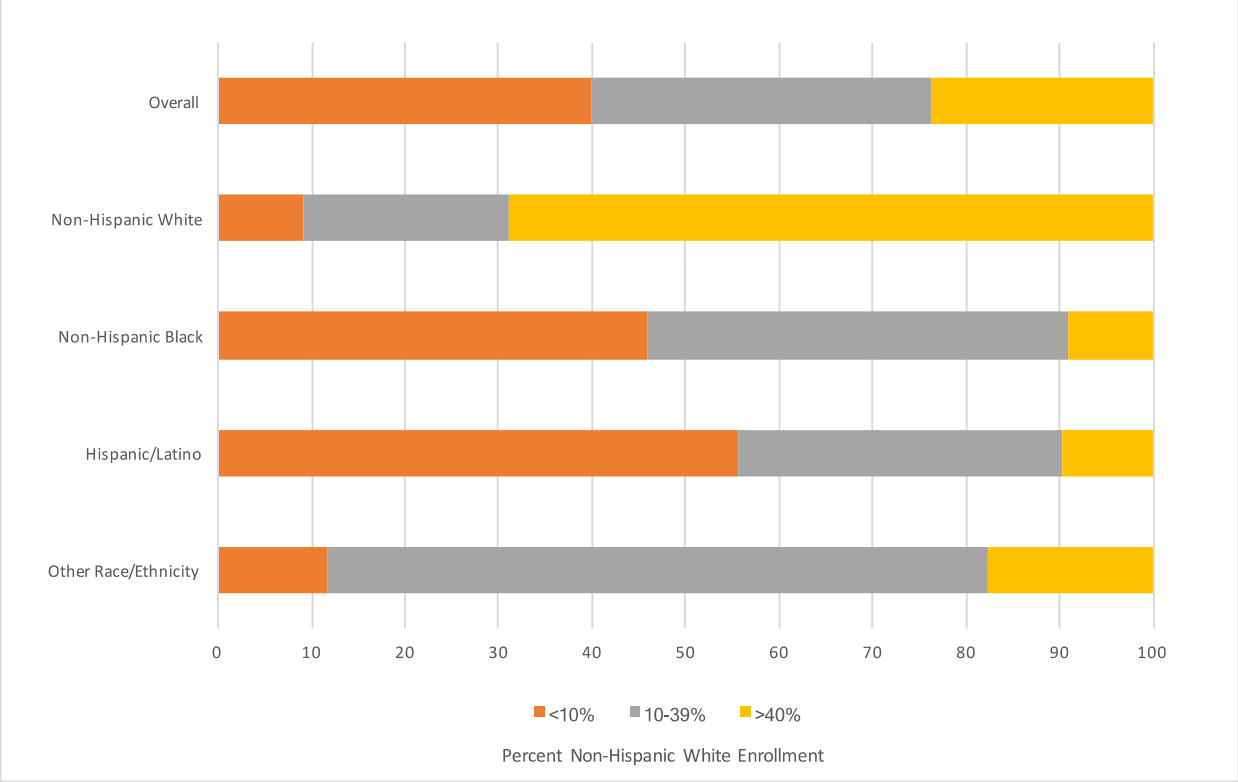


Figure 2. Predicted counts of depressive-anxious symptoms across changes in race/ethnic density measured by non-Hispanic white enrollment

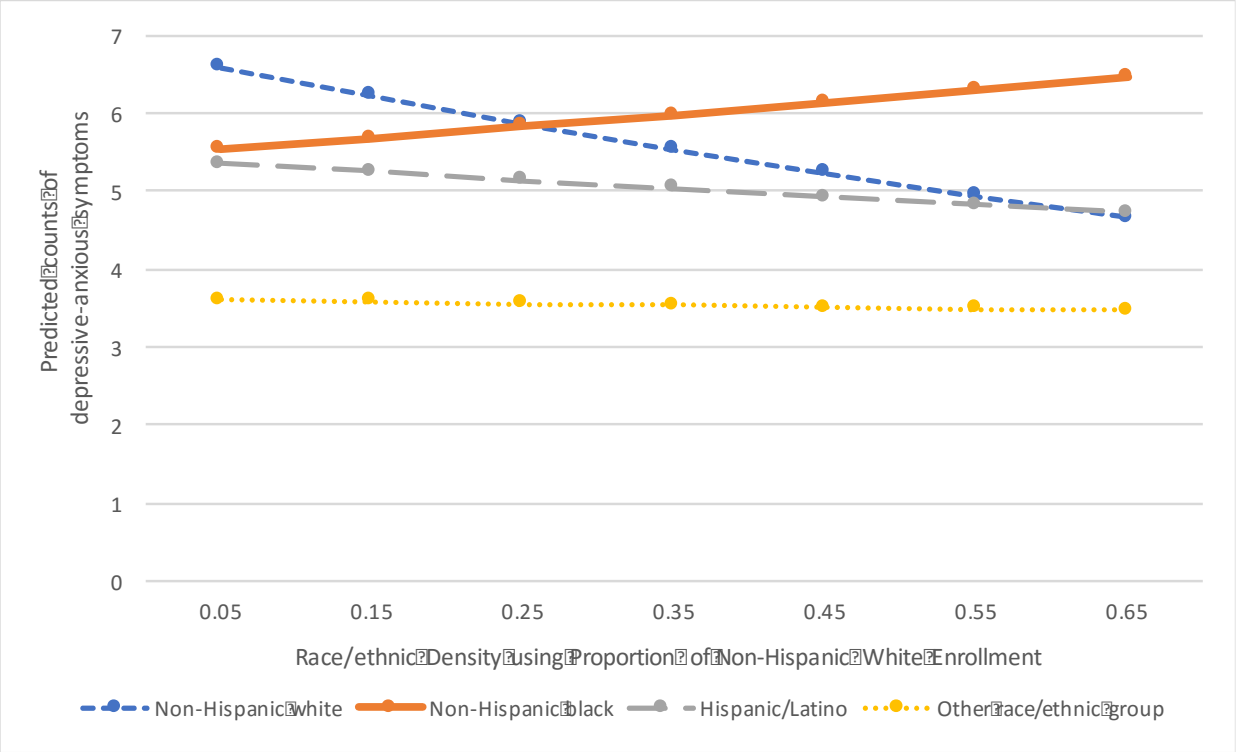
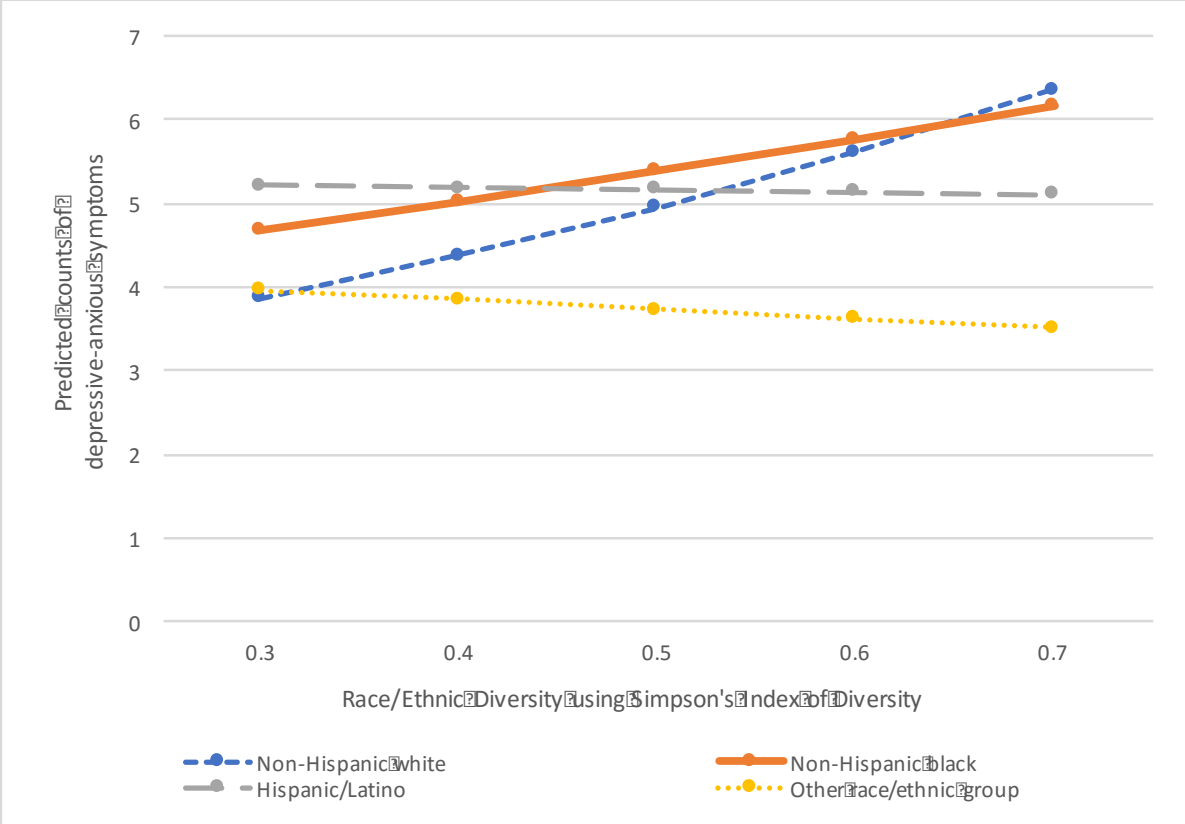


Figure 3. Predicted counts of depressive-anxious symptoms across changes in school race/ethnic diversity



Appendix

Table A1. Frequencies of mental health checklist items at baseline in longitudinal sample; School-based stigma intervention study, Texas, 2011-2013 (N=484)

In the past 6 months, have you…	% Yes (n)	% No (n)
Depressive-Anxious Items		
1. Felt really sad or depressed most all day for several days in a row?	29.00 (136)	71.00 (333)
2. Often felt afraid of going out of the house by yourself?	29.64 (139)	70.36 (330)
3. Had any thoughts that keep coming back into your mind …?	49.03 (227)	50.97 (236)
4. Worried about how things would turn out for you?	58.10 (269)	41.90 (194)
5. Felt there were certain things that you did over and over …?	30.75 (143)	69.25 (322)
6. Often felt afraid of being in crowded places?	34.83 (163)	65.17 (305)
7. Felt nothing was fun for you and you just weren't interested …?	52.45 (246)	47.55 (223)
8. Often thought about death … being dead yourself?	43.07 (202)	56.93 (267)
9. Felt you can't do anything … not as good looking or smart …?	45.32 (213)	54.68 (257)
10. Felt lonely, like you didn't have any friends?	38.25 (179)	61.75 (289)
11. Been grouchy or angry most of the time for several days in a row?	30.49 (143)	69.51 (326)
12. Thought that you have special abilities or powers …?	28.75 (136)	71.25 (337)
13. Slept a lot less than usual, say, only three or four hours a night …?	40.68 (192)	59.32 (280)
14. Often felt like your mind was racing too quickly …?	40.69 (190)	59.31 (277)
15. Worried too much about a number of different things …?	34.91 (162)	65.09 (302)
16. Often felt very nervous/uncomfortable … with people your age?	27.14 (127)	72.86 (341)
17. Had a sudden attack of feeling very scared and strange things …?	32.48 (152)	67.52 (316)
Hyperactive-Attention Items		
18. Often had trouble keeping your mind on what you are doing …?		
19. Often disliked doing things where you had to pay attention …?		
20. Often not finished things because you started … something else?	52.23 (246)	47.77 (225)
21. Often made many mistakes because it's been too hard for you …?	44.49 (210)	55.51 (262)
22. Often been too active and fidgety so that you couldn't sit still?	40.47 (191)	59.53 (281)
23. Felt very restless, so that you've had to keep walking around …?	39.02 (183)	60.98 (286)

Table A2. Comparisons of unstandardized coefficients and robust standard errors [β(SE)] across generalized estimating equations models by specification of the outcome and correlation; School-based stigma intervention study, Texas, 2011-2012 (N=484)

