Distribution Agreement

In presenting this thesis or dissertation as a partial fulfillment of the requirements for an advanced degree from Emory University, I hereby grant to Emory University and its agents the non-exclusive license to archive, make accessible, and display my thesis or dissertation in whole or in part in all forms of media, now or hereafter known, including display on the world wide web. I understand that I may select some access restrictions as part of the online submission of this thesis or dissertation. I retain all ownership rights to the copyright of the thesis or dissertation. I also retain the right to use in future works (such as articles or books) all or part of this thesis or dissertation.

Signature:

_____ _____

Kirsten Noel Reed Date

Correlation Between Neighborhood Education and Child Socio-Emotional Development

By

Kirsten Noel Reed
Master of Public Health

Epidemiology

_____

Michael Kramer
Committee Chair

Correlation Between Neighborhood Education and Child Socio-Emotional Development

By

Kirsten Noel Reed

B.S., Worcester Polytechnic Institute, 2015

Thesis Committee Chair: Michael Kramer, PhD, MPH

An abstract of
a thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Epidemiology
2017

Abstract

Correlation Between Neighborhood Education and Child Socio-Emotional Development

By

Kirsten Noel Reed

Socio-emotional competency is not an innate characteristic; the ability to conform to societal norms develops over time, shaped by children's interactions with their environment. Family SES going back at least two generations, as well as neighborhood SES play a role in child socio-emotional outcomes (1-4). However, use of a composite SES measure in most studies makes comparison between studies difficult, and the association of census tract college education percentage with child socio-emotional health has not been studied previously. Multilevel linear models were used in this cross-sectional study to account for the nesting of 13,000 children in census tract quintiles of adult education across the United States in estimating the association between neighborhood education and child socio-emotional health. Analyses were controlled for a variety of child and family characteristics. Maternal education and race were also included in the model as effect modifiers of the neighborhood exposures – child outcomes association. The adjusted effects for child approaches to learning, interpersonal skills, social interaction, and self-control were 0.03 (95% CI: -0.03, 0.09), 0.00 (95% CI: -0.08, 0.07), -0.01 (95% CI: -0.04, 0.03), 0.01 (95% CI: -0.03, 0.04) respectively when comparing the moderate proportion (18.6% - 27.2%) to the highest proportion (>41.1%) of college educated adults. In addition, adjusted effects for externalizing and internalizing behavior were -0.02 (95% CI: -0.05, 0.02), and 0.00 (95% CI: -0.03, 0.03) respectively. Overall, children residing in tracts with adult college education below 41% (below the highest quintile) expressed better approaches to learning but worse self-control and interpersonal skills. There was a crude association between tract education quintiles and outcomes, largely attenuated by adjustment for individual SES. Tract education influenced both measures of problem behavior, but the effects showed no consistent trend across quintiles of college educated adults. In summation, neighborhood education may be more strongly associated with academic social skills than those socio-emotional competencies involving interaction with others and expression.

Correlation Between Neighborhood Education and Child Socio-Emotional Development

By

Kirsten Noel Reed

B.S., Worcester Polytechnic Institute, 2015

Thesis Committee Chair: Michael Kramer, PhD, MPH

A thesis submitted to the Faculty of the
Rollins School of Public Health of Emory University
in partial fulfillment of the requirements for the degree of
Master of Public Health
in Epidemiology
2017

Acknowledgements

I would first like to thank my thesis advisor, Professor Michael Kramer of the Rollins School of Public Health at Emory University. The door to Michaels' office was always open whenever I ran into a trouble spot or had a question about my research, coding (SAS), or writing. He consistently allowed this paper to be my own work, but steered me in the right the direction whenever he, or I, thought it necessary. I can truly say that with Michael's guidance, I have grown into a woman worthy of her MPH in Epidemiology.

I would also like to acknowledge fellow MPH candidates, Emma Kaiser and Allison Bagley of the Rollins School of Public Health at Emory University, as comrades in this journey of endless SAS code and sleepless nights. I am gratefully indebted to them for their very valuable comments and theoretical discussion regarding this thesis.

Finally, I must express my very profound gratitude to my parents and to my spouse for providing me with unfailing support and continuous encouragement throughout my years of study and through the process of researching and writing this thesis. This accomplishment would not have been possible without them.

Thank you!

Kirsten Noel Reed

Table of Contents

Chapter I: Background/Literature Review 1
Socio-Emotional Health 1
Determinants of Socio-Emotional Health 2
Family and individual SES factors 2
Child characteristics and demographics 4
Census tract level factors 5
Neighborhood Interventions 7
Proportion of College Educated Adults & Socio-Emotional Health 8
Issues with Neighborhood Studies 9
Chapter II: Manuscript 11
Abstract 11
Introduction 11
Methods 14
Study design 14
Variables 15
Statistical methods 18
Survey Methods 19
Results 20
Study Size 20
Bivariate analysis 21
Socio-emotional Outcomes 22
Interaction Assessment 24
Discussion 26
Socio-emotional Outcomes 27
Interaction Assessment 28
Limitations 29
References 31
Tables 37
Figures 45
Chapter III: Summary, Public Health Implications, Possible Future Directions 49

Chapter I: Background/Literature Review

Socio-Emotional Health

Socio-emotional health, a broad spectrum of social skills and problem behaviors, is not an innate characteristic. The ability to conform to societal norms develops over time, shaped by children's interactions with their environment, which can vary depending on a child's socioeconomic status (SES), gender, race, mother's age, and age at the start of school.

The social skills commonly measured include approaches to learning, eagerness to learn, self-control, and interpersonal skills; problem behaviors often include externalizing behavior, and internalizing behavior. Externalizing behavior can be thought of as under-controlled behaviors including defiance, aggression, and rule-breaking over an extended period of time (usually more than 6 months). Internalizing behavior problems such as anxiety, depression, social withdrawal, and somatoform disorders, result from over-controlling behaviors (5). These dimensions of socio-emotional competency are easily visible in children as they interact with classmates or friends. Kindergarten teacher ratings of pro-social skills are predictive socio-emotional deficits later in life (6).

Socio-emotional competencies as early in life as kindergarten serve as substantial markers for important long-term outcomes and are instrumental in influencing developmental factors that resonate throughout the life-course (6). For example, socio-emotional functioning in kindergarten is strongly associated with employment, health

behavior, graduating high school on time, full-time/stable employment, use of public housing and other public assistance, and varying levels of criminal activity (6-8). Childhood aggression, in particular, strongly predicts adult criminal and violent behavior; early onset of aggression and antisocial behavior is the strongest observed predictor of criminal convictions (7).

Determinants of Socio-Emotional Health

There is mixed evidence regarding the association of individual SES on children's socio-emotional health. Associations between socio-emotional health and multiple dimensions of SES, including material, social, and human capital, are complex and not fully understood. Individual measures of SES, such as poverty may not fully quantify these dimensions. A child's demographic traits and characteristics such as age of entry into kindergarten, race/ethnicity, and sex also contribute to their socio-emotional health. In the following sections we will discuss the evidence for associations between these different dimensions of SES, as well as individual characteristics, and child socio-emotional health.

Family and individual SES factors

There is evidence that family SES, even in past generations, is associated with children's behavioral health (1-3). Effects of SES on externalizing problems is more pronounced than on internalizing behaviors such as anxiety, depression and dependency. These social class differences in rates of externalizing behavior increase gradually throughout early school years. In addition, low SES is correlated with the early onset of social skill

deficits such as psychiatric disturbance and maladaptive social functioning (1). However, SES is more strongly associated with cognitive competency than socio-emotional health (2).

Greater total debt has been associated with poor socio-emotional outcomes among children (9). However, child socio-emotional outcomes vary by type of debt (9). Type of debt is an interesting measure because debt is related to material capital, but different types of debt may indicate human capital. Education and mortgage debt, which facilitate access to better housing and schools, is associated with higher socio-emotional functioning (9). Unsecured debt, which may result from limited financial resources, is associated with lower socio-emotional well-being (9).

Family income is a measure of material capital. Lower family income is associated with an increase in externalizing and internalizing behaviors in children as young as 5, and remains important at least through age 14 (3). A possible explanation for the importance of poverty on socio-emotional health is the presence of multiple physical and psychosocial stressors due to a low-income home environment (10). One such stressor is housing quality, which is positively associated with child socio-emotional functioning, specifically psychological well-being and task persistence (11). Another stressor due to poverty is food insecurity (12). Food insecurity can have a direct and indirect impact on a child's socio-emotional health and intellectual development (13, 14). However, when attempting to alleviate this food insecurity through WIC nutrition interventions in a large longitudinal study, no differences in socio-emotional skills were

observed between intervention and non-intervention groups of high needs populations (17). Although WIC participation improves child nutrition, attenuates stress related child health risks through health referrals, and reduces food insecurity, WIC alone may not be a sufficient intervention for the complex outcome of socio-emotional health. In addition, the WIC study allowed for self-selection into WIC, which introduced selection bias if families with socio-emotionally impaired children enrolled in WIC more than families without socio-emotional deficits (17).

Child characteristics and demographics

Socio-emotional health can also differ between children based on their individual characteristics and demographics. Externalizing and internalizing behaviors differ between girls and boys among varying grade levels (kindergarten,1st, 3rd, and 5th) (18). Girls tend to score lower in antisocial behaviors and boys score lower in pro-social behaviors (19).

Socio-emotional functioning also varies by age of entry into kindergarten. Children who enter kindergarten at a later age (5-5.5, and >5.5 years) have higher socio-emotional scores on average compared to children who enter kindergarten earlier in life (<5 years) (20). Additionally, younger mothers are more likely to have children with internalizing and externalizing problems at a young age (3). Race and ethnicity may also play a role in socio-emotional outcomes (21). When controlling for SES and demographic characteristics, African-American boys had lower socio-emotional health than white boys at various life-points (9 months old, 24 months old, preschool, and kindergarten) (22).

Child interaction with their mother plays a role in child's socio-emotional health as well. Maternal interactions with their infants, harsh and inconsistent punishments for example, determined how infants responded emotionally in stressful situations as well as their attachment to their mother (2, 23). Because factors such as age, education level, employment, marital status, number of adults in the household, number of children in the household, and father presence have an effect on maternal stressors and presence in the household, they may serve as a proxy for mother-child interaction (2).

Census tract level factors

Census tract or neighborhood level characteristics in addition to individual or family characteristics can also contribute to child socio-emotional health or other child outcomes. The general ecological hypothesis states that as the number of neighborhood stressors increase and support decreases, distress among residents rises (24). In addition, social disorganization theory explains that neighborhoods with high proportions of low SES residents (and cofactors of low SES) decrease the likelihood of social order (25). Lack of social order combined with unemployment and single parent families lead to social isolation of parents. Eventually this feeling of isolation results in family practices that are not conducive to adaptive functioning leading to defiant behavior in children (1).

Peer influences of neighborhood residents can have an effect on children as early as pre-school (4). The most commonly studied neighborhood characteristics include income/SES, racial/ethnic diversity, and residential stability (4). Community level SES can provide indications of association between individual factors and violence, hazards,

recreational and institutional resources. Children growing up in urban environments may have more exposure to guns, knives, drugs, and acts of random violence than their counterparts, in less urban environments (1). In neighborhoods with few managerial and professional workers, children experience greater behavior problems (4).

Children are observant of their neighborhood and surroundings, and children living in high poverty neighborhoods report greater stressors than those living in more advantaged neighborhoods (2). In addition, parental supervision and monitoring may mediate the associations between neighborhood effects and socio-emotional health through determining their child's exposure to the neighborhood. As previously mentioned, race is associated with socio-emotional health; race may also moderate the effect that neighborhood has on children, where black children may be more susceptible to characteristics of their neighborhood (4). Trans-generational effects, where links between race and SES in previous generations are stronger, may be partially responsible. Because neglectful (and not authoritative) parenting, more common with lower SES individuals, strengthens a child's social ties to other individuals within the neighborhood, SES in previous generations may moderate the effect of neighborhood on children similar to race (26). Therefore, where race indicates parental SES, race may modify the association between neighborhood and child characteristics, including socio-emotional health.

