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Hidden Impairment: Mild Cognitive Impairment and Associated Factors in Older Prisoners.

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Submitted in partial fulfilment of the requirements for the degree of

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Chapter 1: Systematic Review

Cognitive Screening Performance in Older Prisoners: A Systematic Review

Prepared in accordance with the author requirements for the Journal of Forensic Psychiatry and Psychology.
https://www.tandfonline.com/action/authorSubmission?show=instructions&journalCode=rjfp20

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Abstract

Background: Older adults in prison are a growing population yet cognitive impairment may be under recognised. This systematic review examined cognitive screening performance among older prisoners, including whether performance differed from younger prisoners or age-matched community samples. Methods: Seven databases were searched alongside forward and backward citation searching and grey literature and 14 / 2,828 met inclusion criteria. These studies varied in age thresholds, cognitive screening tools and impairment cut-offs with the Mini-Mental State Examination (MMSE), Montreal Cognitive Assessment (MoCA), Addenbrooke's Cognitive Examination (ACE) and Six-Item Cognitive impairment Test (6-CIT) used. Results: Narrative synthesis indicated that impairment prevalence ranged widely (7% - 49%), reflecting differences in screening tool (lower estimates with MMSE, higher with MoCA), applied cut-offs and the population (higher prevalence in USA than UK). Studies with comparison groups indicated poorer performance among older prisoners than in age-matched community samples (Mean MMSE 26.33 vs. 28.99) and than younger prisoners. Study quality was assessed using Joanna Briggs Institute (JBI) critical appraisal tools and was moderate to high in all studies. Discussion: This review supports the need for there to be policies of routine screening, using appropriate prison-based cut-offs and improved pathways from screening to further assessment. PROSPERO: CRD420251237225.

Keywords: mild cognitive impairment, prisoners, cognitive screening, older adults, head injury, dementia

Introduction

The ageing prison population is growing, creating substantial clinical and operational challenges (Blundell-White et al., 2023; Ridley, 2022). In England and Wales, adults aged 50 and over have more than doubled in number over the past decade and now represent 17% of the prison population (House of Commons, July, 2020). Similar trends have been reported internationally; in the United States of America (USA) between 1999 and 2016 the number of people in prison aged over 55 increased by 280% (Kaiksow et al., 2023). These growing numbers reflect ageing populations, longer custodial sentences and prosecution of historical sex offences. This shift is important because older prisoners have higher rates of illness and disability than younger prisoners (Psick et al., 2017). Cognitive decline including mild cognitive impairment (MCI) and dementia represents an increasingly important issue for older people in prison (Forsyth et al., 2020). Older prisoners are estimated to cost double that of younger prisoners, reflecting complex multi-morbidities in this group, and is an economic burden for governments (Chettiar et al., 2012; Prison Reform Trust, 2022). The definition of 'older prisoner' differs across countries and studies, but a threshold of 50 years is often used, reflecting the concept of accelerated ageing in prisoners (Greene et al., 2018; House of Commons, July, 2020).

Accelerated ageing is not solely a consequence of imprisonment, but is linked to cumulative effects of adverse childhood experiences, mental illness, substance use, head injury and homelessness which are common experiences prior to incarceration (Blankenship et al., 2023; Henry, 2020). In the UK and Europe the principle of equivalence of care states that those in prison should have access to healthcare which is comparable to what is available in the community (First Step Alliance, 2024) although in practice this may be difficult to achieve. In relation to cognitive deterioration, the prison environment may both mask and amplify cognitive difficulties with impairment remaining undetected until disability becomes severe (Forsyth et al., 2020).

Cognitive screening tools offer an accessible and practical means of identifying individuals who may require further assessment. Several brief measures have been used in older adult research in prisoners including the Mini Mental State Examination (MMSE) (Folstein et al., 1975), Montreal Cognitive Assessment (MoCA) (Nasreddine et al., 2005), Addenbrooke's Cognitive Examination (ACE) (Mathuranath et al., 2000), Brief Neuropsychological Cognitive Examination (BNCE) (Tonkonogy, 1997) and Six Item Cognitive Impairment Test (6-CIT) (Brooke & Bullock, 1999). While these tools are not diagnostic they provide validated information about cognitive performance, and can highlight the need for a neuropsychological assessment (Lui et al., 2026). However, the screening tools differ in length, cognitive domains assessed, and sensitivity in

detecting MCI (Iloabachie et al., 2025). The MMSE is widely used but has limitations in detecting mild cognitive impairment and executive dysfunction. The MoCA was developed to improve sensitivity in detecting MCI (de Boer et al., 2025). The ACE tool provides broader multi-domain assessment (Larner, 2017) and the 6-CIT offers a brief option which may be useful in busy and demanding healthcare contexts (O'Caoimh & Molloy, 2023).

Dementia and mild cognitive impairment (MCI) exist on a spectrum of age-related cognitive decline. Dementia is characterised by a significant decline from a person's previous level of functioning in one or more cognitive domains (e.g. memory, executive function, language, visuospatial ability), severe enough to interfere with independence in everyday activities (American Psychiatric Association, 2022). MCI describes a measurable but less severe decline in cognitive performance relative to a person's previous level, where independence in everyday activities is largely preserved (American Psychiatric Association, 2022). MCI is widely regarded as a stage between normal cognitive ageing and dementia, although not all individuals with MCI go on to develop dementia (Pandya et al., 2016).

Executive function refers to a set of higher cognitive processes that support behaviour, including inhibitory control, working memory, and cognitive flexibility, which is associated with planning, problem solving, motivation and emotional self-regulation (Uddin, 2021). Executive dysfunction is a feature of both MCI and dementia but is under-detected in clinical practice by brief screening tools and the subtilties of cognitive changes (Doshier et al., 2025).

Several factors are associated with cognitive outcomes and are of relevance to interpreting cognitive screening performance in prison populations. Educational attainment is related to both cognitive performance and lowered chance of later life dementia (Lövdén et al., 2020), this is relevant to prison populations where educational attainment is often lower than in the general population. Substance use and head injury are both established risk factors for poorer cognitive outcomes and later dementia risk (Saha et al., 2025; Snowden et al., 2020). In a UK sample, it was reported that while there were no group differences between those with or without significant head injury, generally cognitive function is poorer among adult male prisoners in Scotland than general population (McMillan et al., 2025).

The interpretation of cognitive screening in prison populations is complicated because cut-off scores are often derived from community or clinical samples and may not transfer to those who are incarcerated (Iloabachie et al., 2025). Many factors can influence performance on a screening tool besides cognitive impairment, including the prison environment (Meijers et al., 2015) and

psychological distress and depression (Kriesche et al., 2023; Tian et al., 2025). Applying standard cut-offs may therefore risk errors in interpretation of scores and inaccurate prevalence estimates. This issue is particularly important because cognitive screening in prison is not only concerned with diagnosis but with identifying support needs and reasonable adjustments. Validation of tools including the MoCA has begun to address this issue in a general adult prison sample but there is little work on other screening tools (Pereira et al., 2023). Studies suggest that cognitive impairment is common among older prisoners, but the evidence varies, due to differences in study designs and methods. In England and Wales, MCI prevalence has been estimated at 7-12% among prisoners aged over 50 (Forsyth et al., 2020), while USA studies report estimates ranging from 35-78% (Ahalt et al., 2018; Baillargeon et al., 2023; Perez et al., 2021). Although methodological differences likely contribute to this variation, findings consistently suggest older prisoners are at risk of cognitive impairment. However, little is known about the prevalence of MCI in Scottish prisoners who are at greater risk of cognitive impairment than the general population.

One systematic review has looked at the impact of dementia in prisoners (Brooke et al., 2020), and another explored cognitive screening tools in custodial settings (Iloabachie et al., 2025). However, neither review focused on whether performance of older prisoners on cognitive screening tools is worse than expected. This is an important gap because older prisoners are likely to have different needs compared to younger prisoners, therefore a systematic synthesis on the performance of older prisoners using cognitive tools is therefore required.

Aims of the study

This systematic review aimed to examine whether cognitive performance on validated screening tests is poorer than expected in older adults in prisons when compared to age-matched community or younger prison samples.

Method

Protocol and registration

This systematic review was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) statement guidelines (Page et al., 2021) and was prospectively registered on PROSPERO (CRD420251237225) on 5th May 2026. Two protocol amendments were submitted on 3rd June 2026 (PROSPERO v2.0 and v3.0). The first was to update the planned quality appraisal tool from the Newcastle-Ottawa Scale to the Joanna Briggs Institute (JBI) Critical Appraisal Tools (Barker et al., 2026; Munn et al., 2020) reflecting the predominant cross-sectional design of studies, and the second to refine the review title to

reflect a focus on cognitive screening performance. Both amendments were made prior to the commencement of data extraction.

Search strategy

The search strategy was developed and refined following consultation with a librarian at the University of Glasgow. A systematic search of published studies examining older prisoners' performance measured using a cognitive screen was undertaken by the lead researcher (CDC) in early May 2026 using a combination of Boolean searches of keywords on the following seven databases; Embase (Ovid), Medline (EBSCO), CINAHL (EBSCO) PsycINFO (EBSCO), SocINDEX (EBSCO), ASSIA (ProQuest), Web of Science (Science Citation Index Expanded, Social Sciences Citation Index, Arts & Humanities Citation Index and Emerging Sources Citation Index). The yield of records was further complemented through grey literature searches on UK, Australian and American government databases, Google Scholar and forward and backward citation searches. See Appendix 1.2 for the full search terms used.

The 6916 records identified through database search were uploaded into Rayyan (https://www.rayyan.ai/) for the removal of duplicates. Title and abstract screening and full text review was conducted by the lead reviewer (CDC). To assess inter rater consistency a second reviewer (RO) independently screened 10% of records at both stages. Of 350 abstracts and 2 full texts co-reviewed there were two discrepancies which were resolved through discussion.

Eligibility Criteria

Eligibility criteria were applied in two stages. At title and abstract screening, broader criteria were used; records were advanced to full-text review where the population appeared to include prisoners or individuals in custodial settings, and where administration of a cognitive screening measure was reported or implied. Confirmation of a valid screening tool and an extractable older-prisoner data set was assessed at full-text screening. The detailed inclusion and exclusion criteria are outlined in Table 1.

