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ORIGINAL ARTICLE

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Prevalence of attention-deficit hyperactivity disorder in adult prisoners: An updated meta-analysis

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Abstract

Background: Previous meta-analyses may have over-estimated the prevalence of attention-deficit hyperactivity disorder (ADHD) in prisoners by including data from selected samples.

Aims: To estimate the prevalence of ADHD in unselected samples of adults in prison and examine potential sources of heterogeneity by meta-regression and subgroup analyses.

Methods: We assessed all studies included in a 2018 systematic review for eligibility and updated the literature search to include studies published up to September 2023.

Results: A total of 11 studies reporting robust diagnostic data on ADHD in 3919 unselected adults in prison were included. In meta-regression, ADHD prevalence did not differ between men and women but it was significantly higher in studies using a two-phase design. In random sampling studies, the pooled prevalence of ADHD was 8.3% (95% CI: 3.8–12.8) which was further halved after the removal of an outlier.

Conclusion: One in 12 adults in prison have been diagnosed with ADHD. Our findings highlight the importance of using clear and consistent inclusion criteria in meta-analyses of prevalence.

KEYWORDS
ADHD, prison, systematic review

1 | INTRODUCTION

Attention-deficit hyperactivity disorder (ADHD) is a childhood-onset neurodevelopmental disorder that frequently persists into adulthood (Faraone et al., 2024) and is associated with a wide range of adverse outcomes, including offending (Angström et al., 2024; Anns et al., 2023). Therefore, people with ADHD are thought to be over-represented in the criminal justice system, although prevalence estimates vary widely. A recent meta-analysis examined the prevalence of ADHD among incarcerated adolescents and adults (Baggio et al., 2018). By pooling diagnostic interview data from 83 samples, it was estimated that 26.7% (95% confidence interval [CI]: 22.7–30.7) of all 'people living in detention' are diagnosed with ADHD. Their broad definition of detained people included selected samples such as people in (forensic) psychiatric units, violent offenders, and those referred to treatment or selected on the basis of particular diagnoses. Because ADHD is more common in these clinical and selected subgroups, the pooled prevalence of 27% may be an overestimation and not reflective of the ADHD prevalence among adults in the general prison population—which to our knowledge has not been examined before. Therefore, we aimed to review the prevalence of ADHD, assessed by robust diagnostic methods, in unselected samples of adult prisoners. In so doing, we examined studies identified in a previous systematic review (Baggio et al., 2018) and conducted an updated search.

2 | METHODS

We examined the prevalence of ADHD based on clinical or diagnostic interviews among unselected samples of adults in the general prison population. By unselected samples, we refer to studies that did not a priori select participants based on particular criteria (e.g. offence type, psychiatric diagnosis or service contact) as this would influence prevalence (Fazel & Seewald, 2012; Fazel et al., 2017). Our literature search consisted of two phases.

First, each of us independently reviewed the studies identified in the most recent systematic review, which was published in 2018 (Baggio et al., 2018). Of the 142 samples included in that review, 59 (42%) were exclusively based on screening instruments. We excluded studies only using screening tools as rates of false positives are high and these measures are not equivalent to clinical diagnoses (Chamberlain et al., 2021; Harrison & Edwards, 2023). This left 83 samples that used diagnostic interviews to assess ADHD (Figure S1). Of these, we excluded 55 studies that were solely or mainly about adolescents, reviewed elsewhere (Beaudry et al., 2021). We initially retained 28 adult samples (reported in 22 studies) but 14 of these studies were further excluded because they comprised selected and clinical samples (e.g. patients referred to forensic psychiatric assessment, prisoners with personality disorder or severe mental illness, and those convicted of violent offences) or adopted unclear assessment instruments (see Table S1 for studies with their reason for exclusion). Thus, eight studies met our inclusion criteria.

Secondly, we conducted a title and abstract search in two databases (PubMed and Web of Science) for the period from 1 January 2018 to 30 September 2023, using the search terms (ADHD OR 'attention-deficit hyperactivity disorder') AND (prison* OR inmate* OR incarcer* OR jail* OR custod* OR offend*) without language restrictions. Inclusion criteria were the same as in the first phase: observational studies that (1) assessed ADHD by diagnostic interviews (2) in unselected samples of (3) adult prisoners. Our systematic search yielded 315 records for screening, of which 177 full-text articles were assessed for eligibility, independently by both of us (Figure 1). Three eligible studies were identified (Chaplin et al., 2022; Naidoo et al., 2022; Vélez-Pastrana et al., 2020). Thus, combined with the eight studies identified in phase one, a total of 11 studies were included (Table 1).