Neighborhood Interventions

Even though a child's poverty can contribute to socio-emotional deficiencies, neighborhood level interventions may be effective in reducing child poverty through increasing opportunity. The Moving to Opportunity study moved children out of neighborhoods of high poverty concentration into neighborhoods with less concentrated poverty and greater opportunities (27). When children were younger than 13 years at the time of the intervention, total lifetime earnings were increased, likelihood of attending college increased, and likelihood of women becoming single mothers decreased (28). Additionally, the program had the most profound effects on children 8 to 13 years old and boys where in, boys experienced a 25% reduction in depressive/anxiety and dependency issues (27). Children, who lived in higher opportunity neighborhoods longer, experienced greater gains in benefits (28). However, moving to higher opportunity neighborhoods had no effect on adults and a negative effect on older children (28). A possible explanation for worse socio-emotional outcomes in high poverty neighborhoods is that parents in poorer neighborhoods are less likely to disapprove of aggressive behavior because their children need to learn to defend themselves (2).

Additionally, the Head Start Intervention, which allocates federal funds to community organizations focused on providing comprehensive early childhood education, health, nutrition, and parent involvement services to underprivileged children, may mediate the association between neighborhood disadvantage and child socio-emotional health.

Negative teacher-student interactions mediated the association between neighborhood disadvantage and child behavior problems. During a short prospective investigation of this intervention, neighborhood socioeconomic disadvantage was correlated with lower Head Start classroom quality defined through lower structural quality, higher levels of negative teacher-student interactions, and lower levels of positive teacher-student interactions. Poorer classroom quality was also associated with worse socio-emotional outcomes. Although not statistically significant, poor structural quality of classrooms was associated with worse approaches to learning.(29) However, Head Start staff in neighborhoods with socioeconomic disadvantage often lack the financial resources, expertise, and technical assistance pertinent to integration of research based strategies into local programs (30). The incomplete integration of Head Start in classrooms within disadvantaged neighborhoods may have contributed to the mediation of neighborhood on socio-emotional health.

Proportion of College Educated Adults & Socio-Emotional Health

The proportion of college-educated adults in a census tract is a neighborhood measure of human capital not commonly studied alone in relation to child socio-emotional health. Studies consistently show that high neighborhood SES is associated with better school readiness and greater achievement as well as IQ, verbal ability, and reading recognition scores (4). Neighborhood education level and percentage of adults with low educational attainment have both been studied, in combination with other SES measures, in relation to adult mental health, specifically depression (15).

The association between neighborhood SES and child socio-emotional health outcomes has been rarely investigated, showing a general association of lower SES with worse socio-emotional outcomes (4). However, use of a composite SES measure in most studies makes comparison between studies difficult. Additionally, there is no standard measure of SES, so similar studies may find conflicting results based on their SES measure (16). Through the use of census tract proportion of college educated adults, we are attempting to specify the neighborhood exposure of SES into a more easily explainable predictor of socio-emotional outcomes.

Issues with Neighborhood Studies

Neighborhood studies are subject to over and under estimating effects because of the confounding by individual characteristics that may determine if a family continues to live in an area with low SES, high poverty, or a lower proportion of college educated adults. Neighborhood effects may be overestimates when the magnitude of the neighborhood impact on families that choose not to move is inflated from that of families who chose to move. One example would be the differential social support between families who choose to move and those who do not in an instance where a family with a depressed matriarch lacks social support to move the family. Underestimates of the neighborhood effects may result through the choice to stay resulting in a suppression of neighborhood effects and confounding by social support. For example, if a family chooses to stay in (or move to) a low SES neighborhood because of a higher paying job, the additional income and financial savings from staying in the

low SES neighborhood may allow children to attend private schools or attend recreational activities (4). This could lead to confounding of the neighborhood exposure to individual outcome by income and poverty.

Ecologic fallacy can also play a role in neighborhood studies where inferences regarding the associations between individual level exposures and outcomes rely on the association between the exposure aggregated at the group level and the mean outcome for the members of the group. When grouping by the dependent variable there can be differences between the ecologic and individual level associations. For example, people are typically grouped into neighborhoods based on income. If a study were interested in the association between race and income for individuals, using the ecologic variables of percent black and mean income would give different results due to the “group effect” when using contextual effects. (31)

Chapter II: Manuscript

Correlation Between Neighborhood Education and Child Socio-Emotional Development

Kirsten Noel Reed & Michael Kramer, PhD, MPH

Abstract

Socio-emotional competency is not an innate characteristic; the ability to conform to societal norms develops over time, shaped by children's interactions with their environment. Family SES going back at least two generations, as well as neighborhood SES play a role in child socio-emotional outcomes (1-4). However, use of a composite SES measure in most studies makes comparison between studies difficult, and the association of census tract college education percentage with child socio-emotional health has not been studied previously. Multilevel linear models were used in this cross-sectional study to account for the nesting of 13,000 children in census tract quintiles of adult education across the United States in estimating the association between neighborhood education and child socio-emotional health. Analyses were controlled for a variety of child and family characteristics. Maternal education and race were also included in the model as effect modifiers of the neighborhood exposures – child outcomes association. The adjusted effects for child approaches to learning, interpersonal skills, social interaction, and self-control were 0.03 (95% CI: -0.03, 0.09), 0.00 (95% CI: -0.08, 0.07), -0.01 (95% CI: -0.04, 0.03), 0.01 (95% CI: -0.03, 0.04) respectively when comparing the moderate proportion (18.6% - 27.2%) to the highest proportion (>41.1%) of college educated adults. In addition, adjusted effects for externalizing and internalizing behavior were -0.02 (95% CI: -0.05, 0.02), and 0.00 (95% CI: -0.03, 0.03) respectively. Overall, children residing in tracts with adult college education below 41% (below the highest quintile) expressed better approaches to learning but worse self-control and interpersonal skills. There was a crude association between tract education quintiles and outcomes, largely attenuated by adjustment for individual SES. Tract education influenced both measures of problem behavior, but the effects showed no consistent trend across quintiles of college educated adults. In summation, neighborhood education may be more strongly associated with academic social skills than those socio-emotional competencies involving interaction with others and expression.

Introduction

Socio-emotional competency refers to a broad spectrum of social skills and problem behaviors which collectively represent early developmental markers for outcomes across the life-course (5, 6) As part of this construct, social skills encompass approaches

to learning (ATL), social interaction (SI), self-control (SC), and interpersonal skills (IP); and problem behaviors including externalizing behavior (EB), and internalizing behavior (IB) (1). Socio-emotional functioning in kindergarten is strongly associated with young adult crime, health behavior, graduating high school on time, full-time/stable employment, use of public housing/other public assistance, and varying levels of criminal activity (6-8). Research indicates that socio-emotional health is not an innate characteristic; the ability to conform to societal norms develops over time and is shaped by children's interactions with their environment. These interactions can vary depending on a child's socioeconomic status (SES), sex, race, mother's age, and age at the start of school. Therefore, the progression of socio-emotional development early in childhood may be a risk factor for subsequent health outcomes, and the differences in childhood environment may lead to variation in socio-emotional health contributing to population health disparities.

There is evidence that family SES, even in past generations, is associated with children's behavioral health (1-3). More family debt is associated with poorer socio-emotional outcomes in children, and child socio-emotional health is worse when debt is related to limited financial resources compared to education/mortgage debt (9). Lower family income is associated with higher levels of EB and IB in children as young as 5, and remains important at least through age 14 (3). A possible explanation for the importance of poverty in relation to socio-emotional health is the presence of multiple physical and psychosocial stressors related to a low-income home environment (10). One such stressor is housing quality, which is positively associated with child socio-

emotional functioning, specifically psychological well-being and task persistence (11). Another stressor due to poverty is food insecurity (12). Food insecurity can have a direct and indirect impact on a child's socio-emotional health and intellectual development (13, 14).

In addition to individual and family level SES, neighborhood level SES plays a role in socio-emotional development. The proportion of adults who have obtained a college education within a census tract is one of several neighborhood measures commonly used to represent neighborhood SES in studies of population health. In addition to use of many measures including education to determine neighborhood SES, these measures collectively have been associated with adult health/development outcomes, specifically depression (15). The few studies investigating the association between neighborhood SES and child socio-emotional health outcomes show a general trend of lower SES relating to worse socio-emotional outcomes (4). However, use of a composite SES measure in most studies makes comparison between studies difficult. Additionally, there is no standard measure of SES, so similar studies may find conflicting results based on their SES measure (16). Finally, higher educational attainment as a measure of human capital is only one aspect of SES and may show a different association than a composite SES measure.

We know that child socio-emotional health is affected by parental and household SES factors, and that neighborhood SES factors are associated with adult mental health. However, the literature to date does not adequately address the impact of

neighborhood SES factors such as college education on child socio-emotional health. Current gaps in the literature include the scarcity of studies investigating associations between neighborhood human capital and child socio-emotional health and the difficulty in comparing studies using varied SES composite measures. To address these gaps we conducted a cross-sectional study on percentage of college educated adults by census tract and child socio-emotional health, which is to the best of our knowledge, the first to utilize this singleton measure of neighborhood SES. The overall goal of this study is to build the evidence base to inform understanding of associations between neighborhood education and child socio-emotional health, as well as the potential for implementing successful neighborhood interventions. In accordance with our goal, we established the following 2 aims: [1] to test the association between the proportion of college educated adults, 23-64 years old, within US census tracts with the socio-emotional health of kindergarten children using a population-based, nationally representative, longitudinal cohort study of 18,200 children; and [2] to investigate whether the association between the proportion of college educated adults within US census tracts and the socio-emotional health of kindergarten children differs according to maternal education level, categorized in four levels from less than high school to college completion.

Methods

Study design

Data for this study came from two sources. The Early Childhood Longitudinal Study, Kindergarten Class of 2010-11 (ECLS-K:2011) conducted by the National Center for

Education Statistics (NCES), is a longitudinal study of approximately 18,200 students who attended kindergarten in the 2010-2011 school year from a diversity of school types, socioeconomic levels, and racial/ethnic backgrounds throughout the United States. For the present study we focused on socio-emotional measures collected during the first two periods of data collection, in the fall and spring of the kindergarten year. Child and family characteristics, including census tract of residence, were collected though parent and teacher interviews. (32)

The U.S. Census Bureau's 2006-2010 American Community Survey (ACS) Five Year estimates, uses a series of monthly samples to produce estimates, updated annually, for census tracts and block groups previously surveyed through the decennial census. The survey is conducted in the US and Puerto Rico separately and includes residents of both single and multiple family residences. (33) Data was acquired from the Minnesota Population Center National Historical Geographic Information System: Version 11.0 (34).

The ACS dataset was merged with the ECLS-K:2011 dataset by residential census tract for the year of kindergarten data collection (2010), for the use of adult college education percentage in this study. For the present study, data analysis was limited to US kindergarten children nested within census tract college education quintiles with non-missing data on socio-emotional health, college education, and covariates included in each model. Emory University IRB reviewed and approved this study.

Variables

Socio-emotional health was ascertained from parent and teacher surveys in the in ECLS-K:2011 study and categorized into four measures of social-skills: approaches to learning

(ATL), social interaction (SI), self-control (SC), and interpersonal skills (IP); and two measures of behavioral health: internalizing (IB) and externalizing behavior (EB). These measures were based on an NCES modification of the Social Skills Rating System (SSRS) to allow for teacher assessment of socio-emotional health on a four-point scale (32). Although questions are not available to researchers, the Teacher Social Rating Scales (SRS) are continuous averages of a series of frequency questions with responses ranging from 1 (never) to 4 (often) (32). Two additional outcomes, the combination of all social skills, and the combination of both problem behaviors, were also investigated. These measures added the values from the outcomes combined so that the scale for social skills was 4-16 and the scale for problem behaviors was 2-8.

