

Self-perceived bullying victimization in pre-adolescents on the autism spectrum: EPINED study

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Abstract

Autistic individuals are at increased risk of experiencing various forms of victimization during their lifespan. The present study analyzes the self-reported prevalence of bullying victimization in autistic pre-adolescents and those with subthreshold autistic traits in comparison with peers without neurodevelopmental conditions. The sample was comprised of 323 participants (11 and 12 years old; 45 with autism or subthreshold autistic traits) from Spanish general education schools. The assessment protocol included psychopathological (autism characteristics and co-occurrent problems), cognitive, and academic characteristics. Bullying victimization was self-reported by the pre-adolescents themselves using the Bullying and School Violence Questionnaire (AVE). Autistic participants (57.9%) and those with subthreshold autistic traits (26.9%) showed a higher rate of bullying victimization in comparison with their peers (18.3%). Bullying rates were more frequent and severe and were characterized by intimidation and social exclusion behaviours. These problems were associated with greater intensity of restrictive and repetitive behaviours and with more co-occurring behavioural and emotional problems. We did not find any association with other individual or family factors. Our data reveal the greater risk of bullying behaviours among autistic young people and those with subthreshold autistic traits, which implies the need for detection and establishment of protocols to prevent consequences for their mental health and quality of life.

Lay abstract

Autistic individuals face a higher risk of various forms of victimization throughout their lives, with bullying being especially prevalent during their school years. Previous studies indicate that autistic children are 2.4 times more likely to be bullied than their typically developing peers and twice as vulnerable as those with other disabilities. However, the extent of this issue among Spanish schoolchildren with autism remains unexplored. Additionally, there is no information regarding the presence of bullying victimization in children with marked but undiagnosed autistic traits (i.e., subthreshold autistic traits). This study examines the self-reported prevalence of bullying victimization in autistic pre-adolescents and those with subthreshold autistic traits, comparing them to peers without neurodevelopmental conditions. The study involved 323 participants (11 and 12 years old; 45 with autism or subthreshold autistic traits) from Spanish general education schools. The results revealed a higher rate of bullying victimization among autistic participants (58%; 3.1 times higher risk) and those with subthreshold autistic traits (27%; 1.5 times higher risk) compared to their peers without neurodevelopmental conditions (18.3%). Victimization was linked to more intense restrictive behaviours and increased behavioural and emotional problems. No significant associations were found with other individual or family factors. Our findings underscore the heightened risk of bullying faced by autistic pre-adolescents and those with subthreshold autistic traits at school, emphasizing the need to identify and implement preventive measures to mitigate bullying and its detrimental impact on their mental well-being and overall quality of life.

Keywords: Bullying, Autism, Subthreshold autistic traits, School-age children, self-reported

Introduction

Autism is a lifelong neurodevelopmental condition with early onset in child development and present in at least 1% of the global population (Zeidan et al., 2022). It is characterized by high heterogeneity in the expression of traits and needs, as well as frequent psychopathological comorbidities. The main characteristics of autism include social communication differences and patterns of repetitive, restrictive, and stereotyped behaviour.

Autistic individuals are at increased risk of experiencing various forms of victimization throughout their lives (Trundle et al., 2022) and bullying is the most frequent form of victimization in the school context. Meta-analytic and cross-cultural meta-analytic studies in autistic populations indicate co-occurrent rates of bullying between 47% and 67%, with 33%, 50%, and 31% for physical, verbal, and relational victimization, respectively (Park et al., 2020; Trundle et al., 2022). Autistic children are 2.4 times more vulnerable to bullying victimization than their typically developing peers and two times more vulnerable than those with other disabilities (Park et al., 2020). Park et al. (2020) did not find differences across studies in prevalence estimates regarding assessment methods (i.e., questionnaire or interview), timeframe (i.e., month, year or lifetime) or respondents (i.e., self, parents or teacher). In this sense, it has been reported that the level of understanding that autistic students have of bullying does not influence the extent to which they report bullying or concern about bullying (Ashburner et al., 2019).

The impact of bullying victimization on children's psychosocial adjustment can be very serious, especially considering that individuals on the autism spectrum may be particularly susceptible to mental health challenges (Hossain et al., 2020). Being bullied

is linked to higher intensity of anxiety, hyperactivity, self-injury, stereotypic behaviour, and over-sensitivity (Cappadocia et al., 2012). It mediates between social communication differences and depression (Rai et al., 2018) and predicts suicidality (Holden et al., 2020). It has also been related to educational functioning and is considered as a significant inhibitor, preventing autistic children from taking full advantage of their schooling (Saggers et al., 2017). In addition, bullying victimization increases the risk of early refusal to attend school and dropping out (Bitsika et al., 2021; Ochi et al., 2020). It seems that verbal and relational forms of victimization are the ones most associated with negative educational outcomes, such as being afraid to go to school, being disobedient at school, poor schoolwork, and social problems at school (Adams et al., 2016).

