



Research Article

Links between early-life contextual factors and later-life cognition and the role of educational attainment

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Abstract

Objective: Educational attainment is a well-documented predictor of later-life cognition, but less is known about upstream contextual factors. This study aimed to identify which early-life contextual factors uniquely predict later-life global cognition and whether educational attainment mediates these relationships. **Method:** Participants were drawn from the Michigan Cognitive Aging Project ($N = 485$; $M_{\text{age}} = 63.51$; $SD_{\text{age}} = 3.13$; 50% non-Hispanic Black). Early-life exposures included U.S. region of elementary school (Midwest, South, Northeast), average parental education, household composition (number of adults (1, 2, 3+), number of children), school racial demographics (predominantly White, predominantly Black, diverse), self-reported educational quality, and school type (public/private). Later-life global cognition was operationalized with a factor score derived from a comprehensive neuropsychological battery. Sequential mediation models controlling for sociodemographics estimated total, direct, and indirect effects of early-life contextual factors on cognition through educational attainment (years). **Results:** Higher educational quality, higher parental education, and attending a private school were each associated with better cognition; attending a predominantly Black or diverse school and reporting three or more adults in the household were associated with lower cognition. After accounting for educational attainment, associations remained for educational quality, school type, and reporting three or more adults in the household. Indirect effects through educational attainment were observed for school region, educational quality, school racial demographics, and parental education. **Conclusions:** School factors appear to consistently predict later-life cognition more than household factors, highlighting the potential long-term benefits of school-level interventions for cognitive aging. Future research should consider additional mediators beyond educational attainment such as neighborhood resources and childhood adversity.

Keywords: Education; Life Course Perspective; Family Characteristics; Cognitive Aging; Socioeconomic Factors; Social Determinants of Health

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Introduction

Educational attainment is one of the strongest predictors of cognition in late life (Glymour, Kawachi, Jencks, & Berkman, 2008; Jefferson et al., 2011), and this relationship appears to be causal (Caamaño-Isorna, Corral, Montes-Martínez, & Takkouche, 2006). However, less is known about potential upstream, early-life determinants of both educational attainment and later-life cognition. Studies consistently support the association between early-life factors and later-life health and cognitive outcomes (Bowen & González, 2010; Fors, Lennartsson, & Lundberg, 2009; Glymour & Manly, 2008; Jefferson et al., 2011; Mantri, Nwadiogbu, Fitts, & Dahodwala, 2019). During early-life, school and household contextual factors are extremely salient and can reflect both promotive and deleterious environments. Because preserved cognitive functioning in later life is an essential component of healthy aging (Castro-Lionard et al., 2011), identifying early indicators of educational and cognitive outcomes can prove beneficial. Better

characterization of life course risk and protective pathways underlying later-life cognitive performance is needed for the development of preventative measures and policies.

Early-Life Contextual Factors

Geographic location can have lasting influences on the community, resources, and opportunities available to an individual. In the United States, Southern birth and residence has been associated with lower global cognition in late life (Lamar et al., 2020). Liu and colleagues (2015) demonstrated that this effect was more pronounced among Black individuals than Whites. These findings could be representative of the inequities caused by Jim Crow era policies and racial turmoil that many Black older adults experienced during their childhood (Liu et al., 2015). Early residence may indirectly influence later-life cognition through various pathways including its impact on childhood school and household factors.

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Schooling represents a critical early-life context. School racial demographics, school type (i.e., private, public), and educational quality (e.g., teacher-student ratio) reflect differences in opportunities and experiences with schooling. As a legacy of the Jim Crow era, school racial composition serves as a proxy for resources and opportunities (Card & Krueger, 1992) due to links between residential segregation and school funding in the U.S. (Boozer, Krueger, & Wolkon, 1992; Johnson, 2011; Margo, 1982). Although most baby boomers attended school after *Brown v. Board of Education of Topeka* (347 U.S. 483, 495 [1954]), racial inequities in school funding persisted for this generation due to the use of property taxes to finance public schools (Henderson, 2004). The ruling of *San Antonio Independent School District v. Rodriguez* (411 U.S. 1 [1973]) further solidified inequitable financing strategies for schooling (Straus & Lemieux, 2016). Another school-level contextual factor that reflects available resources for students is school type. Private school admission is often dependent on family wealth, limiting the pool of students to those who are more advantaged (Walton, 2010). Thus, both racial composition and school type are relevant to school quality. Because higher quality education is associated with better cognitive functioning (Crowe et al., 2013; Sisco et al., 2015), it is important to understand links between each of these school factors and later-life cognition. Indeed, educational quality is an important factor to consider when evaluating cognition in diverse samples (Manly, Jacobs, Touradji, Small, & Stern, 2002).

