



Factors From Middle Childhood That Predict Academic Attainment at 15–17 Years in the UK: A Systematic Review

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Success in adult life is associated with end of school academic attainment, but educational inequality is a major issue in the UK. Contextual background factors and personal attributes associated with student academic attainment have been identified in cross-sectional research. However, there has not been a systematic synthesis of these factors from longitudinal studies particularly with a focus on factors from middle childhood. The aim of this systematic review was to identify factors from middle childhood (6–12 years) that are associated with academic attainment at 15–17 years. Ninety UK studies met the inclusion criteria. Factors identified related to the student, socioeconomic, academic attainment, and the school. The quality of studies was generally rated as poor, and evidence for most factors was sparse, suggesting caution in interpretation. The middle childhood factors with the strongest evidence of association with later attainment were: prior attainment at the student level, student mental health, and gender. Generally, the results supported UK Government guidance on narrowing the education inequality gap although there was a lack of high-quality studies. The findings could be potentially useful for policymakers and schools in making decisions on effective interventions, policy choices, and funding allocations, particularly in the context of a socioecological framework. However, further research is needed in this area.

Systematic Review Registration: https://www.crd.york.ac.uk/PROSPERO/display_record.php?RecordID=136747, identifier: 136747.

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INTRODUCTION

An individual's academic attainment can have a significant effect on adult wellbeing and lifelong opportunities. Low academic attainment is linked to poor mental wellbeing (Marmot et al., 2010), reduced employment opportunities, and lower earning potential (Marmot et al., 2010; Office for National Statistics, 2017); whilst higher academic attainment is related to increased life satisfaction (Suldo et al., 2006). For example, Crawford and Cribb (2013) found that a one standard deviation increase in Mathematics scores at age 10 years was directly related to earning 13% more per week at 30 years of age. Leaving school without any qualifications is also associated with increased mental

health difficulties in adulthood (Fergusson et al., 2015) and substance misuse (e.g., Fergusson et al., 2002). Good academic attainment is, therefore, strongly associated with good outcomes in adult life.

In the UK, the national curriculum has traditionally been organized into series of years known as Key Stages (KS) in England, Wales, and Northern Ireland whilst in Scotland, schooling is divided into primary and secondary levels (see **Table 1**). At the end of every KS in England and Wales, academic attainment is assessed, although not at the end of KS3 in England (Department for Education, 2020). In all four nations of the UK, students work toward public examinations in the year they become 16 years of age. Educational inequality, where some groups of children are disproportionately more likely to have lower academic attainment, has been identified as a major issue in the UK (Pickett and Vanderbloemen, 2015; Organisation for Economic Co-operation Development, 2016; Education Endowment Foundation, 2018). The attainment gap is largest for students eligible for free school meals (i.e., those students from families in poverty) and students assessed with special educational needs and disabilities, is evident from as early as 5 years old, and increases as these students move through education (Education Endowment Foundation, 2018). This has led to additional funding for UK schools to support disadvantaged learners with the goal of reducing the attainment gap (e.g., Department for Education, 2015a; Welsh Government, 2017). Additional funding can typically be used by schools to target a variety of support and interventions for disadvantaged students with the goal of reducing the attainment gap. Evidence-based recommendations for schools to reduce the attainment gap include using whole-school approaches; the effective use of data to track progress; improving language, literacy, and social-emotional skills; improving attendance and behavior; developing high quality teaching; and improving the quality of school leadership (Estyn, 2012; Department for Education, 2015a). Due in part to the implementation of these recommended strategies and additional funding, there is evidence that the attainment gap has started to reduce over the past decade, but it is still significant and has begun to widen further due to disruptions in education provision during the Covid-19 pandemic (Education Endowment Foundation, 2021).

To develop effective interventions/strategies to support vulnerable learners, it is crucial to know which factors affect academic attainment. Bronfenbrenner's Ecological Systems Theory (Bronfenbrenner and Morris, 2006; Darling, 2015) posits that a child's development is influenced by interactions with their environment including characteristics of the child, their family, school, and community. Research has shown that, in early childhood, better quality pre-school education, higher educational qualification level for mothers, and a supportive early years home learning environment predicts better academic attainment at the end of primary school (Sylva et al., 2008). Maternal education (Mensah and Kiernan, 2010), social factors such as income (Cooper and Stewart, 2013), and school-related factors such as teacher expectations (Banerjee, 2016) have been shown to be associated with academic attainment. The more risk factors present, the larger the impact on children's outcomes

(Rouse et al., 2011). This suggests that an overview of factors affecting academic attainment, within a socioecological context, would be useful for schools and policy makers in tackling educational inequalities and supporting vulnerable learners.

The period between KS2 and KS4 in the UK has been identified as being crucial for ensuring that children stay on high attainment trajectories (Crawford et al., 2014), and there has been an increasing focus on the need to ensure that all learners, and especially those deemed to be vulnerable, make appropriate progress when they transition from primary to secondary school (Estyn, 2020). A recent report by the school inspectorate in England urged school leaders to place a greater focus on students' academic progress in the early years of KS3, and to liaise more closely with primary schools to ensure teaching builds more effectively on students' prior knowledge, experience, and skills (Department for Education, 2015b). These recommendations highlight the need for schools to do more to ensure that their provision for students in first year of secondary education (11–12 years) provides sufficient challenge for students of all abilities, and that students' literacy and numeracy skills are developed effectively. To achieve this, information on the factors from primary school (middle childhood) that will enable schools to identify more vulnerable students when they start secondary school would be of great benefit to school leaders. Early childhood (0–5 years) factors have been shown to affect later academic attainment (e.g., see Sammons et al., 2014), but these may be different factors to middle childhood. Middle childhood is a crucial time for child development and is under-researched compared to other child developmental stages. During this time, children are exposed to important educational and social experiences that can shape their life outcomes (Feinstein and Bynner, 2004; Del Giudice, 2018). Young children spend most of their time in the home but, during middle childhood, school becomes increasingly important, suggesting that middle childhood factors may be broader in context (Darling, 2015). Identifying the factors from middle childhood that affect later academic attainment could help schools to better target their resources for students most in need during the first year of secondary school ensuring that these students start out on the right academic trajectory.