As stated by Sreckovic et al. (2014) and Cappadocia et al. (2012), bullying can be related to a wide range of individual factors (i.e., autistic traits, social vulnerability, internalizing and externalizing problems, intellectual disability, academic achievement, age, and ethnicity) and contextual factors (i.e., educational setting, school transport, social support and friendships, and family mental health or socioeconomic status). Children in general education schools and classrooms, compared to those in special education, are at the greatest risk (Park et al., 2020; Zablotzky et al., 2014). In relation to characteristics associated with autism, victimization seems to be linked to challenges in peer interactions, social communication, and social skills (Matthias et al., 2021; Sreckovic et al., 2014), as well as resistance to changes (Forrest et al., 2020), but fewer studies have focused on the cognitive and language profiles of children in relation to victimization (e.g., Kloosterman et al., 2013). Some authors suggest that children who exhibit more autism characteristics and additional comorbid conditions might face a higher risk of bullying victimization (Eroglu & Kilic, 2020; Zablotzky et al., 2014). Conversely, other authors did not find a

clear relationship between bullying and the degree of autism expression (Fink et al., 2018). Some even reported increased victimization among individuals with lower scores on measures of autistic characteristics (Ferringo et al., 2022) emphasizing the role of the social context and supports.

Taking all the above factors into account, the present study aims to explore the prevalence of self-reported bullying victimization in a Spanish community-based sample of pre-adolescents diagnosed with autism or presenting subthreshold autistic traits. The specific objectives include: 1) To describe and compare the prevalence of self-perceived bullying victimization among pre-adolescents, including those with autism, subthreshold autistic traits, and those without neurodevelopmental conditions; 2) To explore, within these groups, differences in the severity and typology of bullying behaviours that the child may perceive; and 3) To analyze in pre-adolescents with autism or subthreshold autistic traits the association between bullying victimization and sociodemographic characteristics, cognitive and linguistic performance, nuclear characteristics (e.g. social communication, restricted, repetitive and sensory behaviour or interests) and comorbid psychological profile, educational functioning and parental mental health. Based on the above objectives, the following hypotheses were established: 1) We anticipate that autistic pre-adolescents and those with subthreshold autistic traits might experience significantly higher rates and more severe self-perceived bullying victimization than those without neurodevelopmental conditions; 2) We also expect to find more frequent and severe forms of victimization related to social exclusion; and 3) The different forms of bullying victimization of pre-adolescents with autism or subthreshold autistic traits may be associated with higher levels of co-occurrent psychopathological problems,

cognitive and language challenges, academic difficulties and parental mental health concerns.

Method

Study design and participants

The data of the present study comes from the Neurodevelopmental Disorders Epidemiological Research Project (EPINED; see supplementary Figure S1 for protocol details) (Canals et al., 2020; Morales-Hidalgo et al., 2021). The research involved a cross-section two-phase study that was validated by the Ethics Committee of the Sant Joan University Hospital (13-10-31/10proj5). Its main goal was to estimate the prevalence of autism and attention deficit hyperactivity disorder (ADHD) in two age groups of the community school population: preschoolers (4-5 years old) and school-aged children (10-11 years old). It was conducted in 86 public and private schools selected by areas from Tarragona (Spain). The first phase included a screening for autism and ADHD likelihood, addressed at parents and teachers. The second phase involved a diagnostic procedure with the child and the family, which included the assessment of self-perceived bullying victimization among school-aged children, so the present study focuses on this age group.

In the first phase, 3,520 school-aged children participated, and we obtained informed consent from 54% of their families to participate in the second phase. The sample of the second phase was comprised of 486 children considering participants with increased likelihood scores for autism and/or ADHD in the screening phase and paired peers without increased likelihood scores (see supplementary information S2 for details). After the diagnostic assessment, which made it possible to confirm or rule out the diagnosis of these conditions, N = 323 school-aged children were included in the current

analyses: $N = 45$ (15.8% females; mean age of 11.05, $SD = 0.62$) with autism or subthreshold autistic traits (19 and 26 participants, respectively), and $N = 278$ (41.7% females; mean age of 11.04, $SD = 0.47$) without neurodevelopmental conditions and/or behaviour disorders. The mean calibrated ADOS-2 severity score for autism participants was 5.40 ($SD = 2.08$) and 3.85 ($SD = 1.97$) for those with subthreshold autistic traits.

In relation to community participation, school coordinators provided us with facilities to assess students and their families in the natural environment. Also, teachers provided us with relevant qualitative information in the clinical assessment and helped us to involve families more closely in the project.

Procedure and instruments

In the context of the project, a comprehensive assessment of participants was conducted by means of the Autism Diagnostic Interview-Revised (ADI-R) and the Autism Diagnostic Observational Schedule (ADOS-2) for core traits of autism, Achenbach scales for co-occurring emotional and behavioural challenges (CBCL/6-18 and YSR/11-18), Wechsler Intelligence Scales for Children (WISC-IV) for cognitive performance and the Battery of Objective and Criteria-Screening Language Revised (BLOC-SR) for pragmatic communication competence. Additionally, we collected sociodemographic, educational, and clinical information and assessed the overall psychological well-being of parents through the General Health Questionnaire (GHQ-12). Details on the use of these instruments and the assessment procedure are described in the supplementary information S2. The method and procedure used in the assessment of bullying is described below.

The Bullying and School Violence Questionnaire (*Acoso y violencia escolar*, AVE; Piñuel & Oñate, 2006) is a self-report questionnaire to assess current self-perceived bullying victimization in children and adolescents between 7 and 18 years old. For the present study, we administered the 50 items with three response options (0 = “never”, 1 = “sometimes”, and 2 = “many times”) related to eight bullying scales: harassment, intimidation, threats, coercion, social blocking, social exclusion, social manipulation, and aggressions. These scales led to the following four overall factors: harassment, intimidation, exclusion, and aggression corresponding to verbal, relational and physical behaviours of the construct of bullying, respectively (Campbell et al., 2017). These factors provide two global indexes: 1) Global Bullying Index (GBI), which measures the level of bullying and harassment behaviours based on reported frequency, calculated by summing the scores of all items; and 2) Intensity, which provides an overall indicator of the perceived severity of the bullying. The Intensity scale only scores those behaviours that are given a frequency of “many times”. Within each index, different levels of both frequency in the GBI (slightly frequent, frequent, highly frequent) and severity in the Intensity (mild, moderate, severe) were also specified. These classifications are provided by scoring tables based on the Spanish population according to age and gender. In the results, scores on self-reported bullying scales, factors, and indexes have been reported in a dichotomous format (that is, not reported bullying versus reported bullying, ranging from “mild intensity” and “slightly frequent” to the highest ratings).

