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REVIEW PAPER

Assessment and Prevalence of PTSD in People with Neurodevelopmental Conditions in Criminal Justice Settings - A Systematic Review

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Abstract
People with neurodevelopmental conditions are over-represented in criminal justice settings. PTSD is under-detected and under-treated in this population, and there is a lack of research in this area. The purpose of the study is to establish prevalence of PTSD in people with autism, ADHD and intellectual disability in criminal justice settings, by conducting a systematic literature review. The review identifies eight studies published between 2008 and 2024. Reported prevalence ranges from 4.6% to 80%, indicating methodological differences in screening and assessment of both neurodevelopmental conditions and PTSD. There is a need to develop effective methods for screening and assessment of PTSD in neurodivergent people in prison and for further high-quality research into the prevalence of these co-occurring conditions in these settings.

Keywords Criminal justice · Prisons · PTSD · Trauma · Autism · ADHD

Introduction

Attention hyperactivity disorder (ADHD) and autism are neurodevelopmental (ND) conditions that are increasing in prevalence globally. ADHD is characterised by a persistent pattern of inattention and/or hyperactivity-impulsivity, which impacts functioning. Autism is characterised by difficulties with social communication and social interaction and restricted, repetitive behaviours or interests (World Health Organisation, 2022). Recent reviews suggest that the global prevalence of ADHD is 6.8%, and of autism is 1% (Salari et al., 2022; Song et al., 2021). Post-traumatic stress disorder (PTSD) can develop after exposure to traumatic events and is characterised by re-experiencing of the trauma, an ongoing sense of current threat, and avoidance of reminders of the event (World Health Organisation, 2022). Global lifetime rates of are estimated to be 3.9% (Kessler et al., 2005; Koenen et al., 2017). In the UK, estimated current prevalence for PTSD is 3.7% for men and 5.1% for women (Baker and Kirk-Wade, 2023). For people who seek help from community mental health services, rates of PTSD are far higher (Atwoli et al., 2015; Pincus et al., 2022).

People with neurodevelopmental conditions and intellectual disability have experienced higher rates of trauma exposure and have higher likelihood of developing PTSD than neurotypical or allistic people (Andrzejewski et al., 2024; Kildahl et al., 2019; Lobregt-van Buuren et al., 2021; Song et al., 2024). One study has found that adults with autism are four times as likely to be diagnosed with PTSD (Griffiths et al., 2019). There are several possible reasons for this, including increased exposure to adverse and traumatic events and vulnerability to victimisation (Hoover, 2015; Kerns et al., 2019). Difficulties with emotion regulation and social cognition are found in both PTSD and autism, and may in themselves be a risk factor for the development of

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PTSD following exposure to traumatic events (Del'Osso et al., 2024; Rumball et al., 2021; Stevens and Janovic, 2019). Autistic people may experience more severe PTSD symptoms, and their autism may also lead to 'diagnostic overshadowing' of PTSD symptoms in clinical contexts, making detection and treatment more difficult (Quinton et al., 2024). Similarly, people with ADHD have a significantly increased risk of PTSD following exposure to a traumatic event (Bierderman et al., 2013; Spencer et al., 2016).

Within custodial and other criminal justice settings, there is an increased prevalence of PTSD compared to community settings. A recent study found that, amongst male prisoners in a UK prison, point prevalence rates of PTSD were 7.7%, and rates for complex post-traumatic stress disorder (CPTSD) were 16.7% (Facer-Irwin et al., 2022). As in the community, female prisoners have a higher prevalence of PTSD than male prisoners, and in one international meta-analysis, this was found to be 21% (Baranyi et al., 2018; Shalev et al., 2019).

Research shows that rates of neurodevelopmental conditions are also significantly higher in prisons and criminal justice settings than in the community (Gonzalez et al., 2015). For ADHD, there is an estimated prevalence of 25% in these settings (Young et al., 2015). People with ADHD in criminal justice settings have higher rates of psychiatric morbidity, and there is an association with higher rates of offending and of violent behaviour within prisons (Ginsberg, 2022). Estimates of autism within this population vary widely, depending on the methodology and sampling strategies (Ministry of Justice, 2022). However, in a recent systematic review, Collins et al. found that autistic people may be no more likely than non-autistic people to engage in offending behaviour and to encounter the criminal justice system (Collins et al., 2023). Furthermore, other authors found that ADHD did not lead to increased rates of offending, and that, instead, high levels of co-morbid mental health conditions, substance misuse and personality disorders in this group may mediate the association with violent offences (Tully, 2022; Young et al., 2022).

Similarly, recent research has shown that PTSD and complex PTSD (CPTSD) within this population are associated with high levels of co-morbidity, including ADHD and ASD, as well as increased levels of violent behaviour (Facer-Irwin et al., 2023). However, there are considerable difficulties with detection and assessment where there are high levels of co-morbidity, and diagnostic overshadowing between ADHD, autism and PTSD is common. PTSD may be under-detected and under-treated in this population, and treatment outcomes reduced (Malik et al., 2023; Peterson et al., 2019). There is therefore a need to identify the epidemiology of co-occurring PTSD and ND within prisons, to develop standards that can be used to inform effective clinical pathways for the management of these conditions within prisons, and to better understand the experiences of people with these comorbid conditions.

There has been a recent systematic review of assessment and prevalence of PTSD in autistic people within the community (Rumball et al., 2020; Quinton et al., 2024). However, there is a scarcity of research into the prevalence of co-occurring PTSD in individuals with autism, ADHD or intellectual disability (ID) in criminal justice services, and to our knowledge, there have been no systematic reviews in this area. Therefore, the primary purpose of the study is to conduct a systematic review of the literature to establish the prevalence of PTSD in offenders with autism, ADHD and ID in criminal justice settings. Secondary aims are to establish the methods of screening and assessment used to identify people with these co-occurring conditions and to explore the quality of research used to identify these co-occurring conditions in these settings.

