Developmental Review 71 (2024) 101104

Contents lists available at ScienceDirect

Developmental Review

journal homepage: www.elsevier.com/locate/dr

Review

Childhood socioeconomic position and later-life cognitive functioning in the U.S.: A critical review

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ARTICLE INFO

Keywords:
Socioeconomic status
Life course
Cognitive aging
Childhood

ABSTRACT

An emerging body of research suggests that later-life cognitive functioning may be partly the result of influences across the life course. Low socioeconomic position in childhood is associated with disparities in cognitive functioning in older adulthood. Framed by the life course perspective, several explanations for this association exist: the *latency model*, positing that the conditions of low early-life socioeconomic position are directly linked to later-life cognitive functioning; the *pathway hypothesis*, suggesting that the association is mediated through adult socioeconomic position; and the *accumulation of (dis)advantage hypothesis*, proposing that the combined conditions of the childhood and adulthood contexts are more impactful than either socioeconomic context alone. The purpose of this critical review was to assess the empirical evidence supporting each hypothesis through a synthesis of the extant literature on the association between childhood socioeconomic position and later-life cognitive functioning. We reviewed 29 studies with U.S. samples and found the strongest evidence for the pathway hypothesis, followed by the accumulation hypothesis. Support for the latency model is present but weaker than the other explanations. The influence of childhood socioeconomic position on cognitive functioning is stronger when cognitive functioning is assessed at a single time point rather than as change over time, suggesting that childhood socioeconomic position might not affect the rate at which cognition declines in later life but does impact performance measured at any designated testing occasion. We conclude with a discussion of the limitations of the state of the literature, directions for future research, and implications for policy.

Introduction

Cognitive abilities are central to healthy aging and autonomy. Older adults with low cognitive performance are more likely to experience functional impairments, stop driving, and require formal or informal care (Dodge et al., 2006; Dugan & Lee, 2013; Wood et al., 2005). The predictors of cognitive functioning are varied and complex (Beydoun et al., 2014), and gerontologists are increasingly interested in *the long arm of childhood* (Hayward & Gorman, 2004), suggesting that later-life cognitive functioning may be, at least in part, the result of influences across the life course. In particular, childhood socioeconomic position (SEP) has been consistently associated with disparities in cognitive functioning in childhood (Hoff, 2003) and older adulthood, including global and domain-

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https://doi.org/10.1016/j.dr.2023.101104
Received 7 March 2023; Received in revised form 26 October 2023;
Available online 22 November 2023

specific performance (Goveas et al., 2016; Zhang et al., 2015). To identify the gaps in the literature and provide directions for future research in this area, it is crucial to expand our understanding of SEP and cognitive functioning across, not just within, developmental periods. The present review focuses on the growing body of empirical work that addresses the question of how childhood SEP is related to later-life cognitive functioning, with the goal of furthering research to inform policies on the best ways to foster individuals' health and cognitive well-being across the life course.

We use the term socioeconomic position rather than socioeconomic status given its more comprehensive focus on resource-based (e.g., income) and prestige-based measures (e.g., occupational prestige, educational level; Krieger, 2001) to better reflect the range of measures used in the studies reviewed here. Although education may not be considered an indicator of SEP in all fields, it is a common operationalization in social epidemiology, from which much of this literature is drawn (e.g., Roberts, 1999). Further, we focus on normative cognitive functioning, as opposed to diagnoses of Alzheimer's disease or other dementias, as the former literature is currently more robust and representative of a broader scope of cognitive functioning. There is a substantial literature on childhood SEP and later-life cognitive functioning with samples from the United Kingdom (e.g., Landy et al., 2017), Japan (e.g., Nishizawa et al., 2019), Denmark (e.g., Foverskov et al., 2019), and Latin America and the Caribbean (e.g., Nguyen et al., 2008), amongst others. Fewer studies have been conducted with U.S.-based samples. Given the unique welfare policies, social inequality, systemic racism, and high rates of poverty in the United States (11 % of the population and 16 % of children live in poverty; U.S. Census Bureau, 2021), compared to other developed countries, it is essential to review the state of literature drawn from this nation to describe overall findings and provide directions for future research. We focus on studies with U.S. samples that include a measure of childhood SEP at or before age 18 and a measure of normative cognitive functioning at or after age 50. We review the prevailing theories, the state of empirical findings and limitations, and propose directions for future research.

Theoretical frameworks

The life course perspective frames much of the literature on the influence of childhood SEP on older adults' cognitive functioning (Elder, 1998). Childhood SEP goes beyond financial well-being and plays an integral role in shaping children's environments and lived experiences. For example, many children in low-SEP families live in substandard and unsafe communities with high crime rates and limited access to high-quality early education programs, schools, and healthcare (Evans & Kim, 2013). Many low-SEP children also experience hunger and poor nutrition due to food insecurity. Such hardships can take a toll on parents' or caregivers' mental health, which can lead to harsh and inconsistent experiences with caregivers at home and create home learning environments that provide limited support for children's cognitive development, including their development of language and executive function skills (Evans & Kim, 2013; Hoff, 2003). However, the experiences of low-SEP children vary considerably. Some children experience multiple hardships associated with socioeconomic disadvantage that accumulate and persist throughout childhood, whereas others experience fewer hardships for shorter or intermittent periods of time during childhood. These types of experiences during childhood can have a lasting effect on children's adult-life cognitive functioning.

Assuming a continuous relationship between an individual's social address and developmental outcomes, the life course perspective posits that early-life experiences impact individuals across time (Alwin & Wray, 2005). In the current context, life course research underscores the importance of examining socioeconomic predictors of later-life cognitive functioning that precede older adulthood, as conditions from one developmental period may be connected to those of another. From this perspective, three main hypotheses have been used to explore the relation between early-life SEP and later-life cognitive functioning: (1) the latency hypothesis, (2) the pathway hypothesis, and (3) the accumulation of (dis)advantage hypothesis.

First, the *latency hypothesis* (sometimes referred to as the *biological programming hypothesis* or *sensitive period hypothesis*) suggests that the conditions associated with early-life SEP result in enduring outcomes that directly influence coOperationalizing Childhood Socioeconomicgnitive functioning in older adulthood (Ben-Shlomo & Kuh, 2002). Childhood SEP is a proxy for various related environmental and biological factors that have long-term, direct consequences for cognitive functioning. For instance, evidence suggests that children from low-income families are less likely to live in cognitively stimulating environments (Linver et al., 2002; Taylor et al., 2004) or hear maternal speech (Hoff, 2003) than their wealthier counterparts. Such experiences can adversely affect cognitive performance, especially during early childhood when children generally exhibit dramatic growth in their cognitive development (Center on the Developing Child, 2012), and, possibly, their cognitive functioning in adulthood, particularly if those experiences persist throughout childhood (Hawkins et al., 2021). We also know that childhood poverty is associated with increased risks in childhood, including morbidity (Chen et al., 2002), delayed healthcare, inflammation (Miller & Chen, 2013), damaging health behaviors such as alcohol consumption, and exposure to violent and traumatic incidents (Evans, 2004) as well as environmental toxins like lead, which may impact cognitive functioning. Thus, the *latency hypothesis* posits that childhood SEP affects later-life cognitive functioning directly and independently of factors such as financial status or health in adulthood.

By contrast, the *pathway hypothesis*, or *chain of risk hypothesis*, suggests that the conditions of childhood SEP impact adult cognitive functioning via financial and social resources in adulthood. Indeed, evidence suggests that childhood poverty is associated with lower educational attainment and income in adulthood (Duncan et al., 2010). Also, childhood and adult SEP are positively correlated, highlighting the stability of SEP for many individuals throughout life (Oi & Haas, 2019). In sum, the *pathway hypothesis* posits that low childhood SEP indirectly affects cognitive functioning in older adulthood via SEP in midlife, often assessed as educational attainment and/or economic resources.

Finally, the *accumulation of (dis)advantage hypothesis* states that the additive effects of lifelong disadvantage—neither childhood nor adult resources alone—influence cognitive functioning in older adulthood. Thus, according to this hypothesis, chronic, lifelong poverty would result in worse cognitive functioning than transitory, relatively short-term experiences with poverty during childhood

Table 1
Overview of Studies Included in This Review.

