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Effects of family and neighborhood vulnerability on dual language learner and monolingual children's preschool outcomes

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Introduction: Research has documented that home and neighborhood contexts of children from low-income families are associated with lower cognitive and social–emotional skills than their higher-income peers. Even though over a third of young children growing up in poverty are dual language learners (DLLs), little research has examined how contextual effects differ between DLL and monolingual children. The current study examines how these two contexts, neighborhood vulnerability and family socioeconomic risk, impact executive function (EF) and social–emotional skills in DLL and monolingual preschoolers.

Methods: A secondary analysis was completed on data from two Head Start programs. A series of cross-classified models with interactions were conducted to examine the moderating role of DLL status on associations between neighborhood vulnerability and family risk and preschoolers' EF and social-emotional skills.

Results: Proficient bilingual children's EF skills were not impacted by neighborhood risks, suggesting that proficient bilingual children may have more opportunities to grow their EF skills when switching between English and Spanish regardless of neighborhood context. An unexpected result occurred for emergent bilingual children who were reported to demonstrate fewer behavior problems regardless of family risk, highlighting the importance of ensuring all DLL families have access to resources to promote their children's social–emotional skills; and teachers have the proper training to support the behaviors of children in their classroom with varying levels of English proficiency.

Discussion: Although speaking two languages may be a protective factor for young DLLs growing up in poverty, little research has examined how contextual effects differ between DLL and monolingual children. The current study contributes by examining how DLL status, especially two different DLL statuses (i.e., Proficient Bilinguals and Emergent Bilinguals), may vary as a buffer in moderating the negative associations between collective neighborhood vulnerability, individual family risk, and children's EF and social–emotional skills.

KEYWORDS

neighborhood effects, DLL, preschool-age, family effects, cognitive advantages of bilingualism

Introduction

Preschoolers from low-income families are often raised in neighborhood and home environments with elevated risks that impact their development (Jeon et al., 2014; Morrissey and Vinopal, 2018). More specifically, research has documented that home and neighborhood contexts of children from low-income families are associated with lower cognitive (Raver et al.,

2013) and social–emotional skills (Bassett et al., 2012) than their higher-income peers. Over a third of young children growing up in poverty are dual language learners (DLLs) and speak Spanish in the home (Park et al., 2017). Although speaking two languages may be a protective factor for young DLLs growing up in poverty (Kim et al., 2018; Hanno and Surrain, 2019; Hartanto et al., 2019; Grote et al., 2021; López and Foster, 2021), little research has examined how contextual effects differ between DLL and monolingual children. The current study examines how DLL status may act as a buffer by moderating the negative associations between collective neighborhood vulnerability, individual family risk, and children's executive function (EF) and social–emotional skills.

Vulnerability and risk theoretical framework

This study is rooted in the bioecological model (Bronfenbrenner and Morris, 2006), which suggests that children's development is shaped by multiple, nested contexts within their environment. The environment includes the neighborhood, classroom, and family contexts that interact with one another and influence children's development. For example, the various risks in a child's community (e.g., extreme poverty) or home (e.g., having a single parent) may influence the access to learning experiences a child has in their neighborhood or home.

The *investment perspective* and *family stress perspective* (Guo and Harris, 2000; Yeung et al., 2002; Jeon et al., 2014) also guide the objectives of this study. The investment perspective posits that the disadvantageous effects on children's development result from socioeconomic home and neighborhood risks. Due to their family's economic adversity and disadvantaged neighborhood, low-income families may lack energy, time, and financial and community resources to invest in a high-quality learning environment at home. The family stress perspective posits that the detrimental effects on children's development stem from economic burdens on the parents resulting in increased psychological distress and associated negative impacts on parenting (Masarik and Conger, 2017). Together, these theories highlight the anticipated harmful impacts of increased family risk and neighborhood vulnerability on children's outcomes.

Neighborhood environment

Collective neighborhood vulnerability, as conceptualized in this paper, includes several characteristics that together form cumulative disadvantage. These characteristics include poverty, unemployment, racial composition (a marker of racial residential segregation; Duncan et al., 2012), household structure, and the percentage of families who received subsidized care (Burchinal et al., 2002; Sampson et al., 2002; Jeon et al., 2014). A number of studies have demonstrated that children's neighborhood environment is related to their developmental outcomes (Minh et al., 2017). Neighborhoods play an essential role for young children's development because their outcomes are likely a product of their early experiences (Bronfenbrenner and Morris, 2006). Neighborhood vulnerability factors including poverty impact the quality of early experiences children have because there may be less access to high-quality developmental learning materials, activities, and interactions (Ellen et al., 2001; Sharkey and Sampson, 2017; Reynolds et al., 2019). For example, neighborhoods showing high poverty levels were less likely to have well-managed parks, high quality grocery stores, and other public places where children can visit. Research found that parks in high poverty neighborhoods were less used that parks in low poverty area and park-use was correlated with organized and supervised activities offered by the parks (Cohen et al., 2012). In other words, low-income neighborhoods often lack learning opportunities due to the inequitable distribution of environmental resources (Cohen et al., 2012; Hilmers et al., 2012; Bustamante et al., 2019). Duncan et al. (2012), noting racial segregation, found that census tracts indicating higher percentage of non-Hispanic Blacks were associated with lower open access recreational space which can promote young children's play and learning. Taken together, neighborhood risks are associated with children's lower performance on measures of cognitive (e.g., literacy, math) (Carpiano et al., 2009; Froiland et al., 2013; Jeon et al., 2014) and social–emotional skills (e.g., behavior problems) (Caughy et al., 2013; Delany-Brumsey et al., 2014; Heberle et al., 2014).

Home environment and family socioeconomic risk

Risks associated with the more proximal home and family context also play a role in shaping development (Whittaker et al., 2011). Cumulative family risk focuses on how an individual's environment increases or decreases the chance of developing negative outcomes (Jessor, 1998). For example, cumulative family risk includes characteristics that represent overall family socioeconomic status (SES) including household income, parent education level, and family structure (i.e., single-parent households). Family risk is associated with access to fewer social and economic resources, which are associated with lower academic and social–emotional success (Rimm-Kaufman et al., 2009; Crosnoe et al., 2010). Family risk has been found to be more predictive of lower child success when families fall further below the poverty line (Mistry et al., 2004). Taken together, cumulative family risk is associated with parents who are less likely to engage in behaviors at home that are supportive of cognitive and social–emotional development (Vandermaas-Peeler et al., 2009; Schmitt et al., 2015). Therefore, children who are exposed to extreme family risk may be at higher risk for lower cognitive, EF, and social–emotional skills. Accordingly, it is important to examine moderating factors that may buffer or amplify the negative effect family risk has on children's outcomes.