Method

Search

We conducted a systematic literature review according to PRISMA guidelines (Aromataris et al., 2015; Page et al., 2021) and registered the study in PROSPERO (registration number: CRD42023384417). We searched for studies published in the English language on eight databases (Psych Info, Advanced Scopus, EBSCO/CINHAL, ASSIA via ProQuest, PTSD Pubs, ProQuest Dissertations and Theses, Web of Science and Medline via Ovid) for the complete years from inception of each database to December 2022. To ensure that the search was up to date, an updated search using the same search terms was carried out from January 2022 to November 2024. This ensured that all potentially relevant studies published since the last search were captured, including those that may have been missed due to updates in databases or delays in indexing or reporting.

Inclusion and Exclusion Criteria

Empirical papers were included if they included the following:

- Adults.
- Within prisons or criminal justice system (probation, courts, liaison diversion) for any offence, in any country 6 and who also had a diagnostic assessment or positive screening using a validated screening measure of.
- Autism, ADHD or intellectual disability.
- And post-traumatic stress disorder or complex post-traumatic stress disorder.

Studies were excluded if the included data examined:

- Youth offending OR.
- People who are not in the Criminal justice system (CJS) OR.
- People who do not have ADHD, autism or intellectual disabilities OR.
- People who do not have PTSD or Complex PTSD.

Search Terms

Search terms were generated for PTSD and neurodevelopmental conditions within criminal justice settings. See Supplementary materials for complete search strategy across all databases.

Study Designs

The following study designs were included: experimental studies such as randomised controlled trials and non-randomised controlled studies that reported prevalence; and non-experimental studies such as cohort studies, cross-sectional studies and case-studies. The following article types were included: peer reviewed articles, doctoral dissertations, book chapters and unpublished 'grey literature' reporting empirical data. The following articles were excluded: introductions to special editions, book reviews, conference presentations, obituaries and literature reviews (primary sources were sought).

Data Extraction

All titles and abstracts were first imported into Endnote, duplicates were then removed, and an initial screening of titles and abstracts was conducted in Rayyan. The entire search and screening process was conducted independently by NK, CB and IP, each blind to the other at the time of extraction, and any disagreements over eligibility were discussed and resolved between the reviewers and CCR. Data on study and sample characteristics, screening or assessment method and type of neurodevelopment condition, screening or assessment method for PTSD or Complex PTSD, and prevalence of PTSD cases in the ND sample were extracted. Data from included papers were extracted into templates developed for the study (Tables 1 and 2). Narrative synthesis was conducted by CCR. Data extraction and synthesis were conducted in line with Cochrane Collaboration Guidelines (Higgins et al., 2011), and Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) (Moher et al., 2009). All analytic options were considered, and a formal narrative synthesis was used as there was too much heterogeneity within the included studies to perform a meta-analysis (Munn et al., 2020).

Quality Assessment

Risk of bias (quality assessments) were carried out on all eligible papers. Observational cohort and case–control studies were assessed using Joanna Briggs Institute (JBI) checklists. We assessed and reported the method of screening or diagnosis for ADHD/Autism and PTSD in all studies. Any disagreement in quality assessment was discussed by CCR and NK, and if no resolution was reached, these were resolved through discussion with the whole team Studies were not excluded from synthesis on the basis of the quality assessment.

Results

Systematic Search Results

The search (including the updated search) identified a total of 743 results; 234 results were removed after de-duplication. The titles and abstracts of 509 unique results were screened, with 452 removed. The excluded papers at the title and abstract screening stage were either not the desired publication type (letters to the editor, literature reviews and conference posters), or did not meet the inclusion criteria set out in Sect. 2.1, or were not in English. Fifty-seven results were sought for retrieval for full-text screening, all of which were accessed. The reference lists of these papers were screened and hand-searched and 3 additional publications were included for full text reading. Thirty-eight of these papers were excluded in line with the review inclusion and exclusion criteria, leaving 9 publications eligible for data extraction and analysis within the review. During analysis, it was identified that two of the included papers utilised the same participants and data set, and therefore one of these papers was excluded (Gonzalez et al., 2015) leaving 8 papers for the final analysis.

Full details of study selection can be seen in the PRISMA flow diagram (Fig. 1), and study characteristics for the final 8 papers are detailed in Table 1. Results are described below, split into characteristics of included studies, assessment and prevalence of neurodevelopmental conditions, assessment and prevalence of PTSD, and rates of co-occurring PTSD and neurodevelopmental conditions.

Characteristics of Included Studies

Date of publication ranged from 2009 (Einarsson et al., 2009; Rosler et al., 2009) to 2022 (Facer-Irwin et al., 2022). All of the included studies took place in prisons.

Table 1 Study characteristics

Author (year)	Title	Location	Setting	Type of offence	Sex/gender %	Study type	Sampling technique	No. of ND participants	No. of non-ND comparison group	Mean age in years (range)
Van Buitenen et al. (2021)	'Risk Factors of Violent Offending in mentally ill prisoners with autism spectrum disorders'	Netherlands	Four penitentiary psychiatric centres, housing inmates with severe dysfunctional behaviour relating to their mental state	89.3% violent offences: 32.2% moderate violent offences 11.2% severe violent offences 7.1% violent property offences 11.9% manslaughter 8.1% arson 8.3% murder 9.4% sexual offences 10.7% non-violent	Male (100%)	Analytic cross-sectional to determine risk factors of violent offending Secondary analysis of all data collected at intake from diagnostic interview of all inmates Relationship between co-morbid psychiatric conditions compared using descriptive cross-sectional methodology	Data from all inmates at penitentiary psychiatric centres was subject to secondary analysis	394 participants with ASD	0	31.7
Einarsson et al. (2009)	'Screening for attention-deficit hyperactivity disorder and co-morbid mental disorders among prison inmates'	Iceland	1 prison	52% property offences, 42% traffic violations, 28% drug offences, 17% violent offences and 7% sex offences (some consecutive sentences)	Male (100%)	Analytic cross sectional design: The purpose was to investigate the relationship between ADHD and co-morbid disorders	106 prisoners were 'asked to participate' but unclear whether sampling was purposive, convenience or other	27 currently symptomatic of ADHD	63	31 (19–56)

Table 1 (continued)

