Residential and Preschool Neighborhoods: Exploring Patterns of Socioeconomic Match and Its

Association with Child Skills Across Massachusetts

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Abstract

The current study analyzed patterns of neighborhood socioeconomic match across 3- and 4-year-old children's (N = 2,029) residential and preschool neighborhoods in Massachusetts. Most children (80%) lived and attended early education and care in different neighborhoods. Children in households with the lowest incomes and those whose families identified as Black or African American were among the likeliest to have mismatched residential and preschool neighborhoods. Yet children's residential and preschool neighborhoods were typically socioeconomically similar across all categories we considered. Associations between residential and preschool neighborhood socioeconomic match and children's skills were inconsistent and depended on the socioeconomic status of children's residential neighborhood. These findings illustrate how the concept of demographic match can be applied to a range of contexts and contribute to the field's understanding of how the dynamic interplay of children's multiple day-to-day contexts may relate to early learning and development.

Keywords: demographic match; residential neighborhood; preschool neighborhood; socioeconomic status; early education and care

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In recent years, studies of demographic match—the alignment of characteristics such as race, ethnicity, and gender between students and their teachers or peers—have provided important insights into how features of children's day-to-day environments shape their learning and development. In K-12 contexts, students' engagement and achievement benefit when they share elements of their personal identities with teachers or peers. These patterns are especially prominent among students whose identities have traditionally been marginalized in schools (Dee, 2004; Egalite & Kisida, 2018; Gershenson et al., 2016). Studies in early education and care (EEC) settings likewise suggest that racial and ethnic demographic match is associated with increased family engagement and student performance on skill assessments, particularly among Black, African American, and Hispanic or Latinx children (Benner & Yan, 2015; Downer et al., 2016; Markowitz et al., 2020). Across these studies, demographic match has been conceptualized at an interpersonal (i.e., student-teacher, student-peers) level.

Here we extend the concept of demographic match to a broader set of contexts in which children learn and develop: their residential and preschool neighborhoods. The demographic characteristics of children's residential and preschool neighborhoods, such as socioeconomic status (SES), are associated with a range of early academic and social-emotional outcomes (Leventhal et al., 2015; McCoy et al., 2015; Scott et al., 2018; Wei et al., 2021). Longstanding theories of child development emphasize the dynamic and intersecting nature of individual development and the surrounding contexts and systems. Yet few studies have examined how the characteristics of children's residential and preschool neighborhoods compare and how alignment or misalignment across these contexts relate to children's learning and development.

Comparing residential and preschool neighborhoods is especially informative because EEC programs vary in purpose (e.g., workforce support, child development), setting type (e.g., community-based centers, licensed family child care, public schools), and funding source (e.g., private tuition, public aid, or both; Gomez et al., 2015). Caregivers searching for EEC typically must navigate this complex patchwork of options across a mixed delivery landscape to secure care for their young children, in contrast to K-12 school systems which typically provide access to a zoned public program near a family's residence.

This paper considers whether preschool-age children (3- and 4-year-olds) experience distinct neighborhood contexts at home and at their EEC settings (i.e., community-based centers, licensed family child care, Head Start programs, and public school pre-Kindergarten) and how the characteristics of the two contexts in combination relate to children's skills. By attending to the degree of match in SES across residential and preschool neighborhoods, we gain a more comprehensive view of children's development in context and illuminate the potential complementarities between children's home and school environments.

Neighborhoods in Children's Developmental Ecosystem

Bioecological theories propose that children's environments shape their development through ongoing, bidirectional interactions with and within multiple contexts (Bronfenbrenner & Morris, 2006). The neighborhoods where children and their families spend much of their time are key settings for the interactions, relationships, and experiences that drive human development and learning (Bronfenbrenner & Morris, 2006; Leventhal et al., 2015). Neighborhood SES, measured by characteristics connoting both advantage (e.g., high household median incomes and adult educational attainment) and disadvantage (e.g., high poverty rates), is one demonstrably important aspect of neighborhoods that is linked to children's development.

Most prior work examining neighborhood SES and child development has focused on residential neighborhoods. Greater affluence and lower disadvantage in residential neighborhoods are associated with small to moderate positive differences in young children's academic skills (e.g., early math and literacy skills) and social-emotional outcomes (e.g., externalizing behaviors) (Leventhal & Brooks-Gunn, 2000; Leventhal et al., 2015; Morrissey & Vinopal, 2018b; Wolf et al., 2017). Prior early childhood research suggests that institutional and social processes may underlie associations between neighborhood SES and children's development and learning, though we do not examine these mechanisms in the current study. For instance, higher residential neighborhood SES has been linked to better access to quality institutional resources that promote learning and development, including local educational, health, and recreational assets (Leventhal et al., 2015; Morrissey & Vinopal, 2018a). Social factors such as community norms and trust may also help to explain the association between higher residential neighborhood SES and positive child outcomes (Minh et al., 2017).

Recent work similarly investigates how the environments surrounding children's EEC settings, referred to as preschool neighborhoods (McCoy et al., 2022), shape children's learning. Young children increasingly spend significant time in and around EEC settings. In Massachusetts, 58% of 3- and 4-year-olds regularly attend group-based EEC (i.e., community-based centers, family child care, Head Start, or public school pre-Kindergarten; Jones et al., 2020). Preschool neighborhoods are likely a salient developmental context for these children. Recent studies report positive direct or indirect links between higher preschool neighborhood SES and children's math, literacy, language, and social-emotional learning trajectories (Dupéré et al., 2010; McCoy et al., 2015; Wei et al., 2021). Wei et al. (2021) observed a negative association between preschool neighborhood SES and children's executive function gains during

preschool after accounting for indirect associations via classroom quality; children attending preschool in less affluent neighborhoods showed larger growth in inhibitory control than those attending in more affluent areas. Existing literature posits both direct and indirect pathways linking neighborhood characteristics and child skills. First, children experience their preschool neighborhoods directly through commuting, outdoor play time, and local outings. For example, nationally representative data suggest children in Head Start programs spend about forty minutes outdoors per day on average (Marino et al., 2012), while another study of 20 child care centers in North Carolina found nearly all (95%) scheduled time for outdoor play each day (Bower et al., 2008). Second, preschool neighborhood characteristics may shape children's experiences indirectly, such as by influencing school climate or caregivers' interactions with their children (McCoy et al., 2022). For instance, higher preschool neighborhood SES is associated with access to higher quality EEC settings, which is in turn linked with greater language, literacy, math, and social-emotional skills among children (Bassok & Galdo, 2016; Dupéré et al., 2010; McCoy et al., 2015; Wei et al., 2021).

Exploring Residential and Preschool Neighborhood Match

Despite evidence that the characteristics of both residential and preschool neighborhoods influence child development, little work has examined children's residential and preschool neighborhoods together. Studies documenting the distance between children's residences and their EEC settings provide some of the few available insights into the nature of the ecosystems in which children live and learn. Children in the United States live an average of 3.9 miles from their EEC programs (National Survey of Early Care & Education Project Team, 2016). For example, in Maine, children living in urban areas on average lived 3.5 miles from care; in rural areas, the average distance was 7.5 miles (Smith et al., 2020). Thus, many children's residential

and preschool neighborhoods are distinct from each other. Considering the characteristics of children's residential and preschool neighborhoods together can show how children's multiple developmental contexts complement or oppose each other and reveal potential disparities in the daily contexts young children experience.

There are systematic differences between where children live and attend EEC based on individual and household characteristics. Residential segregation by income and race is widespread in the U.S. (Massey et al., 2009; Reardon & Bischoff, 2011), and as a result, the locations of children's residential neighborhoods are likely to be associated with household class and race or ethnicity. The use of different EEC settings likewise appears associated with household characteristics. Among Massachusetts families, middle-income households are less likely than lower- or higher-income households to send their children to center-based care (Jones et al., 2020). One survey from a Southern state found that non-White mothers are less likely than White mothers to prefer nonparental care (Rose & Elicker, 2010). Documented differences in where children live and attend EEC underscore the importance of examining residential and preschool neighborhood match by individual and household characteristics such as income, race or ethnicity, and EEC setting type.

At the same time, the explanation for patterns in where children live and attend EEC is likely to include both household preferences (Peyton et al., 2001; Reardon & Bischoff, 2011; Meyers & Jordan, 2006) and structural factors of neighborhoods such as housing and EEC supply (Economic Policy Institute, 2020; Reardon & Bischoff, 2011; Smith et al., 2020), mortgage lending practices (Bond & Williams, 2007), and public policies related to residential zoning and social support (Hardy et al., 2018; Rothstein, 2017). For example, child care deserts – neighborhoods where the population of young children is larger than the local supply of licensed

EEC available – are more common in lower SES, urban areas than in other contexts (Economic Policy Institute, 2020). Thus, families' decisions about where to live and seek EEC for their children are likely the result of dynamic interactions between and among household and neighborhood characteristics. This view that families make choices about housing and EEC in the context of varying constraints is supported by research on child care (Meyers & Jordan, 2006; Chaudry et al., 2010) and housing (Kleit & Galvez, 2011; Pager & Shepherd, 2008) decisions.

