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The Role of Economic Status and Environmental Factors in Early Childhood Cognitive Development: Systematic Literature Review and Bibliometric

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Abstrak

Low socioeconomic status (SES) significantly affects adolescents' cognitive development, influenced by factors like stress, parental education, and limited resources. This study explores themes and publication trends related to SES and cognitive development using a systematic literature review (SLR) and bibliometric analysis (BA). Data from Scopus were analyzed with VOSviewer and Microsoft Excel. A total of 26 peer-reviewed articles were reviewed using statistical methods. Findings show that variables like BMI, household income, parental education, brain structure, and family background positively correlate with cognitive development. In contrast, depression, trauma, puberty, and disciplinary history negatively impact it. Bibliometric analysis reveals a shift from general child development research to more focused areas like executive function and prenatal influences, showing strong ties between SES and cognitive development.

1. INTRODUCTION

According to data from the U.S. Census Bureau in 2017, approximately 38.8% of children in the United States live in low socioeconomic status (SES) conditions, ranging from deep poverty to low income (Gonzalez, 2020). SES, often measured through family income, parental education, and access to resources, has been consistently linked to various outcomes in children's cognitive development. Children from low-SES backgrounds tend to perform more poorly in cognitive and academic tasks compared to peers from more affluent environments. Moreover, low SES in childhood is associated with elevated risks for physical and mental health problems in adulthood.

A growing body of research highlights significant associations between SES and both global and regional brain structures in children. Environmental factors such as exposure to chronic stress, food insecurity, and lack of stimulation contribute to these developmental disparities. Understanding how SES influences brain and cognitive development requires a comprehensive bio-psycho-social-ecological approach. Such a model considers the complex interactions between a child's biological makeup and the surrounding environmentincluding social support systems that may buffer against the adverse impacts of low SES on development (Gonzalez, 2020).

Environmental conditions that affect adolescent brain development and psychopathology are varied. These include prenatal complications such as low birth weight and preterm delivery, parental factors such as maternal psychopathology and substance use, socioeconomic status, and broader social environments like schools and home settings (Qiu, 2023). Most studies tend to examine these variables in isolation, despite their high intercorrelation, making it difficult to determine which factors contribute most significantly to neurodevelopmental outcomes. There is a clear need for more integrative research that explores the interaction between environmental and genetic variables in influencing brain and mental health development during adolescence.

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Working memory is considered a core element of human cognition. Baddeley's multicomponent model defines working memory as the ability to hold information "online" during thinking processes. It supports short-term memory retention and ongoing processing and is closely linked to executive functions, particularly in the upper cortical areas such as the prefrontal cortex (PFC). Numerous studies indicate that working memory plays a crucial role in cognitive tasks, mathematical ability, and academic performance, serving as a major determinant of educational success in children. Children from higher SES backgrounds tend to demonstrate stronger working memory and academic achievement, likely due to more enriched environments and reduced exposure to chronic stress. Conversely, children from low-SES households are at greater risk for suboptimal brain development, which can impair memory, emotional regulation, learning capacity, and increase vulnerability to psychopathology (Akhlaghipour, 2020).

Socioeconomic status and parenting behaviors also play a significant role in shaping children's ability to control impulses. In a study involving 147 children aged 7–10 years, Cabello et al. explored the relationship between parental education level, impulse control (IC), and aggressive behavior in children. Teachers rated children's aggressive behavior using the Teacher Rating Scale (TRS) from the Behavior Assessment System for Children 2 (BASC-2), while children completed a go/no-go task to assess IC, and parents reported their education levels. The findings revealed that lower parental education and lower IC scores predicted higher levels of aggression in children. Interestingly, impulse control was found to partially mediate the relationship between parental education and aggressive behavior, particularly among boys (Assari, 2020).

One of the brain regions most sensitive to SES is the orbitofrontal cortex (OFC), which is involved in cognition, learning, memory, and decision-making. OFC function is closely tied to cognitive performance and can be influenced by both stress and socioeconomic context. Individuals with underdeveloped OFC structures tend to show deficits in learning and memory. A growing number of studies have demonstrated that factors such as race, SES, and chronic stress influence OFC morphology and functioning. Dysfunction in this region has also been associated with a range of psychiatric conditions, including dementia, Alzheimer's disease, psychosis, PTSD, depression, and substance use disorders. Therefore, understanding the impact of low SES on brain development is crucial to explaining why adolescents from economically disadvantaged families often exhibit poorer developmental outcomes, academic achievement, emotional regulation, and mental health (Assari et al., 2021).

Recent research using large-scale datasets like the Adolescent Brain Cognitive Development (ABCD) study has explored the relationships among body mass index (BMI), brain structure, and cognitive function in adolescents. Findings indicate that higher BMI is associated with reduced thickness in the prefrontal cortex and poorer executive functioning. Furthermore, low SESparticularly in terms of environmental disadvantageis linked with lower cognitive scores and reductions in frontal brain structures. These outcomes suggest that targeted interventions aimed at increasing access to nutritious food and opportunities for physical activity in low-income communities could help mitigate SES-related developmental disparities (Dennis et al., 2022).