In the original validation, the reliability of the bullying scales ranged from $\alpha = .67$ to $\alpha = .95$ and the cut-off scores were based on the general standards validated in the Spanish population by gender (Piñuel & Oñate, 2006). In the present sample, reliability was $\alpha = .97$ for the total scale with the following values per factors: harassment (.90),

intimidation (.86), exclusion (.93) and aggression (.84) without differences by diagnostic group. In the present study, school-aged participants answered the AVE individually, with the researchers present for support and to answer any queries, thus also avoiding the presence of missing items. We could not obtain responses to the bullying questionnaire from 11.8% of autistic children with high support needs and non-verbal characteristics due to the self-reported nature of the questionnaire, who were not included in the sample.

Autism spectrum and self-perceived bullying victimization case definition

Three mutually exclusive diagnostic conditions were established in this study. Diagnoses were based on DSM-5 criteria and clinical consensus among the researchers. Autism was considered when the child reached or exceeded the cut-off scores in all the domains of the ADI-R diagnostic algorithm and the ADOS-2 calibrated score of severity was ≥ 4 . Subthreshold autistic traits were considered when the child scored slightly below the cut-off scores in ADI-R and ADOS-2, the screening questionnaires were positive in both contexts and two professionals agreed that they do not meet all the DSM-5 diagnostic criteria. The comparison group consisted of participants without neurodevelopmental conditions and/or behavioural disorders.

The prevalence of self-perceived bullying victimization was calculated considering the GBI (frequency) and the Intensity (severity) independently. In addition, the combination of these two indexes (GBI + Intensity) provides an overall view of the perceived bullying victimization situation considering both frequency and severity.

Data analysis

The prevalence of self-perceived bullying victimization was calculated for participants with autism, subthreshold autistic traits, and without neurodevelopmental

conditions considering the GBI, Intensity, GBI + Intensity, and the AVE scales and factors. To explore the association between autism characteristics, ADHD comorbidity and the presence of victimization, we conducted logistic regression analysis adjusted for socioeconomic level, sex, and place of birth. The independent variable was having diagnosis of autism or subthreshold autistic traits, and the outcomes were: GBI + Intensity, and the AVE factors. Sociodemographic information, psychological characteristics (intensity of autism traits, co-occurrent psychological challenges, ADHD comorbidity), cognitive and language skills, academic characteristics and parents' mental health were compared between the following groups of children: 1) autism or subthreshold autistic traits reporting bullying, 2) autism or subthreshold autistic traits not reporting bullying, 3) non-neurodevelopmental conditions reporting bullying, 4) non-neurodevelopmental conditions not reporting bullying. Group differences were assessed using the Z test for categorical variables and analysis of variance (ANOVA) for continuous variables. Levene's test was used to assess variance homogeneity, with Bonferroni or Tamhane's T2 for post-hoc analysis for equal or unequal variances, respectively. The statistical analyses were performed using SPSS (version 28, SPSS Inc., Chicago, IL, USA) and EPIDAT 3.1 (Xunta de Galicia).

Results

Prevalence of co-occurring self-perceived bullying victimization by groups

Table 1 shows the self-perceived bullying victimization prevalence rates for participants with autism or subthreshold autistic traits in comparison with those without neurodevelopmental conditions.

Pre-adolescents with autism and those with subthreshold autistic traits reported the highest rates of self-perceived current bullying victimization (GBI + Intensity: 57.9% for autism, 26.9% for subthreshold autistic traits, and 40% for both groups together), while in the group without neurodevelopmental conditions the prevalence was 18.3%. Prevalence rates were 63.2% for GBI and 57.9% for Intensity in autistic pre-adolescents, compared to 34.5% and 21.6% in the group without neurodevelopmental conditions respectively. Both in overall prevalence and when the global indexes of bullying were considered separately, statistically significant differences were only found between autistic children and those without neurodevelopmental conditions (GBI + Intensity: $p < .001$; GBI: $p = .024$; Intensity: $p < .001$). The GBI revealed higher rates of frequent bullying situations among autistic children in comparison with the group without neurodevelopmental conditions (36.8% vs. 15.8%, $p = .042$). Also, significantly higher rates of severe intensity bullying were observed in autistic participants compared to those without neurodevelopmental conditions (15.8% vs. 2.9%; $p = .024$) and a trend towards higher rates of moderate intensity (26.3% vs. 9.4; $p = .051$).

When examining bullying factors and scales, no differences were found in victimization forms between participants with autism and those with subthreshold autistic traits. Among factors, the rate of certain types of bullying differed significantly between autistic children and those without neurodevelopmental conditions, namely exclusion (68.4% vs. 41%; $p = .036$), intimidation (57.9% vs. 29.9%; $p = .022$) and harassment (52.6% vs. 24.5%; $p = .015$). Children with subthreshold autistic traits also reported a higher frequency of exclusion (65.4% vs. 41%; $p = .028$) than the group without neurodevelopmental conditions. In relation to specific scales, autistic preadolescents reported more harassment, intimidation, social blocking, and social exclusion than the

group without neurodevelopmental conditions ($p \leq .016$). Those with subthreshold autistic traits reported significantly higher rates of intimidation, coercion, and social exclusion than the group without neurodevelopmental conditions ($p \leq .017$).

