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ESTUDIOS

Prevalence of reading difficulties and attention deficit hyperactivity disorder in a sample of Spanish prisoners

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Abstract: This is the first study examining prevalence and co-occurrence of reading difficulties and attention deficit hyperactivity disorder (ADHD) in a Spanish prison population[1]. A main goal was to explore if prisoners' reading problems were linked to an underlying phonological deficit or to insufficient schooling. The performance of 117 prisoners on reading, phonological, and rapid automatized naming (RAN) tasks were compared to that of 13-15-year-old secondary students. ADHD was assessed by two self-rating questionnaires. Results showed that prisoners were poorer readers but performed equally on the phonological tasks as the secondary students. These results suggest that lack of reading training and practice could account for prisoners' low reading performance rather than a phonological deficit. In addition, students' and prisoners' prevalence of dyslexia was within the rate of the general population, while prisoners' prevalence of ADHD was elevated. Finally, 67% of prisoners with poor reading, low phonological skills, or declared dyslexic exhibited comorbid symptoms of ADHD. This is taken as evidence that dyslexia itself may not be directly linked to involvement in antisocial behavior, but in combination with other conditions. Adequate schooling along with regular screening and intervention on learning difficulties could help to prevent the incidence of disturbed behavior or, in the case of conviction, to reduce the likelihood of recidivism.
Keywords: Attention deficit hyperactivity disorder; Dyslexia; Prisoners; Reading skills.

ES Prevalencia de las dificultades lectoras y de Déficit de Atención con Hiperactividad en una muestra de reclusos españoles

Resumen: Este es el primer estudio que examina la prevalencia y la coocurrencia de las dificultades de lectura y el trastorno por déficit de atención con hiperactividad (TDAH) en una población reclusa española. Uno de los principales objetivos era explorar si los problemas de lectura de los reclusos estaban asociados a un déficit fonológico subyacente o con una insuficiente escolarización. Se comparó el rendimiento de 117 presos en tareas de lectura, metafonología y denominación rápida automatizada (RAN) con el de estudiantes de secundaria de 13-15 años. El TDAH se evaluó mediante dos cuestionarios de autoevaluación. Los resultados mostraron que los reclusos eran peores lectores, pero su rendimiento era equivalente al de los estudiantes de secundaria en las tareas metafonológicas. Estos resultados sugieren que el bajo rendimiento lector de los presos se podría explicar mejor por la falta de entrenamiento o de práctica en la lectura más que por un déficit fonológico. Además, la prevalencia de la dislexia en estudiantes y presos estaba dentro de los valores de la población general, mientras que la prevalencia del TDAH en los presos era más elevada. Por último, el 67% de los presos con lectura deficiente, bajas habilidades fonológicas o declarados disléxicos presentaban síntomas comórbidos de TDAH. Esto se considera una prueba de que la dislexia por sí misma puede no

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estar directamente relacionada con la implicación en conductas antisociales, sino en combinación con otras condiciones. Proporcionar una escolarización adecuada junto con la inclusión de programas sistemáticos de detección e intervención en las dificultades de aprendizaje podrían contribuir a prevenir la incidencia de conductas disruptivas o, en caso de condena, a reducir la probabilidad de reincidencia.
Palabras clave: Dislexia; Habilidades lectoras; Reclusos; TDAH.

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Introduction

From an early stage in children's schooling careers, reading is crucial to meet the demands of everyday life. Reading skills are clearly involved in an individual's progress within the educational system (Snowling et al., 2000). Besides, children with poor reading skills may show greater difficulties than their peers to adapt to the school environment (Reid & Kirk, 2001), and be more prone to externalize behavioral problems than typical readers (Heiervang et al., 2001). In adulthood, ordinary activities such as finding an address, communicating with digital messaging, or filling out application forms require, at least, a minimum mastery of reading. Hence, people who do not acquire good reading abilities may be limited in their ability to function in adulthood, for instance, struggling to find a job and to be socially integrated (Bartlett et al., 2010). The reported high incidence of reading difficulties among prison populations (Critchley, 1968; Greenberg et al., 2007) has strengthened the evidence for a link between reading skills and social adaptation (Macdonald, 2012). However, there is inconsistent evidence that prisoners' poor reading performance is a manifestation of dyslexia rather than a consequence of low education. In addition, dyslexia is frequently comorbid with ADHD (Attention deficit hyperactivity disorder) (Willcutt et al., 2007), another condition highly prevalent among inmates (Sexton et al., 2012). Furthermore, several studies have linked ADHD to maladaptive behaviors and delinquency (Dayan et al., 2023) suggesting that ADHD might play a key role in the relationship between reading difficulties and antisocial behavior that needs to be taken into consideration (Trzesniewski et al., 2006). Examining these questions constitutes the aims of this study.