Despite these insights, no study has yet comprehensively examined adolescent cognitive development in relation to SES using the ABCD dataset through a combined systematic literature review (SLR) and bibliometric analysis (BA). This study addresses this gap by exploring the thematic structure and publication trends in Scopus-indexed journals published between 2020 and 2024, specifically focusing on research that investigates the relationship between adolescent cognition and SES factors. The analysis aims to identify major trends, structural patterns, and research gaps to inform future studies in this domain.

From this analysis, five research questions (RQs) are proposed:

RQ1: Can cognitive development be enhanced to improve socioeconomic outcomes in adolescents?
RQ2: Which countries and institutions contribute most to publications on cognition and SES?
RQ3: Which journals are the primary sources for publishing studies on cognition and SES?
RQ4: What are the thematic trends in publications related to cognition and SES?
RQ5: Who are the most influential contributors to research on cognition and SES?

The combined approach of SLR and BA provides a robust framework for analyzing both the content and metadata of existing studies. SLR enables systematic content review, while BA facilitates performance analysis, science mapping, and network analysis of scholarly outputs (Donthu et al., 2021). These methods, when used together, can generate predictive insights about future trends and offer a roadmap for future cognitive development research in the context of SES.

Each research question is based on core features of SLR and BA methodology. RQ1 reflects the content-focused characteristics of SLR by exploring whether cognitive improvements can drive upward social mobility. RQ2 and RQ3 represent the performance analysis aspect of BA, identifying leading countries, institutions, and journals. RQ4 addresses science mapping by highlighting shifts in thematic focus over time, and RQ5 emphasizes the network analysis dimension by examining influential scholars and collaborations in the field. Together, these RQs support a comprehensive understanding of the evolving academic landscape concerning SES and adolescent cognitive development.

2. METHODOLOGY

The data in this study were obtained from the Scopus database, accessed on October 19, 2024. This literature review was conducted by identifying journal articles related to the theme of cognitive development in adolescents influenced by socioeconomic status (SES). The initial search was performed via Google Scholar using the keywords: "socioeconomic status" AND "cognitive development" AND ("children" OR "early childhood"), with the inclusion criteria being: (1) articles published within the last five years (2020–2024),(2) written in English, and (3) fully accessible in full-text format.

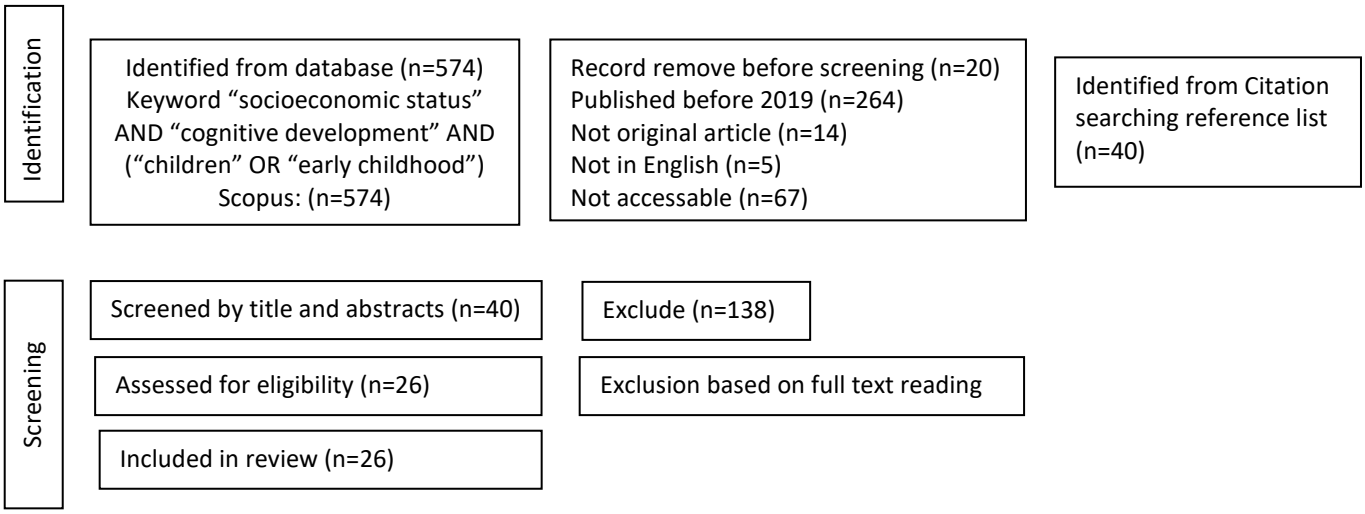

Figure 1. PRISMA Flowchart

The search yielded 574 international journal articles. After screening titles and abstracts using inclusion criteriaspecifically that (1) the article focused on adolescent cognitive development influenced by SES, and (2) used data from the Adolescent Brain Cognitive Development (ABCD) study a total of 26 relevant peer-reviewed journal articles were selected for this review. After determining the relevant research topic and identifying keywords (Figure 2), the data were exported in CSV format. These data were then analyzed using VOSviewer and Microsoft Excel. An additional content analysis was also conducted. Findings were presented using visual aids such as figures, graphs, and tables. All retrieved data were refined, organized, and selected using Excel.