Insert Table 1

A multivariate logistic regression analysis indicated that pre-adolescents with autism and those with subthreshold autistic traits have a 2.9-fold increased likelihood of self-perceived bullying victimization (95% CI: 1.47-5.88, $p = .002$). More specifically, the results showed a 2.6-fold increased likelihood of experiencing intimidation (95% CI: 1.35-5.05, $p = .004$) and 3.0-fold increased likelihood of experiencing exclusion (95% CI: 1.53-5.99, $p = .001$). Additionally, when we specifically analysed the effect of the comorbidity of autism and ADHD, the overall likelihood of experiencing bullying increased (OR 3.4; 95% CI: 1.27-8).

As shown in Table 2, socioeconomic level, place of birth, sex, cognitive and pragmatic language competence were not significantly related to bullying self-perception in pre-adolescents with autism or subthreshold autistic traits. Although they had more academic accommodations, this was not associated with more victimization.

In regard to the psychological profile, participants with autism or subthreshold autistic traits reporting bullying showed significantly more intense repetitive behaviours, but not social communication differences or ADHD comorbidity than those in the same diagnosis group but without bullying. They exhibited higher levels of self-reported externalizing, internalizing and total challenges compared to those with autism or subthreshold autistic traits but not reporting bullying. Parents indicated that co-occurrent psychological challenges were significantly higher compared to the group without neurodevelopmental conditions, whereas the pre-adolescents themselves only reported

more total problems. In terms of cognitive profile, participants with autism or subthreshold autistic traits reporting bullying obtained lower scores than those without neurodevelopmental conditions reporting bullying in working memory, processing speed, total intelligence quotient and pragmatic skills. Lower scores were also observed in verbal comprehension compared to the comparison group of children without neurodevelopmental conditions not reporting bullying.

No relevant differences were observed in parents' general health status among groups. Only the mothers of pre-adolescents with autism or subthreshold autistic traits reported more psychological problems than the control group.

Insert Table 2

Discussion

Autistic students are particularly vulnerable to being bullied (Park et al., 2020; Trundle et al., 2022). This study analysed this situation for the first time in the Spanish school population. It also expands the study of this phenomenon within the spectrum by considering those children with marked but undiagnosed autistic traits (i.e., broad autism phenotype or subthreshold autistic traits). The rate of current self-perceived bullying victimization was 58% in autistic pre-adolescents. Moreover, bullying victimization was experienced more frequently, and, in most cases, it was also more severe in intensity than among their peers without neurodevelopmental conditions. For pre-adolescents with subthreshold autistic traits, the rate of self-perceived bullying victimization was also high in comparison to those without neurodevelopmental conditions (27% versus 18%), but differences were not statistically significant. These high figures are in accordance with the 67% of pooled prevalence of bullying victimization found in the meta-analysis conducted by Park et al. (2020) and the 47% and 44% reported, respectively, in the

systematic-reviews and meta-analysis of Trundle et al. (2022) and Maïano et al. (2016). These studies include a wide range of temporal approaches in the estimation of bullying, including research with the current timeframe, such as the present study. A considerable 18.3% of the participants without neurodevelopmental conditions also self-reported bullying victimization, which highlights what UNESCO (2019) has communicated, that overall, one in three children experiences bullying, which leads to serious health and educational consequences. A further concern is that children with neurodevelopmental conditions are extremely vulnerable to victimization and to emotional problems (Voltas et al., 2023), with bullying constituting a predictor of later suicidal behaviours (Holden et al., 2020). This must be considered so that prevention strategies can be created that are more specific in such cases.

Our findings showed that the ratio of bullying problems among neurodivergent students compared to those without neurodevelopmental conditions was 3.2:1 for autism and 1.5:1 for subthreshold autistic traits. We found higher victimization rates in autistic participants, although those with subthreshold autistic traits also showed an increased vulnerability. Ferrigno et al. (2022) found that children with fewer autistic traits experienced higher levels of bullying (65%) compared to those with more elevated traits (7-21%); however, we did not find this continuity across conditions in the broader autistic phenotype. Bullies frequently target individuals with fewer autistic traits in less socially protected environments, precisely because of the lack of supports and strategies to prevent or cope with such situations. Similar to us, Junttila et al. (2023) found an increased vulnerability to bullying in both the autistic community and in people with autistic symptoms in the general population, which suggests the need to make efforts for preventing bullying across the entire autism spectrum. The profile of perceived bullying

behaviours was consistent regarding intimidation and social exclusion in children with autism and those with subthreshold autistic traits, showing an elevated vulnerability in comparison to participants without neurodevelopmental conditions. Autistic children also reported harassment and social blocking situations. This is in line with the experience of increased difficulties and stress in social group situations reported frequently by autistic children and adolescents, and the feeling of social exclusion in these settings (Cresswell et al., 2019). Moreover, the challenges of navigating an ambiguous social context, combined with prior victimization or other negative experiences, can increase their sense of vulnerability, leading to feelings of fear or intimidation in group settings. Most importantly, autistic children report these situations, but often their experiences are not validated by their environment, resulting in no action being taken to address them. Hence, Begeer et al. (2015) stated that children are competent reporters of their own and their peers' bullying behaviours and victimization but have more challenge in displaying defending behaviours.