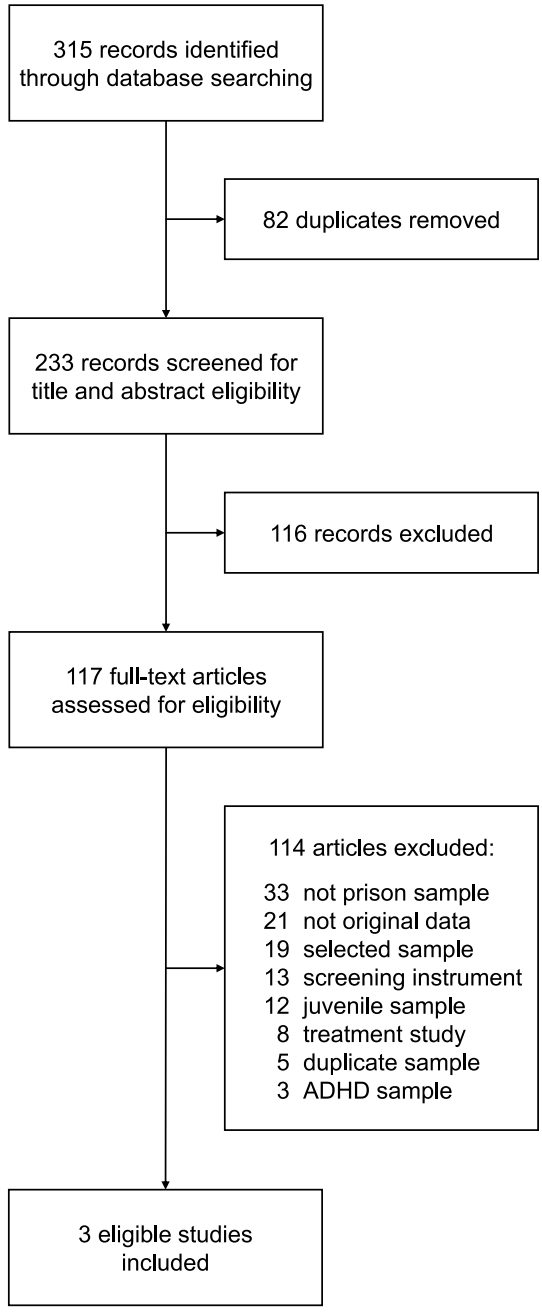

FIGURE 1 Study selection (2018–2023).

Prevalence data were extracted. The Poisson distribution was used to obtain 95% CIs when events were rare (Beaudry et al., 2021). To calculate a pooled prevalence of ADHD, a random-effects model was chosen to account for the anticipated high heterogeneity between studies. In meta-regression and subgroup analyses, we examined sex differences and whether two-phase procedures (i.e. an initial ADHD screening followed by a diagnostic interview only for those who screen positive) yield different prevalence estimates compared with random sampling (one phase) approaches (i.e. without a screening phase). Analyses were done using Stata version 13.

TABLE 1 Included studies of adult prisoners using replicable measures of diagnosing ADHD.

Study	Country	Age (M)	Sample (*n*)	Women (*n*)	Diagnosis (*n*)	Prevalence (%)
Kavanagh et al. (2010)	Australia	31.9	30	0	2	6.7
Pondé et al. (2011)	Brazil	33.0	497	0	23	4.6
Mundt et al. (2013)	Chile	32.6	1008	153	22	2.2
Gaïffas et al. (2014)	France	26.0	93	0	10	10.8
Konstenius et al. (2015)[a]	Sweden	39.7	56	56	16	28.6
Hamzeloo et al. (2016)[a]	Iran	31.4	908	0	147	16.2
Moore et al. (2016)[a]	Australia	41.0	88	21	15	17.0
Young et al. (2016)	Scotland	30.3	390	0	96	24.6
Vélez-Pastrana et al. (2020)[a]	Puerto Rico	30.7	483	0	82	17.0
Chaplin et al. (2022)[a]	England	34.0	240	0	54	22.5
Naidoo et al. (2022)	South Africa	38.9	126	126	12	9.5

Abbreviation: ADHD, attention-deficit hyperactivity disorder.
[a]Two-phase procedure.

3 | RESULTS

We included a total of 11 studies from 10 countries with a pooled sample of 3919 adults (91% men, mean age = 34.1 years) in the general prison population (Table 1). All studies but one (Young et al., 2016) assessed psychiatric comorbidity using diagnostic instruments (e.g. the Mini International Neuropsychiatric Interview).