Developmental Dyslexia (henceforth DD) is defined as slow and inaccurate reading even after adequate teaching conditions or years of practice (Lyon et al., 2003). Poor word decoding may affect reading comprehension and produce scarce reading practice with a consequent reduction in vocabulary and background knowledge. Research has demonstrated that at the core of this disorder, there is a phonological deficit (Peterson & Pennington, 2012). Although figures vary according to the criteria used, independently of the orthographic system, it is estimated that dyslexia affects between 3% and 13% of the general population (DSM V; Moll et al., 2014; Snowling, 2012). However, the prevalence rate increases notably when studying convicted populations (Critchley, 1968; Gellert & Elbro, 1999; Svensson, 2011; Svensson et al., 2001). In fact, Jensen et al. (1999) found that 41% of 63 Swedish prisoners aged 19-57 assessed by neuropsychological and literacy tests were diagnosed as dyslexic. Moody et al., (2000) reported similar prevalence rates using Woodcock measures of word attack and reading comprehension to assess 253 prisoners confined in Texas prisons. They found that 47% participants showed limited word decoding, and almost 70% underscored in a reading comprehension task. More recently, Cassidy et al. (2021) included IQ, phonological, word, nonword and text reading measures to find that 47% of their 145 male and female participants were classified as dyslexics.

An obvious problem in diagnosing reading disorders among the prison population is the frequency with which prisoners experience deprived educational trajectories. According to data from the Spanish Penitentiary Institutions, in 2019, 65% of prisoners had primary or lower education, and only 10% completed secondary education (Secretaría General de Instituciones Penitenciarias, 2019, see also Gutiérrez et al., 2010). The question therefore arises as to whether the poor reading ability of prisoners is due to a reading disorder or whether it is the result of a lack of adequate training (Svensson et al., 2015). Two studies suggested that the proportion of dyslexics among prisoners may not differ when compared to samples matched for schooling or reading practice. In a first study, Samuelsson et al. (2000) used the mean scores obtained by 6th grade students (12-year-olds) to assess the performance of a sample of 48 male prisoners (mean age 33 years, range 19-52 years) in tests of reading comprehension, spelling to dictation, phonological and orthographic decision. Similar to previous findings, prisoners showed a general lower performance than the 12-year-old control participants did. However, when phonological abilities — the core deficit in dyslexia — were analyzed, no significant differences were found. In view of these results, it could be questioned whether the prisoners really have DD or whether their poor performance on reading tasks may simply reflect limited reading practice. To test this hypothesis, Samuelsson et al. (2003) carried out another study with a larger inmate sample constituted by 82 participants from three prisons in Sweden, and ensured participants differed in backgrounds and punishments. Two control samples were selected: a group of adults from an adult education center with equivalent age, SES, early school history, and reading habits; and a group of 38 13-15-year-old participants matched in reading level. All participants completed Raven's Progressive Matrices (1983), and tests of vocabulary, spelling, decoding, and phonological skills. Compared to their adult controls, prisoners were less efficient, but differences were only significant on Raven test. In contrast, prisoners significantly outperformed their reading controls on all tasks. Interestingly, the

proportion of poor readers matched that of controls when measures of phonological awareness and school level were taken into account. These findings suggest that the prisoners' low reading performance may be related to scarce schooling and reduced print exposure rather than to an underlying reading (phonological) deficit.

Another concern is whether limited reading resources alone can entirely account for maladaptive behavior. In this regard, it may be particularly valuable considering the role played by attention deficit-hyperactivity disorder (ADHD), characterized by impulsive behavior, short attention span, and hyperactivity (Willcutt, 2012), that co-exists in 20% – 40% of individuals with RD (Snowling et al., 2020; Sexton et al., 2012; Wadsworth et al., 2015). This association is relevant because ADHD has been frequently pointed as a risk factor for delinquency (Dayan et al., 2023; Mordre et al., 2011, Pratt et al., 2002).

Compared to the 5% rate reported for the general population, the prevalence of ADHD among young offenders (Harpin & Young, 2012) and inmates (Edvinsson et al., 2010, Ginsberg et al., 2010; Rasmussen et al., 2001; Usher, Stewart, & Wilton, 2013) is clearly high. In fact, the estimated prevalence of ADHD among prison populations ranges from 25% (Young et al., 2015) to 56% in a Swedish sample (Asbjørnsen et al., 2015). Two studies with samples of Spanish prisoners show similar high rates: 25% (Rodríguez et al., 2015) and 39% (Sanz-Garcia et al., 2010), respectively.