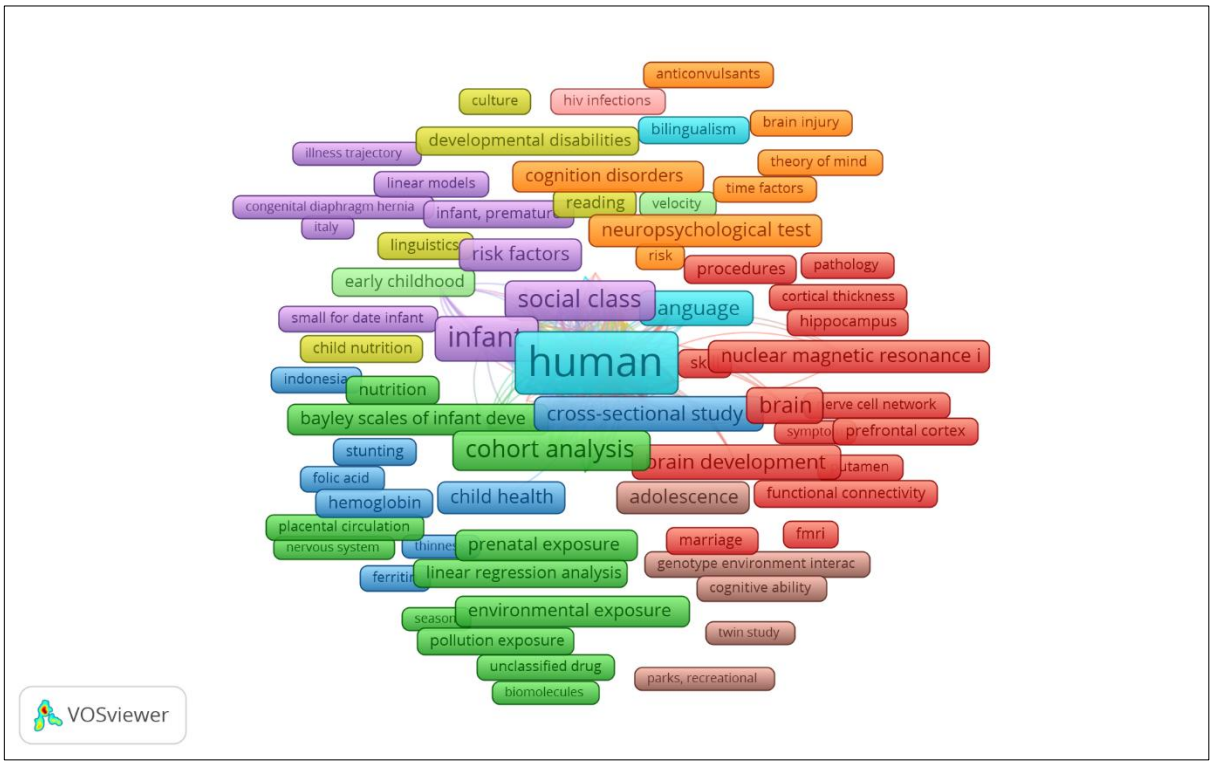

Figure 2. Keywords

This study constructed visual maps using VOSviewer and conducted content analysis using Consensus. Data extraction involved identifying publications and Scopus-indexed journals relevant to the topic (Figure 1). Only peer-reviewed articles were included in the analysis; letters, editorials, conference proceedings, and short communications were excluded. The 26 selected publications were independently reviewed by the researchers to ensure reliability. Final selections were made after reaching consensus among the research team. These articles formed the primary source for analysis.

Statistical and Bibliometric Analysis

The 26 selected publications were analyzed in terms of topic, journal, contributing institutions, key concepts, methodologies, and suggestions for future research. This study employed bibliometric analysis, applying mathematical and statistical approaches to examine relevant literature across disciplines, including education (Budd, 1988; Adams, 2009; Diem & Wolter, 2013; Nylander et al., 2020). The VOSviewer software (version 1.6.20) was used to perform bibliometric mapping. VOSviewer is a freely available tool for constructing and visualizing bibliometric networks. Unlike most bibliometric software, VOSviewer places strong emphasis on graphical representation and interpretation of large bibliometric maps, which makes it particularly effective for analyzing complex publication data (van Eck & Waltman, 2010). It was especially helpful for visualizing metadata such as bibliographic coupling and co-authorship networks.

3. RESULT AND DISCUSSION

Based on the analysis of 26 selected peer-reviewed articles, all studies utilized data from the Adolescent Brain Cognitive Development (ABCD) study. The research subjects across these articles were adolescents who participated in the ABCD study, with each article examining cognitive development in adolescents under varying socioeconomic-related variables.

Among the analyzed studies, several variables were found to have positive correlations with adolescent cognitive development. These include body mass index (BMI), socioeconomic status (household income, highest parental education, and living environment), brain structure, race, ethnicity, and parental marital status. In general, higher cognitive performance in adolescents is associated with more favorable conditions in these variables. In contrast, psychological conditions (such as depression, trauma, and aggression), pubertal timing, and disciplinary history were negatively correlated with cognitive development, suggesting that lower cognitive performance is associated with increased prevalence of these risk factors.