	Poisson Distribution			
	Correlation			
	Independent	**Unstructured**	**Exchangeable**	**Autoregressive**
Student Race/ethnicity				
NH white	ref.	ref.	ref.	ref.
NH black	-0.08 (0.15)	-0.12 (0.14)	-0.12 (0.14)	-0.02 (0.16)
Hispanic/Latino	-0.22 (0.13)	-0.25 (0.13)	-0.24 (0.13)	-0.14 (0.15)
Other	-0.44 (0.25)	-0.49 (0.23) *	-0.48 (0.24) *	-0.61 (0.27) *
School covariate				
% NH White	0.03 (0.22)	-0.01 (0.21)	-0.04 (0.21)	0.02 (0.24)
Student by School Interactions				
NH black X % NH white	0.80 (0.39) *	0.83 (0.35) *	0.81 (0.35) *	0.71 (0.47)
Hispanic/Latino X % NH white	0.47 (0.30)	0.47 (0.29)	0.41 (0.29)	0.20 (0.34)
Other X % NH white	-0.08 (0.56)	-0.11 (0.57)	-0.03 (0.60)	0.18 (0.61)
Constant	2.29 (0.12) *	2.32 (0.12) *	2.33 (0.12) *	2.27 (0.14) *
Wald χ 2 (11 df)	104.46	114.90	104.02	81.70
QIC	7800.59	7940.66	7793.85	7812.61
	Negative Binomial Distribution			
	Correlation			
	Independent	**Unstructured**	**Exchangeable**	**Autoregressive**
Student Race/ethnicity				
NH white	ref.	ref.	ref.	ref.
NH black	-0.08 (0.15)	-0.14 (0.14)	-0.12 (0.14)	-0.03 (0.16)
Hispanic/Latino	-0.21 (0.14)	-0.27 (0.13) *	-0.24 (0.13)	-0.14 (0.15)
Other	-0.44 (0.25)	-0.52 (0.23) *	-0.47 (0.23) *	-0.59 (0.27) *
School covariate				
% NH white enrollment	0.06 (0.22)	< 0.01 (0.21)	0.02 (0.21)	0.04 (0.24)
Student by School Interactions				
NH black X % NH white	0.87 (0.39) *	0.93 (0.36) *	0.90 (0.36) *	0.80 (0.47)
Hispanic/Latino X % NH white	0.48 (0.31)	0.51 (0.30)	0.42 (0.29)	0.20 (0.35)
Other X % NH white	-0.11 (0.55)	-0.08 (0.55)	-0.10 (0.56)	0.14 (0.58)
Constant	2.28 (0.13) *	2.33 (0.12) *	2.32 (0.12) *	2.27 (0.14) *
Wald χ 2 (11 df)	102.29	118.09	107.82	81.41
QIC	2262.28	2268.62	2261.43	2267.69

Notes: *P < 0.05; "NH" denotes "Non-Hispanic".

Table A3. Sample model building process of generalized estimating equations models predicting the mental health symptoms checklist and regressing on non-Hispanic white enrollment; School-based stigma intervention study, Texas, 2011-2012 (N=484)

	Model 1a IRR (95%CI)	Model 2b IRR (95%CI)	Model 3c IRR (95%CI)	Model 4d IRR (95%CI)
Intercept	8.78 (7.35, 10.48)**	10.30 (8.19, 12.95)**	6.97 (5.29, 9.19)**	8.00 (4.46, 14.35)**
Study wave				
Post-test	0.82 (0.77, 0.88)**	0.82 (0.77, 0.87)**	0.82 (0.77, 0.87)**	0.82 (0.77, 0.87)**
12-Month	0.98 (0.96, 1.00)[a]	0.98 (0.96, 1.00)[a]	0.99 (0.97, 1.01)	0.99 (0.97, 1.01)
18-Month	0.76 (0.69, 0.84)**	0.76 (0.69, 0.84)**	0.76 (0.69, 0.84)**	0.76 (0.69, 0.84)**
24-Month	0.78 (0.71, 0.85)**	0.78 (0.71, 0.85)**	0.79 (0.72, 0.86)**	0.79 (0.72, 0.86)**
Student covariates				
Race/ethnicity				
NH black	1.14 (0.95, 1.36)	0.89 (0.68, 1.16)	0.87 (0.67, 1.14)	0.88 (0.67, 1.14)
Hispanic/Latino	0.94 (0.80, 1.10)	0.79 (0.61, 1.01)[a]	0.86 (0.67, 1.10)	0.86 (0.67, 1.10)
Other race/ethnic group	0.66 (0.50, 0.88)**	0.61 (0.39, 0.97)*	0.61 (0.39, 0.96)*	0.62 (0.39, 0.97)*
Gender				
Female			1.11 (1.00, 1.23)*	1.11 (1.00, 1.23)*
Family income				
< $40K			1.09 (0.93, 1.27)	1.09 (0.93, 1.27)
$40-75K			1.11 (0.95, 1.29)	1.11 (0.95, 1.29)
Parent education				
≤ H.S. diploma			0.94 (0.82, 1.08)	0.94 (0.82, 1.08)
Intervention assignment				
Curriculum			1.29 (1.10, 1.51)**	1.29 (1.10, 1.51)**
Contact			1.22 (1.05, 1.41)**	1.21 (1.04, 1.41)*
Curriculum/contact			1.16 (0.96, 1.39)	1.17 (0.97, 1.41)
Family history of mental illness				
Yes			1.14 (1.02, 1.27)*	1.14 (1.02, 1.27)*
Past mental health service use				
Yes			1.20 (1.08, 1.34)**	1.21 (1.08, 1.35)**
School covariates				
% NH white enrollment	1.31 (1.01, 1.70)*	0.96 (0.64, 1.44)	0.90 (0.59, 1.37)	0.78 (0.39, 1.54)
% Economically disadvantaged				0.86 (0.51, 1.46)
Student by School Interactions				
NH black X % NH white		2.26 (1.14, 4.46)*	1.96 (1.02, 3.79)*	1.91 (0.98, 3.72)[a]
Hispanic/Latino X % NH White		1.50 (0.85, 2.63)	1.37 (0.79, 2.40)	1.35 (0.77, 2.36)
Other Race/Ethnicity X % NH white		0.98 (0.30, 3.13)	1.17 (0.40, 3.42)	1.15 (0.39, 3.40)

Notes: Referent groups include: NH white race/ethnicity, pre-test time point, male gender, >$75K family income, some college or more parent education, control assignment, and no family history or past mental health service use.
Abbreviations: "NH": Non-Hispanic, "K": thousand in annual income, "H.S.": high school, and "N.S.": not significant.
[a]$p < 0.10$, *$p < 0.05$, **$p < 0.01$.
a Included race/ethnicity, time and the direct effect of % NH White.
b Included Model 1 variables and added the interaction term between race/ethnicity and % NH White.
c Included Model 2 variables plus adjusted for gender, family income, parent education, intervention assignment, family history of mental illness, and history of receiving mental health services.
d Adjusted for Model 3 covariates plus school proportion of economically disadvantaged students.

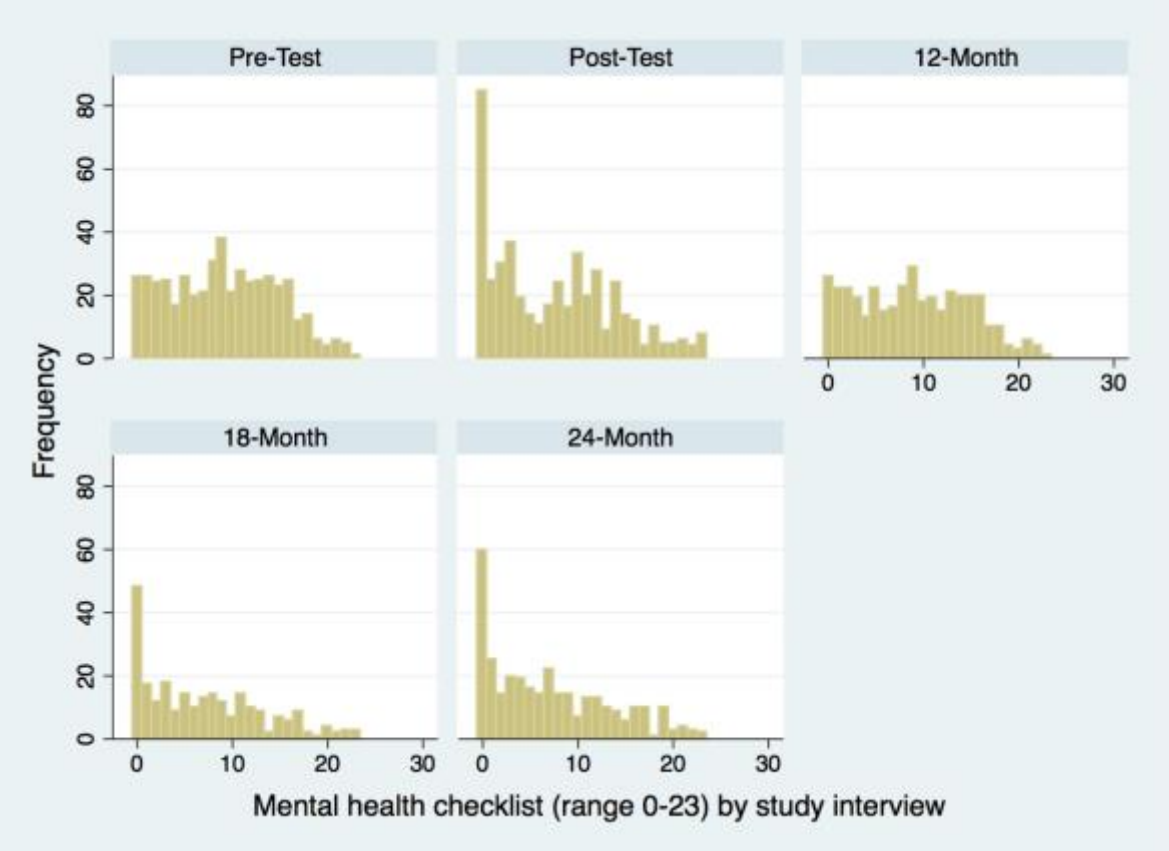
Table A4. Generalized estimating equations models comparing complete cases and MICE analyses; School-based stigma intervention study, Texas, 2011-2012 (N=751)

	Regressing on school proportion of non-Hispanic white enrollment, β (SE)			Regressing on school diversity, β (SE)		
	Full Sample Complete Case (n=635)	**Longitudinal Sample Complete Case (n=429)**	**Longitudinal Sample MICE (n=471)**	**Full Sample Complete Case (n=620)**	**Longitudinal Sample Complete Case (n=429)**	**Longitudinal Sample MICE (n=471)**
Intercept	2.36 (0.23) ***	2.25 (0.30) ***	2.04 (0.30) ***	1.68 (0.22) ***	1.51 (0.28) ***	1.51 (0.28) ***
Study wave						
Post-test	-0.22 (0.03) ***	-0.20 (0.03) ***	-0.20 (0.03) ***	-0.22 (0.03) ***	-0.20 (0.04) ***	-0.20 (0.03) ***
12-Month	-0.02 (0.01) [a]	-0.01 (0.01)	-0.02 (0.01) *	-0.02 (0.01) [a]	-0.01 (0.01)	-0.02 (0.01) [a]
18-Month	-0.30 (0.05) ***	-0.29 (0.05) ***	-0.27 (0.05) ***	-0.30 (0.05) ***	-0.29 (0.05) ***	-0.27 (0.05) ***
24-Month	-0.25 (0.05) ***	-0.24 (0.05) ***	-0.25 (0.05) ***	-0.25 (0.05) ***	-0.24 (0.05) ***	-0.25 (0.05) ***
Student covariates						
Race/ethnicity						
NH black	-0.15 (0.10)	-0.19 (0.13)	-0.13 (0.13)	0.08 (0.30)	0.11 (0.37)	0.12 (0.37)
Hispanic/Latino	-0.17 (0.10) [a]	-0.15 (0.13)	-0.17 (0.13)	0.48 (0.27) [a]	0.60 (0.33) [a]	0.48 (0.32)
Other group	-0.33 (0.16) *	-0.59 (0.25) *	-0.50 (0.23) *	0.20 (0.56)	0.02 (0.70)	0.10 (0.68)
Gender						
Female	0.09 (0.05) [a]	0.11 (0.05) [a]	0.10 (0.05) [a]	0.09 (0.05) [a]	0.09 (0.05) [a]	0.09 (0.05) [a]
Family income						
<$40K	0.07 (0.07)	0.11 (0.08)	0.10 (0.08)	0.08 (0.07)	0.12 (0.08)	0.12 (0.08)
$40-75K	0.07 (0.07)	0.14 (0.08)	0.12 (0.08)	0.09 (0.07)	0.15 (0.08) [a]	0.13 (0.08) [a]
Parent education						
≤ H.S. diploma	-0.03 (0.06)	-0.03 (0.07)	-0.04 (0.07)	-0.02 (0.06)	-0.03(0.07)	-0.03 (0.07)
Intervention assignment						
Curriculum	0.13 (0.07) [a]	0.20 (0.09) *	0.24 (0.08) **	0.13 (0.07) [a]	0.19 (0.09) *	0.22 (0.08) **
Contact	0.13 (0.07) *	0.18 (0.08) *	0.20 (0.08) *	0.15 (0.06) *	0.18 (0.08) *	0.18 (0.08) *
Curriculum/contact	0.10 (0.08)	0.15 (0.10)	0.16 (0.10)	0.09 (0.08)	0.16 (0.09) [a]	0.18 (0.09) *
Family history of mental illness						
Yes	0.10 (0.05) *	0.10 (0.06) [a]	0.13 (0.06) *	0.11 (0.05) *	0.11 (0.06) [a]	0.14 (0.06) *
Past mental health service use						
Yes	0.23 (0.05) ***	0.22 (0.06) ***	0.19 (0.06) ***	0.23 (0.05) ***	0.22 (0.06) ***	0.20 (0.06) ***
School covariates						
% NH white enrollment	-0.40 (0.28)	-0.38 (0.36)	-0.19 (0.35)	n/a	n/a	n/a
Diversity Index	n/a	n/a	n/a	0.75 (0.36) *	0.95 (0.47) *	0.85 (0.48) [a]
% Economically disadvantaged	-0.33 (0.21)	-0.30 (0.28)	-0.12 (0.27)	-0.18 (0.90)	-0.24 (0.13) [a]	-0.21 (0.12) [a]
Student by School						