Other family and child data collected in ECLS-K:2011, from parent and teacher interviews, were used to adjust for confounding at the child-level. Primary parent employment and marital status, number of adults and children in the household, non-domestic birth of child, child gender, type of school, school location type, primary parent occupational prestige and type of employment, race/ethnicity, number of siblings in the household, maternal age at first birth, English language not spoken at home, primary parent highest education and age were controlled as child-level covariates.

To assess neighborhood characteristics, child residential census tracts were used to merge child-level data with census level data from the ACS. Exposure was evaluated as the percentage of adults (25-64 years old) with a college education within census tracts. Prior to dissemination of the ACS dataset, the educational attainment ACS data were

tabulated for people 18 and older, and highest education was classified as the degree or highest level completed. (33)

Although census tracts may not be considered by residents as neighborhood confines, they represent small, mostly permanent, constructs widely used for neighborhood level research (4). Additionally, residential census tracts may be interchanged with school census tracts when examining contextual effects on child health and well-being. (35) Similar to previous studies that evaluated neighborhood level variables as an exposure, percentage of adults with a college education were classified into quintiles of all tracts in which a child in the study resided (4). *High college education percentage* was defined as census tracts with more than 41.1% of adult residents having at least a college education, *moderate high college education percentage*, as census tracts with 27.3-41.1% of resident adults having at least a college education, *moderate college education percentage*, as 18.6-27.2% of resident adults having at least a college education, *moderate low college education percentage,* as 12.1-18.5% of resident adults having at least a college education, and *low college education percentage* as 12% or less of resident adults having at least a college education. These cutoff points are evenly distributed quintiles to allow large group sample sizes and because previous research has not established a standard for categories cut off points when examining percentage of college educated adults per census tract.

Coding Variables

To create larger sample sizes within values of covariates, some values were combined. For race, we combined Asian, Native Hawaiian/Pacific Islander, and American

Indian/Alaska Native as well as both original values of Hispanic (no race specified, and race specified). School locations were simplified from specific areas within the rural, city, suburb, and town boarders to rural, city, suburb, town categories. Number of siblings was made categorical so that values more than 5 were combined into the >5 category. For parent education level "< high school" combined "8th grade or below", and "9th-12th grade", "high school diploma/equivalent" included the "some college" category, "bachelor's degree" included "graduate/professional school-no degree", and "≥ master's degree" included "doctorate or professional degree".

Statistical methods

SAS 9.4 (Copyright (c) 2002-2012 by SAS Institute Inc., Cary, NC, USA.) was used to implement survey methods and multilevel linear modeling to estimate the association of percentage of college educated adults with child socio-emotional health. Additionally, bivariate analysis on the model determined the child, family, and neighborhood characteristics for children within each of the five categories of neighborhood college education percentage. Significant differences in characteristics across tract levels of college educated adults were determined through chi square tests of homogeneity. Selection of initial covariates was based on inclusion of the variables in previous literature where the association between education and child socio-emotional health was modeled (Figure 1).

For each of the eight outcomes, an all subsets change in estimate approach to model selection was performed using three subsets (No covariates, only SES covariates, only demographic covariates) of the full models to choose subsets of covariates that changed

the effect estimate of census tract education by 10% or more compared to the empty model. Interaction of the exposure with primary parent education and/or race was determined through backwards elimination with α=0.05. In the full model we controlled for primary parent employment and marital status, number of adults and children in the household, non-domestic birth of child, child gender, type of school, school location type, primary parent occupational prestige and type of employment, child race/ethnicity, number of siblings in the household, maternal age at first birth, primary parent highest education and age, and English language not spoken at home. The normality assumption of linear regression was not met for the problem behavior measures, determined through the skewness (>2) and kurtosis (>2) of the outcome measures. Both IB and EB were log transformed which normalized their distributions. Combining the problem behaviors also normalized the distribution, and this was run as a separate outcome controlling for all covariates.

Survey Methods

As suggested in the ECLS-K:2011 user manual, the data was weighted to compensate for differential selection bias through adjustment of the effect of non-response (32). For the fixed effects linear modeling, full sample weights were used to produce survey estimates of socio-emotional health. The Taylor series method was implemented to adjust the standard errors during hypothesis testing. Weights, PSU and stratum identifiers were provided in the ECLS-K:2011 dataset for use with the Taylor series methods (32, 36). The W1T0 and W1P0 child base weights (plus strata and PSU) adjusted for non-response associated with the child-level teacher and parent

questionnaires respectively were used as the sample weights for the child socio-emotional outcomes when investigated separately (36). For more details on the calculation of weights used in the ECLS-K:2011 dataset, please refer to the "Early Childhood Longitudinal Study, Kindergarten Class of 2010-11 (ECLS-K: 2011). User's Manual for the ECLS-K: 2011 Kindergarten Data File and Electronic Codebook, Public Version" (32).

Results

Study Size

All counts of respondents rounded to nearest 50 per NCES requirements. For the present study, data analysis was limited to approximately 13,000 kindergarten children residing in neighborhoods characterized by quintile of adult college educational attainment, with non-missing data on socio-emotional health, college education, and covariates included in each model. The NCES collected data on approximately 18,200 students who attended kindergarten in the 2010-2011 school year through ECLS-K:2011 (32). Of these students, approximately 600 resided in census tracts with missing education percentages and were excluded from the study. Of the remaining students, 3,200 were missing teacher reported ATL, 4,600 were missing parent reported SC, 4,550 were missing parent reported SI, 4,250 were missing teacher reported IP, 3,600 were missing teacher reported EB, and 3,750 were missing teacher reported IB. These students, and those missing any of the covariates tested, were excluded from the respective analyses. Therefore, the study sample size for each analysis was as follows:

ATL = 6,600, SC = 7,000, SI = 7,000, IP = 6,200, logEB = 6,400 logIB = 6,500, social skills combined =6,150, and problem behaviors combined = 6,300.

Census tract education quintiles

The percentage of college educated adults in each census tract, categorized into the quintiles used throughout this study, are represented on a map of the continental United States in Figure 2. Census tracts in the northern US are primarily categorized into the moderate through high quintiles (18.6% - 100%) of college educated adults. Stretching from the western side of Texas to the middle of Virginia and upwardly bounded by Kentucky, census tracts have the lowest percentages of college educated adults (< 12%). There are, however, pockets of tracts characterized by high quintiles of college educated adults in urban/metropolitan areas such as Atlanta, GA and Lexington, KY. In the northwest, a band of high quintile (>41.1%) census tracts stretches through Maryland, Western Pennsylvania, Central New Jersey, New York City, Connecticut, Rohde Island, Massachusetts, New Hampshire, and Vermont.

Bivariate analysis

Selected child, parent, household, school, and neighborhood characteristics for children within each quintile of neighborhood education are shown in Table 1. Most characteristics presented are either not evenly distributed across all education quintiles or mean values differ in at least one quintile, according to the test of homogeneity. Child sex, however, is evenly distributed across all levels of neighborhood education (p-value = 0.64; Table 1).

Socio-emotional Outcomes

This analysis then examined the association between census tract education and eight socio-emotional competencies of US kindergarteners. First, four models for each outcome were compared to determine the difference in the association between tract education and social-skills when adjusting for no covariates, SES, demographics, and all covariates.

Table 2 compares the linear regression estimates for the quintiles of college educated adults in census tracts between four model subsets: crude, SES covariates, demographics, and full set of covariates. Crude estimates, not controlling for any covariates, result in a decrease in approaches to learning, social interaction, social-skills; and an increase in interpersonal skills, externalizing behavior and internalizing behavior across all quintiles of adult education compared to the census tracts with the highest percentage of college educated adults. A similar trend occurred when demographics were controlled for in the models. When including only SES covariates in the models, approaches to learning and social interaction showed increases in frequency across education quintiles compared to the highest percentage of college educated adults. Other socio-emotional outcomes increased or decreased depending on the quintile. Controlling for all covariates resulted in estimates most similar to the SES model throughout all outcomes modeled.

Table 3 and Table 4 present the linear regression results of the best model pertaining to social skills and behavior problems respectively. Regression coefficients as well as 95% confidence intervals are presented.

Beginning with the four social skill competencies, and a combination of the four scales, the results suggest that children, residing in census tracts where 18.6% - 27.2% (moderate quintile) of adults have a college education, have higher frequencies of approaches to learning, and social interactions compared to their counterparts living in census tracts with more than 41.1% (high quintile) college educated adults (Table 3; Figure 3). This was to be expected based on previous research of neighborhood effects on child outcomes. Children who reside in tracts where 27.3% - 41.1% (moderate high quintile) and 12.1% - 18.5% (moderate low quintile) of adults are college educated have better self-control and interpersonal skills respectively compared to those residing in tracts with the most college educated adults (Figure 3). Overall, children residing in tracts with adult college education below 41% (low through moderate high quintiles) have better approaches to learning but worse social interaction and interpersonal skills (Figure 3). Child social interaction is mostly unchanging across all tract education quintiles.

Of the two problem behaviors, percentage of college educated adults in tracts where children reside seems to have a greater association with externalizing behaviors (Table 4). The children with the most externalizing behaviors seem to reside in the tracts where, either the quintile of college educated adults was the highest (> 41.1%), or where 12.1% - 18.5% (moderate low quintile) of adults had college degrees (Figure 3). Children residing in tracts where less than 12% (low quintile) of adults have a college degree show similar frequencies of internalizing and externalizing behavior, which is lower compared to the tracts with the highest percentage of college educated adults.

Where the percentage of college educated adults was 12.1% - 18.5% (moderate low quintile) and 27.3% - 41.1% (moderate high quintile), children had the greatest frequencies of internalizing behaviors. The frequency of child externalizing behaviors were lowest where the percentage of college educated adults was between 18.6 and 41 (moderate to moderate high quintiles).

Interaction Assessment

After examining the association between census tract education and eight socio-emotional competencies of US kindergarteners, this analysis investigated whether race and primary parent education modified the association between tract education and socio-emotional competencies. Figure 4 presents significant interaction of primary parent education level on the association between tract education and self-control. Significant interaction of race on the association between tract education and externalizing behaviors is presented in Figure 5. The 95% confidence intervals for these estimates are large and therefore not presented on the figures for simplicity.

Among children whose primary parent went to a VOC/tech school or completed at least a master's degree, frequencies of self-control were greater in all other quintiles of tract education compared to the highest percentage of tract college education (Figure 4). In addition, children whose primary parent only went to a VOC/tech school had greater self-control across tract education quintiles, compared to other levels of primary parent education. The greatest decrease in self-control compared to the tracts with the highest percentage of college educated adults was observed in children with the least educated (< high school) primary parent. Similar trends occurred in child self-control where

primary parents achieved moderate education (high school, tech school, bachelor's degree). Self-control increased for those residing in tracts with 27.3% - 41.1% (moderate high quintile), decreased in tracts with 18.6% - 27.2% (moderate quintile), and increased again in tracts with 12.2% - 18.5% (moderate low quintile) relative to self-control levels at other percentages of college educated adults (Figure 4).

The associations of tract education with externalizing behavior varied depending on race. Black and Hispanic children showed a similar externalizing behavior trend with similar magnitudes of difference compared to the tracts with greatest percentage of college educated adults (Figure 5). These children residing in census tracts where 18.6% - 27.2% (moderate quintile) of the adults had a college degree had the lowest frequencies of externalizing behaviors compared to the tracts with college educated adults reaching over 41.1% (high quintile). White children showed the least association between tract education and externalizing behaviors. Children who were identified as two or more races had less externalizing behaviors in the tracts where less than 12% (low quintile) of the adults had a college degree and the most externalizing behaviors were observed when these children resided in tracts with 12.1% - 18.5% (moderate low quintile) college educated adults. Children identified as Asian, Native Hawaiian/Pacific Islander, or American Indian/Alaska Native are represented as one group. These children experienced greatest externalizing behaviors in the tracts with the lowest percentage of college educated adults and the least externalizing behavior in the tracts with the second highest percentage of college educated adults (Figure 5).

