

## RESEARCH ARTICLE

# Prevalence of neurodevelopmental differences and autism in Scottish primary schools 2018–2022

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**Abstract**

This study investigated the prevalence of neurodevelopmental needs among children in primary schools in Scotland. Two groups were identified: autistic learners and a larger group of learners who had neurodevelopmental differences. These differences encompassed any need for additional support in various domains, including communication, interaction, emotional regulation, coordination, movement, and cognition. A two-phase process was employed, drawing on data from a cross-sectional study followed by a secondary analysis of a population census. In the first phase, a random sample of 688 children with additional support needs from 22 schools participated. Demographics, support characteristics, and neurodevelopmental needs were identified. Results revealed that 76.89% of children with additional support needs exhibited a need type consistent with a neurodevelopmental difference. In the second phase, data from the Scottish Government Annual Pupil Census, covering all state-provided primary school children between 2018 and 2022, were analyzed. Modeling was conducted using data from the first phase to estimate prevalence of neurodevelopmental differences. Data on autism were directly extracted from the census. Analysis revealed an increase in the prevalence of neurodevelopmental differences and autism. The prevalence of autism rose by 31.98%, with 2.60% of primary school children identified as autistic in 2022. Similarly, the prevalence of neurodevelopmental differences increased by 10.57%, with 16.22% of primary school children exhibiting such differences in 2022. Across 32 localities, regional variations in prevalence were observed. These findings show the substantial number of neurodivergent children within Scottish primary schools and emphasize the need for a neurodevelopmentally informed approach to inclusive education.

**Lay Summary**

This study investigated how common neurodevelopmental needs were among children in Scottish primary schools. We focused on two groups: autistic children and a bigger group of children who had neurodevelopmental differences. These differences meant they needed extra help with things like communication, feelings, and coordination. The study happened in two parts. In the first part, we included a random sample of children from 22 schools in one area to learn about them and the kind of help they needed. The second part looked at data from all the primary school children in Scotland between 2018 and 2022, using data from a national census. What we found was surprising. Before, we thought about 1% of children were autistic, but this research showed that 2.6% of primary school children were

autistic and 16.2% of them had some kind of neurodevelopmental difference. These numbers were different in different places in Scotland, which tells us that some areas might be better at noticing these needs than others. This study tells us that schools need to pay more attention to children with neurodevelopmental needs and have better ways to help them.

#### KEYWORDS

autism, neurodevelopmental, prevalence, schools

## INTRODUCTION

Neurodevelopmental differences are characterized by life-span variations in motor, cognitive, communicative, and/or social development, overlap between diagnoses, differing requirements for support, and heterogeneous outcomes (American Psychiatric Association (APA), 2013; Gillberg, 2021). Various diagnoses, including autism and attention-deficit hyperactivity disorder (ADHD), are associated with such differences. In the ICD-11 (World Health Organization, 2022), they are grouped within the section “Mental, behavioral, and neurodevelopmental disorders.” This category includes other categories such as “intellectual development disorders,” “speech or language disorders,” “learning disorders,” and “motor coordination disorder.” Similarly, the DSM-5 (American Psychiatric Association, 2013) includes categories such as “intellectual disabilities,” “communication disorders,” “specific learning disorder,” and “motor disorder.”

While medical diagnostic taxonomy is not routinely integrated into educational settings, apart from some specific labels, there has been a significant shift in the approach to educating children with such needs. The focus has moved from the belief that children require segregated settings toward an understanding that most children with neurodevelopmental differences should be educated in inclusive, “mainstream,” or community schools (Beckman et al., 2016; Bitta et al., 2017; Bölte et al., 2021; Bonati et al., 2018; Sokal & Katz, 2020; Zablotzky et al., 2019). Inclusion, with consideration of the social model of disability and neurodiversity paradigm (Pellicano & den Houting, 2022), is understood to occur best through adaptations to naturally occurring environments, and the responsibility for change lies primarily with people around the child, not with the child themselves (Rutherford & Johnston, 2022). Having the appropriate expectations and making necessary adjustments to the physical and social environment in daily settings is therefore the fundamental basis of effective support (Maciver, Rutherford, et al., 2023). In this case, for schoolchildren, the responsibility for change lies with schools and teachers. There are numerous ideas about what makes an effective inclusive school (De Bruin, 2019; Maciver et al., 2021; Scottish Government, 2017a) and although principles that should underpin inclusion are widely accessible, there is still difficulty operationalizing

them (Morgan, 2020; Scottish Government, 2020). There are issues with attitudes to inclusion (Krischler & Pit-ten Cate, 2019), understanding of autism and neurodevelopmental differences (Vincent & Ralston, 2020), and knowledge of staff (Attwood et al., 2019), leading to calls for more training, support, and resources (Lewis et al., 2019).