In addition to educational quality, childhood socioeconomic status (SES) is predictive of cognition in later life (Fors et al., 2009; Jefferson et al., 2011). Parental education and household composition (e.g., number of adults/children in the home) are common indicators of childhood SES. Higher levels of parental education were associated with better cognition at age 65 in a regional sample of older Americans (Greenfield & Moorman, 2019), and larger family size was associated with lower levels of educational attainment and worse cognition in a nationally representative study of older adults in Sweden (Fors et al., 2009). Household factors that serve as proxies for childhood SES have the potential to influence schooling, educational attainment, and later-life cognition.

The Current Study

Previous literature has been inconsistent when evaluating the effects of early- versus later-life factors on cognition. González and colleagues (2013) found no association between childhood SES and later-life cognition after considering adulthood SES (i.e., educational attainment, income, wealth), suggesting that the effects of childhood SES may only operate through later SES. Other studies revealed that childhood SES was a unique predictor of cognition in later life above and beyond adulthood SES (Greenfield & Moorman, 2019; Fors et al., 2009). This points to the potential for other plausible mechanisms by which early-life factors could influence later-life cognition. Literature evaluating early-life influences on later-life cognition is largely focused on childhood SES, with relatively less consideration of other contextual variables (e.g., school characteristics). Additionally, early-life factors have typically been evaluated individually or as a composite, limiting the interpretation of intermediating paths among them.

The current study sought to reevaluate associations of early-life factors on cognition in later-life by investigating a comprehensive group of contextual exposures in childhood within a mediational framework. Specifically, the study aimed to determine 1) which

Table 1. Sample characteristics

Variable [range]	Mean/Percentage	SD
Age [55 – 82]	63.51	3.13
Race (%)		
NHW	44.10	
NHB	50.70	
Other	5.20	
Sex/Gender (% Female)	59.00	
Educational Attainment [7 – 20]	14.14	2.58
Region of elementary (%)		
Midwest (reference)	87.00	
Northeast/West	6.20	
South	6.60	
Parental Education [0 – 20]	11.49	3.05
# of Children in the Home [1 – 14]	4.19	2.29
# of Adults in the Home (%)		
1 Adult	12.60	
2 Adults (reference)	71.10	
3 + Adults	15.30	
Educational Quality [1 – 5]	3.48	1.03
School Type (% public)	84.50	
School Demographics (%)		
Predominantly White (reference)	38.80	
Predominantly Black	28.50	
Diverse	31.10	

Note. Educational quality was scored on a scale from 1 (poor) to 5 (excellent).

early-life regional, school-level, and household-level factors were associated with later-life cognition; and 2) the extent to which educational attainment mediated these relationships. Based on prior research, we hypothesize that early-life factors will each be associated with later-life cognition, and educational attainment would at least partially mediate these associations. The novelty of evaluating these relationships in a sequential mediation framework helps develop a more comprehensive understanding of the lasting effects of early-life context on cognitive aging. In turn, this can highlight associations among early-life exposures and mechanistic pathways that impact later-life cognition.

Methods

Participants and Procedures

Participants were part of the Michigan Cognitive Aging Project (MCAP) (Zahodne, 2021). MCAP began in 2017 as a prospective, longitudinal study of cognitive decline in adults 55 years of age and older. Participants were recruited through voter registration lists in tandem with census data to collect a racially balanced sample of non-Hispanic White (NHW) and non-Hispanic Black (NHB) individuals residing in Southeast Michigan. Additional participants joined the study through word-of-mouth. Individuals were included if they resided in Wayne or Washtenaw counties, did not report a dementia diagnosis, were fluent in English, and were at least 55 years old at the initial visit. Although MCAP is a longitudinal cohort, only baseline data were available at the time of study, making it cross-sectional ($N=500$). Individuals who attended school outside the U.S. were excluded ($N=14$). An additional participant was excluded due to missingness on covariates, bringing the final analytic sample to 485. Characteristics of the sample are displayed in Table 1.

