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# Neurodevelopmental disorders among Spanish school-age children: prevalence and sociodemographic correlates

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## Original Article

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## Abstract

**Background.** Prevalence estimates of neurodevelopmental disorders (ND) are essential for treatment planning. However, epidemiological research has yielded highly variable rates across countries, including Spain. This study examined the prevalence and sociodemographic correlates of ND in a school sample of Spanish children and adolescents.

**Methods.** The Child Behaviour Checklist/Teacher's Report Form/Youth Self-Report and the Conners' Rating Scales were administered for screening purposes. Additionally, teachers provided information on reading and writing difficulties. Subjects who screened positive were interviewed for diagnostic confirmation according to the Diagnostic and Statistical Manual of Mental Disorders criteria. The final population comprised 6834 students aged 5–17. Multivariate analyses were performed to determine the influence of gender, age, educational stage, school type, socioeconomic status (SES), and ethnicity on the prevalence estimates.

**Results.** A total of 1249 (18.3%) subjects met criteria for at least one ND, although only 423 had already received a diagnosis. Specifically, the following prevalence rates were found: intellectual disabilities (ID), 0.63%; communication disorders, 1.05%; autism spectrum disorder (ASD), 0.70%; attention-deficit/hyperactivity disorder (ADHD), 9.92%; specific learning disorder (SLD), 10.0%; and motor disorders, 0.76%. Students of foreign origin and from low SES evidenced higher odds of having ID. Boys were more likely to display ASD or a motor disorder. Age, SES, and ethnicity were significant predictors for SLD, while communication disorders and ADHD were also associated with gender.

**Conclusions.** The prevalence of ND among Spanish students is consistent with international studies. However, a substantial proportion had never been previously diagnosed, which emphasise the need for early detection and intervention programmes.

According to the fifth edition of the Diagnostic and Statistical Manual of Mental Disorders (DSM-5; American Psychiatric Association, 2013), neurodevelopmental disorders (ND) comprise intellectual disabilities (ID), communication disorders, autism spectrum disorder (ASD), attention-deficit/hyperactivity disorder (ADHD), specific learning disorder (SLD), and motor disorders. These conditions initiate during the early life period and affect normal development, producing delays in the expected social, emotional, language, cognitive, and/or movement milestones. Therefore, children with unrecognised ND are more likely to underperform academically, experience social difficulties, emotional, and behavioural problems, which may result in low educational achievement, school dropout, unemployment, and poorer mental health in adulthood (Dockrell & Hurry, 2018). Given that early intervention has been shown to improve school performance, behaviour, social interactions, cognitive, and motor skills (DuPaul, Kern, Caskie, & Volpe, 2015; Petrenko, 2013; Rosenberg, Maeir, Yochman, Dahan, & Hirsch, 2015), timely identification and treatment of subjects at risk should be prioritised to enhance long-term outcomes and allow for a proper development.

In this sense, prevalence estimates of ND in children and adolescents are essential to provide adequate educational, social and medical services, and to evaluate the effectiveness of future interventions. However, epidemiological research has yielded highly variable rates worldwide, ranging from 0.60% to 1.40% for ID (Westerinen et al., 2017), 3.00% to 16.0% for communication disorders (Rosenbaum & Simon, 2016), 0.60% to 1.00% for ASD (Fombonne, 2009; Hill, Zuckerman, & Fombonne, 2014), 5.90% to 7.10% for ADHD (Willcutt, 2012), 5.00% to 15.0% for SLD (American Psychiatric Association, 2013), and 4.00% to 20.0% for motor disorders (Cubo et al., 2011; Delgado-Lobete, Santos-Del-Riego,



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Pértega-Díaz, & Montes-Montes, 2019). This heterogeneity in estimates is mainly due to methodological differences among studies, such as the diagnostic criteria, measurement tools, and source of information used. Additionally, the prevalence of ND varies across many sociodemographic factors, including gender, age, socioeconomic status (SES), and ethnicity, although results have been inconsistent (Bax, Bard, Cuffe, McKeown, & Wolraich, 2019; Delgado-Lobete et al., 2019; Dockrell & Hurry, 2018; Durkin et al., 2017; Fortes et al., 2016; Jiménez et al., 2011; McGuire, Tian, Yeargin-Allsopp, Dowling, & Christensen, 2019; Werling & Geschwind, 2013; Willcutt, 2012).

Further research is also warranted to determine the prevalence and distribution of ND in Spain, since prevalence studies are scarce, almost all of them have focused on a specific disorder, the published findings are conflicting, with a wide range in reported rates, and sociodemographic correlates other than gender or age have received little attention (Carballal Mariño et al., 2018; Catalá-López et al., 2012; Cuadro, von Hagen, & Costa Ball, 2017; Cubo et al., 2011; Delgado-Lobete et al., 2019; Fortea, Escandell, & Castro, 2013; García-Mateos, Mayor Cinca, de Santiago Herrero, & Zubiauz de Pedro, 2014; González et al., 2010; Jiménez et al., 2011; Linazasoro, Van Blercom, & Ortiz de Zárate, 2006; Morales-Hidalgo, Roigé-Castellví, Hernández-Martínez, Voltas, & Canals, 2018).

Considering this knowledge gap and the discrepant results from other countries, the aims of the current research were (1) to measure the prevalence of ND (i.e. ID, communication disorders, ASD, ADHD, SLD, and motor disorders) in a school-based population, and (2) to explore the influence of gender, age, educational stage, type of school, SES, and ethnicity on the prevalence estimates.

Overall, this study provides, for the first time, the prevalence rates of multiple ND and examines a wide variety of sociodemographic factors in 6834 Spanish children aged 5–17. In addition to the large size and age range of the sample, we combine the administration of screening tools to different informants with standardised diagnostic methods based on the DSM criteria for a comprehensive case identification, which also surpass previous investigations. Finally, the use of a school-based rather than a clinical sample produces a more valid reflection of the broader population and allows the detection of undiagnosed children.