To be able to use research findings on factors affecting academic attainment effectively (e.g., to lessen the attainment gap), some insights on the causal processes are needed. Cross-sectional studies make comparisons between groups over a relatively short period of time and may constitute initial evidence of risk or compensatory factors. However, change over time is needed to infer causality more clearly. Longitudinal studies are designed to examine changes over a longer period (Caruana et al., 2015), which allows researchers to explore how variables change or remain stable over time.

The aim of this systematic review was to identify factors from middle childhood that are associated with academic attainment at the end of compulsory schooling in the UK (15–17 years) focusing specifically on evidence from longitudinal studies. Previous reviews have examined factors affecting academic attainment. However, these reviews have focused on specific factors (e.g., socioeconomic status, Sirin, 2005;

TABLE 1 | Structure of education systems in the UK (approximate equivalents)^a.

Student age	England	Wales	Northern Ireland	Scotland
4–5 years	Reception (EYFS)	Reception (FP) STA	Year 1 (FS)	P1 (Early level) SSA
5–6 years	Year 1 (KS1)	Year 1 (FP)	Year 2 (FS)	P2 (First level)
6–7 years	Year 2 (KS1) SATs	Year 2 (FP) STA	Year 3 (KS1)	P3 (First level)
7–8 years	Year 3 (KS2)	Year 3 (KS2)	Year 4 (KS1) STA	P4 (First level) SSA
8–9 years	Year 4 (KS2)	Year 4 (KS2)	Year 5 (KS2)	P5 (Second level)
9–10 years	Year 5 (KS2)	Year 5 (KS2)	Year 6 (KS2)	P6 (Second level)
10–11 years	Year 6 (KS2) SATs	Year 6 (KS2) STA	Year 7 (KS2) STA	P7 (Second level) SSA
11–12 years	Year 7 (KS3)	Year 7 (KS3)	Year 8 (KS3)	S1 (Third/fourth level)
12–13 years	Year 8 (KS3)	Year 8 (KS3)	Year 9 (KS3)	S2 (Third/fourth level)
13–14 years	Year 9 (KS3)	Year 9 (KS3) STA	Year 10 (KS3)	S3 (Third/fourth level)
14–15 years	Year 10 (KS4)	Year 10 (KS4)	Year 11 (KS4)	S4 (Senior phase) Nationals
15–16 years	Year 11 (KS4) GCSE	Year 11 (KS4) GCSE	Year 12 (KS4) GCSE	S5 (Senior phase) Highers
16–17 years	Year 12 (KS5) AS-Level	Year 12 (KS5) AS-Level	Year 13 AS-Level	S6 (Senior phase) Advanced Highers
17–18 years	Year 13 (KS5) A-Level	Year 13 (KS5) A-Level	Year 14 A-Level	

A-Level, Advanced level exams; AS-Level, Advanced Subsidiary Level; EYFS, Early Years Foundation Stage; FP, Foundation Phase; FS, Foundation Stage; GCSE, General Certificate for Secondary Education; KS, Key Stage; National, Scottish National Qualifications; P, Primary; S, Secondary; SATs, Standardized Assessment Tests; SCE, Scottish Certificate of Education; SSAs, Scottish Standardized Assessments; STA, Statutory Teacher Assessments.

^aThe Scottish Education system differs from the rest of the UK. The school academic year runs from August to June whilst it is September to July for the rest of the UK. Students start school at 4.5–5.5 years of age depending on their birthday. The school academic year in Northern Ireland begins in early September (similar to England and Wales), however the school year finishes at the end of June.

attention problems, Polderman et al., 2010), specific outcomes (e.g., science and mathematics, Banerjee, 2016), or specific populations (e.g., ethnic minority students, Miller-Cotto and Byrnes, 2016). For UK-based research, researchers have explored factors that relate to outcomes such as participation in post-16 education (See et al., 2011) and subject choice (Tripney et al., 2010). To the authors' knowledge, there are no systematic reviews that have examined factors in middle childhood associated with later academic attainment in the UK context. It is important to identify these factors to provide the necessary support/intervention that children may need to maintain good academic attainment. Schools would benefit from knowing what factors are associated with later outcomes. This information could potentially help schools and policymakers to effectively target policy, interventions, and funding to support vulnerable learners.

METHODS

A systematic review was reported using the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Liberati et al., 2009). A protocol for the systematic review was registered with PROSPERO (Registration No.: CRD42019136747; URL: https://www.crd.york.ac.uk/PROSPERO/display_record.php?RecordID=136747) in July 2019.

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Inclusion and Exclusion Criteria

Titles and abstracts for records were initially screened and retained if they: (a) were written in English; (b) were published in peer-review journals; (c) described a longitudinal, cohort or population-based quantitative study; (d) were based on UK data (from any of the four UK nations); (e) reported measurement of factors associated with academic attainment during middle childhood (ages 6–12 years); and (f) reported academic attainment as an outcome at the end of compulsory mainstream schooling (ages 15–17 years).

Following initial screening, full text articles were obtained and assessed for eligibility for review according to the following set of expanded inclusion criteria.

Participants/Population

Studies were included if they examined students that had completed their final year of mainstream compulsory schooling in any UK nation (aged 15–17 years). Students typically take a series of examinations in their final years, known as level 2 qualifications (see Outcomes for more details). No limits were placed on the sample size or recruitment methods used.

TABLE 2 | Study synthesis indicators.