Discussion

The progression of socio-emotional development early in childhood may be a risk factor for subsequent health outcomes, and the differences in childhood environment may lead to variation in socio-emotional health contributing to population health disparities. Given that socio-emotional functioning in kindergarten is strongly associated with so many life avenues such as crime, and education, and that socio-emotional develops over time and is shaped by children's interactions with their environment, addressing current gaps in literature to determine possible interventions is essential (6-8). This study addressed gaps, including scarcity of studies investigating associations between neighborhood human capital and child socio-emotional health, through a cross-sectional study on percentage of college educated adults by census tract and child socio-emotional health. This is to the best of our knowledge, the first to utilize this singleton measure of neighborhood SES.

This study relied on the most recent collection of US wide child socio-emotional health outcomes, the ECLS-K:2011 compiled by NCES at the U.S. Department of Education. Because of the nature of the survey methods implemented and the large sample size of the dataset, we were able to rely on teacher and parent surveys for the majority of the variables modeled in this study. Therefore, an advantage in this study is the ability to control for a wide range of child, parent, household, school, and neighborhood characteristics, which might have confounded neighborhood associations with child outcomes in previous studies.

Socio-emotional Outcomes

Eight child socio-emotional outcomes were modeled through linear regression to determine the effect of residence within census tracts varying by percentages of college educated adults. Children, residing in census tracts where 18.6% - 27.2% (moderate quintile) of adults have a college education, showed higher frequencies of approaches to learning, and social interactions compared to those living in census tracts with more than 41.1% (highest quintile) college educated adults. Overall, children residing in tracts with adult college education below 41% (below the highest quintile) were observed to have better approaches to learning but worse self-control and interpersonal skills. There was a crude association between tract education quintiles and outcomes, largely attenuated by adjustment for individual SES. Both measures of problem behaviors seemed to be influenced by tract education, but the effects showed no consistent trend across quintiles of college educated adults.

These trends (or lack thereof) in the effect of tract education on social skills and problem behaviors indicates that neighborhood education may be more strongly associated with academic social skills than those socio-emotional competencies involving interaction with others and expression. This is consistent with previous findings where high neighborhood SES is associated with better child academic outcomes, and where neighborhood education level combined with other SES measures is associated with adult mental health, specifically depression (4, 15).

Interaction Assessment

Similar trends, but not magnitudes in the effect of tract education on self-control between children whose parents achieved the moderate levels of education (high school, tech school, and bachelor's degree) may be due to neighborhood factors other than education. The large increase in self-control among children whose parents went to a VOC/tech school could be explained by the importance family and child well-being has in the parents' lives. Prioritizing children and family over advancing education would mean that the primary parent is spending more time with children, working on self-control. Maternal, or in this case, primary parental factors play a role in child's socio-emotional health as well as their exposure to neighborhood influences (4). Through primary parent impact on a child's exposure to their neighborhood environment, education interacts with the association between neighborhood education and socio-emotional health at this young age. Further avenues for research could include a longitudinal analysis of this relationship over the course of adolescence to determine when primary parent education no longer interacts with this association.

In addition, in locations where college education percentage is low, the social networks between lower educated parents may be stronger and could result in sharing of best parenting practices leading to more self-control in children. Parents with at least a master's degree may research parenting practices more or have the resources to send children to counseling/advising when issues arise with self-control.

In the present study, associations between census tract college education percentage and externalizing behavior varied depending on race. Previous study has been limited to

differences between white and black/African American children, yet found differences in susceptibility to neighborhood effects based on race (4). Links between race and SES in previous generations are stronger and may be partially responsible. Neglectful parenting is more common with lower SES individuals, so SES in previous generations may moderate the effect of neighborhood on children similar to race (26). Therefore, race may modify the association between neighborhood and socio-emotional health when race serves as a proxy for parental SES. Further research should be conducted to investigate the modification of this association by more direct measure of parental SES such as education, income, and poverty.

Limitations

There are a few limitations of the present study worth mentioning. Due to the cross-sectional nature of this study, temporality cannot be established leading to the possibility of ecologic fallacy. If a majority of the families in the study with socio-emotionally health children are self-selected into their census tracts based on the educational opportunities available, the socio-emotional health of the child may have caused relocation into a census tract with a higher/lower percentage of college educated adults.

Additional limitations to this study include small effect estimates. Most effect estimates calculated through linear regression were not significant and were small in magnitude. It is possible that neighborhood effects are too small to see large differences in socio-emotional outcomes. However, similar magnitudes of socio-emotional health were found in previous literature of child level exposures (37). This indicates that the cross-

sectional study design may not be powerful enough to make concrete inferences on association with socio-emotional health. Further research should expand this study to follow children throughout their adolescence to establish temporality, and investigate the effects of relocation on socio-emotional health.

The modifiable area unit problem is a common limitation in studies examining the effect of neighborhood on individuals when the boundary of the neighborhood does not reflect the social process or interaction studied. Because we studied the percentage of college educated adults in census tracts, but children's neighborhoods can extend past tract lines, we may have been making assumptions about neighborhood interactions at improper geographical divisions. A better boundary of a child's neighborhood, for this study, may have been school districts since children interact with their classmates who reside in the same school district. A multi-scale analysis, in which the associations are examined repeatedly for blocks, block groups, tracts, school districts, and/or counties, may also be helpful in understanding the area level in which neighborhood education is associated with child socio-emotional competencies. In addition, the use of spatial surfaces, where values of adult education are smoothed across geographical areas, can allow for a continuous area without boundaries. This continuous area may be more representative of neighborhood since people do not interact solely within arbitrary boundaries such as census tracts.

References

1. Bradley RH, Corwyn RF. Socioeconomic Status and Child Development. *Annu Rev Psychol.* 2002:371-99.
2. McLoyd VC. Socioeconomic disadvantage and child development. *American psychologist* 1998;53(2):185.
3. Najman JM, Aird R, Bor W, et al. The generational transmission of socioeconomic inequalities in child cognitive development and emotional health. *Social science & medicine* 2004;58(6):1147-58.
4. Leventhal T, Brooks-Gunn J. The neighborhoods they live in: the effects of neighborhood residence on child and adolescent outcomes. *Psychological bulletin* 2000;126(2):309.
5. Wilmshurst L. *Essentials of Child and Adolescent Psychopathology*. 2nd ed. Hoboken: *John Wiley and Sons*2014.
6. Jones DE, Greenberg M, Crowley M. Early social-emotional functioning and public health: the relationship between kindergarten social competence and future wellness. *Journal Information* 2015;105(11).
7. Liu J. Childhood externalizing behavior: theory and implications. *Journal of child and adolescent psychiatric nursing* 2004;17(3):93-103.
8. Heckman J, Pinto R, Savelyev P. Understanding the mechanisms through which an influential early childhood program boosted adult outcomes. *The American economic review* 2013;103(6):2052-86.

9. Berger LM, Houle JN. Parental Debt and Children's Socioemotional Well-being. *Pediatrics* 2016;137(2):e20153059.

10. Evans GW, Saltzman H, Cooperman JL. Housing quality and children's socioemotional health. *Environment and Behavior* 2001;33(3):389-99.

11. Evans GW, English K. The environment of poverty: Multiple stressor exposure, psychophysiological stress, and socioemotional adjustment. *Child development* 2002;73(4):1238-48.

12. Morrissey TW, Oellerich D, Meade E, et al. Neighborhood poverty and children's food insecurity. *Children and Youth Services Review* 2016;66:85-93.

13. Perez-Escamilla R, Pinheiro de Toledo Vianna R. Food insecurity and the behavioral and intellectual development of children: a review of the evidence. *Journal of Applied Research on Children: Informing Policy for Children at Risk* 2012;3(1):9.

14. Alaimo K, Olson CM, Frongillo EA. Food insufficiency and American school-aged children's cognitive, academic, and psychosocial development. *Pediatrics* 2001;108(1):44-53.

15. Truong KD, Ma S. A systematic review of relations between neighborhoods and mental health. *Journal of Mental Health Policy and Economics* 2006;9(3):137.

16. Brauner CB, Stephens CB. Estimating the prevalence of early childhood serious emotional/behavioral disorders: challenges and recommendations. *Public health reports* 2006:303-10.

17. Arons A, Bolbocean C, Bush NR, et al. Participation in the special supplemental nutrition program for women, infants, and children is not associated with early childhood socioemotional development: Results from a longitudinal cohort study. *Preventive Medicine Reports* 2016.

18. Bertrand M, Pan J. The trouble with boys: Social influences and the gender gap in disruptive behavior. *American Economic Journal: Applied Economics* 2013;5(1):32-64.

19. Garaigordobil M, Maganto C, Pérez JI, et al. Gender Differences in Socioemotional Factors During Adolescence and Effects of a Violence Prevention Program. *Journal of Adolescent Health* 2009;44(5):468-77.

20. Datar A, Gottfried MA. School Entry Age and Children's Social- Behavioral Skills: Evidence from a National Longitudinal Study of U.S. Kindergartners. *Educational Evaluation and Policy Analysis* 2015;37(3):333-53.

21. Reardon SF, Portilla XA. Recent Trends in Income, Racial, and Ethnic School Readiness Gaps at Kindergarten Entry. *AERA Open* 2016;2(3):2332858416657343.

22. Aratani Y, Wight VR, Cooper JL. Racial Gaps in Early Childhood: Socio-Emotional Health, Developmental, and Educational Outcomes among African-American Boys. Report. *National Center for Children in Poverty* 2011.

23. Cerezo MA, Pons-Salvador G, Trenado RM. Mother– infant interaction and children's socio- emotional development with high- and low- risk mothers. *Infant Behavior and Development* 2008;31(4):578-89.

24. Zuravin SJ. The ecology of child abuse and neglect: Review of the literature and presentation of data. *Violence and Victims* 1989;4(2):101-20.

25. Sampson RJ. Family management and child development: Insights from social disorganization theory. *Advances in criminological theory* 1992;3:63-93.

26. Berge JM, Wall M, Bauer KW, et al. Parenting characteristics in the home environment and adolescent overweight: a latent class analysis. *Obesity (Silver Spring, Md)* 2010;18(4):818.

27. Leventhal T, Brooks-Gunn J. Moving to opportunity: an experimental study of neighborhood effects on mental health. *American Journal of Public Health* 2003;93(9):1576-82.

28. Sandel M, Faugno E, Mingo A, et al. Neighborhood-level interventions to improve childhood opportunity and lift children out of poverty. *Academic pediatrics* 2016;16(3):S128-S35.

29. McCoy DC, Connors MC, Morris PA, et al. Neighborhood economic disadvantage and children's cognitive and social-emotional development: Exploring Head Start classroom quality as a mediating mechanism. *Early childhood research quarterly* 2015;32:150-9.

30. Bierman KL, Domitrovich CE, Nix RL, et al. Promoting Academic and Social-Emotional School Readiness: The Head Start REDI Program. *Child Development* 2008;79(6):1802-17.

31. Roux AVD. The study of group-level factors in epidemiology: rethinking variables, study designs, and analytical approaches. *Epidemiologic reviews* 2004;26(1):104-11.

32. Tourangeau K, Nord C, Lê T, et al. Early Childhood Longitudinal Study, Kindergarten Class of 2010-11 (ECLS-K: 2011). User's Manual for the ECLS-K: 2011 Kindergarten Data File and Electronic Codebook, Public Version. NCES 2015-074. *National Center for Education Statistics* 2015.