Author (year)	Title	Location	Setting	Type of offence	Sex/gender %	Study type	Sampling technique	No. of ND participants	No. of non-ND comparison group	Mean age in years (range)
Rosler et al., (2009)	'Attention deficit/hyperactivity disorder in female offenders: prevalence, psychiatric comorbidity and psychosocial implications'	Germany	Single State Women's prison	81% drug offences, 21% fraud, 8% theft, 5% assault, 4% robbery, 1% murder/manslaughter, 15% other	100% female	Cross-sectional/prevalence	Not reported	11 with ADHD (100% female)	99	34 (22–46)
Hamzeloo et al. (2016)	'The Prevalence of ADHD and Comorbid Disorders in Iranian Adult Male Prison Inmates'	Iran	Single male prison	Robbery, drug-related, battery, murder, rape abduction, multiple crimes	100% male	Cross-sectional/prevalence	Stratified	147 with ADHD (100% male)	760	31.4 (18–70)
Westmoreland, P., et al. (2009)	Attention Deficit Hyperactivity Disorder in Men and Women Newly Committed to Prison	United States of America	Iowa Medical and Classification Center (intake center for all newly sentenced prisoners in the State)	Drug offences 32.4, assault or abuse 27.9% driving offences 8.8%, burglary 10.3%, parole violation 13.2%, fraud 5.9%, possession of firearm 0, unknown 1.5%	82.7% male 17.3% female	Cross sectional/prevalence	Random selection	68 in total with ADHD $n = 8$ female $n = 60$ male	251	30.4 (sd 1.2)

Table 1 (continued)

Author (year)	Title	Location	Setting	Type of offence	Sex/gender %	Study type	Sampling technique	No. of ND participants	No. of non-ND comparison group	Mean age in years (range)
Facer-Irwin et al., 2022)	PTSD and Complex PTSD in sentenced male prisoners in the UK: prevalence, trauma antecedents, and psychiatric comorbidities	UK	UK Prison Service: Medium Security Prison in London	Violence 54%, weapons16%, theft 16% Burglary (39%) Robbery (27%) Drugs 21%, Fraud 15%, Sexual offences 10%, Other 21%	100% male	Cross-sectional data collected as part of a wider cohort study	Stratified according to prisoner status (e.g., newly sentenced, recalled, transferred from other prisons). Potential participants then randomly selected	76 with ADHD (100% of ND participants were male)	145	31.3
Moore et al., 2016	Adult ADHD among NSW Prisoners: Prevalence and Psychiatric comorbidity	Australia	4 new south Wales correctional facilities (2 male, 2 female)	Not known	$m = 76\%, f = 24\%$	Cross-sectional data to explore psychiatric characteristics of ND sample was collected as part of a wider analytic cross-sectional study	Random sampling of all prisoners	Total: 20 with ADHD $n = 5$ female $n = 15$ male	73	41
Perez-Pedrogo et al., (2018)	Sex differences in traumatic events and psychiatric morbidity associated to probable post traumatic stress disorder among Latino Prisoners	Puerto Rico	26 prisons		Male 81.34% Female 18.66%	Prevalence study (cross-sectional survey)	Probabilistic	Total: 267 with ADHD $n = 198$ men $n = 69$ women	912 altogether 761 men 151 women	Age range: 18–24—$N = 277$ Age range: 25–34: $N = 561$ Age range: 35 or more: $N = 341$

Table 2 Prevalence of co-occurring PTSD in individuals with neurodevelopmental conditions

Author (year)	Title	Type of neurodiversity	How is ND identified/measures	Diagnostic framework used	How is trauma-exposure or PTSD assessed or identified	Diagnostic framework used	Prevalence of co-occurring PTSD in ND sample (%)	Prevalence of PTSD in non-ND sample
Van Buitenen et al. (2021)	'Risk Factors of Violent Offending in mentally ill prisoners with autism spectrum disorders'	Autistic Spectrum Disorder	Independent Diagnostic interview carried out by two mental health professionals (psychologist and psychiatrist) as part of routine intake process, and diagnoses agreed through consensus. Informed by information from previous admissions and clinical reports	Diagnostic interviews carried out during transition from DSM-IV and DSM-V. For the secondary analysis, all were retrospectively coded using DSM-V	Independent Diagnostic interview carried out by two mental health professionals (psychologist and psychiatrist) as part of routine intake process, and diagnoses agreed through consensus. Informed by information from previous admissions and clinical reports Exposure to trauma or victimisation before the age of 18 assessed using the HKT Scale (Canton et al. 2004)	Diagnostic interviews carried out during transition from DSM-IV and DSM-V. For the secondary analysis, all were retrospectively coded using 'broad diagnostic code' of 'trauma and stressor related disorder' using DSM-V	No = 18 (4.6%)	N/A
Einarsson et al. (2009)	'Screening for attention-deficit hyperactivity disorder and co-morbid mental disorders among prison inmates'	ADHD	Wender Utah Rating Scale (WURS) – self-report retrospective assessment of ADHD symptoms in childhood Plus: DSM IV Checklist of ADHD Symptoms (ASRS) – self-report diagnostic criteria (only meet criteria for adulthood if met criteria for childhood ADHD in WURS)	Wender-Utah criteria for retrospective assessment of childhood symptoms DSM-IV for adult ADHD diagnosis	Mini International Neuropsychiatric Interview – structured diagnostic interview for 19 most common disorders, based on the DSM-IV framework	DSM-IV	4 (15%)	0 (0%)

Table 2 (continued)

Author (year)	Title	Type of neurodiversity	How is ND identified/measures	Diagnostic framework used	How is trauma-exposure or PTSD assessed or identified	Diagnostic framework used	Prevalence of co-occurring PTSD in ND sample (%)	Prevalence of PTSD in non-ND sample
Rosler et al. (2009)	'Attention deficit/hyperactivity disorder in female offenders: prevalence, psychiatric comorbidity and psychosocial implications'	ADHD	Rating instruments & self-report scales Wender Utah Rating Scale (WURS-k) – self-report retrospective assessment of ADHD symptoms in childhood – cutoff of 30 ADHD Diagnostic Checklist (ASRS)- DSM IV criteria for adult ADHD diagnosis Wender–Reimherr interview – to assess criteria of adult ADHD. German version, acceptable psychometric properties	Wender-Utah criteria for retrospective assessment of childhood symptoms DSM-IV for adult ADHD diagnosis	Psychiatric examination using standardised psychopathological rating scales — to assess general psychopathology. No detail given about the types and psychometric properties of these screening measures German translation of SCID-I and SCID-II	DSM-IV	*N* = 2 (18.2%)	*N* = 11.9 (12% of inmates without ADHD)