## Methods

### Participants and procedure

The present study is part of a larger, ongoing research called INSchool, aiming to identify children and adolescents' mental health problems in a school setting. Prior to the start of data collection in 2011, the project was authorised by the Ministry of Health and the Ministry of Education (Generalitat de Catalunya, Spain), with the approval from the Ethics Committee of the Vall d'Hebron Hospital Universitari, in Barcelona. In order to preserve confidentiality, data were anonymised by allocating an identifying code number to each student and all original questionnaires were stored in a lock drawer accessible only by the principal investigator. A two-stage procedure was applied over 6 academic years. First, 28 schools from seven different counties in Catalonia were contacted and invited to participate after explaining the study to the school staff. All of them accepted, which resulted in 10 418 eligible subjects, with ages comprised between 5 and 17 years (i.e. first grade of primary through fourth grade of secondary education). Families were then informed and written consent was obtained for 7272 children (participation rate = 69.8%), 2338 of whom were at least aged 11 and also gave permission. Parents and teachers of the students enrolled in this first phase received a questionnaire about child's mental health and functioning, including the Child Behaviour Checklist (CBCL; Achenbach, 1991a)/Teacher's Report Form (TRF; Achenbach, 1991b) and the Conners' Parent Rating Scale-Revised: Short Form (CPRS-R:S; Conners, 1997)/Conners' Teacher Rating Scale-Revised: Short Form (CTRS-R:S; Conners, 1997). Additionally, teachers provided information on reading and writing difficulties through the Protocol for Detection and Management of Dyslexia. Educational Scope (PRODISCAT; Col·legi de Logopedes de Catalunya, 2011), and children in secondary education, with ages over 11 years old, were asked to fill in the Youth Self-Report (YSR; Achenbach, 1991c). According to the manual for the Achenbach System of Empirically Based Assessment, individuals with more than eight missing items on the CBCL, TRF, or YSR were removed. On the other hand, we excluded subjects with more than 20% missing values on the CPRS-R:S/CTRS-R:S (i.e. >5 missing items), based on previous publications (Chen et al., 2008). Thus, the final sample comprised 7180 pupils, who completed at least CBCL, TRF, YSR, CPRS-R:S, or CTRS-R:S. Of them, 2644 were identified as potential cases in accordance with the following criteria: (a) a $T$ score $\geqslant$70 on any of the syndrome scales from the CBCL, TRF, or YSR; (b) a $T$ score $\geqslant$70 on any of the subscales from the CPRS-R:S or CTRS-R:S; (c) five or more high-risk indicators on the PRODISCAT; or (d) a previous diagnosis of ND from a medical professional. In the second phase of the project, subjects who screened positive and provided consent ($n$ = 2298) were interviewed by trained psychiatrists and neuropsychologists for diagnostic confirmation. Specifically, psychiatric disorders were evaluated using the Kiddie Schedule for Affective Disorders and Schizophrenia Present and Lifetime version (K-SADS/PL; Kaufman et al., 1997). Children with symptoms suggestive of ASD or communication disorders were referred to a specialist for a definitive diagnosis. The Wechsler Intelligence Scale for Children (WISC; Wechsler, 2003, 2014) was applied to identify ID. The presence of dyslexia was determined based on the Battery for the Evaluation of Reading Processes, Revised (PROLEC-R; Cuetos, Rodríguez, Ruano, & Arribas, 2007) and Battery for the Evaluation of Reading Processes in Junior and Senior High-School Students, Revised (PROLEC-SE-R; Cuetos, Arribas, & Ramos, 2016), whereas dysgraphia was established by administering the Test for the Analysis of Reading and Writing (T.A.L.E.; Toro & Cervera, 1991), and Battery for the Evaluation of Writing Processes (PROESC; Cuetos, Ramos, & Ruano, 2002). In total, the second-phase population included those students with a negative screening score and those who underwent the diagnostic assessment ($n$ = 6834).

### Measures

#### Child behaviour checklist, teacher's report form, and youth self-report

The CBCL (Achenbach, 1991a), TRF (Achenbach, 1991b), and YSR (Achenbach, 1991c) are standardised screening questionnaires internationally used to identify mental health problems as reported by parents, teachers, and youth aged 11–18, respectively. Symptoms are grouped into eight syndrome scales, namely: Withdrawn, Somatic complaints, Anxious/Depressed, Social problems, Thought problems, Attention problems, Delinquent behaviour, and Aggressive behaviour. The $T$ scores were

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computed for each participant according to gender and age, based on the distribution of normative samples from the United States, since no Spanish normative data are available for school-age children. The 1991 edition of the CBCL/TRF/YSR used in the current study and the 2001 version may be considered equivalent, since correlations between the new and previous scales are very high on most syndromes, and children obtain approximately the same percentiles and *T* scores (Achenbach & Rescorla, 2001).

#### *Conners' parent rating scale-revised: short form and Conners' teacher rating scale-revised: short form*

The CPRS-R:S and CTRS-R:S (Conners, 1997) assess the frequency of ADHD symptoms and related behaviours over the last month through 27 and 28 items, respectively. Both questionnaires include the Oppositional, Cognitive problems/Inattention, and Hyperactivity subscales, in addition to a global ADHD index. Given that norms for Spanish children and adolescents are unavailable, raw scores were converted to gender- and age-adjusted *T* scores using the United States norms.

#### *Protocol for detection and management of dyslexia. Educational scope*

The PRODISCAT (Col·legi de Logopedes de Catalunya, 2011) is a protocol developed by the Speech Therapists Association of Catalonia and aimed at teachers of preschool, primary and secondary education, and vocational training with the objective to detect possible cases of dyslexia at an early stage. It consists of 18–44 items, depending on the educational stage, some of which represent high-risk indicators that require intervention (e.g. 'He/she has a family history of reading and writing difficulties', 'He/she has lexical access difficulties when speaking', 'He/she makes many spelling mistakes compared to the class group', 'His/her reading speed is slow compared to the class group'). The remaining items indicate associated difficulties that may worsen the symptomatology and that will need to be considered in the intervention plan.

#### *Kiddie schedule for affective disorders and schizophrenia present and lifetime version*

The K-SADS/PL (Kaufman et al., 1997) is a semi-structured interview that assesses current and past psychopathology in school-age children according to the DSM-IV-TR (American Psychiatric Association, 2000). Specifically, it contains five diagnostic groups: (1) affective disorders; (2) psychotic disorders; (3) anxiety disorders; (4) ADHD and behavioural disorders; and (5) substance abuse, tic, eating, and elimination disorders. The K-SADS/PL was administered to parents and children/adolescents, separately.

#### *Wechsler intelligence scale for children*

The WISC is an individually administered intelligence test for children aged 6–16 years. In addition to a global intelligence quotient, the WISC-IV (Wechsler, 2003) measures four domains of cognitive ability through the verbal comprehension, perceptual reasoning, working memory, and processing speed indices, whereas the fifth edition (WISC-V; Wechsler, 2014) separates the perceptual reasoning factor into visual spatial and fluid reasoning indices.

#### *Battery for the evaluation of reading processes, revised*

The PROLEC-R (Cuetos et al., 2007) is one of the most extensively used instruments to assess reading performance in Spanish children aged 6–12 years. The battery explores the perceptual, lexical, syntactic, and semantic processes involved in reading comprehension. Both reading accuracy and speed are measured.

#### *Battery for the evaluation of reading processes in junior and senior high-school students, revised*

The PROLEC-SE-R (Cuetos et al., 2016) evaluates the reading ability and the underlying lexical, syntactic, and semantic processes of adolescents from 12 to 18 years.

#### *Test for the analysis of reading and writing*

The T.A.L.E. (Toro & Cervera, 1991) allows to determine the general level and specific characteristics of reading and writing in children from first to fourth grade of primary school (6–10 years).

#### *Battery for the evaluation of writing processes*

The PROESC (Cuetos et al., 2002) aims to evaluate the main writing processes in children from third grade of primary to adolescents in secondary education (8–15 years old).

#### *Sociodemographic variables*

Parents completed a questionnaire on sociodemographic data, including child's gender, age, and country of birth. They also provided information about their educational level, occupation, and country of birth. Students who were not native Spanish or with at least one foreign-born parent were considered of foreign origin. Parents' education and occupation were weighted to compute the Hollingshead Four-Factor Index (Hollingshead, 2011), a measure of SES ranging from 8 to 66, where higher scores reflect higher SES.

### *Statistical analyses*

All analyses were performed with SPSS 22.0. We present descriptive statistics for the prevalence of ND, already-diagnosed cases, and sociodemographic characteristics in the second-phase population. Prevalence estimates were compared by gender (male, female), age, educational stage (primary, secondary education), type of school (public, private), SES, and ethnicity (native, foreign origin) using the $\chi^2$ test for categorical variables and the Mann–Whitney *U* test for continuous variables. Those variables found to be significant in bivariate analyses were subsequently included in multivariate logistic regression models to determine the factors independently associated with each diagnostic category, in accordance with previous publications (Fortes et al., 2016; Goldfield & Hayes, 2012; Madsen et al., 2018). A two-sided *p* value of 0.05 was set as significance level in all tests.