Table 1. Eligibility Criteria Applied at Title/Abstract and Full-Text Screening

Screening Stage	Criteria Applied
Title/Abstract Screening	Records were advanced to full-text review where the title/abstract indicated: • The population included prisoners, or individuals in jails, custodial settings, or correctional facilities

	• Administration of a cognitive test or screening measure was reported or implied *Confirmation of a validated tool and an extractable older-prisoner data set was deferred to full-text review.*
Full-Text Screening	**Inclusion criteria — studies were required to:** (a) include adults aged ≥50 years in a prison, jail, custodial setting, or correctional facility (lower threshold of 45 years accepted where participants were identified as an 'older' prisoner group with extractable data) (b) report administration of a validated cognitive screening tool (e.g. MoCA, 6-CIT, MMSE, ACE, BNCE) with extractable data for the older prisoner population (c) employ a single-group, cross-sectional, or cohort design, or report baseline data from a longitudinal study, with or without a comparison group (younger prisoners and/or age-matched community samples) (d) be published in English **Exclusion criteria — studies were excluded if:** (a) incarceration was a historical exposure only (b) a cognitive screen was used as an inclusion or exclusion criterion and did not provide extractable data.

Screening cut-offs

In the included studies, the cut-offs for impairment on cognitive tests varied. The screening tools used also differed across studies. This review reports the cut-offs applied within each paper, supplemented by cut-offs recommended in existing and emerging literature in the prison population. The MoCA uses a <26 cut-off for the general population but has been validated in prison populations with a cut-off ≤23 (Ahalt et al., 2018; Baillargeon et al., 2023; Forsyth et al., 2025; Pereira et al., 2023). For the MMSE cut-offs <26 are typically used in community samples. It has not been validated for the prison population, but a recent review recommends a cut-off of <24 or <23 (Iloabachie et al., 2025) which is supported by prison research (Fazel et al., 2002; Hayes et al., 2012). Different versions of the ACE have different cut-offs, for the ACE-III and ACE-R the cut-offs are either ≤88 for suspected MCI or ≤82 for suspicion of dementia. The Mini-ACE (M-ACE) is a shorter test with a maximum score of 30, and the cut-offs used are ≤25 for typical populations or ≤21 in clinical and prison populations (Forsyth et al., 2025; McCarthy et al., 2024; Modini et al., 2025; Rodriguez et al., 2017). A cut-off of >7/8 for MCI is used for

the 6-CIT in clinical settings (Abdel-Aziz & Larner, 2015; O'Caoimh & Molloy, 2023; Tucker et al., 2021). Table 2 shows descriptive properties of the above psychometrics used in this review.

Table 2 Psychometric Properties of Cognitive Screening Tools

Tool	Items / Max Score	Example Items	Internal Consistency	Test-Retest Reliability
MMSE (Folstein et al., 1975)	11 items / 30	Orientation (time, place); registration of 3 words; serial 7s subtraction; delayed recall of 3 words; naming; 3-stage command; copying intersecting pentagons	α = .68–.77 across validation samples	r = .88 to r = .82
MoCA (Nasreddine et al., 2005)	30 items / 30	Trail-making task; cube copy; clock drawing; 5-word delayed recall; serial 7s; sentence repetition; verbal fluency; abstraction (similarities)	α = .83	r = .92
ACE-III (Hsieh et al., 2013, Larner & Mitchell, 2014)	20 items / 100	Orientation/attention; name/address recall; category and letter verbal fluency; naming; reading irregular words; clock drawing; overlapping pentagons	α = .71 to .87 across validation samples	Not reported
ACE-R (Mioshi et al., 2006)	5 sub-domains / 100	Orientation/attention; memory (name/address recall); verbal fluency; language; visuospatial (clock drawing, pentagons)	α = .8	Not reported (omitted by authors)
M-ACE (Hsieh et al., 2015)	5 items / 30	Time orientation; name/address immediate and delayed recall; animal verbal fluency; clock drawing	α = .83	Not reported
6-CIT (Brooke & Bullock, 1999)	6 items / 28	Orientation (year, month); repeat name/address memory phrase; count backwards from 20; months of year in reverse; delayed recall of memory phrase	Not reported	Not reported
BNCE (Ball et al., 2009)	10 subtests	Orientation; presidential memory; naming body parts; simple commands; copy a closed figure (Part I); months backwards; incomplete pictures; verbal similarities; digit tracking; working memory recall (Part II)	Not reported	Not reported

Note. α=Cronbach's alpha; r=Pearson/Spearman correlation coefficient reported in citation. (Ball et al., 2009; Brooke & Bullock, 1999; Folstein et al., 1975; Hsieh et al., 2015; Hsieh et al., 2013; Larner & Mitchell, 2014; Mioshi et al., 2006; Nasreddine et al., 2005).

Quality appraisal

Methodological quality was appraised using the Joanna Briggs Institute (JBI) cross-sectional checklist (Barker et al., 2026) and the JBI prevalence checklist (Munn et al., 2020). Quality appraisal was conducted by the lead reviewer (CDC), a second reviewer (RO) independently appraised two included studies accounting for approximately 14% of the included papers. Using Rayyan the reviewers selected a randomised sample from the papers to reduce possible bias. For one paper, appraisal differed on item 3 (whether exposure was measured in a valid reliable way), which was resolved through discussion, all other items were similarly rated by both reviewers. The remaining 12 studies were appraised by the lead reviewer. Studies were not excluded based on quality appraisal ratings. Ratings were used to contextualise findings during synthesis.

Data extraction

A structured data extraction form was created comprising 49 fields across seven sections. This is summarised in the 25 columns in Appendix 1 (Tables 1a and 1b). The sections were: study identification, study design and setting, participant characteristics, cognitive screening tools and scores, context and generalisability, outcomes and synthesis, and quality appraisal. Where any required data was not available in the report, authors were contacted to request additional information.

Results

Data synthesis and analysis

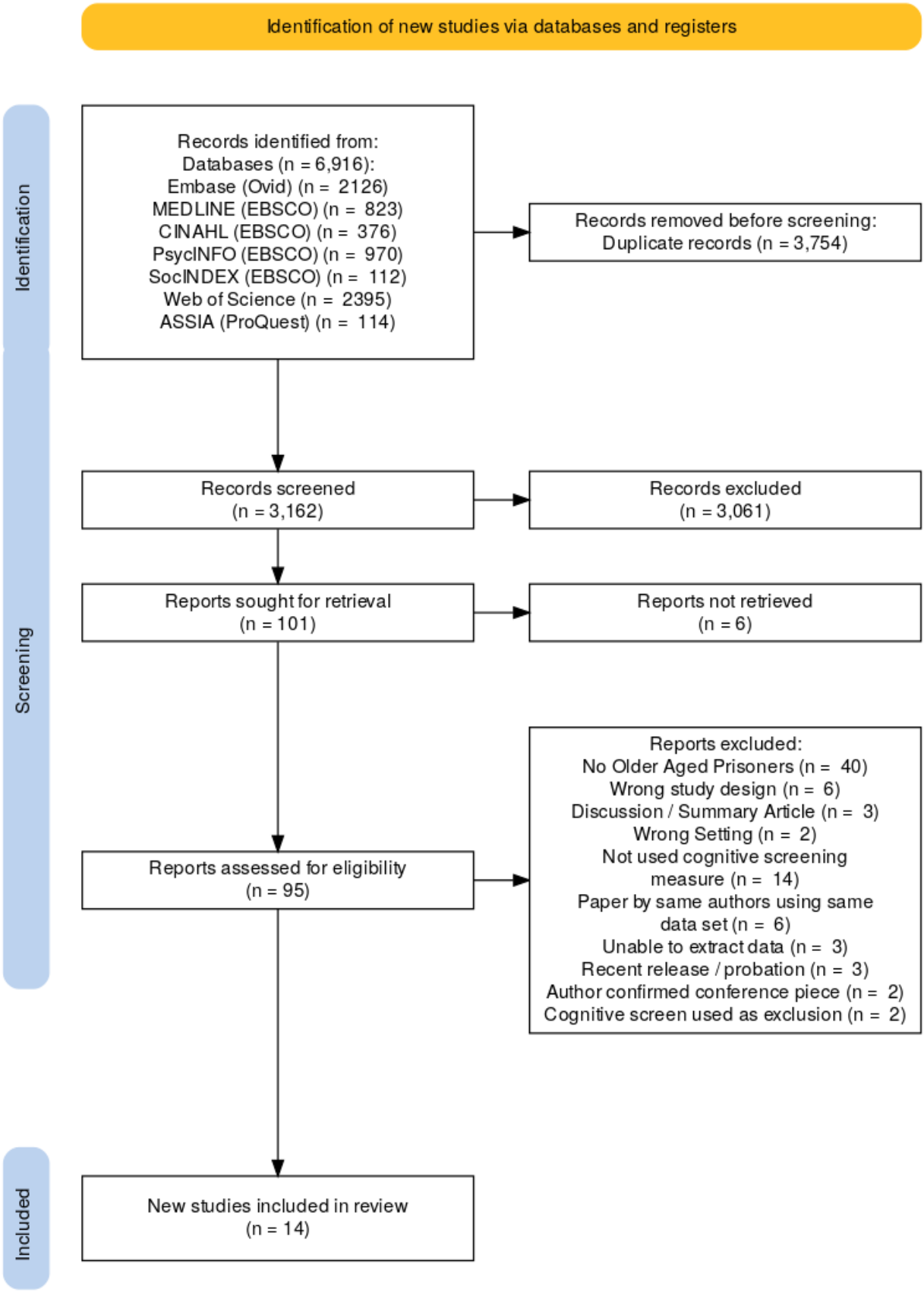
A narrative synthesis was the primary method of data synthesis. It was organised using a three-tier hierarchy reflecting the type of quantitative data available across the included studies. Tier 1 comprised of studies reporting means and standard deviations and a comparison group of younger prisoners or a community sample. Tier 2 comprised of studies that reported means and standard deviations without a comparison group and Tier 3 comprised of studies which reported prevalence of cognitive impairment at a defined threshold only and did not include complete descriptive statistics.

The criterion for meta-analysis was having three or more studies using the same cognitive screening tool. Heterogeneity was evaluated using the I^2 statistic applying the thresholds proposed in the Cochrane Handbook (Deeks et al., 2024; Higgins & Thompson, 2002). Where heterogeneity was considerable pooled estimates were not reported as primary findings.

Database searches conducted on 2nd May 2026 across seven databases yielded 6,916 records. Following the identification and removal of 3,754 duplicate records, titles and abstracts were

screened for 3,162 records, of which 3,061 were excluded as ineligible, the remaining 101 records were sought for full text retrieval. Authors of six papers that were not accessible through the university, were contacted by the lead researcher; six papers could not be retrieved and were excluded at this point. Full text assessment of the remaining 95 records against the eligibility criteria resulted in a further 81 being excluded, the reasons were no older adult prison population (or extractable data for this population) (*n*=40), no valid cognitive screening test used (*n*=14), wrong study design (population data or qualitative designs, *n*=6) and duplicated datasets from the same authors (*n*=6). Manual hand searching of grey literature including government databases and Google Scholar alongside forward and backward citation searches yielded no further papers. Full search terms for each database and grey literature are in Appendix 1.2. In summary, 14 studies met eligibility criteria and were included. A full breakdown is presented in the PRISMA flow diagram (Figure 1).