The “ESSENCE” framework (Gillberg, 2021) highlights the interconnectedness of neurodevelopmental needs and the importance of taking a broader perspective that considers overlapping needs, rather than individual diagnoses. Currently, support efforts tend to center around the presence or absence of single diagnoses, disregarding related differences and leaving needs unmet. As a result, there is a growing consensus advocating for a departure from a single diagnosis focus in favor of adopting a comprehensive “neurodevelopmental” perspective (Maciver, Rutherford, et al., 2023; Rutherford et al., 2021). It is increasingly recognized that integrated assessment and services for children hold promise in terms of enhancing efficiency and overall experience (Male et al., 2020). The guidelines from the UK National Institute for Health and Care Excellence (NICE) pertaining to autism and ADHD both recommend a multidisciplinary and multi-focus approach (NICE, 2011; NICE, 2018). The goal is to create a full picture of each child’s situation and to recognize that co-occurrence is common in this group (NICE, 2011, NICE, 2018).

Implementing neurodevelopmental perspectives in practice remains challenging (Thapar et al., 2017). Fostering neurodevelopmental understanding in education requires assessment pathways, expertise, and support frameworks to effectively address diverse neurodevelopmental differences. Central to this is recognizing learners who may benefit from these perspectives. Therefore, understanding the prevalence of neurodevelopmental needs is pivotal. A significant knowledge gap concerns the numbers and characteristics of learners with neurodevelopmental differences in education. This gap persists due to the need to move beyond small-scale studies and other limited cohorts. Instead, a focus on gathering regional or national data can lead to a more comprehensive examination of neurodevelopmental differences within education. Analyzing national and regional data serves a dual purpose. It not only acts as an indicator of prevalence but also sheds light on potential inequalities

and variations in the provision of assessment and support. Regional disparities may signify differences in services, including access to specialized support. For instance, regions with more robust educational and mental health services may exhibit higher rates of identification and support, whereas those with limited resources might experience lower rates, potentially leading to inadequate or absent assistance for children.

## Aims of the current study

This study aimed to identify the prevalence of autism and neurodevelopmental differences in the Scottish primary school system. Despite collecting data on additional support needs and autism in a yearly school population census, challenges arise from anonymized aggregated data and variations in definitions compared to international standards, necessitating further analysis for accurate estimates. To overcome these obstacles, a two-phase study was completed. First, a study employing random sampling in a large urban area in Scotland identified the numbers and characteristics of children with additional support needs in primary schools (ages 4–12). This enabled identification of the prevalence of neurodevelopmental differences in this sample. Then, we used this information to estimate how prevalent these differences might be in the 4 to 12-year-old population in Scotland, using school census data. In Scotland, autism is directly recorded in school census data, and we also provide those figures.

## Language statement

The stakeholder community increasingly highlights the importance of using non-medical terms, including identity-first language, to describe people in a manner that is helpful, free from pejorative or ableist connotations, and accurate (Bottema-Beutel et al., 2021; Dwyer et al., 2022). The term “neurodevelopmental disorders/diagnoses/conditions” originates from medical terminology and is associated with diagnostic practices aligned with ICD and/or DSM classifications. Our research uses the term “neurodevelopmental differences” to refer to individuals who may have the mentioned diagnoses or needs. By using this term, the aim is to recognize diversity of individuals without categorizing them as having “disorders” or “illnesses.” The use of terms like “impairment,” “disorder,” “behavioral difficulty,” and “problem” in this research aligns with the current language employed in school and national census data in Scotland. However, it is important to understand that these terms are specific to this context and are used to convey a particular aspect of practice. We also acknowledge that individuals have different preferences, and

outside of published materials, it is good practice to ask about and use language that respects preferences.

## Background to the Scottish educational system

Scotland is the second largest country in the United Kingdom, with an estimated population of 5.4 million. Children begin primary school at 4.5–5.5 years and attend for 7 years. Scotland’s education system aims to be highly inclusive, but concerns persist about support for children with additional support needs. There have been criticisms of the assessment process and a lack of resources and funding (Morgan, 2020). Almost all children attend “mainstream” schools, irrespective of need, reflecting a policy of universal inclusive practice. Children are typically supported by teachers and other staff, and some areas have specialist teachers providing additional support and guidance. Various instruments, including “Individualized Educational Programs” and “Coordinated Support Plans” are in place to support children with additional needs. While policy describes multi-disciplinary and multiagency teams for diagnosis, assessment, and intervention, the health and education systems are organizationally separate, with different funding structures, locations, staff, and training. Allied health professionals, psychologists, charities, advocacy organizations, and community organizations may support children. Support organizations may or may not link into the child’s school. Children may be identified as having an additional support need by doctors or other health professionals (e.g., a diagnosis of autism), but parents maintain the right not to disclose a diagnosis to schools. Alternatively, children may be identified as having additional support needs in education (e.g., a learning difficulty) and not be in receipt of health support, therapies, or a health system diagnosis. In many areas, school support may be classified in an escalating system as follows: “Pathway 1” in which needs are met by a teacher in the classroom; “Pathway 2” when involvement of a person within the school (e.g., more specialist or experienced teacher) is required; and “Pathway 3” which includes involvement of agencies external to the school (e.g., speech and language therapist or occupational therapists). Educational administration in Scotland is decentralized, with 32 geographical “local authorities” overseeing the implementation of national policies and responding to local needs.