Linking Neighborhood Socioeconomic Match and Children's Skills

To our knowledge, no prior studies have directly examined the association between neighborhood SES match and preschool-age children's skills. However, evaluations of housing interventions indicate that sequential exposure to two socioeconomically different residential neighborhoods can shape children's development. For example, the Moving to Opportunity experiment studied the effect of providing housing vouchers for families to move from higher- to lower-poverty neighborhoods. Young children whose families moved on average had higher rates of college attendance and earnings as adults than children whose families did not (Chetty et al., 2016). Broadly, this finding suggests that socioeconomic similarity and difference across children's multiple neighborhood contexts can affect their outcomes.

In the current study, we ask whether the degree of socioeconomic similarity across two different neighborhoods, experienced concurrently, is also associated with child skills. Although research in this area is lacking, we identify three hypotheses for child skills. First, children may experience *cumulative* neighborhood advantage or disadvantage (Ceci & Papierno, 2005; Wei et al., 2021), perhaps mediated by the layering of protection or risk from institutional and social processes across neighborhoods (Leventhal et al., 2015). Because higher neighborhood SES

tends to be positively associated with child development, we might expect to observe a skill gradient under a cumulative advantage or disadvantage hypothesis: Children in higher-SES residential and preschool neighborhoods may display higher skill levels than children in lower-SES residential and preschool neighborhoods.

Second, it may be that residential and preschool neighborhood SES are *complementary* and that reaching a minimum threshold in either context offers adequate access to institutional and social processes promoting positive child outcomes. For example, it could be that access to natural spaces in either the residential or the preschool neighborhood is sufficient to support children's development and well-being (Scott et al., 2018). The same may hold true of other institutional resources, such as public libraries and health care facilities. Under a complementary hypothesis, we might expect to see few average skill differences among children situated in varied residential and preschool neighborhood SES contexts, apart from children who both live and attend EEC in lower-SES neighborhoods.

Relative deprivation models would predict a third pattern. Relative deprivation theories posit that individuals gauge their standing and skills relative to others in their contexts and have less desirable outcomes when they draw unfavorable comparisons with others (Jencks & Mayer, 1990). Spending time in a new context—the preschool neighborhood—may shift children's and families' perceptions of their residential neighborhoods. In line with relative deprivation theory, children who experience relatively higher residential, as compared to preschool, neighborhood SES may draw more favorable comparisons of their situation and demonstrate relatively higher skill levels than other children. In contrast, children whose residential neighborhood SES is relatively lower than their preschool neighborhood's may demonstrate relatively lower skill levels. Though most prior work on relative deprivation focuses on older youth (Galster, 2011),

some evidence suggests that children are sensitive to differences in class from a young age (Howard et al., 2018).

The three hypotheses suggest the association between neighborhood SES match and child skills may differ based on the SES level of children's residential and preschool neighborhoods. For example, under a cumulative neighborhood advantage and disadvantage hypothesis, we might predict a positive association between neighborhood SES match and child skills among children who experience two similarly high SES contexts, because residential and preschool neighborhood affluence tend to be positively associated with child outcomes (Leventhal et al., 2015; McCoy et al., 2015; Wei et al., 2021). For the same reason, we might anticipate a negative association among children who experience neighborhood SES match with two similarly low SES contexts. This possibility underscores that it is important to examine whether associations between neighborhood SES match and children's skills depend on the absolute level of neighborhood SES children experience (i.e., an interaction between neighborhood SES match and residential SES level).

Finally, prior work focused on residential or preschool neighborhoods alone has linked neighborhood SES to a range of child skills, including math, literacy, executive function, and social-emotional skills (Leventhal & Brooks-Gunn, 2000; Leventhal et al., 2015; McCoy et al., 2015; Wei et al., 2021; Wolf et al., 2017). This varied set of associations suggests value in considering whether residential and preschool neighborhood SES match is associated with a similarly wide range of skills.

The Current Study

Here we extend the concept of demographic match to an analysis of children's residential and preschool neighborhoods. We address three research aims using a unique data set that

includes information on 2,029 3- and 4-year-old children across Massachusetts attending group-based EEC settings in 2017-18 (i.e., community-based centers operated by private for- or non-profit providers, licensed family child care providers operating out of their homes, federally funded Head Start programs, and public school pre-Kindergartens). First, we explore young children's experiences with residential and preschool neighborhood match by describing: (a) how many children attend EEC in their residential neighborhood, (b) the distances between children's residences and EEC settings, and (c) the degree of SES match across children's residential and preschool neighborhoods, measured by an SES index combining household income, poverty, and educational attainment (Aim 1). Second, we examine these three dimensions by child and household characteristics (i.e., household income, child race and ethnicity, child EEC setting type) to better characterize patterns in neighborhood match (Aim 2). Finally, we explore the association between residential and preschool neighborhood SES match and young children's social-emotional and pre-academic skills (Aim 3).

This study builds upon existing research on demographic match and neighborhood effects. We extend the traditional conception of demographic match beyond interpersonal, school-based analyses to a study of aggregate neighborhood characteristics. In doing so, we illustrate the conceptual value of demographic match in generating new insights about children's developmental environments across a range of contexts. We also operationalize match using a continuous measure (degree of SES alignment) rather than a dichotomous one, in contrast to many prior studies. This continuous approach creates new possibilities for the types of characteristics that could be examined using the broad concept of demographic match. Finally, although neighborhood research has established that both residential and preschool neighborhoods are important for children's development, few studies have examined these

contexts simultaneously and considered how they may interact to shape children's development. We do so using a data set designed to produce state-representative estimates of the experiences of 3- and 4-year-olds attending group-based EEC in Massachusetts.

Method

Sample and Procedures

Data for the study came from the Early Learning Study (ELS), a longitudinal, statewide study of young children in the context of their early education and care settings in Massachusetts. The ELS uses sample weights to generate estimates that are representative of the population of 3- and 4-year-olds in Massachusetts (see Appendix B for additional details about sample weights).

The ELS includes data collected in several ways. Here we used a caregiver survey, direct child assessments, and administrative records collected in the first year of ELS (2017-18), when children were 3 and 4 years old. Between May and September 2018, children's caregivers completed an online survey that included questions about the backgrounds and behaviors of children, their caregivers, and their households. Between February and August 2018, trained assessors conducted one-on-one direct child assessments in children's EEC settings that lasted no longer than 45 minutes per child. Finally, administrative records created during child recruitment included the locations of children's residences and EEC settings. We linked these locations to 2010 Census tracts, which represented children's residential and preschool neighborhoods.

Census tracts are spatial units capturing a population of about 4,000 people, though their size ranges from 1,200 to 8,000 people depending on population density (United States Census Bureau, 2022). Several features make Census tracts a reasonable choice for delineating neighborhood boundaries. Census geographies are developed with input from local communities and regard for social and physical features of the local environment (United States Census

Bureau, 2022; Leventhal et al., 2015) and there is evidence that Census tracts are similar in size to residents' perceptions of neighborhoods (Coulton et al., 2001). Further, Census tracts are relatively stable over time (United States Census Bureau, 2022) and have often been used to represent neighborhoods in existing literature (Leventhal et al., 2015), allowing us to situate our findings within. Each child was associated with two Census tracts: one representing residential neighborhood and one representing preschool neighborhood.

The full Year 1 ELS sample includes 3,222 3- and 4-year-old children. The analytic sample for the current study was 2,029 children who met three criteria for inclusion (62.97% of the full Year 1 ELS sample). First, all children in the sample attended group-based EEC (i.e., community-based centers, Head Start, licensed family child care, or public school public school pre-Kindergarten programs), rather than informal care provided by parents, other relatives, or nonrelative caregivers (n = 2,562 or 79.52% of the full Year 1 ELS sample). Second, the sample included only children for whom residential and EEC locations were available (20.45% of those in group-based care were missing one or both locations). Finally, we included only children who lived and attended EEC in Massachusetts (0.35% of those in group-based care lived or attended EEC out of state). The analytic and excluded samples were largely similar, with several exceptions (see Appendix Table A1). By design, excluded children were rarely in group-based care. Children in the excluded sample were less likely than those in the analytic sample to be Hispanic or Latinx or to live in households earning the lowest incomes. Excluded children were also more likely to be female, English speaking, and White, and more likely to have a caregiver with a bachelor's degree.