Table 2 (continued)

Author (year)	Title	Type of neurodiversity	How is ND identified/measures	Diagnostic framework used	How is trauma-exposure or PTSD assessed or identified	Diagnostic framework used	Prevalence of co-occurring PTSD in ND sample (%)	Prevalence of PTSD in non-ND sample
Hamzeloo et al. (2016)	'The Prevalence of ADHD and Comorbid Disorders in Iranian Adult Male Prison Inmates'	ADHD	Adult ADHD self-report scale (ASRS) screening that rates the frequency of symptoms. ASRS evaluates the frequency of all 18 ADHD symptoms, defined by the DSM-IV criteria, and with good validity and reliability within clinical and community samples (Adler et al. 2003) Clinical interview based on DSM IV — to validate screening tool and give information about childhood ADHD Psychiatrist confirmed diagnoses in psychiatric interview	DSM-IV	Clinical interview based on DSM IV — to get psychiatric history and assess psychiatric disorders	DSM-IV	*N* = 15 (10.2%)	N/K
Westmoreland, P., et al. (2009)	Attention Deficit Hyperactivity Disorder in Men and Women Newly Committed to Prison	ADHD	Medical Outcome Study Short Form-36 Health Survey to assess adult persistent ADHD and functioning Mini International Neuropsychiatric Interview PLUS (MINI-Plus)	DSM-IV	Mini International Neuropsychiatric Interview-Plus to assess for DSM disorders	DSM-IV	*N* = 14 (20.6%)	26.1 (10.4%)

Table 2 (continued)

Author (year)	Title	Type of neurodiversity	How is ND identified/measures	Diagnostic framework used	How is trauma-exposure or PTSD assessed or identified	Diagnostic framework used	Prevalence of co-occurring PTSD in ND sample (%)	Prevalence of PTSD in non-ND sample
Facer-Irwin et al. (2022)	PTSD and Complex PTSD in sentenced male prisoners in the UK: prevalence, trauma antecedents, and psychiatric comorbidities	ADHD	Adult ADHD self-report Scale Probable ADHD was established using the Adult ADHD Self-report Scale (ASRS), a well validated six-item self-report scale developed by the WHO and previously used in prison research (Ginsberg, 2022), with probable ADHD estimated using threshold cutoff scores for each symptom question	DSM-IV	International Trauma Questionnaire Adverse Childhood Experiences and Life Events Checklist (LEC) (self-report)	ICD-11	PTSD $N = 8$ (10.5%) CPTSD $n = 24$ (31.6%) Total $n = 32$ (21.1%)	$N = 9$ (6.3%) had PTSD $N = 13$ (9.1%) had CPTSD Total: $N = 22$ (15.4%)
Moore et al. (2016)	Adult ADHD among NSW Prisoners: Prevalence and Psychiatric comorbidity	ADHD	Adult ADHD self-report scale (ASRS), followed by diagnostic assessment by trained mental health professionals, using the MINI-Plus interview	DSM-IV	Diagnostic assessment, plus 17 item self-report PTSD assessment (PCL-5)	DSM-V	$n = 12$ (80%) (sex differences not known)	$N = 36.5$ (50.7%)

Table 2 (continued)

Author (year)	Title	Type of neurodiversity	How is ND identified/measures	Diagnostic framework used	How is trauma-exposure or PTSD assessed or identified	Diagnostic framework used	Prevalence of co-occurring PTSD in ND sample (%)	Prevalence of PTSD in non-ND sample
Perez-Pedrogo et al. (2018)	Sex differences in traumatic events and psychiatric morbidity associated to probable post traumatic stress disorder among Latino Prisoners	ADHD	Wender Utah Rating Scale (WURS) detecting ADHD in childhood by self-report questionnaire	Wender-Utah	Davidson Trauma Scale (Spanish Translation), validated for this population (Caraballo et al. 2013). Before administering, the authors previously asked about 15 traumatic events types (across lifespan) and selected the most distressing to use scale to test for probable PTSD	DSM-IV	Female: $N = 18$ (26.5%) Male = 53 (26.8%) Total = 71 (26.7%)	Male: $N = 57$ (8.1%) Female: $N = 14$ (9.4%) Total: $N = 71$ (8.8%)

Five studies were carried out in single site prisons, two were conducted across four prisons and one study included participants from across 26 prisons, representing 13% of the total sentenced population of the country Puerto-Rico (Perez-Pedrogo et al., 2018). Seven studies were carried out within the general prison population, and one was conducted across four prison psychiatric centres (van Buitenen et al., 2021). Participants were convicted of a diverse range of offences, including property offences, traffic violations, sex offenses, fraud, manslaughter, drug related offences, robbery, assault, murder, abduction, parole violation and weapons offences.

Four studies included just male participants (van Buitenen et al., 2021; Einarsson et al., 2009; Facer-Irwin et al., 2022; Hamzaloo et al., 2016). One paper included just female participants (Rosler et al., 2009), and the remaining three included both males and female participants (Moore et al. 2016; Perez-Pedrogo et al., 2018; Westmoreland et al., 2009). In total, males comprised 90.8% of the sample ($n = 917$), with females comprising 8.2% of the sample ($n = 93$). One of the papers reported the age range of participants but did not report data that allowed the mean age to be identified (Perez-Pedrogo et al., 2018). For the remaining seven papers, the mean age reported was 37.9, with a range of 18 and 70. One study was conducted in the UK (Facer-Irwin et al., 2022); one in Puerto Rico (Perez-Pedrogo, 2018); one in the USA (Westmoreland et al., 2009); one in Australia (Moore et al., 2016); one in Iran (Hamzaloo et al., 2016); one in Germany (Rosler et al., 2009); one in Iceland (Einarsson et al., 2009) and one in the Netherlands (van Buitenen et al., 2021). All publications were published in English.