Dual language learners

One individual factor that may influence the effect of children's environment on their developmental outcomes is children's DLL status. Within the population of children from low-income homes, there is a growing number of young Spanish-English speaking DLLs in the United States (Baker and Páez, 2018). Previous research demonstrates that DLL children are often at higher risk than their monolingual peers for lower school success (Wildsmith et al., 2016). Due to systemic oppression, DLL children are also more likely to live in neighborhoods with concentrations of poverty and Spanish-speaking populations (Child Trends Databank, 2019). Although some researchers have theorized that exposure to Spanish may impede young DLL's developmental outcomes (Snow and Kang, 2006), a growing body of literature refutes this claim (Halle and Darling-Churchill, 2016; Kim

et al., 2018; Hanno and Surrain, 2019; López and Foster, 2021). For example, the social cohesion brought about by concentrations of home language speaking neighbors may be a benefit for young DLLs (Leventhal and Shuey, 2014). Additionally, there may be benefits associated with learning two languages that are protective for DLL's developmental outcomes (White and Greenfield, 2017; Hartanto et al., 2019; Frechette et al., 2021; Grote et al., 2021). For example, Grote et al. (2021) found that bilingual preschool children from low-SES families showed cognitive advantages in several components of EF compared to their monolingual English- and Spanish-speaking peers. Hartanto et al. (2019) also found a bilingual advantage in their study using ECLS-K data for children in Kindergarten and Grade 1, reporting results that show bilingualism significantly attenuated the negative effects of SES on components of EF and self-regulatory behaviors. These findings support the Cognitive Advantage Hypothesis which posits that learning two languages produces cognitive advantages over monolingual speakers (Barac and Bialystok, 2012; Bialystok et al., 2012). Because this is an emerging area of research with gaps, inconsistent findings, and little understanding of underlying processes (Grote et al., 2021), further examination focused on young children's DLL status and associations among neighborhood vulnerability, family risk, and child outcomes is warranted.

The DLL population is a heterogenous group with varying levels of proficiency in their home and second language (López and Foster, 2021). Recently, researchers have begun to examine nuances in DLLs and subgroups have emerged including emergent bilinguals and proficient bilinguals (Lonigan et al., 2018; Francot et al., 2021; Halpin et al., 2021; López and Foster, 2021). Emergent bilinguals are less proficient in English compared to the average proficiency for their age, whereas proficient bilinguals are proficient in both English and Spanish. These two groups of DLLs may experience their environments in different ways. For example, young DLLs are often in classrooms that are primarily English-speaking (Páez et al., 2007) so emergent bilinguals could have a more difficult time engaging in classroom learning experiences and rely more heavily on their neighborhood and home environments.

Bilingual thresholds theory

The focus on proficient bilingual and emergent bilingual DLL children in this study is guided by the Thresholds Theory (Cummins and Swain, 2014). This theory posits that DLL children need a threshold level of each of their languages to benefit from the cognitive advantages associated with bilingualism (Baker and Wright, 2017). Therefore, proficient bilingual children who are able to switch between English and Spanish with more ease may benefit from a broad range of cognitive advantages (Ardasheva et al., 2017) that may buffer the deleterious effect neighborhood and home risks have on their cognitive and social–emotional outcomes.

Defining cognitive and social–emotional development in context

Executive functions

Executive functions (EF) are a domain-general, cognitive skill set that enables goal-directed behavior and includes thinking flexibly, attending to information, and mentally manipulating information (Blair, 2016). EF skills are foundational for children's learning and overall school readiness (Blair and Razza, 2007; Zelazo et al., 2016). In preschool, EF skills include resisting distractions (e.g., a talkative peer), shifting and maintaining focus on the teacher or task, and remembering to follow directions (e.g., "line up in a straight line") (McClelland et al., 2007; Bierman et al., 2008; Garon et al., 2008; Cuevas et al., 2012; Ursache et al., 2012; Ackerman and Friedman-Krauss, 2017). EF skills are important for young children to develop because they are predictors of later success both academically and socially (Best et al., 2009; Monette et al., 2011; McClelland et al., 2013; Cirino and Willcutt, 2017).

EF is a skill set that may be a strength for young DLL children (Nigg, 2000; Diamond, 2013). As discussed above, previous studies demonstrate that DLL children sometimes demonstrate better EF skills and social–emotional skills than their monolingual peers, including DLLs from low-income contexts (Halle et al., 2014; White and Greenfield, 2017; Hartanto et al., 2019; Grote et al., 2021). In general, children who are proficient and demonstrate strong skills in both languages (i.e., home language and English) tend to demonstrate higher EF skills (Melzi et al., 2017; White and Greenfield, 2017; Thomas-Sunesson et al., 2018). For example, proficient bilingual children may have more experience inhibiting one language while speaking the other (inhibition) and appropriately switching between languages (cognitive flexibility), thus strengthening their EF skills (Bialystok, 2009). More recently, attentional control has been advanced as the key mechanism supporting developmental advantages demonstrated by bilingual children (Bialystok and Craik, 2022). The extant literature identifies several potential mechanisms for why DLL children, especially those with higher Spanish and English proficiency, may demonstrate higher EF skills based on their bilingual status.

Given that EFs are a domain general skill set, not tied to a particular learning setting, and predictive of later success, it is critical to examine if the neighborhood and family environments impact EF skills. Previous studies examining how neighborhood risk is associated with EF skills have found that children living in poverty have lower EF skills than their peers (Willoughby et al., 2018) and that children in more vulnerable neighborhoods show slower growth in EF skills compared to their peers in less vulnerable neighborhoods (Wei et al., 2021). Previous studies examining family risk and EF abilities have found links between indicators of family risk (e.g., single-parent status) and children's EF inhibition skills, such that children who were from single parent households had lower inhibition (Baker et al., 2019). Other studies have found that parental education is directly linked to poorer EF skills in children (Vrantsidis et al., 2020) and theorize that parents with lower education experience more psychological distress, which may impact their ability to optimally foster their child's EF growth. However, no studies to date have examined if these relations vary across subgroups of DLL, with proficient bilinguals demonstrating less negative impact of neighborhood or family vulnerability than their peers.