Figure 3 presents the network map generated using VOSviewer, which visualizes the relationships between keywords and concepts extracted from the bibliometric analysis. In this network, each node represents a keyword or concept from the literature. The size of a node reflects the frequency of the keyword's appearance across publications, with larger nodes indicating higher usage. Color denotes thematic clusters, while linkages between nodes represent co-occurrence relationships; the thicker the line, the stronger the relationship.

Three primary thematic clusters were identified: (1) Green cluster (Socioeconomic and Cognitive Development): Includes keywords such as socioeconomic, working memory, education, and executive function. This cluster focuses on the influence of socioeconomic factors on brain function and cognitive development, particularly in relation to executive functioning and memory, (2) Blue cluster (General Child Research and Controlled Studies): Encompasses keywords like child, human, controlled study, and cognitive development. This theme relates to general child development studies and the application of controlled research designs, (3) Red cluster (Infant and Early Development): Includes terms such as infant, preschool child, gestational age, and pregnancy. This cluster emphasizes early developmental stages, including prenatal and postnatal influences on childhood development.

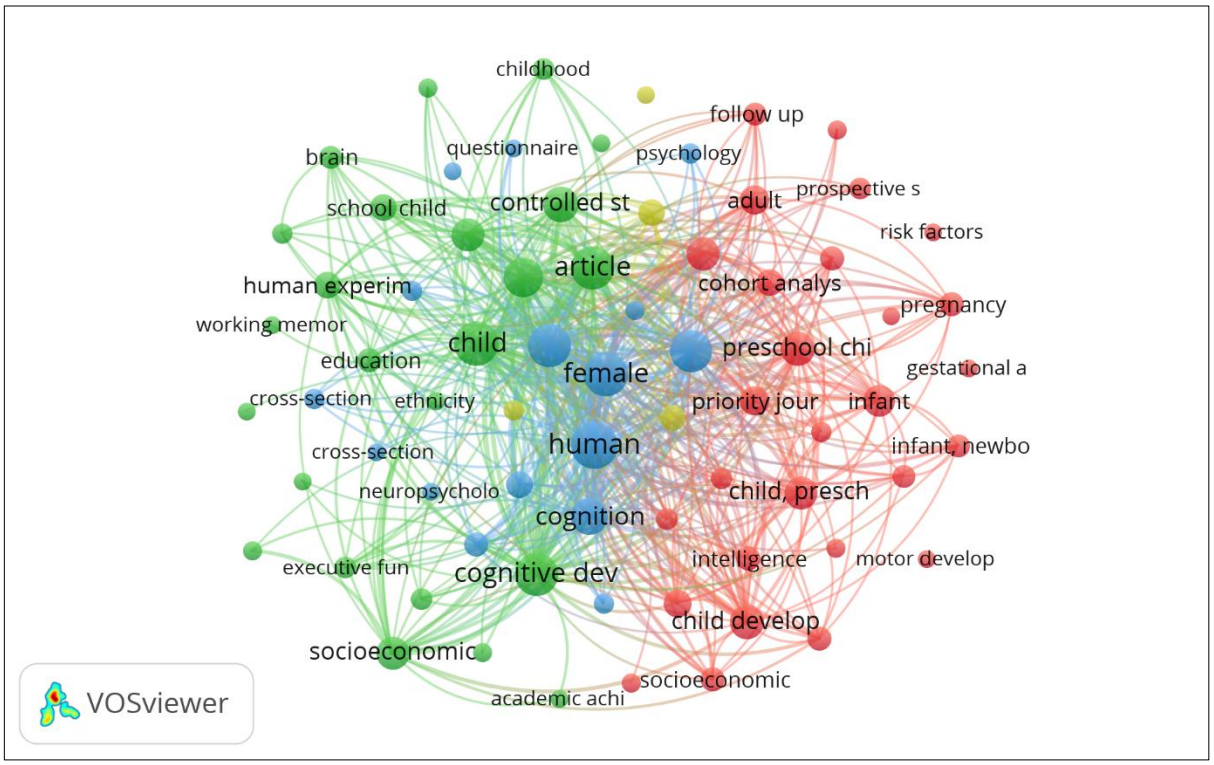

Figure 3. Linkages and Cluster Theme

Figure 3 illustrates the interconnectedness of these clusters, indicating a comprehensive view of how socioeconomic, biological, and environmental factors interact in shaping developmental outcomes. The inter-cluster connections reflect an integrated understanding of adolescent development across different stages and domains. In addition, Figure 4 presents an overlay visualization from VOSviewer, mapping keyword relationships based on publication timelines. Each node is colored according to the average year of publication, using a gradient from blue (older, ~2012) to yellow (newer, ~2020).

Older Keywords (Blue to Green, ~2012–2016): Dominated by foundational research topics such as child development, infant, cognition, and socioeconomic. The prevalence of blue-colored nodes suggests that early studies primarily focused on classical themes such as general developmental processes, socioeconomic impact, and traditional research designs. Middle-Aged Keywords (Green to Yellow-Green, ~2016–2018): Represent a transition phase with increasing attention to topics like working memory, executive function, and neuropsychology. These studies began to bridge earlier developmental themes with more specific cognitive domains, often intersecting with themes of education and cross-sectional research. For instance, Hyde et al. (2022) found that socioeconomic status interacted with parenting behaviors, particularly warmth and monitoring, in predicting adolescent cognitive control—highlighting a shift in thematic focus toward specific executive processes in the middle period.