## METHODS

The study comprised two phases, the first of which involved an initial study using random sampling to determine the numbers and characteristics of children in one location, while the second phase involved a secondary

analysis of a population census dataset. In the second phase, autism prevalence data was available in the dataset, but for neurodevelopmental differences, findings from the first phase were used to model prevalence estimates.

## Phase 1

### Sample and study design

Full sampling, recruitment, and other study details are published elsewhere (Maciver et al., 2023). In summary, data collection was conducted in one of the largest local authorities in Scotland, representing a major urban area with a population of approximately 500,000. The area has a large primary school population, with 89 primary schools and approximately 30,000 state-educated children. Twenty-two randomly sampled primary schools were included in 2018, in this area. Within participating schools, school leaders identified children with additional support needs, selected using a lottery method. Teachers were responsible for selecting participants and completing measures. An overview of the sample is presented in Supplemental File 1.

### Case definition: Additional support needs

Inclusion was based on need categories used in national practice and in records and therefore commonly understood by reporting teachers, these were: learning disability; dyslexia; other specific learning difficulty; other moderate learning difficulty; visual impairment; hearing impairment; deafblind; physical or motor impairment; language or speech disorder; autism; social, emotional, and behavioral difficulty; physical health problem; or mental health problem. To be included, children could have one or more of these needs recorded. Scottish need categories that captured transient needs, linguistic needs, and other forms of need that did not align with internationally understood definitions of disability-related or “special” educational needs were excluded, these were: interrupted learning, English as an additional language, looked after pupil, more able pupil, young carer, bereavement, substance misuse, family issues, and risk of exclusion.

### Case definition: Neurodevelopmental differences

There is growing acceptance that having multiple neurodevelopmental needs is common (Gillberg, 2021). While this may then resolve into any number of individual diagnoses over time, it remains useful to view overlapping neurodevelopmental needs. In this analysis, neurodevelopmental differences were identified within the cohort of

children with additional support needs. The categories of need used to define the neurodevelopmental differences group were: autism, communication support need, language or speech disorder, learning disability, mental health problem, moderate/specific learning difficulty, and social emotional and behavioral difficulty. To be included, children could have one or more of these needs recorded. Although these categories are not formally recognized as “neurodevelopmental” in the Scottish system, they served to identify a group of children who may require support and assessment for differences related to communication, interaction, emotional regulation, coordination, movement, and cognition. This approach aligns with the criteria outlined in the ICD and DSM systems and aims to proxy for common diagnoses and needs, encompassing areas such as motor (e.g., developmental coordination disorder), cognitive or executive function (e.g., intellectual disability or ADHD), and communication (e.g., autism or developmental language disorder).

### Other measures

In addition to demographic information, data were collected on support and involvement of professionals. Specifically, the involvement of the Additional Support for Learning Service, Occupational Therapy, Speech and Language Therapy, Educational Psychology, Physiotherapy, and Community Pediatrics (Medical). Additionally, the study looked at the supports and interventions that were provided to the children, such as Individualized Educational Programs, Coordinated Support Plans, and whether the child had been excluded or had a part-time timetable. These variables allowed for a comprehensive examination of the level and types of support received by the children.

### Analytic methods

Descriptive statistics were employed to summarize the demographic information and characteristics of interest for the groups of interest. The data are presented for children in the following categories: any need, children with neurodevelopmental differences, children without neurodevelopmental differences, autistic children, and children who are not autistic.

## Phase 2

### Sample and study design

Publicly available Government annual pupil census data for years 2018, 2019, 2020, 2021, and 2022 was used (Scottish Government, (n.d.)). The cohorts of interest comprised children who attended a primary school (typically

aged 4.5–12.5 years old) maintained by a local authority and who were included in any of the censuses in 2018 (399,815 children), 2019 (398,334 children), 2020 (393,497 children) 2021 (389,853 children) and 2022 (388,132 children). Data are based on teacher report, collected annually in September by a government agency, and made publicly available in an anonymous aggregated form. The census provides information on the number of schools and pupils, types and sizes of schools and classes, and characteristics of pupils, including the reasons children are in receipt of additional support, including autism. The chosen years for analysis (2018–2022) ensure data consistency and minimizes the influence of shifting definitions and identification practices. This timeframe offers a snapshot of prevalence trends and allows for the examination of neurodevelopmental differences within a reasonable period.

## Analytic methods

To identify autistic children, we relied on the “autism” category in the annual pupil census data, which indicates students receiving support for this need (see Supplemental File 2 for details). To estimate the prevalence of neurodevelopmental differences, we applied the proportion of children with such differences identified during the initial phase of the study to the publicly available data on children with additional support needs. Our definition of additional support needs differed from the broader Scottish definition found in publicly available data, which may have caused an overestimate of prevalence, therefore we restricted the population in the public data to match our study’s criteria for additional support needs, necessitating removal of Scottish need categories that did not align with internationally understood definitions of disability-related or special educational needs (see Supplemental File 2 for details). We completed an analysis for all 32 local authority geography areas (see Supplemental File 3 for details). This enabled us to estimate national numbers of children with neurodevelopmental differences for the years 2018, 2019, 2020, 2021, and 2022.