Social–emotional skills

Development of positive social–emotional skills in early childhood has been linked to a number of positive outcomes ranging from physical health, later behavior, academic motivation, and employment (Moffitt et al., 2011; Jones et al., 2015; Heckman, 2018). Two social–emotional skills that young children develop are prosocial skills and self-regulation of behavior and emotion (Crane et al., 2011).

Prosocial skills include children's strengths in self-control, initiative, and attachment with adults as the antecedent conditions associated with an increase in the likelihood of positive outcomes (Crane et al., 2011). DLLs with higher prosocial skills in preschool show more rapid growth in school success into elementary school (Kim et al., 2014). Low self-regulation results in behavior problems or challenging behaviors (e.g., aggression, disruption) and is associated with lower school success (LeBuffe and Naglieri, 1991; Hartman et al., 2017). These two social–emotional skills, prosocial skills and self-regulation, are important for young children to develop because they are related to better transitions into formal schooling (Ansari et al., 2020) and later achievement (Duckworth and Carlson, 2013).

A bilingual advantage for social–emotional skills may exist. Some studies report that DLL children from low-income homes, regardless of their language proficiency in both languages, out-perform their monolingual peers on social–emotional assessments (Han, 2010; Halle et al., 2014; Kim et al., 2018). More specifically, young DLL children show stronger prosocial skills and lower behavior problems compared to their monolingual peers (De Feyter and Winsler, 2009; Galindo and Fuller, 2010; Han, 2010; Han and Huang, 2010; Luchtel et al., 2010; Winsler et al., 2014a; Hartanto et al., 2019). Yet other studies report that within the DLL group, only children who have higher proficiency in English and Spanish (e.g., proficient bilinguals) have a social–emotional advantage compared to their less proficient peers (e.g., emergent bilinguals) (Melzi et al., 2017). Therefore, depending on children's language status, there may be differential relations between neighborhood vulnerability, family risk, and social–emotional skills.

Studies examining the impact of neighborhood vulnerability indicate that living in a high poverty neighborhood as a young child is predictive of increased behavior problems (Edwards and Bromfield, 2009; Roy et al., 2014). Additionally, young children who live in more vulnerable neighborhoods show lower prosocial skills (Edwards and Bromfield, 2009). At the family level, low-income status can put a great deal of stress on families. Increased stress can result in reduced quality of the home environment, thus impacting children's behaviors (Blair and Raver, 2012). For example, poverty-related parent stress can impact their ability to provide a stimulating home environment that has ample opportunities for their children to practice their prosocial skills (Bradley et al., 1989; Hart and Risley, 1995; McClelland et al., 2000; Schmitt et al., 2015). Previous work examining family risk and children's social–emotional skills has identified a relation between single parent status, one of the family risk indicators, and young children's behavior problems (Baker et al., 2019), such that children of single-parents had more behavior problems compared to their peers from two-parent households. Finally, as parents' education level decreases, their children demonstrate more behavior problems (Sektnan et al., 2010). Although associations have been identified between neighborhood vulnerability and family risk to children's outcomes, few studies have examined how DLL status may impact these relations. Given the strengths associated with learning two languages it is critical to examine if DLL status buffers some of the negative environmental effects on their developmental outcomes.

Current study

The current study examines how two contexts (1) neighborhood vulnerability and (2) family socioeconomic risk impact children's EF and social–emotional skills. Family and neighborhood contexts are considered influential environments for the development of preschoolers because they are likely to spend most of their time in these two environments (Jeon et al., 2014). Moreover, given the need to best serve the growing number of young DLLs raised in low-income environments, this study also examines group differences among monolingual and DLL children. Specifically, the current study has three aims:

1. examine if neighborhood vulnerability and family risk are associated with EF skills. It was hypothesized that higher neighborhood vulnerability and family risk would be associated with lower EF skills (Baker et al., 2019; Vrantsidis et al., 2020; Wei et al., 2021).
2. examine if neighborhood vulnerability and family risk are associated with social–emotional skills. It was hypothesized that higher neighborhood vulnerability and family risk would be associated with higher behavior problems (Edwards and Bromfield, 2009; Roy et al., 2014; Baker et al., 2019) and lower prosocial skills (Edwards and Bromfield, 2009).
3. examine if DLL status moderates the relation between family socioeconomic risk and neighborhood vulnerability on EF and social–emotional outcomes. It was hypothesized that proficient bilingual status would moderate the relation between neighborhood vulnerability and EF skills as well as family risk and EF skills (Melzi et al., 2017; White and Greenfield, 2017; Thomas-Sunesson et al., 2018). It was also hypothesized that proficient bilingual status would moderate the relation between neighborhood vulnerability and social–emotional as well as family risk and social–emotional skills (Winsler et al., 2014b; Melzi et al., 2017).

Methods

Data sources and procedure

Data were obtained from two Head Start (HS) program evaluation studies conducted by a university research team. Both HS programs served preschoolers from low-income families and were located in an urban Midwest city in the mid-southern portion of the U.S. Data from these studies were collected between 2016 and 2019. The university's Institutional Review Board approved all procedures for these studies. Center directors, teachers, and parents provided informed consent to participate and were provided with a detailed description of what participation in the study involved.

Participants

Data were combined across the two evaluation studies for a total of 1,367 participants. As noted above, all participants were enrolled in HS and thus their families met the program eligibility requirement of having incomes at or below the federal poverty level (Administration for Children and Families, 2018). Due to a lack of addresses to identify neighborhoods, 304 children were dropped from the sample because their family homes could not be geocoded. An additional 42 children were dropped who were DLLs but had a home language other than Spanish. The final sample included 1,021 children (48% male) from 152 HS classrooms in 13 HS centers geographically dispersed across

TABLE 1 Descriptive statistics and bivariate correlations.