Citation	Data Source, Sample Size, Participant Ages	Childhood SEP Operationalization	CF Domains and Measures	Hypotheses Tested	Findings
Beck et al., 2018	• Vietnam Era Twin Study of Aging (N = 1,009) • Ages 57–67 (M = 62, SD = 2.48)	Parents' education, parents' occupation	• Global (Armed Forces Qualifications Test) • Abstract reasoning (Wechsler Abbreviated Scale of Intelligence Matrix Reasoning subtest) • Verbal fluency/language (D-KEFS Verbal Fluency Letter and Category Fluency) • Visual-spatial ability (card rotations, hidden figures) • Processing speed (Stroop word and color conditions, D-KEFS Trails number sequencing and letter sequencing) • Episodic memory (California Verbal Learning Test-II short-delay recall and long-delay recall, WMS-III Logical Memory and Visual Reproduction subtests) • Working memory (Reading Span, WMS-III Digit Span, Spatial Span, and Letter-Number Sequencing tests) • Inhibition (Stroop color/word interference) • Switching (D-KEFS Trails letter-number switching and Verbal Fluency category switching)	Latency and pathway	Only the direct effect between childhood SEP and abstract reasoning (β = 0.071) remained significant after accounting for adult SEP, age 20 cognitive ability, and midlife engagement in cognitively stimulating activities (latency). Direct effects for all other cognitive functioning domains (β = 0.001–0.046) were not significant with adult mediators in the model (pathway).
Brewster et al., 2014	• UC Davis Aging Diversity Cohort (N = 333) • Ages 60+ (M = 73.62; SD = 6.77)[a]	Parents' education, father's occupation, number of siblings, siblings' early mortality	• Global (Spanish and English Neuropsychological Assessment Scales) • Episodic memory (word list recall) • Semantic memory (object naming, picture association) • Executive function (digit-span backward, visual-span backward, list sorting)	Latency and pathway	Comparing SEP quintiles, lower childhood SEP was associated with lower baseline semantic memory (Q1 vs. Q5: β = -0.540), episodic memory (Q4 vs. Q5: β = -0.356) and executive function (Q4 vs. Q5: β = -0.381; latency). In univariate analyses, the highest SEP quintile had slower cognitive decline than others (e.g., Q1 vs. Q5: β = -0.074), but this effect became nonsignificant after including adult literacy and physical activity (β = -0.030– −0.052; pathway).
Chan et al., 2018	• Dallas Lifespan Brain Study (N = 168) • Ages 20–89 (M = 59.79; SD = 16.89)	Highest level of education completed by either parent	• Brain functional network organization (fMRI) • Cortical thickness (structural imaging)	Accumulation, latency, and pathway	Childhood SEP either did not significantly contribute or contributed minimally to models linking adult SEP and cognitive functioning (latency, pathway), including under high and low adult SEP contexts (accumulation).
Everson-Rose et al., 2003	• Chicago Health and Aging Project (N = 4,398)	Parents' education, parents' occupation, perceived family financial status	• Global, including: • Episodic memory (East Boston Story immediate and delayed recall)	Latency and pathway	Childhood SEP was associated with cognitive functioning at baseline (β = 0.158; latency).

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Table 1 (*continued*)

Citation	Data Source, Sample Size, Participant Ages	Childhood SEP Operationalization	CF Domains and Measures	Hypotheses Tested	Findings
	• Ages 65+ (*M* = 73.9; *SD* = 6.4)		• Perceptual speed (Symbol Digit Modalities Test) • Global (MMSE)		Accounting for education greatly attenuated this effect (β = 0.034; latency). Childhood SEP was not related to cognitive decline with (β = –0.003) or without education (β = –0.005) in the model (latency; pathway).
Faul et al., 2021	• HRS (*N* = 23,229) • Ages 50+ (*M* = 63.2; *SD* = 10.36)	Father's occupation, father's unemployment, family receipt of financial assistance from relatives	Episodic memory (TICS immediate and delayed word list recall)	Accumulation, latency, and pathway	Childhood SEP was associated with baseline cognitive functioning but not decline (latency), but the former became nonsignificant with adult SEP in the model (pathway). Respondents with upward social mobility and lifelong high SEP had higher cognitive functioning than those with lifelong low SEP or downward social mobility (accumulation).
Glei et al., 2022	• MIDUS (*N* = 8,844) • Ages 23–94 (*M* = 58.4; *SD* = 13.2)	Parents' education, foreign nativity, hometown size, presence of each parent/ caregiver, family receipt of welfare	• Episodic memory (BTACT immediate and delayed word list recall) • Executive function (BTACT) including: • Working memory (digit span backwards) • Verbal fluency (category fluency) • Reasoning (number series, Stop and Go Switch Task) • Processing speed (30-Seconds and Counting Task)	Latency and pathway	Childhood SEP reduced the difference in cognitive functioning performance between Black and White respondents by 0.02–0.16 standard deviations or 9–16 % (latency). Educational attainment explained an equal or greater share (pathway).
González et al., 2013	• HRS (*N* = 8,833) • Ages 65+ (*M* = 73.9; *SD* = 0.1)	Parents' education, perceived family financial status	Global (TICS) • Episodic memory (immediate and delayed word list recall) • Attention/working memory (serial 7 s) • Language (object naming) • Orientation (date, president, and vice president naming)	Latency and pathway	Childhood SEP was associated with baseline cognitive functioning (β = 0.29–0.71; latency) but these effects became nonsignificant or highly attenuated after accounting for adult SEP (β = 0.01–0.22) latency, pathway). Childhood SEP was not related to cognitive decline (β = 0.01 to 0.07; latency).
Greenfield & Moorman, 2019	• WLS (*N* = 5,074) • Age 65	Highest level of education completed by either parent, father's occupation, household income	• Memory • Episodic memory (immediate and delayed word list recall) • Working memory (digit ordering) • Executive function/ language • Verbal fluency (letter and category fluency) • Abstract reasoning (WAIS-R similarities)	Latency and pathway	Global childhood SEP, parent's education, father's occupation, and household income predicted cognitive functioning (latency). After accounting for adult SEP, only the associations between parents' education and global childhood SEP on executive function/ language remained (latency, pathway). Childhood SEP was not

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Table 1 (*continued*)

Citation	Data Source, Sample Size, Participant Ages	Childhood SEP Operationalization	CF Domains and Measures	Hypotheses Tested	Findings
					related to cognitive decline (latency).
Greenfield et al., 2021	• WLS (*N* = 3,706) • Age 72	Highest level of education completed by either parent, father's occupation, household income	• Memory • Episodic memory (immediate and delayed word list recall) • Working memory (digit ordering) • Executive function/ language • Verbal fluency (letter and category fluency) • Abstract reasoning (WAIS-R similarities)	Latency and pathway	In multivariate models, the direct effect of adult SEP (β = 0.08–0.37) on cognitive functioning (pathway) was significant and stronger than the association between childhood SEP and cognitive functioning, which was not significant (β = –0.02 to –0.07; latency).
Haan et al., 2011	• SALSA (*N* = 1,789) • Ages 60–101 (*M* = 70.66; *SD* = 7.04) [a]	Parents' education, parents' occupation, food insecurity, siblings' early mortality	• Global (Modified MMSE) • Episodic memory (Spanish English Verbal Learning Test delayed word list recall)	Accumulation, latency, and pathway	Childhood SEP predicted cognitive functioning (latency) and including adult SEP highly attenuated this effect (latency, pathway). Respondents with upward social mobility and lifelong high SEP had more favorable cognitive functioning than those with lifelong low SEP (accumulation). There was no difference between stable low and downward SEP groups.
Hale, 2017	• HRS (*N* = 12,278) • Ages (*M* = 75.52; *SD* = 5.01)[a]	Parents' education, father's unemployment/absence, perception of family financial status, childhood health	Fluid cognition (TICS) including: • Episodic memory (immediate and delayed word list recall) • Attention/working memory (backwards counting, serial 7 s)	Accumulation, latency, and pathway	Childhood SEP predicted cognitive functioning (latency), but only the association with parents' education remained after accounting for adult SEP (latency, pathway). Respondents with downward social mobility and lifelong high SEP had higher cognitive functioning than those with lifelong low SEP or upward mobility (accumulation).
Jefferson et al., 2011	• Rush Memory and Aging Project (*N* = 951) • Ages 54–100 (*M* = 79; *SD* = 8)	Parents' education, father's occupation, number of children in the family, community-level SEP	• Episodic memory (WMS-Revised Logical Memory, East Boston Story, word list immediate and delayed recall) • Semantic memory (Boston Naming Test, verbal fluency) • Working memory (WMS-Revised Digit Span, digit ordering) • Visuospatial ability (judgment of line orientation, Raven's progressive matrices) • Perceptual speed (symbol digit modalities, number comparison, Stroop test) • Reading ability (National Adult Reading Test)	Pathway	Childhood SEP significantly predicted global cognitive functioning (β = 0.255), episodic memory (β = 0.156), semantic memory (β = 0.322), working memory (β = 0.215), visuospatial ability (β = 0.206), and perceptual speed (β = 0.215) via adult SEP, education, and later-life cognitively stimulating activities (pathway).
Lee et al., 2003	• Nurses' Health Study (*N* =	Father's occupation	Global (variation in test administration across waves)	Latency	Childhood SEP was not related to either cognitive

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Table 1 (*continued*)