33. Torrieri, N. American Community Survey: Design and Methodology (January 2014): Version 2.0. *United States Census Bureau*2014. Available on-line at: https://www2.census.gov/programs-surveys/acs/methodology/design_and_methodology/acs_design_methodology_report_2014.pdf

34. Minnesota Population Center. National Historical Geographic Information System: Version 11.0 [Database]. Minneapolis: University of Minnesota. 2016. http://doi.org/10.18128/D050.V11.0.

35. Humphrey JL. Relevant social and spatial contexts for elementary school children: An examination of multiple scales. *Health & Place* 2016;40:178-84.

36. Thurgood L, Walter E, Carter G, et al. NCES Handbook of Survey Methods: Technical Report. 2003.

37. Gottfried MA. Chronic absenteeism and its effects on students' academic and socioemotional outcomes. *Journal of Education for Students Placed at Risk (JESPAR)* 2014;19(2):53-75.

Tables

Table 1. Child and family characteristics by percentage of adults with a college education in each U.S. census tract, for the 2010-2011 kindergarten year of The Early Childhood Longitudinal Study

	Percentage Levels of College Educated Adults in Child Residing Census Tracts												
	Low		Moderate low		Moderate		Moderate high		High		Total		P-value
	% or M	(SE)	% or M	(SE)	% or M	(SE)	% or M	(SE)	% or M	(SE)	N or M	(SE)	
Child age (months)	68.5	0.2	68.5	0.2	68.7	0.2	68.5	0.2	68.1	0.2	68.5	0.13	<.0001
Child sex (female) %	49.4	0.9	46.7	1.0	48.7	1.0	48.6	0.8	49	1.0	7,475		0.64
Domestic born child %	97.8	0.4	98.0	0.4	97.9	0.4	97.2	0.4	96.6	0.5	11,302		<.0001
Child race %													<.0001
White	27.8	3.6	46.6	4.1	57.2	3.3	62.4	2.9	65.2	2.6	7,533		
Black/African American	19.7	3.2	18.5	2.7	12.9	2.1	11.2	1.8	6.3	1.0	2,082		
Hispanic	44.8	5.0	27.1	3.0	21.5	2.0	16.8	1.8	13.1	1.3	3,670		
Asian/AHPI/AIAN	4.5	1.6	3.7	0.7	4.6	0.8	5.2	0.8	10.4	2.0	1,352		
≥ 2 Races	3.2	0.5	4.1	0.5	3.7	0.5	4.4	0.4	5.0	0.5	695		
Maternal age at 1st birth (years)	21.0	0.2	22.2	0.2	23.4	0.2	25.2	0.2	27.9	0.2	23.3	0.23	<.0001
Primary parent employment %													<.0001
≥ 35 hours/week	37.6	1.4	43.1	1.7	43.6	1.7	42.7	1.5	41.4	1.7	5,308		
< 35 hours/week	16.3	0.9	17.8	1	21.2	1.1	23.2	0.9	24.5	1.1	2,596		
Looking for work	10.7	0.9	11.2	0.9	6.8	0.6	5.8	0.6	3.8	0.4	908		
Not in labor force	35.4	1.6	28	1.4	28.4	1.3	28.3	1.5	30.4	1.7	3,739		
Primary parent occupational prestige	40.4	0.4	42.2	0.4	43.6	0.5	46.2	0.3	49.1	0.4	31.1	0.49	<.0001
Primary parent age	32.0	0.2	32.5	0.2	33.4	0.2	34.6	0.2	36.7	0.2	33.9	0.17	<.0001
Parent 2 age	35.0	0.2	35.6	0.3	36.3	0.2	37.4	0.2	39.5	0.2	28.2	0.47	<.0001
Primary parent married %	66.2	2.0	70.2	1.9	76.2	1.6	82.8	1.2	86.8	0.9	9,893		<.0001
Primary parent highest education %													<.0001
< High school	27.9	1.8	16	1.2	12.6	1.2	7.1	0.8	3.1	0.4	1,826		
High school diploma/GED	55.6	1.6	60.5	1.4	54.8	1.2	46.5	1.5	31.5	1.6	6,765		
VOC/TECH program	6.9	0.5	7.3	0.8	7.5	0.8	5.8	0.5	2.7	0.4	800		
Bachelor's degree	7.1	0.7	11.7	0.8	18.2	1.0	27.7	1.4	38.1	1.4	2,997		
≥ Master's degree	2.5	0.4	4.5	0.5	7.0	0.7	13	0.8	24.5	1.3	1,528		
English not spoken at home %	2.1	0.6	1.6	0.3	2.1	0.4	2.7	0.6	3.2	0.8	512		<.0001
Household FPL %													<.0001
< 100%	49.8	2.3	33.6	1.8	24.4	1.9	16.2	1.1	8.7	0.9	2,879		
100 - 200%	26.5	1.2	28.1	1.1	25.3	0.9	19.6	1.1	12.9	0.8	2,551		
> 200%	23.7	2.0	38.3	1.9	50.3	2.0	64.1	1.8	78.5	1.4	6,185		
# Children in household	2.7	0.0	2.5	0.0	2.5	0.0	2.5	0.0	2.4	0.0	2.5	0.02	<.0001

	Percentage Levels of College Educated Adults in Child Residing Census Tracts												
	Low		Moderate low		Moderate		Moderate high		High		Total		P-value
	% or M	(SE)	% or M	(SE)	% or M	(SE)	% or M	(SE)	% or M	(SE)	N or M	(SE)	
# Siblings in household %													<.0001
0	15.8	1.0	18.0	0.9	17.5	1.1	14.7	0.8	15.5	0.9	2,113		
1	35.6	1.3	38.2	1.0	40.3	0.8	44.0	1.3	45.7	1.4	5,329		
2	27.2	1.2	28.3	1.4	26.8	0.9	27.6	0.9	26.9	0.9	3,452		
3	14.6	0.7	10.2	0.7	10.2	0.6	9.5	0.7	9.2	0.9	1,346		
4	4.5	0.6	3.5	0.5	3.7	0.4	2.7	0.4	2.0	0.3	403		
> 5	2.2	0.3	1.9	0.4	1.5	0.3	1.5	0.3	0.7	0.2	206		
# Adults in household	2.1	0.0	2.0	0.0	2.0	0.0	2.0	0.0	2.0	0.0	2.0	0.01	0.01
Private school %	4.7	1.1	7.4	1.7	9.6	2.0	12.1	2.3	20.2	3.8	2,002		<.0001
School location %													<.0001
City	43	5.6	27.1	4.4	29.7	4.6	29.1	4.1	33.8	4.4	4,923		
Suburb	23.5	4.6	28.5	4.5	25.2	3.9	37.7	4.8	50.9	4.6	5,383		
Town	9.5	2.4	13.4	3.1	20.1	5.6	9.8	3.5	3.7	1.2	1,253		
Rural	24	4.5	31.0	4.6	25.0	3.0	23.3	3.7	11.6	2.7	3,582		
School region %													<.0001
Northeast	12.9	4.7	11.8	3.4	10.7	3.1	21.3	5.5	24.6	5.7	2,337		
Midwest	10.9	3.5	24.8	6.6	28.2	7.3	23.5	5.9	21.2	5.2	3,496		
South	50.3	6.8	41.7	6.4	38.7	6.8	32.1	6.0	27.5	5.4	5,808		
West	25.9	5.2	21.6	4.7	22.4	5.0	23.2	5.4	26.8	5.9	3,745		

M=mean; SD = Standard deviation; FPL = Federal poverty level; Percentage levels of college educated adults in census tracts: high (41.1-100%), moderate high (27.3-41.1%), moderate (18.6-27.2%), moderate low (12.1-18.5%), low (<12%).

Table 2: Effect estimates in all model subsets for all outcomes.

Approaches to Learning												
	M0 – Crude			M1 – SES Covariates			M2 – Demographics			M3 – Full Model		
	Est.	95% CI		Est.	95% CI		Est.	95% CI		Est.	95% CI	
College educated adults												
< 12%	-0.17	-0.22	-0.12	0.04	-0.03	0.11	-0.11	-0.16	-0.05	0.06	-0.01	0.12
12.1% - 18.5%	-0.15	-0.21	-0.10	0.04	-0.03	0.11	-0.09	-0.16	-0.02	0.05	-0.01	0.12
18.6% - 27.2%	-0.09	-0.15	-0.04	0.09	0.02	0.15	-0.04	-0.10	0.03	0.09	0.03	0.14
27.3% - 41.1%	-0.08	-0.13	-0.03	0.02	-0.04	0.09	-0.05	-0.11	0.00	0.03	-0.03	0.09
41.2% - 95%	Ref.			Ref.			Ref.			Ref.		

Interpersonal Skills	M0 – Crude			M1 – SES Covariates			M2 – Demographics			M3 – Full Model		
	Est.	95% CI		Est.	95% CI		Est.	95% CI		Est.	95% CI	
College educated adults												
< 12%	0.13	0.05	0.21	-0.02	-0.13	0.09	0.12	0.03	0.22	-0.02	-0.13	0.09
12.1% - 18.5%	0.14	0.07	0.22	0.01	-0.08	0.11	0.13	0.05	0.21	0.01	-0.08	0.10
18.6% - 27.2%	0.09	0.03	0.15	-0.02	-0.10	0.06	0.07	0.00	0.15	-0.03	-0.10	0.05
27.3% - 41.1%	0.05	-0.01	0.12	0.00	-0.08	0.07	0.03	-0.04	0.09	-0.01	-0.09	0.06
41.2% - 95%	Ref.			Ref.			Ref.			Ref.		

Social Interaction	M0 – Crude			M1 – SES Covariates			M2 – Demographics			M3 – Full Model		
	Est.	95% CI		Est.	95% CI		Est.	95% CI		Est.	95% CI	
College educated adults												
< 12%	-0.09	-0.13	-0.04	0.02	-0.04	0.07	-0.05	-0.09	-0.01	0.01	-0.04	0.07
12.1% - 18.5%	-0.05	-0.1	-0.01	0.02	-0.03	0.06	-0.05	-0.09	-0.01	0.01	-0.03	0.06
18.6% - 27.2%	-0.04	-0.08	0.00	0.02	-0.02	0.07	-0.04	-0.08	0.00	0.02	-0.03	0.06
27.3% - 41.1%	-0.03	-0.06	0.01	0.00	-0.04	0.04	-0.04	-0.07	0.00	-0.01	-0.04	0.03
41.2% - 95%	Ref.			Ref.			Ref.			Ref.		

Self-Control	M0 – Crude			M1 – SES Covariates			M2 – Demographics			M3 – Full Model		
	Est.	95% CI		Est.	95% CI		Est.	95% CI		Est.	95% CI	
College educated adults												
< 12%	-0.12	-0.15	-0.09	-0.02	-0.06	0.02	-0.04	-0.07	0.00	-0.03	-0.07	0.02
12.1% - 18.5%	-0.09	-0.12	-0.06	-0.01	-0.05	0.04	-0.03	-0.07	0.00	-0.01	-0.06	0.03
18.6% - 27.2%	-0.07	-0.1	-0.03	-0.01	-0.05	0.03	-0.03	-0.07	0.01	-0.02	-0.06	0.03
27.3% - 41.1%	-0.03	-0.05	0.00	0.01	-0.02	0.04	-0.01	-0.04	0.02	0.01	-0.03	0.04
41.2% - 95%	Ref.			Ref.			Ref.			Ref.		

Externalizing Behavior	M0 – Crude			M1 – SES Covariates			M2 – Demographics			M3 – Full Model		
	Est.	95% CI		Est.	95% CI		Est.	95% CI		Est.	95% CI	
College educated adults												
< 12%	0.07	0.04	0.10	0.00	-0.04	0.04	0.06	0.02	0.09	-0.01	-0.05	0.03
12.1% - 18.5%	0.06	0.03	0.09	0.00	-0.04	0.04	0.05	0.01	0.08	0.00	-0.04	0.03
18.6% - 27.2%	0.05	0.02	0.07	-0.01	-0.05	0.02	0.03	0.01	0.06	-0.02	-0.05	0.02
27.3% - 41.1%	0.02	-0.01	0.04	-0.01	-0.05	0.02	0.00	-0.02	0.03	-0.02	-0.05	0.01
41.2% - 95%	Ref.			Ref.			Ref.			Ref.		