		Bivariate correlations									
Variable	M (*SE*)	Range	*n*	1	2	3	4	5	6	7	8
1. Family socioeconomic risk	1.81 (0.93)	0–3	1,063	–							
2. Neighborhood vulnerability	0.00 (1.00)	−1.94-2.7	1,063	0.21**	–						
3. Executive function (EF) skills	21.17 (12.73)	0–58	1,063	−0.18**	−0.14**	–					
4. Protective factors (DECA)	49.92 (9.96)	28–72	1,020	−0.11**	−0.08**	0.27**	–				
5. Behavior problems (DECA)	51.58 (9.70)	29–72	868	−0.12**	0.03	−0.23**	−0.67**	–			
6. Child sex (1 = male)	0.52 (0.50)	0–1	1,063	0.02	−0.09**	−0.16**	−0.21**	0.27*	–		
7. EF age	43.41 (6.47)	36–61	1,063	−0.23**	−0.07*	0.56**	0.09**	−0.15**	−0.01	–	
8. DECA age	41.62 (8.81)	23–61	1,020	−0.27**	−0.07*	0.50**	0.02	−0.15**	0.02	0.91**	–
9. Total time enrolled (in months)	14.90 (11.47)	0–65	1,063	−0.11**	−0.05	0.12**	0.05	0.01	0.05	0.13**	0.12**

**$p < 0.01$, *$p < 0.05$.

the city. Children ranged in age from 23 to 61 months (see Table 1). Children were predominantly Hispanic (37.7%) and Black (32.9%) with small percentages of White, Non-Hispanic (13.0%), and other races (16.4%). On average, children had been enrolled in their HS center for 14.92 ($SD = 11.47$) months.

Measures

Neighborhood vulnerability

Using geocoded census tract address data, HS child data were linked to U.S. Census Bureau Data (2017), which were collected at approximately the same time children in this sample were enrolled in the HS centers. Neighborhood vulnerability was modeled after previous research (Burchinal et al., 2002; Sampson et al., 2002; Duncan et al., 2012; Jeon et al., 2014). Children's geocoded census tract was linked to indicators of neighborhood vulnerability including (1) the percentage below the federal poverty line, (2) the unemployment ratio, (3) the percentage of female-headed households with children, (4) the percentage receiving public assistance, (5) the percentage of African Americans (an indicator of racial residential segregation and structural racism; Duncan et al., 2012), and (6) the percentage receiving food stamps. The percentage of African Americans was included in the measure of neighborhood vulnerability but not the percentage of Latinx given the history and current census tract data for the city where this study was conducted which shows high racial residential segregation for African Americans only. The same degree of residential segregation is not true for Latinx residents. These six indicators were summed and transformed into a z-score to create a total neighborhood vulnerability score. Cronbach's alpha of the six indicators = 0.92.

Family socioeconomic risk

Child demographic information was obtained from administrative records of parent reports at enrollment from both HS evaluation studies and confirmed through parent interviews during fall data collection. Family socioeconomic risk was estimated by summing the number of risks reported in the demographic forms (Jeon et al., 2014). The indicators included household income (dummy coded as 1 = annual income below 100% of the poverty line and 0 = annual income above 100% of the poverty line), single-parent status (dummy coded as 1 = single parent and 0 = more than one parent in the household), and parent education [dummy coded as 1 = less than an associate of arts (AA) degree and 0 = AA degree or higher].

Dual language learner status

Children's language status was determined by the parent's response during enrollment (i.e., does your child speak Spanish?). Spanish-speaking children were grouped into two DLL categories, emergent bilingual or proficient bilingual, based on their standardized performance on the Peabody Picture Vocabulary Test (PPVT) (Dunn and Dunn, 2007; Campbell and Dommestrup, 2010), an English vocabulary measure. The PPVT has a reliability of 0.92. If children spoke Spanish at home and scored more than one standard deviation below the mean ($M = 100$, $SD = 15$) on the PPVT, they were categorized as an emergent bilingual. National standard scores were used because they allow for comparison across national samples in contrast to the mean of the sample in the current study. All children who spoke only English were grouped into the monolingual category.

Executive function

EF was measured during children's first year of preschool using the Minnesota Executive Function Scale (MEFS) (Carlson and Zelazo, 2014), a standardized, adaptive, tablet-based card sort measure administered by trained research associates. Research associates administered the MEFS in either English or Spanish, based on the child's dominant language. The measure consists of seven levels of varying complexity and children are instructed (e.g., "If it's red put it here, but if it's blue put it here") to sort a variety of cards by one of two dimensions: color or shape. The MEFS has been validated on a large sample of young children including children from low-income homes (ICC = 0.93). A total score based on accuracy and response time is computed and higher scores indicate better EF skills.

Social–emotional skills

Teachers rated children's social–emotional skills on two components, Total Protective Factors and Behavior Concerns, using the Devereux Early Childhood Assessment for Preschoolers, Second Edition (DECA) (LeBuffe and Naglieri, 1991). Ratings of children's social–emotional skills were collected in the fall of the year the child enrolled in HS to get a rating of social–emotional skills before the child spent a prolonged amount of time in the preschool environment. Both DECA scales were rated by the child's teacher. Total Protective

Factors is made up of three subscales: initiative, self-control, and attachment and higher scores indicate better protective factors. Behavior concerns is a scale that reflects poor behavior and the higher the score, the worse the teacher rates the child's behavior. Reliability estimates for Total Protective Factors and Behavior Concerns are 0.88 and 0.78, respectively (Carlson and Voris, 2018).

Data analytic plan

Bivariate correlations were computed for all independent variables (IVs) and dependent variables (DVs) to inspect correlations and differences between the performance of the language status groups. In addition, covariates (i.e., age and total time enrolled) and family risk were grand mean-centered before conducting the Bayesian cross-classified models to account for the multilevel structure of the data.

Before conducting multilevel models, we conducted intraclass correlation coefficients (ICCs) for EF and social–emotional outcomes. Mplus Version 8.7 (Muthén and Muthén, 1998-2017) was used to analyze Bayesian multilevel cross-classified models for study aims 1, 2, and 3. Cross-classified models allowed for children (Level 1) to be nested within their classroom (Level 2) and neighborhoods (Level 2) simultaneously. Group differences were examined for three groups: (1) monolingual English speakers ($n = 719$), (2) emergent Spanish-English bilinguals (emergent bilingual; $n = 219$), and (3) proficient Spanish-English bilinguals ($n = 104$). Given that the models were analyzed using a Bayesian framework, deviance information criterion was used to inspect model fit where descending values indicate better fit (Spiegelhalter et al., 2002). Multi-group analysis was not diminished by unequal sample size by managing the complexity in the analysis. In addition, we used an exploratory approach which does not require an adjust p-value (Moran, 2003). This study tested multiple hypotheses rather than conducted a simultaneous test (Saville, 1990).