There is also evidence that poor reading skills and ADHD frequently co-occur in prison populations. Of the 10 rapists studied by Dåderman et al. (2004), 7 met DSM-IV criteria for reading disorders, of which only 1 was not classified as ADHD, although he did have another psychiatric disorder. Similarly, Lindgren et al. (2002) corroborated previous results (Jensen et al., 1999) by finding that a high percentage of the 45 prisoners in their study manifested persistent symptoms of ADHD (55%), were diagnosed with dyslexia (62%), and 33% presented both conditions. A relevant result was that the differences in personality traits and deviant behavior were associated with ADHD, but not with dyslexia. Examining a sample of 89 Israeli prisoners, Einat and Einat (2008) reported similar prevalence rates of 57% declared to have ADHD, 70% manifesting phonological and orthographic deficiencies, and 30% affected by both conditions. These findings suggest that ADHD, as it makes individuals more prone to exhibit socially deviant behaviors (Horbach et al., 2020), is a plausible underlying factor that link reading difficulties with behavioral problems and later entry into jail (Snowling et al., 2000).

Low educational levels are another common finding among incarcerated participants with ADHD (Manger et al., 2006). For example, 70% of the prisoners with ADHD from the Swedish sample of Asbjørnsen et al., (2015), and 44% from the Spanish sample (Rodríguez et al., 2015) abandoned school before completing secondary school. Similarly, Ginsberg et al. (2010) found that the percentage of participants with less than 9 years of education was higher among the ADHD prisoners than among other psychiatric patients (83% vs. 30%, respectively), however, this percentage descended to 6% in the control sample. In the same line, a closer examination to the above mentioned Einat and Einat (2008) findings-revealed that the reading difficulties shown by their participants were closely associated to early school dropout. It suggests that young people with learning difficulties who are unable to keep up with their classmates may tend to drop out of school prematurely. In consequence, they have fewer opportunities to receive adequate education. Dropping out of school may also have a negative impact on their socialization process, making them more vulnerable to engaging in antisocial behavior (Evans et al., 2015).

A second key finding of this study that warrants further explanation is the strong and significant connection between LD, low level of education, and onset of criminal activity at young age, as well as the correlation between low education level and early age of criminal onset. The results suggest that people with LD who gave up school at early stages are more likely to initiate a criminal career at an early age, compared with individuals —with or without LD, who did not leave school. This finding is consistent with earlier research that indicates a relationship between quitting school, lack of education, and criminal conduct (Winters, 1997).

Taken together, these findings indicate that people with reading difficulties and ADHD experience imprisonment more frequently than people without such difficulties. However, the data do not allow for a direct link between reading difficulties and criminality. On the contrary, the evidence seems compatible with the idea that other factors, such as ADHD and limited education, play a key role in this association.

The present study

The current study will focus on four questions that emerge from previous research findings. First, it was intended to examine whether there is a higher prevalence of reading difficulties among a prison sample than in the general population, and second, in the case prisoners showed limited reading skills, if their underperformance may result from a phonological deficit or could be associated to low print exposure. To achieve these goals, a sample of prisoners filled a self-report questionnaire of reading difficulties and were assessed using literacy, phonological awareness, verbal short-term memory, verbal fluency, and RAN tasks. As reading practice could affect performance, prisoners' scores will be compared with that obtained by a sample of secondary students, since they have a similar average number of years of schooling. Consistent with previous studies, it was predicted that prisoners would show poorer reading and phonological skills than the secondary students. In addition, the number of dyslexics was expected to be higher in the prison sample.

If most of the prisoners fail to show phonological deficits, lack of reading experience would be taken as a better explanation for their reading achievement than a deficit for learning to read (dyslexia). The third and fourth questions concern the involvement of ADHD. Self-report questionnaires were used to examine the prevalence of ADHD among prisoners. It was expected that the rate of ADHD among our incarcerated participants would exceed that of the normal population. Finally, the extent to which prisoners share DD and ADHD symptoms will be explored.

If the proportion of participants with ADHD symptoms is notably higher than the proportion of participants with DD, then it will be assumed that ADHD would be a more appropriate factor to account for antisocial behavior than DD.

This research has been approved by la Secretaría General de Instituciones Penitenciarias (No Registro 519410).

Method

Participants

Prison sample. Participants were 117 male prisoners, mean age = 38.29 (range: 21-74), from a Preventive prison[2] placed in Alhaurín el Grande (Málaga). All participants had Spanish as their native language, and received final judgement. 25 (21.4%) had primary studies or less; 72 (61.5%) started secondary studies; 6 (5.1%) finished secondary; 11 (9.4%) received vocational training, and 3 (2.5%) attended university. The mean age of leaving school was 15.8 years, which is close to the age at which students finish secondary school in Spain (12-16 years).