Children in the analytic sample lived in 863 residential Census tracts, representing nearly 60% of tracts in Massachusetts (United States Census Bureau, n.d.), and attended EEC in 405

Census tracts. As Table 1 shows, the weighted sample included more 4-year-olds than 3-year-olds and was predominantly English-speaking and White, non-Hispanic or Latinx. It included children from households with a range of incomes and caregiver education levels. Consistent with prior ELS estimates, most children were served in community-based centers, with smaller proportions attending Head Start, licensed family child care, and public school pre-Kindergarten. The weighted sample is designed to be representative of the population 3- and 4-year-old children attending group-based EEC in Massachusetts. There are differences between young children who attend group-based EEC and the overall population of 3- and 4-year-olds in the state; for example, prior work using ELS data suggests children from the lowest and highest income households are more likely than those from middle income households to attend formal, group-based settings such as Head Start and community-based centers. Moreover, there are differences between the population of young children in Massachusetts and that of the United States as a whole. For instance, greater proportions of young children in Massachusetts identify as White, non-Hispanic and Asian, non-Hispanic than the national population of preschool-age children (Annie E. Casey Foundation, 2021).

Measures

Residential and Preschool Neighborhood Match

We generated three measures of neighborhood match from administrative data. First, we created a dichotomous indicator of residential and preschool neighborhood match reflecting whether children's residential and preschool neighborhoods were the same. A value of one indicated that children resided in the same Census tract in which they attended EEC, or a residential and preschool neighborhood match. Figure A1 (Appendix) illustrates the distinction between a match and mismatch based on this measure. Second, we calculated the shortest point-

to-point distance in miles between children's residence and their EEC setting using latitude and longitude coordinates. Higher values indicated that children lived farther from their EEC setting.

Third, we generated a measure of residential and preschool neighborhood SES match using a standardized SES index. Composite measures of SES are common in neighborhood studies (see, e.g., Anderson et al., 2014; Dupéré et al., 2010; Wei et al., 2021). We computed the SES index for the current study using principal components analysis. It combines three measures of SES used in prior neighborhood research (e.g., Anderson et al., 2014, Dupéré et al., 2010): median household income (in dollars), poverty rate (percentage of all people in the tract estimated to have poverty-level incomes), and adult educational attainment (percentage of adults over age 25 with a 4-year degree). All data were from the 2018 American Community Survey 5-year estimates (United States Census Bureau, 2018a, 2018b, 2018c) and indicators were standardized before inclusion in the model. The eigenvalues produced by the model indicated that the index was unidimensional. We calculated the SES index for each Census tract in Massachusetts such that a value of zero on the index represents the Massachusetts state average. Positive or negative values on the SES index represent standard deviation units above or below the state average. Each child record was linked to two values of the SES index: one for their residential neighborhood and one for their preschool neighborhood (see Appendix C for additional details about the construction of the neighborhood SES index).

To measure the degree of SES match between children's residential and preschool neighborhoods, we calculated the simple difference between the SES index for each child's residential and preschool neighborhoods. Values closer to zero indicated greater neighborhood SES match, while larger absolute values indicated greater mismatch. Positive values indicated that residential neighborhood SES was higher than preschool neighborhood SES, whereas

negative values indicated that residential neighborhood SES was lower than preschool neighborhood SES.

Child Skills

Across the child direct assessments, higher scores reflected higher demonstrated levels of the tested skills.

Mathematics. Children's early mathematical skills were assessed using the Applied Problems subtest of the Woodcock-Johnson Tests of Achievement (WJ-III; Woodcock et al., 2001). The assessment includes up to 63 items evaluating children's problem-solving and early math skills and ends when a child incorrectly answers six consecutive items. Children in the sample answered between six and 58 items. The WJ-III has been widely used with racially and socioeconomically diverse samples of preschool-aged children (Weiland & Yoshikawa, 2013; Wong et al., 2008). All scores were standardized.

Literacy. Children's early literacy skills were measured using the Letter-Word Identification subtest of the WJ-III, an oral assessment of letter and word knowledge (Woodcock et al., 2001). The test includes up to 76 items and ends when a child incorrectly answers six consecutive items. Children in the sample answered between six and 70 items. All scores were standardized.

Executive Function. Children's executive function skills were measured using the Minnesota Executive Function Scale (MEFS), an adaptive, tablet-based assessment (Carlson & Zelazo, 2014). The assessment asks children to virtually sort cards into two boxes based on rules that become progressively more complex. The MEFS taps multiple dimensions of executive function, including cognitive flexibility (i.e., adapting to shifting rules), working memory (i.e., holding rules in mind), and inhibition (i.e., resisting impulse to sort; Bailey et al., 2018; Perone et

al., 2018). Children's scores were automatically computed on a 100-point scale that reflected both accuracy and response time. Assessment scores have been nationally normed and demonstrate adequate reliability across a large sample of children (Carlson & Zelazo, 2014)

Social-Emotional Skills. Children's social-emotional skills were assessed using two subscales of the Leiter-3 Examiner Rating Scale (Leiter-3; Roid et al., 2013). Assessors completed the scale after the conclusion of all other assessments based on their observations of children's behaviors throughout the session. The Examiner Rating Scale has been used in a range of research studies and been shown to have adequate reliability and internal consistency in a standardization sample diverse in age, gender, race, ethnicity, parent or individual education level and region of residence (Roid et al., 2013). The Attention/Impulsivity subscale comprises 27 items and focuses on impulse control, activity level, and sociability. The Positive Emotion subscale comprises 22 items and gauges children's energy, regulation, and anxiety, among other emotions. Scores on both subscales were calculated as an average of all items and ranged from 0 to 3. Both subscales were found to have adequate internal consistency in the analytic sample; Cronbach's alpha was .98 for Attention/Impulsivity and .96 for Positive Emotion.

Child and Household Characteristics

Child and household characteristics were collected via administrative records and the caregiver survey. Administrative records provided children's EEC setting type. Caregiver-reported characteristics included children's age, gender, race and ethnicity (Asian, Black or African American, Hispanic or Latinx, or White), primary home language (English speaking or not), household income bracket ($30k or less, between $30,001 and $75k, between $75,001 and $125k, between $125,001 and $200k, and more than $200,001), total household size, number of children in the household, and whether a child's parents lived together. Caregivers responding to

the survey also reported their own education level (12th grade or less, high school, some college, associate degree, bachelor's degree, and graduate degree; in most cases, the responding caregivers were children's mothers (86.7%; 9.1% were fathers and 4.2% other caregivers).

Analytic Plan

Aim 1. Documenting Residential and Preschool Neighborhood Match

We first conducted descriptive analyses to characterize residential and preschool neighborhood match among young children in Massachusetts (Aim 1). To begin, we calculated how many children attended EEC in their residential neighborhood (a residential and preschool neighborhood match) and how far children's residences were from the EEC settings they attended. The proportion of children attending EEC in their residential neighborhood offered initial insights into how many children experienced very close alignment in residential and preschool neighborhood characteristics. Examining the distance between children's residences and EEC settings allowed us to check whether children whose residential and preschool neighborhoods were matched lived closer on average to where they attended EEC than those whose neighborhoods were unmatched. It also allowed us to compare our findings with prior research on where young children attend EEC relative to their homes.

We then examined means and standard deviations for residential and preschool neighborhood SES match, as well as bivariate correlations between residential and preschool neighborhood SES levels. These statistics provided a snapshot of the average degree of socioeconomic alignment between young children's residential and preschool neighborhoods. All estimates presented for Aim 1 were weighted to be representative of the population of 3- and 4-year-old children in Massachusetts attending group-based care, a common and appropriate reason for using sample weights (Solon et al., 2015).

Aim 2. Describing Patterns in Residential and Preschool Neighborhood Match

To examine variation in residential and preschool neighborhood match by household and child characteristics (Aim 2), we repeated the Aim 1 descriptive analyses (i.e., examining general neighborhood match, distance between residence and EEC setting, and neighborhood SES match) by household income, child race or ethnicity, and EEC setting type. As in Aim 1, all Aim 2 analyses were weighted to be representative of the population of 3- and 4-year-old children in Massachusetts who attended group-based care.

Aim 3. Exploring Associations Between Residential and Preschool Neighborhood SES Match and Child Skills

To explore the association between residential and preschool neighborhood SES match and children's skills (Aim 3), we first examined descriptive statistics for children's skills and examined scatterplots of each skill on neighborhood SES match to examine the functional form of the associations. We then fit a series of regression models examining the association between residential and preschool neighborhood SES match and children's skills. We first fit models regressing each outcome on neighborhood SES match, controlling residential neighborhood SES. We next added an interaction between neighborhood SES match and residential neighborhood SES. This interaction term tested whether the association between child skills and neighborhood SES match depended on the absolute level of children's neighborhood SES. We selected residential rather than preschool neighborhood as the reference for the interaction because children likely had greater exposure to their residential neighborhood at the time of data collection.