In all of the studies, the analysis of prevalence of co-occurring PTSD and ND represented secondary data relating to a smaller subset of total participants in larger scale studies, one of which was a longitudinal cohort study (Facer-Irwin et al., 2022) and the others were a cross-sectional design. Therefore, the sample size of ND participants varied widely. Across all of the included studies, the total population size of ND participants was 1010 with a mean population of 125.6 ND participants and a range of 15–394. In terms of the type of neurodevelopmental conditions studied, all but one of the studies investigated ADHD. One study investigated ASD, with a population size of 394 participants (van Buitenen et al., 2021). Excluding this cohort of ASD participants, the mean population size of ADHD participants was 87.3, with a range between 20 (Moore et al., 2016) and 147 (Hamzaloo et al., 2016).

Screening and Assessment of Neurodevelopmental Conditions

None of the studies investigated intellectual disability (ID). Within seven of the eight studies, the neurodevelopmental condition identified was ADHD. Just one of the studies investigated Autistic Spectrum Disorder (ASD) (van

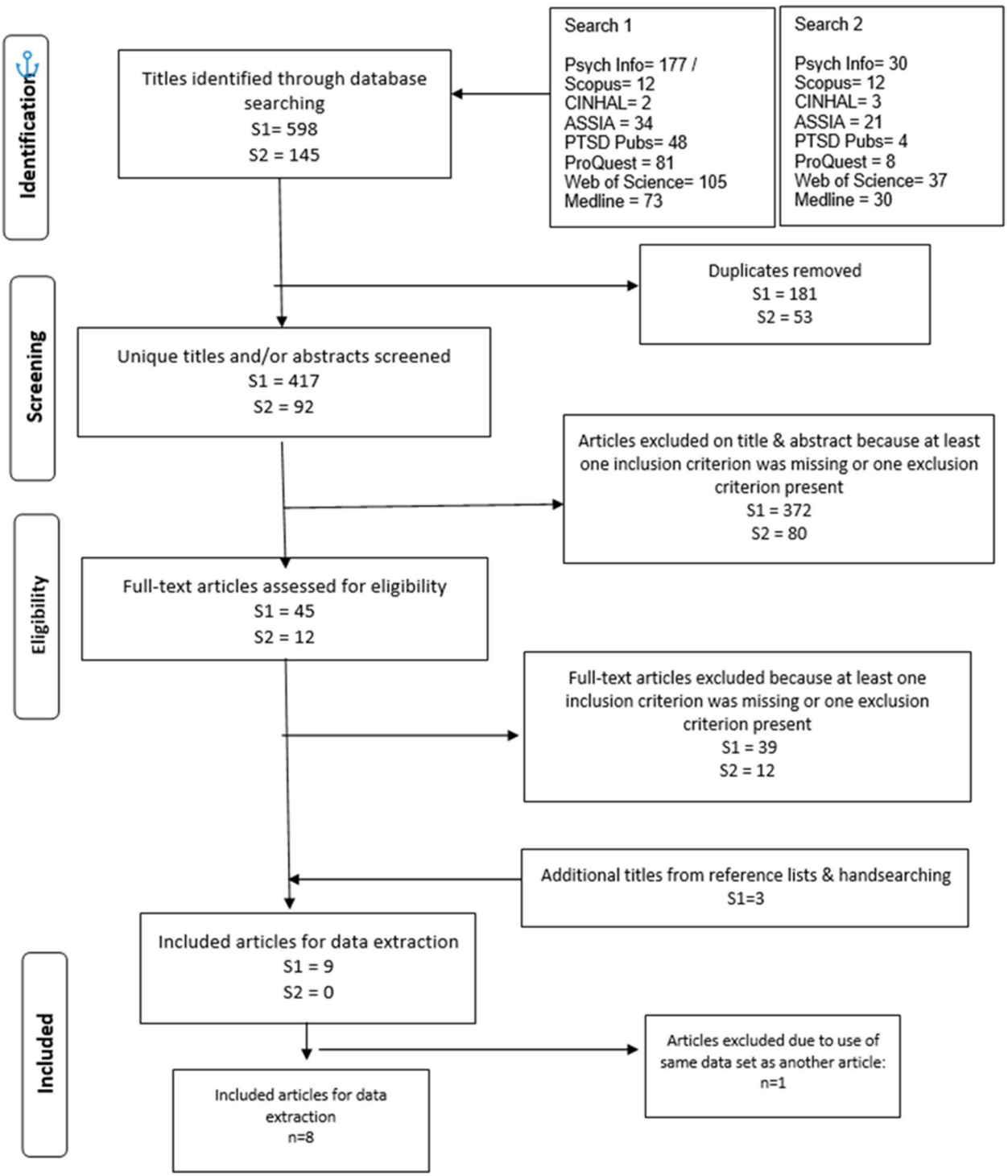

Fig. 1 PRISMA flow diagram for systematic reviews

Buitenen et al., 2021). Within this paper, an unspecified independent diagnostic interview was carried out by two mental health professionals (psychologist and psychiatrist) as part of routine intake process, and diagnoses were informed by information from previous admissions and clinical reports and agreed through consensus. The diagnostic interviews were carried out during the period where the Diagnostic and Statistical Manual of Mental Disorders (DSM) was being updated to the 5th Edition, and therefore some of the interviews were conducted using criteria for

DSM-IV (American Psychiatric Association, 2000) and some using the DSM-5 criteria (American Psychiatric Association, 2013). Therefore, for the secondary analysis, the authors reported that all were retrospectively coded using DSM-V (van Buitenen et al., 2021).

For the seven studies that included participants with ADHD, two studies just utilised self-report screening of current symptoms, using the Adult Self-Report Scale (ASRS) (Facer-Irwin et al., 2022) or the WURS (Gift et al., 2021; Perez-Pedrogo, 2018), respectively. The ASRS is a self-report screening tool that is validated against the DSM-IV diagnostic criteria and the Wender-Utah rating scale (WURS) to retrospectively screen for the presence of childhood ADHD symptoms. Both tools have been shown to have good psychometric properties (Kessler, 2005; Ward et al., 1993). Einarrson et al. (2009) and Rosler et al., 2009) used the WURS in conjunction with the ASRS and this combination of screening measures has been found to be particularly useful in screening for the presence of ADHD (Brevik et al., 2020). Three of the studies used a structured diagnostic interview, the MINI-Plus, to confirm the diagnosis of ADHD using the DSM-IV criteria in conjunction with either the ASRS (Hamzaloo et al., 2016, Moore et al., 2016), or the WURS (Rosler et al., 2009). In summary, six of the papers identified ADHD using the DSM-IV diagnostic criteria, and one used the ICD-11 criteria (Facer-Irwin et al., 2022). ASD was identified using the DSM-5 criteria (van Buitenen et al., 2021).