Factors	No. studies	Associated outcomes	Level of evidence	Association with academic achievement	
				High quality	Low quality
Student					
Age	3	KS4 capped score	Inconsistent	+ [26]	0 [61, 62]
Gender (male)	5	GCSE (total score, best 8, and 25 individual subjects) KS4 capped score	Strong	- [16, 26]	- [23, 61, 62]
Ethnicity (non-white)	3	KS4 capped score GCSE total score	Moderate	+ [26]	+ [61, 62]
Fluency in English/EAL	5	GCSE (total score, exam entry, best 8) KS4 capped score	Inconsistent	0 [20], + [26]	+ [50], - [61], 0 [62]
Physical activity	1	GCSE (English and science)	Insufficient	+ [5]	
Body mass index	2	GCSE (English and best 8)	Moderate	- [6]	- [31]
Emotional Intelligence	2	GCSE (total score and best 8)	Moderate	+ [85]	+ [56]
SEND status	1	KS4 capped score	Insufficient	- [26]	
Bullied status	1	O-levels	Insufficient		- [8]
Mental health	7	GCSE (total score, best 8)	Strong	- [9, 67]	- [31, 54, 55, 64], 0 [45]
Physical health	2	GCSE best 8 O-level (total passes, English and mathematics)	Moderate		- [10, 31]
Autistic traits	1	GCSE best 8	Insufficient		- [31]
Confidence	1	GCSE total score	Insufficient		+ [45]
Quality of friendships	2	GCSE best 8	Inconsistent	- [85]	0 [45]
Entry into care	1	GCSE best 8	Insufficient		+ [69]
School enjoyment	1	GCSE (total score and passes)	Insufficient		+ [45]
Likes teacher	1	GCSE (total score and passes)	Insufficient		0 [45]
Motivation to write	1	GCSE English	Insufficient		0 [81]
Socioeconomic					
Family Income (low)	2	GCSE (total score, English, and mathematics)	Moderate	+ [63]	+ [44]
Parent Social Class (low)	3	GCSE total score CSE passes	Moderate		+ [61, 62, 75]
eFSM	8	GCSE (total score, entry, passes, best 8) KS4 capped score O-level (passes)	Inconsistent	0 [20], - [26] ^b	- [8, 23, 61, 62, 69], 0 [50]
Neighborhood deprivation	5	KS4 capped score GCSE passes	Inconsistent	0 [20], - [26]	- [50, 76], 0 [48]
Home learning environment	2	GCSE (total score, English, mathematics, entries, and passes) English Baccalaureate O-level passes	Moderate	+ [63]	+ [8]
Attend school in different authority	1	KS4 capped score	Insufficient	- [26]	
Stressful life events	2	GCSE total score O-level passes	Moderate		- [8, 35]
Chaos at home	1	GCSE total score	Insufficient		- [1]
Maternal cognitive support	1	GCSE best 8	Insufficient		+ [47]
Parent-child relationship	1	GCSE best 8	Insufficient		- [55]
Parent-teacher relationship	1	O-level passes	Insufficient		+ [8]
Academic					
Overall prior attainment (KS1, KS2 or other overall test score)	45	GCSE (total score, average score, best 8, individual subjects, passes, and entries) Attainment 8 Progress 8 KS4 scores, capped score, and total score English Baccalaureate GCE total	Strong	+ [12, 17, 18, 20, 26, 29, 30, 32, 37, 42, 66, 85]	+ [2, 3, 7, 11, 19, 22, 25, 27, 33, 34, 38-41, 48, 50, 55, 57, 58, 60, 65, 68-74, 76, 82, 83, 89, 90]

(Continued)

TABLE 2 | Continued

Factors	No. studies	Associated outcomes	Level of evidence	Association with academic achievement	
				High quality	Low quality
English (KS2 or other test score)	16	GCSE (best 8, passes, entries, total score, average score, English, mathematics, science, history, and French) KS4 capped score	Strong	+ [17, 20, 32, 63]	+ [4, 23, 28, 47, 58, 59, 65, 72, 73, 80, 81, 84]
Mathematics (KS2 or other test score)	18	GCSE (passes, best 8, entries, average score, total score, English, mathematics, science, and geography) KS4 capped score GCE/CSE mathematics and passes O-level passes	Strong	+ [17, 20, 32, 63]	+ [4, 8, 23, 28, 43, 46, 58, 59, 65, 72, 73, 75, 80, 84]
KS2 science	8	GCSE (best 8, English, mathematics, science, total score, average score, and entries)	Strong	+ [20, 32]	+ [46, 59, 65, 72, 84], 0 [73]
Reading (KS2 or other test score)	10	GCSE (total score, English, mathematics, science, history, and French) SCE total score GCE/CSE English and passes O-level passes	Moderate		+ [8, 21, 23, 24, 43, 46, 61, 62, 75, 78]
KS2 writing	1	None	Insufficient		0 [46]
Verbal reasoning	19	GCE/CSE (total score, English, mathematics, and science) GCSE (total score, best 8, 25 individual subjects, and passes) SCE (total score, passes, English, and arithmetic)	Strong	+ [16]	+ [13–15, 21, 23, 24, 33, 49, 51, 61, 62, 73, 75, 77–79, 86, 87]
Quantitative reasoning	3	GCSE (total score, best 8, English, and mathematics)	Moderate		+ [73, 77, 79]
Cognitive ability	12	GCSE (total score, best 8, average, passes, and 25 individual subjects)	Strong	+ [16, 36]	+ [44, 45, 47, 55, 56, 68, 71, 80, 81, 83]
Non-verbal score	4	GCSE (total score, English, and mathematics) GCE/CSE passes	Inconsistent		+ [73, 75 ^a , 77, 79], – [75] ^a
Creative expressiveness	2	GCSE English	Moderate		+ [80, 81]
Logic	2	GCSE English	Inconsistent		+ [80], 0 [81]
Executive function	1	GCSE English and mathematics	Insufficient		+ [52]
School					
School size	1	KS4 capped score	Insufficient	– [26]	
Class size (student-teacher ratio)	1	O-level passes	Insufficient		– [8]
School/Cohort Mean Prior Attainment (KS1, KS2 or other overall test score)	11	GCSE best 8, total score KS4 capped score Progress 8	Inconsistent	– [17, 26, 37], + [12, 20]	+ [27, 53, 58, 82, 89], – [11]
School verbal reasoning	2	SCE (total score, English, and arithmetic)	Moderate		+ [86, 88]
School eFSM Level	2	KS4 capped score	Moderate	– [26] ^b	– [48]
School SEND Level	1	KS4 capped score	Insufficient	– [26]	

CSE, Certificate of Secondary Education; EAL, English as an Additional Language; eFSM, eligible for Free School Meals; GCE, General Certificate of Education; GCSE, General Certificate of Secondary Education; KS, Key Stage; SCE, Scottish Certificate of Education; SEND, Special Educational Needs and Disabilities.