Internalizing Behavior	M0 – Crude			M1 – SES Covariates			M2 – Demographics			M3 – Full Model		
	Est.	95% CI		Est.	95% CI		Est.	95% CI		Est.	95% CI	
College educated adults												
< 12%	0.01	-0.02	0.03	-0.01	-0.05	0.02	0.01	-0.01	0.04	-0.01	-0.04	0.03
12.1% - 18.5%	0.02	0.00	0.05	0.01	-0.02	0.04	0.03	0.00	0.05	0.01	-0.01	0.04
18.6% - 27.2%	0.01	-0.01	0.03	0.00	-0.03	0.03	0.01	-0.01	0.04	0.00	-0.03	0.03
27.3% - 41.1%	0.01	-0.01	0.03	0.01	-0.02	0.03	0.01	-0.01	0.03	0.01	-0.02	0.03
41.2% - 95%	Ref.			Ref.			Ref.			Ref.		
Social Skills Combined	M0 – Crude			M1 – SES Covariates			M2 – Demographics			M3 – Full Model		
	Est.	95% CI		Est.	95% CI		Est.	95% CI		Est.	95% CI	
College educated adults												
< 12%	-0.51	-0.65	-0.36	0.07	-0.11	0.26	-0.32	-0.46	-0.18	0.11	-0.05	0.28
12.1% - 18.5%	-0.37	-0.52	-0.23	0.07	-0.09	0.23	-0.26	-0.42	-0.11	0.09	-0.06	0.24
18.6% - 27.2%	-0.27	-0.42	-0.11	0.15	-0.01	0.31	-0.18	-0.35	-0.02	0.14	-0.01	0.3
27.3% - 41.1%	-0.21	-0.34	-0.08	0.05	-0.10	0.19	-0.19	-0.32	-0.06	0.05	-0.08	0.19
41.2% - 95%	Ref.			Ref.			Ref.			Ref.		
Problem Behaviors Combined	M0 – Crude			M1 – SES Covariates			M2 – Demographics			M3 – Full Model		
	Est.	95% CI		Est.	95% CI		Est.	95% CI		Est.	95% CI	
College educated adults												
< 12%	0.13	0.05	0.21	-0.02	-0.13	0.09	0.12	0.03	0.22	-0.02	-0.13	0.09
12.1% - 18.5%	0.14	0.07	0.22	0.01	-0.08	0.11	0.13	0.05	0.21	0.01	-0.08	0.10
18.6% - 27.2%	0.09	0.03	0.15	-0.02	-0.10	0.06	0.07	0.00	0.15	-0.03	-0.10	0.05
27.3% - 41.1%	0.05	-0.01	0.12	0.00	-0.08	0.07	0.03	-0.04	0.09	-0.01	-0.09	0.06
41.2% - 95%	Ref.			Ref.			Ref.			Ref.		

Est. = Effect Estimate; Percentage levels of college educated adults in census tracts: high (41.1-100%), moderate high (27.3-41.1%), moderate (18.6-27.2%), moderate low (12.1-18.5%), low (<12%).

Table 3. Social skills linear regression results from the 2010-2011 kindergarten year of The Early Childhood Longitudinal Study.

	Approaches to learning (n = 6,600)			Interpersonal skills (n = 6,200)			Social interaction (n = 7,000)			Self-control (n = 7,000)			Combined (n = 6,150)		
Parameter	Est.	95% CI		Est.	95% CI		Est.	95% CI		Est.	95% CI		Est.	95% CI	
Intercept	1.76	1.35	2.16	3.29	3.00	3.59	3.49	3.22	3.76	3.04	2.82	3.25	10.93	9.90	11.95
College educated adults															
< 12%	0.06	-0.01	0.12	-0.02	-0.13	0.09	0.01	-0.04	0.07	-0.03	-0.07	0.02	0.11	-0.05	0.28
12.1% - 18.5%	0.05	-0.01	0.12	0.01	-0.08	0.11	0.01	-0.03	0.06	-0.01	-0.06	0.03	0.09	-0.06	0.24
18.6% - 27.2%	0.09	0.03	0.14	-0.02	-0.10	0.06	0.02	-0.03	0.06	-0.02	-0.06	0.03	0.14	-0.01	0.30
27.3% - 41.1%	0.03	-0.03	0.09	0.00	-0.08	0.07	-0.01	-0.04	0.03	0.01	-0.03	0.04	0.05	-0.08	0.19
41.2% - 95%	Ref.			Ref.			Ref.			Ref.			Ref.		
Household FPL															
<100%	-0.14	-0.20	-0.08	0.21	0.12	0.29	-0.07	-0.13	-0.01	-0.05	-0.11	0.00	-0.42	-0.58	-0.26
100-200%	-0.05	-0.09	-0.01	0.08	0.02	0.14	-0.02	-0.07	0.02	-0.02	-0.06	0.01	-0.14	-0.24	-0.04
>200%	Ref.			Ref.			Ref.			Ref.			Ref.		
School location type															
City	0.00	-0.06	0.05	0.03	-0.07	0.13	0.03	-0.02	0.09	0.00	-0.06	0.06	0.08	-0.05	0.21
Rural	-0.04	-0.10	0.02	0.06	-0.04	0.16	0.02	-0.02	0.07	-0.02	-0.07	0.04	0.01	-0.15	0.16
Suburb	-0.01	-0.07	0.04	0.00	-0.09	0.10	0.03	-0.02	0.08	0.00	-0.06	0.06	0.07	-0.07	0.21
Town	Ref.			Ref.			Ref.			Ref.			Ref.		
Primary parent employment															
< 35 Hours	0.06	0.02	0.09	-0.08	-0.14	-0.01	-0.01	-0.04	0.03	0.01	-0.02	0.04	0.12	0.03	0.22
Looking for work	-0.05	-0.12	0.01	0.05	-0.04	0.15	0.02	-0.04	0.08	-0.04	-0.09	0.01	-0.09	-0.27	0.08
Not in labor force	-0.02	-0.18	0.14	-0.03	-0.23	0.18	0.05	-0.07	0.16	-0.12	-0.25	0.02	-0.10	-0.52	0.32
≥ 35 Hours	Ref.			Ref.			Ref.			Ref.			Ref.		
Primary parent highest education															
< High school	-0.14	-0.24	-0.04	0.07	-0.07	0.20	-0.21	-0.29	-0.13	-0.18	-0.26	-0.11	-0.63	-0.86	-0.39
High school diploma/equivalent	-0.10	-0.16	-0.04	0.09	0.00	0.18	-0.01	-0.07	0.04	-0.06	-0.10	-0.02	-0.21	-0.37	-0.05
Voc/tech program	-0.16	-0.24	-0.07	0.08	-0.05	0.21	-0.02	-0.10	0.06	-0.08	-0.16	0.01	-0.38	-0.62	-0.13
Bachelor's degree	-0.02	-0.07	0.04	0.00	-0.07	0.07	0.01	-0.03	0.05	-0.03	-0.07	0.01	-0.02	-0.15	0.12
≥ Master's degree	Ref.			Ref.			Ref.			Ref.			Ref.		
Public school	-0.03	-0.09	0.04	-0.06	-0.15	0.03	-0.04	-0.08	-0.01	-0.02	-0.05	0.02	-0.18	-0.32	-0.04
Maternal age at 1st birth (years)	0.01	0.00	0.01	0.00	-0.01	0.00	0.00	-0.01	0.00	0.00	0.00	0.00	0.01	0.00	0.02
# Children in household	0.00	-0.04	0.04	-0.06	-0.08	-0.03	-0.04	-0.08	0.01	-0.05	-0.08	-0.01	-0.07	-0.18	0.04
# Adults in household	-0.01	-0.04	0.02	-0.05	-0.09	-0.01	-0.03	-0.05	0.00	-0.01	-0.03	0.01	-0.02	-0.09	0.05

	Approaches to learning (n = 6,600)			Interpersonal skills (n = 6,200)			Social interaction (n = 7,000)			Self-control (n = 7,000)			Combined (n = 6,150)		
Parameter	Est.	95% CI		Est.	95% CI		Est.	95% CI		Est.	95% CI		Est.	95% CI	
Primary parent occupational prestige	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.01	0.00	0.01
Child sex (male)	-0.31	-0.34	-0.28				-0.09	-0.12	-0.06	-0.07	-0.09	-0.04	-0.7	-0.78	-0.62
Child age (months)	0.02	0.01	0.02				0.00	0.00	0.01	0.00	0.00	0.00	0.03	0.02	0.04
Race	-0.02	-0.11	0.06												
2 or more	0.12	0.00	0.25				-0.04	-0.09	0.02	0.01	-0.05	0.07	-0.06	-0.28	0.16
Asian/NHPI/AIAN	-0.01	-0.07	0.05				-0.13	-0.22	-0.05	-0.01	-0.06	0.04	0.08	-0.20	0.35
Black/African-American	0.01	-0.05	0.07				0.00	-0.05	0.04	0.08	0.04	0.12	0.06	-0.07	0.2
Hispanic	0.02	0.01	0.02				-0.10	-0.15	-0.05	0.00	-0.04	0.04	-0.08	-0.22	0.06
White	Ref.			.			Ref.			Ref.			Ref.		
# of siblings in household															
1	0.04	-0.02	0.10				0.01	-0.04	0.07	-0.06	-0.11	-0.01	0.04	-0.11	0.19
2	0.09	-0.01	0.20				0.04	-0.05	0.12	-0.03	-0.11	0.06	0.2	-0.07	0.46
3	0.08	-0.06	0.22				0.07	-0.06	0.19	0.03	-0.09	0.16	0.19	-0.16	0.54
4	0.14	-0.08	0.36				0.13	-0.06	0.32	0.00	-0.19	0.19	0.45	-0.15	1.04
> 5	0.03	-0.24	0.29				0.13	-0.15	0.40	-0.01	-0.21	0.2	0.06	-0.63	0.75
none	Ref.			.			Ref.			Ref.			Ref.		
English not spoken at home	0.07	-0.05	0.19				-0.09	-0.19	0.01	0.13	0.02	0.24	0.11	-0.18	0.41
Primary parent married	0.09	0.04	0.14				0.00	-0.04	0.04	0.05	0.01	0.09	0.16	0.06	0.27
Primary parent age	-0.01	-0.01	0.00				0.00	-0.01	0.00	0.00	0.00	0.00	-0.01	-0.02	-0.01
Non-domestic born child	0.01	-0.12	0.14				-0.04	-0.15	0.07	0.07	-0.02	0.16	-0.05	-0.35	0.26

Est. = Effect Estimate; FPL = Federal poverty level; Percentage levels of college educated adults in census tracts: high (41.1-100%), moderate high (27.3-41.1%), moderate (18.6-27.2%), moderate low (12.1-18.5%), low (<12%).

Table 4. Problem behaviors linear regression results from the 2010-2011 kindergarten year of The Early Childhood Longitudinal Study.