Figure 1. PRISMA Flow Chart



Study characteristics

Fourteen studies published between 2002 and 2025 were included in this review, eleven of which were published from 2016 onwards, reflecting a growing research interest in this area. Studies were conducted in five countries, the United Kingdom (*n*=5, England and Wales), the United States of America (*n*=3; USA), Germany (n=2), Australia (*n*=3), and France (*n*=1). All included studies were conducted with participants while they were in prison.

The predominant study design was cross sectional; one used a feasibility design (Verhülsdonk et al., 2023b), one examined the social care needs of older prisoners with extractable data of the cognitive screen as a secondary outcome (Tucker et al., 2021) another assessed psychiatric characteristics of elderly sex offenders which had extractable data for a cognitive screen (Fazel et al., 2002). The combined sample of older prisoners totalled 2,828 of which 2,786 completed a cognitive screening test. Sample sizes ranged from 18 to 869 participants.

The age threshold used to define 'older prisoner' varied across the studies. Eight used a threshold of ≥ 50 years (Baidawi et al., 2016; Combalbert et al., 2018; Forsyth et al., 2025; Hayes et al., 2012; Kingston et al., 2011; Modini et al., 2025; Perez et al., 2021; Rodriguez et al., 2017), four used ≥ 55 years (Ahalt et al., 2018; Baillargeon et al., 2023; Tucker et al., 2021; Verhülsdonk et al., 2023b) and two used ≥ 60 years (Fazel et al., 2002; Verhülsdonk et al., 2021). Where reported in the studies the mean ages ranged from 56.4 to 67.86 (Modini et al., 2025).

Nine studies had only male participants, five included older female prisoners and the percentage of females ranged from 5% (Ahalt et al., 2018) to 31.4% of the sample (Forsyth et al., 2025).

One of the studies warranted a note regarding the extractable sample. Of the 100 participants recruited, 12% were engaging in a community intervention for historic sexual offences, and data was extractable for the remaining 88% (*n*=64) who met the inclusion of being in custody at the time of the cognitive screening (Rodriguez et al., 2017).

Four validated cognitive screening tools were used in the 14 studies, these were; the Mini Mental State Examination (MMSE) (*n*=7), the Montreal Cognitive Assessment (MoCA) (*n*=4), the Addenbrooke's Cognitive Examination (ACE) in different versions (ACE-III, M-ACE, ACE-R) (*n*=2) and the Six Item Cognitive Impairment Test (6-CIT) (*n*=1). Forsyth et al., (2025) administered the MoCA and the ACE-III. The included studies were assigned to one of the three tiers based on how they addressed the aim of this systematic review study. Two studies met criteria for Tier 1, five for Tier 2 and seven for Tier 3. The study characteristics are presented in Appendix 1, Tables 1.1a and 1.1b. Therefore, while the comparison group is useful for contextualising Combalbert's findings that older prisoners performed more poorly on cognitive

screening, it should be interpreted cautiously when used as a visual reference point for the other studies included in this review. For this reason, the Combalbert et al, community mean was used as a descriptive reference line in the below visual rather than as a formal benchmark for comparison across the wider evidence base.

Quality Appraisal

Ratings of JBI appraisal checklists are presented in Appendix 1, Tables 2a and 2b. Of the studies appraised with the JBI cross sectional tool, five were rated as high (≥6) (Ahalt et al., 2018; Baidawi et al., 2016; Baillargeon et al., 2023; Combalbert et al., 2018; Perez et al., 2021) and three of moderate quality (4-5/8) (Fazel et al., 2002; Rodriguez et al., 2017; Verhülsdonk et al., 2021). Of the six studies appraised using the prevalence checklist, three were rated as high (≥7/9) (Forsyth et al., 2025; Hayes et al., 2012; Modini et al., 2025) and three as moderate quality (5-6/9) (Kingston et al., 2011; Tucker et al., 2021; Verhülsdonk et al., 2023b). No study was rated as low quality. Across the studies, the most consistent limitation regarding methodology was insufficient description of the prisons, the testing environments and the qualifications or training of those administering the cognitive screening tools, and were appraised as 'unclear' on the checklist. Several studies did not include the means, standard deviations (*SD*), medians or confidence intervals for the screening outcomes, particularly when the cognitive screening tool was a secondary aim of the research (Fazel et al., 2002; Hayes et al., 2012; Tucker et al., 2021). Confounding variables were often identified in the research but were inconsistently addressed when applying statistical tests, particularly when they were not considered in relation to the primary aim involving MCI prevalence (Baidawi et al., 2016; Fazel et al., 2002; Rodriguez et al., 2017). The lowest rated study (Rodriguez et al., 2017) was rated as 'unclear' for four ratings, reflecting limited descriptions of confounding variables, testing conditions, reasons for missing data, the prison and the test setting. The additional tables of distribution of scores and confounding variables referred to by Modini et al. (2025) were inaccessible but did not affect the ratings given.

Meta analysis feasibility and results

A random effects pooled prevalence estimate was computed for the MoCA studies (k=4) (Ahalt et al., 2018; Baillargeon et al., 2023; Forsyth et al., 2025; Perez et al., 2021), using the Freeman-Tukey double arcsine transformation, which yielded a pooled estimate of 32.5% (95% CI: 13.7-54.9%). However, heterogeneity was considerable (I^2 = 98%), the I^2 statistic quantifies the proportion of variability across studies attributable to genuine between-study differences rather than sampling error. Values of 75-100% are classified as considerable, and this pooled estimate

should therefore be interpreted with caution. Given this level of heterogeneity formal meta-analysis was therefore not taken further, and narrative synthesis was adopted, consistent with Cochrane guidance (Deeks et al., 2024; Higgins & Thompson, 2002). No other screening tool group reached the minimum $k \geq 3$. The MMSE studies (k=7) use different cut-offs for impairment (≤24 and ≤26) with no more than two studies using the same cut-off.

For MMSE studies that reported means and standard deviations (k=5) individual study means with ±1 standard deviation (*SD*) were calculated and are presented as a descriptive means plot. These were presented rather than confidence intervals because the purpose was to show the within sample spread of cognitive scores for each study. As no other screening tool reached the minimum of three or more studies with a comparable cut-off, a formal meta-analysis was not feasible for any screening tool. Narrative synthesis was consequently adopted as the primary approach consistent with PRISMA-2020 guidance (Page et al., 2021).

Narrative synthesis

Tier 1 (*M* & SD comparison of prisoners with age-matched community comparison group) (k=2)

Combalbert et al. (2018) provided a clear comparison group, making it a methodologically informative source of evidence for addressing the first review question. This study recruited 138 older male prisoners age ≥50 (*M*=59.71, *SD*=8.01) from French custodial facilities and compared their MMSE performance against 138 age-matched men in the community. Prisoners scored significantly lower than the community group on the MMSE. The prisoners had a mean MMSE score of 26.33 (*SD*=3.83), compared with 28.99 (*SD*=1.31) in the community sample. This difference in mean scores was statistically significant (Anova, $F(1; 274) = 59.2$, $p < .0001$). The wider standard deviation in the prisoners group indicated greater heterogeneity in the MMSE scores, with the lower tail of scores extending into the clinically abnormal range. A similar pattern was observed for executive functioning. Prisoners had a lower mean score on the Frontal Assessment Battery (FAB) than the community sample 13.6 (*SD*=3.86) versus 16.54 (*SD*=1.66), which was significant ($F(1,272)=67.5$, $p < .0001$). Educational attainment significantly moderated MMSE performance within the prisoner group ($F(2,135)=7.98$, $p<0.001$) with those who had not completed secondary school scoring lower on the MMSE compared to participants who had competed secondary school and sought further education. There was no significant difference in years of schooling in the community group ($F(2,135)=1.55$, $p=0.22$). Among those with below secondary school level education, the community groups MMSE mean (*M*=28.91)

remained roughly 3-points higher than the prisoners (*M*=25.63). This study was rated using the JBI as high quality (7/8).

The community comparison group in Combalbert et al (2018) were recruited from the general population in different regions of France including urban and rural areas, half recruited by general practitioners and half through acquaintance networks. The participants were community-dwelling rather than living in care homes and had no criminal records. This sample provided a relevant same country community-based comparison for the French prisoner sample. However, the community comparison group was older (*M*=68.4, *SD=8*) on average than the prisoner group (*M*=59.7, *SD=8)*, and the groups also differed significantly in educational attainment with fewer prisoners having completed secondary school or sought further education.

Baidawi et al., recruited 173 older prisoners aged ≥50 (*M*=63.1, *SD*=8.3) from Australian prisons. They compared them to younger prisoners in the same prisons (*N*=60, aged 21-49) on demographic factors and measures of cognitive functioning using MMSE, psychological distress (K-10 scale, (Kessler et al., 2002)), and diagnosis of mental health. The younger prisoners (*M*=26.9, *SD*=3.04) performed better than the older prisoners (*M*=26.80, *SD*=3.17) on the MMSE. This effect was more pronounced when looking at numbers scoring below the cut-off of <23 on the MMSE (younger prisoners *n*=8, 13.3%; older prisoners *n*=26, 15.3%). This study was rated as high quality 6/8.

<u>Tier 2 Comparison of MMSE scores (M & SD) in studies without community comparison (*k*=5)</u>

Means and +/- 1 standard deviation are presented for individual studies in Figure 2 as visually descriptive rather than a formal meta-analysis because of the studies heterogeneity of the studies and because effect sizes cannot be computed. Standard deviations rather than confidence intervals are displayed as the primary purpose of the figure is to convey within each sample the spread of cognitive screening scores rather than the precision of each study's mean estimate; the spread is clinically relevant in a population where the proportion falling below a clinical cut-off is the key focus. Also included in Figure 2 is a community group reference line from the Tier 1 paper by (Combalbert et al., 2018) whose narrow SD whisker supports its use as a stable reference point, as a wider whisker would have warranted cautious interpretation. Two established MMSE cut-offs (<24 and <26) are also indicated, allowing prisoner sample variability to be viewed from both cut-offs. Several observations emerge from visual inspection. All five older prisoner means fall below the community reference line consistent with the Tier 1 findings. Secondly, the SD bars extend strikingly below the community mean and approach or cross into ranges associated with cognitive impairment reinforcing the clinical importance of the

within sample variability. Moreover, two studies using ≥60 age threshold (Fazel et al., 2002; Verhülsdonk et al., 2021) produce narrow SD's and higher means relative to the ≥50 studies. The community reference line is visually closer to a higher scoring MMSE which visually reinforces the greater cognitive impairment on screening tools in older prisoners. Figure 2 was produced using the Metafor Package (Viechtbauer, 2010) in R (v4.6.0, (R Core Team, 2026; R Studio Team, 2026)), with the data structured using dplyr (Wickham, 2026) and visualised using ggplot2 (Wickham, 2016).