Evaluations were completed at the University of Michigan (UM), the UM Detroit Center, or in the participant's home. A comprehensive neuropsychological battery was conducted to evaluate

indicated by letter fluency (F, A, S), animal fluency, and the Multilingual Naming Test. The processing speed factor was indicated by Color Trails I, Symbol Digit Modalities Test, and Stroop Color. Factor scores corresponding to each of the five domains were standardized and averaged to create a composite measure of global cognition; higher scores indicated better performance. Exploratory analyses considered individual cognitive domain factor scores as outcomes.

Covariates

Age, race, and sex/gender were used as covariates in all analyses because they could potentially confound associations between early-life contextual factors and later-life cognition. Later-life factors that could influence cognition (e.g., later-life health, depression, anxiety) were not included as covariates because they are plausible mechanisms underlying effects of early-life contextual factors and educational attainment on cognition, and their inclusion could result in underestimation of the parameters of interest.

Age in years was recorded at time of entry into MCAP. Race (White, Black or African American, American Indian or Alaska Native, Asian, Native Hawaiian or Other Pacific Islander, Mixed, and Other) and ethnicity (Hispanic or non-Hispanic) were self-reported. Race/ethnicity was recoded to represent three mutually exclusive categories: non-Hispanic White, non-Hispanic Black, and Other (e.g., Hispanic of any race, Asian). Sex/gender was self-reported and operationalized as a dichotomous variable (Female or Male).

Statistical Analyses

Descriptive statistics and correlations were computed using SPSS version 27 (IBM Corp., Armonk, NY). Sequential mediation models were conducted in Mplus version 8 to depict a life course approach allowing for potential causal pathways among exposures (Muthén & Muthén, 2017). The exposures were ordered according to their hypothesized proximity to the outcome (i.e., later-life global cognition). For example, indicators of childhood SES were modeled as distal exposures since they could influence other early-life variables such as school type and educational quality but are unlikely to be influenced by these exposures due to temporal implausibility. All paths were modeled simultaneously. Each exposure was regressed onto all upstream (i.e., distal) exposures, and all exposures were regressed onto covariates. Associations between variables that did not have clear causal relations or temporal ordering (e.g., school demographics and school type) were modeled as correlations.

Figure 1 displays the conceptual model. Total effects from the aim 1 models identify the associations between each early-life exposure and later-life global cognition. An exposure's total effect represents its association with global cognition while also considering all likely mediating paths. Sensitivity analyses tested for differential impacts of school demographics on global cognition by race and if the exclusion of participants from the West region ($N = 7$) altered findings. For the second aim, educational attainment was added to the sequential mediation model. All total, indirect, and direct effects were estimated. Indirect effects were calculated to understand the extent to which educational attainment could explain associations between early-life factors and global cognition. Direct effects were evaluated to determine if early-life factors were associated with global cognition regardless of educational attainment, which would point to additional life course mechanisms of association.

Table 2. Standardized regression estimates of associations between early-life factors and later-life global cognition

Variable	Estimate	95% CI
Region		
Northeast/West	0.05	−0.03 – 0.12
South	−0.01	−0.08 – 0.07
Parental Education	0.12*	0.05 – 0.20
# of Children in the Home	−0.06	−0.13 – 0.02
# of Adults in the Home		
1 Adult	−0.05	−0.12 – 0.03
3 + Adults	−0.11*	−0.18 – −0.03
School Type	0.14*	0.07 – 0.21
School Demographics		
Predominantly Black	−0.16*	−0.26 – −0.05
Diverse	−0.19*	−0.27 – −0.09
Educational Quality†	0.12*	0.05 – 0.19

Note. Aim 1 Results.

†Direct Effect.

* $p < .05$.

Results

Aim 1: Which Early-Life Contextual Factors Are Associated with Cognition in Later Life?

Results from the aim 1 sequential mediation model are shown in Table 2. Attending private school, having parents with higher levels of education, and reporting higher quality early education were all associated with better global cognition. Conversely, attending either a predominantly Black or diverse school and having three or more adults in the home were associated with worse global cognition. Region of schooling and number of children in the home did not have a total effect on global cognition.