## Prevalence

Prevalence was calculated as the number of autistic children, the estimated number of children with neurodevelopmental differences, and the number of children with both definitions of additional support needs in September of each year (2018, 2019, 2020, 2021, and 2022), divided by the total number of children in the population. The population was defined as children who attended any state primary school maintained by a local authority in September of each year. As the analysis is focused on publicly funded local authority schools, the population excludes children in grant-aided schools or independent

(private) schools. Grant-aided Schools are national and independent from local authorities and includes seven specialist special schools with national catchments.

## Ethics

For the primary data collection, research ethics board approval, and written informed consent were obtained from each participating school and the Queen Margaret University Research Ethics Committee, and the Local Authority (local Government) Research Access Service. Use of the data was permitted through data processing and sharing agreements between Queen Margaret University and the census data providers. This study complied with the Declaration of Helsinki.

## RESULTS

### Phase 1

A total of 688 children with additional support needs from 22 schools were included in the first phase of the study. There were 529/688 (76.89%) children identified in the neurodevelopmental group. There were 159/688 (23.11%) autistic children. The neurodevelopmental group (and autistic) group contained a larger proportion of boys than girls. These groups were distributed equally across the 7 primary school stages. The largest age band of children in the neurodevelopmental group and autistic group was the P5 group, which children typically enter at 9–10 years old. The primary language of most of all children was English, and the majority were white/British, reflecting the demographic character of the locality (see Tables 1 and 2).

### Level of support

Data from 688 children in Phase 1 are presented in Table 3. Children in the neurodevelopmental group, including autistic children, demonstrated higher levels of school support compared to children without neurodevelopmental differences. Specifically, compared to children without a neurodevelopmental difference, 39.51% of children in the neurodevelopmental group received level III support, indicating heightened support needs. Professional involvement was more prevalent among children with neurodevelopmental differences, encompassing all categories except for occupational therapy and physiotherapy. Interventions were more frequent in the neurodevelopmental group, particularly exclusions, where no instances of exclusion were recorded among children without neurodevelopmental differences. Similar patterns emerged when comparing autistic and non-autistic children. Autistic children exhibited higher levels of school support, with 52.83% receiving level III support. They

**TABLE 1** Characteristics of  $n = 688$  children, 22 schools, stage, and age at entry.

Stage (typical entry age)	No ND		Any ND		Not autistic		Autistic		Any need	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
P1 (4.5–5.5 years)	15	9.4	78	14.7	69	13.0	24	15.1	93	13.5
P2 (5.5–6.5 years)	19	11.9	77	14.6	72	13.6	24	15.1	96	14.0
P3 (6.5–7.5 years)	19	11.9	71	13.4	67	12.7	23	14.5	90	13.1
P4 (7.5–8.5 years)	25	15.7	74	14.0	80	15.1	19	11.9	99	14.4
P5 (8.5–9.5 years)	20	12.6	83	15.7	72	13.6	31	19.5	103	15.0
P6 (9.5–10.5 years)	30	18.9	74	14.0	91	17.2	13	8.2	104	15.1
P7 (10.5–11.5 years)	31	19.5	72	13.6	78	14.7	25	15.7	103	15.0

Note: Any need = Additional support need (study definition).  
Abbreviation: ND, neurodevelopmental difference.

**TABLE 2** Characteristics of  $n = 688$  children, 22 schools, sex, ethnicity, and primary language.

	No ND		Any ND		Not autistic		Autistic		Any need	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
<b>Sex</b>										
Female	64	40.25	172	32.51	194	36.67	42	26.42	236	34.30
Male	94	59.12	354	66.92	332	62.76	116	72.96	448	65.12
Missing	1	0.63	3	0.57	3	0.57	1	0.63	4	0.58
Male:Female Ratio	1.47:1		2.06:1		1.71:1		2.76:1		1.90:1	
<b>Ethnicity</b>										
White	133	83.65	442	83.55	446	84.31	129	81.13	575	83.58
Black/African	2	1.26	9	1.70	8	1.51	3	1.89	11	1.60
Asian	11	6.92	32	6.05	36	6.81	7	4.40	43	6.25
Black/Caribbean	1	0.63	0	0.00	1	0.19	0	0.00	1	0.15
Mixed/multiple/other	5	3.14	32	6.05	24	4.54	13	8.18	37	5.38
Missing	7	4.40	14	2.65	14	2.65	7	4.40	21	3.05
<b>Primary language</b>										
English	137	86.16	454	85.82	455	86.01	136	85.53	591	85.90
Other	19	11.95	61	11.53	63	11.91	17	10.69	80	11.63
Missing	3	1.89	14	2.65	11	2.08	6	3.77	17	2.47

Note: Any need = Additional support need (study definition).  
Abbreviation: ND, neurodevelopmental difference.

also received greater support and involvement from others across most categories, except for support for learning teacher, education welfare officer, and social work. Compared to non-autistic children, autistic children also received a higher number of interventions across all categories.