Citation	Data Source, Sample Size, Participant Ages	Childhood SEP Operationalization	CF Domains and Measures	Hypotheses Tested	Findings
	15,594) • Ages 70–79 (*M* = 74.26)[a]		• Global (TICS) • Episodic memory (East Boston Memory Test and TICS immediate and delayed word list recall • Verbal fluency (animal naming) • Working memory (digit span backwards)		functioning at baseline or decline in functioning over time.
Lee & Schafer, 2021	• National Social Life, Health, and Aging Project (*N* = 3,361) • Ages 50+ (*M* = 63.83; *SD* = 9.60)	Highest level of education completed by either parent, perceived family financial status	Global (Montreal Cognitive Assessment) • Orientation (date and month naming) • Abstract reasoning (similarities, modified Trails-b) • Visuospatial ability (clock drawing) • Episodic memory (delayed word list recall) • Attention (digit ordering, serial 7 s) Language (animal naming, verbal fluency, sentence repetition)	Latency and pathway	Childhood SEP was associated with baseline cognitive functioning (β = 0.117, p <.001; latency) and these effects became highly attenuated and nonsignificant after accounting for respondents' education (β = 0.006, *p* >.05; pathway).
Liu & Lachman, 2019	• MIDUS (*N* = 7,108) • Ages 24–75 (*M* = 58.69; *SD* = 11.37)	Highest level of education completed by either parent	• Episodic memory (BTACT immediate and delayed word list recall) • Executive function (BTACT) including: • Working memory (digit span backwards) • Verbal fluency (category fluency) • Reasoning (number series) • Executive functioning (Stop and Go Switch Task) • Processing speed (30-Seconds and Counting Task)	Accumulation, latency, and pathway	Childhood SEP predicted cognitive functioning (latency), even with adult SEP in the model (latency, pathway). For executive functioning only, respondents with upward social mobility and lifelong high SEP had higher cognitive function than those with lifelong low SEP (accumulation). Childhood SEP predicted slower decline for executive function only (latency).
Luo & Waite, 2005	• HRS (*N* = 19,949) • Ages 50+ (*M* = 66.87; *SD* = 10.40)	Parents' education, father's occupation, perceived family financial status	Global (TICS) • Episodic memory (immediate and delayed word list recall, day and date naming, object naming) • Executive function (serial 7 s, backwards counting)	Accumulation, latency, and pathway	Childhood SEP predicted cognitive functioning (latency) and including adult SEP highly attenuated this effect (latency, pathway). Respondents with upward social mobility and lifelong high SEP had higher cognitive functioning than those with lifelong low SEP and downward mobility (accumulation).
Lyu, 2015	• HRS (*N* = 9,407) • Ages 65+ (*M* = 75)	Parents' education, father's occupation, perceived family financial status	Episodic memory (immediate and delayed word list recall)	Accumulation, latency, and pathway	Childhood SEP was associated with baseline memory scores, net of education and adult income (latency, pathway). Cumulative SEP advantage was positively associated with memory scores and this association was stronger for men (β = 0.169) than women (β = 0.108). More advantaged cumulative SEP was

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Table 1 (*continued*)

Citation	Data Source, Sample Size, Participant Ages	Childhood SEP Operationalization	CF Domains and Measures	Hypotheses Tested	Findings
					associated with steeper memory declines for men only.
Lyu & Burr, 2016	• HRS (N = 9,407) • Ages 65+ (M = 75)	Parents' education, father's occupation, perceived family financial status	Global (TICS), including: • Episodic memory (immediate and delayed word list recall) • Attention/working memory (serial 7 s) • Language (object naming) • Orientation (date, president, and vice president naming)	Accumulation, latency, and pathway	Childhood SEP was associated with baseline cognitive functioning (latency) and these effects became nonsignificant or highly attenuated after accounting for adult SEP (latency, pathway). Respondents with upward social mobility and lifelong high SEP had higher cognitive functioning than those with lifelong low SEP and downward mobility (accumulation). Childhood SEP was not related to cognitive decline (latency).
Marden et al., 2017	• HRS (N = 10,781) • Ages 50+ (M = 69)	Parents' education, father's occupation, financial capital	Episodic memory (immediate and delayed recall, IQCODE)	Accumulation, latency, and pathway	Childhood SEP predicted baseline cognitive functioning (β = 0.07; latency) and these effects were not attenuated after accounting for adult SEP (β = 0.07; latency). Respondents with upward social mobility (β = 0.13–0.29), downward social mobility (β = 0.08–0.31), and lifelong high SEP (β = 0.29) had higher cognitive functioning than respondents with lifelong low SEP (accumulation).
Melrose et al., 2015	• UC Davis Aging Diversity Cohort (N = 333) • Ages 60+ (M = 73.62; SD = 6.77)[a]	Parent's education, father's occupation, number of siblings, siblings' early mortality	• Global (Spanish and English Neuropsychological Assessment Scales) • Episodic memory (word list recall) • Semantic memory (object naming, picture association) • Executive function (digit-span backward, visual-span backward, list sorting)	Latency	Lower childhood SEP was associated with lower baseline semantic memory (β = –0.358 to –0.583) and faster global decline (β = − 0.079 to − 0.059), controlling for educational attainment.
Oi & Haas, 2019	• HRS (N = 9,449) • Ages 50–100.32 (M = 70.72; SD = 10.31)	Parent's education, breadwinner's occupation	Global (TICS) • Episodic memory (immediate and delayed word list recall) • Attention/working memory (serial 7 s, backwards counting) • Language (object naming) • Orientation (date, president, and vice president naming)	Accumulation, latency, and pathway	Childhood SEP predicted baseline cognitive functioning (β = 0.407) and decline (β = 0.97; latency). These effects were not significant after accounting for adult SEP (baseline β = –0.059, decline β = 0.027; pathway). Adult SEP fully mediated the link between childhood SEP and cognitive decline (direct effect: β = 0.27, p >.05; total effect: β = 0.89, p <.01; pathway). The interaction between child and adult SEP was not

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Citation	Data Source, Sample Size, Participant Ages	Childhood SEP Operationalization	CF Domains and Measures	Hypotheses Tested	Findings
					significant for baseline (β = –0.001) or decline (β = 0.003; accumulation).
Park et al., 2019	• HRS (N = 3,821) • Ages 65+	Highest level of education completed by either parent, parents' occupation, perceived family financial status	Global (TICS) • Episodic memory (immediate and delayed word list recall) • Attention/working memory (serial 7 s, backwards counting) • Language (object naming) • Orientation (date, president, and vice president naming)	Accumulation and latency	Low childhood SEP was not associated with baseline cognitive functioning (latency) unless respondents also experienced low SEP in midlife and/or late life (accumulation). Childhood SEP was not related to cognitive decline (latency).
Peterson et al., 2021	• Kaiser Healthy Aging and Diverse Life Experiences cohort (N = 1,712) • Ages 65+ (M = 75.26; SD = 6.43)	Parents' education, childhood hunger, perceived family financial status, household tenure	• Global (Spanish and English Neuropsychological Assessment Scales) • Episodic memory (word list recall) • Semantic memory (object naming, picture association) • Executive function (digit-span backward, visual-span backward, list sorting)	Accumulation	Respondents with lifelong high SEP (β = 0.12–0.56) and upward social mobility (β = 0.18–0.32) showed significantly better cognitive functioning than those with lifelong low SEP.
Reynolds et al., 2022	• HRS (N = 8,299) • Ages 65+ (M = 75.65, SD = 7.16)	Parents' education, maternal investment (i.e., mother's effort, time spent with mother, mother's attention), family structure, perceived family financial status, father's unemployment, father's occupation, family financial instability (i.e., receipt of financial assistance from relatives, move for financial reasons, bankruptcy, loss of business)	Global (TICS) • Episodic memory (immediate and delayed word list recall) • Attention/working memory (serial 7 s) • Language (object naming) • Orientation (date, president, and vice president naming)	Latency and pathway	Childhood SEP predicted cognitive functioning (latency), even with respondents' education in the model (latency, pathway). Childhood SEP was not related to cognitive decline (latency).
Vable et al., 2018	• HRS (N = 7,916) • Ages 50+	Mothers' education	Episodic memory (immediate and delayed recall, IQCODE)	Latency and pathway	Low childhood SEP was linked with lower cognitive functioning compared to respondents with high childhood SEP ($\beta = -0.07$; latency). These effects were not significant after accounting for adult SEP ($\beta = -0.02$; pathway).
Wilson et al., 2005	• Chicago Health and Aging Project (N = 4,392) • Ages 65+ (M = 71.75; SD = 6.26)[a]	Parents' education, father's occupation, perceived family financial status	Global, including: • Episodic memory (East Boston Story immediate and delayed recall) • Perceptual speed (Symbol Digit Modalities Test) • Global (MMSE)	Latency and pathway	Childhood SEP was associated with baseline cognitive functioning (latency) and these effects became attenuated and nonsignificant after accounting for adult SEP (pathway). Childhood SEP was not related to cognitive decline either with or without adult SEP in the model (latency).
Zeki Al Hazzouri, Haan, Galea et al., 2011	• SALSA (N = 1,789) and Mexican Health and Aging Study (N = 5,253) • Ages 60+ (M	Parents' education	Episodic memory (MHAS: delayed word recall; SALSA: Spanish and English Verbal Learning delayed word recall)	Latency and pathway	Childhood SEP was positively associated with cognitive functioning (β = 0.13–0.26, p <.05; latency) and these effects became nonsignificant after accounting for