Recent Keywords (Yellow, ~2018–2020): Mark the emergence of newer research directions, indicated by yellow-colored nodes such as psychology, follow-up, questionnaire, and pregnancy. These trends signal a growing interest in methodological tools and prenatal influences in cognitive development. Moreover, a 2024 BMC Pediatrics cohort study revealed that low prenatal SES adversely affected early executive function in children aged 3–5, reinforcing the emerging emphasis on prenatal influences in recent research. Overall, the evolution of research focus from general child development toward specific cognitive processes and prenatal influences reflects a maturing body of literature. The integration of socioeconomic variables with neurodevelopmental, psychological, and environmental factors highlights the multidimensional nature of cognitive development research in adolescents.

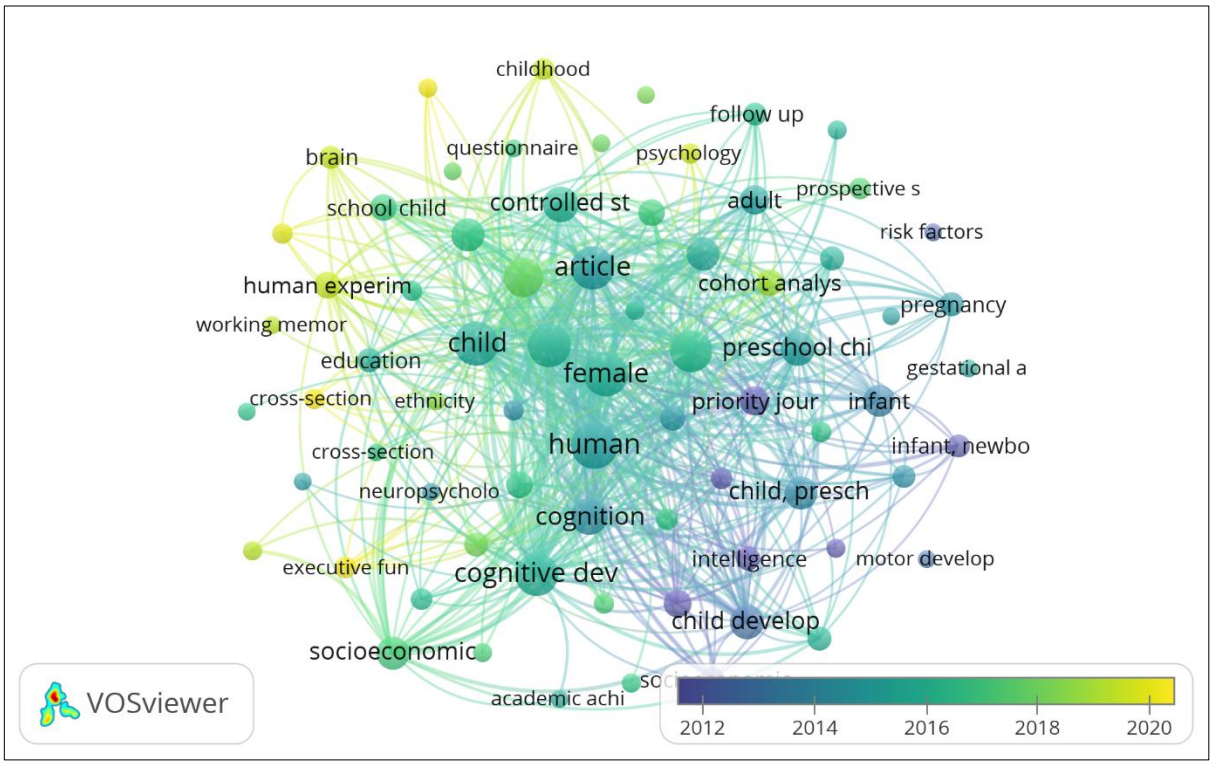

Figure 4. Overlay visualization

The most recent research trends show a growing preference for longitudinal and prospective analyses, focusing on themes such as the impact of pregnancy and gestational age on early childhood development. Overall, the trajectory of child development research has evolved from broad, general themessuch as child, human, and cognitive developmenttoward more specific and applied areas including psychology, education, and pregnancy. The presence of small yellow-colored nodes labeled follow-up and questionnaire in the overlay visualization indicates that new methodological tools have been increasingly employed in recent years. This mapping reflects a clear evolution in research topics over time. Initially centered on foundational themes, the field has progressively moved toward more specialized and complex issues, demonstrating significant shifts in research methodology and priorities in the modern era.

Figure 5 presents a density visualization of keywords used in the relevant literature. In this map, yellow areas represent regions with the highest keyword frequency, while blue areas indicate lower frequencies. Core keywords such as article, child, female, human, and cognition are located at the center of the network, reflecting the highest density. This positioning suggests that these topics form the central focus of most publications within the field. Consistent with Chen et al. (2023), where *executive function* and *cognition* were the most frequent and central nodes in digital cognitive assessment maps . Meanwhile, *attention* and *mental fatigue* appeared in intermediate-density (green-blue) zones in cognitive fatigue research, mirroring our observation of working memory and executive function as secondary yet noteworthy themes

Keywords with moderate frequency, including child development, cognitive development, and socioeconomic, appear in green-colored areas, indicating that while these themes are important, they have less prominence than the core concepts. More specific terms such as working memory, executive function, and pregnancy are positioned in blue-green areas, suggesting that they represent emerging or secondary focuses within the literature rather than dominant topics.