Interactions						
NH black X % NH white	0.47 (0.33)	0.54 (0.36)	0.63 (0.34) [a]	n/a	n/a	n/a
Hispanic/Latino X % NH white	0.07 (0.28)	0.29 (0.29)	0.34 (0.28)	n/a	n/a	n/a
Other X % NH white	0.23 (0.43)	0.41 (0.54)	0.17 (0.55)	n/a	n/a	n/a
NH black X Diversity	n/a	n/a	n/a	-0.19 (0.50)	-0.17 (0.63)	-0.13 (0.62)
Hispanic/Latino X Diversity	n/a	n/a	n/a	-1.03 (0.46) *	-1.18 (0.58) *	-0.92 (0.57)
Other X Diversity	n/a	n/a	n/a	-0.76 (0.90)	-0.80 (1.14)	-0.88 (1.11)

Notes: All models adjust for time, gender, family income, parent education, intervention assignment, family history of mental illness, past mental health service use, and percent economically disadvantaged students in school.
Referent groups include: NH white race/ethnicity, pre-test time point, male gender, >$75K family income, some college or more parent education, control assignment, and no family history or past mental health service use.
Abbreviations: "NH": Non-Hispanic, "K": thousand in annual income, "H.S.": high school, and "n/a": not applicable.
[a] $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Figure A1. Histogram of mental health symptoms checklist scores by study wave



Chapter 3: An Empirical Analysis within Hispanic/Latino group

"Does the Effect of School Race/Ethnic Composition on Mental Health Symptoms Vary by Acculturative Stress? An Empirical Analysis in Mexican and Chicano Youth"

Abstract

Objectives: Studies that have examined the effect of race/ethnic composition in schools on mental health outcomes have identified that increasing race/ethnic diversity is associated with fewer mental health symptoms for Hispanic/Latino youth. However, these studies have not tested within Hispanic/Latino group differences by meaningful factors that vary within the Hispanic/Latino group that may help explain the patterns found across groups. New evidence relevant to these issues is provided by examining patterns in mental health symptoms with respect to school race/ethnic composition and acculturative stress.

Methods: Analysis used a sub-sample from a linked dataset of youth identifying as Hispanic/Latino (N=234) where 91% identified as Mexican/Chicano. The data set combines, 1) publically available data about school racial/ethnic composition, and 2) an existing diverse sample of sixth-graders who participated in an anti-stigma intervention. A longitudinal self-administered survey assessed mental health symptoms over five time points and included acculturation and acculturative stress measures. Repeated measures Poisson regression was used to test if the mental health impact of school race/ethnic composition varied among the Hispanic/Latino sample according to acculturative stress. Density of English language learners in the school was also explored.

Results: Hispanic/Latino youth who experience high as compared to low acculturative stress had an estimated incidence rate ratio of 0.22 for mental health symptoms for every one-unit

increase in school race/ethnic diversity during the 24-month study period. The point at which high and low acculturative stress experienced the same predicted levels of symptoms occurred when school diversity index was equal to about 0.70, a high-level diversity index. The proportion of non-Hispanic white and English language learner enrollment did not have a significant association with mental health symptoms as a main or interactive effect.

Conclusions: Mental health symptoms decreased for Hispanic/Latino youth experiencing high acculturative stress in schools with greater race/ethnic diversity, suggesting that Hispanic/Latino youth are not all similarly impacted but rather impact varies by the degree of acculturative stress. As acculturative stress taps into aspects of discrimination, perceived discrimination may also be an underlying mechanism linking school race/ethnic diversity and mental health outcomes.

INTRODUCTION

Schools are projected to be more racially and ethnically diverse over the next century largely due to growth in the Hispanic/Latino population.[1] Though schools will likely always vary considerably in terms of their race/ethnic composition, Hispanic/Latino youth have and continue to be funneled into racially and ethnically segregated schools that are also often economically disadvantaged.[2] Previous evidence suggests a significant effect of school race/ethnic composition on mental health outcomes particularly for racial/ethnic minorities, a pattern that was replicated in Chapter 2.[3-9] For Hispanic/Latino youth, increasing non-Hispanic white enrollment is negatively associated with mental health outcomes.[3-9] Despite evidence that aggregating Hispanic/Latinos into one ethnic group masks within group variation in the prevalence and risk of mental health problems, only one study in Chapter 1 assessed an analysis specific to the Hispanic/Latino group by examining the effect of the proportion of English language learner enrollment.[3] Thus, this final chapter explores within Hispanic/Latino group variation in terms of the effect of school race/ethnic composition on mental health symptoms.

Patterns in Mental Health Outcomes Among and Within Hispanic/Latino Youth

Hispanic/Latino youth as a group consistently report higher rates of feeling sad or hopelessness and depressive symptoms in the past year compared to non-Hispanic white and black youth.[10-12] The National Comorbidity Survey–Adolescent Supplement compared non-Hispanic white to Hispanic/Latino youth and found an increased risk of lifetime mood disorders and a smaller likelihood of receiving services in Hispanic/Latino youth regardless of level of impairment the youths were experiencing.[13,14] In the National Longitudinal Study of Adolescent Health, Hispanic/Latinos reported the highest levels of depressive symptoms of all groups across three waves.[15] From the Centers for Disease Control's Youth Risk Behavior Survey. all five

items assessing suicide-related behaviors and events including sad mood, suicide ideation, and suicide attempts were higher in Hispanic/Latino compared to non-Hispanic white youth ever since 1990 when the survey was first implemented on an annual basis.[16] Socioeconomic and demographic differences may explain some of these patterns.[17] Of note, many national studies have systematically excluded non-English speaking populations and consequently excluded immigrant and undocumented populations; thus, these findings do not generalize to these populations. Mental health disparities may be larger as these populations face great adversity.[18]

Conceptualizing Hispanic/Latinos as a homogeneous group becomes problematic particularly in the area of race/ethnic disparities research in mental disorders, psychopathology, and service utilization.[19-22] While using the Hispanic/Latinos group for studying between group differences can quantify the magnitude of difference across groups as in Chapter 2, the use of Hispanic/Latinos as a homogenous group cannot identify factors that explain the mechanisms behind the disparities that are unique to the Hispanic/Latino group. The Hispanic/Latino group encompasses a wide range of national backgrounds, social classes, races, legal statuses, migration experiences, literacies either singly or combination of English, Spanish or indigenous languages, genders, and other distinctions; yet some shared linkages include Spanish language use and cultural values.[21-23] To explain the statistical association in race/ethnic differences found in Chapter 2, that fewer predicted depressive-anxious symptoms were found with greater school diversity among Hispanic/Latinos, other constructs of immigrant adaptation and discrimination that describe heterogeneity must be measured and evaluated.[21-23]

There is considerable variation in mental health risk among Hispanic/Latino youth. Those with increased contact with a country or territory outside of the continental United States including Mexico, Latin America, and Caribbean in terms of birthplace and years lived is

protective for mental health. On the other hand, those who were born and spent more years in the continental United States have increased psychiatric risk where the risks/harms may outweigh the benefits of social mobility.[19,24-29] These patterns have been replicated in youth identifying as Puerto Rican and Mexican. Studies also have identified a critical period where Hispanic/Latinos who arrive in the continental United States before 7-12 years, or the "1.5 generation," result in the same poorer mental health outcomes as those born in the United States.[30] Discrimination and lacking legal documentation among youth and/or their families is associated with increased risk of depressive symptoms and anxiety particularly among youth and families that have both documented and undocumented members (i.e. mixed-status).[31,32]

The Impact of Acculturation and Acculturative Stress on Mental Health in Hispanic/Latino Youth

Acculturation, defined as the adaptation or preservation of particular cultural norms and values that control and shape healthy and unhealthy behavior,[33,34] describes an aspect of immigrant and cultural adaptation along with other factors such as birthplace, generation status, age of migration, years lived in the United States, citizenship, documentation status, degree of contact with country(s) of heritage, and perceived discrimination.[21,35] While including these multiple factors to examine the effects of immigrant adaptation on health is comprehensive and most informative, some factors such as documentation status are particularly sensitive and increasingly unsafe to measure in certain local contexts in the United States. Thus, acculturation may be a practical alternative for estimating meaningful heterogeneity and interpreting "ethnic" effects in research. Specifically, if language use and social affiliations are of interest, measures of acculturation typically emphasize language preferences and amount socially embedded in one group over another. In fact literature has shown that increased acculturation increases risk for anxiety, depression, low self-esteem, conduct problems, and other psychiatric disorders in

youth.[19,29,36-39] Acculturation is also independently and positively correlated with suicide attempts among Hispanic/Latinos, even in those without psychiatric problems and particularly among girls and those with high levels of family conflict.[40]

Relatedly, acculturative stress arises when the acculturation process causes problems for youth as they face conflicts between customs and culture found in the continental United States and a Hispanic/Latino heritage and culture.[41,42] Hispanic/Latino youth often must grapple with multiple identities which can be problematic for mental health in many ways. For example, individuals may lose the sense of belonging, experience a change or loss of a culture, feel overwhelming obligation to family, or feel isolated due to fear of vulnerabilities in a new environment.[43] Hispanic/Latino youth may experience language barriers that result in discrimination (e.g. jokes at school or at home about having an accent or limited proficiency in English or Spanish) or challenges in communication in interpersonal relationships (e.g. negotiating with parents across different languages and cultural expectations).[44] Hispanic/Latino youth may experience gender role inversions: men may take on more household duties where women take on paid work outside of the home, challenging the notion of "machismo"; or youth may prefer "Latinx/Latin@", a gender-neutral identity which practice and semantics around it are not widely accepted in Latin America. Parent-child role inversions are possible too: children may take on responsibilities typically belonging to a parent because they have the skills or the language abilities to do so and learn and know the systems in the United States better than their parents. Youth may also face questions from others about social class from "De que barrio son?" ("what neighborhood are you from?") to "Where will you go to college?". Measures of acculturative stress tap into these challenges from grappling with multiple identities.

Acculturative stress has been found to be associated with higher levels of suicidal thoughts, depression, and anxiety, particularly among girls.[40,45-50]

Testing Hispanic/Latino Group Differences by Acculturation Factors of Chapter 2 Findings

Most research regarding the prevalence of and risk factors for mental health problems among Hispanic/Latino youth has been in household and national surveys.[10,18,21,51] How the school context, particularly the racial and ethnic make-up of the school, shapes mental health outcomes of Hispanic/Latino youth has not been explored. As Chapter 1 and 2 found that Hispanic/Latino youth experience fewer depressive-anxious symptoms in schools with less non-Hispanic white enrollment and greater race/ethnic diversity, Chapter 3 aims to investigate within Hispanic/Latino group differences of these patterns using measures of acculturation and acculturative stress. Race/ethnic composition will be tested in two ways: 1) race/ethnic density measured as the proportion of non-Hispanic white enrollment, and 2) race/ethnic diversity, a calculated index that uses the proportions of individual race/ethnic groups. The effect of the race/ethnic density and diversity may vary among Hispanic/Latinos according to acculturation factors or acculturative stress. Finding within group variation would indicate that some Hispanic/Latinos are not influenced by non-Hispanic white enrollment and appear more as non-Hispanic white youth in terms of mental health risk such as those with fewer social ties to Hispanic/Latinos or those with less of a preference for Spanish language. The second construct, school diversity (i.e. range and representation of different race/ethnic groups in school), will test if the mental health benefit of increasing school race/ethnic diversity in Hispanic/Latino youth found in Chapter 2 varies according to social or language preferences or acculturative stress.