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Table 1 (*continued*)

Citation	Data Source, Sample Size, Participant Ages	Childhood SEP Operationalization	CF Domains and Measures	Hypotheses Tested	Findings
	= 70.6, *SD* = 7.7)				respondents' education (β = 0.03–0.07, p >.05; pathway).
Zeng et al., 2022	• HRS (N = 8,376) • Ages 65+ (M = 74.06)	Parents' education, father's occupation, perceived family financial status	• Episodic memory (TICS immediate and delayed word list recall) • Mental status (TICS) • Attention/working memory (serial 7 s) • Language (object naming) • Orientation (date, president, and vice president naming)	Accumulation, latency, and pathway	Childhood SEP was associated with baseline mental status for White (β = − 0.10, p <.01) but not Black (β = 0.02, p >.05) respondents (latency). Childhood SEP was not linked with baseline episodic memory for either group (total sample β = -0.01, p >.05) There was an indirect effect of childhood SEP on cognitive functioning via adult SEP (β = 0.25–0.32, p <.001; pathway). With adult SEP in the model, only the direct effect on mental status for White respondents remained (β = − 0.10, p <.01; latency, pathway). Compared to lifelong high SEP, respondents with downward mobility (β = -0.14, p <.001) and lifelong low SEP (β = -0.30, p <.001) had lower baseline cognition (accumulation). There was no difference between stable high and upward social mobility for Black respondents (β = -0.06, p >.05; accumulation).
Zhang et al., 2020	• WLS (N = 5,880) • Ages 63–67 (*M* = 64.8; *SD* = 0.7)	Parents' education, parents' occupation, household income	• Episodic and working memory (immediate and delayed word recall, digit ordering) • Abstract reasoning (WAIS-R similarities) • Verbal fluency (letter and category fluency)	Latency and pathway	There was an indirect effect of childhood SEP on cognitive functioning via education, adult earnings, adult health, and adolescent cognitive ability (β = 0.362, p <.001; pathway). With education in the model, a direct effect of childhood SEP was present (β = 0.072, p <.01; latency).

Note. Unless otherwise noted, "parents' education" includes both parents. In longitudinal analyses, we report the age at baseline cognitive assessment. Standardized coefficients (β) are included when either reported in the original work or sufficient data were reported to standardize the unstandardized coefficients. Coefficient ranges are presented when multiple measures of childhood SEP and/or cognitive functioning were reported (e.g., mother's and father's education) or when modeled as categorical variables (e.g., well off vs. average and poor vs. average). BTACT = Brief Test of Adult Cognition by Telephone; D-KEFS = Delis–Kaplan Executive Function System; fMRI = functional magnetic resonance imaging; HRS = Health and Retirement Study; IQCODE = Informant Questionnaire for Cognitive Decline; MIDUS = Midlife in the United States; MMSE = Mini–Mental State Examination; SALSA = Sacramento Area Latino Study on Aging; SEP = socioeconomic position; TICS = Telephone Interview for Cognitive Status; WAIS-R = Wechsler Adult Intelligence Scale-Revised; WLS = Wisconsin Longitudinal Study; WMS = Wechsler Memory Scale.

[a] When descriptive statistics were reported separately between groups, the weighted mean is presented here.

(Graham, 2002; Lyu & Burr, 2016). High-skilled, high-paying, and prestigious occupations can provide cognitively stimulating experiences during early and middle adulthood, which can reduce the negative impact of childhood SEP on adults' long-term cognitive functioning (Baldivia et al., 2008). Support for this notion is found in research demonstrating that older adults who experienced low

SEP as children but relatively higher SEP as adults (i.e., upward mobility) exhibited better cognitive performance than their peers with similar childhood SEP but less upward mobility (Faul et al., 2021). Unlike the pathway hypothesis, which is often assessed via stepwise model comparisons or indirect effects, the accumulation hypothesis is often assessed with moderation terms or by classifying respondents according to their trajectories of life course SEP and subsequently comparing classes. Another difference between the hypotheses is that the accumulation hypothesis primarily addresses the multiplicative effects of SEP at various life stages without concern for the direct predictive power of childhood SEP. The pathway hypothesis, by contrast, is concerned with childhood SEP as a direct driver of later SEP.

Importantly, the *latency*, *pathway*, and *accumulation hypotheses* are not mutually exclusive. It may be that some aspects of childhood SEP influence cognitive functioning indirectly, whereas others have more direct effects, and still, others are most influential over time and in association with adult SEP. Further, because the pathway hypothesis is often assessed via mediational analyses, evidence for the pathway and latency models can co-exist if midlife SEP variables only partially mediate the association between early-life SEP and later-life cognitive functioning (Lyu & Burr, 2016). It is also plausible that childhood SEP impacts various domains of cognitive functioning differently, supporting each hypothesis depending on the cognitive outcome of interest.

Method

We searched several databases to evaluate the literature on childhood SEP and cognitive functioning in older adulthood: PsycINFO, Science Direct, PubMed, and Medline. As this topic is interdisciplinary, the selected databases index journals across gerontological, sociological, epidemiological, public health, and medical outlets. Search terms, developed in consultation with a research librarian, included variations on *childhood* (e.g., *early life, young, youth*), *socioeconomic position* (e.g., *socioeconomic status, poverty, low income*), *older adulthood* (e.g., *older adult, late life, aging*), and *cognitive functioning* (e.g., *memory, cognition, executive function*). We limited results to empirical peer-reviewed articles published in English or Spanish without restrictions on the date of publication. Studies were included if they met the following four criteria: (1) the sample was based in the United States; (2) the study used quantitative analyses; (3) the study used a measure of childhood SEP at or prior to age 18 (whether prospective or retrospective); and (4) the study included a measure of normative cognitive functioning when the mean age of the sample was at least 50 years old. We specified a wide age range to encompass a greater number of results and mirror the inclusion criteria often employed by researchers and large public-use datasets. This approach also enabled us to synthesize longitudinal studies that examine cognitive decline from midlife through older adulthood while minimizing survivor bias and attrition related to severe cognitive impairment or mortality, both of which are associated with SEP (Bosworth, 2018; George et al., 2020). We included studies that examined cognitive functioning at one time point and/or across multiple time points to assess change over time. We excluded studies that (1) examined incident dementia or cognitive impairment as outcomes; (2) included participants with traumatic brain injuries; and/or (3) combined childhood SEP into a single measure with other confounding constructs, such as childhood health or adversities. We also engaged in ancestry searching, examining the reference lists of included studies for additional articles.

Twenty-nine studies ($N = 29$) fit the inclusion criteria and were systematically coded. Extracted information included operationalization and measurement of SEP and cognitive functioning; analytic method; theoretical grounding; other variables relevant to the primary association (i.e., covariates, mediators, and/or moderators); and overall findings. We also coded participant characteristics, including age distribution, data source, sample size, and study design characteristics, including whether the study was cross-sectional or longitudinal and, in the latter case, the number of years and waves of data collection. We extracted effect sizes via standardized regression coefficients when available. Several studies reported unstandardized coefficients, which we standardized with $\beta = b^*\frac{SD_x}{SD_y}$ when sufficient information was present to compute β. Coefficients were considered small at 0.10–0.29, medium at 0.30–0.49, and large at 0.50 (Cohen, 1988).

Results

Operationalizing childhood socioeconomic position and later-life cognitive functioning

Table 1 provides an overview of the 29 studies included in this review. Researchers used a variety of proxies for childhood SEP, which is operationalized differently across studies. Five studies operationalized SEP via a single factor, such as parents' education or fathers' occupation (see Table 1, column 3). The remaining studies operationalized SEP via composite or latent variables involving a combination of indicators (Galobardes et al., 2006), including one or both parents' education (the most commonly included indicator, present in 27 of the 29 articles reviewed here), parents' occupation (typically fathers' occupation), and indicators of household income, financial stability, and/or family financial status in childhood (e.g., Everson-Rose et al., 2003; Luo & Waite, 2005). Occasionally, researchers included additional measures correlated with financial disadvantage, such as childhood food insecurity (Haan et al., 2011) and household size (Jefferson et al., 2011). No studies included samples who had uniformly experienced childhood poverty or disadvantage. For instance, approximately one-third of Health and Retirement Study (HRS) respondents reported that their family was poor during childhood, compared to 6 % and 60 % who reported their families were well-off and average, respectively (e.g., González et al., 2013). In the Sacramento Area Latino Study, by contrast, approximately half of respondents reported that their parents had no formal education (e.g., Zeki Al Hazzouri, Haan, Galea, et al., 2011). Thus, these samples represent a substantial spread of early-life conditions.