Secondary controls. The control sample was constituted by 60 students, with a mean age of 13.6 years (range: 13.3-16.1), who were studying the second course of secondary in a public school. All students had Spanish as their native language.

A t-test carried out to examine if samples differed in mean years of schooling yielded no significant results ($t = 2.93$, $p < .769$)

Tests and procedures

Tests were administered individually in a separate room in the prison or in the School facilities, respectively, in a single session. One of the authors tested the secondary students, two other authors collected data in the prison. To make sure that all inmates had good understanding of the self-rating questionnaires, items were read aloud introducing breaks if necessary.

Estimation of ADHD prevalence. ADHD is usually diagnosed by a combination of checklist scales and a clinical interview in which aspects of behavior at home, at school and in social interaction situations are assessed. Unfortunately, we did not have the opportunity to interview the participants. However, several studies demonstrated high agreement between clinicians' assessment and self-reports, supporting that rating measures are reliable and informative tools for ADHD diagnosis (Abrams et al., 2018). Then, to assess ADHD symptoms the Spanish versions of two scales used as standard tools in clinical and non-clinical settings were selected. The ASRSS v1.1. (Kessler et al., 2005) is a 5-points checklist composed of 18 items based on DSM-IV criteria (Cronbach's alpha= .911, Pedrero &Puerta, 2007; .937 for the present sample). The cut-off level indicating ADHD is a score equal or above 24 points. The Conners Adult ADHD Rating Scale—Self Report (CAARS-S; Conners et al., 1999; Erhardt et al., 1999) consists of 42 items rated using a 4-point Likert scale (ranging from *never* 0 for *not at all* to 3 for *very much*). Four consistent factors emerged: Inattention-Cognitive Problems, Hyperactivity-Restlessness, Impulsivity-Emotional Liability, and Problems with Self-Concept with internal consistency coefficient ranging from .710 to .835 (Amador-Campos et al., 2014). The cut-off level indicating ADHD was a score equal or above 67 points (Cronbach's alpha= .945; .961 for the present sample). Reaching the criteria on the two scales was necessary to declare a participant presents ADHD symptomatology.

Self-report of Reading difficulties. All participants fulfilled a self-report questionnaire on adult reading disabilities (ATLAS; Gimenez et al., 2015). ATLAS included 43 items covering reading history, DD, associated difficulties, reading family background, reading habits, and anxiety about reading. To estimate DD, scores on the current DD section (items 10-25) were summed. The cut-off level indicating DD is a score equal or above 24 points (alpha= .948).

Literacy

Test of reading efficiency (*TECLE,* Carrillo et al., 2024). This is a 64 items test to be completed in 3 minutes. Each item consists of a short sentence in which the last word is missing. The participant is required to select the word that completes the sentence among four options: the correct word and three distractors (orthographic, phonological and semantic, respectively). Cronbach's alpha = .96.

Word reading. Stimuli were presented in four different lists, a practice list with 10 words of different length, and three lists of 20 frequent words of two, three, and four syllables, respectively. The participant was asked to read aloud the items from each list as accurately and quickly as possible. Correct answers, errors, and time to complete the task were computed. (Maximum score = 60 words, Cronbach's alpha= .948).

Pseudoword reading. Pseudowords were constructed based on the word lists by changing one or two letters. Stimuli were presented in four different lists, a practice list with 10 pseudowords of different length, and three lists of 15 frequent words of two, three, and four syllables, respectively. The participant was asked to read aloud the items from each list as accurately and quickly as possible. Correct answers, errors, and time to complete the task were computed. (Maximum score = 45, Cronbach's alpha= .735).

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[2] A prison for the holding and custody of persons awaiting trial or final destination.

Phonological Processing

In the *syllable deletion task*, the participant was asked to say what sounds remained after deleting from a pseudoword the syllable indicated by the evaluator (first, medium or last). Three training items, and fourteen test trisyllable CV and CCV pseudowords were used. (Maximum score = 14; Cronbach's alpha= .925). For the assessment of the Secondary students sample a 24 items version was used.

In the *phoneme deletion task*, the participant was instructed to say what sounds remained after deleting from a nonsense syllable the phoneme indicated by the evaluator (first, medium or last). Three training and fourteen test CCV syllables were used. (Maximum score = 14; Cronbach's alpha= .859). For the assessment of the Secondary students sample a 24 items version was used.