The prevalence of ADHD ranged from 2.3% to 24.6% in men (9 samples, $n = 3563$) and from 1.3% to 28.6% in women (4 samples, $n = 356$; Figure 2). In meta-regression, there was no significant difference in ADHD prevalence between men and women ($p = 0.997$). Using a random-effects model, the pooled prevalence of ADHD was 13.2% (95% CI: 8.6–17.8) in men and women combined, with substantial heterogeneity ($I^2 = 96\%$). However, sampling method (random vs. two-phase) was a significant moderator in meta-regression analysis ($p = 0.019$), indicating that it would be inappropriate to pool the estimates across sampling types. In a subgroup analysis, the prevalence was 8.3% (95% CI: 3.8–12.8) in random sampling studies and 18.3% (95% CI: 15.4–21.3) in two-phase procedure studies. When we removed a clear outlier (Young et al., 2016) based on visual inspection of the forest plot, which reported a 2.5-fold higher prevalence than any other random sampling study, the pooled prevalence declined to 4.4% (95% CI: 2.1–6.7) in random sampling studies.

In men, an estimated 13.4% (95% CI: 7.6–19.1) of prisoners were diagnosed with ADHD ($I^2 = 97\%$). In a subgroup analysis, random sampling studies (9.8%, 95% CI: 3.4–16.1) again showed a lower prevalence compared with studies that used a two-phase procedure (17.5%, 95% CI: 14.9–20.0). After removal of the outlier, the prevalence was 4.5% (95% CI: 1.8–7.3) in random sampling investigations.

In women, the pooled prevalence was 13.6% (95% CI: 3.1–24.0) with substantial heterogeneity ($I^2 = 90\%$). We did not conduct a subgroup analysis by sampling method because there were only two studies for each category.

4 | DISCUSSION

In this updated systematic review and meta-analysis on the prevalence of ADHD in the general prison population, we identified 11 studies reporting replicable diagnostic data on 3919 adults. Despite the strict and clinically relevant inclusion criteria, heterogeneity was high and prevalence varied widely across primary studies, ranging

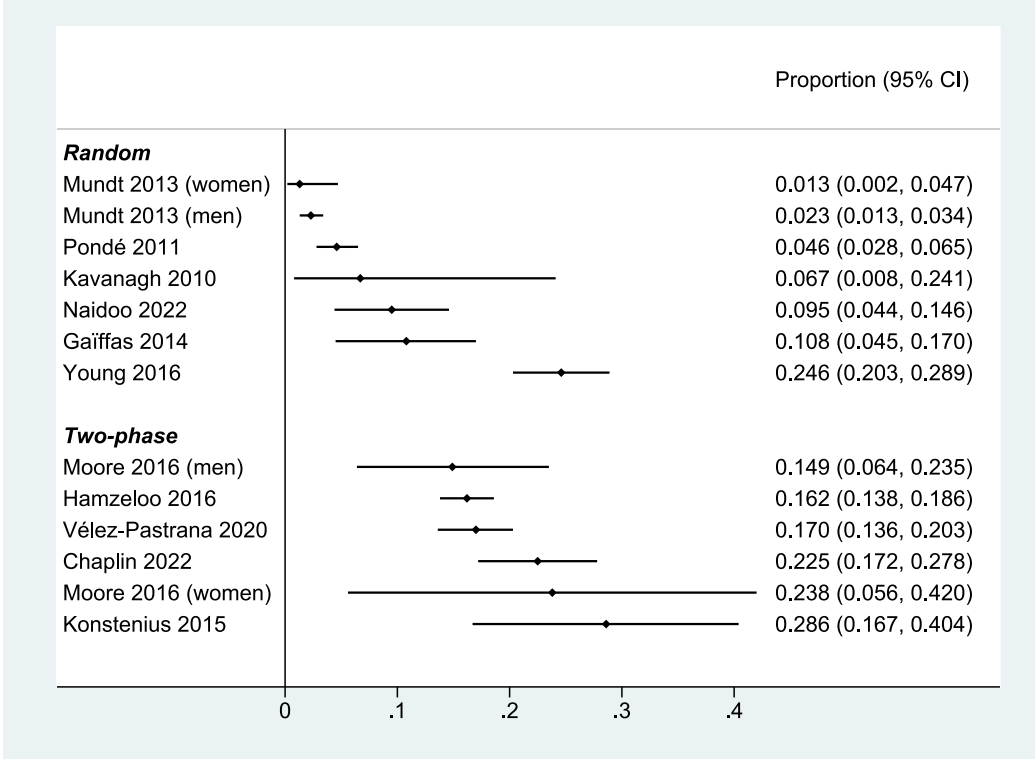

FIGURE 2 Prevalence of attention-deficit hyperactivity disorder in adult prisoners by sampling method. [Colour figure can be viewed at wileyonlinelibrary.com]