## Results

### *Sample characteristics*

Among the 28 participating schools, 25 were located in urban regions with more than 5000 inhabitants and a population density of above 600 inhabitants/km$^2$ at the time of the study. The rest were in villages with populations around 1400–3000 and accounted for 2.03% ($n = 139$) of the second-phase sample. Specifically, the majority of students ($n = 4022$, 58.8%) attended schools from the Barcelona Metropolitan Area, including cities such as Rubí ($n = 1286$, 18.8%), Sant Cugat ($n = 1860$, 27.2%), and Barcelona ($n = 876$, 12.8%), which had an approximate population of 75 700, 88 800, and 1 600 000, respectively. The sample

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comprised 3852 (56.4%) boys and 2982 (43.6%) girls with ages ranging from 5 to 17 years ($M = 9.40$; S.D. = 2.87), 4720 (69.1%) were primary students, and 3811 (55.8%) went to public schools. Subjects had predominantly a Spanish background (80.7%), although those of foreign origin were slightly over-represented among schools placed in an urban environment (18.0% *v.* 12.1%). Students who were not born in Spain ($n = 336$) came mostly from Spanish-speaking countries ($n = 141$), Russia ($n = 50$), China ($n = 30$), and Morocco ($n = 20$). In addition, 868 native Spanish children were considered of foreign origin because they had one ($n = 497$) or both ($n = 371$) foreign-born parents, the majority of whom came from Latin America ($n = 401$) and Morocco ($n = 117$). The average Hollingshead Four-Factor Index in this sample was 43.4 (S.D. = 13.6), which corresponds to a middle-class household income.

## Prevalence rates and demographics

### Previous diagnoses

Four hundred and twenty-three (6.19%) participants had received a previous diagnosis of ND, including ID (0.35%), communication disorders (0.40%), ASD (0.51%), ADHD (3.92%), SLD in reading or writing (2.69%), and motor disorders (0.22%). As shown in Table 1, there were significant differences in the prevalence of already-diagnosed cases with regard to gender, age, educational stage, and type of school. Specifically, males [odds ratio (OR) 2.17, 95% confidence interval (CI) 1.73–2.72, $p < 0.001$], older children (OR 1.22, 95% CI 1.17–1.26, $p < 0.001$), and students from private schools (OR 1.62, 95% CI 1.32–1.98, $p < 0.001$) were more likely to report a clinically known ND, according to the multivariate regression analysis. The association with educational stage, however, did not remain significant in the adjusted model.

### Neurodevelopmental disorders

A total of 1249 (18.3%) subjects met criteria for at least one ND based on the diagnostic assessment conducted in the second phase of the study. Table 2 presents the patterns of prevalence among the sociodemographic groups assessed. The multivariate regression model showed that male gender, age, low SES, and being of foreign origin were risk factors for a ND (Table 3).

### Intellectual disabilities

Forty-three children were diagnosed with ID, resulting in a prevalence of 0.63%. Cases were equally distributed by gender, age, educational stage, and type of school, although there were differences with regard to SES and ethnicity (Table 2). In particular, the prevalence rate significantly decreased with SES, whereas students of foreign origin evidenced higher odds of having ID when both factors were taken into account (Table 3).

### Communication disorders

Communication disorders were found in 72 (1.05%) participants. As shown in Table 2, the prevalence was significantly different across each of the sociodemographic groups compared, with the exception of educational stage. At the adjusted analysis, foreign origin was the strongest predictor, followed by being male, low SES, and age. School type, on the contrary, did not show association in the full model (Table 3).

**Table 1.** Prevalence of already-diagnosed ND by sociodemographic variables

| | Previous ND ($N = 423$, 6.19%) | | |
|---|---|---|---|
| | *n* (%) | *M* (S.D.) | *p* |
| Gender | | | |
| Male | 314 (8.17) | | <0.001 |
| Female | 109 (3.66) | | |
| Age | | | |
| Cases | | 11.0 (2.51) | <0.001 |
| Controls | | 9.29 (2.87) | |
| Educational stage | | | |
| Primary | 215 (4.56) | | <0.001 |
| Secondary | 208 (9.87) | | |
| Type of school | | | |
| Public | 174 (4.58) | | <0.001 |
| Private | 249 (8.25) | | |
| SES | | | |
| Cases | | 42.6 (13.7) | NS |
| Controls | | 43.5 (13.6) | |
| Ethnicity | | | |
| Native | 331 (6.01) | | NS |
| Foreign origin | 85 (7.08) | | |

ND, neurodevelopmental disorders; *M*, mean; S.D., standard deviation; SES, socioeconomic status; NS, non-significant.
Prevalence estimates across sociodemographic variables were determined as the number of cases divided by the total number of students in each subgroup.

### Autism spectrum disorder

Forty-eight students were identified as having ASD, which represents a prevalence rate of 0.70%. Among all the assessed variables, only gender was significantly associated with ASD (Table 2). Specifically, the male to female ratio was 7:1 and boys had more than five-fold higher odds of being diagnosed (Table 3).

### Attention-deficit/hyperactivity disorder

The overall prevalence of children with ADHD was 9.92% ($n = 678$). Of these, 47.8% ($n = 324$) met criteria for the combined presentation, 44.2% ($n = 300$) had the predominantly inattentive presentation, and 7.96% ($n = 54$) were diagnosed with the predominantly hyperactive-impulsive presentation. Bivariate analyses indicated that the relationship between school type and the diagnosis rates was not significant. Conversely, boys, older children, students in secondary education, those from families with low SES, and children of foreign origin appeared to have a higher prevalence of ADHD (Table 2). Of these, gender, age, SES, and ethnicity were identified as significant predictors in the multivariate regression model, whereas educational stage was no longer associated with the disorder (Table 3).

The same pattern of distribution across groups was noted for the combined and predominantly inattentive presentations (Table 4), although the results of the multivariate analyses differed slightly. Boys (OR 1.84, 95% CI 1.44–2.35, $p < 0.001$), students from families with low SES (OR 0.97, 95% CI 0.97–0.98, $p < 0.001$), and those of foreign origin (OR 1.43, 95% CI 1.10–1.87, $p = 0.008$) were

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**Table 2.** Prevalence of ND by sociodemographic variables

| | Any ND | | | ID | | | Communication disorders | | | ASD | | | ADHD | | | SLD | | | Motor disorders | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | *n* (%) | *M* (S.D.) | *p* | *n* (%) | *M* (S.D.) | *p* | *n* (%) | *M* (S.D.) | *p* | *n* (%) | *M* (S.D.) | *p* | *n* (%) | *M* (S.D.) | *p* | *n* (%) | *M* (S.D.) | *p* | *n* (%) | *M* (S.D.) | *p* |
| Gender | | | | | | | | | | | | | | | | | | | | | |
| Male | 814 (21.1) | | <0.001 | 30 (0.78) | | NS | 50 (1.30) | | 0.024 | 42 (1.09) | | <0.001 | 477 (12.4) | | <0.001 | 405 (10.5) | | NS | 50 (1.30) | | <0.001 |
| Female | 435 (14.6) | | | 13 (0.44) | | | 22 (0.74) | | | 6 (0.20) | | | 201 (6.74) | | | 281 (9.42) | | | 2 (0.067) | | |
| Age | | | | | | | | | | | | | | | | | | | | | |
| Cases | | 10.1 (2.77) | <0.001 | | 10.1 (2.87) | NS | | 8.51 (2.60) | 0.008 | | 9.81 (2.80) | NS | | 10.3 (2.87) | <0.001 | | 10.2 (2.58) | <0.001 | | 9.10 (2.57) | NS |
| Controls | | 9.24 (2.87) | | | 9.39 (2.87) | | | 9.41 (2.88) | | | 9.39 (2.88) | | | 9.30 (2.86) | | | 9.31 (2.89) | | | 9.40 (2.88) | |
| Educational stage | | | | | | | | | | | | | | | | | | | | | |
| Primary | 747 (15.8) | | <0.001 | 26 (0.55) | | NS | 57 (1.21) | | NS | 33 (0.70) | | NS | 386 (8.18) | | <0.001 | 402 (8.52) | | <0.001 | 40 (0.85) | | NS |
| Secondary | 502 (23.7) | | | 17 (0.80) | | | 15 (0.71) | | | 15 (0.71) | | | 292 (13.8) | | | 284 (13.4) | | | 12 (0.57) | | |
| Type of school | | | | | | | | | | | | | | | | | | | | | |
| Public | 739 (19.4) | | 0.007 | 26 (0.68) | | NS | 53 (1.39) | | 0.002 | 23 (0.60) | | NS | 377 (9.89) | | NS | 436 (11.4) | | <0.001 | 24 (0.63) | | NS |
| Private | 510 (16.9) | | | 17 (0.56) | | | 19 (0.63) | | | 25 (0.83) | | | 301 (10.0) | | | 250 (8.27) | | | 28 (0.93) | | |
| SES | | | | | | | | | | | | | | | | | | | | | |
| Cases | | 38.5 (14.2) | <0.001 | | 35.3 (13.4) | <0.001 | | 36.9 (11.7) | <0.001 | | 43.0 (13.3) | NS | | 39.6 (14.2) | <0.001 | | 37.1 (14.3) | <0.001 | | 40.8 (14.1) | NS |
| Controls | | 44.5 (13.2) | | | 43.5 (13.6) | | | 43.5 (13.6) | | | 43.4 (13.6) | | | 43.8 (13.5) | | | 44.1 (13.3) | | | 43.4 (13.6) | |
| Ethnicity | | | | | | | | | | | | | | | | | | | | | |
| Native | 922 (16.7) | | <0.001 | 27 (0.49) | | 0.003 | 45 (0.82) | | <0.001 | 41 (0.74) | | NS | 499 (9.05) | | <0.001 | 506 (9.18) | | <0.001 | 47 (0.85) | | NS |
| Foreign origin | 304 (25.2) | | | 15 (1.25) | | | 25 (2.08) | | | 6 (0.50) | | | 168 (14.0) | | | 169 (14.0) | | | 5 (0.42) | | |