Screening and Assessment of PTSD

In six of the studies, PTSD was identified within diagnostic interviews. Two of these used the MINI-Plus (Einersson et al., 2009; Westmoreland et al., 2009), one used the SCID-I and SCID-II (Rosler et al., 2009), and the remaining three did not specify the diagnostic interview, but stated that these were used to assess for DSM-IV disorders (Hamzaloo et al., 2016; Moore et al., 2016; van Buitenen et al., 2021). Two of the studies used validated self-report screening measures only — the International Trauma Questionnaire (ITQ) (Facer-Irwin et al., 2022) and the Davidson Trauma Questionnaire (DTQ) (Perez-Pedrogo et al., 2018). Of the studies that used diagnostic interviews, two also used self-report questionnaires as well. Of these, one did not specify the questionnaire (Rosler et al., 2009), and one used the PCL-5 (Moore et al., 2016). Seven studies identified PTSD within the DSM-IV framework. One study used the most recent DSM-5 category of 'trauma and stressor related disorders' and therefore used different diagnostic criteria to those used within DSM-IV (van Buitenen et al., 2021). One study identified both PTSD and Complex PTSD (CPTSD) within the ICD-11 diagnostic framework and was therefore the only study to sub-categorise participants into CPTSD (Facer-Irwin et al., 2022).

Prevalence of Co-occurring PTSD in Individuals with Neurodevelopmental Conditions

All included studies reported the prevalence of PTSD in participants with neurodevelopmental conditions (ASD and ADHD), with a range between 4.6% and 80%. Just one study investigated the prevalence of PTSD co-occurring with ASD in prisoners and reported a prevalence rate of 4.6% (van Buitenen et al., 2021). Pooled analysis of the seven studies that reported the prevalence of PTSD co-occurring with ADHD showed a range between 10.2% (Hamzaloo et al., 2016) and 80% (Moore et al., 2016). Five studies reported prevalence of co-occurring PTSD in male participants with ND and found a range between 4.6% (van Buitenen et al., 2021) and 26.8% (Perez-Pedrogo et al., 2018). Pooled analysis of the three studies that investigated prevalence of PTSD in males with ADHD (excluding ASD) showed a range between 10.2% (Hamzaloo et al., 2016) and 26.8% (Perez-Pedrogo et al., 2018). Within the two studies which reported prevalence of PTSD within female prisoners with ADHD, there was a range between 18.2% (Rosler et al., 2009) and 26.5% (Perez-Pedrogo et al., 2018). Two studies did not give a breakdown of prevalence by gender (Moore et al., 2016 and Westmoreland et al., 2009).

The two studies that used self-report screening questionnaires only showed prevalence rates of 26.7% (Perez-Pedrogo et al., 2018) and 21.1% (Facer-Irwin et al., 2022), respectively. One study specified co-occurring CPTSD (Facer-Irwin et al., 2022) and found a prevalence of 31.6%, compared to 10.5% in participants with PTSD within the same study.

Quality Assessment

The Joanna Briggs Institute (Hilton, 2024) critical appraisal tool for prevalence studies was used (Munn et al., 2015). This scale had eight items, with a maximum score of eight. The study ratings are presented in Table 3. Overall, quality of the studies was found to be acceptable. Four papers had a score of six, three had a score of seven, and one paper had a score of eight. A slight increase in the quality of the more recent papers was found. Facer-Irwin et al. (2022) and Pérez-Pedrogo et al. (2018) were the strongest rated studies, with detailed descriptions of processes for training and assessing raters and ensuring inter-rater reliability.

For all of the papers, the sampling frame was found to be appropriate to address the target population. However, there was variability in terms of how the participants were

Table 3 Quality assessment table

Author (year)	Title	Was the sample frame appropriate to address the target population?	Were study participants sampled in an appropriate way?	Was the sample size adequate?	Were the study subjects and the setting described in detail?	Was the data analysis conducted with sufficient coverage of the identified sample?	Was the condition measured in a standard, reliable way for all participants?	Was there appropriate statistical analysis?	Was the response rate adequate, and if not, was the low response rate managed appropriately?	Total score (out of 8)
Van Buitenen et al. (2021)	'Risk Factors of Violent Offending in mentally ill prisoners with autism spectrum disorders'	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	7
Einarsson et al. (2009)	'Screening for attention-deficit hyperactivity disorder and comorbid mental disorders among prison inmates'	Yes	Partial	Partial	Yes	Yes	Yes	Yes	Yes	6
Rosler et al. (2009)	'Attention deficit/hyperactivity disorder in female offenders: prevalence, psychiatric comorbidity and psychosocial implications'	Yes	Not known	Yes	Yes	Yes	Not known	Yes	Yes	6
Hamzeloo et al. (2016)	'The Prevalence of ADHD and Comorbid Disorders in Iranian Adult Male Prison Inmates'	Yes	Partial	Yes	Yes	Yes	Partial	Yes	Yes	6

Table 3 (continued)