## Phase 2

### Prevalence in the primary school population: National 2018–2022

The prevalence of additional support needs (study definition) was 21.18% (82,204 children) in 2022. This represents a 10.60% increase from the 2018 prevalence of

19.15% (76,551 children). The prevalence of autism was 2.60% (10,089 children) in 2022. This represents a 31.98% increase from the 2018 prevalence of 1.97% (7883 children). The prevalence of neurodevelopmental differences was 16.22% (62,968 children) in 2022. This represents a 10.57% increase from the 2018 prevalence of 14.67% (58,637 children) (see Tables 4 and 5).

### Prevalence in the primary school population: By geography 2018–2021

The mean prevalence of additional support needs (study definition) in 32 local authorities in 2022 was 23.10% (SD = 6.28), with a range of 8.47% to 37.23% of the primary school population. The mean prevalence of autism

**TABLE 3** Characteristics of  $n = 688$  children, 22 schools, supports and involvement of professionals.

	No ND		Any ND		Not autistic		Autistic		Any need	
	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%	<i>N</i>	%
<b>School support level<sup>a</sup></b>										
I	71	44.65	138	26.09	172	32.51	37	23.27	209	30.38
II	56	35.22	182	34.40	200	37.81	38	23.90	238	34.59
III	32	20.13	209	39.51	157	29.68	84	52.83	241	35.03
<b>Professional involvement</b>										
Additional support for learning service	25	15.72	153	28.92	111	20.98	66	41.51	177	25.73
Occupational therapy	17	10.69	50	9.45	48	9.07	19	11.95	67	9.74
Speech and language therapy	9	5.66	124	23.44	87	16.45	46	28.93	133	19.33
Educational psychology	14	8.81	134	25.33	95	17.96	53	33.33	148	21.51
Physiotherapy	12	7.55	17	3.21	23	4.35	6	3.77	29	4.22
Community pediatric/medical	12	7.55	67	12.67	54	10.21	25	15.72	79	11.48
Barnardo's	2	1.26	23	4.35	15	2.84	10	6.29	25	3.63
CAMHS	4	2.52	75	14.18	49	9.26	30	18.87	79	11.48
Social work	8	5.03	69	13.04	65	12.29	12	7.55	77	11.19
Education welfare officer	2	1.26	17	3.21	16	3.02	3	1.89	19	2.76
Support for learning teacher	66	41.51	253	47.83	257	48.58	62	38.99	319	46.37
<b>Interventions</b>										
Assessment of need	36	22.64	239	45.18	194	36.67	81	50.94	275	39.97
Child planning meeting	45	28.30	287	54.25	211	39.89	121	76.10	332	48.26
Individual education plan	8	5.03	91	17.20	54	10.21	45	28.30	99	14.39
Coordinated support plan	0	0.00	19	3.59	8	1.51	11	6.92	19	2.76
Supporting learning profile	22	13.84	82	15.50	73	13.80	31	19.50	104	15.12
Excluded	0	0.00	17	3.21	13	2.46	4	2.52	17	2.47
Part-time timetable	3	1.89	29	5.48	24	4.54	8	5.03	32	4.65

*Note:* Any need = Additional support need (study definition); Barnardo's = third sector support organization; Support for Learning Teacher and Education Welfare Officer = professionals who support children and young people to overcome barriers to their education, working with schools, parents/carers, and other professionals; Additional Support for Learning Service = central department within the local authority that provides specialist support and advice for children and young people with additional support needs; Assessment of Need = process of identifying a child or young person's additional support needs and the support required to meet those needs; Child Planning Meeting = involves the child, parents/carers, school staff, and other professionals to discuss a child or young person's additional support needs and to plan appropriate support; Individual Education Plan = a plan that outlines learning goals and strategies for a child or young person; Coordinated Support Plan = legal document that outlines a child or young person's additional support needs, the support required to meet those needs, and who will provide support; Supporting Learning Profile = local document that provides detailed information about a child or young person's learning, strengths, and support needs; Excluded = a pupil has been temporarily or permanently removed from their school; Part Time Timetable = a pupil attends school for a reduced number of hours.

Abbreviations: CAHMS, child and adolescent mental health service; ND, neurodevelopmental difference.

<sup>a</sup>Level I: child's needs are managed by the class teacher; Level II: with help from specialists or more senior teachers within the school; Level III: with support from partnership services/agencies (e.g., therapists).

**TABLE 4** Prevalence of additional support needs, neurodevelopmental differences, and autism in Scottish state school primary school children, 2018–2022.