ND, neurodevelopmental disorders; ID, intellectual disabilities; ASD, autism spectrum disorder; ADHD, attention-deficit/hyperactivity disorder; SLD, specific learning disorder; *M*, mean; S.D., standard deviation; NS, non-significant; SES, socioeconomic status.

Prevalence estimates across sociodemographic variables were determined as the number of cases divided by the total number of students in each subgroup.

**Table 3.** Sociodemographic variables associated with ND in the multivariate regression analyses

| | Any ND | | ID | | Communication disorders | | ASD | | ADHD | | SLD | | Motor disorders | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | OR (95% CI) | *p* | OR (95% CI) | *p* | OR (95% CI) | *p* | OR (95% CI) | *p* | OR (95% CI) | *p* | OR (95% CI) | *p* | OR (95% CI) | *p* |
| Gender | | | | | | | | | | | | | | |
| Male | 1.64 (1.43–1.87) | <0.001 | NS | | 1.94 (1.16–3.25) | 0.012 | 5.47 (2.32–12.9) | <0.001 | 1.95 (1.64–2.33) | <0.001 | NS | | 19.6 (4.76–80.6) | <0.001 |
| Female (Ref.) | – | | – | | – | | – | | – | | – | | – | |
| Age | 1.10 (1.07–1.12) | <0.001 | NS | | 0.88 (0.81–0.96) | 0.006 | NS | | 1.11 (1.08–1.14) | <0.001 | 1.10 (1.07–1.13) | <0.001 | NS | |
| SES | 0.97 (0.97–0.98) | <0.001 | 0.97 (0.95–0.99) | 0.001 | 0.97 (0.96–0.99) | <0.001 | NS | | 0.98 (0.98–0.99) | <0.001 | 0.97 (0.96–0.97) | <0.001 | NS | |
| Ethnicity | | | | | | | | | | | | | | |
| Native (Ref.) | – | | – | | – | | – | | – | | – | | – | |
| Foreign origin | 1.42 (1.22–1.66) | <0.001 | 2.06 (1.07–3.95) | 0.030 | 2.21 (1.33–3.67) | 0.002 | NS | | 1.44 (1.19–1.75) | <0.001 | 1.31 (1.08–1.59) | 0.006 | NS | |

ND, neurodevelopmental disorders; ID, intellectual disabilities; ASD, autism spectrum disorder; ADHD, attention-deficit/hyperactivity disorder; SLD, specific learning disorder; OR, odds ratio; CI, confidence interval; NS, non-significant; SES, socioeconomic status.

more likely to have the combined presentation. The predominantly inattentive presentation, on the other hand, was also associated with age (OR 1.17, 95% CI 1.12–1.22, $p < 0.001$), in addition to gender (OR 1.85, 95% CI 1.43–2.38, $p < 0.001$), SES (OR 0.99, 95% CI 0.98–1.00, $p = 0.010$), and ethnicity (OR 1.47, 95% CI 1.11–1.93, $p = 0.006$). Finally, the predominantly hyperactive-impulsive presentation was significantly more prevalent in males ($n = 40$, 1.04%) than females ($n = 14$, 0.47%), so boys were at higher risk of meeting diagnostic criteria (OR 2.22, 95% CI 1.21–4.10, $p = 0.008$).

### *Specific learning disorder*

The prevalence of SLD was 10.0% ($n = 686$), with reading and writing difficulties being present in 9.28% ($n = 634$) and 5.18% ($n = 354$) of the sample, respectively. Bivariate analyses indicated a relationship between SLD and each of the sociodemographic variables assessed, except for gender (Table 2). The influence of educational stage and type of school did not remain significant in the full model, whereas age, SES, and ethnicity were identified as risk factors for SLD (Table 3).

Similarly, both reading and writing difficulties had a higher prevalence among older children, students in secondary education, those from families with low SES, and children of foreign origin (Table 5). Besides, there was a significant difference in the rate of reading difficulties between subjects attending public and private schools (10.7% *v.* 7.51%, $p < 0.001$). Writing difficulties, on the contrary, were more frequent in boys than girls (5.74% *v.* 4.46%, $p = 0.018$), with a male to female ratio of 1.7:1. At adjusted analyses, factors significantly associated with reading difficulties included age (OR 1.09, 95% CI 1.05–1.12, $p < 0.001$), SES (OR 0.97, 95% CI 0.96–0.97, $p < 0.001$), and ethnicity (OR 1.24, 95% CI 1.01–1.52, $p = 0.037$), whereas gender also predicted the occurrence of writing difficulties (OR 1.37, 95% CI 1.09–1.71, $p = 0.007$), in addition to age (OR 1.07, 95% CI 1.03–1.11, $p = 0.001$), SES (OR 0.97, 95% CI 0.96–0.98, $p < 0.001$), and foreign origin (OR 1.66, 95% CI 1.29–2.12, $p < 0.001$).

### *Motor disorders*

Fifty-two (0.76%) students had motor disorders, 50 (1.30%) of whom were male. Indeed, boys were more likely to meet criteria for a motor disorder than girls, whereas no significant differences were found in prevalence rates with regard to age, educational stage, type of school, SES, and ethnicity (Tables 2 and 3).

## Discussion

To our knowledge, this is the first study to provide the prevalence rates and sociodemographic correlates of ND in a large school-based sample of Spanish children aged 5–17. Overall, the prevalence of students with at least one ND was estimated at 18.3%, although a substantial proportion of them (66.1%) had never been previously diagnosed.