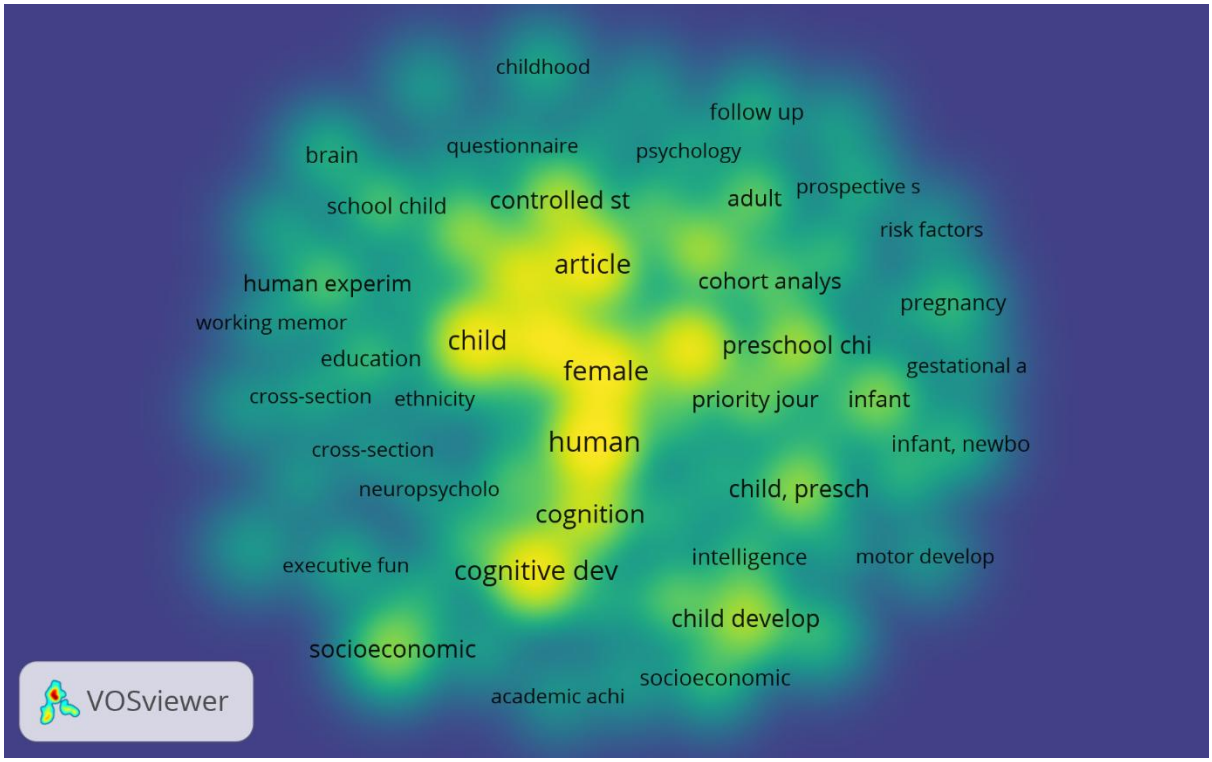

Figure 5. Density Visualization

Overall, this density map reveals the diversity and interconnectivity of variables studied in this research domain. More than 30 distinct variables were identified, spanning aspects of child development, cognition, social factors, and research methodology. This variety demonstrates that current research in this field is highly multidimensional, incorporating a wide range of complementary elements to build a comprehensive understanding of adolescent cognitive development and its influencing factors.

Table 1. Research list of literature review

No	Instrument and Subject	Result	Source
1	This study used data from the Adolescent Brain Cognitive Development (ABCD) study to investigate the role of BMI in the relationship between socioeconomic status (SES), neurocognition, and brain morphology. SES was measured by household income, parental education, and area deprivation.	Mediation analysis showed BMI significantly mediated the link between area deprivation and both total and prefrontal cortical volume. BMI also mediated the relationship between area deprivation and neurocognitive scores, mainly through working memory and cognitive flexibility tasks.	Dennis et al. (2022)
2	The study analyzed data from the ABCD study to examine how pubertal timing interacts with social environments (family, peers, school, community, and SES) in youth aged 10–13.	Early puberty combined with negative social environments predicted higher emotional and behavioral problems. Both boys and girls showed associations with rule-breaking behaviors, while depressive symptoms were more common in girls. Each social context had different moderating effects depending on pubertal timing.	Vijayakumar et al. (2024)
3	Using data from the ABCD study, the researchers assessed the impact of normative parental internalizing and externalizing behaviors on the limbic brain structure of children and adolescents without mental disorders. Median regression models were applied.	Normative parental behaviors were uniquely associated with children's limbic structure, even after adjusting for biological and SES confounders. Findings suggest early parental influence shapes limbic brain development in typically developing youth.	Albar et al. (2022)
4	The study used data from 9,168 participants in the ABCD study. It included 32 environmental variables, 10 child psychopathology scales, polygenic risk scores (PRS), cognitive performance, and brain networks.	Lower SES was linked to weaker brain connectivity and more severe psychopathology. Parental psychopathology, lower school engagement, and maternal substance use were strongly associated with developmental and mental health problems in adolescents. Genetic risk had a moderate effect.	Qiu & Liu (2023)