The Tier 2 group of studies (*k*=5), (Fazel et al., 2002; Perez et al., 2021; Rodriguez et al., 2017; Verhülsdonk et al., 2023b; Verhülsdonk et al., 2021) built upon the second question in this review of whether older prisoners perform more poorly than community samples where data is extractable to compare to wider community samples. Three used the MMSE (Fazel et al., 2002; Verhülsdonk et al., 2023b; Verhülsdonk et al., 2021), these findings are used alongside Tier 1 data and presented in the descriptive means plot Figure 2. Across the 3 MMSE studies means range from 27.89 to 28.11, with all falling below the Combalbert et al, community reference MMSE of 28.99. One study within this tier used ACE-R (Rodriguez et al., 2017) and another used the MoCA (Perez et al., 2021) and both are discussed separately.

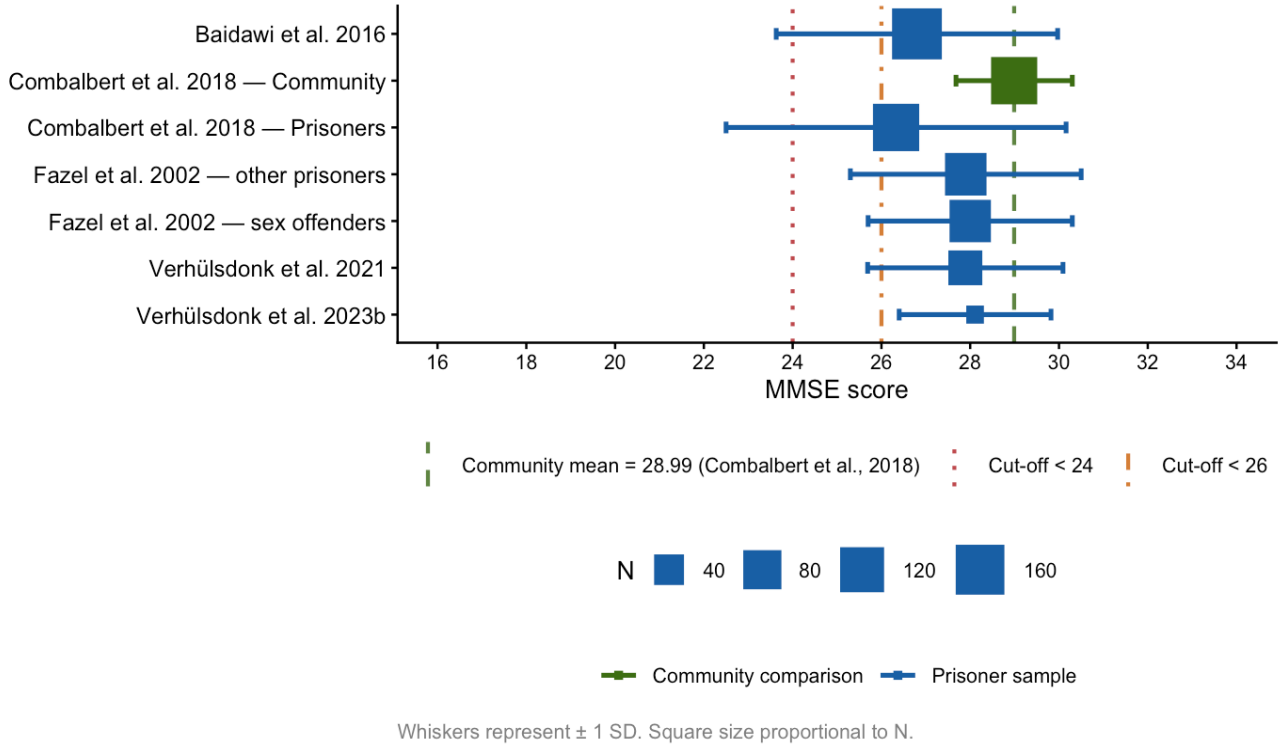


Figure 2: MMSE descriptive means plot with ± 1 SD and reference line of community sample from Combalbert et al., 2018.

Studies using MMSE

Fazel et al., (2002) compared sex offenders (SO *n*=101) to non-sex offenders (NSO *n*=102) among older prisoners (≥60 years) in England and Wales finding no significant MMSE difference between the groups (SO *M*=28.0, *SD* 2.3, NSO *M*=27.9, *SD* 2.6). Both means on the MMSE are higher than those from ≥50 years old studies. While this study only included prisoners over 60 years, regardless of offence, prisoners scored lower on the MMSE than a community based sample (using Combalbert's study). The MMSE was a secondary outcome within this study; although demographic and offence characteristics were reported in detail, there was not demographic breakdown in relation to cognitive test performance, limiting the ability to compare to other studies. The paper was rated to be moderate quality 5/8.

Verhülsdonk et al., (2021) reported a mean MMSE of 27.89 (*SD*=2.20) in a cross-sectional sample of 58 German prisoners aged ≥60 (*M*=65.52, *SD*=6.01). A separate feasibility study by the same author (Verhülsdonk et al., 2023b) conducted in different prisons and at a later time point, reported MMSE data for 18 older prisoners, the smallest sample and highest mean age for Tier 2 studies (*M*=66.17, *SD*=5.64). The 18 prisoners' MMSE scores were *M*=28.11, *SD*=1.71. Although both studies SD's are similar to comparable larger samples (Fazel et al., 2002), their sample sizes are smaller which could risk wider confidence intervals. Both samples were convenience samples which may limit generalisability. Both studies were rated as moderate quality, Verhülsdonk et al., (2021) scored 5/8 and Verhülsdonk et al., (2023b) scored 5/9.

MoCA Study

Perez et al. (2021) screened 239 older US prisoners aged ≥50 (*M*=56.4, *SD*=6.07) and reported a mean MoCA of 24.12 (*SD*=3.38) and 38.5% scored <23. Education and race adjustments were also applied. The impact of adjustments varied substantially by each racial group, applying education and race cut-offs reduced impairment rates from 63% to 19% for Black prisoners, which was a larger adjustment than the 15% reduction in impairment rates of White prisoners. The standard deviation of 3.38 indicates that the distribution of mean MoCA scores extends into the impaired ranges beyond the cut-off of <23 (*M*–1 *SD* = 20.74). The study also administered the Trail Making Test (TMT, (Strauss et al., 2006)) finding differences in executive function performance in each racial group ($\chi^2(2,191) = 4.25$, p=0.039). This paper was rated as high quality (6/8).

ACE-R Study

Rodriguez et al. (2017) compared first-time sex offenders (FTSO) with non sex offenders (NSO) making an extractable group of 64 older aged ≥50 (*M*=61.2, *SD*=7.1) in Australian correctional facilities. FTSO were significantly older than non sex offenders (*M*=63.9, *SD*=7.1 vs *M*=57.3, *SD*= 6.5) and had a lower mean ACE-R score (*M*=87.7, *SD*=10.4, *n*=32) than NSO (*M*=92.5, *SD*=4.1, *n*=32) this difference was statistically significant (p <.001) based on a MANOVA controlling for age. The FTSO mean fell just below the commonly used ACE-R cut-off of <88. However, the study did not report the proportion of participants scoring below the threshold in each group so it cannot be confirmed from the reported means whether a greater proportion of FTSO met criteria for impairment, therefore this interpretation should be treated with caution. The largest standard deviation in the FTSO group also indicates greater within-group variability in cognitive performance. Overall, this study provides evidence of a statistically significant age adjusted difference in ACE-R performance between FTSO and NSO. Although, this is limited by the sample specific offending groups and smaller sample size. This paper was rated as moderate quality (4/8).

Tier 3 studies – Prevalence studies (*k*=7)

Although Combalbert et al. (2018) is discussed as a Tier 1 study due to providing means and SD with a community comparison group, it also reported categorical prevalence data. Using the MMSE cut-off of <23, 18.8% of prisoners scored below cut-off compared to just 0.72% of the community comparison group. The difference was tested using a chi square (χ^2 (2) = 44.86, *p* <0.0001).

Seven of the 14 studies reported MCI prevalence data only, these are grouped by screening tool used.

MoCA studies (*k*=3)

Ahalt et al. (2018) screened 310 older prisoners aged ≥55 (*M*=59.2, *SD*=7.4) in San Francisco, USA using education and race adjusted MoCA scores. MCI prevalence was high across all cut-offs used; 78% scored <26, 49% scored <23 and 25% scored <20. Scoring below 20 is a cut-off associated with dementia. This study was rated as high quality (7/8) because it considered the potential confounding variables of race and education in prison populations and adjusting for this.

Baillargeon et al. (2023) administered the MoCA to 143 older US prisoners aged ≥55 (*M*=61.3,

SD= 5.5). Reporting a mean of 23.3 (median 24.0) and no standard deviation making it impossible to understand the distribution of data, and therefore it is included in the Tier 3 category. Of those tested 35% met the screening cut-off <23 and 25.9% scored within the MCI category below 23 (range 18-22). This paper was rated as high quality (7/8).
Forsyth et al. (2025) is the largest study in this review (*N*=869 aged ≥50) and the only MoCA study conducted in the United Kingdom (England and Wales); this paper reports a much lower prevalence of 12% at ≤23 for older prisoners. This paper was rated as high quality (7/9).

MMSE studies (*k*=2)
Hayes et al. (2012) reported that 7% of 262 English prisoners aged ≥50 scored below a cut-off of 24 on the MMSE. This study recruited across all 13 accessible prisons in one large area of the northwest of England, specifically to compare the health needs across age bands from 50+ years through to 70+ and to test the utility of an age 50 cut-off for defining 'older prisoners'. Response rates were high, between 75% and 80% in the 50 and 60 age brackets. This paper was rated as high quality (8/9).

Kingston et al. (2011) reported that 13% of the 121 English prisoners aged >50 scored below the higher cut-off of ≤26 on the MMSE a threshold more commonly used in non-prison populations (Fazel et al., 2002; Iloabachie et al., 2025). This study recruited from four prisons within a single NHS trust catchment area in Staffordshire and had a lower response rate of 51% which the authors acknowledge as a limitation. Both figures are lower than the US estimates. In both studies cognitive screening was a secondary outcome within a broader psychiatric or health needs assessment. Consequently, neither study reported the mean or standard deviation MMSE scores or analysed the cognitive impairment scores which limits comparability with studies where cognitive screening was the primary focus. This paper was rated as moderate quality (6/9).