In particular, we found the prevalence of ID to be 0.63%, which is comparable to that reported by Hughes-McCormack et al. (2018) for the Scotland's population. The authors identified a total of 26 349 (0.50%) people with ID, including 5234 (0.60%) children/youth from 0 to 15 years. However, it should be noted that the study from Hughes–McCormack covered a wider age range, since they examined children who were not in primary education yet. Given that they observed an increase in the identification of ID until age 5 years, our estimate might be slightly greater. In this regard, Boyle et al. (2011) found a prevalence of

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**Table 4.** Prevalence of ADHD presentations by sociodemographic variables

| | ADHD-C | | | ADHD-I | | | ADHD-HI | | |
|---|---|---|---|---|---|---|---|---|---|
| | *n* (%) | *M* (S.D.) | *p* | *n* (%) | *M* (S.D.) | *p* | *n* (%) | *M* (S.D.) | *p* |
| Gender | | | | | | | | | |
| Male | 226 (5.87) | | <0.001 | 211 (5.48) | | <0.001 | 40 (1.04) | | 0.008 |
| Female | 98 (3.29) | | | 89 (2.98) | | | 14 (0.50) | | |
| Age | | | | | | | | | |
| Cases | | 9.98 (2.91) | <0.001 | | 10.8 (2.75) | <0.001 | | 9.59 (2.94) | NS |
| Controls | | 9.37 (2.87) | | | 9.33 (2.87) | | | 9.39 (2.87) | |
| Educational stage | | | | | | | | | |
| Primary | 196 (4.15) | | 0.001 | 154 (3.26) | | <0.001 | 36 (0.76) | | NS |
| Secondary | 128 (6.05) | | | 146 (6.91) | | | 18 (0.85) | | |
| Type of school | | | | | | | | | |
| Public | 196 (5.14) | | NS | 153 (4.01) | | NS | 28 (0.73) | | NS |
| Private | 128 (4.23) | | | 147 (4.86) | | | 26 (0.86) | | |
| SES | | | | | | | | | |
| Cases | | 38.0 (14.1) | <0.001 | | 40.9 (14.1) | 0.001 | | 41.9 (14.1) | NS |
| Controls | | 43.7 (13.5) | | | 43.5 (13.6) | | | 43.4 (13.6) | |
| Ethnicity | | | | | | | | | |
| Native | 233 (4.23) | | <0.001 | 223 (4.05) | | 0.001 | 43 (0.78) | | NS |
| Foreign origin | 83 (6.89) | | | 76 (6.31) | | | 9 (0.75) | | |

ADHD, attention-deficit/hyperactivity disorder; ADHD-C, attention-deficit/hyperactivity disorder combined presentation; ADHD-I, attention-deficit/hyperactivity disorder predominantly inattentive presentation; ADHD-HI, attention-deficit/hyperactivity disorder predominantly hyperactive-impulsive presentation; *M*, mean; S.D., standard deviation; SES, socioeconomic status; NS, non-significant.
Prevalence estimates across sociodemographic variables were determined as the number of cases divided by the total number of students in each subgroup.

0.71% among a nationally representative sample of US children aged 3–17 using data from the 1997–2008 National Health Interview Surveys (Boyle et al., 2011). Additionally, our rate significantly decreased with SES whereas students of foreign origin evidenced higher odds of having ID. These results concur with previous research that shows an association between ID and socioeconomic disadvantage (McGuire et al., 2019).

The prevalence of communication disorders (1.05%), on the other hand, was lower than the estimated in an American sample of 8-year-olds (6.34%, 95% CI 6.04–6.62; Pinborough-Zimmerman et al., 2007). Similarly, data from the 1988 National Health Interview Survey in the United States showed that 1.89% of children aged under 17 had stammering or stuttering, whereas 2.65% had other speech defects (Boyle, Decouflé, & Yeargin-Allsopp, 1994). In contrast, the Second National Sample Survey on Disability of China revealed that the prevalence of speech disability was 0.53% (Zheng, Zhang, Chen, Pei, & Song, 2008), thus suggesting a wide variability in prevalence rates between studies. These remarkable disparities may reflect differences in the terminology, diagnostic criteria, population characteristics (e.g. proportion of subjects with foreign language background), and methodologies applied. In this sense, previous reports mostly relied on questionnaire surveys of parents and teachers, whereas the current investigation used direct assessment by speech therapists to identify participants with communication disorders. Nevertheless, the relationship found between communication disorders and sociodemographic variables such as gender, age, SES, and ethnicity agrees with past research reporting higher rates of speech and language disabilities among boys, younger children, those socially disadvantaged, and of foreign origin (Dockrell & Hurry, 2018; Rosenbaum & Simon, 2016).

Our estimate for ASD (0.70%) was within the expected range of 0.60–1.00% derived from systematic reviews of the epidemiological literature (Fombonne, 2009; Hill et al., 2014). Similarly, the rates recently found in Spain following a two-phase design vary from 0.61% in toddlers to 1.00% in primary school children (Fortea et al., 2013; Morales-Hidalgo et al., 2018). Additionally, the overrepresentation of boys observed is also consistent with results from previous research, although the male to female ratio was higher than the general ratio of 4:1 (Werling & Geschwind, 2013).

The ADHD prevalence provided in the present study (9.92%) was higher than the worldwide pooled prevalence for children and adolescents (5.90–7.10%; Willcutt, 2012) and the average prevalence in Spain, estimated at 6.80% (95% CI 4.90–8.80) by Catalá-López et al. (2012) through a meta-analysis of 14 epidemiological studies. Interestingly, however, García-Jiménez, López-Pisón, and Blasco-Arellano (2005) obtained a prevalence rate of 9.00%, using a two-stage survey to determine the DSM-IV ADHD prevalence in a school population of children with ages between 6 and 12 years. Comparable figures have also been found among 4- to 18- (10.3%; Vicente et al., 2012) and 8- to 15-year-old youths (8.60%, 95% CI 7.20–10.0; Merikangas et al., 2010), as established by the Diagnostic Interview Schedule for Children version IV. Furthermore, Wolraich et al. (2014) screened 10 427 children from four school districts in South Carolina and Oklahoma and reported rates of 8.70% (95% CI

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**Table 5.** Prevalence of SLD with difficulties in reading and writing by sociodemographic variables

| | Reading difficulties | | | Writing difficulties | | |
|---|---|---|---|---|---|---|
| | *n* (%) | *M* (S.D.) | *p* | *n* (%) | *M* (S.D.) | *p* |
| Gender | | | | | | |
| Male | 366 (9.50) | | NS | 221 (5.74) | | 0.018 |
| Female | 268 (8.99) | | | 133 (4.46) | | |
| Age | | | | | | |
| Cases | | 10.1 (2.59) | <0.001 | | 10.0 (2.54) | <0.001 |
| Controls | | 9.32 (2.89) | | | 9.36 (2.89) | |
| Educational stage | | | | | | |
| Primary | 377 (7.99) | | <0.001 | 227 (4.81) | | 0.039 |
| Secondary | 257 (12.2) | | | 127 (6.01) | | |
| Type of school | | | | | | |
| Public | 407 (10.7) | | <0.001 | 214 (5.62) | | NS |
| Private | 227 (7.51) | | | 140 (4.63) | | |
| SES | | | | | | |
| Cases | | 37.0 (14.2) | <0.001 | | 37.4 (14.7) | <0.001 |
| Controls | | 44.1 (13.4) | | | 43.7 (13.5) | |
| Ethnicity | | | | | | |
| Native | 473 (8.58) | | <0.001 | 245 (4.44) | | <0.001 |
| Foreign origin | 152 (12.6) | | | 102 (8.47) | | |

SLD, specific learning disorder; *M*, mean; S.D., standard deviation; NS, non-significant; SES, socioeconomic status.
Prevalence estimates across sociodemographic variables were determined as the number of cases divided by the total number of students in each subgroup.

7.20–10.5) and 10.6% (95% CI 7.50–14.9), respectively. Regarding ADHD presentations, population-based studies have yielded mixed results. In this sense, our estimates are in line with those showing a predominance of the combined presentation, followed by the inattentive and hyperactive-impulsive presentations (Angold et al., 2002; Ford, Goodman, & Meltzer, 2003; Rodhe et al., 1999). Finally, the analysis of sociodemographic correlates provided evidence that add to a wealth of data from epidemiological research, since the increased prevalence of ADHD in boys and socioeconomically disadvantaged children has been well established (Willcutt, 2012). Nevertheless, no significant differences were found across age, except for the predominantly inattentive presentation, which tended to persist over time, as shown in longitudinal studies.