In the articles included in this review, cognitive functioning was measured most frequently as episodic memory performance via assessments of immediate and/or delayed word recall, sometimes nested in comprehensive measures that capture multiple aspects of cognitive functioning, such as executive functioning, verbal fluency, and abstract reasoning (e.g., the Telephone Interview for Cognitive Status, or TICS; Ofstedal et al., 2002). Most samples represented varying degrees of cognitive ability. Three studies excluded respondents with cognitive impairment or dementia at baseline (Haan et al., 2011; Jefferson et al., 2011; Peterson et al., 2021), whereas others included respondents with dementia. For instance, the UC Davis Aging Diversity Cohort classified 66 % of respondents as having normative cognition, 25 % with mild cognitive impairment, and 9 % with dementia (Brewster et al., 2014; Marden et al., 2017). Notably, few reports included a measure of cognitive ability in childhood (for exceptions, see Beck et al., 2018; Zhang et al., 2020), an issue we expand upon in the Limitations section of this review. Thus, notions of causality should be approached tentatively.

Childhood SEP and cognitive functioning in older adulthood

Low early-life SEP was associated with lower cognitive functioning in adulthood across most studies (e.g., Everson-Rose et al., 2003; Greenfield & Moorman, 2019; Haan et al., 2011; Marden et al., 2017; Moorman et al., 2018; Liu & Lachman, 2019; Lyu, 2015; Lyu & Burr, 2016; Oi & Haas, 2019; Reynolds et al., 2022; Wilson et al., 2005; Zhang et al., 2020), but not all (e.g., Lee et al., 2003). Sampling idiosyncrasies may explain why some findings deviate from the general pattern. For instance, one study's sample is composed entirely of highly educated women working in a single profession (i.e., registered nurses; Lee et al., 2003), another study includes only older adults living alone (Park et al., 2019), and a third study used a relatively smaller sample of 168 participants, which may have underpowered the analyses (Chan et al., 2018). Nevertheless, most findings suggest that low childhood SEP is significantly associated with lower cognitive performance in older adulthood.

In many cases, however, the linkages between childhood SEP and cognitive functioning in later life attenuate or no longer reach significance when accounting for individuals' SEP in adulthood, often measured as adult educational attainment. For example, the authors of one of the early studies in this area examined change in global cognitive functioning (i.e., episodic memory and perceptual speed) in a sample of 4,398 community-dwelling older adults in Chicago, Illinois (Everson-Rose et al., 2003). They found that childhood SEP predicted baseline cognitive functioning in older adulthood ($\beta = 0.158$, SE = 0.014, $p < .001$), but adding respondents' educational attainment in adulthood to the model reduced the childhood SEP coefficient to approximately one-fifth of its original size ($\beta = 0.034$, SE = 0.014, $p = 0.01$), supporting both the pathway and latency hypotheses. Although the adverse effects of childhood SEP remained statistically significant, the strength of that effect was substantially weakened after including respondents' educational attainment. Later studies have corroborated these results, finding similar attenuations (e.g., Beck et al., 2018; Brewster et al., 2014; Faul et al., 2021; Glei et al., 2022; Greenfield & Moorman, 2019; Haan et al., 2011; Liu & Lachman, 2019; Lyu & Burr, 2016; Marden et al., 2017; Oi & Haas, 2019; Vable et al., 2018; Wilson et al., 2005; Zeki Al Hazzouri, Haan, Galea, et al., 2011; Zeng et al., 2022; Zhang et al., 2020). For instance, Haan et al. (2011) found that less childhood SEP disadvantage positively and independently predicted later-life cognitive functioning (measured with the Modified Mini-Mental State Examination and the Spanish English Verbal Learning Test), but adult SEP, including income, occupation, and educational attainment, accounted for 50 % of the variance in this association. Similarly, Oi and Haas (2019) showed that the moderate association between higher childhood SEP and better performance on the Telephone Interview for Cognitive Status ($\beta = 0.407$, SE = 0.022, p $< .001$) was largely accounted for by adult earnings, occupational prestige, assets, and education (β = -0.059, SE = 0.033, $p > .05$). Across another report assessing global cognitive functioning, the magnitude of this association was reduced from $\beta = 0.117$ to 0.006 (Lee & Schafer, 2021) when adult SEP indicators were included. Thus, the small direct association between childhood SEP and later-life cognitive functioning is generally weakened upon the inclusion of adult resources.

Mediation models also provide insight into the role of childhood SEP as a predictor of later-life cognitive functioning via adult resources. For instance, examining seven domains of cognitive functioning, Beck et al. (2018) found that whereas the direct effect of childhood SEP on episodic memory was not significant ($\beta = 0.004$, 95 % CI [−0.040, 0.056]), there was a small, significant indirect effect via adult SEP, age 20 cognitive abilities, and later-life cognitive leisure activities ($\beta = 0.064$, 95 % CI [0.026, 0.117]). This pattern was similar across processing speed, verbal fluency, and working memory in support of the pathway model. Only the link to abstract reasoning was partially mediated (direct effect, $\beta = 0.071$, 95 % CI [0.020, 0.140]; indirect effect $\beta = 0.094$, 95 % CI [0.051, 0.122]), supporting both the latency and pathway models with a small effect size. Similarly, Greenfield et al. (2021) found that the small direct effect of childhood SEP on language/executive function at age 73 (β = -0.07, SE = 0.04, $p > .05$) was far weaker than the large impact of childhood SEP on occupation, income, and education at age 53 ($\beta = 0.60$, SE = 0.04, $p < .001$) and, in turn, the medium association between those adult resources and later-life language/executive function ($\beta = 0.37$, SE = 0.03, $p < .001$). In sum, the extant research consistently suggests that childhood SEP is associated with later-life cognitive functioning, at least partly via adulthood educational attainment, which supports the pathway hypothesis and the latency hypothesis to a lesser degree.

Some aspects of childhood SEP demonstrate persistent, albeit small, independent associations with later cognitive functioning. Specifically, Greenfield and Moorman (2019) examined the association of childhood SEP (i.e., parental education, father's occupation, family income) on memory and executive functioning at age 65 while accounting for SEP in adulthood (i.e., educational attainment, midlife occupation, household income). They found that parental education was the only measure of childhood SEP that remained significantly associated with cognitive functioning after accounting for adulthood conditions. However, using functional magnetic resonance imaging (fMRI) techniques, others have found that parental education was not associated with brain organization and anatomy in later life, although this sample was relatively small ($n = 168$) and included younger adults (age range 20 to 89), which may have contributed to the mixed results (Chan et al., 2018).

Other researchers have tested similar models that distinguished between paternal and maternal education (Luo & Waite, 2005; Lyu, 2015; Lyu & Burr, 2016; Zeki Al Hazzouri, Haan, Galea, et al., 2011). Their results generally indicate that maternal education alone is associated with higher cognitive functioning in older adulthood, in some cases even after accounting for educational attainment and income. These findings may reflect gendered differences in parenting. Specifically, Lyu and Burr (2016) speculated that mothers of today's older adults were likely the primary childcare providers and thus responsible for creating a cognitively stimulating environment. Moreover, research spanning the 1960 s to 1990 s shows that mothers are likely to spend more time with their children than fathers do, and they spend a greater proportion of that time engaged in childcare, whereas fathers spend more time playing with their children (Sayer et al., 2004). Evidence also suggests that highly educated mothers are likely to speak to their young children more than less educated mothers, which fosters vocabulary development (Hoff, 2003). As academic socialization theory suggests (Taylor et al., 2004), highly educated mothers may be better equipped to create home learning environments that enhance early cognitive development, and they are more likely to have the financial resources to do so, leading to lifelong benefits for their children. Collectively, these results demonstrate that it may be possible to leverage educational attainment—among parents and/or adult children—as a protective factor.

The studies that find independent associations between childhood SEP and later-life cognitive functioning support the latency model, although these effects have typically been small. Although β coefficients ranged from 0.07 to 0.71 across all studies reviewed here, most effect sizes were below 0.29. Overall, the support for the latency model was weak. Although many studies found a persistent and significant association between childhood SEP and later-life cognitive functioning even after accounting for adult SEP, these coefficients were considerably attenuated when considering adult SEP variables. Additionally, when authors included multiple indicators of childhood SEP and/or cognitive functioning, some of these associations were no longer significant upon including adult SEP. For example, Greenfield and Moorman (2019) found that accounting for respondents' adult SEP (i.e., education, income, and occupational prestige) rendered the association between childhood household income and later-life language/executive functioning nonsignificant, but the association between highest parental education and language/executive functioning remained significant (though attenuated). In only one study, accounting for respondents' educational attainment did not reduce the size of the coefficient of childhood SEP, yet statistical uncertainty increased (β without education = 0.07, 95 % CI [0.05, 0.08]; β with education = 0.07, 95 % CI [0.02, 0.12]; Marden et al., 2017). Thus, although there is some support for the latency model, it is generally weak.