For the first and second aims, we examined direct paths from neighborhood vulnerability and family risks to children's EF and social–emotional skills. For the third aims, we examined moderation models including interaction effects between DLL status and neighborhood or family risks on children's EF and social–emotional skills.

Results

Descriptive statistics

Table 1 lists means and correlations for all variables. All variables were inspected for normality and all correlations were in the expected directions. Neighborhood vulnerability was negatively associated with children's EF skills and protective factors, such that as neighborhood vulnerability increased children had lower EF skills and lower prosocial social–emotional skills. Family SES risk was positively associated neighborhood vulnerability and behavior problems. Family SES risk was negatively associated with EF and prosocial skills. Therefore, as family risk increased children had more behavior problems, lower prosocial skills, and lower EF skills. EF was positively associated with protective factors and negatively associated with behavior problems. Protective factors were negatively associated with behavior problems.

Intraclass correlation coefficients (ICCs) were computed for EF and social–emotional outcomes. ICCs ranged from 16 to27% when clustering by classroom, indicating it was necessary to nest children within their classrooms. ICCs ranged from 1 to 3% when nested within the neighborhood (see Table 2). However, Moran's I, which is a measure of how dependent geographically adjacent census tract data are based on the surrounding tracts, was significant ($p < 0.05$) for all six Census data indicators, ranging from 0.29 to 0.65, indicating that children should also be clustered within their neighborhood.

Executive function models

A series of cross-classified models were run to examine the association between neighborhood vulnerability, family risk, and DLL status on EF skills. First, a model was examined where covariates (e.g., age in months, total time enrolled, sex), predictor variables (e.g., neighborhood vulnerability and family SES risk), and dummy codes for DLL status groups predicted the dependent variable, EF skills. DLL status was dummy coded so English monolingual children were the reference group. Neighborhood vulnerability was a significant predictor of children's EF skills ($b = -0.83$, $SE = 0.14$, $p < 0.01$). Family risk was not associated with children's EF skills ($b = -0.03$, $SE = 0.03$, $p = 0.16$) (see Table 3).

Language status group differences

DLL group differences emerged on EF skills. Emergent bilingual children scored significantly lower on EF skills compared to monolingual children ($b = -0.10$, $SE = 0.03$, $p < 0.01$). There were no significant differences in EF performance between proficient bilingual and monolingual children ($b = 0.03$, $SE = 0.03$, $p = 0.12$) (see Figure 1). The box plots were performed using R Statistical Software (R Core Team, 2023).

DLL interactions

Next, a cross-classified model was examined where the interactions between DLL status and neighborhood vulnerability and DLL status and family risk were entered into the model. There was a significant moderating effect of proficient bilingual status on the relation between neighborhood vulnerability and EF skills ($b = 0.07$, $SE = 0.03$, $p < 0.05$), indicating that compared to monolingual children, proficient bilingual's EF skills are not as impacted by neighborhood risk (see Figure 2). Yet, there was no significant moderating effect between neighborhood vulnerability and EF skills by emergent bilingual status ($b = 0.01$, $SE = 0.03$, $p = 0.40$). There were also no significant moderating effects of emergent bilingual status ($b = 0.02$, $SE = 0.03$, $p = 0.27$) or proficient bilingual status ($b = -0.03$, $SE = 0.03$, $p = 0.16$) on the relation between family risk and EF skills.

TABLE 2 Intraclass correlations for child outcomes.

	Classroom cluster	Neighborhood cluster
Executive function skills	0.27	0.03
Total protective factors	0.16	0.02
Behavior concerns	0.19	0.02

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TABLE 3 Crossclassified model results.

	Executive function outcome model			Social emotional outcomes model					
	Executive function			Protective factors			Behavior problems		
	B	Posterior *SD*	95% CI	*B*	Posterior *SD*	95% CI	*B*	Posterior *SD*	95% CI
Covariates									
Child age	**0.57*****	0.02	[0.52, 0.60]	0.01	0.04	[−0.08, 0.07]	−0.01	0.05	[−0.11, −0.09]
Child sex	**−0.16*****	0.02	[−0.21, −0.12]	**−0.25*****	0.03	[−0.08, −0.07]	**0.29*****	0.03	[4.59, 6.61]
Total time enrolled	0.04	0.03	[−0.02, 0.09]	0.07	0.03	[.-0.01, 0.13]	−0.02	0.03	[−0.08, 0.05]
Language status									
DLL 1 (1 = EB; ref. = Mono)	**−0.10*****	0.03	[−0.15, −0.05]	−0.01	0.04	[−0.07, 0.07]	**−0.14*****	0.04	[−0.21, −0.07]
DLL 2 (1 = PB; ref. = Mono)	0.03	0.03	[−0.02, 0.08]	**0.12****	0.03	[0.07, 0.19]	**−0.17*****	0.04	[−0.24, −0.10]
Level 1 independent variables									
Family socioeconomic risk	−0.03	0.03	[−0.09, 0.03]	**−0.08***	0.04	[−0.16, −0.01]	**0.09***	0.04	[0.01, 0.18]
Level 2 independent variables									
Neighborhood vulnerability	**−0.83*****	0.14	[−0.99, −0.48]	**−0.38***	0.19	[−0.70, −0.01]	0.18	0.21	[−0.23, 0.57]

Bold values indicate statistically significant coefficients. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

Social–emotional models

A series of multilevel models were run to examine the association between neighborhood vulnerability, family risk, and DLL status on social–emotional skills. First, a model was examined where covariates (e.g., age in months, total time enrolled, sex), predictor variables (e.g., neighborhood vulnerability and family risk), and dummy codes for DLL status groups predicted the social–emotional dependent variables, Total Protective Factors and Behavior Concerns. Again, DLL status was dummy coded so English monolingual children were the reference group. Neighborhood vulnerability was a significant predictor of children's Protective Factors ($b = -0.40$, $SE = 0.19$, $p < 0.05$). As neighborhood risk increased, children's Total Protective Factors decreased. However, neighborhood vulnerability was not related to children's Behavior Concerns ($b = 0.18$, $SE = 0.21$, $p = 0.21$). Family SES risk was associated with children's Protective Factors ($b = -0.08$, $SE = 0.04$, $p < 0.05$). Family SES risk was also predictive of children's Behavior Concerns ($b = 0.09$, $SE = 0.04$, $p < 0.05$).