With respect to SLD, the overall prevalence was 10.0%, which falls within the range of 5.00–15.0% proposed by the DSM-5. Reading difficulties were the most common SLD and our rate (9.28%) converged the upper end of the worldwide prevalence range for school-age children, estimated to be between 4.00% and 11.0% (Karande & Kulkarni, 2005; Sexton, Gelhorn, Bell, & Classi, 2012). Consistently, previous studies in Spain yielded values of 8.60% and 11.8% among primary students (Carrillo, Alegría, Miranda, & Sánchez, 2011; Jiménez, Guzmán, Rodríguez, & Artiles, 2009). Writing difficulties, on the other hand, were found in 5.18% of the participants. This figure is in line with Fortes et al. (2016), who provided a prevalence of 5.40% in a representative school sample of second to sixth graders from Brazil, and slightly lower than the rate reported by González et al. (2010) for Spanish adolescents (6.10%), based on a semi-structured interview with the teachers. However, differences in the study population, definitions, methods, and diagnostic criteria may account for the discrepant results. Moreover, the current investigation supports the association of age and SES with learning difficulties. Indeed, previous research evidenced a higher prevalence of SLD among older students and children from lower SES, due to the increasing academic demands of the school curriculum and a less favourable environment for learning that hinders the acquisition of language skills (Abu-Hamour & Al-Hmouz, 2016; Fortes et al., 2016). Finally, we found a preponderance of boys with difficulties in writing, whereas the gender ratio for reading disabilities was balanced. These results replicate those from Moll, Kunze, Neuhoff, Bruder, and Schulte-Körne (2014) and are in line with data indicating that boys and girls are equally affected by dyslexia (Jiménez et al., 2011; Pennington, Peterson, & McGrath, 2009). The relationship between SLD and ethnicity, on the contrary, might be attributed to the language background of children with foreign origin, although a substantial proportion (86.3%) of them spoke either Spanish or Catalan at home. Therefore, we cannot rule out the influence of other sociocultural factors, especially considering that ethnicity was also a risk factor for ND such as ID and ADHD in the present sample.

The prevalence of motor disorders in the current investigation is significantly low compared to earlier reports, showing estimates of 4.00–20.0% for tic disorders (Cubo et al., 2011) and 5.00–19.0% for developmental coordination disorder among school-age children (Delgado-Lobete et al., 2019). Nevertheless, it is in accordance with a recent study conducted in Spain, where only 1.09% of children received a clinical diagnosis of a neurodevelopmental

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motor disorder (Carballal Mariño et al., 2018). The male dominance, on the other hand, has consistently been reported and, as expected, we found that boys were more likely to meet criteria for a motor disorder than girls (Knight et al., 2012).

Thus, the prevalence rates of ND in the present sample largely concur with findings from different countries. Strikingly, however, only 6.19% of the participants had received a formal diagnosis before the study, which suggests that ND are widely underestimated among Spanish school-age children. According to previous investigations, several sociodemographic and contextual factors might affect the probability of a child to be referred to diagnostic services. For instance, female gender, non-white ethnicity, rural residence, low parental education, and socioeconomic disadvantage have been identified as barriers to accessing care (Sayal, Prasad, Daley, Ford, & Coghill, 2018; Thomas, Ellis, McLaurin, Daniels, & Morrissey, 2007). Similarly, we found that males, older children, and students from private schools were more likely to report a clinically known diagnosis.

Given that children with ND are at risk for academic failure, dropout, social emotional difficulties, poorer mental health in adulthood, and unemployment (Dockrell & Hurry, 2018), our results reinforce the need for early detection and intervention programmes to improve their developmental trajectories and quality of life. In this sense, schools may offer the best environment to implement regular screening, which has shown to increase the likelihood of being identified and referred to intervention facilities in a timely manner, thus yielding positive health and educational outcomes (Guevara et al., 2013; Zwaigenbaum et al., 2015).

The findings of this first attempt to estimate the prevalence of ND among Spanish students should be interpreted in light of some strengths and limitations. The main advantages include the use of a large sample, covering a broad age range, and the comprehensive case identification based on the administration of screening tools to different informants and standardised instruments for diagnostic confirmation by trained psychiatrists and neuropsychologists. Moreover, we considered and controlled for multiple sociodemographic factors in assessing ND. Finally, our study incorporated a school-based sample, which allowed the detection of undiagnosed children and provides a more valid reflection of the broader population than a clinically derived sample.

Nevertheless, students who screened negative did not undergo the clinical ascertainment and, therefore, false negatives might have occurred. Similarly, we might have misclassified some cases, since we computed *T* scores on the CBCL/TRF/YSR and CPRS-R:S/CTRS-R:S based on the distribution of normative samples from the United States and values may differ across cultures. Besides, we concentrated on scores that were clearly in the clinical range (i.e. *T* score $\geqslant$70) in order to minimise the number of false positives, considering the sample size, study design, and available resources, which may have also increased the rate of false negatives. However, additional criteria were considered to screen positive, including the presence of high-risk indicators on the PRODISCAT, which is specifically designed for the Spanish school population, or a previous diagnosis of ND, thus increasing the chance to detect children with difficulties. On the other hand, we could not test whether children who refused to participate in the screening phase differed from those who eventually comprised the study population with respect to sociodemographic variables, since this information was not available for the former. Yet, we observed that students in secondary education and those attending private schools or schools located in a rural setting were over-represented among non-participants, which may have biased the estimated prevalence. Furthermore, the research was conducted in schools from seven different counties in Catalonia and thus its generalisation to other Catalan or Spanish regions is uncertain. Indeed, the selected sample included a higher proportion of boys (56.4%) and primary school students (69.1%) than that of Catalonia (51.4% and 60%) and Spain (51.5% and 59.8%), according to the most recent data from the Spanish Ministry of Education. Public schools, on the other hand, constitute 65.4% and 66.9% of the total Catalan and Spanish schools, respectively, whereas in the current study subjects from public schools were underrepresented (55.8%). Conversely, the percentage of students with foreign origin (19.3%) outnumbered that reported in Catalonia (14.4%) and Spain (9.85%), although these differences may be due to the definition established by the Ministry of Education, which refers to foreign students as those who do not have Spanish nationality. Given that these sociodemographic characteristics may affect prevalence rates, future epidemiological studies using random sampling techniques are required to increase the representativeness of the population and fully validate these results.

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## References

Abu-Hamour, B., & Al-Hmouz, H. (2016). Prevalence and pattern of learning difficulties in primary school students in Jordan. *Australian Journal of Learning Difficulties*, *21*, 99–113.

Achenbach, T. M. (1991a). *Manual for the child behavior checklist/4–18 and 1991 profile*. Burlington, VT: Department of Psychiatry, University of Vermont.

Achenbach, T. M. (1991b). *Manual for the teacher's report form and 1991 profile*. Burlington, VT: Department of Psychiatry, University of Vermont.

Achenbach, T. M. (1991c). *Manual for the youth self-report and 1991 profile*. Burlington, VT: Department of Psychiatry, University of Vermont.

Achenbach, T. M., & Rescorla, L. A. (2001). *Manual for the ASEBA school-age forms and profiles*. Burlington, VT: University of Vermont, Research Center for Children, Youth, and Families.

https://doi.org/10.1017/S0033291720005115 Published online by Cambridge University Press

American Psychiatric Association (2000). *Diagnostic and statistical manual of mental disorders* (4th ed., text rev.). Washington, DC: American Psychiatric Publishing Association.

American Psychiatric Association (2013). *Diagnostic and statistical manual of mental disorders* (5th ed.). Washington, DC: American Psychiatric Publishing Association.

Angold, A., Erkanli, A., Farmer, E. M. Z., Fairbank, J. A., Burns, B. J., Keeler, G., & Costello, E. J. (2002). Psychiatric disorder, impairment, and service use in rural African American and white youth. *Archives of General Psychiatry*, *59*, 893–901.