–/+/0 represent negative, positive or no association respectively. Numbers refer to the study number (more information can be found in **Supplementary Table 1**).

^aResults differed depending on age of the child when completing non-verbal tests and outcome tested (– association 7 year-old draw-a-man test and likelihood of CSE science passes).

^bTwo factors of eFSM were tested: Student-level Factors (current eFSM status and number of years eFSM); School-level Factors (% eFSM in school and eFSM segregation).

Independent Variables

Studies were included if they assessed the association of at least one personal (e.g., month of birth, ethnicity), school (e.g., school size), home (e.g., language spoken at home), or socio-demographic (e.g., socioeconomic status) factor during middle childhood (ages 6–12 years) with academic attainment at age 15–17 years.

Outcomes

This review focused on factors from middle childhood and their association with academic attainment at age 15–17 years. To be included in the review, studies were required to report academic attainment at age 15–17 years. Academic attainment was based on results from academic examinations such as General Certificates of Secondary Education (GCSE, e.g., grades A* to U), National Vocational Qualifications (e.g., categorical fail/pass/merit/distinction), and/or cumulative examination results such as Capped 9 in Wales, a point score measure that is composed of the best nine first entry outcomes by the time a student reaches their final compulsory year in education. Three of the Capped 9 must include a literacy outcome, a numeracy outcome, and a science outcome. The remaining six can be GCSEs or Vocational qualifications (Welsh Government, 2019). No limits were placed on the academic subjects for outcomes.

Study Design

Longitudinal, cohort, data linkage or population-based quantitative studies were included if they reported at least two waves of data collection, where one wave was during middle childhood (ages 6–12 years) and another wave was at the end of compulsory schooling (ages 15–17 years).

Search Strategy

Literature searches were conducted in March 2020 and an updated search in September 2021. The following electronic databases were used: Social Science Citation Index, the Education Collection, Social Science Database, Sociology Collection, PsycInfo, and Proquest Applied Social Sciences Index and Abstracts. The search strategy for electronic databases was based on the combination of four lists of words: list 1—search terms related to study design (e.g., longitudinal OR prospective OR cohort OR predict OR follow-up*); list 2—search terms related to participants (e.g., child* OR pupil* OR student*); list 3—search terms related to factor time point (e.g., primary school OR Key Stage 2); list 4—search terms related to outcome time point (e.g., secondary school OR Key Stage 4), educational outcome (e.g., academic outcome OR academic attainment OR educational outcome OR educational attainment OR exam attainment OR exam outcome* OR qualification* OR performance measure* OR GCSE OR General Certificate of Education OR BTEC OR National Vocational Qualification OR Progress 8 OR National 4 OR National 5 OR Intermediate exam*), and educational subject headings (e.g., Welsh OR English OR Irish OR Scottish OR Mathematics OR Science OR Literacy OR Numeracy OR Design Technology OR Information Technology OR History OR Geography OR Modern Foreign Languages OR Religious

Studies). The four lists were then combined using AND (see example search string in **Supplementary Material**).

Database searches were supplemented with searches of gray literature including national level reports from the four UK nations' governmental websites, Department for Education and statistics webpages, as well as websites for the National Foundation for Educational Research, Center for Longitudinal Studies (1970 British Cohort Study, 1958 National Child Development Study, Millennium Cohort Study, Next Steps) and the University College London Institute for Education, Cambridge Assessment, AQA Research and Policy Analysis, National Audit Office, Institute for Fiscal Studies, Nuffield Foundation, Sutton Trust, and Center for Multilevel Modeling. Reference lists of included papers were also reviewed as well as publications from birth cohorts not included on the Center for Longitudinal Studies website (Avon Longitudinal Study of Parents and Children, and British Household Panel Survey). The keyword “academic attainment” was used in the searches of gray literature.

One author (MEW) conducted the initial screening of records based on information from titles and abstracts. Another author (SC) reviewed the first 2,500 (35.8%) potentially relevant abstracts to check for accuracy. Interrater agreement was 99.7%. All full texts were appraised by MEW and any queries discussed with SC.