For the assessment of *verbal short-term memory*, a subtest of DISEP (Carrillo, Alegría, and Luque, in preparation) was used. It consisted of a list of 15 CV syllable strings, grouped in sets of three items with 1, 2, 3, 4, and 5 syllables pronounced separately to avoid resembling a pseudoword. The participant was instructed to repeat the items from the CV list until two consecutive wrong answers were given. One point was given if the participant correctly repeated any of the one-syllable non-words, 2 points for two-syllable words, 3 points for three-syllable words, and so forth. (Maximum score = 45; Cronbach's alpha= .861).

In the *verbal fluency task*, the participant was required to say as many words as possible following a semantic or phonemic criterion within 60 seconds. The semantic condition included two categories: animal and clothes. In the phonemic condition words starting by /p/ and /f/ were required. Care was taken to provide the phoneme and not the letter as a cue. Repetitions and alternate endings of the same word were excluded. The number of correct words was noted (semantic criterion Cronbach's alpha= .646; phonemic criterion Cronbach's alpha= .807).

The *rapid automatized naming* (RAN) assessment comprised one matrix of objects and one of digits. The objects matrix consisted of 5 figures repeated 10 times each, corresponding to frequent words in Spanish: clown (*payaso*), scissors (*tijeras*), guitar (*guitarra*), spoon (*cuchara*), and turtle (*tortuga*). The digits naming task comprised a matrix of 100 numbers (each number repeated 10 times) in 5 rows of 20 items). The participant was asked to name the items as quickly as possible moving from left to right. The time taken to name the stimuli in each matrix was recorded.

Results

The analyses were centered on four questions. First, did prisoners show low performance on reading and phonological tasks when compared to a sample of secondary school students? Second, did prisoners' poor reading skills be accounted by a phonological deficit? Third, what proportion of the prison participants showed ADHD symptoms? Fourth, to what extent were ADHD and reading or phonological deficits comorbid conditions in this population?

Table 1. Prison and Secondary student samples' mean scores, Standard Deviation (Sd) and results from ANOVA on the reading and phonological processing tasks.

	Prison N=120 Mean (Sd)	Students N= 60 Mean (Sd)	F	p
Reading				
Words Accuracy	58.82 (3.33)	59.45 (1.11)	2.583	.110
Words Time	41.77 (22.62)	37.25 (11.95)	1.799	.182
Pseudowords Accuracy	39.95 (4.15)	55.92 (3.58)	673.747**	.000
Pseudowords Time	66.78 (27.68)	80.12 (31.92)	8.613**	.006
TECLE (Reading efficiency)	25.85 (10.96)	40.09 (13.14)	56.409**	.000
Phonological Processing				
Syllable Deletion Accuracy+	10.13 (3.04)	20.97 (2.91)	.131	.878
Syllable Deletion Time+	116.28 (38.30)	143.87 (32.52)	1.145	.322
Phoneme Deletion Accuracy+	11.75 (7.47)	17.27 (2.63)	.095	.910
Phoneme Deletion Time+	80.19 (26.13)	136.51 (38.09)	.040	.960
Verbal Short-term Memory	33.63 (9.36)	39.92 (8.78)	18.990**	.000
Semantic Fluency	26.01 (5.93)	26.22 (5.20)	.056	.813
Phonological Fluency	14.69 (5.78)	13.33 (3.77)	2.890	.091
Total Fluency	40.75 (9.70)	39.52 (7.04)	.803	.371
RAN				
RAN objects	46.61 (10.54)	56.17 (11.30)	31.688**	.000
RAN Digits	41.99 (10.09)	45.53 (11.60)	4.553*	.034

+ z-scores were used to compare results of the samples of prisoners and secondary school students

In answer to the first question, self-report ratings and performance on the behavioral tasks were examined. It was confirmed that the prevalence of self-reported reading difficulties was high (26.5%) compared with estimations in the general population. Then, analyses of variance (ANOVA) were calculated to examine if prisoners showed lower reading and phonological skills than secondary students. Direct scores were used, except for the deletion tasks where z-scores were preferred. As displayed in Table 1, no differences were found on word reading. However, prisoners were significantly poorer on pseudoword reading accuracy $F(1,176) = 673.747$, $p < .001$, time $F(1,176) = 8.613$, $p < .001$, and showed significantly lower reading efficiency (TECLE) $F(1,176) = 56.409$, $p < .001$. When phonological processing scores were examined, the groups performed similarly on deletion, verbal fluency, and verbal short-term memory tasks. Significant differences were only found on the Verbal Memory task $F(1,176) = 18.990$, $p < .001$. Moreover, regarding RAN, prisoners were significantly quicker than the secondary students on both the pictures task $F(1,176) = 31.688$, $p < .001$, and the digits task $F(1,176) = 4.553$, $p < .005$. Thus, an emerging picture based on our results is that the prisoners' low performance on reading tasks might not be related to a phonological deficit.