The neighborhood SES match variable and all outcome measures were z-scored for regression analyses to promote interpretability. Given extensive evidence of endogeneity in

household and neighborhood characteristics (Leventhal et al., 2015), all regression models

included the child and household covariates described previously (e.g., child age, gender,

race/ethnicity; household income, size). All regression models also included clustered standard

errors based on the child's city of residence. We opted to cluster over residential cities rather

than Census tracts because clustering at higher (i.e., more aggregate) levels of nesting guards

against bias from within-cluster correlations of errors and regressors while avoiding concerns

about having too few clusters to support standard error estimation (Cameron & Miller, 2015).

All estimates for Aim 3 were calculated without the use of sample weights for two reasons. First,

the purpose of Aim 3 differs from the prior aims. Unlike the first two aims, the purpose of these

analyses was exploratory and not intended to generate state representative estimates, making the

use of sample weights less relevant to addressing our question of interest. Second, there are

distinct subsamples for regression analyses predicting each child skill because we do not impute

any dependent variable scores, and the sample weights used in the prior aim were not adjusted to

reflect the composition of these subsamples.

Missing Data

All children in the analytic sample had information on neighborhood match. Likewise, all

but a few children had information for variables constructed using administrative records,

including EEC setting type, child age, and child gender. Missing data arose primarily from

nonresponse to the caregiver survey and direct child assessments. Rates of missingness for

variables drawn from the caregiver survey ranged from 20.87% for child race or ethnicity to

30.08% for household income. In most cases, missing data represented caregivers declining to

participate in the survey, rather than item-level nonresponse. Rates of missingness for direct

assessments ranged from 10.65% for social-emotional skills to 26.32% for executive function.

The primary reasons children did not participate in the assessments were that a child (or child's caregiver) refused to assent (or consent) to assessments ($n = 90$) or that a child did not pass an English language proficiency screening ($n = 61$). A smaller number of assessments were not completed due to technical difficulties, time limitations, children moving out of the setting, or developmental delays that made assessments inappropriate.

By construction, there was no missing data for Aim 1 analyses. We took two approaches to addressing missing data in the remaining aims. In calculating descriptive statistics regarding residential and preschool neighborhood match by child and household characteristics (Aim 2), we used all available data. For each characteristic, we present a "missing" category that characterizes residential and preschool neighborhood match among children whose caregivers did not provide child or household information. For exploring associations between residential and preschool neighborhood SES match and child skills (Aim 3), we used multiple imputation with chained equations to create 10 imputed data sets to address missing covariate data. Although we included the entire set of covariates and outcome variables in the imputation model, analyses used only imputed covariate variables and not imputed outcome variables. As such, sample sizes for regressions on each child skill differed based on nonmissing outcome data, ranging from 1,425 to 1,813 of the 2,029 children included in the analytic sample.

Sensitivity Analyses

Because there is little existing research on residential and preschool neighborhood SES match, we ran several sensitivity analyses to confirm that the results were not driven by our analytic choices. For Aims 1 and 2, we replicated analyses without the use of sample weights to confirm that the observed and weighted estimates were largely consistent. For Aims 1 and 2, we also examined descriptive statistics for only the subsample of children whose residential and

preschool neighborhoods were mismatched to see whether the patterns observed were driven by children who lived in the same neighborhood as they attended school. Finally, we ran the analyses using an alternative operationalization of SES (i.e., the three indicators used to create the standardized index) to ensure the results were consistent with those generated using the SES index. For Aim 3, we tested the robustness of the associations between neighborhood SES match and child skills by including only the subsample of children with mismatched residential and preschool neighborhoods (approximately 80% of the analytic sample). We then ran all regression models again at two more conservative levels of nesting, residential neighborhood and preschool neighborhood, to confirm results were consistent across alternative approaches to clustering.

Results
Aim 1. Documenting Residential and Preschool Neighborhood Match

The first row of Table 2 displays weighted estimates of match between children's residential and preschool neighborhoods. Roughly one in five (19.76%) preschool-age children attending group-based care lived in the same neighborhood where they attended EEC. Though most children's residential and preschool neighborhoods were different, many nonetheless attended EEC close to home—children lived on average 1.81 miles from their EEC setting ($SD =$ 2.89) and about half of children (52%) lived one mile or less from their EEC setting (see Figure 1). Very few children (6%) lived five or more miles away, although the largest distance between a child's residence and EEC setting in the sample was nearly 34 miles. The small portion of children who lived in and attended preschool in geographically distant neighborhoods resided in various regions of the state, without a clear geographic pattern.

The top row of Table 2 also shows that children's residential and preschool neighborhoods were generally matched socioeconomically. The mean difference in SES between children's residential and preschool neighborhoods is nearly zero ($M = 0.01$, $SD = 0.78$) and the

correlation between residential and preschool neighborhood SES is positive, strong, and statistically significant (r = 0.73, p < .001).

Although most children lived and attended EEC in neighborhoods that were closely matched socioeconomically, there was a small group of children whose residential and preschool neighborhoods represented distinct socioeconomic contexts. About 16% of the sample had differences of greater than one standard deviation unit between residential and preschool neighborhood SES. This group was about evenly split between children whose residential neighborhoods had much higher SES than their preschool neighborhoods (8.9%) and children whose residential neighborhoods had much lower SES than their preschool neighborhoods (7.4%).

Aim 2. Describing Patterns in Residential and Preschool Neighborhood Match

The bottom of Table 2 displays weighted estimates of neighborhood match by household income, child race and ethnicity, and child EEC setting type. In nearly every category we examined, at least three-fourths of children lived and attended EEC in different neighborhoods, and children lived between 1 and 2 miles from their EEC setting on average. Further, across all demographic groups, children's residential and preschool neighborhoods were generally of similar SES. For example, children whose families reported incomes of $30,000 or less resided in neighborhoods whose SES was only about a tenth of a standard deviation higher than that of their preschool neighborhood ($M = 0.11$, $SD = 1.06$). This was one of the largest differences observed, with most other estimates falling closer to zero. There were also moderate to strong and statistically significant correlations between residential and preschool neighborhood SES, ranging from 0.52 to 0.84 across subgroups.

Despite these broad similarities, children's experiences of neighborhood match varied by household or individual characteristics. Children from the lowest-income households ($30,000 per year or less, or approximately the federal poverty guideline for a family of five in 2018 [Annual Update of the HHS Poverty Guidelines, 2018]) were the least likely to attend EEC in their residential neighborhood (10.53%). Children from lower-income households also tended to live farther from where they attended EEC ($M = 2.04$, $SD = 2.81$) than did children from higher-income households (more than $200,000, or nearly seven times the federal poverty guideline for a family of five; $M = 1.40$, $SD = 1.94$). Whereas mean differences between residential and preschool neighborhood SES were small across income groups, children from lower-income households seemed to experience greater variability in residential and preschool neighborhood SES match than those from higher-income households. The standard deviation of the SES match measure was 1.06 among children whose household income was $30,000 or less and only 0.54 among children in households with incomes of more than $200,000. This variability is shown visually in Figure 2a. Children from the most affluent households rarely lived or attended EEC in neighborhoods below the state mean neighborhood SES. In contrast, children from lower-income households appeared throughout the distribution; some children from households with lower or moderate incomes lived and attended EEC in higher-SES neighborhoods. Asian and Black or African American children appeared modestly more likely than children of other races and ethnicities to have mismatched residential and preschool neighborhoods. Moreover, Black or African American children tended to live the farthest from their EEC settings (2.53 miles on average), and the distance between their residences and EEC settings varied more ($SD = 4.81$) than it did for children of other racial or ethnic groups. However, consistent with the overall pattern observed across subgroups, children of all racial and ethnic groups tended to live and

attend EEC in socioeconomically matched neighborhoods. Finally, children attending public school pre-Kindergarten tended to have matched residential and preschool neighborhoods more often (30.57%) than children in other EEC setting types. There were no other clear patterns in residential and preschool neighborhood match by setting type.

Aim 3. Exploring Associations Between Residential and Preschool Neighborhood SES Match and Child Skills

Table 3 displays unweighted means and standard deviations for children's scores on skill assessments by the degree of residential and preschool neighborhood SES match. We observed no clear pattern in child skills by degree of match using this uncontrolled, exploratory approach. Examining scatterplots of each skill on neighborhood SES match indicated the appropriateness of assuming a linear functional form for multivariate models (see Appendix Figure A2). Table 4 displays unweighted bivariate correlations between neighborhood SES match and child skills. We observed only one statistically significant correlation, albeit a weak one: between match and positive emotion *(*r= .05, *p* <.05).