Two data sources were linked to conduct these empirical analyses: (1) a school-based randomized controlled intervention funded by the National Institutes of Mental Health (NIMH)

that aimed to reduce stigma and promote help-seeking for mental illness;[52] (2) public data from the Texas Education Agency (TEA) on the 14 participating schools in Texas that comprised the study.[53] The NIMH-study contains comprehensive and longitudinal data regarding the social and mental conditions for 234 Hispanic/Latino sixth graders who completed measures of acculturation factors: 91% identified as Mexican/Chicano. Notable strengths of this study are the collection of relevant data over six waves in multiple schools that vary with respect to race/ethnic composition. Studying sixth-graders is also of developmental importance; mental health symptoms emerge at this age and issues of truancy and drop-out are not prevalent as in high-school samples. Examining how the school context can uniquely impact the mental health of Hispanic/Latino youth can advance scientific understanding regarding how psychiatric risk among Hispanic/Latino youth may develop in a school context in the United States.

METHODS

Chapter 3 utilizes the same longitudinal dataset as Chapter 2 from an evaluation of the effectiveness of three anti-stigma school-based interventions aimed at changing mental health attitudes. The selection of participants, design, and procedures of the intervention are described in detail elsewhere and in Chapter 2.[52] As the research aims of Chapter 3 pertain to the Hispanic/Latino group, Chapter 3 utilizes youth who self-reported as Hispanic/Latino only. Though the survey was offered in either English or Spanish, all youth completed the survey in English. The majority of the Hispanic/Latino sample agreed to participate in both Phase I and II of the study (i.e. longitudinal sample; n=234 youth) while 94 agreed to Phase I only. The longitudinal sample had more youth coming from families with an income of less than $40,000 and a history of mental illness, but fewer youth in the curriculum only intervention group. The samples were not significantly different in mental health variables, gender, ethnicity, parent

education, past mental health service use, and school proportion of non-Hispanic white or economically disadvantaged enrollment. After being given information about the study, parent consent and student active assent was required for participation. The study was approved by the Institutional Review Boards of MHMR of Tarrant County, the primary mental health community center of this county, and Columbia University Medical Center.

Study Sample

In the Hispanic/Latino longitudinal sample, more than half were female and had a mean age of 11.5 years at baseline (Table 1). The majority of the Hispanic/Latino sample identified as Mexican/Chicano (91%); other ethnicities included Puerto Rican, Cuban and other Hispanic/Latino backgrounds. Among all Hispanic/Latino youth, 41% preferred using English at home. About 72% came from families that had an annual income of less than $40,000 and about two-thirds had parents with a high school diploma or less. As in Chapter 2, the NIMH-study was linked to publicly available data on each of the participating schools that comprised this study. The public data on the schools from the TEA[53,54] from the same year as the pre-test survey was linked to each Hispanic/Latino student in the NIMH-study by matching the student school assignment and detail to the TEA composite school data. The current analysis used the proportions of race/ethnic groups in each participating school to measure non-Hispanic white enrollment and to calculate school race/ethnic diversity, as well as the proportion of students enrolled as English language learners and socioeconomically disadvantaged.

Measures

Dependent variables. A self-reported mental health symptoms checklist was administered to youth at pre-posttest, 12-, 18-, and 24-month interviews. The mental health checklist provided a compact screen that drew on items from the National Institute of Mental

Health Diagnostic Interview Schedule for Children, Version IV.[55] Exploratory factor analysis of youth self-reported symptoms suggested one factor and that using the full 23-item scale fit the data better than reduced scales (alpha = 0.90; see Appendix Table 1). However, factor analysis of the parent reports of symptoms pertaining to their child suggested a two-factor specification: 1) symptoms of depression and anxiety; and 2) symptoms of hyperactivity and attention issues. As race/ethnic composition was expected to evoke a specific effect on depressive and anxious symptoms and not hyperactivity, youth self-reported items were summed to create three count variables to explore patterns by symptom type and examine hyperactivity as a negative control: 1) all items combined to create a global mental health score; 2) depressive-anxious symptoms only; and 3) hyperactive-attention symptoms only.

School race/ethnic composition. Race/ethnic composition was measured in two ways: 1) race/ethnic density, and 2) diversity. To measure race/ethnic density, non-Hispanic white enrollment at each school was obtained from the TEA data. Because the distribution of non-Hispanic white enrollment in schools was restricted by examining a sample of Hispanic/Latino youth only, tertiles of non-Hispanic white enrollment at each school were created to distinguish segregated schools enrolling predominantly Mexican/Chicano students from schools with greater non-Hispanic white enrollment. Thus, tertiles included 3.80-5.00%, 5.01-15.80%, and 15.81-70.40% non-Hispanic white enrollment, respectively (Table 1).

The Simpson diversity index[56] measured school race/ethnic diversity and was previously validated for use in demography, education, and social science research.[57-61] The diversity index measures the range of different race/ethnic groups in a school, and the general representation of each race/ethnic group in a school. Diversity, ranging from 0 to 1, equals the probability that two youth taken at random from the sample represent the same race/ethnicity. Using the

percentages of non-Hispanic white, non-Hispanic black, Hispanic/Latino, and other race/ethnic group in school from the TEA data, the diversity index was calculated using the following formula, $D = 1 - \sum(n^2)$, where 'n' represents the proportion of each race/ethnic group. A higher index was interpreted as greater race/ethnic diversity in the school.

School proportion of English language learners. Percent of English language learners (ELL) at each school was also obtained from the School Report Cards and included students identified as having limited English proficiency by the Language Proficiency Assessment Committee according to criteria established in the Texas Administrative Code. Not all, but most students identified as ELL received bilingual or English as a second language instruction. The school proportion of ELL enrollment was calculated by the TEA by dividing the number of ELL students by the total number of students in the school.

Acculturation and acculturative stress. The NIMH-study survey did not include items assessing immigration or migration history such as birthplace, generation status, citizenship, or documentation status as study investigators believed that this information was too sensitive in the local context and would potentially deter families from participating. Therefore, measures of acculturation and acculturative stress previously validated for use in Mexican American youth samples[40,42,62] were administered at the 6-month survey to tap into aspects of bicultural adaptation in the United States.[21] To test within group variation of the effect of school race/ethnic composition on mental health outcomes, the 12-item Short Acculturation Scale for Hispanics (SASH) measured preferences in terms of language and social relationships among Hispanic/Latino youth (see Appendix Table 2).[42,62] Responses to items about language preferences were based on a Likert scale ranging from "Only Spanish", "More Spanish than English", "Both Equally", "More English than Spanish", and "Only English." Similarly, items

assessing social preferences were responded to using a Likert scale ranging from "All Latinos/Hispanics/Mexicans", "More Latinos/Hispanics/Mexicans than Anglos", "About Half and Half", "More Anglos than Latinos/Hispanics/Mexicans", and "All Anglos."

Principal axis factor analysis suggested three dimensions (see Figure 1) allowing the creation of three scales: 1) home language preference, 2) personal and media language preference, and 3) social preferences. Items with high loadings (>0.40) on the same factor were summed to create composite scales of between three and five item scales (see Appendix Table 2). I examined content validity of the items that clustered on the same factor and then labeled the scales. 'Home language preference' (range 4 to 20; $\alpha = 0.81$) consisted of four items concerning personal language preferences and language spoken with parents and at home. 'Media language preference" (range 5 to 25; $\alpha = 0.81$) is a five-item scale centered around the language that the youth thinks in, speaks in, and prefers for television watching, movies, or listening to the radio. Finally, "social preferences" (range 3 to 15; $\alpha = 0.68$) consisted of three items concerning the amount embedded with Hispanic/Latino compared to Anglo people.

Acculturative stress was measured using a modified version of the Social, Attitudinal, Familial, and Environmental (SAFE) Acculturative Stress in Children scale (range 20-120; $\alpha = 0.89$). Items were summed with lower values indicating lower levels of acculturative stress.[42] Items measured the level of stressfulness from experiences of discrimination, feeling like an outsider, and being faced with different expectations (see Appendix Table A3). The top tertile of scores was used as a cut-off to create a dichotomous variable of "0 Low acculturation stress" and "1 High acculturation stress". Finally, self-reported language preference in the survey was cross-referenced with the language items in both the SASH and SAFE scales.

Covariates. The analyses controlled for several covariates; some were common causes of the exposure and outcome of interest, while others were included due to having theoretical and statistical importance. A theoretically important covariate included gender (male—referent category). Family socioeconomic status, a common cause of school race/ethnic composition and mental health outcomes, was measured using parent reports of family income (0 "<$40,000", 1 "$40K-$75K", 2 ">$75K") and parent education (0 "High school diploma or less", 1 "Some college or greater"), with the highest income and education level serving as the referents. To control for and examine the potential modifying influence of the NIMH-study intervention, dummy variables indexed the intervention cell the youth was assigned to: curriculum, contact, curriculum/contact combination, and control—referent. Study wave indexed time using the pre-test survey as the referent. Finally, to control for history of mental illness that may be associated with the outcome, I controlled for family history of mental illness (0 "None/Don't Know" —referent, 1 "Yes") and past formal mental health service use including a doctor, therapist or school counselor (0 "None/Don't Know" —referent, 1 "Yes") as reported at baseline.

School socioeconomic status, also a common cause of school race/ethnic composition and mental health outcomes, was measured using the percentage of economically disadvantaged students and per pupil expenditure in the TEA data. The percent of economically disadvantaged students in the school was calculated by the TEA as the sum of students coded as eligible for free or reduced-price lunch or eligible for other public assistance, divided by the total number of students in the school. Total operating expenditures per student was also calculated by the TEA taking the annual school expenditures and dividing it by the total number of students enrolled in the school that year. The total operating expenditures per student was not the amount actually spent on each and every student, but rather a per pupil average of the total.

Data Analysis

Generalized estimating equations (GEE) were used to analyze the correlated longitudinal data with the three mental health count variables summed over five time points as the outcomes.[63,64] All Hispanic/Latino youth from the longitudinal component of the study were included in the model. The distribution of the outcome was assessed overall and by study assessment. The histograms of the count outcome suggested a Poisson family and a log link to appropriately model the Poisson distribution. After the family and link were determined, an exchangeable correlation structure was selected to account for clustering at the student and school levels. Robust standard errors (e.g. Huber/White Sandwich Estimators) were used to allow the estimates to be valid in the event of a misspecification of correlation structure. GEE models are robust to misspecification of the correlation structure; however, the QIC statistic and consistency across coefficients and standard errors using different specifications of correlation structures suggested that an exchangeable correlation was sufficient.[63,64]

For multivariate GEE modeling, the associations between school race/ethnic density (i.e. tertiles of non-Hispanic white enrollment) and global mental health outcomes adjusted for time and acculturative stress were modeled. Next, to investigate whether the relationship between tertiles of non-Hispanic white enrollment and mental health varied by acculturative stress, an interaction term between acculturative stress and tertiles of non-Hispanic white enrollment was added and included in all subsequent models. Then I examined whether the effects of tertiles of non-Hispanic white enrollment were attenuated after adjusting for gender, family socioeconomic status, intervention assignment, history of family mental illness, past mental health service use, and acculturation variables (i.e. home language, media language, and social preferences). The final model added the school socioeconomic indicator of proportion of economically

disadvantaged students. Additionally, I tested for potential interactions with all covariates (n=22 tests) including with the acculturation variables and found none to be significant. I found no statistically significant association with per pupil expenditure in the data; thus, percentage of economically disadvantaged students adjusted for school socioeconomic status.