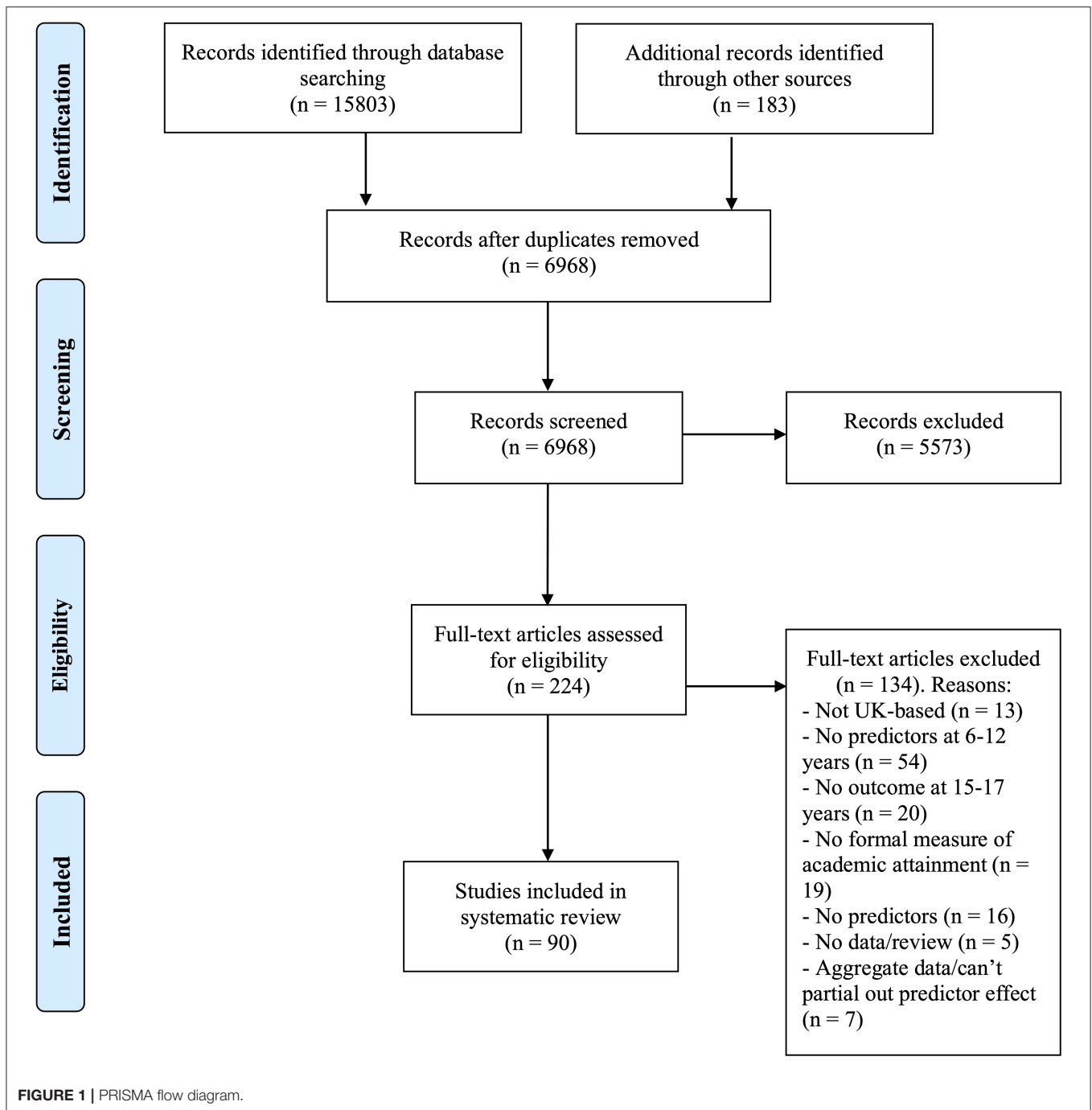
Study Selection

Literature searches were conducted in March and April 2020 with an updated search in September 2021. There were no date limits to the searches and only peer-reviewed articles published in English or Welsh were included. The only exception was the gray literature search which often included non-peer reviewed content (e.g., government reports) but may have included pertinent information for this review. The initial database search yielded 14,088 articles and an additional 1,715 in the updated search. Following the removal of duplicates, the titles and abstracts of 6,622 articles were screened against the eligibility criteria. Forty-one articles were selected for full-text review with a further 183 identified through supplemental means. A total of 90 studies met the inclusion criteria (see **Figure 1** for a flow diagram of study selection) and were retained for the review.

Data Extraction and Analysis

For the 90 retained studies, information was extracted on sample information, methodology, factors and timing, attainment outcomes and timing, and study findings using a bespoke data extraction tool designed for this review. **Supplementary Table 1** summarizes the extracted information from the 90 studies.

The methodological quality of each included study was assessed using items from existing quality criteria lists (Bohensky et al., 2011; National Institute for Health, 2013; Critical Appraisal Skills Programme, 2018). The list of 10 items are categorized into four dimensions: 1) study population and participation (3 items); 2) data collection (3 items); 3) reporting (2 items); 4) data analyses (2 items). Each item had three possible responses, either “yes,” “no,” or “unclear.” The maximum points given to any item was 1. For each study, a total methodological quality score was



calculated by summing the items. A quality score of 8 or above, i.e., 80% of items scored positively, was considered a high-quality study. Lower scores were considered low quality.

Due to the differences in study methodologies, time points, factor and outcome variables, a formal meta-analysis was not possible. Therefore, a narrative synthesis was conducted. Individual middle childhood factors were grouped by general type (e.g., student, socioeconomic, school) and analyzed in

terms of the number of times explored in the research, range of academic outcomes with which the factor is associated, consistency of direction of effect, magnitude of effect, and quality of the studies.

To summarize the results and ease the drawing of conclusions regarding level of evidence, best evidence synthesis was used (see Belmon et al., 2019). Levels of evidence were defined as follows: Strong evidence—consistent findings in multiple (2 or more)

high quality studies; Moderate evidence—consistent findings in one high quality study and at least one low quality study, or consistent findings in multiple (2 or more) low quality studies; Inconsistent evidence—inconsistent findings in multiple studies (2 or more); Insufficient evidence—only one study available. If there were two or more high quality studies showing consistent results, the low-quality studies were disregarded in the narrative synthesis and conclusions.

RESULTS

Characteristics of Studies

Characteristics of the included studies are shown in **Supplementary Table 1**. Sample sizes in the studies ranged from 59 (Toivainen et al., 2017) to 2,740,182 students (Goldstein and Leckie, 2016). Twenty-nine of the studies used the UK Department for Education National Student Database as the sole data source, 10 used local Education Authorities' databases, six used education surveys, four used exam board databases, 17 were based on UK cohorts, and 24 studies used multiple data sources. Factors were measured at ages 6–12 years, with 67 of the studies measuring factors at only one time point, 18 studies at two time points, three at three time points, one at four time points, and one at seven time points. The most frequently used outcome measure at ages 15–17 was GCSE attainment ($n = 65$), whilst nine used GCE or O-Level attainment, eight used a KS4 points score, five used the Scottish Certificate of Education (SCE) or O-grade, and three used the Attainment 8 and/or Progress 8 indicators. Four studies reported results for each factor separately: one by gender, two by cohort year, and one by city.

Quality of Studies

Results for the critical appraisal of study quality are summarized in **Supplementary Table 1** (a more detailed appraisal based on individual items can be seen in **Supplementary Table 2**). Overall, the risk of bias was moderate with only 19 studies rated as high quality. The most common limitations were not reporting rates of missing data for the variables used and low participation rate (although many of these were rated as unclear due to insufficient information). A total of 54 of the studies reported an estimate of effect size.

Associations Between Factors and Later Academic Attainment

A summary of the results for each middle childhood factor can be found in **Table 2** with detailed descriptions across all included studies in **Supplementary Table 3**.