Bax, A. C., Bard, D. E., Cuffe, S. P., McKeown, R. E., & Wolraich, M. L. (2019). The association between race/ethnicity and socioeconomic factors and the diagnosis and treatment of children with attention-deficit hyperactivity disorder. *Journal of Developmental and Behavioral Pediatrics*, *40*, 81–91.

Boyle, C. A., Boulet, S., Schieve, L. A., Cohen, R. A., Blumberg, S. J., Yeargin-Allsopp, M., … Kogan, M. D. (2011). Trends in the prevalence of developmental disabilities in US children, 1997–2008. *Pediatrics*, *127*, 1034–1042.

Boyle, C. A., Decouflé, P., & Yeargin-Allsopp, M. (1994). Prevalence and health impact of developmental disabilities in US children. *Pediatrics*, *93*, 399–403.

Carballal Mariño, M., Gago Ageitos, A., Ares Alvarez, J., del Rio Garma, M., García Cendón, C., Goicoechea Castaño, A., … Pena Nieto, J. (2018). Prevalencia de trastornos del neurodesarrollo, comportamiento y aprendizaje en atención primaria [Prevalence of neurodevelopmental, behavioural and learning disorders in pediatric primary care]. *Anales de Pediatría* (*Barcelona*), *89*, 153–161.

Carrillo, M. S., Alegría, J., Miranda, P., & Sánchez, N. (2011). Evaluación de la dislexia en la escuela primaria: Prevalencia en español [Evaluating dyslexia in primary school children: Prevalence in Spanish]. *Escritos de Psicología*, *4*, 35–44.

Catalá-López, F., Peiró, S., Ridao, M., Sanfélix-Gimeno, G., Gènova-Maleras, R., & Catalá, M. A. (2012). Prevalence of attention deficit hyperactivity disorder among children and adolescents in Spain: A systematic review and meta-analysis of epidemiological studies. *BMC Psychiatry*, *12*, 168.

Chen, W., Zhou, K., Sham, P., Franke, B., Kuntsi, J., Campbell, D., … Asherson, P. (2008). DSM-IV combined type ADHD shows familial association with sibling trait scores: A sampling strategy for QTL linkage. *American Journal of Medical Genetics. Part B, Neuropsychiatric Genetics*, *147B*, 1450–1460.

Col·legi de Logopedes de Catalunya (2011). *PRODISCAT. Protocol de detecció i actuació en la dislèxia. Àmbit educatiu*. Barcelona: Departament d'Ensenyament de la Generalitat de Catalunya.

Conners, C. K. (1997). *The Conners' rating scales–revised: Technical manual*. North Tonawanda, NY: Multi-Health Systems.

Cuadro, A., von Hagen, A., & Costa Ball, D. (2017). Procedural differences in the calculation of the prevalence of reading difficulties in Spanish-speaking school children. *Estudios de Psicología*, *38*, 169–197.

Cubo, E., Trejo Gabriel y Galán, J. M., Ausín Villaverde, V., Sáez Velasco, S., Delgado Benito, V., Vicente Macarrón, J., … Benito-León, J. (2011). Prevalence of tics in schoolchildren in central Spain: A population-based study. *Pediatric Neurology*, *45*, 100–108.

Cuetos, F., Arribas, D., & Ramos, J. L. (2016). *PROLEC-SE-R. Batería de evaluación de los procesos lectores en secundaria y bachillerato – revisada*. Madrid: TEA Ediciones.

Cuetos, F., Ramos, J. L., & Ruano, E. (2002). *PROESC. Evaluación de los procesos de escritura*. Madrid: TEA Ediciones.

Cuetos, F., Rodríguez, B., Ruano, E., & Arribas, D. (2007). *PROLEC-R: Batería de evaluación de los procesos lectores. Revisada*. Madrid: TEA Ediciones.

Delgado-Lobete, L., Santos-Del-Riego, S., Pértega-Díaz, S., & Montes-Montes, R. (2019). Prevalence of suspected developmental coordination disorder and associated factors in Spanish classrooms. *Research in Developmental Disabilities*, *86*, 31–40.

Dockrell, J., & Hurry, J. (2018). The identification of speech and language problems in elementary school: Diagnosis and co-occurring needs. *Research in Developmental Disabilities*, *81*, 52–64.

DuPaul, G. J., Kern, L., Caskie, G. I. L., & Volpe, R. J. (2015). Early intervention for young children with attention deficit hyperactivity disorder: Prediction of academic and behavioral outcomes. *School Psychology Review*, *44*, 3–20.

Durkin, M. S., Maenner, M. J., Baio, J., Christensen, D., Daniels, J., Fitzgerald, R., … Yeargin-Allsopp, M. (2017). Autism spectrum disorder among US children (2002–2010): Socioeconomic, racial, and ethnic disparities. *American Journal of Public Health*, *107*, 1818–1826.

Fombonne, E. (2009). Epidemiology of pervasive developmental disorders. *Pediatric Research*, *65*, 591–598.

Ford, T., Goodman, R., & Meltzer, H. (2003). The British child and adolescent mental health survey 1999: The prevalence of DSM-IV disorders. *Journal of the American Academy of Child and Adolescent Psychiatry*, *42*, 1203–1211.

Fortea, M. S., Escandell, M. O., & Castro, J. J. (2013). Estimated prevalence of autism spectrum disorders in the Canary Islands. *Anales de Pediatría*, *79*, 352–359.

Fortes, I. S., Paula, C. S., Oliveira, M. C., Bordin, I. A., de Jesus Mari, J., & Rohde, L. A. (2016). A cross-sectional study to assess the prevalence of DSM-5 specific learning disorders in representative school samples from the second to sixth grade in Brazil. *European Child and Adolescent Psychiatry*, *25*, 195–207.

García-Jiménez, M. C., López-Pisón, J., & Blasco-Arellano, M. M. (2005). El pediatra de atención primaria en el trastorno por déficit de atención con hiperactividad. Planteamiento tras un estudio de población [The primary care paediatrician in attention deficit hyperactivity disorder. An approach involving a population study]. *Revista de Neurología*, *41*, 75–80.

García-Mateos, M., Mayor Cinca, M. A., de Santiago Herrero, J., & Zubiauz de Pedro, B. (2014). Prevalencia de las patologías del habla, del lenguaje y de la comunicación. Un estudio a lo largo del ciclo vital [Prevalence of speech, language and communication disorders. A study throughout the life cycle]. *Revista de Logopedia, Foniatría y Audiología*, *34*, 163–170.

Goldfield, S. R., & Hayes, L. (2012). Factors influencing child mental health: A state-wide survey of Victorian children. *Journal of Paediatrics and Child Health*, *48*, 1065–1070.

González, D., Jiménez, J. E., García, E., Díaz, A., Rodríguez, C., Crespo, P., & Artiles, C. (2010). Prevalencia de las dificultades específicas de aprendizaje en la Educación Secundaria Obligatoria. *European Journal of Education and Psychology*, *3*, 317–327.

Guevara, J. P., Gerdes, M., Localio, R., Huang, Y. V., Pinto-Martin, J., Minkovitz, C. S., … Pati, S. (2013). Effectiveness of developmental screening in an urban setting. *Pediatrics*, *131*, 30–37.

Hill, A. P., Zuckerman, K., & Fombonne, E. (2014). Epidemiology of autism spectrum disorders. In F. R. Volkmar, S. J. Rogers, R. Paul & K. A. Pelphrey (Eds.), *Handbook of autism and pervasive developmental disorders. Diagnosis, development, and brain mechanisms* (4th ed., Vol. *1*, pp. 57–96). New York, NY: Wiley.

Hollingshead, A. B. (2011). Four factor index of social status. *Yale Journal of Sociology*, *8*, 21–52.