Using the same model building process, four models were estimated for depressive-anxious symptoms and hyperactive-attention symptoms to test the effect specifically in depressive-anxious symptoms and then separately in hyperactive-attention symptoms as a negative control. Lastly, in addition to regressing on race/ethnic density using tertiles of percent non-Hispanic white enrollment, a separate series of GEE models were built using the same step-wise model building process to test the association between 1) race/ethnic diversity, and 2) the proportion of English language learner enrollment, on the mental health outcome variables. Stata SE 14 was used to estimate descriptive sample statistics and GEE models.[65]

Sensitivity Analyses

Several sensitivity analyses were conducted to test whether findings from alternative GEE regression models were robust to changes in model specification and in the approach to addressing missing data. To address missing data in the longitudinal sample, models were run using, 1) a complete case analysis where all time points were available, and 2) a multiple imputation strategy. The following variables required imputation: mental health checklist items, family income, parent education, acculturation variables, and acculturative stress (see % Missing in Table 1). To fill in missing values of these variables, the multiple imputation analysis used other available variables that were found to be correlated with the missing variables which included student characteristics, bullying behaviors, familiarity with mental illness, family functioning, and number of rooms in the home. All available covariate and outcome data to be

used in GEE models were also used to impute the missing values. GEE analyses were conducted for each of 20 imputed data sets as the largest 'Fraction of Missing Information' was about 20% for family income. The results were combined according to Rubin's rules, improving the analytic sample size from n=157 in complete case to n=206.

The size and direction of the effect of the covariates were similar across the different analytical approaches (i.e. complete case analyses and multiple imputation); however, the interaction terms between school and acculturation variables were attenuated in the imputed dataset. I present the results from the multiple imputation analysis of the longitudinal sample. Stratified analyses were also used to test whether our findings varied by gender. Because results were similar, the combined findings are presented. Finally, a three-level multi-level model approach with time nested in students that were nested in schools was considered for analysis. However, the calculated Intraclass Correlation Coefficient in the crude model was less than 1% indicating that the observations within schools are no more similar than observations from different schools. Thus, GEE modeling was sufficient to test the research questions.

Results

Table 1 presents the distribution of sample characteristics at pre-test, where the mean score on the mental health checklist was about 8.5 (range 0-23). About 32% had a family history of mental illness and about a fifth had received mental health services in the past. Among all Hispanic/Latino youth, about 43% experienced high acculturative stress. Table 1 also summarizes missing data on the variables included in these analyses. Less than 5% were missing a combination of gender and mental health symptoms while 10-12% were missing family income and parent education. About 23% of the Hispanic/Latino sample did not complete acculturation measures. Multiple imputation resulted in no imputes for those missing on gender; thus, missing

values were imputed for the following variables: mental health symptoms, family income, parent education, acculturation, and acculturative stress. In terms of school race/ethnic composition, Hispanic/Latino youth attended schools had an overall diversity index of 0.53 and ranged between 4-70% non-Hispanic white enrollment. On average, they attended schools that enrolled 81% economically disadvantaged and 42% English language learner students.

Density of non-Hispanic white enrollment and mental health symptoms

Table 2 presents the resulting incidence rate ratios of global mental health symptoms from the fully adjusted GEE model regressing on tertiles of non-Hispanic white enrollment. To build the fully adjusted model, first tertiles of non-Hispanic white enrollment was modeled, adjusting for time and acculturative stress. The main effect for tertiles of non-Hispanic white enrollment was found to be not significant while acculturative stress was found to be positively and significantly associated with the mental health outcome ($P < 0.01$). To test if this main effect varied by acculturative stress, a second model added an interaction term between tertiles of non-Hispanic white enrollment and acculturative stress; the term was found to be not significant. Next, covariates were added to include gender, family income, parent education, intervention assignment, family history of mental illness, past mental health service use, and acculturation variables. No changes to the null main or interactive effect were found. The final model added the proportion of economically disadvantaged students in school. As the interaction between acculturative stress and the tertiles capturing the proportion of non-Hispanic white enrollment in school was consistently found to be not significant, the results in Table 2 exclude the interaction.

Table 2 presents the results of the model examining the main effect of acculturative stress and tertiles of the proportion of non-Hispanic white enrollment, adjusting for time, gender, family income, parent education, intervention assignment, family history of mental illness, past

mental health service use, and acculturation variables. The main effect of non-Hispanic white enrollment and acculturation variables were not significant. However, high compared to low acculturative stress was found to be positively and significantly associated with mental health symptoms (Incident Rate Ratio (IRR) = 1.27; 95% Confidence Interval (CI): 1.07, 1.51). The sensitivity of these findings with respect to symptom type was examined (i.e. depressive-anxious versus hyperactive-attention), but no differences were found (results not shown).

School race/ethnic diversity and mental health symptoms

Using the same model building process for understanding the effect of school race/ethnic density, Table 3 presents the results of the GEE model of global mental health, depressive-anxious symptoms, and hyperactive-attention symptoms regressing on school race/ethnic diversity. To build the fully adjusted model, the main effect of the diversity index was tested, adjusting for time and acculturative stress. School diversity and acculturative stress were found to be positively associated with mental health symptoms ($P<0.01$). Next, an interaction term was entered into the model between acculturative stress and school diversity, adjusting for time, and was found to be significant ($P<0.01$). This significant interaction term between acculturative stress and school diversity retained after adjusting for gender, family income, parent education, intervention assignment, family history of mental illness, past mental health service use, acculturation variables, and percent of economically disadvantaged enrollees.

The main effect of acculturative stress was attenuated in the fully adjusted model where youth with high compared to low acculturative stress had an increased incidence rate ratio of 2.83 (95%CI: 1.54, 5.21). The statistically significant interaction term between acculturative stress and school diversity indicated that those with high compared to low acculturative stress saw a reduced rate of mental health symptoms by a factor of 0.22 (95%CI: 0.07, 0.69) for every

one-unit increase in school diversity during a 24-month period, net of covariate adjustments. Sensitivity analyses showed that these patterns were driven primarily by depressive-anxious symptoms (Table 3). In the model assessing depressive-anxious symptoms, a marginally significant main effect for diversity (IRR=2.07; 95%CI: 0.89, 4.82) and a significant main effect for acculturative stress (IRR=3.26; 95%CI: 1.67, 6.34) were found. The interactive effect between the two variables resulted in an incidence rate ratio of 0.17 (95%: 0.05, 0.59).

To better understand the direction and magnitude of the interactive effects found between acculturative stress and school race/ethnic diversity, post-estimates with respect to number of mental health symptoms were obtained.[66] The post-estimation tests were based on the values of diversity found in the data. Post-estimated predicted symptoms were plotted to examine at what point in school diversity do rates of symptoms converge for those with high and low acculturative stress. Figure 2 displays the predicted rates of mental health symptoms net of covariates by acculturative stress levels as school diversity increases along the x-axis. As school diversity increased, the rate of mental health symptoms decreased for youth experiencing high acculturative stress but slightly increased for youth experiencing low acculturative stress (see Figure 2). From the figure, youth with high acculturative stress had higher mental health symptoms than those with low acculturative stress up to a school diversity index about 0.70. For youth with low acculturative stress, symptoms increased with increasing school diversity.

Proportion of English language learners and mental health symptoms

Table 4 presents the results of the GEE model building process for mental health symptoms regressing on the proportion of enrolled English language learners (ELL) at school. Similar to the models regressing on race/ethnic density and diversity, first the main effect of the proportion of enrolled ELL adjusted for time and acculturative stress was examined following by

adding an interaction term between proportion of enrolled ELL and acculturative stress. A marginally significant main effect for proportion of enrolled ELL was found ($P<0.10$) and acculturative stress was found to be positively and significantly associated with the mental health outcome ($P<0.01$); however, the interaction between the two variables was not significant. After adjusting for gender, family income, parent education, intervention assignment, family history of mental illness, past mental health service use, acculturation variables, and percent of economically disadvantaged enrollees, the interaction term remained not significant. Thus, the fully adjusted model is shown without the interaction term. I found no evidence for a significant main effect of density of ELL enrollment on rates of mental health symptoms. Similar patterns were found by examining mental health symptoms separately by type (results not shown).

DISCUSSION

The current study examined if the effect of race/ethnic density (i.e. tertiles of the school proportion of non-Hispanic white enrollment), race/ethnic diversity (i.e. Simson's Index), and the proportion of enrolled ELL on mental health symptoms varied by acculturative stress among a predominantly Mexican/Chicano sample of Hispanic/Latino youth. Overall the analyses examining the main effects of density of non-Hispanic white and English language learner enrollment on mental health symptoms were not significant in addition to their interactive effect with acculturative stress. In these analyses and consistent with prior literature examining the impact of acculturative stress on mental health, acculturative stress had a persistent main effect on mental health symptoms that was both positively and statistically significant.

In the analyses that regressed on school race/ethnic diversity, a statistically significantly interaction was found between acculturative stress and school diversity, net of covariates. Hispanic/Latino youth who experienced high compared to low acculturative stress had a

decreasing incidence rate of mental health symptoms with increasing school diversity during the 24-month study period. Significant and positive independent effects were also found for acculturative stress and marginally so for school diversity. Estimates were adjusted for time, gender, family income, parent education, intervention assignment, history of family mental illness, past mental health service use, acculturation variables, and the proportion of enrolled economically disadvantaged students. For students who experience high acculturative stress, rates of mental health symptoms decreased with greater school diversity, superseding those with low acculturative stress at a school diversity index equal to about 0.70. These findings make an important contribution to understanding the role that the race/ethnic make-up of a school has on mental health symptoms of Hispanic/Latino adolescents.

Little evidence was found to suggest large within group differences with respect to acculturation variables including home language, personal and media language, and social preferences. However, high acculturative stress was found to be associated with increased rates of mental health symptoms as a main effect. That acculturative stress presented as a significant risk factor for mental health symptoms for Hispanic/Latino youth has also been known from prior literature. Thus, the finding that rates of mental health symptoms were suppressed in schools with substantially greater school race/ethnic diversity for Hispanic/Latinos experiencing high versus low acculturative stress is novel. Further these findings were consistent for males and females, but robust only in depressive-anxious and not hyperactive-attention symptoms.

Rates of mental health symptoms diverged according to levels of acculturative stress at a school diversity index of about 0.70, a high index indicating a large range and proportioned sizes of race/ethnic groups. Perhaps attending schools with less race/ethnic diversity increases the chances of a range of negative experiences related to Hispanic/Latino identity and that contribute

to acculturative stress. These negative experiences may include experiencing discrimination and negative stereotypes about one's ethnicity, leading to feelings of isolation and loneliness. As acculturative stress taps into these mechanisms, it is plausible that an increased race/ethnic diversity minimizes the occurrence of these mechanisms particularly in Hispanic/Latino youth with high acculturative stress. Students with low acculturative stress may not be susceptible in school contexts with less race/ethnic diversity as low acculturative stress may also be indicative of the absence of some characteristics that would increase vulnerability, such as having an accent. Policies focused in the mental health of Hispanic/Latino youth may benefit from this evidence regarding how school context shapes mental health outcomes.

The findings also point to the potential for screening for acculturative stress among Hispanic/Latino youth as it may be a strong risk factor for mental health symptoms. Acculturative stress can be an important indicator for current or later mental health distress, particularly in school contexts without a large race/ethnic diversity. Further empirical research can inform if referring youth with acculturative and/or mental health distress to school or mental health counselors may help these youths navigate challenging and stressful circumstances contributing to his/her acculturative stress occurring in and outside of the school.

Main effects examining the proportion of English language learners (ELL) in the school were not significant, which was an unexpected finding. This may be explained in part due to the degree of integration of ELL in the school. For example, some schools segregate classrooms based on language proficiency while other schools may be "bilingual" and integrate English language learners in the same classroom as non-English language learners. This information was not provided in the TEA data. Though all sixth-grade participants completed the survey in English, individual data as being registered as ELL in the school was unknown. Further, the

ELL category may also include English learners who were not Hispanic/Latino or did not have Spanish as a native language. Future research should explore individual ELL status, the meaning of the designation as an ELL, and the degree of integration in the school, exploring the potential role of stigma and consequences to mental health, if any.

Several limitations require discussion. First, the current study uses measures of acculturation as well as school race/ethnic composition at one point in time, the beginning of sixth grade. As the race/ethnic composition of schools can be dynamic and vary over time for youth, longitudinal measures of changes in school context may further understanding of these relationships. Similarly, acculturation and acculturative stress may change over time and are not necessarily fixed measures. Acculturation data collected over time would be able to capture changes experienced by individual students, though it would be unlikely that these factors would drastically change during the 24-month follow-up. Second, as the local setting of the study did not permit sensitive questions regarding birthplace, citizenship, or documentation status, other aspects of immigrant adaption were not assessed. Instead acculturation and acculturative stress measures served as proxies of aspects of immigrant adaptation. Third, as the study aimed to test the direct effects of indicators of race/ethnic composition on mental health outcomes, other indirect effects that can help explain underlying mechanisms were not examined including school attachment and perceived discrimination. Future analyses should examine these mechanisms. Finally, results may not be applicable to other populations of Hispanic/Latino youth in the United States given that the sample was predominantly Mexican/Chicano in public schools in Texas and not reflective of other Hispanic/Latino groups in the United States.