To examine if the proportion of participants with reading difficulties was higher in the prison than in the secondary sample, participants were classified as *poor readers* when at least three of the five reading scores (accuracy and reading times on word and pseudoword, and TECLE) deviated significantly from the mean. A participant was identified as having *phonological deficit* when he obtained deviant scores on three of the five following measures: accuracy and performance time on Syllable and phoneme Deletion, and Verbal Short-term Memory. According to DSM-V, scores were considered to be significantly deviant if they were 1.5 SD above the mean in the time measures (reaction time), or 1.5 SD below the mean in the accuracy measures (number of correct responses). Then, since dyslexia is considered a difficulty for reading, particularly words and pseudowords, that arises from deficits in phonological processing (Snowling et al., 2020), a participant was declared *dyslexic* when he was detected as poor reader and showed phonological deficit.

Following these criteria, as shown in Table 2, the proportion of poor readers (0.8 vs. 3.3%) and of participants with phonological deficits (3.4 vs. 11.6%) was higher among the secondary sample than among the internal participants. However, in the case of participants declared dyslexic — i.e. showing poor reading performance and failing phonological tasks — the differences in the proportion were reversed. The results showed a slightly higher prevalence in the prison (2.5%) than in the school group (1.7%), rates which were otherwise no higher than in the general population.

A closer examination of Table 2 reveals that all the inmate poor readers, with phonological deficits, or declared dyslexic had low schooling levels, while there was no incidence among the prisoners that ended secondary or that progressed to university.

Table 2. Number and percentage (in brackets) of participants that reported reading difficulties (ATLAS), exhibited poor reading, showed phonological deficit, or were declared dyslexics using assessment task results. For the inmate sample, the number and percentage of participants who self-rated ADHD symptoms are also reported.

	Prison sample							
	Primary studies N= 25	**Started secondary N= 72**	**Finished secondary N= 6**	**Vocational training N= 11**	**University N= 3**	**Total N=117**	**+ADHD**	**Students Sample N=60**
ADHD								
Self-reported	15 (60)	42 (58.3)	2 (33.3)	4 (36.4)	2 (66.6)	65 (55.5)		
Reading difficulties								
Self-Reported (ATLAS)	13 (52)	17 (23.6)	0	1 (9)	0	31 (26.5)	23 (74.2)	
Assessment Tasks								
Poor Reading	1 (4)	0	0	0	0	1 (0.8)	1 (100)	2 (3.3)
Phonological Deficit	1 (4)	3 (4.2)	0	0	0	4 (3.4)	3 (75)	7 (11.6)
Dyslexics	3 (12)	0	0	0	0	3 (2.5)	2 (66.6)	1 (1.7)

To examine if prisoners' poorer reading abilities may be related to print exposure, the answers to two questions of the ATLAS were considered. When asked them if they like reading, 70% of prisoners responded *little* or *not at all*, a percentage that reached 100% among those with primary education. Regarding the time since they read the last book, 49% indicated that it had been months or years since the last time. Furthermore, time since last reading correlates with semantic fluency ($r = -.652$, $p < .05$).

With regard to ADHD, prevalence rates yielded by the two questionnaires to assess ADHD were compared. Although, ASRS obtained slightly higher percentages of positive cases (61%) than CAARS (56%), scores were significantly correlated ($r = .894$, $p < .001$). A closer inspection of the 17 (16%) discrepant cases indicated that when it did not pass the cut-off points, scores were situated close to it. Thus, a participant was considered as ADHD if he fulfilled the criterion for any of the two questionnaires resulting in 65 (55.5%) participants. This prevalence rate is clearly above the average for the general population.

Next, we examined the link of low reading skills, phonological deficits, and dyslexia to ADHD among the prison participants. The cross-tabulation revealed that 74% of the prison participants who declared themselves as having reading difficulties, 100% exhibiting poor reading performance, 75% of those who

demonstrated phonological deficit, and 67% of those declared dyslexics showed comorbid symptoms of ADHD. Moreover, from the dyslexic participants with primary studies, there is only one without ADHD symptoms. Thus, the mean 75% comorbidity with ADHD rate observed in individuals with literacy, phonological deficits or declared dyslexic in this sample was largely higher than expected in the general population.

Discussion

This study investigated whether prevalence of poor literacy skills is especially high among the prison population inmates, and then it can be assumed that such reading problems represent a risk factor for the involvement in antisocial behavior. The premise that a high proportion of prisoners have reading difficulties was not confirmed. Although 26% of prisoners reported themselves as poor readers, when specific tasks were used to assess reading and phonological skills, a different picture emerged. Not only were few prisoners showing poor reading skills (0.8%), but they represented a lower percentage than that found in the group of students (3.3%). The discrepancy between the scores obtained from self-reported and objective measures reflects that the questionnaires lose reliability in identifying people with reading difficulties when the user does not have sufficient literacy training or practice (Asbjørnsen et al., 2021). A person with little schooling will realistically indicate a low reading ability, as he or she is likely to make many errors. Therefore, these low scores should only be taken as a reliable sign of reading difficulties when the training received leads to the expectation that the person will show good reading performance.