Language status group differences

DLL group differences emerged on both Protective Factors and Behavior Concerns. Proficient bilingual children were rated as having significantly higher Total Protective Factors skills compared to monolingual children ($b = 0.12$, $SE = 0.03$, $p < 0.01$). There were no significant differences in Total Protective Factors between emergent bilingual and monolingual children ($b = -0.01$, $SE = 0.04$, $p = 0.49$). For Behavior Concerns, both emergent bilingual ($b = -0.14$, $SE = 0.04$, $p < 0.001$) and proficient bilingual ($b = -0.17$, $SE = 0.04$, $p < 0.001$) children were rated as having fewer behavior problems compared to their monolingual peers.

DLL interactions

Next, the interactions between (1) DLL status and neighborhood vulnerability and (2) DLL status and family SES risk were entered into the model. There were no significant moderating effects of DLL status on the relation between neighborhood vulnerability and social–emotional skills. There was no significant moderating effect of DLL status on the relation between family SES risk and Total Protective Factors. However, there was a significant effect of emergent bilingual status ($b = -0.10$, $SE = 0.04$, $p < 0.01$) on the relation between family SES risk and Behavior Concerns. Emergent bilingual children were rated low on Behavior Concerns regardless of their level of family SES risk (see Figure 3). The same moderating effect was not significant for the proficient bilingual group ($b = -0.03$, $SE = 0.04$, $p = 0.47$).

Discussion

The goal of the current study was to determine if neighborhood vulnerability and family SES risk were predictive of monolingual and DLL children's EF and social–emotional skills. This was the first study to examine differences by DLL language proficiency status. Neighborhood vulnerability was predictive of children's EF skills and prosocial social–emotional skills. Family risk was predictive of both social–emotional outcomes but not EF skills. There were also differences in children's outcomes based on their DLL status. Proficient bilingual children were rated as having better social–emotional skills compared to their monolingual peers. Emergent bilingual children performed lower on the measure of EF skills, yet there was no difference between proficient bilingual children and their monolingual peers. Finally, there were two significant interactions by DLL status. Proficient bilingual status moderated the effect of neighborhood

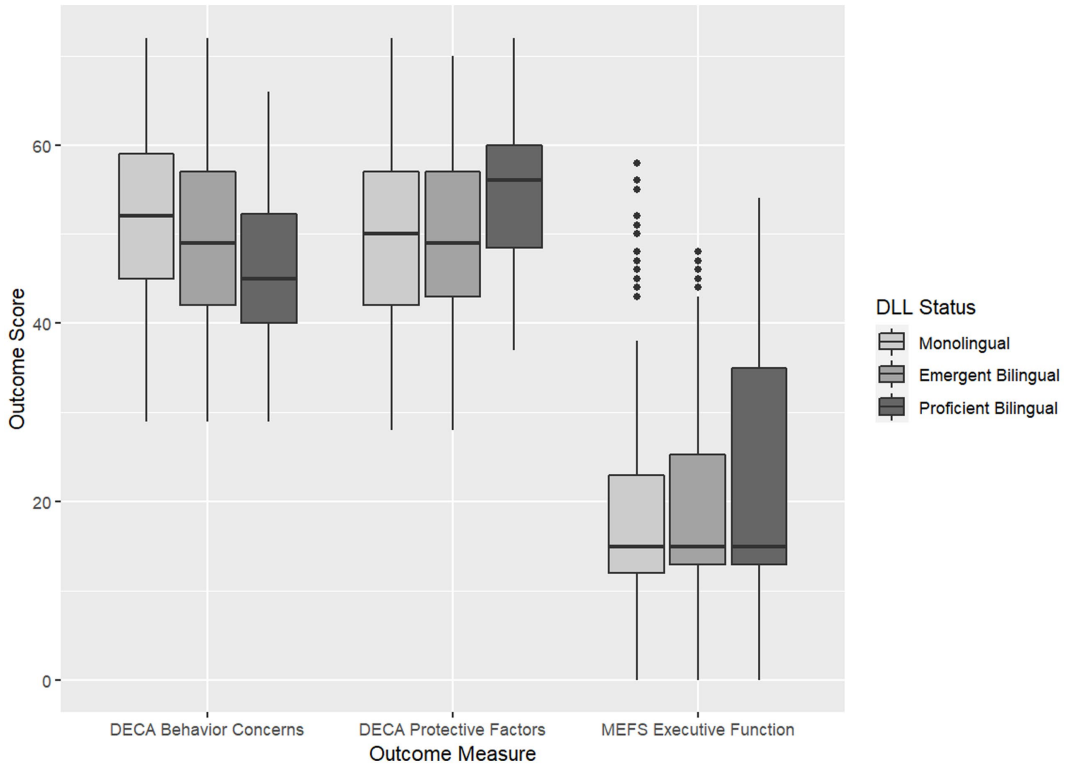

FIGURE 1
Group differences on child outcomes.