There was little evidence that total effects were driven by sequential associations among early-life contextual factors. One exception was the association between school type and educational quality. Additionally, there were intermediating effects between educational quality and other school characteristics, such that attending a predominantly Black or diverse school was associated with lower quality education, while attending a private school was associated with higher quality education. Another intermediate path existed between parental education and school type such that higher levels of parental education were associated with attending a private school.

Sensitivity analyses

Differential impact of school demographics by race. A race-stratified model was analyzed to detect the differential impact of school demographics on global cognition depending on an individual's race. For the model to converge, region was excluded from analyses, and the predominantly Black and diverse school categories were merged to account for the small portion of non-Hispanic White individuals who attended predominantly Black schools ($N = 3$). The analysis showed that attending a predominantly Black or diverse school was associated with worse later-life cognition in both Black ($\beta = -0.206$, 95% CI $[-0.325 - -0.087]$) and White ($\beta = -0.135$, 95% CI $[-0.258 - -0.013]$) participants, but this association was stronger among Black participants. Only total effects were evaluated for this sensitivity analysis.

Excluding west region. An additional model excluded participants from the West ($N = 7$) who were originally combined with the Northeast region based on similar global cognition scores. The

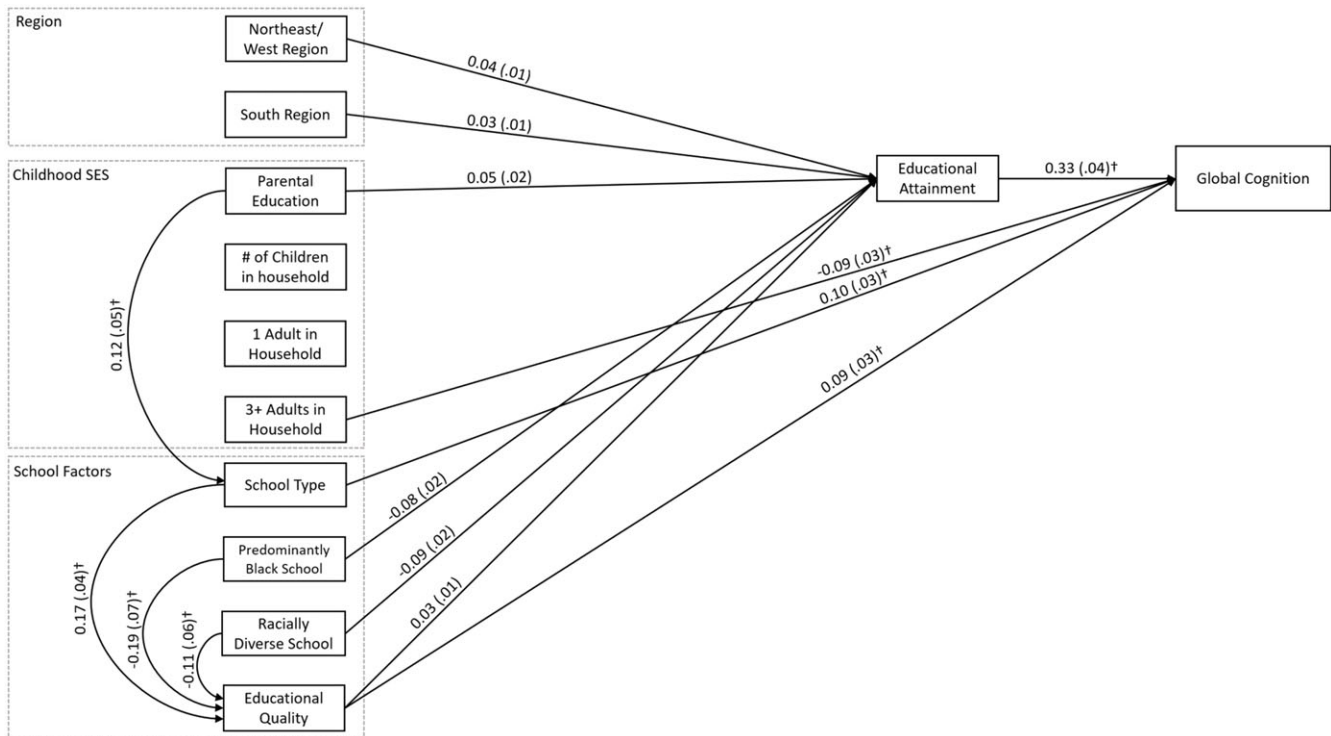


Fig. 2. Standardized parameter estimates and standard errors for direct and indirect effects of early-life factors through educational attainment on global cognition; intermedating direct effects are also presented. All depicted estimates were significant at $p < .05$ level. For simplicity, non-significant paths are not shown. † Direct effect.

sensitivity analysis showed minimal changes in effects; patterns of associations and significance remained the same compared to the original aim 1 model.