The presence of bullying in autistic pre-adolescents was significantly associated with increased repetitive behaviours. This may be because bullying leads to more emotional problems (Cappadocia et al., 2012; Rai et al., 2018), which could act as a mediator for increased repetitive behaviours (Morales-Hidalgo et al., 2023). No differences were found in the socio-communicative area in contrast to what previous studies suggest (Cappadocia et al., 2012; Chou et al., 2019). On the other hand, we did not find that any linguistic or cognitive factors were associated with bullying in autistic children as previously stated by Sreckovic et al. (2014) and Cappadocia et al. (2012). Among autistic children and those with subthreshold autistic traits, we observed a higher comorbidity with ADHD in the presence of bullying compared to the group without

bullying. However, the differences were not statistically significant. It was expected to find more bullying victimization in autistic pre-adolescents with ADHD because both conditions involve higher vulnerability, as previously reported in children with ADHD in the same population sample (Voltas et al., 2023) and in autistic adults with ADHD characteristics (Gibbs et al., 2023).

The present study has several limitations that need to be highlighted. First, the sample size of children with autism and subthreshold autistic traits was small, as it was drawn from a sample of community schools. Second, it should be noted that the bullying questionnaire used does not explicitly assess cyberbullying and is quite unspecific in terms of time frame (i.e., only refers to current situations). However, it specifically targets verbal, relational, and physical bullying behaviours through different scales and examines the frequency and severity of these problems. Also, the use of a self-reported bullying questionnaire made it difficult to collect bullying victimization situations in children with higher support needs. In this sense, Morton et al. (2021) points out the lack of gold-standard bullying assessment procedures for the autistic community, which highlights the need for further research in this field. As a third limitation, the cross-sectional design of the study did not allow us to establish causal relationships between factors. As a way forward, it is important to continue researching social and communication skills in autistic children that could facilitate coping and resilience skills to face bullying behaviours. We must also be aware of all the factors that could lead to an increase in the emotional challenges in autistic individuals in order to prevent them. Identifying the socio-contextual factors that influence the degree of social inclusion and the presence of bullying within the school community is crucial.

Conclusion

The presence of bullying victimization in children with autism is an overwhelming reality, with ratios of 3.2:1 in autistic pre-adolescents and 1.5:1 in pre-adolescents with subthreshold autistic traits compared to their peers without neurodevelopmental conditions. The bullying situations are characterized by increased frequency and severity than their peers, as well as by the predominance of social exclusion and intimidation. These challenges are associated with greater intensity of restrictive and repetitive behaviours and with more co-occurring behavioural and emotional difficulties.

Table 1. Bullying prevalence rates (AVE scores in the global indexes, bullying scales, and factors) by groups

AVE scores	Children with autism or subthreshold autistic traits			Children without neurodevelopmental conditions	Comparison by groups (<i>p</i>)		
	Total <i>n</i> = 45	Autism <i>n</i> = 19	Subthreshold autistic traits <i>n</i> = 26	Total <i>n</i> = 278	Autism vs. Subthreshold autistic traits	Autism vs. Without neurodevelopmental conditions	Subthreshold autistic traits vs. Without neurodevelopmental conditions
Global indexes, % (<i>n</i>)							
Global Bullying Index (GBI)	53.3 (24)	63.2 (12)	46.2 (12)	34.5 (96)	.408	.024	.332
Slightly frequent	15.6 (7)	10.5 (2)	19.2 (5)	14.0 (39)	.704	.933	.668
Frequent	26.7 (12)	36.8 (7)	19.2 (5)	15.8 (44)	.328	.042	.863
Highly frequent	11.1 (5)	15.8 (3)	7.7 (2)	4.7 (13)	.709	.121	.837
Intensity	40.0 (18)	57.9 (11)	26.9 (7)	21.6 (60)	.074	<.001	.703
Mild	13.3 (6)	15.8 (3)	11.5 (3)	9.4 (26)	.976	.607	.989
Moderate	17.8 (8)	26.3 (5)	11.5 (3)	9.4 (26)	.376	.051	.989
Severe	8.9 (4)	15.8 (3)	3.8 (1)	2.9 (8)	.390	.024	.744
GBI + Intensity	40.0 (18)	57.9 (11)	26.9 (7)	18.3 (51)	.074	<.001	.422
Bullying scales, % (<i>n</i>)							
Harassment	37.8 (17)	52.6 (10)	26.9 (7)	24.5 (68)	.148	.015	.968
Intimidation	46.7 (21)	52.6 (10)	42.3 (11)	19.1 (53)	.702	.002	.012
Threats	24.4 (11)	26.3 (5)	23.1 (6)	13.3 (37)	.919	.217	.284
Coercion	37.8 (17)	36.8 (7)	38.5 (10)	16.5 (46)	.841	.054	.013
Social blocking	55.6 (25)	63.2 (12)	50.0 (13)	33.1 (92)	.566	.016	.129
Social exclusion	62.2 (28)	68.4 (13)	57.7 (15)	32.4 (90)	.673	.003	.017
Social manipulation	48.9 (22)	57.9 (11)	42.3 (11)	34.2 (95)	.464	.066	.537
Aggressions	13.3 (6)	21.1 (4)	7.7 (2)	10.8 (30)	.391	.324	.874
Factors, % (<i>n</i>)							
Harassment factor	37.8 (17)	52.6 (10)	26.9 (7)	24.5 (68)	.148	.015	.968

Intimidation factor	53.3 (24)	57.9 (11)	50.0 (13)	29.9 (83)	.824	.022	.058
Exclusion factor	66.7 (30)	68.4 (13)	65.4 (17)	41.0 (114)	.915	.036	.028
Aggression factor	13.3 (6)	21.1 (4)	7.7 (2)	10.8 (30)	.391	.324	.874

AVE: Bullying and school violence questionnaire. In bold $p \leq .05$.