Type of need identified	2018 cases	Prev (%)	2019 cases	Prev (%)	2020 cases	Prev (%)	2021 cases	Prev (%)	2022 cases	Prev (%)
Additional support need (Scottish definition) <sup>a</sup>	101,530	25.39	107,606	27.01	109,415	27.81	108,061	27.72	109,954	28.33
Additional support need (study definition) <sup>b</sup>	76,551	19.15	80,350	20.17	81,584	20.73	80,979	20.77	82,204	21.18
Neurodevelopmental difference <sup>b</sup>	58,637	14.67	61,547	15.45	62,493	15.88	62,029	15.91	62,968	16.22
Autistic <sup>a</sup>	7883	1.97	8801	2.21	9291	2.36	9482	2.43	10,089	2.60

*Note:* The population for prevalence calculation comprises schoolchildren who attended a Scottish local authority primary school (typically aged 4.5–12.5 years old) in 2018 (399,815 children), 2019 (398,334 children), 2020 (393,497 children), 2021 (389,853 children), and 2022 (388,132 children).

Abbreviation: Prev, Prevalence.

<sup>a</sup>Government census data.

<sup>b</sup>Estimated.

**TABLE 5** Increases, additional support needs, neurodevelopmental differences, and autism in Scottish state school primary school children, 2018–2022.

Type of need	Prevalence		
	Percentage point increase	% increase	N increase
Additional support need (Scottish definition) <sup>a</sup>	2.94	11.58	8424
Additional support need (study definition) <sup>b</sup>	2.03	10.60	5653
Neurodevelopmental difference <sup>b</sup>	1.55	10.57	4331
Autistic <sup>a</sup>	0.63	31.98	2206

Note: The population for prevalence calculation comprises schoolchildren who attended a Scottish local authority primary school (typically aged 4.5–12.5 years old) in 2018 (399,815 children), 2019 (398,334 children), 2020 (393,497 children), 2021 (389,853 children) and 2022 (388,132 children).

<sup>a</sup>Government census data.

<sup>b</sup>Estimated.

**TABLE 6** Geographical differences: prevalence range across 32 local authorities for additional support needs, neurodevelopmental differences, and autism in Scottish state primary school children, 2018–2022.

Type of need	2018 prevalence range (%)	2019 prevalence range (%)	2020 prevalence range (%)	2021 prevalence range (%)	2022 prevalence range (%)
Additional support need (Scottish definition) <sup>a</sup>	10.20–41.83	11.24–42.58	13.21–42.80	12.38–43.18	10.78–44.34
Additional support need (study definition) <sup>b</sup>	8.60–35.13	9.48–35.76	10.38–35.94	9.72–36.26	8.47–37.23
Neurodevelopmental difference <sup>b</sup>	6.59–26.91	7.26–27.39	7.95–27.53	7.45–27.77	6.49–28.52
Autistic <sup>a</sup>	0.45–3.55	0.59–3.74	0.63–4.19	0.66–4.15	0.88–4.56

Note: The population for prevalence calculation comprises schoolchildren who attended a Scottish local authority primary school (typically aged 4.5–12.5 years old) in 2018 (399,815 children), 2019 (398,334 children), 2020 (393,497 children), 2021 (389,853 children) and 2022 (388,132 children).

Abbreviation: Prev, Prevalence.

<sup>a</sup>Government census data.

<sup>b</sup>Estimated.

was 2.73% (SD = 0.87), with a range of 0.88% to 4.56%. The mean prevalence of neurodevelopmental differences was 17.69% (SD = 4.81), with a range of 6.49% to 28.52% (see Table 6).

## DISCUSSION

Using a population census of Scottish state-educated primary-aged schoolchildren and analyzing data over 5 years, our goal was to identify recent patterns and trends. We had a relatively high level of confidence that consistent understanding and definitions across this contemporary period would facilitate valid year-to-year comparisons. Our study's findings reveal a notable increase in the number of children with additional support needs, autism, and other neurodevelopmental differences between 2018 and 2022. Specifically, the number of students with neurodevelopmental differences rose by 4331, representing a 10.57% increase, and the number of autistic children rose by 2206, representing a 31.98% increase. Over 5 years, the prevalence of autism increased from 1.97% to 2.60%, and the prevalence of neurodevelopmental differences increased from 14.67% to 16.22%. Furthermore, our investigation has shed light on disparities in the prevalence of these needs across different regions in

Scotland, indicating that some areas exhibit higher incidence or identification rates compared to others.

The analysis conducted in this study is important for several reasons. First, it shows on the substantial number of neurodivergent children in the primary school population, highlighting the need for resources and policies to support them. The high prevalence of neurodevelopmental differences has implications for raising awareness and reducing stigma. Acknowledging the commonality of differences supports arguments for the establishment of more accepting and understanding environments. The identification of significant local variance in incidence or identification also raises important questions about consistency of practice across Scotland, and the need to further develop understanding and good practice. Lastly, childhood prevalence rates hold future relevance in terms of further education, employment, and provision of adult services, where neurodevelopmental differences are also commonly expected. This highlights the importance of appropriate support and services throughout individuals' lifespans.