Despite these limitations, the study provides new knowledge regarding the effect of race/ethnic composition on mental health symptoms during 24-months in a Hispanic/Latino

sixth-grade sample. This study was a unique opportunity to examine within the Hispanic/Latino group in a school context by acculturative stress. Using reliable and validated measures of mental health symptoms in youth recommended for research,[55] new data was offered regarding the impact of school race/ethnic race/ethnic composition on mental health symptoms in Hispanic/Latino youth. In addition to using the validated mental health measures with data available over time, differences by symptom type were explored. To my knowledge, this is the first attempt at a within Hispanic/Latino analysis assessing the impact of the race/ethnic make-up in schools on mental health outcomes, providing a foundation for understanding how school context may impact mental health uniquely for Hispanic/Latino youth and differently within the Hispanic/Latino group. The study period in the analyses span approximately two and half years of middle school (sixth to eighth grade) where this area of research is most appropriate— mental health symptoms begin to emerge and drop-out and truancy are not yet prevalent as in high school samples. As the exposure was captured at baseline, temporal order was established in which baseline school race/ethnic composition in sixth grade was used to measure the rates of mental health symptoms over the length of a middle school period. Finally, results can apply to Hispanic/Latino youth in Texas and Mexican/Chicano youth in the United States.

Future research should test the underlying mechanisms for less mental health distress in Hispanic/Latinos with high acculturative stress in schools with greater school diversity. Prior research suggest school attachment, perceived discrimination, and ethnic-specific support and programming including resources for multi-lingual speakers that is embedded in the school curriculum and culture as potential mechanisms linking race/ethnic composition and mental health outcomes.[8,67] Research is needed that explores these mechanisms and tests ways to feasibly modify these factors in a school context. Future research should assess if differences by

race or race/ethnic identity within the Hispanic/Latino group particularly as it relates to institutional and interpersonal discrimination. Finally, acculturative stress items assessed the social and family domains but should be expanded to include items regarding the school context including interactions between peers, teachers, and parents. Mixed methods and qualitative research of a student's experience regarding the school race/ethnic composition can help our understanding of mechanisms and develop strategies for intervention.

This study adds to the knowledge base regarding acculturative stress as a risk factor for mental health distress among Hispanic/Latino youth by evaluating the risk factor in the school context: youth with high compared to low acculturative stress saw fewer mental health symptoms in school contexts with greater school diversity. On the other hand, non-Hispanic white enrollment was not found to be associated with mental health outcomes. Further research is necessary to explain the null findings with respect to density of students enrolled as English language learners. As Hispanic/Latinos represent a significant proportion of the public-school population and as immigrant and Mexican/Chicano groups in the United States increasingly experience high levels of stress as a community, school-based interventions and policies that improve mental health outcomes for Hispanic/Latino youth in schools, particularly in schools with less race/ethnic diversity, are recommended.

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Tables

Table 1. Baseline sample characteristics in the longitudinal sub-sample identifying as Hispanic/Latino; School-based stigma intervention study, Texas, 2011-2012 (N=234)

	Mean (SD) or %	% Missing (N)
Mental health outcomes		
Global mental health score (0-23)	8.55 (5.69)	2.56 (6)
Depressive-anxious symptoms (0-17)	5.74 (4.01)	2.56 (6)
Hyperactive-attention symptoms (0-6)	2.74 (1.78)	2.56 (6)
Student covariates		
Female	55.79	0.43 (1)
English language preference	41.38	0.85 (2)
Hispanic/Latino ethnicity		2.99 (7)
Mexican/Chicano	91.19	
Other group	8.81	
Family income < $40,000	72.33	11.97 (28)
Parent education ≤ H.S. diploma	65.50	9.83 (23)
Intervention assignment		0 (0)
Curriculum	16.19	
Contact	36.91	
Curriculum and Contact	16.11	
Control	30.79	
Family history of mental illness	31.63	0 (0)
Past mental health service use	21.06	0 (0)
Acculturation		
Home language preference (4-20)	11.08 (3.78)	23.5 (55)
Media language preference (5-25)	19.91 (3.63)	23.5 (55)
Social preference (3-15)	7.39 (2.30)	23.08 (54)
Acculturative stress		
High	43.60	23.08 (54)
School covariates		
Non-Hispanic white enrollment		0 (0)
Tertile 1: 3.80-5.00%	37.16	
Tertile 2: 5.01-15.80%	31.80	
Tertile 3: 15.81-70.40%	31.04	
Diversity index	0.53 (0.15)	0 (0)
% English language learners	42.22 (17.78)	0 (0)
% Economically disadvantaged	81.43 (19.46)	0 (0)

Notes: Baseline mean and standard deviations are shown for continuous and count variables and percentages are shown for categorical variables, presented as "Mean (SD)" or "%". "≤H.S. diploma" denotes "Less than or equal to High School diploma"

Table 2. Generalized estimating equations predicting incidence rate ratios of mental health symptoms and regressing on race/ethnic density using tertiles of non-Hispanic white enrollment; School-based stigma intervention study, Texas, 2011-2012 (N=234)

	Global Mental Health IRR (95%CI)
Intercept	5.43 (2.47, 11.92) ***
Study wave	
Post-test	0.79 (0.70, 0.88) ***
12-Month	0.97 (0.94, 1.00)
18-Month	0.73 (0.63, 0.85) ***
24-Month	0.76 (0.65, 0.88) ***
Student covariates	
Gender	
Female	0.95 (0.81, 1.12)
Family income	
< $40,000	1.27 (0.95, 1.71)
$40,000-$75,000	1.39 (1.04, 1.88) *
Parent education	
≤ H.S. diploma	0.98 (0.80, 1.21)
Intervention assignment	
Curriculum	1.19 (0.91, 1.56)
Contact	1.17 (0.95, 1.44)
Curriculum/contact	1.23 (0.95, 1.61)
Family history of mental illness	
Yes	1.12 (0.94, 1.32)
History of mental health services	
Yes	1.30 (1.09, 1.54) **
Home language preference	1.00 (0.98, 1.03)
Media language preference	1.01 (0.98, 1.03)
Social preference	1.00 (0.96,1.04)
Acculturative stress	
High	1.27 (1.07, 1.51) **
School covariates	
% Non-Hispanic white enrollment	
Tertile 1: 3.80-5.00%	0.96 (0.72, 1.27)
Tertile 2: 5.01-15.80%	0.90 (0.69, 1.19)
% Economically disadvantaged	0.81 (0.45, 1.48)

Notes: All models adjust for time, gender, family income, parent education, intervention assignment, family history of mental illness, past mental health service use, acculturation variables, acculturative stress, and percent economically disadvantaged students in school.
Referent groups include: Pre-test time point, male gender, >$75K family income, some college or more parent education, control assignment, no family history or past mental health service use, low acculturative stress, and third tertile of non-Hispanic white enrollment.
Abbreviations: "NH": Non-Hispanic and "H.S.": high school.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 3. Generalized estimating equations predicting incidence rate ratios of mental health symptoms and regressing on school race/ethnic diversity; School-based stigma intervention study, Texas, 2011-2012 (N=234)

	Global Mental Health IRR (95%CI)	Depressive-Anxious Symptoms IRR (95%CI)	Hyperactive-Attention Symptoms IRR (95%CI)
Intercept	3.65 (1.51, 8.87) **	2.17 (0.84, 5.60)	1.36 (0.49, 3.80)
Study wave			
Post-test	0.79 (0.71, 0.89) ***	0.79 (0.69, 0.89) ***	0.78 (0.69, 0.89) ***
12-Month	0.98 (0.95, 1.01)	0.98 (0.95, 1.02)	0.97 (0.94, 1.00) *
18-Month	0.73 (0.63, 0.85) ***	0.73 (0.61, 0.87) ***	0.77 (0.65, 0.92) ***
24-Month	0.76 (0.65, 0.89) ***	0.74 (0.62, 0.88) ***	0.81 (0.70, 0.95) *
Student covariates			
Gender			
Female	0.93 (0.79, 1.10)	0.96 (0.81, 1.15)	0.90 (0.76, 1.07)
Family income			
< $40,000	1.21 (0.91, 1.61)	1.25 (0.92, 1.70)	1.14 (0.83, 1.56)
$40,000-$75,000	1.37 (1.02, 1.85) *	1.42 (1.04, 1.96) *	1.31 (0.93, 1.87)
Parent education			
≤ H.S. diploma	1.00 (0.81, 1.22)	0.99 (0.80, 1.23)	1.03 (0.84, 1.26)
Intervention assignment			
Curriculum	1.16 (0.90, 1.49)	1.15 (0.88, 1.50)	1.19 (0.90, 1.59)
Contact	1.18 (0.96, 1.45)	1.15 (0.92, 1.44)	1.26 (1.01, 1.58) *
Curriculum/contact	1.21 (0.94, 1.56)	1.23 (0.94, 1.61)	1.18 (0.89, 1.58)
Family history of mental illness			
Yes	1.11 (0.94, 1.30)	1.14 (0.95, 1.35)	1.06 (0.90, 1.26)
Past mental health service use			
Yes	1.29 (1.09, 1.52) **	1.28 (1.06, 1.54) **	1.28 (1.08, 1.51) **
Home language preference	1.00 (0.98, 1.03)	1.00 (0.98, 1.03)	1.00 (0.98, 1.03)
Media language preference	1.01 (0.99, 1.03)	1.01 (0.99, 1.03)	1.01 (0.99, 1.04)
Social preference	1.00 (0.97, 1.04)	1.00 (0.96, 1.04)	1.01 (0.97, 1.05)
Acculturative stress			
High	2.83 (1.54, 5.21) **	3.26 (1.67, 6.34) **	1.99 (1.03, 3.86) *
School covariates			
Diversity Index	1.85 (0.85, 4.04)	2.07 (0.89, 4.82) [a]	1.46 (0.62, 3.43)

% Economically disadvantaged	0.81 (0.53, 1.26)	0.87 (0.53, 1.43)	0.70 (0.45, 1.09)
School by Student Interaction			
Acculturative stress X Diversity Index	0.22 (0.07, 0.69) **	0.17 (0.05, 0.59) **	0.41 (0.12, 1.42)

Notes: All models adjust for time, gender, family income, parent education, intervention assignment, family history of mental illness, past mental health service use, acculturation variables, acculturative stress, and percent economically disadvantaged students in school.
Referent groups include: Pre-test time point, male gender, >$75,000 family income, some college or more parent education, control assignment, no family history, no receipt of mental health services, and low acculturative stress.
Abbreviations: "NH": Non-Hispanic and "H.S.": high school.
[a] $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Table 4. Generalized estimating equations predicting incidence rate ratios of mental health symptoms and regressing on proportion of English language learners enrolled at school; School-based stigma intervention study, Texas, 2011-2012 (N=234)

	Global Mental Health IRR (95% CI)
Intercept	5.14 (2.43, 10.84) ***
Study Wave	
Post-test	0.79 (0.70, 0.88) ***
12-Month	0.97 (0.94, 1.00) [a]
18-Month	0.73 (0.62, 0.85) ***
24-Month	0.76 (0.65, 0.89) ***
Student covariates	
Gender	
Female	0.94 (0.81, 1.21)
Family income	
< $40,000	1.28 (0.96, 1.70) [a]
$40,000-$75,000	1.39 (1.03, 1.88) *
Parent education	
≤ H.S. diploma	0.99 (0.81, 1.21)
Intervention assignment	
Curriculum	1.10 (0.83, 1.45)
Contact	1.15 (0.93, 1.41)
Curriculum/contact	1.21 (0.93, 1.58)
Family history of mental illness	
Yes	1.11 (0.93, 1.31)
Past mental health service use	
Yes	1.30 (1.10, 1.53) **
Home language preference	1.00 (0.98, 1.03)
Media language preference	1.01 (0.99 1.03)
Social preference	1.00 (0.97, 1.04)
Acculturative stress	
High	1.28 (1.08, 1.51) **
School covariates	
% ELL enrollment	0.71 (0.27, 1.91)
% Economically disadvantaged	0.92 (0.43, 1.94)

Notes: All models adjust for time, gender, family income, parent education, intervention assignment, family history of mental illness, past mental health service use, acculturation variables, acculturative stress, and percent economically disadvantaged students in school. Referent groups include: Pre-test time point, male gender, >$75,000 family income, some college or more parent education, control assignment, no family history or past mental health service use, and low acculturative stress.

Abbreviations: "NH": Non-Hispanic, "H.S.": high school, and "ELL": "English language learner".
[a] $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$.