Individual cognitive domains. Additional exploratory analyses were conducted to evaluate the impact of early-life factors on specific cognitive domains. Generally, early-life factors were less related to episodic memory compared to other domains (e.g., executive functioning, language). School factors were more consistently related to all domains of cognition compared to household factors.

Aim 2: Does Educational Attainment Mediate the Association Between Early-Life Contextual Factors and Global Cognition?

Figure 2 shows indirect and direct effects from the sequential mediation analysis for aim 2. Receiving higher quality education, having parents with higher levels of education, and attending grade school in the Northeast/West or South (compared to the Midwest) were all indirectly associated with better global cognition through higher educational attainment. Educational attainment accounted for 25% of the effect of educational quality and 48.76% of the effect of parental education on global cognition. Attending a predominantly Black or diverse school was indirectly associated with worse global cognition through lower educational attainment. Educational attainment accounted for roughly half the effects of attending predominantly Black (50%) or diverse schools (49%). Among exposures associated with global cognition, school type and number of adults in the home were the only early-life factors that did not have an indirect effect on cognition through educational attainment.

Aside from mediating pathways involving educational attainment, the indirect path from attending private school to better global cognition through higher educational quality identified in

aim 1 remained. Educational quality accounted for 14% of this effect. Direct effects on global cognition were also evidenced. Receiving higher quality education and attending private school were both directly associated with better global cognition independent of educational attainment. Conversely, having three or more adults in the home was directly associated with lower global cognition independent of educational attainment.

Discussion

This study of a racially and socioeconomically diverse sample of older adults living in Southeastern Michigan enhances understanding of life course contextual factors that influence later-life cognition. Specifically, it extends the literature by parsing out the effects of household and school factors in early-life on cognitive functioning later in life. Based on relative magnitudes of associations identified in Aim 1, these findings further suggest that school factors (e.g., school demographics) may be stronger predictors of later-life global cognition than household factors (e.g., household composition). However, these results could also reflect differences in measurement precision. Educational attainment served as a mechanism for many of these associations (i.e., region of elementary schooling, parental education, school racial composition, and educational quality), but not all (i.e., school type, number of adults in the home). These findings highlight multiple points of intervention early in the life course to maximize later-life cognitive health and help to clarify mechanisms by which early-life contextual factors may influence later-life cognition.

Early-Life Factors and Later-Life Cognition

Of the seven early-life factors examined in this study, the strongest predictors of later-life cognition were related to school context.

Specifically, attending a private school compared to a public school was associated with better cognition in later life. Attending a predominantly Black or diverse school compared to a predominantly White school was associated with worse cognition in later life. The root of these findings can be traced back to inequitable school funding strategies that served to increase racial disparities in educational quality (Henderson, 2004). As depicted in the sequential mediation model, the effects of school type and school racial composition were partially explained by school quality. Consistent with previous literature, higher level of educational quality in grade school was associated with better cognitive outcomes later in life (Mantri et al., 2019; Sisco et al., 2015). Together, these results indicate that school quality is a critical early-life context for later-life cognition, and both school type and racial composition are important indicators of school quality in this age cohort. Additionally, the negative cognitive outcomes associated with attending a predominantly Black or diverse school were 50% larger among Black individuals than among White individuals, which may be reflective of racial disparities in the availability of compensatory resources outside of the school context (e.g., at home or in the neighborhood).

School factors may be more salient predictors of cognitive outcomes than household factors because educational attainment is a stronger predictor of cognition than other SES indicators (Cagney & Lauderdale, 2002). This may be because education is a multi-compartmental exposure that directly affects not only the development of core cognitive abilities, but also economic, social, psychological, behavioral, and physical functioning. However, household factors can promote other benefits outside of educational attainment that indirectly support healthy cognitive aging (Lövdén et al., 2020).