5	This study analyzed data from 9,720 adolescents before and during the COVID-19 pandemic using ABCD data. It examined the effects of household wage loss and financial stress on youth mental health over time.	Wage loss during the pandemic significantly impacted adolescent mental health. Financial stress reported by youth and family dynamics mediated the link between income loss and mental health outcomes.	Argabright et al. (2022)
6	The study examined resting-state brain connectivity in 5,821 adolescents using ABCD data and a multilevel analysis at the whole-brain, network, and connection levels.	Parental education was the key driver linking SES to brain connectivity. It affected somatosensory and subcortical brain areas, partially through home enrichment and children's cognitive abilities.	Sripada et al. (2022)
7	This cross-sectional study used baseline data from 8,842 children aged 9–11 across 21 U.S. sites from the ABCD study.	Household and environmental context was linked to white matter development. Obesity and cognitive performance may mediate this relationship. Future brain health studies should consider socioeconomic factors.	Li et al. (2023)
8	Used baseline data from children aged 9–10 from the ABCD study across 21 U.S. locations to study how SES indicators relate to brain structure.	Different SES indicators had varied effects. High income-to-needs ratio may protect children in low-resource environments. The study highlights the need to consider multiple SES indicators together.	Rakesh et al. (2022)
9	The study analysed resting-state brain connectivity in 7,834 youth aged 9–10 from ABCD, focusing on how different SES dimensions and environmental experiences affect the brain.	SES and psychosocial threat predicted changes in frontal limbic connectivity. Psychosocial threat moderated the effect of income on attention-related brain networks.	DeJoseph et al. (2022)
10	This study examined how household SES and environmental disadvantage influence brain connectivity in 9,475 children aged 9–10 using ABCD data.	Environmental disadvantage was linked to lower sensorimotor network connectivity. High income-to-needs ratios reduced this effect, showing SES factors interact in complex ways.	Rakesh et al. (2021)
11	This study examined 8,158 children aged 9–10 from the ABCD study to explore how 22 environmental and SES-related factors affect brain structure and cognitive function.	Lower SES was linked to reduced cortical surface area and worse cognitive outcomes. Positive environments (social support, perinatal health) predicted better brain and cognitive development regardless of SES.	Gonzalez et al. (2020)
12	Used ABCD data on 10,418 children aged 9–10 to study how race, parental education, and income affect working memory, using the NIH Toolbox Card Sorting Test.	Higher parental education and income were associated with better working memory. However, Black children showed less benefit from high parental education compared to White children.	Akhlaghipour & Assari (2020)
13	Retrospective cross-sectional study of 11,200 children in the ABCD study. Psychiatric symptoms were analysed based on parental and grandparental history of depression.	Children with a family history of depression were more likely to experience depression and suicidal thoughts, regardless of gender, SES, or race.	Van Dijk et al. (2021)
14	In 4,485 children aged 9–10, this study assessed maladaptive guilt using diagnostic interviews and related it to family conflict, maternal depression, and parental rejection.	Maladaptive guilt was linked to low family income, high conflict, and maternal depression. These associations remained even after adjusting for child depression severity.	Donohue et al. (2020)
15	Cross-sectional study of 7,072 adolescents from the ABCD study examining how parental education affects reward responsiveness (RR) using BIS/BAS measures.	Higher parental education was linked to lower RR. However, this effect was weaker for African-American youth compared to non-Hispanic White youth.	Assari et al. (2020a)
16	fMRI data from 4,290 Black and White adolescents (age 9–10) in the ABCD study was used to examine SES indicators and brain activity during the N-Back task.	Parental education was linked to greater activity in the left orbitofrontal cortex (OFC) during the taskbut only in White adolescents. The effect was weaker or absent in Black adolescents.	Assari et al. (2021)
17	Sample of 11,875 children from the ABCD study. Researchers used caregiver and self-reports to assess suicidal thoughts and behavioursand used logistic regression for analysis.	Multiple protective and risk factors for suicide in children were identified. The findings highlight the need for early school and family-based interventions.	Janiri et al. (2020)
18	Cross-sectional study of 4,188 youth from the ABCD study, analysing how parental education affects inhibitory control, using the Stop-Signal Task and CBCL.	Higher parental education predicted better inhibitory control, especially in Black youth. However, the positive effect was stronger in White youth.	Assari (2020a)