	Externalizing Behaviors (n = 6,400)			Internalizing Behaviors (n = 6,500)			Combined (n = 6,300)		
Parameter	Est.	95% CI		Est.	95% CI		Est.	95% CI	
Intercept	0.59	0.37	0.80	0.28	0.19	0.38	3.14	2.55	3.73
College educated adults									
< 12%	-0.01	-0.05	0.03	-0.01	-0.05	0.02	-0.02	-0.13	0.09
12.1% - 18.5%	0.00	-0.04	0.03	0.01	-0.02	0.04	0.01	-0.08	0.10
18.6% - 27.2%	-0.02	-0.05	0.02	0.00	-0.03	0.03	-0.03	-0.10	0.05
27.3% - 41.1%	-0.02	-0.05	0.01	0.01	-0.02	0.03	-0.01	-0.09	0.06
41.2% - 95%	Ref.			Ref.			Ref.		
Household FPL									
<100%	0.07	0.03	0.1	0.04	0.00	0.07	0.19	0.11	0.28
100-200%	0.02	0.00	0.05	0.02	0.00	0.05	0.09	0.03	0.15
>200%	Ref.			Ref.			Ref.		
School location type									
City	0.01	-0.03	0.04	0.01	-0.03	0.05	0.05	-0.05	0.15
Rural	0.00	-0.03	0.03	0.02	-0.02	0.06	0.05	-0.04	0.14
Suburb	-0.02	-0.05	0.01	0.01	-0.03	0.04	-0.01	-0.10	0.08
Town	Ref.			Ref.			Ref.		
Primary parent employment									
< 35 Hours	-0.05	-0.08	-0.03	0.01	-0.01	0.02	-0.07	-0.13	-0.01
Looking for work	-0.01	-0.05	0.02	0.04	0.01	0.07	0.06	-0.04	0.15
Not in labor force	-0.04	-0.12	0.04	0.01	-0.08	0.09	-0.03	-0.23	0.18
≥ 35 Hours	Ref.			Ref.			Ref.		
Primary parent highest education									
< High school	0.03	-0.03	0.08	0.02	-0.03	0.06	0.07	-0.07	0.2
High school diploma/equivalent	0.03	-0.01	0.06	0.01	-0.02	0.04	0.07	-0.03	0.16
Voc/tech program	0.03	-0.03	0.08	0.02	-0.02	0.07	0.08	-0.05	0.2
Bachelor's degree	0.01	-0.02	0.04	-0.01	-0.03	0.02	0	-0.07	0.07
≥ Master's degree	Ref.			Ref.			Ref.		
Public school	-0.02	-0.05	0.01	-0.02	-0.06	0.01	-0.06	-0.15	0.04
Maternal age at 1st birth (years)	0.00	-0.01	0.00	0.00	0.00	0.00	-0.01	-0.01	0.00
# Children in household	0.00	-0.03	0.03	0.00	-0.01	0.00	0.01	-0.07	0.09
# Adults in household	-0.01	-0.02	0.01	-0.01	-0.02	0.01	-0.02	-0.05	0.02
Primary parent occupational prestige	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Child sex (male)	0.15	0.13	0.17				0.3	0.25	0.35
Child age (months)	0.00	0.00	0.00				0.00	-0.01	0.01
Race									

	Externalizing Behaviors (n = 6,400)			Internalizing Behaviors (n = 6,500)			Combined (n = 6,300)		
Parameter	Est.	95% CI		Est.	95% CI		Est.	95% CI	
2 or more	0.01	-0.03	0.06				0.03	-0.10	0.15
Asian/NHPI/AIAN	-0.07	-0.11	-0.03				-0.17	-0.26	-0.08
Black/African-American	0.02	-0.02	0.05				-0.05	-0.15	0.05
Hispanic	-0.04	-0.07	-0.01				-0.11	-0.19	-0.03
White	Ref.						Ref.		
# of siblings in household									
1	-0.06	-0.09	-0.02				-0.11	-0.21	-0.01
2	-0.1	-0.17	-0.03				-0.23	-0.43	-0.04
3	-0.07	-0.17	0.02				-0.18	-0.44	0.09
4	-0.12	-0.23	-0.01				-0.33	-0.65	0
> 5	-0.12	-0.28	0.05				-0.26	-0.75	0.24
none	Ref.						Ref.		
English not spoken at home	-0.08	-0.14	-0.02				-0.22	-0.39	-0.06
Primary parent married	-0.04	-0.07	-0.01				-0.13	-0.2	-0.05
Primary parent age	0.00	0.00	0.00				0.01	0.00	0.01
Non-domestic born child	-0.01	-0.09	0.07				0.02	-0.16	0.2

Est. = Effect Estimate; FPL = Federal poverty level; Percentage levels of college educated adults in census tracts: high (41.1-100%), moderate high (27.3-41.1%), moderate (18.6-27.2%), moderate low (12.1-18.5%), low (<12%).

Figures

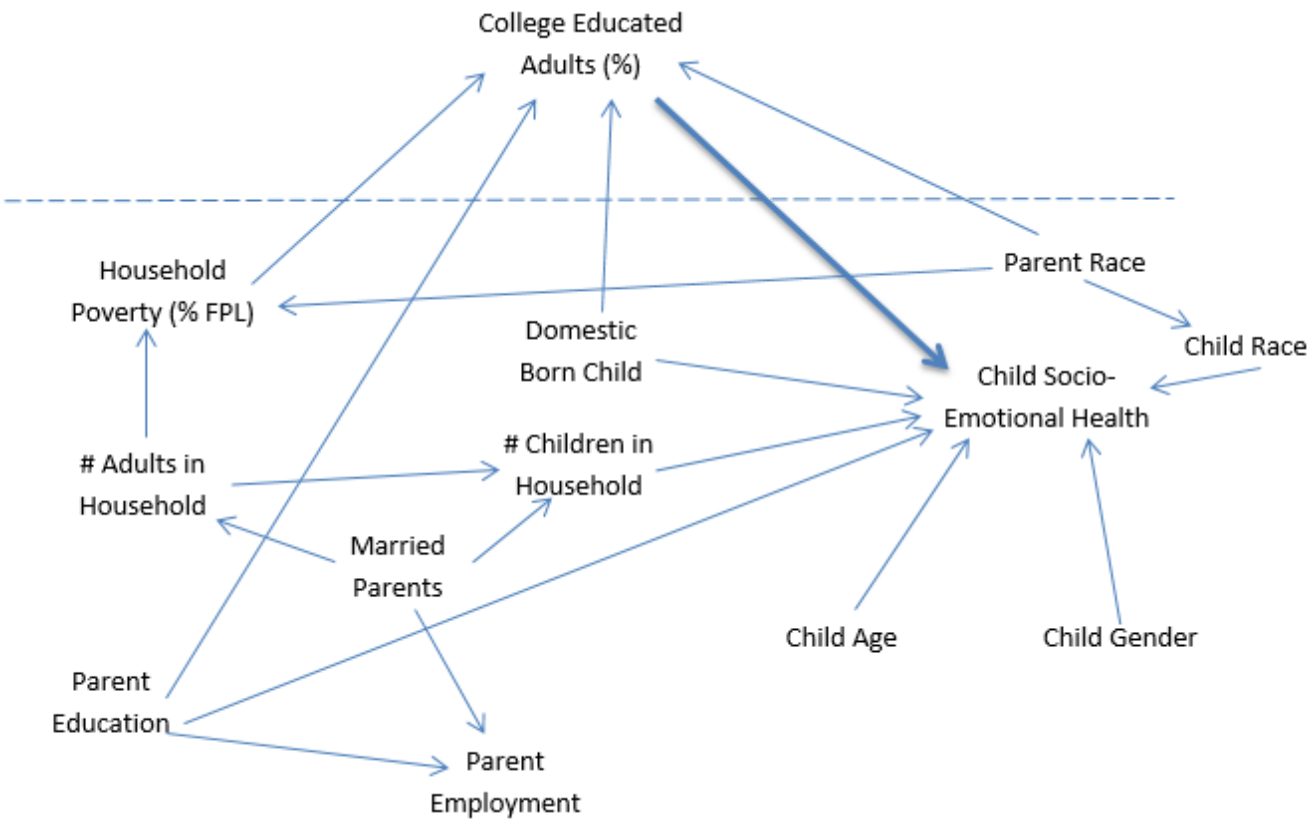

Figure 1: DAG of possible confounders and demographics effecting child socio-emotional health, from investigation of previous literature.

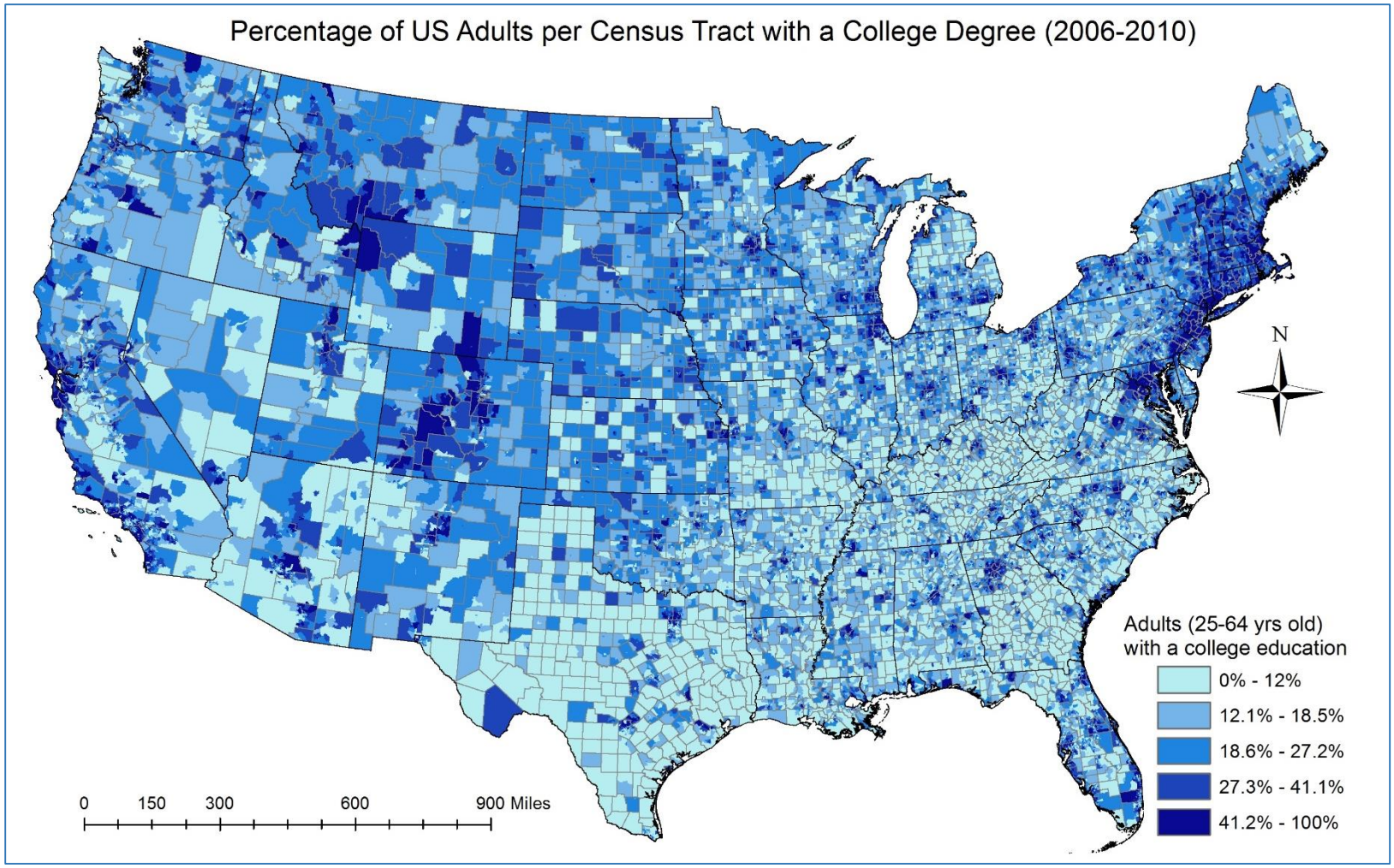

Figure 2: United States map of college educated adults(%) per census tract, categorized into quintiles used for the rest of the study. Grey boarders outline counties, and black boarders outline states.