Table 2. Sociodemographic, academic, psychological and cognitive characteristics of pre-adolescents by diagnosis group in relation to bullying victimization

Children and parent profiles	Children with autism or subthreshold autistic traits		Children without neurodevelopmental conditions		Comparison by groups (p)					
	Bullying ^a	No bullying ^b	Bullying ^c	No bullying ^d	<i>ab</i>	<i>ac</i>	<i>ad</i>	<i>bc</i>	<i>bd</i>	<i>cd</i>
Sociodemographic profile, % (n)	n = 18	n = 27	n = 51	n = 227						
SES										
High	16.7 (3)	18.5 (5)	17.6 (9)	23.8 (54)	.811	.789	.690	.830	.710	.446
Medium	61.1 (11)	63.0 (17)	62.7 (32)	63.4 (144)	.851	.873	.955	.820	.871	.946
Low	22.2 (4)	18.5 (5)	19.6 (10)	12.8 (29)	.939	.917	.441	.853	.596	.295
Sex										
Boys	88.9 (16)	81.5 (22)	54.9 (28)	59.0 (134)						
Girls	11.1 (2)	18.5 (5)	45.1 (23)	41.0 (93)	.801	.022	.024	.038	.040	.702
Place of birth										
Autochthonous	83.3 (15)	81.5 (22)	86.3 (44)	90.3 (205)						
Non-Autochthonous	16.7 (3)	18.5 (5)	13.7 (7)	9.7 (22)	.811	.933	.592	.819	.282	.550
Academic characteristics	n = 18	n = 27	n = 51	n = 227						
Academic achievement, mean (SD)	2.9 (1.2)	2.9 (1.1)	3.0 (1.0)	3.4 (1.0)	1.000	1.000	.560	1.000	.273	.127
Academic accommodations, % (n)	50.0 (9)	44.4 (12)	9.8 (5)	8.4 (19)	.951	.001	<.001	.001	<.001	.957
Psychological profile, mean (SD)										
ADOS-2 severity	n = 18	n = 27	n = 50	n = 226						
Social communication	4.6 (1.7)	5.4 (2.4)	1.7 (1.2)	1.8 (1.3)	.232	<.001	<.001	<.001	<.001	1.000
Repetitive behavior	5.5 (2.5)	2.9 (2.8)	1.3 (.9)	1.1 (.6)	<.001	<.001	<.001	<.001	<.001	1.000
Total severity	4.2 (1.8)	4.4 (2.2)	1.2 (.7)	1.3 (.8)	1.000	<.001	<.001	<.001	<.001	1.000
CBCL co-occurrent problems	n = 18	n = 27	n = 49	n = 223						
Externalized problems	59.9 (11.6)	53.2 (11.6)	51.9 (8.7)	49.5 (9.4)	.137	.016	<.001	1.000	.366	.709
Internalized problems	64.4 (10.3)	62.7 (9.5)	55.6 (8.9)	53.3 (9.5)	1.000	.005	<.001	.011	<.001	.783
Total problems	65.7 (9.5)	60.5 (9.5)	55.5 (7.9)	51.1 (9.1)	.346	<.001	<.001	.115	<.001	.013
YSR co-occurrent problems	n = 18	n = 27	n = 51	n = 227						

Externalized problems	53.8 (9.3)	44.7 (10.0)	47.5 (9.1)	43.0 (8.6)	.005	.056	<.001	1.000	1.000	.008
Internalized problems	61.3 (8.7)	53.3 (12.3)	56.3 (8.8)	47.0 (8.8)	.025	.272	<.001	1.000	.004	<.001
Total problems	60.6 (8.7)	48.4 (12.5)	53.8 (8.2)	44.4 (8.7)	<.001	.037	<.001	.085	.170	<.001
ADHD diagnosis, % (n)	n = 18	n = 27	n = 51	n = 227						
ADHD comorbidity	50.0 (9)	33.3 (9)	0 (0)	0 (0)	.419	<.001	<.001	<.001	<.001	-
Cognitive profile, mean (SD)	n = 18	n = 26	n = 51	n = 227						
Verbal comprehension	96.3 (15.9)	100.5 (16.1)	104.0 (11.9)	106.3 (11.8)	1.000	.149	.007	1.000	.150	1.000
Perceptual reasoning	103.1 (17.4)	104.4 (20.1)	105.1 (15.7)	107.4 (14.7)	1.000	1.000	1.000	1.000	1.000	1.000
Working memory	86.0 (17.3)	95.2 (17.2)	98.4 (14.2)	99.5 (13.9)	.238	.012	.001	1.000	.903	1.000
Processing speed	89.6 (14.6)	94.9 (19.2)	105.0 (13.0)	103.6 (11.7)	1.000	<.001	<.001	.007	.006	1.000
Total intellectual quotient	92.3 (15.8)	99.7 (18.2)	103.4 (13.4)	105.2 (13.3)	.500	.024	.001	1.000	.354	1.000
Pragmatic language competence, % (n)	n = 16	n = 25	n = 42	n = 210						
Impaired	75.0 (12)	68.0 (17)	35.7 (15)	37.1 (78)	.898	.017	.007	.021	.006	1.000
Not impaired	25.0 (4)	32.0 (8)	64.3 (27)	62.9 (132)						
Parents' mental health status, % (n)	n = 14F / 17M	n = 25F / 27M	n = 42F / 49M	n = 195F / 221M						
GHQ-Fathers	14.3 (2)	20.0 (5)	23.8 (10)	17.9 (35)	.991	.707	.988	.953	.980	.508
GHQ-Mothers	52.9 (9)	14.8 (4)	30.6 (15)	19.9 (44)	.863	.175	.004	.213	.708	.147

ADHD: Attention-deficit/hyperactivity disorder; CBCL: Child behavior checklist; YSR: Youth self-report; SES: Socioeconomic level; GHQ: General health questionnaire; F: Fathers; M: Mothers.