19	Cross-sectional analysis of ABCD data from 9–11-year-olds across 21 U.S. locations to examine environmental disadvantage and brain development.	Local environmental disadvantages were linked to lower neurocognitive performance and reduced cortical and subcortical brain volume.	Hackman et al. (2021)
20	Used ABCD data from 11,875 children (ages 9–11) and applied principal component analysis (PCA) on 39 environment and 30 behaviour/cognition measures.	Parental psychopathology clusters were linked to child mental health issues. Higher SES was linked to better executive function and cognition, but less behavioural inhibition.	Zhang et al. (2020)
21	This fMRI study analysed data from 3,067 children to investigate how SES, particularly parental education, affects hippocampal brain activity during a memory task.	Parental education was associated with greater hippocampal activity, but this effect was no longer significant when household income was considered, indicating income may be the key SES driver.	Assari et al. (2020b)
22	Study of 11,135 children from the ABCD dataset to assess the relationship between parental education and mental rotation ability (a spatial cognition task).	Higher parental education was linked to better mental rotation performance. However, this benefit was smaller among Black children compared to White children.	Assari (2020b)
23	Data from 9,270 children were analysed using structural equation modelling to assess how trauma exposure affects brain structure.	Exposure to trauma was associated with a thinner prefrontal cortex and reduced volumes in the amygdala and putamen, areas crucial for emotion regulation and cognitive control.	Jeong et al. (2021)
24	Study of 11,875 children examining school discipline history and its relation to family and demographic factors using parent reports.	Black and multiracial children had higher suspension rates than White children, even after controlling for behavior and other family factors.	Fadus et al. (2021)
25	Study of 4,696 children assessing how SES and race affect exposure to trauma.	Higher SES reduced the risk of trauma exposure, but this protective effect was significantly weaker for Black children than for White children.	Assari (2020c)
26	Analysis of 10,762 children to examine behavioral and emotional problems in relation to parental education and racial background.	Higher parental education was associated with fewer behavioral problems, but the benefits were smaller for Black and Hispanic children compared to White children.	Assari et al. (2020c)

Socioeconomic Status and Brain Development

Studies (Articles 1, 4, 6, 7, 8, 10, 19, and 20) consistently demonstrate that socioeconomic status (SES) has a profound influence on brain structure, neurodevelopment, and functional connectivity. Lower SES is consistently linked to poorer neural and cognitive outcomes, while multivariate approaches, such as in Article 6, confirm that these differences result from the complex interplay among income, parental education, and environmental factors. A systematic review by *Mendis et al.* (2025) further supports these findings, showing that socioeconomic disadvantage is associated with reductions in cortical thickness, gray matter volume, and fractional anisotropy across corticolimbic circuits in youth, highlighting the cumulative neural burden of low SES.

Racial Disparities and Minorities' Diminished Returns (MDR)

Articles (12, 15, 16, 18, 22, 24, 25, and 26) focus on the *Minorities' Diminished Returns (MDR)* phenomenon, in which higher SES—through education or income—provides fewer developmental benefits for Black and Hispanic youth compared to their White peers. Structural racism, segregation, and persistent social barriers are often cited as mechanisms that reduce these returns. The ABCD Study also revealed that parental education and income predicted increased cortical surface area in children, but this effect was significantly weaker among Black youth (Assari, 2020). Articles 15 and 18 explicitly call for structural policy reform to address these inequities through systemic and institutional change.

Emotional and Behavioral Development

A cluster of studies (Articles 2, 3, 5, 11, 13, 14, and 17) investigates emotional and behavioral development in adolescents, emphasizing the mediating roles of early puberty (Article 2), family history of depression (Article 13), financial stress (Article 5), and maladaptive guilt (Article 14). Article 17 highlights suicide risk and protective factors, advocating for early interventions through school- and family-based programs. These findings underline the importance of psychosocial environments and family well-being in mitigating the negative emotional effects of socioeconomic hardship.

Parental and Family Influences

Studies (9, 11, 13, 14, 20, and 21) examine how parental behaviors such as mental health, parenting style, and family structure could affect child development. Article 21 demonstrates that family income mediates the effect of parental education on hippocampal activation, suggesting that financial stability supports cognitive

processes related to memory and learning. Similarly, Article 14 highlights the impact of maternal depression and negative parenting climates on children's emotional risk factors, reinforcing the interconnectedness of family ecology and cognitive-emotional development.

Inequities in Cognitive and Educational Outcomes

Articles (12, 15, 16, 18, 22, and 26) emphasize disparities in cognitive development, including working memory (Article 12), inhibitory control (Article 18), and spatial ability (Article 22). These findings reveal systemic inequalities in how educational and cognitive benefits are distributed across racial and socioeconomic lines. The results point to an urgent need for equity-oriented educational policies that ensure fair access to cognitive enrichment opportunities and academic success.

Policy Implications and Future Directions

Several studies (Articles 5, 12, 15, 21, 25, and 26) extend their findings to policy implications. They emphasize the need for redistributive strategies (Article 21), the removal of social barriers (Articles 12 and 15), and recognition of racialized limitations in SES benefits (Articles 25 and 26). Article 5 further stresses the importance of strengthening family systems during periods of economic instability. Collectively, these studies call for targeted interventions and equitable public policies to mitigate the developmental disparities driven by socioeconomic and racial inequities.

4. CONCLUSION

This review confirms that socioeconomic status (SES) significantly shapes adolescent cognitive and brain development, but its benefits are uneven across racial and ethnic groups due to structural inequalities. Future research should explore interventions that equalize not just SES, but also its developmental returns. If unaddressed, these disparities may reinforce intergenerational inequality. Personally, this study reveals how deeply SES and systemic barriers are woven into youth developmentprompting the need for socially responsive neuroscience and inclusive policy reform to ensure every child, regardless of background, can realize their full cognitive potential.

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