Figures

Figure 1. Scree plot of eigenvalues of acculturation items

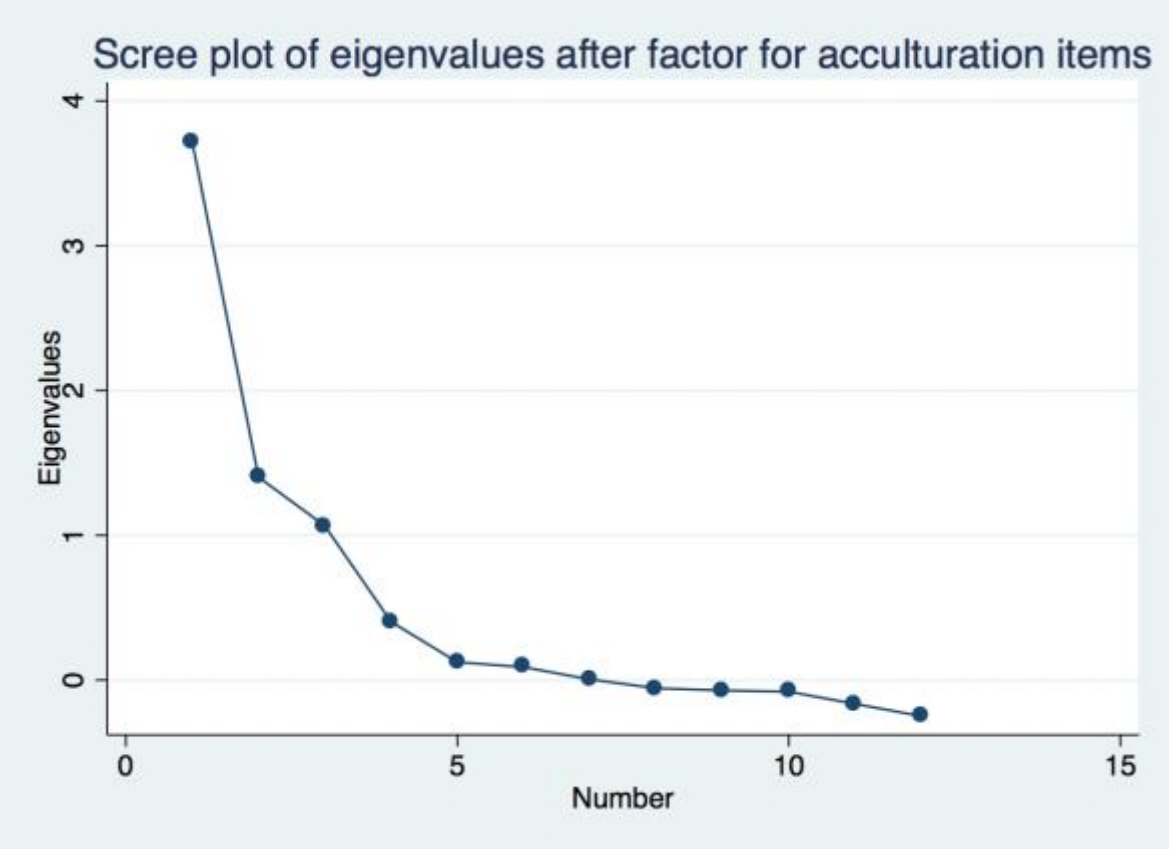
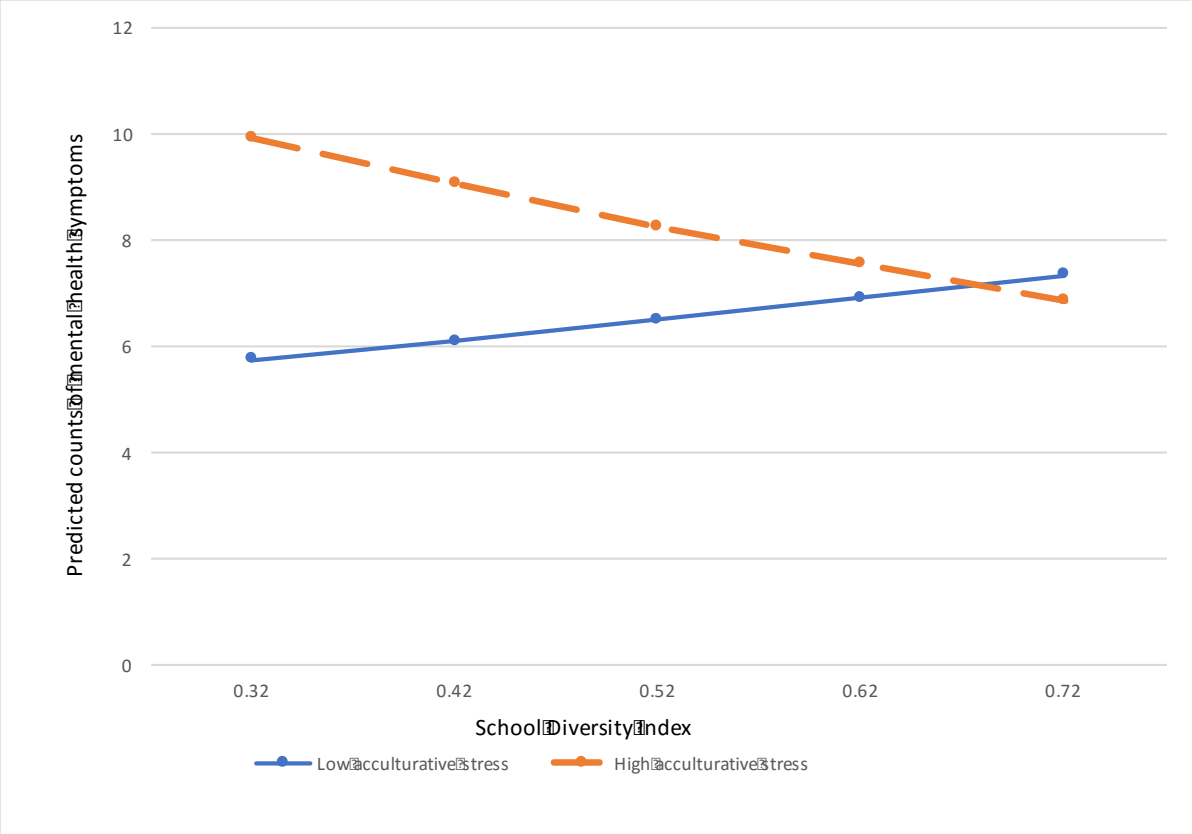


Figure 2. Predicted counts of mental health symptoms across changes in school race/ethnic diversity



Appendix

Table A1. Frequencies of mental health checklist items at baseline in the longitudinal sub-sample identifying as Hispanic/Latino; School-based stigma intervention study, Texas, 2011-2013 (N=234)

In the past 6 months, have you…	% No (n)	% Yes (n)
Depressive-Anxious Items		
1. Felt really sad or depressed most all day for several days in a row?	73.89 (167)	26.11 (59)
2. Often felt afraid of going out of the house by yourself?	67.70 (153)	32.30 (73)
3. Had any thoughts that keep coming back into your mind …?	57.40 (128)	42.60 (95)
4. Worried about how things would turn out for you?	40.99 (91)	59.01 (131)
5. Felt there were certain things that you did over and over …?	72.20 (161)	27.80 (62)
6. Often felt afraid of being in crowded places?	71.88 (161)	28.12 (63)
7. Felt nothing was fun for you and you just weren't interested …?	49.56 (112)	50.44 (114)
8. Often thought about death … being dead yourself?	57.33 (129)	42.67 (96)
9. Felt you can't do anything … not as good looking or smart …?	54.22 (122)	45.78 (103)
10. Felt lonely, like you didn't have any friends?	65.78 (148)	34.22 (77)
11. Been grouchy or angry most of the time for several days in a row?	70.09 (157)	29.91 (67)
12. Thought that you have special abilities or powers …?	70.04 (159)	29.96 (68)
13. Slept a lot less than usual, say, only three or four hours a night …?	64.91 (148)	35.09 (80)
14. Often felt like your mind was racing too quickly …?	61.95 (140)	38.05 (86)
15. Worried too much about a number of different things …?	65.47 (146)	34.53 (77)
16. Often felt very nervous/uncomfortable … with people your age?	74.55 (167)	25.45 (57)
17. Had a sudden attack of feeling very scared and strange things …?	69.33 (156)	30.67 (69)
Hyperactive-Attention Items		
18. Often had trouble keeping your mind on what you are doing …?		
19. Often disliked doing things where you had to pay attention …?		
20. Often not finished things because you started … something else?	48.25 (110)	51.75 (118)
21. Often made many mistakes because it's been too hard for you …?	52.86 (120)	47.14 (107)
22. Often been too active and fidgety so that you couldn't sit still?	63.44 (144)	36.56 (83)
23. Felt very restless, so that you've had to keep walking around …?	35.56 (80)	64.44 (145)

Table A2. Factor loadings and communalities based on principal axis factor analysis with varimax rotation for 12-item acculturation scale; School-based stigma intervention study, Texas, 2011-2012 (N=234)

Item	Home Language Alpha = 0.81	Personal and Media Language Alpha = 0.81	Social Preference Alpha = 0.68	Communality
1. In general, what language(s) do you speak?				
2. What language(s) do your parents speak to you in?				
3. What language(s) do you usually speak at home?	**0.76**			0.64
4. In what language(s) do you usually think?	0.33	**0.47**		0.39
5. What language(s) do you usually speak with your friends?		**0.71**		0.57
6. In what language(s) are the T.V. programs you usually watch?		**0.69**		
7. In what language(s) are the radio programs you usually listen to?		**0.72**		
8. In general, in what language(s) are the movies, T.V. and radio programs you prefer to watch or listen to?		**0.72**		0.55
9. In what language(s) do your parents speak with their parents?	**0.64**			0.42
10. Your close friends are:			**0.72**	0.53
11. You prefer going to social gatherings/parties at which the people are:			**0.70**	0.52
12. The persons you visit or who visit you are:			**0.50**	0.30
Note: Bolded factor loadings represent items that comprised each acculturation domain.				

Table A3. Mean responses to 12-items assessing acculturative stress in the longitudinal sub-sample identifying as Hispanic/Latino; School-based stigma intervention study, Texas, 2011-2013 (N=234)

Item	Mean (Standard Deviation)
1. I feel bad when others make jokes about people of my ethnic background.	
2. I have more things that get in my way than most people do.	
3. It bothers me that people in my family who I am close to don't understand the things that I think are important, that are new to them.	2.98 (1.57)
4. People in my family who I am close to have plans for when I grow up that I don't like.	2.56 (1.57)
5. It is hard for me to tell my friends how I really feel.	2.78 (1.60)
6. I don't have any close friends.	1.97 (1.40)
7. Many people believe certain things about the way people in my group act, think, or are, and they treat me as if those things are true.	2.42 (1.55)
8. I don't feel at home here in the United States.	1.88 (1.36)
9. People think I am shy, when I really just have trouble speaking English.	1.95 (1.46)
10. I often feel that people purposely try to stop me from getting better at something.	2.37 (1.66)
11. It bothers me when people force me to be like everyone else.	2.73 (1.87)
12. I often feel like people who are supposed to help are really not paying any attention to me.	2.53 (1.55)
13. Because of my ethnic background, I don't get the grades that I deserve.	1.88 (1.38)
14. It bothers me that I have an accent.	1.83 (1.30)
15. It's hard to be away from the country I used to live in.	2.06 (1.54)
16. I often think a lot about my ethnic background and its culture.	2.18 (1.41)
17. Because of my ethnic background, I feel others don't include me in some of the things they do, games they play, etc.	1.97 (1.50)
18. It is hard for me to "show off" my family.	1.84 (1.31)
19. People think badly of me if I practice customs or I do the "special things" of my culture.	1.87 (1.33)
20. I have a hard time understanding what others say when they speak.	1.97 (1.47)

Chapter 4: Conclusion

Evidence Regarding the Effect of School Race/Ethnic Composition on Mental Health Outcomes: Future Research Directions and Implications for Public Health and Policy

The race and ethnic composition of public schools in the United States has changed and is projected to be increasingly more diverse with respect to race and ethnicity in the future. There is also considerable variation in the race and ethnic composition across schools. Since the school is a central context for youth, most research to date has examined the impact of efforts to improve school integration in terms of modifying enrollment according to race/ethnicity and socioeconomic status on academic and economic trajectories. However, mental health has not been given sufficient attention even though racial and ethnic minority youth consistently report more depressive, anxious, and suicide-related symptoms compared to their non-Hispanic white counterparts.[1] Therefore, an analysis of the impact of these patterns in school race/ethnic composition on mental health outcomes was needed.