In bold $p \leq .05$.

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Supplementary Material

Self-perceived bullying victimization in pre-adolescents on the autism spectrum: EPINED study

NEURODEVELOPMENTAL DISORDERS EPIDEMIOLOGICAL RESEARCH PROJECT (EPINED)

STUDY PHASES AND PARTICIPANTS

* PRE: Preschool aged children, SCH: School aged children.

Regular Education Schools Target Population (2013)
17,295 Children (PRE 9,027; SCH 8,268)

86 (of 296) Randomly Selected Schools by counties
6,921 (PRE 3,392; SCH 3,529)

PHASE 1: Parent and Teacher Screening Procedure

99.6% Teacher Anonymous Responses: 6,894
(PRE 3,374; SCH 3,520)

Positive Screening autism and/or ADHD
1,080 (PRE 356; SCH 724)

53.9% Parent Responses: 3,727
(PRE 1,802; SCH 1,925)

Positive Screening autism and/or ADHD
1,439 (PRE 678; SCH 761)

53.9% Subjects with Parent and Teacher Responses
3,727 (PRE 1,802; SCH 1,925)

Screened Negative
autism and ADHD: **3,205**
(PRE 1,613; SCH 1,592)

Screened Positive
autism and/or ADHD: **522**
(PRE 189; SCH 333)

PHASE 2: Individual and Specific Clinical Assessment

Non-Likelihood Group
autism and/or ADHD: **297**
(PRE 115; SCH 182)

Likelihood Group
autism and/or ADHD: **484**
(PRE 180; SCH 304)

Second Phase Sample Diagnosis
781 (PRE 295; SCH 486)

Autism

Autism: **35 (PRE 22; SCH 13)**
Subthreshold traits: **33 (PRE 19; SCH 14)**

Diagnoses based on DSM-5 criteria. Autism: Scores above the cut-off on the ADI-R and ADOS-2 calibrated scores. Subthreshold traits: Scores slightly below the cut-off scores on ADI-R and ADOS-2, 2 positive screenings, and 2 researchers' agreement.

ADHD

ADHD: **158 (PRE 32; SCH 126)**
Subthreshold traits: **64 (PRE 15; SCH 49)**

Diagnoses based on DSM-5 criteria. ADHD: Information in the K-SADS-PL meet DSM-5 criteria for any of the 3 presentations. Subthreshold ADHD: 2 positive screenings (T≥65), 4 or 5 symptoms for any ADHD presentation and impairment.

Autism + ADHD

Autism + ADHD: **19 (PRE 7; SCH 12)**
Subthreshold traits: **22 (PRE 9; SCH 13)**

Subthreshold traits included: autism + subthreshold ADHD traits, ADHD + subthreshold autistic traits and subthreshold autistic traits + subthreshold ADHD traits.

ASSESSMENT METHODS

- The **EPINED** is a two-phase cross-sectional study conducted **between 2014 and 2019** in the entire province of Tarragona, Spain. The study protocol was validated by the Ethics Committee validation at the Sant Joan University Hospital (13-10-31/10proj5).
- The sample size was determined using **Ene 3.0 software**. The calculation was based on the autism prevalence reported in previous studies, with a **5%** alpha error, a **20%** beta error, and an expected attrition rate of **50%**.

The screening for autism and/or ADHD likelihood was conducted in two environments:



- Childhood Autism Spectrum Test (CAST; Scott et al. 2002)
- Early Childhood Global Index (Conners, 2009)
- Conners 3 ADHD Index (Conners, 2008)



- EDUTEA Questionnaire (Morales-Hidalgo et al., 2017)
- Early Childhood Global Index (Conners, 2009)
- Conners 3 ADHD Index (Conners, 2008)

Child and family **sociodemographic information** was recruited from both environments.

Autism likelihood: CAST and/or EDUTEA positive screen. **ADHD likelihood:** Conners parent and teacher (T≥65) positive screen.

The assessment included **several areas** of functioning:



- Autism Diagnostic Interview Revised (ADI-R; Rutter et al. 2003)
- Autism Diagnostic Observation Schedule (ADOS-2; Lord et al. 2012)
- ADHD scale of the Schedule for Affective Disorders and Schizophrenia for School-Age Children (K-SADS-PL; Kaufman et al., 1997)



- Wechsler Scales of Intelligence for preschool and school-age children (WPPSI-IV, WISC-IV, Wechsler 2003, 2012)
- Trail Making Test for school-aged children (Portellano et al., 2009)
- Achenbach's behaviour checklists for preschool and school-age children (CBCL; Achenbach & Rescorla, 2000, 2001)



- School grades and support
- Exposure to environmental pollutants
- Bullying and School Violence Questionnaire (AVE; Piñuel & Oñate, 2006)



- Child clinical service use and history
- Child anthropometric/nutritional assessment
- Exposure to environmental pollutants
- Parents General Health Questionnaire (GHQ-12; Goldberg & Williams, 1988)
- Parents autism and/or ADHD characteristics (AQ-short; Hoekstra et al., 2011, ASRS; Adler et al. 2006)

Supplementary Figure S1. Flow chart of the study design including study phases, participants and instruments used.