Author (year)	Title	Was the sample frame appropriate to address the target population?	Were study participants sampled in an appropriate way?	Was the sample size adequate?	Were the study subjects and the setting described in detail?	Was the data analysis conducted with sufficient coverage of the identified sample?	Was the condition measured in a standard, reliable way for all participants?	Was there appropriate statistical analysis?	Was the response rate adequate, and if not, was the low response rate managed appropriately?	Total score (out of 8)
Westmoreland, P., et al. (2009)	Attention Deficit Hyperactivity Disorder in Men and Women Newly Committed to Prison	Yes	Yes	Yes	Yes	Yes	Not known	Yes	Yes	7
Facer-Irwin et al. (2022)	PTSD and Complex PTSD in sentenced male prisoners in the UK: prevalence, trauma antecedents, and psychiatric comorbidities	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8
Moore et al. (2016)	Adult ADHD among NSW Prisoners: Prevalence and Psychiatric comorbidity	Yes	Partial	Yes	Yes	Yes	Yes	Partial	Yes	6
Perez-Pedrogo et al. (2018)	Sex differences in traumatic events and psychiatric morbidity associated to probable post traumatic stress disorder among Latino Prisoners	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	8

sampled. In several of the papers there was no information given about the sampling strategy used (Einarsson et al., 2009), and, further, several stated that participants were approached by prison staff to participate, raising ethical issues that were not addressed (Rosler et al., 2009). Sample size of ND participants varied widely, in part reflected by the fact that, in several studies, analysis of prevalence of co-occurring PTSD and ND represented secondary data relating to a smaller subset of total participants in larger scale cohort or cross-sectional studies (e.g. Facer-Irwin et al., 2022; van Buitenen et al., 2021). Overall, the study participants and setting were described in adequate detail, with details of ages or age ranges given and offence types of the sample described.

The main variation in quality was found in the measurement of PTSD and ND, with significant variation between papers in terms of the use of self-report screening questionnaires, diagnostic interviews, or a combination of these, raising risks of self-report bias, over- or under-reporting, or compromising objectivity. Despite this variation, all of the self-report screening measures or diagnostic interviews were validated within recognised diagnostic frameworks — the DSM-IV or 5, or the ICD-11. Some of the studies gave detail about the professional expertise and experience of the professionals conducting and rating the assessment (Facer-Irwin et al., 2022); however, others did not give sufficient detail about training, experience or processes for ensuring inter-rater reliability (Hamzeloo et al., 2016). One of the papers described administration of questionnaires in 'large groups of 25–50 participants' that would represent ethical and clinical risks (Hamzeloo et al., 2016). Overall, there was significant variability in how the conditions of ASD, ADHD and PTSD were measured, that made rendering data extraction difficult. None of the studies reported co-production or co-design with participants. In terms of data-analysis and reporting, all of the papers were judged to use appropriate methodology, with sufficient statistical power.

Conclusions and Discussion

Eight studies that investigated prevalence of co-occurring PTSD in prisoners with neurodevelopmental conditions were included for data extraction and analysis. Overall, we found a prevalence range between 4.6% and 80% of co-occurring PTSD within prisoners with neurodevelopmental conditions. Only one paper reported co-occurrence of PTSD within prisoners with ASD, finding a rate of 4.6% (van Buitenen et al., 2021). When the study reporting ASD was removed from the analysis, we found a range of between 10.2% and 80% co-occurrence of PTSD for prisoners with ADHD. No papers included intellectual disability. There was substantial heterogeneity within the characteristics of the papers that prevented a meta-analysis and makes it difficult to draw conclusions about the prevalence of co-occurring PTSD within this population. The huge range in reported prevalence of PTSD in neurodivergent prisoners (between 4.6% and 80%) indicates that there are substantial methodological differences within the papers, in particular the type and method of screening and assessment of both ND and PTSD (Abdelnour et al., 2022).

Although no papers were excluded on the grounds of quality, overall, the studies were variable in quality, with estimated rates of co-occurring ADHD and PTSD in prisons varying depending on sample and assessment method. The inclusion of both self-report screening and clinician-led diagnostic interviewing may lead to possible under- and over-reporting (Lehrner & Yehuda, 2020). Under-reporting was likely within the single study that explored co-occurrence of ASD and PTSD and found a 4.6% co-occurrence rate, considerably lower than that found in community and clinical samples (Peterson et al., 2019). There was substantial variation in the types of screening measures used, and the updated diagnostic criteria between successive updates of the DSM framework, as well as between DSM and ICD-11 for both autism and PTSD, make it difficult to draw an accurate comparison between papers (Murphy and Callahan, 2015).

These findings are consistent with Quinton et al.'s recent systematic review of the assessment and prevalence of PTSD in autistic people within a community setting, which found a reported range of 2 to 66.67% (Quinton et al., 2024). They found a substantial variation in sampling and method of screening and assessment, and reported that studies that used self-report screening measures of PTSD, such as the PCL-5, showed approximately double the prevalence of PTSD compared to those that used a professional diagnosis (Quinton et al., 2024; Reuben et al., 2022; Rumball et al., 2021).

Facer-Irwin et al. (2022) was the only study in the current review to explicitly look at rates of co-occurring CPTSD, using the International Trauma Questionnaire, which is a screening measure for PTSD and CPTSD, validated for the ICD-11. They found that rates of co-occurring CPTSD were nearly three times higher than co-occurring PTSD, at 31.6% and 10.5%, respectively. This is consistent with wider research that suggests that CPTSD is associated with higher levels of co-morbidity than PTSD, pointing to the need for standardised screening for these conditions within custodial settings (Karatzias et al., 2019).

Difficulties with establishing prevalence are compounded by the fact that there are yet no validated, clinically available PTSD scales for use with autistic people, and therefore the symptoms investigated in the included studies were confined to those used to diagnose PTSD in neurotypical or allistic people (Rumball et al., 2021). It is possible that issues of diagnostic overshadowing mean that clinicians

and researchers may not be accurately identifying PTSD in this population, and future research is needed to investigate if there are autism-specific presentations of PTSD that fall outside of the established symptomology, as well as ensuring there are validated diagnostic tools that can assess and discriminate PTSD symptoms from characteristics of autism (Quinton et al., 2024).

In addition, papers that investigated the impact of adverse childhood experiences and bullying on autistic people's mental health were excluded as these experiences are not classified as traumatic events within diagnostic classifications (Brewin et al., 2019). Overall, existing studies of prevalence of ADHD in prisons continue to show considerable variation, even where more detailed assessments and stricter application of criteria are applied, and a diagnosis of ADHD does not necessarily equate to clinically relevant symptomatology (Baggio et al., 2018).