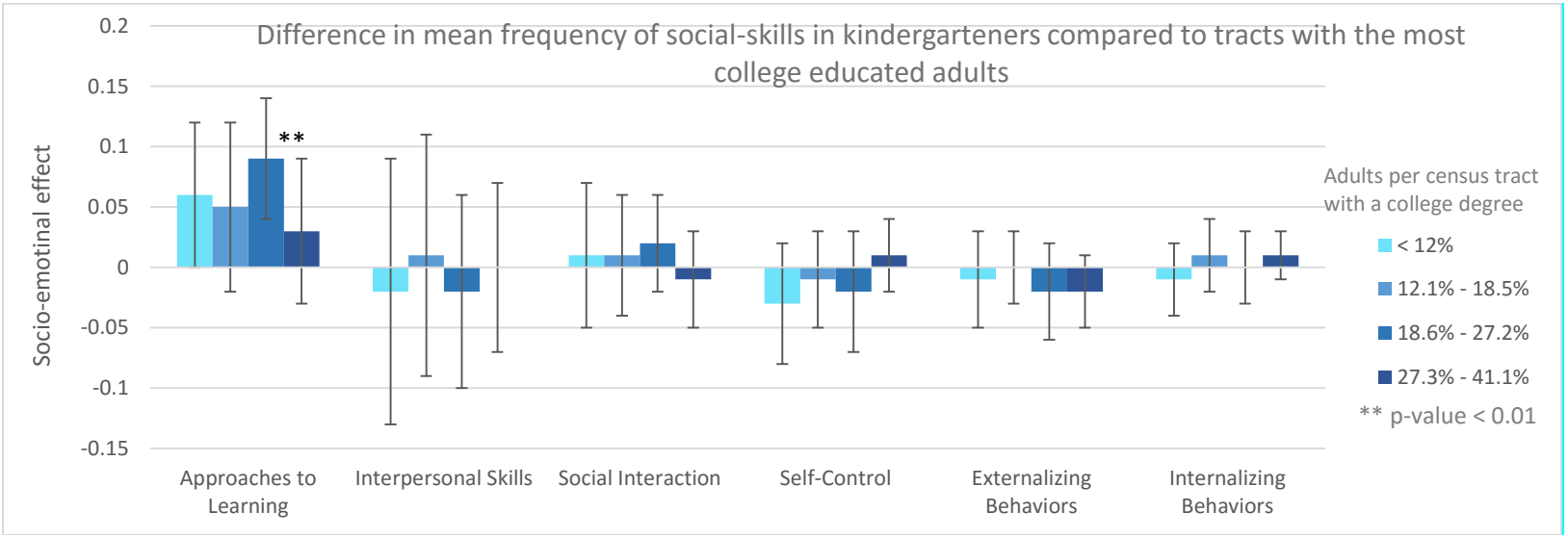

Figure 3: Difference in mean socio-emotional health assessment score (1-4; never-often) for all social-skills investigated, adjusting for covariates in best-fit models.

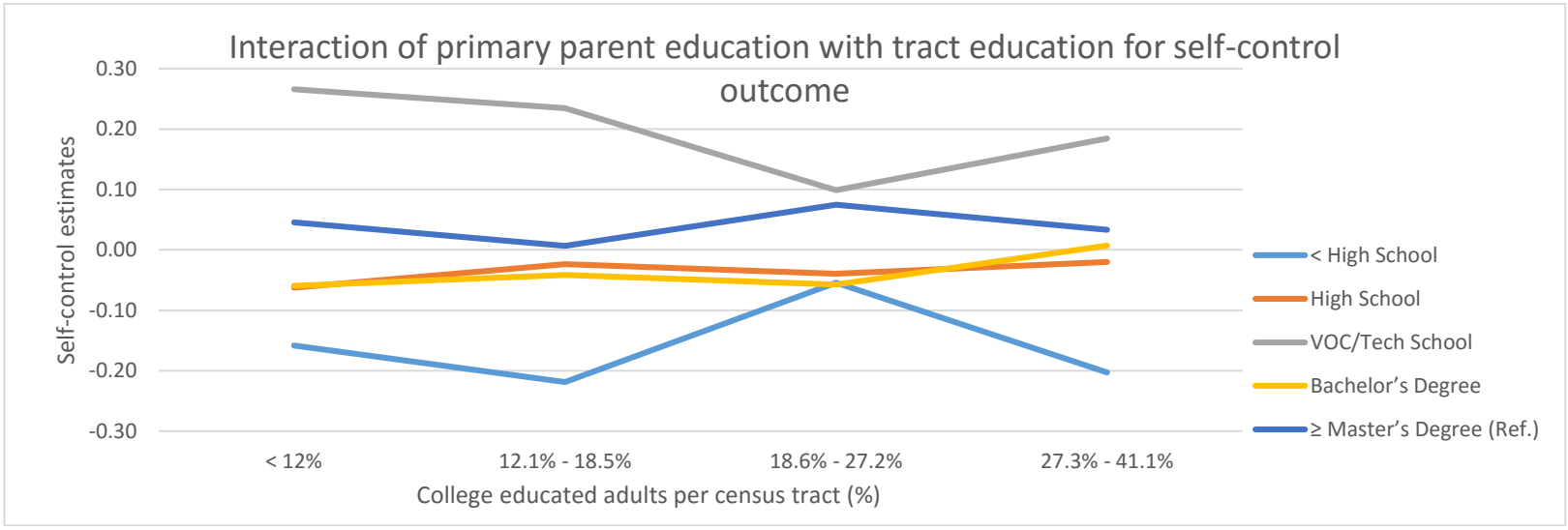

Figure 4: Trends in the association between census tract percentages of college educated adults and self-control among varying levels of primary parent education.

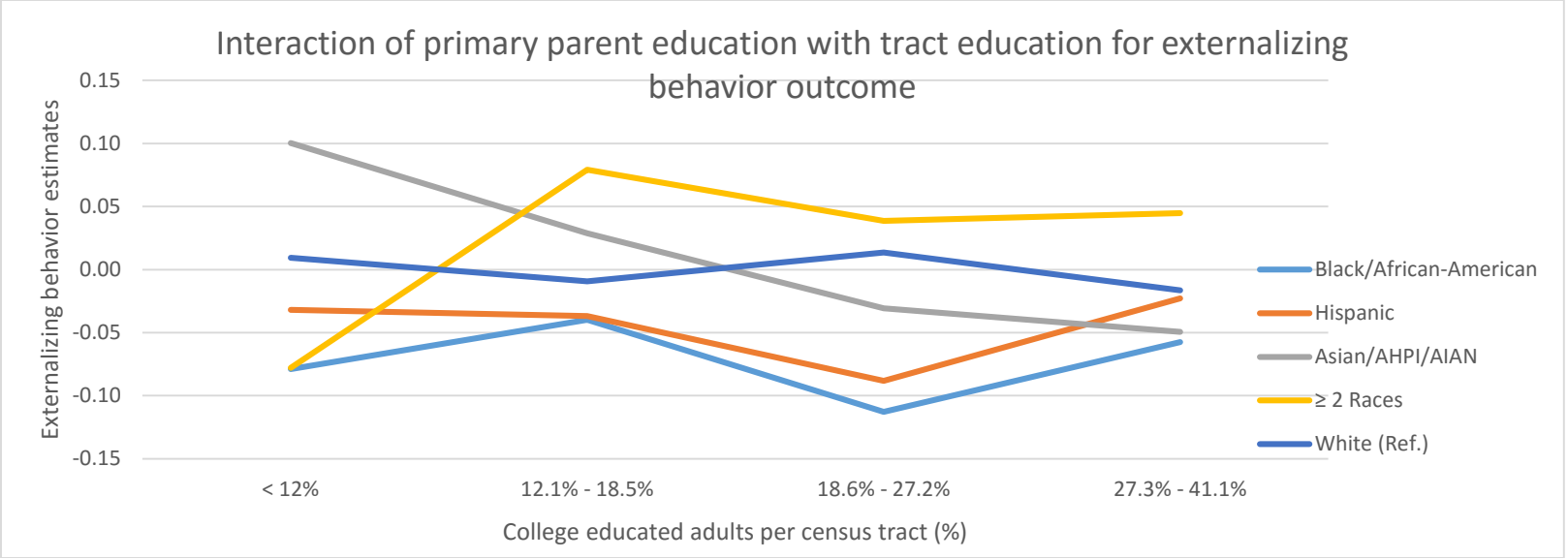

Figure 5: Trends in the association between census tract percentages of college educated adults and externalizing behavior among varying racial groups.

Chapter III: Summary, Public Health Implications, Possible Future Directions

The progression of socio-emotional development early in childhood may be a risk factor for subsequent health outcomes, and the differences in childhood environment may lead to variation in socio-emotional health contributing to population health disparities. Given that socio-emotional functioning in kindergarten is strongly associated with so many life avenues such as crime, and education, and that socio-emotional develops over time and is shaped by children's interactions with their environment, addressing current gaps in literature to determine possible interventions is essential (6-8). This study addressed gaps, including scarcity of studies investigating associations between neighborhood human capital and child socio-emotional health, through a cross-sectional study on percentage of college educated adults by census tract and child socio-emotional health. This is to the best of our knowledge, the first to utilize this singleton measure of neighborhood SES.

This study relied on the most recent collection of US wide child socio-emotional health outcomes, the ECLS-K:2011 compiled by NCES at the U.S. Department of Education. Because of the nature of the survey methods implemented and the large sample size of the dataset, we were able to rely on teacher and parent surveys for the majority of the variables modeled in this study. Therefore, an advantage in this study is the ability to control for a wide range of child, parent, household, school, and neighborhood characteristics, which might have confounded neighborhood associations with child outcomes in previous studies.

Eight child socio-emotional outcomes were modeled through linear regression to determine the effect of residence within census tracts varying by percentages of college educated adults. Children, residing in census tracts where 18.6% - 27.2% (moderate quintile) of adults have a college education, showed higher frequencies of approaches to learning, and social interactions compared to those living in census tracts with more than 41.1% (highest quintile) college educated adults. Overall, children residing in tracts with adult college education below 41% (below the highest quintile) were observed to have better approaches to learning but worse self-control and interpersonal skills. There was a crude association between tract education quintiles and outcomes, largely attenuated by adjustment for individual SES. These associations between tract education and socio-emotional health indicate that neighborhood education may be more strongly associated with academic social skills than those socio-emotional competencies involving interaction with others and expression. This is consistent with previous findings where high neighborhood SES is associated with better child academic outcomes, and where neighborhood education level combined with other SES measures is associated with adult mental health, specifically depression (4, 15).

Results of this study allow speculation that race may modify the association between neighborhood and socio-emotional health where race may serve as a proxy for parental SES. Further research should be conducted to investigate the modification of neighborhood education and child socio-emotional health associations by more direct measures of parental SES such as education, income, and poverty.

Because a cross-sectional study design may not be powerful enough to make concrete inferences on associations between neighborhood educational attainment and socio-emotional health, further research should expand this study to follow children throughout their adolescence. This longitudinal design will establish temporality, cement the socio-emotional health of children through many assessments, and allow investigation of the effects of relocation on the association between neighborhood education and socio-emotional health. A longitudinal design could also include analysis of effect modification by primary parent educational attainment over the course of adolescence to determine when primary parent education no longer interacts with this association.

Further study should also consider different geographical allocations of neighborhood for children. School district boarders is one option since children interact with their classmates who reside in the same school district. In addition, a multi-scale analysis, in which the associations are examined repeatedly for blocks, block groups, tracts, school districts, and/or counties, may be helpful in understanding the area level in which neighborhood education is associated with child socio-emotional competencies. Furthermore, the use of spatial surfaces, where values of adult education are smoothed across geographical areas, will allow for a continuous area without boundaries. This continuous area may be more representative of neighborhood since people do not interact solely within arbitrary boundaries such as census tracts.