Table 5 displays standardized estimates of associations between child skills and neighborhood SES match, net of child and household characteristics. There were no clear linear associations between neighborhood SES match and child skills. Consistent with prior research, residential neighborhood SES was positively associated with children's skills in three areas: math ($\beta = 0.16$, $SE = 0.03$, $p < .001$), literacy ($\beta = 0.08$, $SE = 0.04$, p = .03), and executive function ($\beta = 0.11$, $SE = 0.03$, $p = .002$). These associations were modest in magnitude. For example, a one standard deviation difference in residential neighborhood SES was associated with a 0.16 standard deviation difference in math after accounting for child and household characteristics and neighborhood SES match. There were also two small but statistically

significant interactions between neighborhood SES match and residential neighborhood SES, out of five interactions tested. The significant interactions occurred in models predicting children's social-emotional skills: attention/impulsivity (β = -0.05, SE = 0.02, p = .03) and positive emotion (β = -0.06, SE = 0.03, p = .04). There was also a marginally significant interaction between neighborhood SES match and residential neighborhood match in predicting children's literacy skills (β = -0.03, SE = 0.02 p = .06),

To help interpret these interactions, Figure 3 depicts predicted child skill levels among children experiencing different degrees of neighborhood SES match and living in prototypically higher- versus lower-SES neighborhoods. In each chart, the left-hand set of bars shows predicted scores for children whose residential neighborhood SES is one standard deviation below their preschool neighborhood SES. The remaining sets of bars show predicted scores for children whose residential and preschool neighborhood SES is the same (middle) and for children whose residential neighborhood SES is one standard deviation above their preschool neighborhood SES (right). In both prototypical groups, children experiencing neighborhood SES mismatch had the highest predicted skill scores. However, the direction of mismatch associated with these high scores differed. Among children living in lower-SES neighborhoods, the highest predicted scores were associated with attending EEC in a neighborhood with relatively lower SES than the residential neighborhood. Among children living in higher-SES neighborhoods, the highest predicted scores were associated with attending EEC in a neighborhood with relatively higher SES than the residential neighborhood.

Sensitivity Analyses

The results of sensitivity analyses are presented in Appendix D. Sensitivity analyses for Aims 1 and 2 were consistent with our primary findings, with one exception (see Tables D1-D4).

Without the use of sample weights, Asian children did not appear less likely than other children to experience neighborhood match. Results from the three sensitivity analyses for Aim 3 were also largely consistent with the primary models, though there were several differences in the statistical significance of coefficients (see Table D5). First, residential neighborhood SES was no longer a significant predictor of children's literacy skills when excluding children with matched preschool and residential neighborhoods. Second, across all three sensitivity analyses, the interaction coefficient between neighborhood SES alignment and residential neighborhood SES was no longer significant when predicting children's literacy skills. Third, the interaction coefficient for positive emotion was no longer significant when clustering at the preschool neighborhood level. Nevertheless, the magnitude of these coefficients remained the same.

Discussion

In this paper, we extended the concept of demographic match to young children's multiple neighborhood contexts. Specifically, we applied the match concept to an analysis of residential and preschool neighborhoods, two contexts in which many children spend a great deal of time, with a particular emphasis on SES, a widely studied neighborhood characteristic. We first documented whether children experienced matched residential and preschool neighborhoods and considered the degree of SES match across the two contexts. We then explored the association between neighborhood SES match and children's early academic and social-emotional skills.

Most Children Lived and Attended EEC in Different Neighborhoods

Our analyses indicated that about 80% of children enrolled in group-based care in Massachusetts attended EEC in a neighborhood different from where they lived, or experienced a residential and preschool neighborhood mismatch. However, on average children still attended EEC relatively close to home, with a mean distance between children's residences and EEC

settings of just under two miles. Our distance estimates are lower than those reported in prior analyses (e.g., National Survey of Early Care & Education Project Team, 2016; Smith et al., 2020). Unlike prior analyses, we relied on a sample of children living in Massachusetts. Though we did not control urbanicity in our analyses, Massachusetts is a compact Northeastern state with much of its population concentrated in urban and suburban areas and much of our sample lived in these densely populated areas. We also calculated distances using the point locations of children's residence and EEC settings, which may offer more precise estimates than those based on distances between geographic centroids, such as Smith et al. (2020).

There was evidence of variability in neighborhood match by household and child characteristics. First, children attending public school pre-Kindergarten appeared likelier to have matched residential and preschool neighborhoods than children attending other EEC setting types. This may reflect the use of local attendance zones to determine enrollment eligibility in public schools, a practice that is uncommon in other EEC setting types. At the same time, only about one in three children attending public school pre-Kindergarten had a residential and preschool neighborhood match. This match rate closely mirrors that found in a recent study of kindergarteners and may reflect the small size of Census tracts (Vinopal & Morrissey, 2020). We also found that children from lower-income households were less likely to have a neighborhood match than children from higher-income households. This pattern may reflect differential access to affordable EEC options. The average cost of care for a 4-year-old in center-based EEC in Massachusetts exceeds $15,000 per year (Economic Policy Institute, 2020). Families with higher incomes for whom the cost of care is less of a constraint may have a greater array of options from which to choose and by extension, find it easier to secure EEC near their homes. Families with lower incomes may struggle to afford the market cost for care and therefore may have to

cast a wider net to find care that meets their needs. Moreover, lower-income families in urban areas are likelier than other families to live in child care deserts, where the demand for EEC slots outpaces supply (Economic Policy Institute, 2020). Consequently, lower-income families may live farther from their EEC setting than other families even if they pay market costs. Finally, children whose families identified as Black or African American tended to experience less neighborhood match, to live farther from their EEC setting, and to have greater variability in the distances between home and EEC setting than children of other races and ethnicities. These differences may reflect inequities in access to EEC settings closer to home that are aligned with caregivers' preferences and needs. It may also be that apparent differences by race and ethnicity are partially explained by household income, given that lower income households showed a similar pattern and there are close linkages between race and class more generally in the United States. Broadly, our observation of variation in residential and preschool neighborhood match by child and household characteristics is aligned with prior work highlighting that families face diverse constraints on their decisions about housing and EEC (Chaudry et al., 2010; Kleit & Galvez, 2011; Meyers & Jordan, 2006; Pager & Shepherd, 2008).

Our findings highlight the importance of ensuring all families have access to convenient, high-quality EEC. Quality and practicality (i.e., cost, location) are high-priority considerations for caregivers of diverse backgrounds when selecting EEC for their children (Kim & Fram, 2009; Peyton et al., 2001), but variation in neighborhood match rates suggest families do not have consistent access to arrangements aligned with their preferences. Moreover, though we did not directly measure commute times in the current study, variability in the distances between children's residences and EEC settings suggests some families may bear greater commutes than others. Recent work indicates that commute times are inversely related to children's social and

emotional skills in early childhood (Block et al., 2018), so these differences may have developmental, as well as practical, implications for children and their families. Policy actions such as targeting investments in EEC facilities or incentivizing high quality providers to open in neighborhoods that currently have limited EEC choices could help ensure all families who want it have access to high quality EEC close to home. Future studies could consider salient household and child characteristics concurrently and incorporate information about EEC demand (e.g., caregiver preferences and employment or education) and supply (e.g., EEC capacity and quality) to identify other promising avenues for change, such as the potential role of employers in supporting caregivers' needs for convenient, high-quality care for their children.

Children's Residential and Preschool Neighborhoods Tended to Be Socioeconomically Matched

Children tended to live and attend EEC in socioeconomically matched neighborhoods. This pattern was observed even after excluding the estimated one in five children who attended EEC in their residential neighborhood. Moreover, the general trend toward greater, rather than less, neighborhood SES match held across all child and household characteristics we considered. This finding is generally aligned with Vinopal & Morrissey (2020), who found that Kindergarteners tended to attend school in neighborhoods that were economically similar to their residential neighborhoods. Though enrollment processes for K-12 schools and EEC settings are distinct, it may be that the combination of widespread residential segregation by class (Reardon & Bischoff, 2011) and caregiver preferences for conveniently located EEC (Peyton et al., 2001) result in many children attending EEC in neighborhoods that are relatively like their residential neighborhoods.

A small subset of children lived or attended EEC in more distinct socioeconomic contexts, with residential and preschool neighborhood SES greater than one standard deviation apart. Our sample included both children whose residential neighborhood SES was much higher than their preschool neighborhood SES and the reverse. Future research should more closely examine who these children are (e.g., child and household characteristics) and how their families selected EEC. These analyses could shed new light on the implications of neighborhood SES mismatch for children, whether and how neighborhood characteristics factor into families' decisions regarding EEC arrangements, and how policies can best support children and families' needs for care.

Associations Between Neighborhood Socioeconomic Match and Child Skills Were Inconsistent

We found few associations between residential and preschool neighborhood SES alignment and children's skills, controlling for residential neighborhood SES and child and household covariates. Limited variation in the key predictor, neighborhood SES match, may help explain the largely null findings. It may also be that children had too little exposure to their preschool neighborhood by the time child skills were measured in the winter and spring to detect an association between neighborhood SES match and child skills.