Other screening tools (6-CIT, ACE-III and M-ACE) (*k*=2)
Another study in English prisons (Tucker et al., 2021) used the 6-CIT with 75 prisoners aged ≥55. They found that 20% (*n*=15) scored ≥8 which is the cut-off used to indicate possible MCI and the need for a dementia assessment (Brooke & Bullock, 1999). As the 6-CIT cut-off is suggestive of dementia, the true MCI rate (score >10) may be higher, but this is not reported in the study. This paper was rated as moderate quality (6/9).
Another study (Modini et al., 2025) administered the ACE-III and M-ACE to 114 older prisoners aged ≥50 (*M*=67.86, *SD*=8.53) in Australia. The different versions of the ACE have different cut-off scores. For the ACE-III and ACE-R the cut-offs are either ≤88 for suspected MCI or ≤82 for suspicion of dementia, and for the shorter M-ACE the cut-offs used are ≤25 for high sensitivity

and initial assessment or ≤21 in typical clinical or prison populations (Forsyth et al., 2025; McCarthy et al., 2024). Modini et al, (2025) report that following review with a psycho-geriatrician, 8% received a confirmed dementia diagnosis. However, the positive predictive value of screening alone was 23%-25% using the ACE-III cut-off of <82 and using the M-ACE cut-off of ≤21. This indicated that among those who screened positive, only around a quarter were confirmed to have dementia. The authors reported that approximately 16% of those scoring below cut-offs could have been from false positives (due to poor effort or alcohol-related acquired brain injury). Highlighting a limitation of using screening cut-offs alone for prevalence estimates without further clinical assessment. This prevalence rate is numerically closer to UK estimates of 7%-13% (Forsyth et al., 2025; Hayes et al., 2012; Kingston et al., 2011). The Modini et al paper was rated as high quality (8/9).

In summary, the Tier 3 MCI prevalence estimates range from 7% to 49%; both the lower estimate (Hayes et al., 2012) and the highest estimates (Ahalt et al., 2018) come from high quality studies. The wide range in prevalence estimates may reflect differences between screening tools and the applied cut-offs, although differences may also be due to confounding variables such as cultural differences. This is most notable between the USA MoCA based estimates and the UK's MMSE based estimates rather than differences in the quality of the papers. The two moderate qualities within this tier produced estimates in the middle of the range of prevalence (13% and 20%).

Discussion

This systematic review identified and synthesised 14 studies examining cognitive screening performance in older prisoners across five countries. Findings suggest that cognitive impairment is clinically meaningful among older prisoners, though estimated rates varied by study design, screening instrument, cut-offs and population characteristics. Using a three-tiered hierarchy, findings consistently indicated that cognitive screening performance in older prisoners falls below that of age-match community peers and younger prisoners where comparisons were available. Tier 1 studies provided the most direct comparative evidence in this review. Tier 1 data showed older prisoners having lower scores, rates of performance were similarly low in Tier 2 studies without control groups and higher prevalence in Tier 3. Across Tier 3 studies, estimates ranged from 7% to 49% at varied cut-offs, substantially exceeding the estimated global community prevalence of MCI in older adults (15%). This review is complementary to existing reviews looking at dementia and screening tools in prisons (Brooke et al., 2020; Iloabachie et al., 2025). Across all Tier 2 MMSE studies, a consistent pattern is emerging older prisoners scoring more poorly than expected on the MMSE, than wider literature providing means for older people

in the community. This coupled with the wider range and standard deviations reflects the heterogeneous cognitive profiles of this older prison population compared to community samples.

A key finding was the variety of tools used: four validated cognitive screening tools were represented, each differing in sensitivity and cut-offs. The MMSE was most frequently used, and while this is widely used and easily administered, it is less sensitive to MCI than tools such as the MoCA and ACE (Pendlebury et al., 2012; Siqueira et al., 2019), which may explain lower prevalence estimates (Iloabachie et al., 2025; Pereira et al., 2023). This is relevant in prisons where difficulties in planning, memory, communication and problem solving carry important functional consequences. Older prisoners may already struggle with functioning in the prison setting, such as getting up flights of stairs, climbing into top bunks and walking long distances to vocational wings (Mofina et al., 2022; Williams et al., 2006). Variation within cut-offs further complicates interpretation as several MoCA and MMSE studies used different cut-offs, lower cut-offs in prison research reflects concerns and research that community based thresholds may overestimate the impairment in prison populations which are characterised by higher rates of health and social adversity alongside lower educational attainment (Ahalt et al., 2018; Forsyth et al., 2025; Perez et al., 2021; Washington, 2023). However, the opposite should also be acknowledged, in applying lower prison specific cut-offs this may reduce false positives, but could miss individuals with subtle but significant cognitive difficulties and this is clinically important as one cut-off is not applicable to all prisoners or clinical patients (Dautzenberg et al., 2022; Wong et al., 2015). Screening is not intended to diagnose but identify people who may need further assessments support or adjustments. The inconsistency in the cut-offs used in the studies highlighted the within tool variability, which led to this review being unable to complete a meta-analysis and is a challenge for meaningful interpretation of the research literature.

Variability in age thresholds reflects ongoing debate about which age constitutes ‘older’ in custodial settings, ≥50 years is the most widely used in the UK (House of Commons, July, 2020), though it is not universal and the variation has implications for estimating prevalence. For example, studies with over 60s may capture a narrower population than over 50s. One study found higher MMSE scores in over 60’s, cautiously inferring that those living longer in prison could represent a cognitively preserved subgroup where more severely impaired or functionally disabled individuals may have been transferred to other settings, released on compassionate grounds or deceased (Kaiksow et al., 2023; Novisky et al., 2025)

Influencing factors

Combalbert et al. (2018) identified a significant association between education and MMSE performance in the prisoner group, an association absent in the community group, suggesting education influences screening scores in the custodial settings and should be considered when interpreting unadjusted scores. Nevertheless, lower scores in the prison population should not be dismissed as solely due to educational differences because cognitive screens measure a range of abilities that are relevant. This is applicable in the UK, where 47% of prisoners have no prior qualifications (Parliament UK, 2020). Included samples were predominantly male, consistent with the global prison population where women represent approximately 6.8% of those incarcerated (Fair & Walmsley, 2025). Forsyth et al. (2025) was the only study with a substantial female representation; however, no comparison on the screening tools were reported. This represents a significant gap for future research.

Findings also suggested differences between countries and prison systems, USA samples reported higher impairment rates (35-49%) compared to the UK (7-13%). USA prison populations are characterised by higher rates of low educational attainment and greater racial diversity (Ahalt et al., 2018; Baillargeon et al., 2023; Perez et al., 2021) compared with Australia, France, Germany and UK populations (Combalbert et al., 2018; Fazel et al., 2002; Forsyth et al., 2025; Modini et al., 2025; Verhülsdonk et al., 2021). Healthcare systems also differ. UK prisoners are legally guaranteed NHS care equivalent to the community, potentially mitigating risks through medication and routine health checks (First Step Alliance, 2024); whereas, USA prison healthcare operates under the more restrictive, cost-driven 'deliberate indifference' standard established by court case (Estelle v Gamble, 1976). Notably, the UK evidence base is predominantly English, with no studies identified from Scotland or Northern Ireland, meaning the available evidence does not capture the full diversity within British custodial contexts.

The quality appraisal strengthened confidence in the studies' sampling and inclusion criteria and data analyses. The critical appraisal also identified some limitations in the evidence base, such as a lack of detail on the testing location, prison environment and the qualifications or training of those administrating the tools. These factors are important because research suggests cognitive screening is affected by situational factors, such as the setting, noise, and mental health (Dupuis et al., 2016; Kriesche et al., 2023; Tian et al., 2025; Xue et al., 2025). A few of the included studies treated cognitive screening as a secondary outcome which limited the reporting of means and standard deviations. In addition, confounding variables such as education, ethnicity, substance use and head injury were often identified in the sample, but at times inconsistently

adjusted for. Overall, these limitations reduce the comparability to wider prevalence estimates, and findings should therefore be interpreted with caution.

Policy implications

The emerging evidence from studies which employed dementia level cut-offs suggests a meaningful proportion of older prisoners may fall within the dementia range of impairment (Ahalt et al., 2018; Baillargeon et al., 2023; Tucker et al., 2021). These findings carry direct implications for custodial settings and the right for those in prison to access healthcare that is equivalent to that in the community (Lines, 2008; Prison Advice and Care Trust, 2026). Although there is not a wider agreement of which tool and what cut-off is best used in prison populations, this review highlights recommendations which support existing literature and previous systematic reviews, that routine cognitive screening of older prisoners is needed, using a validated tool administered by trained staff (Brooke et al., 2020; Forsyth et al., 2020; MacRae et al., 2025). In addition, further assessment by a geriatrician following screening can confirm possible diagnosis, highlighting that screening alone should prompt follow-up assessment and routine screening pathways in custody (Modini et al., 2025).

Limitations

Cross-sectional study designs prevent observing cognitive decline over time in custodial settings for individuals. The heterogeneity across studies did not allow for formal meta-analysis. Quality appraisal was predominantly single reviewer and the restriction of English language only publications may have excluded relevant research in other languages. Future research should prioritise the standardisation of cognitive screening approaches in older prisoner populations including a consensus on appropriate tool selection, age thresholds and adjustments for confounding variables such as ethnicity, education or head injury. Further research worldwide accessing older females, and diverse populations needs to be prioritised.

Conclusion

This review found that cognitive impairment is highly prevalent among older prisoners, though estimates varied substantially across studies due to differences in screening tools, cut-offs, and comparison groups. Narrative synthesis using a three-tier hierarchy further highlighted inconsistency in comparator quality with only one study providing a direct community comparator. Despite this variability, findings across tiers show cognitive screening performance in older prisoners falls below that expected of age-matched community populations, with implications for how custodial and forensic services identify and support cognitively impaired

individuals. Future research should prioritise standardised screening protocols and robust community comparison groups to enable more precise prevalence estimation in this population.

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Chapter 2: Major Research Project

Prevalence of Mild Cognitive Impairment and Associated Risk Factors in Scotland's Prisons

Prepared in accordance with the author requirements for the journal of Psychology, Crime and Law.
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Plain English Summary

Title: Number of male prisoners over 50 years old with memory difficulties in Scotland.

Background: The number of prisoners aged over 50 years has doubled in the last 15 years, with increasing concern about their health needs. Mild cognitive impairment (MCI) means difficulties in memory or thinking that are greater than expected for a person's age (Rogers et al., 2023). MCI is known to be more common in older prisoners. Research in England and Wales found up to 12% of older prisoners had MCI (Forsyth et al., 2025), but no research has looked at this in Scotland. This study looks at how common MCI is among men over 50 in Scottish prisons and explored factors why someone might be having memory issues such as; head injuries, trauma, heart disease, age, and alcohol or drug use.