While the global prevalence of autism in school-age children is estimated at around 1–2% (Elsabbagh et al., 2012; Kim et al., 2011; Polanczyk et al., 2015), some recent studies indicate higher prevalence, with the United States Center for Disease Control estimating that



in 2020, one in 36 children aged 8 years (approximately 4% of boys and 1% of girls) was autistic (Centers for Disease Control and Prevention, 2020). The global prevalence of ADHD is higher still, with pooled estimates of around 5% (Polanczyk et al., 2015), but recent studies also suggest higher numbers. A recent study in the United States found a prevalence of ADHD of 8.4% among children aged 2–17 years (Danielson et al., 2020), and a study of school-aged children in South Korea reported a prevalence of ADHD of 8.7% with a prevalence of 11.7% in boys and 5.2% in girls (Cho et al., 2020). Our study findings are broadly in line with this international literature. Our study did find a higher prevalence of neurodevelopmental differences than a previous analysis completed in Scotland (Fleming et al., 2020), which focused on a more limited set of indicators (autism, intellectual disabilities, ADHD, and depression). This previous study identified 35,873 schoolchildren (4.7%) with at least one neurodevelopmental condition using these indicators. Differences to our research are due to inclusion criteria, highlighting that estimating the prevalence of neurodevelopmental differences is challenging, in part due to categorization and labeling issues, and differential focus on specific diagnoses. A recent comprehensive review, with a focus on adopting a broader “neurodevelopmental” perspective, uncovered worldwide prevalence rates for all conditions ranging from 4.7% to 88.5% (Francés et al., 2022). Likewise, specific diagnoses exhibited considerable variations, including ADHD (5%–11%), Autism (0.70%–3%), specific learning disorders (3%–10%), communication disorders (1%–3.42%), and motor disorders (0.76%–17%) (Francés et al., 2022). This review emphasized the significant impact of multiple factors on prevalence figures, including variations in study design, cultural and societal factors, as well as differences in diagnostic criteria, screening tools, and identification (Francés et al., 2022). It further highlights the enduring challenge of assessing and reporting neurodevelopmental differences as a cohesive group.

Our prevalence figures for all neurodevelopmental differences and autism and in the 4–12 year age range in Scottish primary schools, appear reasonable in the context of the previous research, if not a little low. Our figures are an indirect assessment, based on teacher report, with unknown levels of formal clinical diagnosis. The use of direct assessments would detect more cases, especially in the earlier years, where learners’ difficulties may not yet have been identified by teachers. However, our results also imply that there have been improvements in identifying additional support needs in recent years in Scotland, particularly for autism. This may be due to better identification practices, increased awareness and understanding, and changes in reporting and recording methods. These developments are encouraging and should be continued. However, there are still regional disparities in the identification (and therefore support) of children.

Policymakers and educators should address these disparities and work toward ensuring equitable distribution of resources and services for children, regardless of their geographic location.

Between 2018 and 2022, there was an overall increase in students identified with various needs, indicating proactive identification in schools. However, the COVID-19 pandemic significantly impacted case identification. In September 2019, pre-pandemic, there was a substantial increase in identified needs, with +2910 neurodivergent students, marking a 4.96% rise from the previous year. During the pandemic, data from September 2020 showed a slowed growth rate with only +946 neurodivergent students identified (1.54% increase), and by September 2021, there was a 0.74% decrease, with 464 fewer neurodivergent students identified compared to the previous year. This decline can be attributed to disruptions in assessments and diagnoses across health and education systems, as well as reduced student-teacher interaction during pandemic lockdowns. In 2022, post-pandemic, an increase was evident, with +939 neurodivergent students identified, reflecting a 1.51% rise compared to 2021. This suggests a return to historical levels and the possibility of subsequent increases in the prevalence of additional needs and neurodevelopmental differences in future data for 2023/24.

When examining autism identification trends specifically, a somewhat different pattern emerged. In 2019, there was an 11.65% increase in autistic learners, followed by increases of 5.57% in 2020 and 2.06% in 2021. Post-pandemic, in 2022, a 6.40% increase was recorded. Therefore, although the pandemic did have a negative impact on the growth of identified cases, the effect on autism identification was less, and suggests a degree of resilience within the Scottish school system’s capacity to recognize and address support needs related to autism.