Conceptually, our findings provide initial evidence that it is important to consider both absolute and relative differences in residential and preschool neighborhood SES when examining associations with child skills. We observed modest, positive associations between children's residential neighborhood SES and their skills in literacy, math, and executive function. These findings are consistent with prior research demonstrating links between children's residential neighborhood SES and their early academic and cognitive skills (Leventhal & Brooks-Gunn,

2000; Morrissey & Vinopal, 2018b; Wolf et al., 2017). We did not observe any association between residential neighborhood SES and two measures of social-emotional skills, similar to Morrissey & Vinopal (2018b). It may be that the social-emotional skills examined in the current study – attention and positive emotion – are less malleable to residential neighborhood factors than externalizing behaviors, which prior research has linked to neighborhood characteristics (Leventhal & Brooks-Gunn, 2000; Wolf et al., 2017).

We also observed small interactions between neighborhood SES match, residential neighborhood SES, and three child skills: literacy and two measures of social-emotional skills (attention/impulsivity and positive emotion). For these skills, the models indicated different associations between neighborhood SES match among children living in prototypically lower- and higher-SES communities. In both groups, the highest skill levels were observed among children experiencing substantial neighborhood SES mismatch (i.e., greater than one standard deviation difference between residential and preschool neighborhood SES). The direction of the associations differed depending on the SES of children's residential neighborhoods. Children living in lower-SES neighborhoods tended to demonstrate higher skill levels when attending EEC in relatively lower-SES neighborhoods. Children living in higher-SES neighborhoods tended to display greater skills when attending EEC in relatively higher-SES neighborhoods. We found no evidence of an interaction among neighborhood SES match, residential neighborhood SES, and children's math or executive function skills. However, the coefficients for math and executive function were in the same direction as those for social-emotional and literacy skills. It may be that we lacked sufficient statistical precision to identify small associations in these domains.

The unexpected pattern of results is not wholly consistent with any of our three initial hypotheses (cumulative, complementary, or relative deprivation). Rather, the pattern in higher SES neighborhoods is generally aligned with a cumulative advantage hypothesis, and in lower SES neighborhoods appears more consistent with a relative deprivation hypothesis. Our findings suggest that associations between residential and preschool neighborhood SES match and child skills are complex and may differ across neighborhood contexts. Testing mechanisms to explain these findings is beyond the scope of the current study, but future research could examine several possibilities. First, class-based residential segregation is prevalent in the United States (Reardon & Bischoff, 2011). Given the close linkages between household and residential neighborhood SES, it is possible that statistically controlling household income as we have done does not sufficiently capture how household and neighborhood SES combine to shape children's outcomes. Future studies could untangle these complex associations and reveal new insights regarding the unique association of neighborhood SES match and children's skills.

Second, there may be other unmeasured characteristics that explain the counterintuitive results. For example, ethnic and linguistic similarity among neighborhood residents has been linked to child skills (Minh et al., 2017), but we did not control neighborhood racial, ethnic, or linguistic composition in our analyses. Because race and class are often confounded in spatial analyses in the United States (Massey et al., 2009; Osypuk & Acevedo-Garcia, 2010; Reardon & Bischoff, 2011), it may be that the patterns predicted by the models are in part explained by neighborhoods' cultural-linguistic, rather than socioeconomic, characteristics. This may be especially relevant if some parents intentionally lived in or used EEC in neighborhoods based on cultural or linguistic considerations. Likewise, prior work indicates EEC quality is a factor in the association between both residential and preschool neighborhood SES and children's skills

(Bassok & Galdo, 2016; Dupéré et al., 2010; McCoy et al., 2015; Wei et al., 2021). These studies have typically found that higher neighborhood SES is associated with greater access to high quality EEC and skill growth among children. However, it is possible that the relation between neighborhood SES and EEC quality is not monotonic. Studies have shown some lower SES neighborhoods have more, rather than fewer, community resources such as libraries than their more moderate SES counterparts (Small & McDermott, 2006; Small & Stark, 2005; Wei et al., 2021). Children who are traveling to lower SES neighborhoods for EEC may thus have access to rich community resources that support children's development. Future work could examine these alternative dimensions of children's neighborhoods to identify potential points of intervention stemming from variability in neighborhood SES match.

Importantly, only a small proportion of children lived and attended EEC in neighborhoods with highly contrasting levels of SES and the associations were small in magnitude. At the same time, the modeled patterns of child skills suggest that unpacking the characteristics and experiences of children with substantial neighborhood SES mismatch could provide valuable insights about how neighborhoods and children's development intersect. Program and policy developers may likewise gain new perspective by adopting a comprehensive view of children's contexts (i.e., accounting for characteristics of home and EEC environments) in their efforts to build and test interventions serving young children and their families.

Limitations and Future Directions

The study has several limitations that could be addressed in future research. First, the study is descriptive and cross-sectional. We were unable to examine potential associations among residential and preschool neighborhood characteristics over time or make causal claims about the impact of neighborhood characteristics on children's skill levels. This is a common

challenge in neighborhood research given the nonrandom sorting children and families into neighborhoods (Leventhal et al., 2015). Though we controlled household income in analyzing associations between neighborhood SES match and child skills, this may be insufficient to address the potential endogeneity of household and neighborhood SES (Leventhal & Dupéré, 2019).

We also focused exclusively on a single structural measure of neighborhood characteristics that has been extensively studied, SES. However, socioeconomically similar neighborhoods may vary along other dimensions and in ways that are meaningful for children's development. Analyzing other neighborhood characteristics such as residential stability, racial or ethnic composition, the quality and accessibility of institutional resources, or social norms may reveal different insights about children's experiences in their residential and preschool neighborhoods, the match between neighborhood contexts, and associations with child skills. Likewise, testing the associations of child skills with other operationalizations of neighborhood match, such as the distance between children's residences and preschools, could offer complementary perspectives on the combined influence of children's multiple neighborhood contexts on development.

Moreover, we relied on Census tracts to define children's neighborhoods. While Census tracts have many strong qualities as a standardized measure of neighborhoods, individuals' conceptions of neighborhood boundaries are ultimately subjective and context dependent (Coulton et al., 2001; Campbell et al., 2009). Incorporating families' perceptions of neighborhood boundaries into future studies may complement and extend on the current study's findings.

Finally, the sample includes only preschool-age children attending group-based care. Patterns of neighborhood match among infants and toddlers may differ due to factors such as the limited availability of licensed care and caregiver preferences for home-based care for children in that age group (Jessen-Howard et al., 2020; Rose & Elicker, 2010). Future research exploring patterns of neighborhood match among infants and toddlers could further enrich the field's understanding of young children's EEC experiences. Likewise, families who use informal care types such as unlicensed family, friend, and neighbor care may exhibit different patterns of neighborhood match than children in our sample. Future studies could incorporate these non-group-based care types to gain a fuller picture of preschool-age children's multiple neighborhood contexts.

Conclusions

The current study explores the utility and complexity of extending the concept of demographic match to broader contexts and levels. Specifically, we documented patterns of residential and preschool neighborhood match in Massachusetts, with an emphasis on SES as a key neighborhood characteristic, and we explored associations with child skills. Given the myriad socioeconomic contexts to which children experiencing match and mismatch may be exposed, studying match when the phenomenon of interest is measured relatively and continuously, as with neighborhood SES, presents conceptual challenges. At the same time, applying the concept of demographic match to neighborhood SES can shed light on how children's residential and preschool neighborhood characteristics may be related to their learning and development in unexpected ways. Further exploration of demographic match across different aspects of children's daily environments will be important for building the field's understanding

of the complex ways that children's multiple contexts combine to shape learning and

development.

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Tables and Figures

Table 1: Sample Characteristics (*N* = 2,029 children)

	Sample *N* (Unweighted)	Percent or Mean (SD) (Weighted)
Child age (as of Sept. 1, 2017)		
3 years old	1105	46.36%
4 years old	924	53.64%
Child gender		
Female	991	49.62%
Male	1032	49.90%
Missing	6	0.48%
Child race or ethnicity		
Asian	165	9.08%
Black/African American	186	11.39%
Hispanic/Latinx	313	10.51%
White	894	48.15%
Missing	471	20.87%
Child primary home language		
English speaking	1686	88.22%
Not English speaking	308	9.85%
Missing	35	1.94%
Household income		
$30,000 or less	273	10.21%
$30,001-$75,000	266	12.52%
$75,001-$125,000	255	13.01%
$125,001-$200,000	301	19.15%
$200,001 or more	250	15.09%
Missing	684	30.02%
Caregiver education		
Less than high school	67	1.71%
High school	136	5.23%
Some college	216	9,18%
Associate degree	109	5.87%
Bachelor's degree	377	21.15%
Graduate training or degree	465	28.28%
Missing	659	28.58%
Household size	1361	4.20 (1.19)
Number of children in household	1394	2.14 (0.93)
Two-parent household	1353	84.15%
Early education and care setting		
Community-based center	812	57.35%
Head Start	606	10.23%
Licensed family child care	310	10.07%
Public school pre-Kindergartens	301	22.35%
Residential neighborhood socioeconomic status	2029	0.07 (1.02)
Preschool neighborhood socioeconomic status	2029	0.06 (1.10)

Note: "Missing" indicates caregiver did not report on a given characteristic. "Some college" includes some college and vocational schooling. "Bachelor's degree" includes bachelor's degree and some graduate school. "Graduate degree" includes Master's, Doctorate, and Professional degree.