Aims: To estimate how many men over 50 years old in prison in Scotland have MCI and what factors make this more likely.

Methods: Sixty five male prisoners aged 50 and over were recruited from HMP's Low Moss and Shotts. Prisoners were invited to take part, unless they were a risk to researchers or themselves. After giving informed consent, each participant took part in a single session which lasted up to 90 minutes, completing a short test of their memory and other questionnaires about their health and substance use. As a thank you, participants received a £1 chocolate bar.

Main findings and conclusions: The study found that most participants (over 75%) showed signs of mild cognitive impairment which is far more than would be expected in the general older adult population. No single factor by itself explained the difficulties, but men with several risk factors were more likely to show poorer memory and thinking than men with fewer risk factors. Drug use, fewer years of education and previous serious head injuries were linked to poorer performance. These findings suggest that mild cognitive impairment is a significant and previously unrecognised issue among older men in Scotland's prisons. The research supports the introduction of routine memory and thinking checks alongside integrated healthcare to help to support a prisoner's health needs in the future.

References: (Forsyth et al., 2025; Rogers et al., 2023).

Abstract

Background: The older population in Scottish prisons is growing. Research in other countries has found a higher prevalence of mild cognitive impairment (MCI) in prisons than in the general population. However, no such research has been conducted in the Scottish prison population.

Aims: To explore the prevalence of MCI and risk factors associated with this in older prisoners in Scotland.

Methods: A cross-sectional study recruited 65 adult male participants aged 50 and over from two Scottish prisons, HMPs Low Moss and Shotts. Participants undertook a single interview lasting up to 90 minutes; the interview involved completion of questionnaires including background information, a cognitive screening assessment and self-report measures of substance use, trauma, mood, head injury and functional needs.

Results: MCI was identified in 78.5% of participants, substantially exceeding community estimates. No single risk factor was significantly associated with binary MCI status, but cumulative risk factors significantly predicted continuous cognitive performance. Problematic drug use and lower educational years were also associated with poorer cognitive performance.

Discussion: These findings provide the first Scottish prevalence estimate for MCI in older prisoners, supporting approaches which consider routine cognitive screening and holistic integrated healthcare approaches for the ageing prison population.

Keywords

Mild Cognitive Impairment, Dementia, Prisoner, Older Adult, Brain Injury, Mental Health

Introduction

Older adults represent the fastest growing age group in the prison population (Ridley, 2022), creating challenges for prison healthcare systems across the United Kingdom (UK) (House of Commons, July, 2020). In England and Wales, prisoners aged over 60 years have increased by 82% in the last decade, with 17% now over 50 years old (Ridley, 2022). A similar trend is evident in Scotland, where the proportion of people in prison aged over 50 has doubled between 2009-2024, reaching 16% in 2024-25 (Scottish Government, 2025). This increase reflects wider demographic ageing and criminal justice factors, including longer custodial sentences and prosecution of historical sexual offences (House of Commons, July, 2020).

His Majesty's Prison and Probation Service (HMPPS) defines prisoners aged 50 years and over as 'older people', reflecting the evidence that people in prison experience accelerated ageing and develop complex health needs earlier than the general population (House of Commons, July, 2020). Older prisoners experience disproportionately higher rates of physical illness, mental health issues and dementia than older people in the community (Davies et al., 2023; Greene et al., 2018; Novisky et al., 2025). In Scotland, adult prison populations report higher rates of mental health and alcohol use disorders than the general population (Gilling McIntosh et al., 2023; Prison Survey Scottish Prison Service, 2024; Scottish Government, 2025). The health inequalities are compounded by the custodial environment, where healthcare delivery comes second to detention (Ginn, 2012; The Lancet Public Health, 2022).

In Scotland, dementia is one of the leading causes of death (ScotPHO, 2024). Cognitive decline, including mild cognitive impairment (MCI) and dementia, is an increasingly important issue for older prisoners (Forsyth et al., 2020). MCI refers to measurable cognitive decline greater than expected for age, which may represent a prodromal stage of dementia (Lopez et al., 2012). Prison life involves multiple factors that may increase the risk of cognitive decline, including inactivity, poor nutrition and depression (Christodoulou, 2012). Early identification is important for care planning and support to limit further deterioration (Jerjes, 2024).

Despite this, dementia in prisons has been described as a 'hidden problem' due to the absence of routine cognitive screening, limited self-report by older prisoners and limited staff training in recognising the early signs (Forsyth et al., 2020). Symptoms of MCI may therefore be misattributed to mental illness or problematic behaviour (Forsyth et al., 2020). In England and Wales, MCI prevalence has been estimated at 7-12% among prisoners aged over 50 (Forsyth et al., 2020), while USA studies report estimates ranging from 35-78% (Ahalt et al., 2018; Baillargeon et al., 2023; Perez et al., 2021). Although methodological differences likely

contribute to this variation, findings consistently suggest older prisoners are at risk of cognitive impairment. However, little is known about the prevalence of MCI in Scottish prisoners.

Findings from English and Welsh samples may not generalise directly to the Scottish prison population given structural differences in health and social care provision between the nations of the UK. Scotland abolished NHS prescription charges in 2011, whereas prescriptions in England are still chargeable for the majority of the population. Scotland also provides free personal care to adults assessed as those needing it, regardless of existing income or savings, whereas the social care in England remains means tested under the Care Act 2014 (Aujla et al., 2023; Scottish Government, 2019). These differences may affect the extent in which health and social care needs including emerging cognitive difficulties are identified and addressed both in the community and in the prison population.

A recent Scottish study highlighted the absence of both early and ongoing cognitive screening in prisons (MacRae et al., 2024). While important, it involved five prisoner interviews and did not provide a prevalence estimate. This represents a gap in prison healthcare planning and dementia policy, particularly given Scotland's strategic focus on early diagnosis, dementia care and post-diagnostic support (Public Health Scotland, 2024; Scottish Government, 2023).

Assessing cognition in prison is further complicated by the high prevalence of factors that may affect cognition such as, substance use, head injury and cardiovascular disease (CVD).

Scottish prisoners are disproportionately more likely to use substances (Toomey et al., 2022). Scotland also has a very different profile of substance use compared with England. Scotland's drug related mortality rate has been reported as approximately 4 times higher than England's and one of the highest in Europe (National Records of Scotland, 2024). Scotland also has the highest alcohol related death rate of the UK (National Records of Scotland, 2024). Substance and alcohol use disorders may contribute to both acute and long-term cognitive impairment (Mills, 2023; Wang et al., 2023). One study found that 31% of people with substance use disorder scored within impairment range on the Montreal Cognitive Assessment (MoCA), highlighting possible effects on brain function (Bruijnen et al., 2019).

Head injury is highly relevant. Meta-analyses report substantially higher rates of traumatic brain injury (TBI) in criminal justice and prison populations than in the community (Farrer & Hedges, 2011; Hunter et al., 2023; Shiroma et al., 2010), with one study of adult male prisoners finding 60% had one or more TBIs (Williams et al., 2010). Scottish research has similarly demonstrated

a significantly higher prevalence of hospitalised head injury in prisoners than in age and socio-demographically matched community sample (McMillan et al., 2019), and repeated head injuries have been associated with persistent cognitive difficulties (McGinley & McMillan, 2019; McMillan et al., 2021; McMillan et al., 2025; McMillan et al., 2023).

CVD is an established risk factor for cognitive decline and vascular dementia (Brain et al., 2023; Kauko et al., 2024; Luo et al., 2025). Prison populations experience high cardiovascular risk, including smoking, poor diet, limited physical activity, chronic stress and reduced access to preventative medicine (Bondolfi et al., 2020). In prisoners aged over 40, biological heart age has been estimated as nine years older than chronological age (Gray et al., 2023), supporting the relevance of CVD when examining MCI in older prisoners.

Psychological trauma and mental health issues are common in prisoners (Tyler et al., 2019). Depression and chronic psychological distress are associated with impairments in a range of cognitive domains (Kriesche et al., 2023; Tian et al., 2025). Socioeconomic deprivation warrants consideration, as people in prison are disproportionately likely to come from highly deprived backgrounds and experience homelessness (Bashir et al., 2021; Gilling McIntosh et al., 2023; Scottish Government, 2025). Deprivation is associated with poorer health, educational inequalities, exposure to trauma and increased dementia risk across the lifespan (Klee et al., 2023).

There is a significant gap in the literature regarding the prevalence of MCI among older men in Scottish prisons and the extent to which recognised risk factors contribute to cognitive impairment. Without robust evidence, prison services may be limited in their ability to identify needs and support equitable access to dementia pathways. This study addresses this gap by investigating MCI in men aged 50 and over in Scottish prisons. Specifically, it examines the prevalence of MCI using the MoCA, which has been used in prison samples (Forsyth et al., 2025; Pereira et al., 2023; Perez et al., 2021), compared with general population estimates, and explores associations between MCI and potential contributing risk factors including head injury, substance use, socioeconomic deprivation, age, CVD and psychological trauma.

Aims and hypotheses

Aims

This study aimed to investigate MCI in men in Scottish prisons over the age of 50 years.

1. To investigate the prevalence of MCI and how this compares to general population estimates.
2. To explore the association between MCI and possible causal risk factors including age, head injury, cardiovascular disease, substance use, socioeconomic deprivation and psychological trauma.

Hypotheses

1. Prevalence of MCI in older prisoners is higher than in the general population estimates.
2. Causal risk factors such as head injury, substance use, age, CVD, trauma and social deprivation are associated with the presence of MCI.

Method

Ethical Considerations

Prior to ethical approval a Patient and Public Involvement (PPI) session was conducted with an Over-50s group at HMP Shotts. Feedback informed the study posters and participant information sheet. West of Scotland NHS Research Ethics Committee (25/WS/0143) gave approval on 18th September 2025, and Scottish Prison Service (SPS) Ethics approved the project on 6th November 2025 (Appendix 2.2 and 2.3). Given the vulnerability of the prison populations and the potential presence of cognitive impairment particular attention was paid to informed consent procedures. Information sheets were designed to be explained in written and verbal formats; the study was explained verbally once more prior to consent. Participants were made aware they could withdraw at any point and that participation would have no impact on their records, parole hearing or access to healthcare. They were reminded that they could choose to not answer a question or measure if they did not wish to. If a participant was identified as having low cognitive scores or risk of harm to themselves or others, information was shared with prison healthcare teams in line with consent and ethical guidelines.