Overall, the existing evidence supports the pathway model to a greater extent. The strength of the association between childhood SEP and later-life cognitive functioning was far smaller with adult resources in the model (β coefficients ranged from 0.006 to 0.22), suggesting that conditions of adulthood are responsible for a substantial portion of this lifelong link. Further, the magnitude of the indirect effects via adult resources ranged from $\beta = 0.056$–0.362, with total effects (the sum of direct and indirect associations) ranging from $\beta = 0.078$–0.434 across studies. Thus, stronger effects appear when childhood SEP is operationalized as an antecedent of adult status. Educational attainment in adulthood accounts for greater variance in the association between childhood SEP and later-life cognitive functioning than childhood SEP alone (e.g., Everson-Rose et al., 2003). Although less frequently assessed, adult earnings (e.g., Greenfield & Moorman, 2019) and wealth (Glei et al., 2022) may also mediate the relation between childhood SEP and later-life cognitive functioning. Thus, while childhood circumstances play a role in cognitive functioning later in life, so does adult SEP, highlighting other sensitive periods of development (e.g., young adulthood) during which interventions might be especially beneficial for later cognitive performance.

In general, the studies reviewed use measures of childhood SEP at a single time point, although some aspects of SEP, such as household income, are dynamic across the life course. Several of the studies examined how life course social mobility relates to cognitive functioning in older adulthood (Haan et al., 2011; Luo & Waite, 2005; Lyu, 2015; Lyu & Burr, 2016; Marden et al., 2017; Park et al., 2019; Peterson et al., 2021; Zeng et al., 2022). With some variation across studies, researchers generally combined reports from childhood and adult SEP to classify participants by life-course SEP: low stable (low childhood and adulthood SEP), high stable (high childhood and adulthood SEP), downward (high childhood and low adulthood SEP), and upward (low childhood and high adulthood SEP). Across studies, individuals in the high stable group generally perform best on global measures of cognitive functioning, followed by those in the upward mobility group (Luo & Waite, 2005; Lyu & Burr, 2016; Marden et al., 2017; Peterson et al., 2021). In some samples, the high stable and upward groups perform equally well (Haan et al., 2011; Zeng et al., 2022). For instance, among 8,376 respondents ages 65+ at baseline, the strength of the β coefficient comparing the high and upward mobility groups was only 0.03 for mental status and 0.06 for episodic memory (Zeng et al., 2022), indicating a protective effect of achieving higher SEP in adulthood, even when childhood SEP was low.

Findings on downward social mobility are more equivocal as some results show no difference between the low stable and downward groups across global cognitive functioning or episodic memory (Haan et al., 2011). Other work estimating SEP at four time points shows that individuals with downward trajectories outperformed the low stable reference group on episodic memory tasks (β range = 0.08–0.31; Marden et al., 2017), suggesting that access to higher resources during at least one point in the life course is linked to cognitive benefits. Moreover, the difference between respondents with low SEP at all time points and those with low SEP in later life only (i.e., income; $\beta = 0.31$, 95 % CI [0.26–0.36]) was more pronounced than the difference between the stable low group and those with high SEP in later life only ($\beta = 0.13$, 95 % CI [0.08, 0.17]). This indicates that a decline in SEP over the life course may not have as detrimental an impact on cognitive functioning as experiencing early-life disadvantage alone. All studies suggest that the low stable group generally performs worst on cognitive tests, and Zeng et al. (2022) found this association was stronger for Black respondents compared to Whites across mental status (Black: $\beta = -0.45$; White: $\beta = -0.30$) and episodic memory (Black: $\beta = -0.41$; White: $\beta = -0.24$). Together, these findings suggest that upward social mobility may compensate for early-life disadvantage, at least regarding later-life cognitive functioning.

This body of work is consistent with the *accumulation hypothesis* in that the advantages conferred from financial and educational resources build across the life course; the individuals who consistently experienced advantage (i.e., high stable SEP) generally experience the highest cognitive functioning in older adulthood. By comparison, disadvantages also accumulate longitudinally; those who consistently had the fewest resources (i.e., low stable SEP) generally perform worse on cognitive tests as older adults. When comparing stable high and low groups, β coefficients range from 0.12 to 0.56, indicating substantial variability in the strength of effect sizes across studies. In sum, when considered together, the existing literature on the association between childhood SEP and cognitive functioning in older adulthood supports all three major hypotheses—*latency*, *pathway*, and *accumulation*—with the strongest support for the *pathway* and *accumulation of (dis)advantage hypotheses.*

Domains of cognitive functioning

Most studies examining the linkages between childhood SEP and later adult cognitive functioning have relied on global measures of cognitive functioning. Consequently, it is unclear whether childhood SEP impacts later-life cognitive functioning as a whole or differentially depending on the cognitive domain. Although limited, the available evidence from studies that distinguished among cognitive domains suggests that the influence of childhood SEP varies. For instance, some findings convey that low childhood SEP is more strongly associated with later adult working memory capacities (e.g., maintaining and manipulating information) than episodic memory capacities (i.e., immediate and delayed recall; Greenfield & Moorman, 2019; Liu & Lachman, 2019; Marden et al., 2017). In other work (i.e., Beck et al., 2018), direct effects between childhood SEP and domains of later-life cognitive functioning—episodic memory ($\beta = 0.004$), processing speed ($\beta = 0.029$), verbal fluency ($\beta = 0.001$), working memory ($\beta = 0.021$), visuospatial ability ($\beta = 0.046$), and global performance ($\beta = 0.006$)—were small and fully explained by early- and midlife factors, viz., cognitive ability at age 20, educational attainment, occupation, and engagement in cognitively stimulating activities at age 56 (indirect effects $\beta = 0.056$ to 0.094); only the direct association between childhood SEP and abstract reasoning at age 62 ($\beta = 0.071$) remained significant after accounting for these mediating factors. However, Jefferson et al. (2011) found that childhood SEP was more strongly associated with semantic memory ($\beta = 0.322$) compared to episodic memory ($\beta = 0.156$), visuospatial ability ($\beta = 0.206$), working memory ($\beta = 0.215$), perceptual speed ($\beta = 0.215$), or global cognition (a composite of five cognitive domains; $\beta = 0.255$). Thus, further research is needed to assess domain-specific links between childhood SEP and later cognitive functioning, including whether variations in measurement and/or participant characteristics are responsible for these mixed findings.

Cognitive decline in older adulthood

Cognitive functioning decline during older adulthood is normative, although there is considerable variation in the timing and degree of change (Wilson et al., 2020). Compared to the evidence amassed when measuring cognitive functioning at a single time point, the findings connecting childhood SEP to the rate of cognitive decline in later life are less clear. Some researchers have found that low childhood SEP may accelerate cognitive decline (Brewster et al., 2014; Liu & Lachman, 2019; Lyu & Burr, 2016; Marden et al., 2017; Melrose et al., 2015; Oi & Haas, 2019), whereas other studies do not support that conclusion (Everson-Rose et al., 2003; González et al., 2013; Greenfield & Moorman, 2019; Park et al., 2019; Reynolds et al., 2022; Wilson et al., 2005). In both cases, effect sizes are small, with a maximum of $\beta = 0.097$ across studies. As with absolute cognitive functioning, some researchers have found that the adult SEP measures substantially or entirely attenuate the relation between childhood SEP and adult cognitive decline. When testing the link between SEP in childhood and the slope of cognitive decline, β coefficients range from 0.005 to 0.097 without adult resources in the model, and from 0.003 to 0.074 after accounting for the conditions of adulthood. Again, this pattern suggests that childhood SEP may diminish adult cognitive functioning via reduced midlife educational attainment and income earnings (Brewster et al., 2014; Lee et al., 2003; Oi & Haas, 2019).

Notably, it is plausible that prior research has not examined a long enough period to detect disparities in cognitive decline. For instance, only three years passed between data collections in one study (Wilson et al., 2005). Such a relatively short span of time may be insufficient to detect a meaningful change in adult cognitive functioning. However, the precise threshold at which an effect might be detected is unclear due to a lack of research and mixed results in the literature. For instance, using a global measure of cognitive functioning from the HRS, Oi and Haas (2019) detected differences in cognitive decline by the level of childhood SEP over a six-year observation period, whereas research analyzing a seven-year period in the Wisconsin Longitudinal Study (WLS) that also used a global measure of cognitive functioning did not reveal differences (Greenfield & Moorman, 2019). Whether these differences emerged due to measurement approaches (Greenfield & Moorman included a measure of childhood household income, whereas Oi & Haas did not) or to sampling (the HRS includes a wide age range, whereas the WLS focuses on a single cohort of older adults) is unknown. Ultimately, whether childhood SEP is associated with cognitive decline is equivocal, and future research is needed.