Student Factors

The only student factors with strong evidence of an association with later academic attainment were student gender and student mental health. Boys and students with higher levels of mental health difficulties were more likely to have lower GCSE attainment (Gender: Deary et al., 2007; Gorard and Siddiqui, 2019; Mental health: Sellers et al. (2019), Cadman et al. (2021)). Four factors showed moderate evidence of an association. White

students (Sammons, 1995; Sammons et al., 1995; Gorard and Siddiqui, 2019), students with higher body mass index scores (Booth et al., 2014b; Hughes et al., 2021), and students with more physical health problems (Case et al., 2005; Hughes et al., 2021) were more likely to have lower academic attainment at GCSE/KS4. Students with higher emotional intelligence in middle childhood were more likely to have better GCSE scores (Qualter et al., 2012; White et al., 2021). Fluency of English or English as an additional language showed inconsistent results with one high quality study showing no association (Fletcher et al., 2015) and another showing that students with English as an additional language at ages 6–12 years were more likely to have better KS4 attainment (Gorard and Siddiqui, 2019). Both age and quality of friendships also showed inconsistent results with some studies showing no association (age: Sammons, 1995; Sammons et al., 1995; quality of friendships: Morris et al., 2021) and others suggesting that younger students (Gorard and Siddiqui, 2019) and students with peer problems were more likely to have lower attainment at GCSE/KS4. There was insufficient evidence for physical activity, special educational needs and disabilities status, bullied status, autistic traits, confidence, entry into care, school enjoyment, whether student likes their teacher, and motivation to write in middle childhood.

Socioeconomic Factors

None of the identified socioeconomic factors showed strong evidence of association with later academic attainment but several were considered to have moderate evidence. Students from low-income households (Sammons et al., 2014; Morris et al., 2016), students whose parents were of lower social class (Sammons, 1995; Sammons et al., 1995; Sullivan et al., 2010), and students with a positive home learning environment (Brown and Taylor, 2005; Sammons et al., 2014) were more likely to have better GCSE/O-level attainment. Students who had experienced more stressful life events during middle childhood were more likely to have lower GCSE/O-level attainment (Brown and Taylor, 2005; Jones et al., 2013). Both eligibility for free school meals and neighborhood deprivation showed inconsistent results with one high quality study finding no association with later attainment (Fletcher et al., 2015) whilst the other high quality study found that students eligible for free school meals and students living in deprived neighborhoods were more likely to have lower KS4 attainment. There was insufficient evidence for attending school in another authority (other than the local education authority for the area in which the child lived), chaos at home, maternal cognitive support, negative parent-child relationship, and parent-teacher association.

Academic Factors

By far the most frequently examined factor was prior attainment. Strong evidence of an association with later academic attainment was found for numerous measures of prior attainment in middle childhood. For example, 12 high quality studies found that students with higher overall prior attainment were more likely to have higher academic attainment at age 15–17 years (Jenkins et al., 2006; Levacic and Marsh, 2007; Coe et al., 2008; Leckie, 2009; Department for Education, 2010, 2016;

Fletcher et al., 2015; Hampden-Thompson and Galindo, 2017; Schoon and Ng-Knight, 2017; Gorard and Siddiqui, 2019; Hansen and Henderson, 2019; White et al., 2021). Students with higher English, mathematics, and science scores at age 11 (Jenkins et al., 2006; Department for Education, 2010; Sammons et al., 2014; Fletcher et al., 2015) were more likely to have better GCSE attainment. Students with higher verbal reasoning scores at the end of primary school were also more likely to have better academic attainment at age 15–17 based on consistent findings from one high quality study (Deary et al., 2007) and 18 low quality studies (Willms, 1985, 1986; Nuttall et al., 1989; Garner and Raudenbush, 1991; Jesson and Gray, 1991; Paterson, 1991; Goldstein et al., 1993; Daly, 1995, 1996; Sammons, 1995; Sammons et al., 1995; Thomas and Mortimore, 1996; Daly and Shuttleworth, 1997; Goldstein and Sammons, 1997; Thomas et al., 1997a,b; Strand, 2006; Deary et al., 2007; Thomas et al., 2007; Sullivan et al., 2010), as well as students with higher cognitive ability at age 11 based on two high quality studies (Deary et al., 2007; Larose et al., 2021). There was moderate evidence showing that students with higher quantitative reasoning, reading and creative expressiveness in middle childhood were more likely to have better attainment at age 15–17, although based on evidence from low quality studies only (Quantitative reasoning: Thomas and Mortimore, 1996; Strand, 2006; Thomas et al., 2007; Reading: Garner and Raudenbush, 1991; Goldstein et al., 1993; Sammons, 1995; Sammons et al., 1995; Goldstein and Sammons, 1997; Thomas et al., 1997a,b; McNiece et al., 2004; Brown and Taylor, 2008; Sullivan et al., 2010; Mourgues et al., 2016; Creative expressiveness: Toivainen et al., 2017, 2021). There was inconsistent evidence for measures of non-verbal ability during middle childhood with four low quality studies showing that students with higher non-verbal ability in middle childhood had lower O-level attainment (Thomas and Mortimore, 1996; Strand, 2006; Thomas et al., 2007; Sullivan et al., 2010), whilst one study found that students with higher non-verbal ability at age 7 were less likely to achieve CSE science passes (Sullivan et al., 2010). Logic also showed inconsistent results based on two low quality studies, one reporting no association with later academic attainment (Toivainen et al., 2021), and one reporting that students with higher logic scores at age 9 had higher GCSE English attainment (Toivainen et al., 2017). Logic was measured as part of a story writing task and consisted of ratings of the degree to which story events were logical, the straightforwardness of the story, and the grammatical correctness of the written story. KS2 writing skills and executive function had insufficient evidence for an association with later academic attainment.

School Factors

Four of the school factors were measures of the mean level of a factor (e.g., attainment, eligibility for free school meals, level of special educational needs, and disabilities) across the whole school or study cohort. There was moderate evidence showing that students from schools with higher mean verbal reasoning at age 11 had better Scottish O-grade attainment based on two low quality studies (Willms, 1985; Willms and Cuttance, 1985).