Study design

The study employed a cross-sectional quantitative design to investigate MCI in older men in Scottish prisons. Data was collected through a face-to-face structured assessment session comprising of standardised instruments and demographic information. The cross-sectional design was considered appropriate as it allowed for the assessment of prevalence and relationships between variables at a single time point in a seldom researched population.

Setting

Data was collected from December 2025 to May 2026 across two Scottish prisons: HMP Low Moss, which holds men on remand or serving custodial sentences including Order for Life Long Restriction (OLRs) which is a lifelong sentence including a minimum time in prison and lifelong risk management (RMA 2022), and HMP Shotts, which holds men serving long-term sentences. HMP Low Moss has an operational capacity of approximately 884 individuals (HMIPS, 2022), and HMP Shotts has capacity for 538 individuals (SPS HMP Shotts, 2026). These sites were selected to capture a broad representation of older male prisoners in different prisons.
At the time of the study approximately 122 prisoners in HMP Shotts were aged over 50, while HMP Low Moss had an estimated 86 prisoners aged over 50.

Participants

Participants were prisoners aged over 50, which is consistent with HMPPS definitions of older prisoners (House of Commons, July, 2020).

Inclusion and Exclusion Criteria

The criteria for the study is presented in Table 1.

Table 1

Inclusion and Exclusion Criteria

Criterion	Criteria
Inclusion Criteria	• Adult males in prison aged 50 years or older • Fluent in spoken English to ensure validity of psychometric testing • Able to provide informed consent to participate
Exclusion Criteria	• Unable or refuse to provide informed consent • Severe communication difficulties which would affect assessment • Severe or acute health conditions preventing participation • Deemed to pose significant risk to researchers or unsuitable for safe 1:1 or 2:1 basis

Sample Size Estimation

Sample size estimation was based on the median MCI of 35.9% reported by six relevant studies which assessed cognitive impairment in prisons (Ahalt et al., 2018; Baillargeon et al., 2023; Forsyth et al., 2025; Kingston et al., 2011; Perez et al., 2021; Verhülsdonk et al., 2021). The prevalence together with precision (confidence intervals, CI) for the older population in the prisons was estimated using G*Power, giving an original target of 93 participants. For the first

research question regarding prevalence, if the prevalence of MCI in this study was similar to the median estimate of 35.9% a sample of 88 participants would provide a precision (95% CI) of ±15% for the estimate. For the second research question, using this median prevalence estimate together with the anticipated mean and standard deviation of the total risk factor score, the required sample size for the regression analysis was calculated as 93 participants, meaning a target sample of 93 was sufficient to adequately power both research questions.

Recruitment Procedure

Recruitment was conducted in collaboration with the Scottish Prison Service (SPS) and NHS prison psychology departments. The research team consisted of two Doctorate in Clinical Psychology trainees with parallel research projects. Prior to data collection both researchers completed mandatory SPS training courses including personal protection training and suicide prevention training.

Participants were recruited through self-selection from advertised posters and information sheets placed in several areas in the prisons including the prison halls, healthcare waiting areas, libraries and group areas. Information was distributed through the prison information channels (PICs) and via word of mouth, supported by the residential officers in the halls. This had been successful in Scottish prisons previously (McMillan et al., 2025). To minimise recruitment bias and stigma associated with cognitive screening, the study was advertised as a project looking into the health and wellbeing of prisoners aged over 50.

Interested individuals were invited to approach staff for further information and were provided with the participant information sheet (Appendix 2.5). Those potentially interested in taking part put their name and prisoner number on the sign-up form sealed in an envelope, which was posted via the internal mailing systems to the psychology department.

Those interested were approached to attend an appointment with researchers in a confidential space on the prison flats; the flats contained a set of rooms to allow staff to have confidential sessions with prisoners. The rooms had a table and chairs, the doors to the rooms had a small window for guards to view inside, if needed. The rooms were across from the desk where officers are based for full view of the wing. Keeping most appointments on the flats allowed for increased safety for the prisoner and researcher and for minimal disruption to the prison regime as participants did not need to be escorted to the healthcare department. The appointment lasted up-to-90 minutes including time for written informed consent to be obtained and the procedure to be explained verbally to support participants with literacy difficulties. Participants were offered breaks to minimise fatigue. The participants were thanked with a £1 chocolate bar.

Prior to data collection researchers accessed 1-hour online training on the MoCA. The trainees collected the same data set across both prisons but addressed different research questions. The researchers observed each other conducting interviews (n=5) at the start of the study to ensure consistency and high inter-rater reliability. Inconsistencies were resolved through discussion with each other and regular supervision with Professor McMillan.

Measures

All questionnaires were presented both verbally and in written form to allow for variations in literacy and potential cognitive difficulties. The assessment included measures for both researcher studies; those relevant to this study are reported here and in Table 2 which includes psychometric properties.

Demographic questionnaire: Duration 3-minutes

A brief demographic questionnaire was used to collect age, ethnicity, previous occupation, educational attainment, medication and diagnoses. Social deprivation was assessed using the Scottish Index of Multiple Deprivation (SIMD) (Scottish Index of Multiple Deprivation, 2020). Possible CVD was recorded through self-report questions relating to previous heart attacks, transient ischaemic attack (TIA), strokes or coronary stents.

Table 2

Psychometric Properties of Measures Used

Measure and Duration	Domains / Content	Scoring and Cut-off	Example Item(s)	Reliability
MoCA v8.3 English (Nasreddine et al., 2005) 10 minutes	Attention, memory, executive function, abstraction, language, visuospatial ability, orientation	Score 0–30; +1 point adjustment for ≤12 years of education. Standard cut-off ≤26; prison-adapted cut-off ≤23 used in this study (Forsyth et al., 2020)(Forsyth et al., 2020). Memory Index Score (MIS) 0–15 derived from delayed recall.	Trail-making task; clock drawing; naming; 5-word delayed recall; serial 7s; verbal fluency (letter B); abstraction (similarities)	α = .83; test-retest r = .92 (Nasreddine et al., 2005).

Measure and Duration	Domains / Content	Scoring and Cut-off	Example Item(s)	Reliability
OSU TBI-ID (Corrigan & Bogner, 2007) 3-5 minutes	Structured interview eliciting cause, number, severity, and timing of lifetime head injuries	Not a numeric score; classification derived from LOC duration and symptom presence. This study classified significant head injury as 2+ symptomatic injuries with or without LOC. Moderate/severe TBI defined by LOC duration (30 min–24 hrs / >24 hrs).	Ask about incidents causing head or neck injury; ask duration of loss of consciousness; ask whether dazed, confused, or experienced memory gaps	Inter-rater reliability high in original validation (Corrigan & Bogner, 2007) test-retest reliability acceptable to high in a prisoner sample (Bogner & Corrigan, 2009). Has been used successfully in Scottish prisons (McMillan et al., 2021; McMillan et al., 2025; McMillan et al., 2023).
PCL-5 (Weathers et al., 2013) 4 minutes	20 items covering the four DSM-5 PTSD symptom clusters: re-experiencing, avoidance, negative alterations in cognition/mood, alterations in arousal/reactivity	0 (not at all) to 4 (extremely) per item; total score 0–80. Score ≥31 used in this study to indicate probable PTSD.	"Repeated, disturbing, and unwanted memories of the stressful experience"; "Feeling jumpy or easily startled"	α = .94; test-retest r = .82 (Blevins et al., 2015).
HADS (Zigmond & Snaith, 1983) 3-5 minutes	Two 7-item subscales: Anxiety (HADS-A) and Depression (HADS-D), items intermingled and worded to exclude physical/somatic symptoms	0–3 per item; subscale range 0–21. Normal 0–7, Borderline 8–10, Abnormal ≥11 (this study used ≥11 as indicating moderate to severe symptoms).	"I feel tense or wound up" (Anxiety); "I have lost interest in my appearance" (Depression)	α = .68–.93 (mean .83) for HADS-A; .67–.90 (mean .82) for HADS-D, across validation literature (Bjelland et al., 2002).
CORE-10 (Barkham et al., 2013) 5 minutes	10 items covering subjective wellbeing, problems/symptoms, functioning, and risk (including one self-harm item).	0–4 per item; total score 0–40. Score ≥11 used in this study to indicate clinical levels of distress.	Items cover low mood, anxiety, coping, and functioning in daily life over the past week	α = .90 (Barkham et al., 2013, original validation); test-retest ICC = .81 (Steverson et al., 2024).

Measure and Duration	Domains / Content	Scoring and Cut-off	Example Item(s)	Reliability
AUDIT (Bush et al., 1998; Saunders et al., 1993) 5 minutes	10 items: 3 assessing alcohol consumption, 7 assessing alcohol-related problems and possible dependence. Wording adapted in this study to ask about alcohol use prior to custody.	0–4 per item (final two items 0/2/4); total score 0–40. Score ≥8 used in this study to indicate hazardous/harmful drinking.	"How often do you have a drink containing alcohol?"; "Have you or someone else been injured as a result of your drinking?"	*α* typically .80–.86 and test-retest *r* typically .80–.90 across validation studies (Saunders et al., 1993).
DAST-10 (Skinner, 1982) 5 minutes	10 items assessing consequences and severity of drug use (excluding alcohol/tobacco). Wording adapted in this study to ask about drug use prior to custody.	Yes/No per item, scored 0 or 1; total score 0–10. Score ≥3 used in this study, reflecting high sensitivity for problematic substance use.	"Have you used drugs other than those required for medical reasons?"; "Are you unable to stop abusing drugs when you want to?"	Moderate-to-high test-retest, inter-item, and item-total reliability reported across validation literature (Yudko et al., 2007).

Note: α = Cronbach's alpha; ICC = intraclass correlation coefficient; LOC = loss of consciousness. Cut-offs listed reflect those applied in this study; The CORE-10 test-retest figure is drawn from a later replication study.

Statistical Analysis

Data was analysed using IBM SPSS v29. Descriptive statistics were computed for all variables. MCI was treated as a continuous outcome using the MoCA. Linear regression examined whether the total number of risk factors (up to 7) predicted whether the older prisoners were more likely to be above the MCI cut-off. Prior to this primary analysis, distribution of the continuous variables and total risk factor score was assessed using Shapiro-Wilk tests. Following linear regression, and adjusting for years of education exploratory analysis examined relationships between the risk factors and MoCA scores. A multiple regression was used to explore each individual risk as predictors.

Results

Demographics

Sixty-five older prisoners participated and were recruited in two Scottish prisons HMP Low Moss (*n*=37, 57%) and HMP Shotts (*n*=28, 43%). A further 20 volunteered but were unable to take part; some were under 50 years (*n*=11), others had been liberated or transferred (*n*=6), others opted-out (*n*=3). Participants ranged from 50 to 88 years old (*M*= 59.65, *SD*=8.67) and self-identified predominantly as White Scottish or British (95.4%) and the remainder as Black or Mixed ethnicity.