Table 2: Weighted Descriptive Statistics for Residential and Preschool Neighborhood Match, Overall and By Household and Child Characteristics ($N = 2,029$)

	Neighborhood Match (Percent of Children Attending EEC in Residential Neighborhood)	Mean Distance (SD) Between Residence and Preschool (Miles)	Neighborhood SES Match (Mean Difference (SD): Residential and Preschool Neighborhood SES)	Bivariate Correlation: Residential and Preschool Neighborhood SES
Overall	19.76%	1.81 (2.89)	0.01 (0.78)	.73
Household income				
$30,000 or less	10.53%	2.04 (2.81)	0.11 (1.06)	.65
$30,001-$75,000	23.72%	2.54 (5.17)	-0.04 (0.92)	.56
$75,001-$125,000	20.92%	1.99 (2.47)	0.03 (0.77)	.63
$125,001-$200,000	18.04%	1.98 (2.73)	-0.01 (0.52)	.62
$200,001 or more	27.76%	1.40 (1.94)	0.04 (0.54)	.52
Missing	17.83%	1.44 (1.98)	-0.01 (0.92)	.68
Child race/ethnicity				
Asian	14.41%	1.38 (1.63)	-0.03 (0.80)	.61
Black or African American	14.03%	2.53 (4.81)	-0.01 (0.89)	.56
Hispanic or Latinx	18.25%	1.60 (2.43)	0.15 (1.14)	.59
White	22.82%	1.96 (2.61)	0.05 (0.62)	.66
Missing	18.93%	1.35 (1.92)	-0.12 (0.86)	.70
Care type				
Community-based center	15.24%	1.81 (1.94)	0.05 (0.70)	.68
Head Start	18.61%	1.38 (3.49)	0.11 (1.39)	.62
Licensed family child care	22.73%	2.24 (4.69)	-0.04 (0.69)	.84
Public school pre-Kindergarten	30.57%	1.81 (3.16)	-0.10 (0.56)	.70
Missing	0%	N/A	N/A	

Note: All statistics computed using sample weights. Residential and preschool neighborhood socioeconomic status (SES) are represented by a standardized index comprised of median household income, poverty rate, and adult educational attainment for all Massachusetts Census tracts. Mean difference is the average difference between residential and preschool neighborhood SES index at the child level; positive values indicate higher residential, as compared to preschool, neighborhood SES index while negative values indicate higher preschool neighborhood SES index. All bivariate correlations reported were statistically significant with $p < .001$.

Table 3: Unweighted Child Skill Measures by Residential and Preschool Neighborhood Socioeconomic Status (SES) Match (N = 1842 children)

	Overall	ß Greater mismatch		Match	Greater mismatch à	
		Difference: < -1 (n =110)	Difference: -1 to 0 (n = 541)	Difference: 0 (n = 401)	Difference: 0 to 1 (n = 636)	Difference: > 1 (n = 154)
		Residential neighborhood SES much lower than preschool neighborhood SES	Residential neighborhood SES lower than preschool neighborhood SES	Residential neighborhood SES same as preschool neighborhood SES	Residential neighborhood SES higher than preschool neighborhood SES	Residential neighborhood SES is much higher than preschool neighborhood SES
Math	107.07 (15.15)	103.86 (16.46)	106.64 (15.72)	108.23 (15.56)	107.79 (13.92)	104.99 (15.61)
Literacy	102.90 (14.68)	102.54 (15.91)	102.84 (16.52)	104.03 (15.58)	102.66 (14.06)	101.50 (14.05)
Executive Function	41.94 (14.68)	41.31 (16.48)	41.97 (14.37)	41.65 (14.84)	42.72 (14.39)	39.63 (15.17)
Attention/Impulsivity	2.71 (0.49)	2.62 (0.64)	2.71 (0.47)	2.71 (0.48)	2.71 (0.48)	2.74 (0.47)
Positive Emotion	2.87 (0.32)	2.80 (0.50)	2.88 (0.31)	2.88 (0.27)	2.86 (0.32)	2.91 (0.30)

Note: Table includes children who had at least one skill score. Cell values are mean (standard deviation) and are unweighted. Residential and preschool neighborhood SES are represented by a standardized index comprised of median household income, poverty rate, and adult educational attainment for all Massachusetts Census tracts. Positive values indicate higher residential, as compared to preschool, neighborhood SES index while negative values indicate higher preschool, as compared to residential, neighborhood SES index.

Table 4: Unweighted Bivariate Correlations Between Residential and Preschool Neighborhood Socioeconomic Status (SES) Match and Child Skills

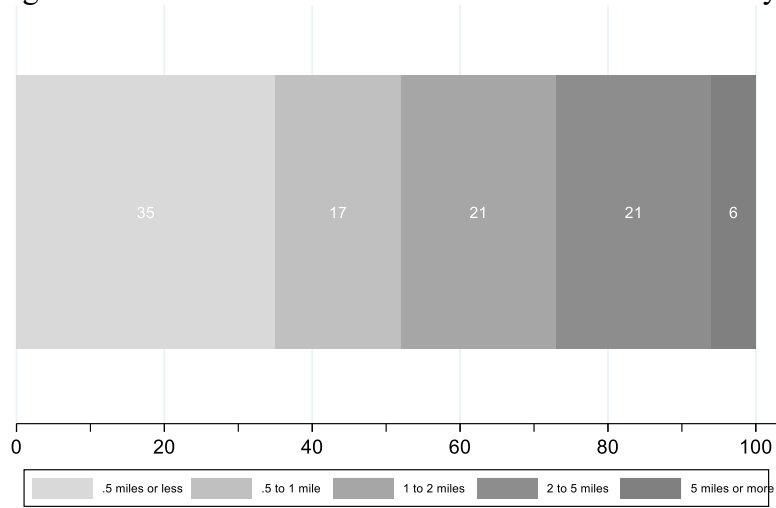|	(1)	(2)	(3)	(4)	(5)	(6)
(1) Residential-preschool neighborhood SES match	1.00					
(2) Math	.02	1.00				
(3) Literacy	-.00	**.41*****	1.00			
(4) Executive Function	-.02	**.42*****	**.17*****	1.00		
(5) Attention/Impulsivity	**.04**[+]	**.35*****	**.18*****	**.34*****	1.00	
(6) Positive Emotion	**.05***	**.22*****	**.12*****	**.17*****	**.76*****	1.00

[+] $p < .10$, * $p < .05$, ** $p < .01$, *** $p < .001$

Table 5: Unweighted, Standardized Results from Exploratory Regression Analyses of Child Skills and Residential-Preschool Neighborhood SES Match

|	Math		Literacy		Executive Function		Attention/Impulsivity		Positive Emotion	
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
Residential-preschool neighborhood SES match	-0.03	-0.03	-0.01	-0.02	-0.03	-0.03	0.02	0.02	0.03	0.02
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)	(0.03)	(0.03)	(0.03)
Residential neighborhood SES	**0.16*****	**0.16*****	**0.08*****	**0.08*****	**0.11******	**0.11******	0.05	0.05	0.03	0.04
	(0.03)	**(0.03)**	**(0.04)**	**(0.04)**	**(0.03)**	**(0.03)**	(0.04)	(0.04)	(0.04)	(0.04)
Match x Residential SES		-0.01		**-0.03**$^{+}$		-0.02		**-0.05*****		**-0.06*****
		(0.02)		**(0.02)**		(0.02)		**(0.02)**		**(0.03)**
Observations	1725	1725	1744	1744	1495	1495	1813	1813	1813	1813

Note. Standard errors in parentheses. Key predictors and outcomes were z-scored prior to fitting regressions; all estimates presented are standardized. All models included child-level covariates and clustering by child's residential city. $+ p < .10$ * $p < .05$ ** $p < .01$ *** $p < .001$

Figure 1: Distance Between Children's Residences and Early Education and Care Settings

| 35 | 17 | 21 | 21 | 6 |

0   20   40   60   80   100

.5 miles or less   .5 to 1 mile   1 to 2 miles   2 to 5 miles   5 miles or more

Note: N = 2,029 children. Percentages shown were calculated using sample weights. The largest distance between a child's residence and early education and care setting in the sample was 33.9 miles.