Other measures of mean school level prior attainment showed inconsistent evidence with three high quality studies showing that students from schools with higher mean KS1/KS2 scores did less well than expected at GCSE (Leckie, 2009; Department for Education, 2010; Gorard and Siddiqui, 2019), whilst two high quality studies showed that students from schools with higher mean KS2 scores performed better at GCSE (Coe et al., 2008; Fletcher et al., 2015). Students from schools with higher mean proportion of students eligible for free school meals across the whole school were more likely to have lower KS4 scores based on one high quality study and one low quality study (Gorard and Siddiqui, 2019; Nieuwenhuis et al., 2021). There was insufficient evidence for primary school size, class size based on student-teacher ratio, and mean proportion of students with special educational needs and disabilities across the whole school.

DISCUSSION

This systematic review identified and qualitatively summarized, using best evidence synthesis, UK-based studies examining the association of middle childhood factors with later academic attainment. Ninety eligible studies published between 1985 and 2021 were identified. Relevant factors from the studies were categorized into four domains: student, socioeconomic, academic, and school. Study quality was generally poor with 19 studies rated high quality and 54 reporting an estimate of effect size.

Due to the low methodological quality of the included studies only a few of the factors showed strong evidence of association with later attainment. For the student factors, only gender and mental health were found to have a strong association with later attainment based on small to medium effect sizes. Boys were consistently found to have lower academic attainment than girls across a range of different end-of-school academic outcomes as were students with higher levels of mental health difficulties (e.g., externalizing behavior, depressive symptoms, and hyperactivity). Previous research supports these findings (e.g., Connolly, 2006; Kingdon and Cassen, 2010; Deighton et al., 2018). However, the lack of effect size estimates for the included studies makes interpreting the results difficult.

The only other factor to show a strong association with later academic attainment was prior attainment in middle childhood. Regardless of the type of prior attainment measured, a consistent direction of effect was reported with higher academic scores in middle childhood associated with higher academic scores at the end of schooling; the exceptions being reading, writing, quantitative reasoning, non-verbal attainment, creative expressiveness, logic, and executive function. A wide range of end-of-school academic outcomes were found to be associated with prior attainment. Prior attainment has been identified consistently as the strongest factor associated with later academic attainment (Sammons, 1995; Goldstein and Sammons, 1997; Gorard and Siddiqui, 2019). In addition, general cognitive ability is moderately or strongly correlated with academic attainment (Bartels et al., 2002; Calvin et al., 2010). Higher verbal ability scores are often associated with better language-based

attainment. The studies in the current review also show positive associations between these factors and with English, science and mathematics attainment. It is important to note, however, that there is a gender effect related to verbal ability, where girls record higher scores than boys (Strand et al., 2006), and this may affect the interpretation of the results.

Thirteen factors showed moderate evidence of an association with later academic attainment including four student factors, four different socioeconomic factors, three measures of prior attainment, and two school factors. Ethnicity has established associations with academic attainment (e.g., Connolly, 2006; Kingdon and Cassen, 2010) and all included studies exploring ethnicity showed consistent direction of effects with students from ethnic minority backgrounds more likely to have high academic attainment. Body mass index, physical health, and emotional intelligence also showed moderate evidence of an association with later academic attainment, but more high-quality studies are needed. Socioeconomic factors with a moderate association with later academic attainment were family income, parental social class, home learning environment, and stressful life events during middle childhood. Socioeconomic factors such as income have been shown previously to be associated with academic attainment (e.g., Cooper and Stewart, 2013) and the results of the current review support this with both family income and parental social class showed consistent direction of association. Interestingly, eligibility for free school meals and neighborhood deprivation showed inconsistent findings with one high quality study showing a negative association with academic attainment and one showing no association. Previous research has suggested a strong link between measures of deprivation and academic attainment (Cook et al., 2014), partially contradicting the findings in current review. This is an important finding given that eligibility criteria for many policies targeting support for disadvantaged learners, such as the Pupil Premium in England or the Pupil Deprivation Grant in Wales, are based on measures such as eligibility for free school meals. There has been some discussion in the literature on the usefulness of eligibility for free school meals and neighborhood deprivation as proxies for socioeconomic disadvantage (see Ilie et al., 2017; Taylor, 2018). Studies suggest that a significant number of students experiencing one form or another of socioeconomic deprivation are being missed (Kounali et al., 2008; Hobbs and Vignoles, 2010; Taylor, 2018) and other indicators, such as parental education and occupation, may be more accurate (Taylor, 2018). However, there are issues related to the availability of such data, and the practicality of obtaining them (Ilie et al., 2017). In the current review, a lack of high-quality studies and estimates of effect size limits the interpretation of these factors more fully. Further research on the longitudinal association of measures of deprivation and academic attainment are needed. For the academic factors, prior reading attainment, quantitative reasoning, and creative expressiveness showed moderate evidence for an association with later academic attainment with a consistent positive direction and small to medium effect sizes, but all studies were of low quality. Similarly, school verbal reasoning level had moderate evidence for an association based on low quality

studies and small to medium effect sizes. School level eligibility for free school meals showed moderate evidence of a negative association with later academic attainment based on one high quality and one low quality study and small to medium effect sizes.

Strengths and Limitations

An important strength of this systematic review is the inclusion of non-peer reviewed reports, as well as peer-reviewed articles. The overall quality of the included studies was relatively poor with only 19 studies rated as high quality. The common weaknesses within these longitudinal studies were a failure to report missing data for the variables used and low participation rates (although many reports were unclear regarding this).

There are also some limitations to consider. First, only papers that were published in English were reviewed. No eligible studies published in other languages in the UK (e.g., Welsh) were eligible. Second, we did not attempt to perform a meta-analysis, which would allow a quantitative analysis of factors related to academic attainment, due to the differing research methods of studies included in this systematic review. Third, many papers were based on the same data (e.g., over half used the Department for Education National Pupil Database). This suggests that caution should be taken when interpreting the results even though there may be advantages to analysis based on large numbers across the UK. Fourth, there is also an issue with relationships between factors that can affect interpretation. For example, Strand (2014) found that the attainment gap at 16 years associated with social class was larger than for gender and ethnicity, although there were substantial interactions between the three factors. A similar relationship can be seen for deprivation (see Parsons, 2016). This suggests that complex relationships exist and that examining such factors in isolation may be misleading. In this review, only 54% of the included studies adequately controlled for confounding variables. Finally, the search was limited to factors in middle childhood (6–12 years). This may have excluded factors from early and later childhood which could affect academic attainment at KS4, but such studies were out of the scope of the current review and could not be assumed to apply to decisions relating to actions that may be taken based on middle childhood factors.