Indeed, parental education and number of adults in the home at age 10 were also found to predict later-life cognition in this study, in addition to school factors. Aligning with previous literature, higher levels of parental education were associated with better cognition in later life (Greenfield & Moorman, 2019). While a previous study found that having only one biological parent in the home compared to two was related to poorer cognitive performance later in life (Fors et al., 2009), we did not find differential effects of one- or two-adult households on later-life cognition. Instead, we found that compared to a two-adult household, having three or more adults in the household was associated with worse cognition in later life. This finding may coincide with previous literature depicting detrimental effects of family financial or psychosocial instability (e.g., relatives or nonrelatives joining or leaving the home) during childhood (Perkins, 2019).

Exploratory analyses suggested that there are differences in associations across individual cognitive domains. For example, parental education was not associated with episodic memory or processing speed but was associated with executive functioning, language, and visuospatial functioning. These results reflect similar findings in prior research (Greenfield & Moorman, 2019). This pattern may suggest that episodic memory is more sensitive to late-life processes (e.g., cognitive aging) than to early-life factors. These hypothesis-generating exploratory findings should be evaluated further in future studies.

Educational Attainment as a Mechanism

One of the mechanisms by which these early-life exposures could impact cognition is educational attainment. In the current study, educational attainment emerged as a key mechanism

underlying the lasting effects of parental education, school racial demographics, region of elementary, and educational quality on later-life cognition.

Previous literature on whether childhood SES is associated with later-life cognition independent of educational attainment has been mixed (Greenfield & Moorman, 2019; González, et al., 2013). In the current study, different childhood SES indicators (e.g., parental education, household composition) supported both possibilities. Specifically, the association between household composition (e.g., three or more adults in the home) and later-life cognition was not mediated by educational attainment. In contrast, educational attainment accounted for roughly half the association between parental education and global cognition. Together, these findings demonstrate different aspects of childhood SES may influence later-life cognition through unique mechanisms and highlights the important role of parental education for educational attainment.

Attending school in the Northeast/West or the South rather than the Midwest was only related to better cognition through its association with higher educational attainment. However, previous literature showed opposite effects, finding Southern birth and residence to be associated with worse cognition later in life compared to the Midwest (Lamar et al., 2020). These conflicting findings may be explained by age and current residence of the sample. Given that all participants were residing in Southeast Michigan at the time of data collection, region of childhood residence may be conflated with migration. It may be that individuals who migrated were those who had the psychosocial and financial resources to do so (i.e., healthy migrant effect; Aldridge et al., 2018). While lower cognitive performance among individuals who resided in the South during childhood has been reported in other regional samples in New York (Liu et al., 2015) and Chicago (Lamar et al., 2020), those studies assessed older individuals (i.e., mean age 75) at an earlier point in time than the current study. Thus, participants in those studies who migrated from the South to the North did so during an earlier period of the Great Migration (Tolnay, 2003) when migration was highly normative, and selection pressures were likely to have been weaker. The participants in the current study migrated later or after the Great Migration, when migration was less normative. Nevertheless, the current finding still supports previous research indicating that schooling is a mechanism by which childhood residency affects later-life cognition (Liu et al., 2015).

The negative association between attending a predominantly Black or diverse school and cognition was no longer significant after educational attainment was accounted for, highlighting the importance of educational outcomes. Similar to the relationship with parental education and cognition, educational attainment accounted for around half the association between school racial demographics and cognition. This emphasizes drastic differences in school conditions amongst predominantly White and predominantly Black schools around the 1960s (Boozer et al., 1992; Donohue & Heckman, 1991). These schooling disparities reduced educational opportunities for students who did not attend predominantly White schools, which in turn was associated with worse cognitive outcomes. As expected, educational attainment was also a mechanism of association between educational quality and cognition.

Other Mechanisms/Direct Effects

Although educational attainment proved to be a main mechanism in which early-life factors can influence later-life cognition, it is

apparent that other mechanisms also play a role in these associations. Specifically, number of adults in the home, educational quality, and school type were associated with cognition when controlling for educational attainment and other early-life factors. Depending on cultural influences within the family, having more adults in the home could potentially be a sign of family closeness and an enriching environment, which would have psychosocial benefits and improve cognitive trajectories (Lee, Ryan, Ofstedal, & Smith, 2021). However, it may also reflect fewer resources for family members, a stressful home environment (e.g., caretaking, disruption of family structure), or household instability (Perkins, 2019) which may be more aligned with the finding of the current study.