Within the current review, studies that screened for both childhood ADHD (using retrospective self-report measures), as well as current symptoms, found that just 36% of adults with childhood ADHD retained the diagnostic criteria in adulthood (Einarsson et al., 2009). Together, this suggests ongoing caution is warranted in estimating the clinical impact of ADHD in any given prison population and highlights the need for systematic screening for this condition across the prison estate (Young et al., 2018). As other authors have highlighted, inflated estimates of ADHD in prisons also risks stigmatising individuals with ADHD in the general population as excessively prone to criminal behaviour (Tully, 2022). In addition, no papers that looked at intellectual disability were included for the final data extraction. The scarcity of research into the prevalence of ASD, intellectual disability (ID), and co-occurring presentations of PTSD in the prison population points to an urgent need to explore this (Haruvi-Lamdan et al., 2020; Hellenbach et al., 2017).

A meta-analysis by Spencer et al. (2016) found a bidirectional relationship between PTSD and ADHD. Furthermore, studies show that exposure to traumatic events within childhood may predispose to persistence of ADHD into adulthood, and the number of adverse or traumatic events increase ADHD prevalence and severity (Ferrer et al., 2017). Although distinct diagnoses, both ADHD and PTSD have a number of overlapping features and a high rate of co-occurrence and other psychiatric co-morbidities. Given the possible association between exposure to traumatic events, and the presence and severity of ADHD symptoms, further research is also needed to better understand the neurobiological and psychological factors that are common to both ADHD and PTSD (Rumball et al., 2024). Adequate treatment of ADHD might lower the subsequent risk of developing PTSD in individuals with ADHD, and similarly, the development of targeted prevention and treatment strategies for PTSD in individuals with ADHD (Wendt et al., 2023). However, identification, assessment, and treatment of these conditions, both individually, and when co-occurring, is challenging. Boodoo and colleagues (2022) have developed a helpful treatment algorithm for co-occurring ADHD and PTSD which may be beneficial within custodial settings (Boodoo et al., 2022).

Two of the studies within the current review included both male and female participants, and one was female only (Rosler et al., 2009). This represents progress in terms of recruiting gender-diverse samples, as women have historically been under-represented in autism and ADHD research within prisons and the justice system (Woodhouse et al., 2024). However, several of the studies excluded female offenders from their participant sample, due to low numbers of female prisoners within their sampling frame and the different symptom profile of females with ADHD (van Buitenen et al., 2021). This is consistent with research which shows that females have historically been found to have lower rates of ADHD and ASD, but have often been under-detected as females have a different symptom profile, with more having ADD than ADHD (Young et al., 2020).

Within the current review, rates of co-occurring PTSD in female prisoners with ADHD and ASD were consistent with those of male prisoners. However, due to small numbers of female prisoners within the sample, and the variation in screening and assessment methods, it was not possible to draw any conclusions about the aetiology of these conditions within this sample. However, the broader literature suggests that issues around misdiagnosis of Emotionally Unstable Personality Disorder (EUPD) in females mean that females remain under-represented within these studies, and points to the need for the development of further research in this population (Collins et al., 2023).

Within the current review, there was substantial heterogeneity within the types of custodial settings, including four penitentiary psychiatric centres and an intake centre for newly sentenced prisoners (Westmoreland et al., 2009; van Buitenen, 2021). However, most papers did not give information about the nature of the regime or security level, or other information such as numbers of prisoners. It is likely that these characteristics are associated with substantial differences in the exposure to traumatic events within the prisons themselves, and levels of traumatisation and re-traumatisation within the prisons experienced by the sample, compounded by the heightened sensitivity of neurodivergent people to sensory overload and unpredictability, and vulnerability to bullying and exploitation within the prison environment (Facer-Irwin et al., 2022; Salter & Blainey, 2024). There has been recent interest internationally in the development of trauma-informed and therapeutic prisons and units, and further research into the prevalence and outcomes for

trauma-exposed people with neurodivergence in these settings is warranted (Auty et al., 2022).

A potential limitation is that the inclusion criteria for papers were studies where the population were adult males or females (over the age of 18) within adult custodial settings. The papers were excluded if the setting was youth offending institutions (YOI). However, the upper age in YOI is often 21 or older and therefore a limitation of our study was that we excluded relevant studies that included adults over the age of 18 within YOI (Turner et al., 2021). In addition, forensic mental health settings were excluded — it is likely that there would be a higher prevalence of these co-occurring conditions with these settings, and that these would be associated with higher levels of violent offending (Bianchini et al., 2022).

There was a large heterogeneity between the types of offences committed, and the association between offence type and rate of co-occurrence was not explored within this review, which could be seen as a limitation. Existing research suggests that both PTSD and ADHD are associated with higher rates of violent offending, and it has been hypothesised that this is related to more externalising symptoms and behaviours within these conditions (Young & Cocallis, 2022). In addition, rates of co-morbidity with other conditions, such as personality disorders and substance misuse were not investigated within the current study. However, existing research demonstrates that, within ADHD, these co-morbidities are very high (Young et al., 2015). It is therefore possible that these comorbid conditions, possibly alongside psychosocial factors, could mediate the relationship between PTSD and ND, and may also account for the high prevalence of re-offending in this population (Mohr-Jenson & Steinhauson, 2016).

Conclusion

Overall, this review suggests that PTSD occurs at comparable rates in neurodivergent individuals compared to the general population rates, although, as stated, it is difficult to draw conclusions from the studies due to variability within the samples and methods of screening and assessment. However, given the wider evidence that neurodivergent people within prisons are particularly vulnerable to traumatisation and re-traumatisation, experience elevated rates of PTSD and CPTSD, and experience reduced outcomes, there is a pressing need to develop effective processes for screening and assessment of these conditions. Recently, there has been interest in developing guidance for screening, or diagnostic and treatment pathways for prisoners with ADHD in the UK (Young et al., 2018). Effective clinical pathways for trauma have been advocated within prisons and are a focus of current research in this area (Crole-Rees et al., 2024). The development of screening and assessment tools for PTSD, that have been adapted and validated for neurodivergent people, are a research priority (Rumball et al., 2024). This work, together with the development of integrated care pathways, and whole-system trauma and developmentally informed approaches can be used to identify the holistic needs of this group and improve outcomes for this vulnerable population.

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Declarations

Conflict of interest The authors declare no competing interests.

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