Implications

The current findings have several implications for policy and interventions targeting educational inequality. For example, Cognitive Ability Tests, particularly verbal reasoning, provide schools with a powerful tool to estimate students' academic attainment (see <https://www.gl-assessment.co.uk/products/cognitive-abilities-test-cat4/>; GL Assessment, 2012). Studies in this review suggest that verbal reasoning is strongly associated with later attainment and the Strand (2006) study suggests that cognitive ability scores show stronger relationship to later attainment than KS2 scores. In the UK, many schools use cognitive ability estimates during primary phase (age 7–11 years) and/or at the start of secondary school (age 11–12 years), although the use of these data is not compulsory. Where schools use cognitive ability estimates effectively, it helps teachers to adjust provision and plan interventions for students to help

them make expected progress (Estyn, 2019). Encouraging school leaders to make the formative use of cognitive ability estimates may be a policy priority to ensure that more students achieve their potential.

This review also has implications for current education policy and guidance. For example, the findings for the socioeconomic factors suggest that providing support to disadvantaged students early to reduce the attainment gap may lead to improved attainment at the end of secondary education. Schools in the UK are given additional funds to support disadvantaged students who are identified as being eligible for free school meals based on measures related to household income. The results of this review partially support this policy, since parent income and parent social class (which is associated with income) in middle childhood were all found to have moderate evidence for an association with later academic attainment, although eligibility for free school meals had inconsistent results and some have questioned its suitability as a proxy for disadvantage (see Ilie et al., 2017).

Guidance for schools on how to best support disadvantaged students across the UK (Estyn, 2012; Department for Education, 2015a) identifies seven key principles of effective practice, three of which are supported by the results of this review: (1) developing a whole-school ethos of high attainment for all—this review suggests on the whole that students from primary schools with higher mean attainment are more likely to have higher later academic attainment; (2) using student data, including cognitive abilities tests, to inform teaching approaches—prior attainment was the factor with the strongest association identified in this review as well as elements of cognitive ability which were all positively related to later academic attainment; and (3) ensuring students acquire early language and literacy skills—language and literacy skills are important for all students and the current review shows that prior attainment is positively related to later academic attainment. For the other four UK recommendations on supporting disadvantaged students (high quality teaching for all; addressing attendance and behavior; deploying staff effectively; and clear and responsive leadership), there were no supporting studies in the current review, mainly because the factors had not been measured in middle childhood. For example, although Department for Education (2016) showed that attendance is negatively associated with GCSE attainment, the study only evaluated the attendance of students during KS3. Also, there was lack of research on school-based factors with most of those identified in this review coming from one study (Gorard and Siddiqui, 2019). Further research needs to be conducted on school-based factors including teaching and leadership quality and staff ratio as suggested by the Department for Education recommendations.

Another implication of the current review relates to the paucity of research addressing middle childhood to end-of-school association with academic attainment since most of the factors identified had very few supporting studies (the exception being academic factors). Given that it is crucial to ask what could be done during primary education, or at the start of secondary education, to increase the chances of young people leaving school with better academic attainment, the paucity of

direct research evidence is a serious concern. Therefore, we call for a step change in longitudinal educational attainment research. A second problem is that not all of the relevant research includes metrics that might directly inform policy makers (i.e., estimates of effect size). The reporting of effect sizes was variable within the studies with 54 providing an effect size estimate, thus limiting meaningful interpretation of results. Effect sizes are important since they tell us the magnitude of an effect whilst statistical testing only tells whether an effect exists (Fan, 2001); but many studies particularly in education neglect to include effect sizes (Sun et al., 2010).

A final significant limitation of the extant literature, and thus the findings of the current review, is the lack of an explicit framework to guide what middle childhood factors might be examined as potential associated factors of end-of-school academic attainment. Several of the factors examined in studies included in the current review may be important but appeared to follow the particular interests of researchers or the availability of certain variables in existing databases. A focus on physical activity and body mass index (Booth et al., 2014a,b) is a case in point. Although potentially important factors, it is unclear why these factors and not others might have been examined. Thus, there are potential biases overall in the findings of the current review relating to researcher priorities.

What is needed is an agreement about how to categorize potentially important variables, to measure them in education databases, and to explore them in future research. One option, prompted by the focus of the studies included in the current review, would be to consider a broader child development framework such as Bronfenbrenner's bioecological approach (Bronfenbrenner and Morris, 2006; Darling, 2015). What is notable about the studies included in the current review is that very few broader contextual factors that may affect a young person's academic attainment from middle childhood have been examined in research. For example, experience at school or the quality of schooling in middle childhood have not been examined as factors associated with later outcome. Such factors are important for a more wholistic understanding of a young person's later academic attainment, but also because they may be amenable to change through their interaction with different practices in primary schools or early in secondary school education.

CONCLUSION

The small number of high-quality studies led to finding strong evidence only for gender, mental health, and prior academic attainment as middle childhood factors associated with later academic attainment. Other factors have shown moderate evidence of association, but many more had inconsistent or insufficient evidence. More high-quality research is needed to identify associated factors during the crucial period of middle childhood for secondary schools to best support students in achieving their full academic potential.

DATA AVAILABILITY STATEMENT

The original contributions presented in the study are included in the article/**Supplementary Material**, further inquiries can be directed to the corresponding author.

AUTHOR CONTRIBUTIONS

SC developed the search criteria and wrote the protocol. MW conducted the literature search, extracted the data, and critically appraised the studies, and developed the first draft of the manuscript. SC, RH, RW, PM, and JH reviewed and edited the manuscript.

All authors read and approved the final manuscript for submission.

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SUPPLEMENTARY MATERIAL

The Supplementary Material for this article can be found online at: <https://www.frontiersin.org/articles/10.3389/feduc.2022.849765/full#supplementary-material>

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