from 2% to 25% in men and from 1% to 29% in women. Our pooled estimates are considerably lower than the 27% reported in another meta-analysis (Baggio et al., 2018). The latter review was largely based on selected samples, such as people with severe mental illness or those detained in psychiatric units, which would inflate prevalence. This large difference highlights the importance of clear and consistent inclusion criteria, particularly if random-effects models are used. Therefore, service development should not be based on pooled estimates where inclusion criteria are too unspecific to be useful. With this in mind, the lack of efficacy found in a recent trial of stimulant medication for ADHD in prisoners (Asherson et al., 2023) may be due to the inclusion of mostly subthreshold cases (due to overdiagnosis) who did not respond to treatment and/or the high rates of comorbidity that could mask some of the effects of medication.

In our updated review, nearly half (45%) of the included studies used a two-phase sampling design, where a diagnostic interview is contingent on a positive ADHD screening result. We found that these studies reported significantly higher prevalence—around double compared with random sampling designs. Explanations for this large difference include methodological problems with this two-phase approach. For example, Moore et al. (2016) randomly allocated 50% screen-positive and 50% screen-negative participants to have a full diagnostic assessment. This meant that diagnostic odds were inflated because the proportion of ADHD diagnoses in screen-positives is more than that would be expected in a random sample. Another possible explanation is a form of confirmation bias—if a participant screens positive, they might report symptoms differently in the subsequent diagnostic interview. As these initial screens are more likely to provide false positives (Vizgaitis et al., 2023), certain settings where the secondary gain for having a diagnosis (including medication) are important considerations. When excluding studies based on a two-phase design, which is consistent with other meta-analyses in prisoners (e.g. Baranyi et al., 2018; Fazel & Seewald, 2012), the pooled prevalence of ADHD was 8.3% (95% CI: 3.8–12.8) in men and women combined.

This estimate of 1 in 12, which we think is the best approximation for the prevalence of ADHD in adults in prison, is three times higher than the 2.5% ADHD prevalence in community-based adults (Simon et al., 2009). Similarly, a recent meta-analysis documented a higher prevalence of ADHD among unselected samples of adolescents in custody (17%) relative to their non-incarcerated peers (Beaudry et al., 2021). The lower prevalence in adults compared with adolescents in prison settings (8% vs. 17%) is consistent with findings in the general population and reflects the overall decrease in prevalence of ADHD with age (Faraone et al., 2006). The higher rate of persistence of ADHD from young to adult prisoners compared with the general population may be due to the link between ADHD and offending (Angström et al., 2024; Anns et al., 2023) and offenders having a specific profile in terms of ADHD, although uncertainty remains about the causal nature of this relationship (Tully, 2022).

In contrast to the general population, we did not find a significant difference in ADHD prevalence between men and women in prison. Relative to men, women in prison are a much more selected population (Svendsen et al., 2023) and tend to have a higher relative excess of many mental disorders compared with the general population (Baranyi et al., 2018; Favril et al., 2024). A symptomatic overlap with cluster B personality traits, which are common in female prisoners, may be another explanation (Tully, 2022). In general, psychiatric comorbidity is substantial in ADHD (Young et al., 2015) and should be taken into account when examining prevalence (Faraone et al., 2024).

Our analysis was in part based on eight eligible studies published before 2018, identified in the Baggio et al. (2018) systematic review (which used much broader criteria and we did not repeat their literature search); an updated search from 2018 identified three more papers, which made a total of 11 included studies in the current review. Unlike other meta-analyses of mental disorders in prisoners (Fazel & Seewald, 2012; Fazel et al., 2017), we did not identify any primary investigations conducted in the USA.

In summary, we found that 2%–25% of men and 1%–29% of women were diagnosed with ADHD. Based on random sampling studies, we conclude that 8% (or 1 in 12) adults in prison have been diagnosed with ADHD and 4% with the removal of a study outlier.

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CONFLICT OF INTEREST STATEMENT

The authors declare no conflicts of interest.

DATA AVAILABILITY STATEMENT

The data that support the findings of this study are available from the corresponding author upon reasonable request.

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SUPPORTING INFORMATION

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

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