Hughes-McCormack, L. A., Rydzewska, E., Henderson, A., MacIntyre, C., Rintoul, J., & Cooper, S. A. (2018). Prevalence and general health status of people with intellectual disabilities in Scotland: A total population study. *Journal of Epidemiology and Community Health*, *72*, 78–85.

Jiménez, J. E., García de la Cadena, C., Siegel, L. S., O'Shanahan, I., García, E., & Rodríguez, C. (2011). Gender ratio and cognitive profiles in dyslexia: A cross-national study. *Reading and Writing*, *24*, 729–747.

Jiménez, J. E., Guzmán, R., Rodríguez, C., & Artiles, C. (2009). Prevalencia de las dificultades específicas de aprendizaje: La dislexia en español [Prevalence of specific learning disabilities: The case of dyslexia in Spain]. *Anales de Psicología*, *25*, 78–85.

Karande, S., & Kulkarni, M. (2005). Specific learning disability: The invisible handicap. *Indian Pediatrics*, *42*, 315–319.

Kaufman, J., Birmaher, B., Brent, D., Rao, U., Flynn, C., Moreci, P., … Ryan, N. (1997). Schedule for affective disorders and schizophrenia for school-age children-present and lifetime version (K-SADS-PL): Initial reliability and validity data. *Journal of the American Academy of Child and Adolescent Psychiatry*, *36*, 980–988.

Knight, T., Steeves, T., Day, L., Lowerison, M., Jette, N., & Pringsheim, T. (2012). Prevalence of tic disorders: A systematic review and meta-analysis. *Pediatric Neurology*, *47*, 77–90.

Linazasoro, G., Van Blercom, N., & Ortiz de Zárate, C. (2006). Prevalence of tic disorder in two schools in the Basque country: Results and methodological caveats. *Movement Disorders*, *21*, 2106–2109.

https://doi.org/10.1017/S0033291720005115 Published online by Cambridge University Press

Madsen, K. B., Ravn, M. H., Arnfred, J., Olsen, J., Rask, C. U., & Obel, C. (2018). Characteristics of undiagnosed children with parent-reported ADHD behaviour. *European Child and Adolescent Psychiatry*, *27*, 149–158.

McGuire, D. O., Tian, L. H., Yeargin-Allsopp, M., Dowling, N. F., & Christensen, D. L. (2019). Prevalence of cerebral palsy, intellectual disability, hearing loss, and blindness, National Health Interview Survey, 2009–2016. *Disability and Health Journal*, *12*, 443–451.

Merikangas, K. R., He, J. P., Brody, D., Fisher, P. W., Bourdon, K., & Koretz, D. S. (2010). Prevalence and treatment of mental disorders among US children in the 2001–2004 NHANES. *Pediatrics*, *125*, 75–81.

Moll, K., Kunze, S., Neuhoff, N., Bruder, J., & Schulte-Körne, G. (2014). Specific learning disorder: Prevalence and gender differences. *PLoS ONE*, *9*, e103537.

Morales-Hidalgo, P., Roigé-Castellví, J., Hernández-Martínez, C., Voltas, N., & Canals, J. (2018). Prevalence and characteristics of autism spectrum disorder among Spanish school-age children. *Journal of Autism and Developmental Disorders*, *48*, 3176–3190.

Pennington, B. F., Peterson, R. L., & McGrath, L. M. (2009). Dyslexia. Chapter 6. In B. F. Pennington (Ed.), *Diagnosing learning disorders: A neuropsychological framework* (2nd edn., pp. 45–82). New York, NY: Guilford.

Petrenko, C. L. M. (2013). A review of intervention programs to prevent and treat behavioral problems in young children with developmental disabilities. *Journal of Developmental and Physical Disabilities*, *25*, 651–679.

Pinborough-Zimmerman, J., Satterfield, R., Miller, J., Bilder, D., Hossain, S., & McMahon, W. (2007). Communication disorders: Prevalence and comorbid intellectual disability, autism, and emotional/behavioral disorders. *American Journal of Speech-Language Pathology*, *16*, 359–367.

Rodhe, L. A., Biederman, J., Busnello, E. A., Zimmermann, H., Schmitz, M., Martins, S., & Tramontina, S. (1999). ADHD In a school sample of Brazilian adolescents: A study of prevalence, comorbid conditions, and impairments. *Journal of the American Academy of Child and Adolescent Psychiatry*, *38*, 716–722.

Rosenbaum, S., & Simon, P. (2016). *Speech and language disorders in children: Implications for the social security administration's supplemental security income program*. Washington, DC: The National Academies Press.

Rosenberg, L., Maeir, A., Yochman, A., Dahan, I., & Hirsch, I. (2015). Effectiveness of a cognitive-functional group intervention among preschoolers with attention deficit hyperactivity disorder: A pilot study. *The American Journal of Occupational Therapy*, *69*, 6903220040.

Sayal, K., Prasad, V., Daley, D., Ford, T., & Coghill, D. (2018). ADHD in children and young people: Prevalence, care pathways, and service provision. *The Lancet. Psychiatry*, *5*, 175–186.

Sexton, C. C., Gelhorn, H. L., Bell, J. A., & Classi, P. M. (2012). The co-occurrence of reading disorder and ADHD: Epidemiology, treatment, psychosocial impact, and economic burden. *Journal of Learning Disabilities*, *45*, 538–564.

Thomas, K. C., Ellis, A. R., McLaurin, C., Daniels, J., & Morrissey, J. P. (2007). Access to care for autism-related services. *Journal of Autism and Developmental Disorders*, *37*, 1902–1912.

Toro, J., & Cervera, M. (1991). *Test de análisis de la lecto-escritura*. Madrid: Aprendizaje-Visor.

Vicente, B., Saldivia, S., de la Barra, F., Kohn, R., Pihan, R., Valdivia, M., … Melipillan, R. (2012). Prevalence of child and adolescent mental disorders in Chile: A community epidemiological study. *Journal of Child Psychology and Psychiatry*, *53*, 1026–1035.

Wechsler, D. (2003). *Wechsler intelligence scale for children–fourth edition* (*WISC-IV*). San Antonio, TX: The Psychological Corporation.

Wechsler, D. (2014). *Wechsler intelligence scale for children–fifth edition* (*WISC-V*). San Antonio, TX: NCS Pearson.

Werling, D. M., & Geschwind, D. H. (2013). Sex differences in autism spectrum disorders. *Current Opinion in Neurology*, *26*, 146–153.

Westerinen, H., Kaski, M., Virta, L. J., Kautiainen, H., Pitkälä, K. H., & Iivanainen, M. (2017). The nationwide register-based prevalence of intellectual disability during childhood and adolescence. *Journal of Intellectual Disability Research*, *61*, 802–809.

Willcutt, E. G. (2012). The prevalence of DSM-IV attention-deficit/hyperactivity disorder. A meta-analytic review. *Neurotherapeutics*, *9*, 490–499.

Wolraich, M. L., McKeown, R. E., Visser, S. N., Bard, D., Cuffe, S., Neas, B., … Danielson, M. (2014). The prevalence of ADHD: Its diagnosis and treatment in four school districts across two states. *Journal of Attention Disorders*, *18*, 563–575.

Zheng, X.–Y., Zhang, L., Chen, G., Pei, L.–J., & Song, X.–M. (2008). Prevalence of visual, hearing, speech, physical, intellectual and mental disabilities in China, 2006. *Zhonghua Liu Xing Bing Xue Za Zhi*, *29*, 634–638.

Zwaigenbaum, L., Bauman, M. L., Choueiri, R., Kasari, C., Carter, A., Granpeesheh, D., … Natowicz, M. R. (2015). Early intervention for children with autism spectrum disorder under 3 years of age: Recommendations for practice and research. *Pediatrics*, *136*, S60–S81.

https://doi.org/10.1017/S0033291720005115 Published online by Cambridge University Press