Summary

We reviewed 29 studies examining whether and how childhood SEP is associated with cognitive functioning in older adulthood. Most support the *pathway hypothesis*, suggesting that childhood SEP works primarily through the mechanism of adult SEP, with adult SEP fully or partially mediating the association between childhood SEP and later-life cognitive functioning. In childhood and adulthood, SEP was most often assessed via educational attainment, highlighting the role of parents and one's own years of formal schooling. Second, several studies support the *accumulation of (dis)advantage hypothesis* and point to the compensatory potential of upward social mobility. Third, support for the latency model is present and consistent, although relatively weaker. The existing evidence suggests that parental education, in particular, may be uniquely and independently associated with later-life cognitive functioning.

Although at first glance these collective results may appear to suggest that childhood SEP is weakly or unrelated to later cognitive functioning, we caution against such interpretations. In fact, this literature speaks to the promise of educational attainment and upward social mobility throughout adulthood as protective factors *despite* childhood disadvantage. Significant barriers to upward mobility exist, and the intergenerational cycle of poverty is well-documented (McEwen & McEwen, 2017). Those unable to experience upward mobility (i.e., the stable low SEP groups found in some of the reviewed articles) may fare worse in cognitive functioning in older adulthood. Taken together, the findings point to the importance of strengthening policies aimed at educational equity, providing resources to families to promote school attendance and achievement, and helping young adults pursue and afford additional education.

Limitations of the literature and future directions

Several limitations are relevant to the study of childhood SEP and later-life cognitive functioning. We hope that drawing attention to these limitations will galvanize research addressing these concerns and thereby strengthen the work in this area. Most studies in this review rely on retrospective reports of childhood SEP. Retrospective reports are informative, but they are susceptible to recall bias and/or inaccurate perceptions from a child's perspective, particularly when including Children of the Depression (birth year 1924 to 1930) who may have distorted perceptions of economic hardship given the nationwide prevalence of poverty in their early years (Luo & Waite, 2005). Additionally, self-report measures give the impression that SEP is static without differentiating between temporary and chronic disadvantage effects. Accordingly, prospective longitudinal work, although costly and time-consuming, would improve the validity of the predictors in this body of literature.

That is not to say all the studies reviewed here have relied on retrospective accounts. On the contrary, three studies used WLS data, including objective household income in participants' family-of-origin as reported on their tax filings. Although tax filings are an improvement to the retrospective accounts regarding measurement error, these measures are more indicative of SEP in young adulthood than early childhood: One study averaged four years of parental income when most participants were 18 to 22 (Greenfield & Moorman, 2019), and another included a single-year indicator when the participants were 18 years of age (Zhang et al., 2020). For a more robust and conclusive testing of the latency hypothesis, it is important to collect data in early childhood, a critical developmental period in which the negative consequences of economic hardship can have lasting effects on adult cognitive functioning (Ben-Shlomo & Kuh, 2002). If the challenges of longitudinal prospective measures are insurmountable, objective measures of financial resources in childhood are sorely needed.

A related limitation is the dearth of studies that account for childhood cognitive ability, which is not feasible in retrospective data. However, evidence suggests that cognitive abilities are linked across the life course. For instance, Gow et al. (2011) found strong correlations between cognitive abilities at age 11 and age 87, ranging from 0.51 to 0.61, and Deary et al. (2012) estimated that genetic factors were responsible for approximately one-quarter of the variance in cognitive change from age 11 to 79. Moreover, childhood cognitive functioning, such as intelligence and working memory capabilities, has been shown to correlate positively with occupational prestige and financial well-being during late adulthood, in part by supporting academic success earlier in life (Alloway & Alloway, 2010; Cheng & Furnham, 2012; Furnham & Cheng, 2017). This limitation curtails our ability to identify the unique contribution of childhood SEP to later-life cognitive functioning.

Nevertheless, two studies demonstrate valid and innovative paths for others to follow. First, the Vietnam Era Twin Study of Aging obtained assessments of cognitive ability that veterans completed at their entrance to the military in young adulthood. With these data, Beck et al. (2018) found a significant indirect effect between childhood SEP and later-life cognitive functioning via cognitive performance at age 20; higher childhood SEP was related to higher cognitive functioning at age 20, which was associated with higher cognitive functioning in later life. Second, using archival results of statewide standardized tests that Wisconsin high school students used to complete, Zhang et al. (2020) also found that adolescent cognitive ability, as well as educational attainment, mediated the association between childhood SEP and cognitive functioning in adulthood. Additionally, they estimated the direct effect of adolescent cognitive ability on global cognitive functioning (i.e., memory, abstract reasoning, and verbal fluency) in older adulthood to be nearly eight times stronger than the direct effect of childhood SEP on later cognitive functioning. Taken together, this work suggests that researchers should account for early cognitive ability in estimations of later cognitive functioning but, to our knowledge, these are the only studies to do so in the literature on childhood SEP and later-life cognitive functioning. Nevertheless, class-based economic disparities in cognitive ability are likely to be evident as early as kindergarten (Quinn, 2015). Therefore, future research should prioritize including measures of early childhood cognitive ability.

Sampling limitations also exist across the literature that limit the generalizability of the findings. First, several study samples reviewed here are racially homogenous, sometimes without non-White participants (Beck et al., 2018; Greenfield & Moorman, 2019; Zhang et al., 2020). As such, some research would be more accurately described as examining the association between childhood SEP and cognitive functioning in White older adults. Those in poverty in the United States are disproportionately likely to be Black and/or Latinx (Cellini et al., 2008), and the compounding effects of chronic class- and race-based discrimination may result in a higher allostatic load and, in turn, lower cognitive functioning (Evans & Kim, 2013; McEwen & Gianaros, 2010). Early-life predictors, including childhood SEP, may partially explain persistent racial disparities in cognitive functioning in the United States (Zahodne et al., 2017). For instance, in a sample of self-identified non-Latinx Black and White respondents, the inclusion of childhood SEP significantly reduced racial disparities in cognition between groups, whether measured as a global score (11–14 % reduction) or as episodic memory (9–13 % reduction) and executive function (11–14 % reduction; Glei et al., 2022). In other samples, the impact of childhood SEP on later-life cognitive functioning manifests differently across participants from different racial (Zeng et al., 2022) and ethnic backgrounds (Zeki Al Hazzouri, Haan, Galea, et al., 2011).

Results from Reynolds et al.'s (2022) study also suggest that geographic factors might place some older adults at greater risk given that non-Hispanic Black participants in the HRS who lived in the South as children had the lowest levels of baseline cognitive functioning and all respondents who lived in the South as children experienced steeper declines in cognitive functioning over six years than those who did not live in the South. On the other hand, cultural strengths such as intentional kin, connections to extended family members, and community embeddedness may serve a protective role (Stein et al., 2015), especially among Latinx individuals, but have yet to be included in research on SEP and its associations with late life cognitive functioning. In sum, more research with non-White samples is essential, as is research that examines additional risk and protective mechanisms.

In addition to methodological and sampling limitations, there are some conspicuous gaps in the literature that should be addressed in future work. The studies we reviewed provide compelling evidence that educational attainment promotes cognitive functioning in older adulthood. Namely, several studies suggest that high school completion or beyond is protective (Faul et al., 2021; Hale, 2017; Lee & Schafer, 2021; Marden et al., 2017). Further, Marden et al. (2017) found that the link between high school graduation and memory performance was stronger ($\beta = 0.19$, 95 % CI [0.15, 0.22]) than the impact of college graduation ($\beta = 0.08$, 95 % CI [0.03, 0.12]) or adult income ($\beta = 0.13$, 95 % CI [0.08, 0.18]). Other work indicates that pursuing at least some higher education benefits late-life cognitive functioning compared to respondents with a high school diploma or less (Peterson et al., 2021). The inclusion of years of education as it is commonly operationalized, however, is an imprecise metric that masks differences in educational quality. School quality varies considerably, and children residing in lower-income areas are more likely to attend poorly performing schools with fewer resources (McLoyd, 1998) and less experienced teachers (Gagnon & Mattingly, 2015). Although research on the implications of school quality for children's learning is still emerging and being debated (Downey et al., 2019), some research suggests that college attendance is associated with earlier school quality (Jennings et al., 2015). Moreover, past work suggests that among high school students with lower class ranks, secondary school quality is positively associated with baseline executive functioning at age 65 (Moorman et al., 2019). However, more advantaged students are likely to attend more advantaged schools across their childhoods, and class-based disparities in academic achievement may already be evident by high school. Additionally, examining school quality in secondary school alone does not account for high school dropouts, who are disproportionately likely to be poor and Black or Latinx (Cellini et al., 2008; McLoyd, 1998). Thus, future research should examine whether preschool, elementary, middle, and high school quality moderates the association between childhood SEP and later-life cognitive functioning.