Figure 2: Residential and Preschool Neighborhood Socioeconomic Status by a) Household Income, b) Child Race or Ethnicity, and c) Child Early Education and Care (EEC) Setting

a) Household Income

b) Child Race or Ethnicity
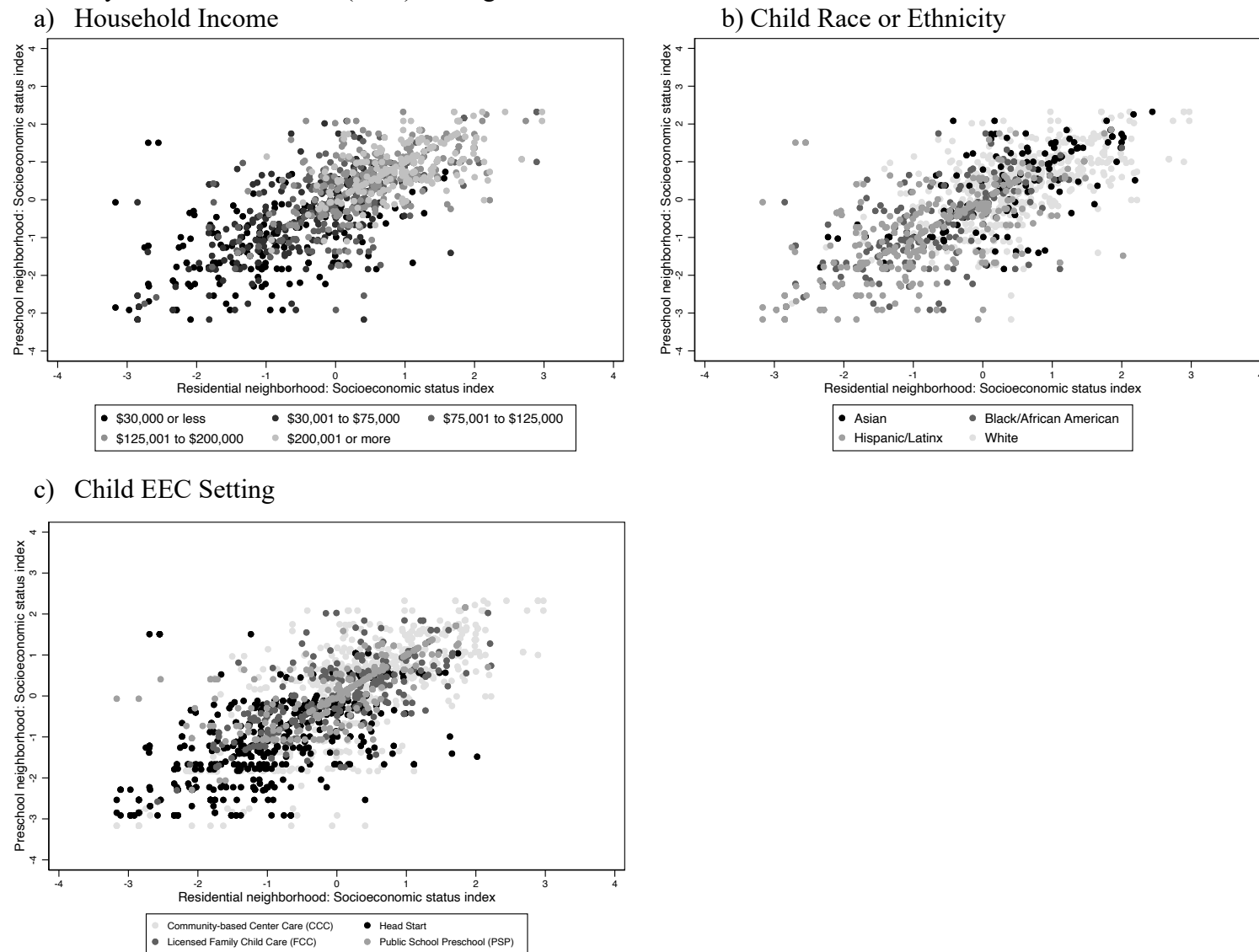
c) Child EEC Setting

Note: N= 1,345 children in panel a (Child household income), 1,558 children in panel b (Child race/ethnicity), and 2,029 children in panel c (EEC setting type)

Figure 3: Estimated Child Skill Scores by Neighborhood Socioeconomic Status (SES) Match and Residential Neighborhood SES for (a) Literacy (b) Attention/Impulsivity (c) Positive Emotion

a) Literacy

b) Attention/Impulsivity

c) Positive Emotion

■ Lower residential neighborhood SES (-1 SD)

■ Higher residential neighborhood SES (+1 SD)
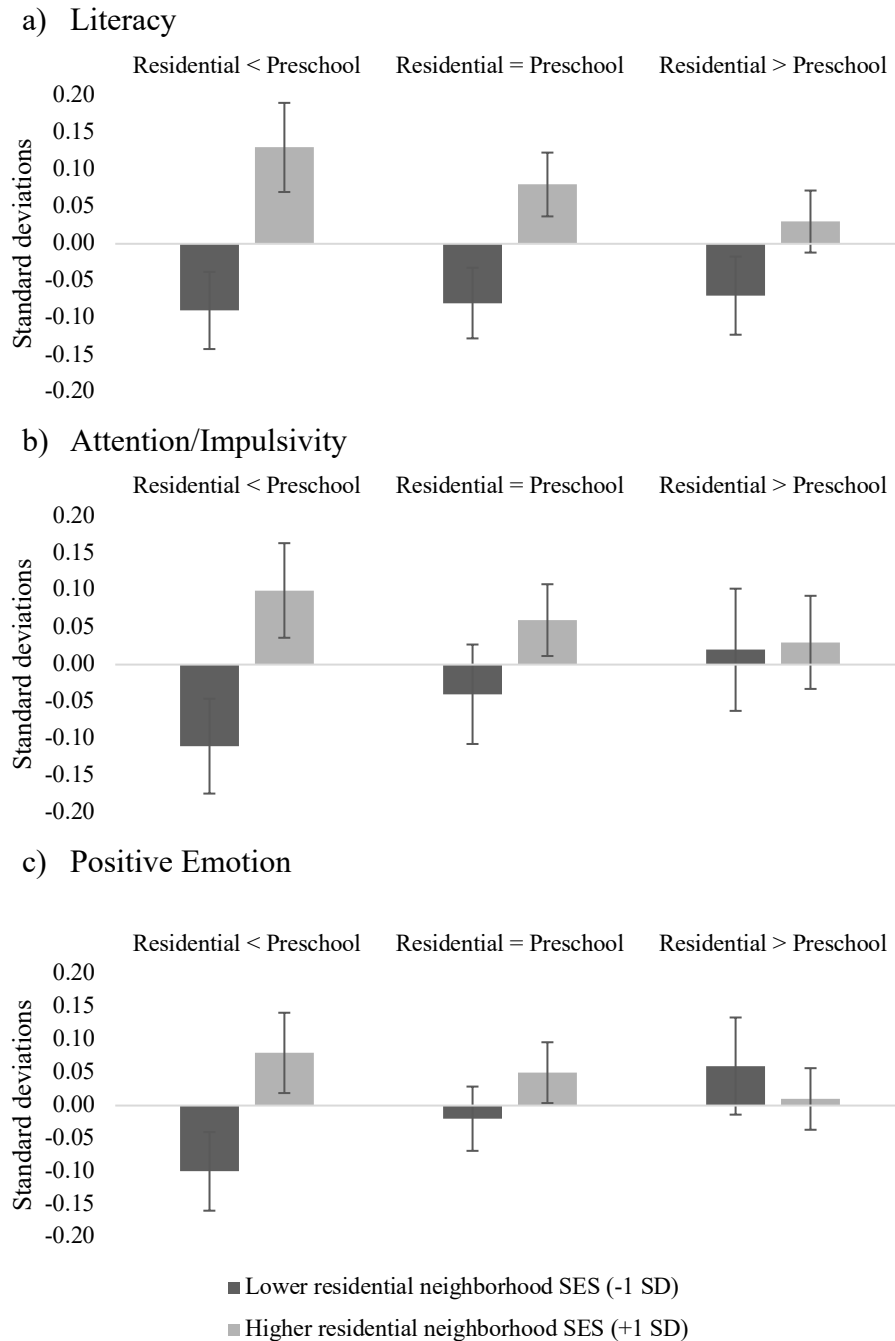
Note: Bars indicate 95% confidence intervals. Predicted skill levels are represented in standard deviations of the outcome variable and account for child-level covariates and clustering by residential city. Lower (higher) residential neighborhood SES is one standard deviation below (above) Massachusetts state average."Residential < Preschool" represents children whose residential neighborhood SES is one standard deviation below preschool neighborhood SES. "Residential = Preschool" represents children whose residential and preschool neighborhood SES are the same. "Residential > Preschool" represents children whose residential neighborhood is one standard deviation above preschool neighborhood SES.