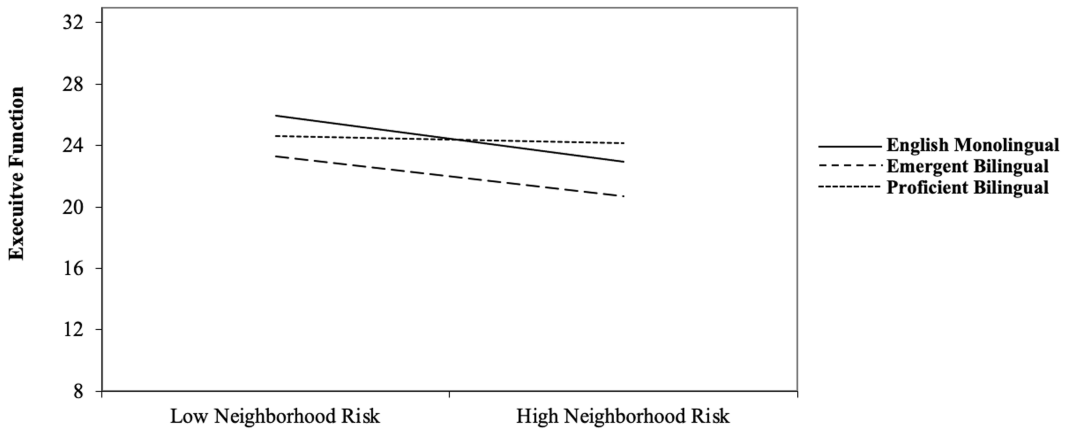

FIGURE 2
DLL moderating neighborhood vulnerability to executive function skills. All groups plotted on same graph for parsimony. Axis minimum is 1 SD below the mean. Axis maximum is 1 SD above the mean.

vulnerability on EF skills and emergent bilingual status moderated the effect of family risk on behavior problems.

The finding that higher neighborhood vulnerability was related to lower EF skills aligns with previous research (Roy et al., 2014; Wei et al., 2021) and with the investment perspective (Guo and Harris, 2000; Yeung et al., 2002; Jeon et al., 2014). Neighborhood vulnerability may be related to young children's EF skills because EF skills are a set of domain general skills that include attending to information, thinking flexibly, and holding information in working memory (Blair, 2016). Therefore, as the neighborhood environment becomes less vulnerable and less chaotic, children may have more opportunities in their neighborhood environment to engage and develop their EF skills. Future studies should examine the mechanisms within the neighborhood where children may have opportunities to engage their EF skills.

Neighborhood vulnerability may be related to children's prosocial social–emotional skills but not behavior problems because children in less vulnerable neighborhoods may have access to more resources (e.g., doctor's offices, libraries) that play a protective role in positive social–emotional development (Wei et al., 2021). Future studies

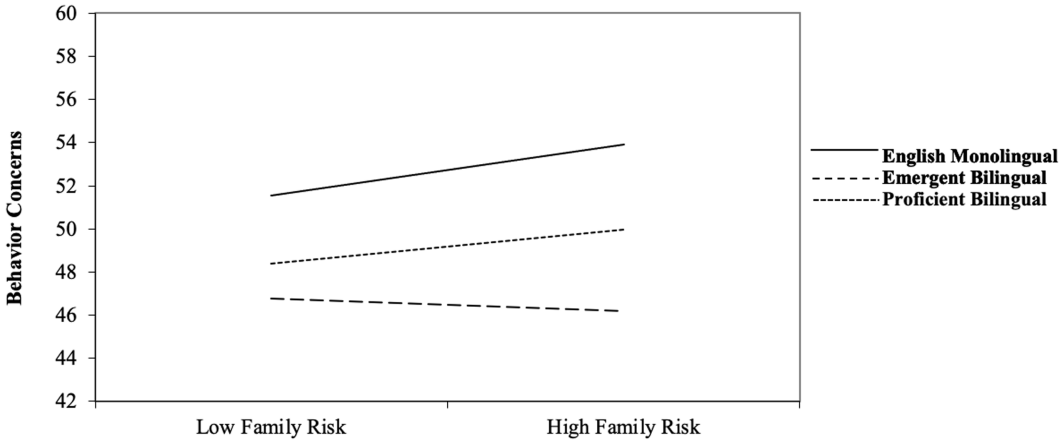

FIGURE 3
DLL moderating family risk to behavior concerns. All groups plotted on same graph for parsimony. Axis minimum is 1 SD below the mean. Axis maximum is 1 SD above the mean.

should consider the mechanisms in less vulnerable neighborhoods that help promote DLL children's prosocial skills. More specifically, it would be important to consider that aspects of the neighborhood that promote language skills and positive social interactions with others in order to identify specific processes that support development. It is possible that the neighborhood was not related to children's behavior problems because the more proximal family environment has a greater impact on young children's ability to regulate their more negative emotions like aggression.

Given that family risk was associated with social–emotional skills, this finding aligns with previous studies that have found family risk is a significant predictor of children's outcomes (Jeon et al., 2014; May et al., 2018). As family risk increased, children's prosocial social–emotional skills decreased, and behavior problems increased. These findings align with the family stress perspective (Guo and Harris, 2000; Yeung et al., 2002; Jeon et al., 2014), which suggests that negative effects on children's development are a result of economic burdens on the parents. Economic stressors could increase parents' psychological distress such as anxiety and depression which are associated with negative parenting impacting on children's social–emotional development (Masarik and Conger, 2017); research has shown that negative parenting is associated with young children's social–emotional development (Barnett, 2008; Masarik and Conger, 2017). Future studies should examine what specific supports schools can provide families with high risk to buffer the negative impact on children's behaviors.

Results suggest that proficient bilingual children have better prosocial skills while also demonstrating lower behavior problems than their monolingual peers. Additionally, being a proficient bilingual may buffer the negative effect that neighborhood risk has on children's EF skills. The moderation of proficient bilingual status on the relation between neighborhood vulnerability and EF skills suggests that proficient bilingual children, even from extremely vulnerable neighborhoods, outperform their monolingual peers on a domain-general skill set that may impact academic achievement. This may be true because proficient bilingual DLL children may consistently use cognitive skills to switch between languages, which may increase their EF skills regardless of neighborhood vulnerability.

Taken together, results suggest that there is a cognitive advantage of speaking two languages proficiently in preschool, which was evident for proficient bilingual children. Specifically, proficient bilingualism seems to function as a protective factor in the context of neighborhood vulnerability. Future studies should examine if proficient bilingual DLL status moderates the relation between neighborhood risk and other academic domains to determine the mechanism that EF plays in academic achievement. Despite the hypothesis that proficient bilingual children would perform higher on the EF measure, there were no group differences in EF skills between the three language groups. We found, however, that there was more variability in EF skills for the proficient bilingual group compared to emergent bilingual and monolingual children. Children in the proficient bilingual group were proficient in English but we did not measure their Spanish skills via direct assessment. Therefore, the DLL groups may vary widely in their Spanish language skills. There may be a subset of the proficient bilingual group that demonstrates high English and high Spanish skills (Melzi et al., 2017; White and Greenfield, 2017; Thomas-Sunesson et al., 2018) that performs better on the EF measure, but we were not able to identify this group in the current study.