To put this issue to scale, the race and ethnic minority population of children and adolescents in the United States is substantial: about half of the total United States population under the age of 18 reported their race and ethnicity as a group other than non-Hispanic white in 2014, which is projected to increase to 64.4% by 2060.[2] The Hispanic/Latino group is now the largest racial and ethnic minority group in the United States comprising a quarter of the population under the age of 18, increasing by 43% in the past decade.[2,3] As enrollment in public schools has multiplied nearly four times among Hispanic/Latinos in the United States from 1968-2012, an analysis unique to this group was also warranted.[4]

The current evidence examining the effect of school race and ethnic composition on mental health outcomes has shown a consistent pattern. Prior literature has measured school race/ethnic composition as either 1) a measure of race/ethnic density using the proportion of non-Hispanic white enrollment, or 2) a measure of race/ethnic diversity using an index. For racial and ethnic minority youth, increasing non-Hispanic white enrollment is consistently associated with increases in mental health symptoms; the opposite is true for non-Hispanic white youth who see reduced mental health symptoms with greater non-Hispanic white enrollment. Increasing school race/ethnic diversity has been shown to be protective of mental health symptoms for racial and ethnic minority youth. Table 1 shows the overall conclusions across 12 studies including the eleven studies evaluated in the systematic literature review of Chapter 1, and the empirical Chapters 2 and 3 of my dissertation. Overall the studies have demonstrated either a main or mediated effect of school race/ethnic density measured as the proportion of non-Hispanic white enrollment and diversity on mental health outcomes particularly for depressive-anxious symptoms. Future research should test potential mechanisms for these patterns.

The extensive systematic literature review provided in Chapter 1 revealed that no other review has recognized this consistency in patterns across studies; thus, the review is a contribution to the knowledge base. Among the studies in the United States, the samples encompass large nationally representative samples in addition to convenience samples of both urban, suburban, and rural populations; thus, findings are generalizable to public school populations in the United States. As different patterns emerged for non-Hispanic white, non-Hispanic black, and Hispanic/Latino youth, I discuss the implications of the findings for each group in turn.

For non-Hispanic black compared to white youth, a consistent pattern is the main and

indirect effect of non-Hispanic white enrollment on mental health outcomes (see Chapter 2) where indirect effects imply that the main effect is mediated by other explanatory variables. This may in part be due to the fact that non-Hispanic black compared to white youth are subject to or have increased chances of negative experiences in schools that have greater non-Hispanic white enrollment. Increasing non-Hispanic white enrollment may be capturing a vector of adverse experiences that have been shown to be negatively associated with mental health symptoms. These adverse experiences include interpersonal, cultural, and institutional discrimination, a lack of culturally-specific programming embedded in the school curriculum and activities, or having few faculty and staff of racial and ethnic minority backgrounds. In the case of bussing programs, non-Hispanic black youth who attend schools with greater non-Hispanic white enrollment may have fewer social ties with youth in their neighborhoods, particularly if the school attended is outside of a youth's neighborhood. Concurrently, non-Hispanic white youth may also not receive programming that could improve interpersonal relationships with racial and ethnic minorities particularly non-Hispanic black youth, and/or increase awareness of potential experiences of discrimination among their peers who are not non-Hispanic white. The potential pathways in which a greater non-Hispanic white enrollment in the school impacts mental health outcomes among non-Hispanic black youth require further investigation. Such research can inform the development of interventions aiming to reduce mental health disparities in school contexts that are particularly affected. Such interventions should then be evaluated for effectiveness and feasibility of dissemination.

For Hispanic/Latino youth, increasing school race/ethnic diversity was found to reduce rates of depressive-anxious symptoms when compared to non-Hispanic white youth (see Chapter 2). Racially and ethnically diverse schools, or those that have a wider and more even range of

different groups, may be advantageous for Hispanic/Latino youth in terms of mental health. Increasing school diversity in terms of the range of race/ethnic groups in a school context also increases the demographic variety surrounding Hispanic/Latino youth in the school to potentially include, for example, non-Hispanic black, immigrant, English language learning, and multi-lingual adolescent groups. As "Hispanic/Latino" youth as a group are heterogeneous and comprise different heritages, language and cultural preferences, birthplaces, and migration histories, it is not surprising that increasing diversity and not necessarily non-Hispanic white enrollment impacts mental health outcomes. Greater racial and ethnic diversity increases the chances for Hispanic/Latino youth to interact with a range of youth of other race/ethnic backgrounds with relatable experiences who are not necessarily captured by the measure of non-Hispanic white enrollment. Therefore, a plausible mechanism for how school diversity impacts mental health outcomes for Hispanic/Latino youth is through the existing large range and even distribution of race/ethnic groups that contributes to more balanced power dynamics and opportunities for youth of any background to socially fit-in.[5-7]

Within the Hispanic/Latino group, this dissertation identified that the effect of increasing diversity on reducing rates of mental health symptoms was particularly relevant for youth with high compared to low acculturative stress (see Chapter 3). The measure of acculturative stress included items relating to stressful experiences or circumstances regarding immigrant adaptation such as having an accent and balancing family expectations across host and native cultures. Acculturative stress also tapped into some of the challenges in the school setting that Hispanic/Latino youth may face with peers and in receiving equal and fair treatment from teachers. Given that increased school race/ethnic diversity allows Hispanic/Latino youth to socialize with youth of different race/ethnic backgrounds and migration experiences,

Hispanic/Latino youth with high acculturative stress may develop stronger ethnic identities and social connections and experience less discrimination in contexts with greater race/ethnic diversity. At the same time, schools that are not racially and ethnically diverse may be detrimental in terms of mental health for Hispanic/Latino youth experiencing high acculturative stress for the same reasons as non-Hispanic black youth with respect to high non-Hispanic white enrollment. Acculturative stress may be signaling negative experiences including school-based discrimination particularly in schools with little race/ethnic diversity. Future research should aim to test if a significant association emerges between non-Hispanic white enrollment and mental health outcomes through perceived discrimination among Hispanic/Latino youth. Other factors that are known to be subject to discrimination such as race, having an accent, and immigration status and that also vary within the Hispanic/Latino group should also be tested.

That the effect of school race/ethnic diversity on mental health symptoms varies by acculturative stress among Hispanic/Latino youth may be particularly useful as a potential screening criterion for mental health problems. Prior literature has also identified acculturative stress as an important risk factor for psychiatric risk among Hispanic/Latino youth, a finding that was replicated in Chapter 3. Future research should empirically test acculturative stress as a tool for screening for mental health distress. If shown to be an effective tool for screening, adolescent health providers and school personnel can be trained to screen for acculturative stress to identify youth who may also be experiencing mental health symptoms. As a result of screening, referrals should be made to school-based mental health providers, counselors, or social workers. This type of screening would be particularly relevant for Hispanic/Latino youth in schools that are not racially and ethnically diverse who are consequently vulnerable to having increased mental health symptoms. Overall, school environments should aim to create a tolerant

environment to reduce acculturative stress and provide resources to Hispanic/Latino youth in schools with little racial/ethnic diversity.

While mental health is one outcome of many to consider in the school context as important for adolescent well-being and overall health, efforts to improve school integration may need to consider school-based strategies and policies that balance mental health outcomes across race/ethnic groups in schools with greater non-Hispanic white enrollment. Given the problem of racism in the United States historically with no immediate change expected in the near future, improving access to school-based mental health counselors particularly for racial and ethnic minority students is recommended. That is, adolescents who may be challenged with racism within and outside of the school context may benefit from school-based counselors. Other necessary steps for uptake of in-school mental health counseling should include improved methods of screening and creating a de-stigmatizing mental health context in the school to encourage awareness of and help-seeking for mental health issues. These pursuits can empower youth to recognize mental health symptoms and seek help for themselves or peers when mental health problems arise. In addition to school nurses, counselors, and social workers, trained instructors or advocates that can deliver school-based programming regarding tolerance, empathy, and awareness of different socio-historical experiences and perspectives, particularly those of racial and ethnic minority groups in the United States, may prevent mental health symptoms that are caused by school-based discrimination.

Though increasing race/ethnic diversity in schools towards integration has historically had substantial public and political support, it is clear from the extensive literature review that increasing non-Hispanic white enrollment produces mental health consequences for racial/ethnic minority youth. Increasing school diversity in terms of range and evenness of different

race/ethnic groups is also beneficial for mental health outcomes particularly Hispanic/Latino youth, and it remains publically desirable.[8-10] While resources and services can be directed to racial and ethnic minorities to address mental health needs, more research is needed that attempts to understand how increasing non-Hispanic white enrollment negatively impacts mental health. Such research will also be able to inform strategies that engage non-Hispanic white youth to work towards reducing racism and garnering tolerance for youth from different racial and ethnic backgrounds. These efforts may be effective in reducing the disparities found in mental health outcomes across race/ethnic groups in schools. A more sustainable and inclusive approach to reducing mental health disparities across race/ethnic groups in school contexts with greater non-Hispanic white enrollment may require addressing all racial and ethnic groups uniquely to address individual group needs as well as in combination to address general school climate and interpersonal relationships.

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Tables

Table 1. Summary of articles examining the effect of school race/ethnic composition on mental health outcomes.

Author, Year	Country; Setting (Study)	Study Design; Years	Total Sample Size	Overall Conclusion
Astell-Burt, T; 2012[11]	United Kingdom; school-based (DASH)	Longitudinal cohort; 2003-2006	N=6,645 students	Indirect effect of race/ethnic density on race/ethnic minorities' mental health. Racism may be the mechanism between race/ethnic density and mental health.
Benner, A; 2015[12]	United States; school-based (ECLS-K)	Longitudinal cohort; 1998-1999 academic year	N=13,970 students	Indirect effect of race/ethnic density and diversity on race/ethnic minorities' mental health. Parent involvement may be the mechanism between race/ethnic density/ diversity and mental health.
Coutinho, M; 2002[13]	United States; Departme nt of Education	Cross-sectional; 1994-1995 academic year	M=4,151 school districts; N=over 24 million students	Direct effect of ethnic density on the identification of emotional disturbance in schools among race/ethnic minorities.
Crosnoe, R; 2009[14]	United States; school-based (Add Health)	Longitudinal cohort; 1995-2002.	M=47 schools; N=1,119 students	Direct effect of school ethnic and socioeconomic density on race/ethnic minorities' mental health. Social isolation may be the mechanism between race/ethnic density and mental health.
DuPont-Reyes, M; 2017	United States; school-based	Longitudinal cohort; 2011-2012.	M=14 schools; N=751 students	Direct effect of school race/ethnic composition measured as race/ethnic density and diversity on depressive-anxious but not hyperactive-attention symptoms that varied by self-reported race/ethnicity. Hispanic/Latino youth with high versus low acculturative stress had fewer mental health symptoms in schools with greater race/ethnic diversity.
Eilbracht, E; 2014[15]	Netherlan ds; school-based (HBSC)	Cross-sectional; fall 2005	M=21 schools; N=4,375 students	Direct effect of school ethnic density on ethnic minority and Dutch majority mental health.

Fisher, S; 2014[16]	United States; school-based	Longitudinal cohort; 2005-2014	M=233 schools (21 school districts); N=4,766 students	Direct effect of diversity on race/ethnic minorities' mental health.
Gieling, M; 2010[17]	Netherlands; school-based (HBSC)	Cross-sectional; fall 2001-2002	N=5,730 students	Direct effect of school ethnic density on externalizing symptoms among ethnic minority and Dutch majority.
Juvonen, J; 2006[5]	United States; school-based	Longitudinal cohort; 2000-2003	N=2,003 students	Direct effect of diversity on race/ethnic minorities' mental health. Perceived peer victimization and school safety may be factors related to diversity and mental health.
Graham, S; 2009[18]	United States; school-based	Longitudinal cohort; 2000-2003	N=2,003 students	Indirect effect of diversity on race/ethnic minorities' mental health. Perceived peer victimization and self-blame may be the mechanism between diversity and mental health.
Seaton, S; 2009[19]	United States; school-based	Cross-sectional	N=252 students	Indirect effect of diversity on race/ethnic minorities' mental health. Cultural and institutional racism may be the mechanism between diversity and mental health.
Walsemann, K; 2011[20]	United States; school-based (Add Health)	Longitudinal cohort; 1994	M=132 junior and senior high schools; N=18,419 students	Direct effect of race/ethnic density on race/ethnic minorities' mental health. Perceived discrimination and not socioeconomic status in school may be the mechanism between race/ethnic density and mental health.