Regarding literacy assessment, the ability of the prisoners to read familiar words was comparable to that of their secondary controls. However, they were significantly less skillful when required to read pseudowords or to read for comprehension a sentence to quickly select its final word (reading efficiency test). That is, the prisoners showed signs of lower decoding skills than their secondary student counterparts. Decoding is the ability to use letter-sound correspondences to pronounce words never seen before. The acquisition of decoding is supported by phonological awareness, a skill that becomes automatic with reading practice. Reading experience is also associated with changes in reading strategy. The reader moves from using a one-to-one decoding strategy to identifying more complex units (syllables and words), thus gaining reading fluency (Rodríguez et al., 2015). Furthermore, there is evidence that the time spent on reading is related to vocabulary, reading comprehension, and spelling skills over the life span (Grant et al., 2007; Mol & Bus, 2011). Then, the question arises as to whether an insufficient exposure to print or a deficit in phonological processing, as it is observed in dyslexic readers (Peterson & Pennington, 2012) might explain the low decoding skills shown by the prisoners. This is exactly what was examined by the phonological awareness assessment.

Phonological deficits have been reported to be frequent among inmates (Cassidy et al., 2021; Einat & Einat, 2008; 2015), even after controlling for school background (Selenius & Hellstrom, 2015). However, in the current study, when the scores of prison participants were compared with the average performance of secondary students no differences emerged from the syllable and phoneme deletion scores (i.e., phonological awareness skills) or verbal fluency rates. Furthermore, the rate of phonological deficits among students (11.6%) was proportionally higher than among prisoners (3.4%). Thus, although as a group the inmate participants showed significant weaknesses in pseudoword reading, their low decoding skills might not be attributed to deficits in their underlying phonological representations. With regard the prevalence of DD, a learning difficulty characterized by phonological deficit, the percentage of prisoners identified as dyslexics, despite slightly higher than the percentage found in the school sample (2.5 vs 1.7, respectively), was within the limits of the rate found in the general population. Then, it is difficult to argue that dyslexia is a prevalent characteristic of prison participants, at least it is not in our sample.

Alternatively, prisoners may have not reached an optimal level of decoding skills due to irregular or insufficient school attendance. This interpretation is supported by the finding that none of the inmate participants who completed secondary school or went on to further education showed literacy or phonological difficulties. Furthermore, DD was related to the prisoners with the lowest school levels. These findings are consistent with previous literature indicating that the percentage of dyslexics in a group of young offenders was close to that found in the general population when those who had not received adequate education were excluded (Snowling et al., 2000). Similarly, Samuelsson et al. (2003) reported that prisoners' performance did not differ from that of participants matched on schooling years. Note that reading proficiency and frequency of exposure to print keep a reciprocal relationship, so that reading skills improve as the reader engages in reading activities and reading becomes more frequent as the reader gains in reading proficiency (Bergen et al., 2020). In line with this idea, the prisoners in our sample, especially those with primary education, declared little interest in reading. Taken together, the present results, together with Samuelson et al. (2000) and Svensson et al. (2015), suggest that prisoners' laborious decoding might evidence insufficient schooling or reduced reading practice rather than specific reading impairments. On the other hand, our results are consistent with research showing a relationship between early school dropout, lack of education, and delinquency (Einat & Einat, 2015; Fernandez-Suarez et al., 2016; Prevatt & Kelly, 2003).

Another issue in the present study concerned the prevalence of ADHD in the prison sample. Several studies reported a strong association between ADHD and behavioral problems (Wåhlstedt et al., 2008), that individuals with ADHD are likely involved in delinquency (Dayan et al., 2023; Retz et al., 2021), and tend to drop out school early (Fried et al., 2016). In addition, other studies have noted the elevated proportion with which ADHD appears in combination with reading difficulties (Gelhorn et al., 2001; Sexton et al., 2012). In this respect, our prevalence of 55.5% reported ADHD symptoms replicated previous studies (Asbjorsen et al., 2015; Einat & Einat, 2008; Ginsberg et al., 2010; Rodríguez et al., 2015) in that it was clearly situated above the roughly 5%

rate of the general population (Faraone & Biederman, 2005). Interestingly, a more detailed inspection to examine comorbidity showed that the great majority of participants with phonological or reading problems reported symptoms of ADHD. The 74% of the inmate participants that self-reported reading difficulties, the only inmate showing poor reading, the 75% of prisoners with deficient phonological skills, and the 67% among those identified as dyslexic met the criteria for ADHD (Dåderman et al., 2004). Therefore, it is reasonable to assume that the behavioral problems associated to ADHD may have affected prisoners' school and social adaptation and constrained their opportunities for the development of reading skills.