Supplementary information S2. Secondary instrument and procedure details

Instruments details

- *Core autistic characteristics:* The information collected from the Autism Diagnostic Interview-Revised (ADI-R; Rutter et al., 2003) and the Autism Diagnostic Observational Schedule (ADOS-2; Lord et al., 2012), as gold-standard instruments, allow us to perform the DSM-5 autism diagnosis. The degree or intensity of autistic traits was established using the ADOS-2 calibrated scores (from 1 to 3 is the non-spectrum classification, from 4 to 5 is the autism spectrum disorder classification, and from 6 to 10 is the autism classification) (Gotham et al., 2009).
- *Cognitive performance:* The Wechsler Intelligence Scales for Children (WISC-IV; Wechsler, 2005) assess the cognitive abilities of children between 6 and 16 years old. It allows us to estimate the overall intelligence quotient as well as specific indexes for verbal comprehension, perceptual reasoning, working memory, and processing speed. The pragmatic subtest of the Battery of Objective and Criteria-Screening Language Revised (BLOC-SR; Puyuelo-Sanclemente et al., 2007) was administered to assess pragmatic communication competence in school-aged children. The subtest comprises 23 items and scores, in percentiles, that can be classified according to the level of competence and need for help as follows: 70-100 superior, 60-70 transition, 30-60 emergency, and ≤ 25 -30 alarm.
- *Co-occurrent emotional and behavioral problems:* The Achenbach scales were used to address emotional and behavioral co-occurring challenges. The Child Behavior Checklist (CBCL/6-18; Achenbach & Rescorla, 2001) is a 113-item questionnaire reported by parents of children and adolescents aged 6-18 years old. It is structured around the following eight syndromic scales: anxious/depressed,

withdrawn/depressed, somatic complaints, social problems, thought problems, attention problems, rule-breaking behaviors, and aggressive behaviors. The first three of these scales make up the internalizing scale, while the rule-breaking behaviors and aggressive behaviors make up the externalizing scale. The total problems scale is composed of the following scales: internalizing and externalizing problems, social problems, thought problems, and attention problems. The reliability of the Spanish version ranged from $\alpha = .71$ to $\alpha = .87$ (Sardinero et al., 1997). The Youth Self-Report (YSR/11-18; Achenbach, 1991) is a 112-item self-reported questionnaire on emotional and behavioral problems and social skills for pre-adolescents and adolescents aged between 11 and 18 years old. It provides the same scales as the CBCL. The reliability of the Spanish version ranged from $\alpha = .81$ to $\alpha = .84$ (Abad et al., 2000). For the present study we only used the CBCL and YSR internalizing, externalizing and total problems scores.

- *Overall psychological well-being in parents:* The General Health Questionnaire (GHQ-12; Goldberg & Williams, 1988) was used to assess overall psychological well-being in parents. The 12-item self-reported questionnaire was completed separately by mothers and fathers. The total score ranges from 0 to 36 and has a cut-off point of 12, with high scores suggesting poor psychological health. The reliability in the Spanish population is $\alpha = .76$. (Sánchez-López et al., 2008).
- *Sociodemographic, educational, and clinical information:* Sociodemographic, educational, and clinical information (previous medical or psychological diagnoses or reports, service use, family psychopathological antecedents) was collected by means of an ad-hoc questionnaire in the first and second phases of the study. The academic achievement measure was obtained from the school grade reports. A 5-point Likert

scale ranging from failure to excellent results was used to express participants' performance in language, mathematics, history and science, music and arts, and physical education. Socioeconomic status was estimated in accordance with Hollingshead (2011).

Procedure details

- In the first phase, parents and teachers completed the screening for autism and ADHD likelihood and provided psychological and sociodemographic data about the children. The screening for autism was positive when parents [Childhood Autism Spectrum Test, CAST; (Morales-Hidalgo, Roigé-Castellví, et al., 2017; Scott et al., 2002)] or teachers [EDUTEA; (Morales-Hidalgo, et al., 2017)] scored above the cut-off points. The screening was positive for ADHD when the children obtained high or very high scores ($T \geq 65$) on the parent and teacher indexes of the 10-item Conners 3 ADHD Index (Conners Hyperactivity Index; Conners, 2008). All the participants with a positive autism and/or ADHD screen and those with a previous diagnosis were invited to participate in the second phase. In addition, a comparison group without autism or ADHD increased likelihood scores, matched by gender, age, and school, was requested to participate. Throughout the project, the assessment ratio between screened positive and screened negative participants was around 2:1.
- In the second phase, an individual assessment of the children and their families was performed in the schools by specially trained clinicians. The assessment protocol for autism included ADI-R and ADOS-2. For ADHD the protocol comprised the ADHD module of the Kiddie-Schedule for Affective Disorders and Schizophrenia for School-Age Children (K-SADS-PL; Ulloa et al. 2006). Complementary measures of co-occurrent emotional and behavioral challenges, cognitive and language performance

were also used. Sociodemographic, educational, and clinical information as well as overall psychological well-being in parents was collected. On completion of the study, a full report of the results was provided to parents and school psychologists.

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