Although there were promising results associated with being a proficient bilingual, the emergent bilingual DLLs did not see all the same benefits of speaking two languages. This finding aligns with the Thresholds Theory that DLL children need a certain level of proficiency in both languages to obtain the cognitive advantages associated with bilingualism (Cummins and Swain, 2014; Baker and Wright, 2017). One advantage emergent bilinguals had over their monolingual peers was they were rated lower on behavior problems. There may be several reasons for this finding. Behavior problems are emotion-related whereas EF is a cognitive skill so children may not need a threshold level of language to reduce their behavior problems. Emergent bilingual children may develop their emotional regulation skills along with their executive function skills including attention. Emergent bilinguals who are learning both languages at the same time develop their EF skills which may also affect their development of self-regulation skills and behaviors. In addition, earlier studies have demonstrated DLL children were less likely to show problem behaviors (De Feyter and Winsler, 2009; Galindo and Fuller, 2010; Han, 2010;

Han and Huang, 2010; Luchtel et al., 2010; Winsler et al., 2014a; Hartanto et al., 2019). An alternative explanation for emergent bilingual children's lower behavior problems is related to teachers' opportunity and experience to observe and children's potential behavior. As emergent bilingual children are developing their English skills in the classroom, they may have fewer opportunities to interact with their English-monolingual peers in majority English speaking classrooms, which may lead to fewer teacher observed behavior problems. Emergent bilingual children may also learn the routines and transitions of the preschool classroom and may be able to follow the rules without causing disruption because they do not truly understand the language interactions as they simply follow routines and rules (Erdemir and Brutt-Griffler, 2022). Teachers may then, consequently, observe fewer behavior problems in emergent bilingual children because they are passively engaged in the classroom and because teachers may not facilitate language interactions between emergent bilinguals and their peers (Gort and Pontier, 2013). Future studies should examine emergent bilingual children's behavior in classrooms that speak majority Spanish and determine how both languages can be used in the classroom to help support emergent bilingual DLL children's interactions.

It is important to note that the results of this study are couched in the sociocultural context of the United States. In this context, there is substantial overlap with socioeconomic status and dual language learner status. Due to systemic oppression, DLLs who are first or second generation immigrants have legal barriers to accessing many supports, and later generation immigrants often continue to face systemic inequities. Families in which the parents have limited English proficiency may face additional barriers to accessing high quality neighborhoods, learning opportunities, or other supports to enrich their children's development. Additionally, the DLLs in the current study come from a city with a relatively homogeneous group of DLLS who are primarily Spanish speaking which presents one type of context that may vary in other parts of the country. Finally, the city in which these participants live remains highly segregated and most schools operate in an English immersion model, highlighting the numerous layers of oppression experienced by these children on a daily basis.

Strengths and limitations

The current study contributes information to the debate regarding bilingual advantage—if bilingualism enhances cognition or other developmental areas—and offers several strengths. Unlike many previous studies, the sample is large with over 100 participants per group. A second strength is that the focus includes the child at the individual level and expands the scope to include both family and neighborhood contexts. A third strength is that both cognitive and socio-emotional skills were examined. Taken together, these strengths position this study to contribute information that is relevant for future research as well as practice and policy.

Despite these strengths, there are several limitations to acknowledge. First, our use of existing data produced some limitations. For example, we did not have access to direct assessments of DLL children's Spanish skills. Therefore, we do not have information about the variations among DLL children in Spanish proficiency. Future studies should examine how proficiency across both English and Spanish moderates the relation between neighborhood vulnerability and/or family risk to EF and social–emotional outcomes. Additionally, the data used in this study was cross-sectional so children's language skills were not examined longitudinally over time. As language is a rapidly developing skill in early childhood it is possible that over time DLL children move from the emergent bilingual profile to the proficient bilingual profile or vice versa. Future studies should examine these research questions longitudinally to determine antecedents to DLL children's positive development. Finally, given U.S. Census data are collected every 10 years, the match to the timeframe of the child dataset was approximate.

Classroom level variables were not investigated in the current study. Future studies should design evaluations to determine if classroom quality or support for Spanish home language in the classroom impacts the interactions between DLL status, neighborhood vulnerability, family SES risk, and developmental outcomes. Finally, children in this study were all from the same region of the U.S. which may not be representative of the U.S. population, so future work should replicate this with DLL children in various areas of the country, specifically in more Spanish speaking communities.

Conclusion

In sum, this study investigated if neighborhood vulnerability and family SES risk were associated with children's cognitive and social–emotional outcomes and the moderating role of DLL status. It extended prior research by examining how variations in DLL language proficiency impact the various environmental risks to development. Consistent with the Bilingual Threshold theory and the Cognitive Advantage Hypothesis, there were several benefits of being a proficient bilingual including better social–emotional skills compared to their monolingual peers. Proficient bilingual children also saw cognitive advantages when their EF skills were high regardless of the neighborhood environment risks they were exposed to, suggesting that proficient bilingual children may have more opportunities to grow their EF skills when switching between English and Spanish regardless of their neighborhood context. A somewhat unexpected result occurred for emergent bilingual children who were reported to demonstrate fewer behavior problems regardless of family risk, highlighting the importance of ensuring all DLL families have access to resources that help promote their children's social–emotional skills and ensuring teachers have the proper training to support the behaviors of children in their classroom with varying levels of English proficiency.

Data availability statement

The datasets presented in this article are not readily available because consent specifies data are only available to the research team. Requests to access the datasets should be directed to DH, dhorm@ou.edu.

Ethics statement

The studies involving humans were approved by the University of Oklahoma Institutional Review Board. The studies were conducted in accordance with the local legislation and institutional requirements. Written informed consent for participation was not required for this secondary data analysis from the participants or the participants' legal

guardians/next of kin in accordance with the national legislation and institutional requirements.

Author contributions

LF, SC, SJ, DH, and SS contributed to the conceptualization and design of the study. LF, SJ, DV, and IM organized the database and cleaned datasets. LF and SJ performed the statistical analysis. LF wrote the first draft of the manuscript. SC wrote sections of the manuscript. DH and SJ finalized writing of manuscript and responded to requests for revisions. All authors contributed to the manuscript revisions, read, and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

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