However, most people with dyslexia or ADHD do not offend. This suggests that each of these conditions alone may not be sufficient to explain such severe behavioral disturbance leading to imprisonment. Rather, considering the complex interplay of a number of factors may provide a better understanding of why prisoners often present reading difficulties. The experience of failure and frustration experienced by children who struggle to read in their attempts to catch up with the class can lead to problematic relationships with peers and teachers (Evans et al., 2015; Livingston et al., 2018; Trzesniewski et al., 2006). Similarly, ADHD may increase the likelihood of engaging in maladaptive or disruptive behavior and to early school dropout (Dayan et al., 2023; Pratt et al., 2002). In turn, both learning difficulties and disruptive behavior can hinder the learning process. Then, it is likely that the teaching received along with a learning disability will negatively affect individuals' academic and social trajectories (Thapar et al., 2006). In addition, school attendance is not only crucial for acquiring academic skills (e.g. reading), but it also plays a relevant role in the socialization process (Keppens, & Spruyt, 2019). At individual level, behavior disorders occur in the context of a complex combination of emotional, cognitive and social conditions that may attenuate, compensate, or exacerbate the risk of antisocial behavior. Our findings suggest that reading difficulties may not be sufficient to trigger severe social or behavioral problems (Snowling et al., 2000). However, the combination with ADHD, and a limited schooling may increase the likelihood of committing offences that result in their entrance to jail. Other factors not included in this study, such as economic status and family support or psychiatric conditions, may also play a relevant role as protective or aggravating factors (De Witte et al., 2013). Early detection and intervention when a child shows the first signs of learning difficulties or ADHD symptoms seem to be good practice to prevent the chain of undesirable events that can lead to maladaptive behavior. Efforts to include routinely assessments in the school should be made.

Limitations

Before concluding, we acknowledge limitations of this work. First, the prisoners in our sample are all men. It is unclear whether women participants would produce different outcomes. Second, as in previous research, the inmate sample has a wide age range, but insufficient number of participants to make age groups. Third, it is possible that our findings depend upon the tests used. However, since there are not reading batteries adapted to adult populations in Spain, the purpose was to provide a reliable score in a short amount of time with measures that could be used in the two populations participating in this study. Further, the reliability coefficient for each task is similar to that of other commercial tests. Fourth, we cannot circumvent the weaknesses of using arbitrary cut-offs on tests to create categorical groups from continuous data and explore between group differences. Nonetheless, it is common practice, and we used the 1.5 SD criterion established by the DSM-V. Regarding ADHD assessment, no information was collected from external evaluators, which may limit the diagnosis despite the reliability of the self-reports. Finally, ADHD was not assessed in the controls. Therefore, further research will be useful to confirm the effects reported including women, contrasting age groups, assessing ADHD among the control sample, and considering other risk factors.

Conclusions

In sum, this is the first investigation on reading difficulties in Spanish prisons. Our results confirm that the inmate participants of this study show poorer reading skills than the control sample and, presumably, the general population. This low reading ability can be accounted for by the limited reading training observed in prison populations, rather than by phonological deficits affecting their acquisition of letter-sound mappings. The present findings lead us to propose that although their reading abilities could have constrained some of the prisoners' socialization process during the school years, it is likely that living with ADHD increased participants' vulnerability to engage in maladaptive behavior and delinquency.

The results from this study indicate that to account for the link between reading difficulties and delinquency it is necessary to consider the involvement of other factors that may act as protectors or aggravators. In this study educational opportunities and ADHD have emerged as relevant factors (Trzesniewski et al., 2006). These findings have relevant implications for social and educational practice. Detection of learning difficulties and appropriate intervention seems priority: during the school years to prevent individuals with disruptive behaviors from getting into trouble, once the individual entered in the legal system, to provide adequate treatment and reduce recidivism (Snowling et al., 2000).

Declaración de la contribución por autoría

Almudena Giménez: Conceptualización del artículo; Redacción primer documento.
Mariana Loredo: Revisión de la primera redacción del documento.
Blanca Monge: Recogida de datos; Realización de las estadísticas.
Pablo Sánchez: Recogida de datos; Realización de las estadísticas.
Javier López-Pérez: Metodología; Realización de las estadísticas.

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