Educational attainment only accounted for 25% of the association between educational quality and cognition, indicating other potential benefits of educational quality that improve cognitive outcomes. Curriculum may be a mechanism in which school quality leads to improved outcomes (Diette, 2012). Outside of improved educational attainment, higher educational quality as early as preschool has been found to be associated with other positive social outcomes such as lower frequency of incarceration, improved employment rates, and higher annual earnings (Schweinhart *et al.*, 2005). Additionally, receiving higher quality education has also been linked to improved health outcomes (e.g., improved self-rated health, smoking habits, obesity, mortality) (Frisvold & Golberstein, 2011).

Educational quality, but not educational attainment, was a mediator of the association between attending private school and better later-life cognition, accounting for roughly 14% of this effect. When accounting for all other variables, the association between school type and cognition remained. This points to other potential benefits associated with private school attendance, outside of its relation to higher educational quality. Attending private schools may reflect greater family wealth, beneficial social connections, and a more cognitively stimulating environment (Dronkers & Robert, 2008).

Limitations, Strengths, & Future Directions

The current study had limitations. Since MCAP is a regional sample, evaluating the connection between region of elementary and global cognition is not straightforward. Outside of the Midwest, there was a limited sample of participants across census regions. Merging regions may have decreased the specificity and accuracy of findings. Additionally, rurality in childhood was not considered which may contribute to differences in cognitive outcomes (Greenfield & Moorman, 2019). Another limitation is that all childhood factors were retrospectively self-reported, which raises concerns about reporting accuracy. Furthermore, since educational quality was self-reported, objectivity in this measure was compromised. Measures such as student-teacher ratio, number of schooling days, and per-pupil spending could capture educational quality more accurately. However, these state-level measures of quality may be an overgeneralization, so the perceived school quality measure used in the current study may better capture educational experiences at the individual level. The lack of a measure of cognitive functioning in childhood is another limitation. Of note, disparities in children's cognitive functioning due to household or school disadvantages may manifest very early, so future cognitive aging studies should carefully consider the timing of any available childhood measures, as they could represent

confounders and/or mediators of the effects of early-life factors (Lee & Burkam, 2002).

This study utilized cross-sectional data to conduct mediation analyses; however, the exposures used were fixated to specific time points, making them temporally distinct (e.g., region of elementary/birth, household composition at the age of 10, educational attainment in adulthood). Additionally, global cognition was only measured once, coinciding with the rest of the exposures. This does not allow us to look at cognitive change over time. However, since disparities are more prominent for initial cognitive level than cognitive change, this is a minor limitation (Manly & Mungas, 2015).

Strengths of this study include the racially diverse and regionally representative sample of older adults, use of a comprehensive neuropsychological battery, inclusion of multiple indices of childhood SES and school factors, and use of more descriptive measures of education (e.g., continuous scale from 0–20). Additionally, the incorporation of a sequential mediation framework to model potential mechanistic paths among early-life factors likely prevented underestimation of effects and provides additional clarity on the unique effects of these interrelated early-life factors on cognition.

Future research should evaluate the impact neighborhood resources and childhood adversity may have in cognitive outcomes. It may also be beneficial to include parental occupation and family wealth during childhood. Delineating the effects of household composition (e.g., multigenerational homes) in future studies should also be prioritized. Other potential mediators such as stress, social relations, and occupational experiences may provide areas for future research.

Conclusion

The current study found that early-life household and school factors were associated with later-life cognition. Educational attainment appeared to be a main mechanism of impact for early-life contextual factors on cognitive trajectories. Indeed, education has been shown to mediate early-life factors to improve cognition even in the presence of low early-life SES (Bertola *et al.*, 2021). The current study suggests that policies for equal access to quality education for children should be at the forefront of intervention work to reduce racial disparities and optimize cognitive aging. School finance reforms that support equal access to high quality early-childhood programs (e.g., rigorous curriculum) should continue to be emphasized (Lafortune *et al.*, 2018). However, some early-life factors appeared to operate through paths outside of education. Educational attainment is only one mechanism by which some of these factors can influence later-life cognition. Further research is needed to characterize other mechanisms throughout the life course that could serve as points of intervention.

Supplementary material. To view supplementary material for this article, please visit <https://doi.org/10.1017/S135561772200090X>

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