Identifying factors above and beyond educational attainment that might protect later-life cognitive functioning among children from low-SEP households is particularly important. Several studies provide paths for researchers to follow and extend. Examining the role of parenting style, Liu and Lachman (2019) found that high paternal discipline was protective for later-life executive functioning among respondents from low-SEP households in childhood, although neither maternal discipline nor the affection of either parent was associated with later cognitive functioning. In other work, researchers found that perceiving one's childhood family environment to be happier was indirectly associated with better global cognitive functioning via various adult resources (Lee & Schafer, 2021). In particular, adult mastery accounted for 43.68 % of the indirect effect, adult social connectedness accounted for 22.89 %, adult health accounted for 19.86 %, and educational attainment accounted for 13.56 %. Taken together, these results suggest that the family context may be a critical avenue for intervention.

To build on these findings, researchers should consider the role of cultural context, as evidence suggests that children's perceptions of parental discipline are culturally guided (McHale et al., 2005). A greater emphasis on family and cultural contexts would provide further knowledge in this area. Although we limited our focus to studies using samples from the United States, a global literature exists on the associations between childhood SEP and cognitive functioning. This literature draws primarily from samples in Western Europe, China, Japan, India, and Latin America, and generally reports similar findings, such that older adults who experienced lower SEP as children have worse cognitive functioning later in life. Indicators of SEP, however, vary considerably based on regionally specific contexts. For example, studies in Latin American, the Caribbean, and India rely on indicators of urban or rural residence in childhood as one marker of childhood SEP (Nguyen et al., 2008; Zhang et al., 2018) due to marked differences in educational attainment (or opportunities to complete any formal schooling) and family financial wellbeing. Taken together, findings from our review and evidence from international contexts suggest that global policies to increase children's socioeconomic stability and standing would likely lead to long-term cognitive benefits in their later years.

Despite evidence that parental conflict is negatively associated with children's cognitive ability (Conger et al., 2010), no studies to date address the possible moderating role of parents' relationship quality. Relatedly, it is important to identify the specific aspects of parental education that predict later-life cognitive performance. Is parental education influential because it confers resources, such as better nutrition, cognitive stimulation, and financial stability in early childhood?

This body of literature would also benefit from a deeper exploration of gender as a potential moderator. Importantly, research suggests that gender is salient to cognitive aging as average performance on cognitive tasks (Langa et al., 2009) and antecedents of dementia differ between men and women (Nebel et al, 2008). Gender also moderates the association between childhood SEP and other later-life outcomes, including depressive symptoms (von Arx et al., 2019) and sleep health (van de Straat et al., 2018). Among the few studies reviewed here that investigated gender, however, conclusions are mixed. Whereas Everson-Rose et al. (2003) found that gender did not moderate the association between childhood SEP and later-life global cognitive functioning, Lyu (2015) found that various components of childhood SEP were differentially important for men's and women's later cognitive functioning. Specifically, comparing 5,544 women and 3,863 men ages 65 and older, results suggested that maternal education was associated with episodic memory performance for women only, whereas paternal occupation (white-collar vs. blue-collar) was associated with episodic memory scores among men only (Lyu, 2015). Additionally, the magnitude of the positive association between episodic memory and accumulated SEP across childhood, young adulthood (educational attainment), and older adulthood (household income) was significantly stronger among men ($\beta = 0.169$) compared with women ($\beta = 0.108$). Given that several studies reviewed here suggest that maternal education may be uniquely and directly related to later-life SEP, future work will help clarify whether this moderation by respondents' gender holds in other samples, and if so, why. Future work should also address how gendered aspects of SEP might change over time alongside women's labor participation and men's involvement in childrearing (Cabrera et al., 2018).

Moreover, across the life course, women experience lower social status and higher barriers to economic resources relative to men, which are linked with health disparities in older adulthood (Denton et al., 2004; Read & Gorman, 2010). For many of today's older women with less access to educational attainment, high earnings, or prestigious occupations, their husbands may have been key to maintaining or achieving high SEP in adulthood. Only one study reviewed here parses out the unique contribution of husbands' SEP among women, finding no association between husband's education and decline in women's global cognitive functioning (Lee et al., 2003). However, as the sample was entirely comprised of registered nurses, all participants had, by definition, obtained a post-secondary education. It remains to be seen how this association may differ among women without paid employment or with less educational attainment.

Additionally, future research on the significance of childhood health status would expand this knowledge base. Childhood disadvantage is positively associated with various health problems, which may relate to school absences and long-term cognitive deficits (McLoyd, 1998). Using HRS data, Luo and Waite (2005) found that self-rated childhood health explained a significant portion of the variance in the association between childhood SEP and later cognitive functioning. However, the limitations of data available in the HRS at that time precluded the inclusion of more specific measures of childhood health. Future research should examine specific conditions that might relate to cognitive functioning in childhood and older adulthood.

Although beyond the scope of the present review, an emerging literature examines the relation between childhood SEP and Alzheimer's disease (AD) or other dementias (George et al., 2020; Moceri et al., 2001; Tom et al., 2020; Zeki Al Hazzouri, Haan, Kalbfleisch, et al., 2011). Critical to understanding AD, a small subset of this literature examines how genetic factors interact with childhood SEP in terms of later cognitive functioning. The association of the apolipoprotein E (APOE) ε4 allele and AD is well-documented (for a review, see Huang & Mahley, 2014), although there is heterogeneity in the trajectories of cognitive functioning even among APOE ε4 carriers. Examining the possibility of a gene-by-environment interaction, Moceri et al. (2001) found that low childhood SEP alone did not increase one's odds of developing AD, but those odds increased significantly when low childhood SEP was experienced in conjunction with genetic risk factors. Further, Moorman et al. (2018) found a significant interaction between APOE ε4 status and childhood SEP, with participants who carried the APOE ε4 allele and who had low childhood SEP exhibiting worse episodic and working memory performance than non-carrier participants or carrier participants with advantaged childhood SEP. In short, given evidence that the risk of low childhood SEP with a simultaneous genetic predisposition for AD may be greater than each risk factor on its own, additional research would illuminate how childhood disadvantage intersects with genetic determinants of cognitive functioning and decline.

Several of the studies we reviewed here account for birth cohort (e.g., isolating children of the Great Depression; Hale, 2017) or defining life trajectory events (e.g., active military service; Vable et al., 2018) in accordance with the life course perspective assumption that shared life events might impact individuals in similar ways to one another but differently than those who did not experience them. Research on the future old will need to consider the timing of such wide-scale events as the global COVID-19 pandemic on cognitive functioning. Will cohorts who experienced the pandemic at important developmental periods, which we argue extend beyond early childhood to include adolescence, early young adulthood, midlife, and the transition to retirement have different profiles of cognitive performance and change over time than those who experienced the pandemic at a different point in the life course? Emerging evidence suggests that some individuals diagnosed with COVID-19 experienced cognitive symptoms (Delgado-Alonso et al., 2022) and that the social and emotional difficulties experienced during the pandemic may influence cognitive performance (e.g., Edwards et al., 2022). It remains unknown whether the pandemic generally or contracting COVID-19 specifically will have long-term effects on cognitive performance among a significant segment of older adults (now or in the future).

Finally, more needs to be known about the unique experience of childhood *poverty*, not only low childhood SEP. Children who live in poverty may face unique adverse challenges, including food insecurity (Thomas et al., 2019), housing insecurity (Masten et al., 2014), environmental toxins (Evans, 2004), trauma, and discrimination (Fuller-Rowell et al., 2012). Furthermore, it is possible that children who experience persistent poverty or a severe depth of poverty may be at a greater disadvantage than children who face temporary economic hardship. Future research should examine whether there is a double-jeopardy or cumulative effect of experiencing multiple adverse correlates of poverty, such as harsh parenting and hunger. Therefore, it is critical for researchers to sample participants who spent time living below the official poverty threshold. We call on researchers and funders to leverage the potential to continue following the children currently enrolled in studies examining families at risk of poverty and low income (e.g., the Future of Families and Child Wellbeing Study; the Study of Early Child Care and Youth Development).

Conclusion

Overall, this review demonstrates a consistent relation between SEP in childhood and lower cognitive functioning in older adulthood. Of the various operationalizations of childhood SEP, parental education seems to uniquely and independently predict later cognitive functioning and is one of the most commonly used indicators of SEP. However, the strongest path from childhood SEP to later cognitive functioning seems to operate primarily through adult educational attainment. Additionally, several studies suggest that upward social mobility may protect individuals from the harmful effects of childhood disadvantage on later cognitive functioning. The *latency, pathway,* and *accumulated (dis)advantage hypotheses* aid in our understanding of disparities in cognitive functioning across the life course, although more work is needed to explain the nuances of these associations, including the contributions of genetic, health, and familial factors.

The literature examining the long arm of childhood disadvantage among U.S. samples is growing. As researchers look to the future, we recommend braving the challenges of prospective longitudinal studies, which would necessarily span multiple generations of research labs. In the absence of prospective studies, objective and more comprehensive measures of SEP and cognitive functioning would greatly strengthen the field.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors. The first author's work is supported in part by the International Chapter of the P.E.O. The second and third authors are supported through their institutional appointments and did not receive additional funding specific to this work.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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