## Practice implications

Our findings highlight the importance of raising awareness of prevalence. It is crucial to acknowledge that neurodevelopmental differences are common and interconnected, and that individual needs are not only determined by diagnosis but also by interactions between a person’s individual neurotype and the environment (Gillberg, 2021; Lundström et al., 2015). Adopting this broader “neurodevelopmental” perspective calls for a more inclusive approach to assessment and support, moving away from condition-specific viewpoints, such as a sole focus on autism (Rutherford & Johnston, 2022). The implementation of assessment systems in education that consider neurodevelopmental factors aligns with this approach and could prove valuable for educators. Another critical issue is addressing inequalities that may arise between children with “formal” diagnoses versus

those without. To promote equity, there is endorsement for the principle that support in schools should not be dependent on diagnosis, and rather that support should be based on need (Rutherford & Johnston, 2022; Scottish Government, 2017b; Scottish Government, 2022). Given the high prevalence of diverse neurodevelopmental needs in the classroom, ensuring that all students have access to appropriate support, regardless of diagnostic status, is paramount. While this approach offers various benefits, there is a risk of misconstruing it as diminishing the significance of diagnosis, as the focus shifts toward addressing individual needs. Nonetheless, it is crucial to re-emphasize the ongoing importance of accurate and timely diagnosis for children and families. Diagnosis provides essential benefits, including tailored support, assistance during transitions, self-understanding, and access to supportive peer communities for children and families (Crane et al., 2021; de Broize et al., 2022; Guilbaud et al., 2021).

An effectively implemented neurodevelopmental approach can serve as a valuable framework for teachers, reducing duplication, aiding in understanding needs and facilitating the identification of appropriate support strategies (Astle et al., 2022). To ensure successful implementation of neurodevelopmentally informed support strategies in education settings, professionals need to make subtle but significant changes in language, mindset, and approach. A neurodiversity-affirming approach (e.g., Fletcher-Watson & Happé, 2019) recognizes strengths and promotes inclusivity. Reflection on language and mindset supports professionals to empathically understand how situations are experienced by the child, why the child acting in certain ways, and how the child's responses can be better understood. Universal inclusive practices and proactive environmental accommodations take precedence as the primary interventions (NICE, 2018; SIGN, 2016), for example, the "CIRCLE" framework (Maciver et al., 2021). Key components encompass staff training, provision of sensory-friendly spaces, integration of visual supports, incorporation of predictable, meaningful, and desirable learning activities, establishment of regular routines, availability of quiet areas, and provision of frequent opportunities for movement (Maciver et al., 2021; Rutherford & Johnston, 2022). This approach avoids stigmatization and labeling associated with overt focus on individuals and their "deficits," "disorders," or "challenging behavior." More specialist approaches are used where required, for example, the Social Communication, Emotional Regulation, and Transactional Support (SCERTS) Model (Yi et al., 2022). Finally, supporting nonverbal and minimally verbal neurodivergent individuals often requires different approaches, necessitating further research for effective strategies. Understanding the neurodiversity perspective and its nuances in individuals with higher support requirements is a crucial and ongoing endeavor.

## Limitations

The census data used covers a significant portion of the 4–12 age range in Scotland but does not include the entire pediatric population. It excludes older and younger children, those who are home schooled, those attending some specialist school provision, and all children in private education. Additionally, during the study period, there was a decrease in the student population. On average, between 2018 and 2022, 57,703 students completed their primary education annually, while only 53,774 students, on average, started education yearly. This resulted in a net reduction of 11,683 students, impacting the prevalence figures. Another limitation lies in how we identify children. Our data analysis does not rely on confirmed medical diagnosis but rather the legally mandated practice in Scottish schools to identify additional support needs. While all categorizations of additional support needs are based on assessment in Scotland, it is the case that some categories we used to classify neurodevelopmental differences are directly identified by teachers without the need for external diagnosis or involvement of other professionals. However, it is important to clarify that teachers cannot diagnose autism; and practice is to base such classifications on formal diagnostic assessments. Furthermore, we are not aware of any political or policy-driven motives to manipulate the count of autistic students or those with additional support needs. Additionally, the census's primary objective is to identify students receiving additional support, rather than counting instances of autistic or neurodivergent children specifically. This approach may lead to an undercount of students who are highly adept at masking or managing well in school without additional support requirements being identified. Prevalence of neurodevelopmental differences was established through indirect approximation, relying on teacher reports and data from only 1 year to estimate prevalence over multiple years. Our identification methods are specific to Scotland, and caution should be exercised when applying the findings to other populations. Steps were taken to remove categories of need that do not align well with internationally understood definitions.

## CONCLUSION

Knowing the number of schoolchildren with neurodevelopmental differences is crucial for anticipating their needs and providing support. Our data reveals a sizable population of neurodivergent students in the Scottish education system, with increases in prevalence over 5 years, highlighting the growing demand for support and resources. Regional variations in prevalence suggest some areas may need additional training, resources, or

support. This data supports the adoption of neurodevelopmentally informed approaches and provides evidence for the need to move toward a more comprehensive and empathetic understanding of neurodivergence in schoolchildren.

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## CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

## DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available on request from the corresponding author. The data are not publicly available due to privacy or ethical restrictions.

## ETHICS STATEMENT

For the primary data collection, research ethics board approval, and written informed consent were obtained from each participating school and the Queen Margaret University Research Ethics Committee, and the Local Authority (local Government) Research Access Service. Use of the data was permitted through data processing and sharing agreements between Queen Margaret University and the census data providers. This study complied with the Declaration of Helsinki.

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## SUPPORTING INFORMATION

Additional supporting information can be found online in the Supporting Information section at the end of this article.

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