Custodial status, sentence length and time served are presented in Table 3. SIMD assessed participants' social deprivation, 67% previously lived in SIMD quintiles 1-2 which are the most deprived in Scotland. Over half the participants were unemployed prior to custody (*n*=34, 52%). Educational disruption was common, thirty-three (51%) reported weekly truancy and three participants had attended a List D school (historic residential schools where children were sent for behavioural reform (Smith, 2022)). Most reported at least one physical health condition (*n*=57, 88%), 26% reported a mental health condition and 21% reported both.

Regarding CVD, 14% (*n*=9) reported previous heart attack and 12% (*n*=8) reported previous stroke. Most were prescribed medications (*n*=58, 89%, *M*=1.91, *SD*=0.96, range 0-4): psychiatric (48%), pain medication (57%), physical health (71%) and substance-related such as methadone/buprenorphine (15%). Demographic characteristics are summarised in Table 3.

Table 3

Demographic and sample characteristics

Variable	Total (*N* = 65)	No MCI (*n* = 14)	MCI (*n* = 51)
Age (years) M;SD	59.65; 8.67	59.36; 6.61	59.73; 9.21
Years of education M;SD	12.02; 3.24	13.36; 2.27	11.65; 3.39
Sentence length (years)[a] M;SD	10.85; 7.18	9.24; 5.47	11.29; 7.58
Time served (years) M;SD	5.48; 6.62	6.27; 8.12	5.26; 6.22
SIMD quintile (n=63)[b]			
Q1 (most deprived)	27 (42.9%)	4 (30.8%)	23 (46.0%)
Q2	15 (23.8%)	3 (23.1%)	12 (24.0%)
Q3	12 (19.0%)	2 (15.4%)	10 (20.0%)
Q4	6 (9.5%)	3 (23.1%)	3 (6.0%)
Q5 (least deprived)	3 (4.8%)	1 (7.7%)	2 (4.0%)

Variable	Total (*N* = 65)	No MCI (*n* = 14)	MCI (*n* = 51)
Custodial status			
Sentenced	54 (83.1%)	11 (78.6%)	43 (84.3%)
Remand	7 (10.8%)	1 (7.1%)	6 (11.8%)
OLR	4 (6.2%)	2 (14.3%)	2 (3.9%)
Previous occupation			
Manager	7 (10.8%)	3 (21.4%)	4 (7.8%)
Technical	8 (12.3%)	5 (35.7%)	3 (5.9%)
Administrative	1 (1.5%)	0 (0.0%)	1 (2.0%)
Skilled/Labour	15 (23.1%)	4 (28.6%)	11 (21.6%)
Unemployed	34 (52.3%)	2 (14.3%)	32 (62.7%)
Truancy frequency			
None	18 (27.7%)	7 (50.0%)	11 (21.6%)
Rarely	10 (15.4%)	2 (14.3%)	8 (15.7%)
Monthly	4 (6.2%)	3 (21.4%)	1 (2.0%)
Weekly	33 (50.8%)	2 (14.3%)	31 (60.8%)
School type			
Mainstream	56 (86.2%)	14 (100.0%)	42 (82.4%)
Mainstream+1:1 support	2 (3.1%)	0 (0.0%)	2 (3.9%)
Specialist	4 (6.2%)	0 (0.0%)	4 (7.8%)
List D	3 (4.6%)	0 (0.0%)	3 (5.9%)

Note. MCI = Mild Cognitive Impairment (MoCA ≤23); SIMD = (Scottish Index of Multiple Deprivation, 2020) of Multiple Deprivation. OLR = Order for Lifelong Restriction. Continuous variables presented as *M*;*SD*. [a]*n* = 54 for sentence length due to remand or OLR [b]Two participants had missing SIMD data.

Prevalence of MCI

As hypothesised MCI prevalence of older men in prison was 78%, (±23% precision width) meaning the true prevalence within this sample is likely to lie between approximately 55% and 100%. Although the window is wider than originally anticipated, reflecting the achieved sample size being smaller than planned, even the lower bound of this range (55%) substantially exceeds general population estimates.

Relationships between MCI and Risk Factors

The mean number of risk factors for those with MCI was 3.53 and was present in 8% to 82% of the individual risk factors.

Cognitive screening

MoCA scores for the full sample ranged from 9 to 28 (Figure 1), and were negatively skewed (skewness = -.913, SE= .297, z=3.08), with Shapiro-Wilk confirming that normality was violated for the full sample (W=.938, df=65, p=.003). When applying the prison-based MCI prevalence cut-off ≤23 (Forsyth et al., 2025; Perez et al., 2021) 51/65 participants scored below cut-off. Normality was violated in both groups (No MCI: W=.801, df=14, p=.005. MCI group: W=.861, df=51, p <.001), justifying non-parametric analysis. The MoCA Memory Index Score (MIS) evaluates delayed recall, with a higher score indicating better performance. Mean MIS score of the full sample was 7.88 (SD=3.69, range 0-15). The cognitive findings are in Table 4 and Figure 1.

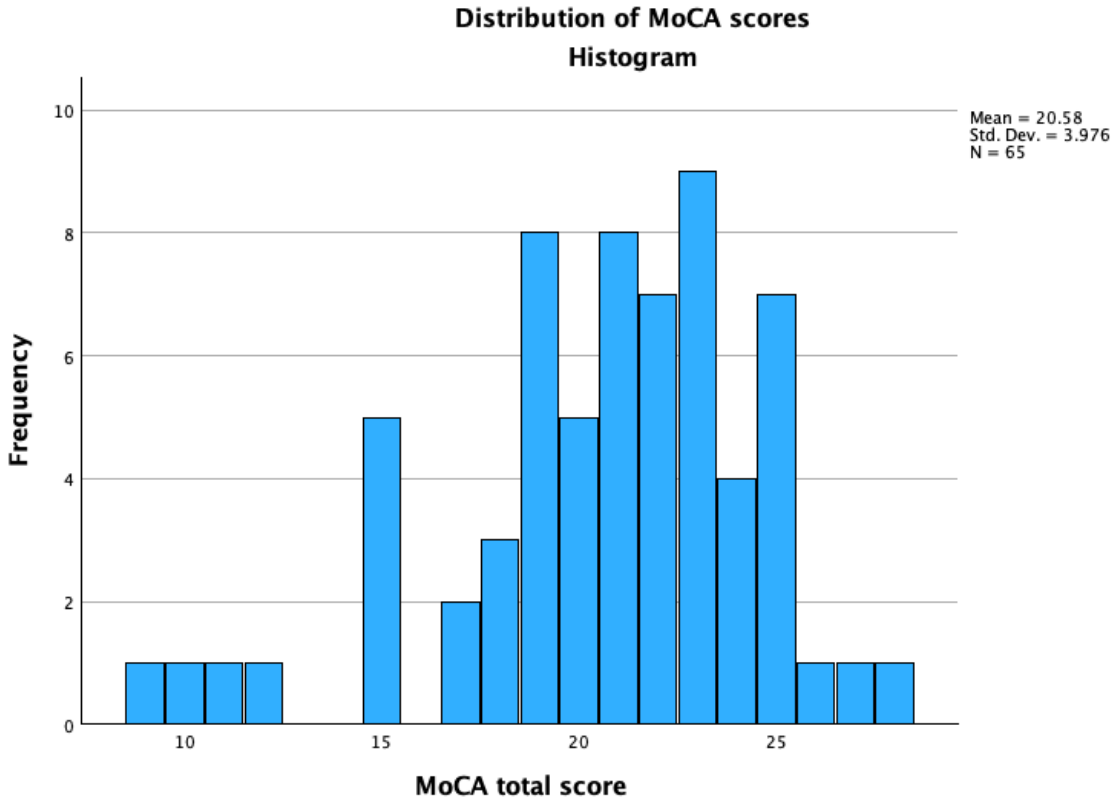
Table 4

Cognitive Screening by MCI Status

Variable	Full Sample (N = 65)	No MCI (n = 14)	MCI (n = 51)
MoCA Score (M;SD)	20.58; 3.97	25.14; 1.16	19.33; 3.53
MoCA Score Median; IQR	21.00; 4	25.00; 1	20.00; 4
MoCA Score range	9–28	24–28	9–23
MoCA MIS (M;SD)	7.88; 3.69	10.29; 3.33	7.22; 3.54
MoCA MIS range	0–15	5–15	0–15
MCI prevalence n (%)	51 (78.5%)	-	-

Note. MoCA = Montreal Cognitive Assessment; MCI = Mild Cognitive Impairment threshold, MoCA ≤23; MIS = MoCA Memory Index Score.

Figure 1. Distribution of MoCA Scores



Head injury

The OSU-TBI indicated a high prevalence of head injury history. Many participants reported at least one head injury (*n*=57, 88%) and 77% met the criteria for the TBI risk factor. Moreover, 71% (*n*=46) reported multiple head injuries (*M*= 4.85, *SD*= 5.39, range 0-25). Loss of consciousness (LOC) was reported in 68% (*n*=44) and 45 (69%) had symptomatic head injuries, through experiences of memory gaps and confusion in the absence of LOC. Over half (52%) had experienced their first head injury at 15 or younger (range 3-53). TBI was more prevalent in the MCI group (41/51, 82%) than the no MCI (8/14, 57%). Head injury characteristics are summarised in Table 5.

Table 5

Head Injury Profile by MCI Status

Variable	Full Sample (*N* = 65)	No MCI (*n* = 14)	MCI (*n* = 51)
Any history of TBI	57 (87.7%)	12 (85.7%)	45 (88.2%)
Multiple head injuries	46 (70.8%)	8 (57.1%)	38 (74.5%)
TBI risk factor[a]	50 (76.9%)	8 (57.1%)	42 (82.4%)
Moderate/severe TBI	29 (44.6%)	4 (28.6%)	25 (49.0%)
First head injury <15yrs	34 (52.3%)	5 (35.7%)	29 (56.9%)

Variable	Full Sample (*N* = 65)	No MCI (*n* = 14)	MCI (*n* = 51)
Loss of consciousness (LOC)			
Any LOC (yes)	44 (67.7%)	8 (57.1%)	36 (70.6%)
No LOC	21 (32.3%)	6 (42.9%)	15 (29.4%)
<30 minutes	20 (30.8%)	6 (42.9%)	14 (27.5%)
30 min–24 hours	21 (32.3%)	2 (14.3%)	19 (37.3%)
24 hours+	3 (4.6%)	0 (0.0%)	3 (5.9%)
Dazed, confused, or memory gap			
No	15 (23.1%)	5 (35.7%)	10 (19.6%)
Yes	45 (69.2%)	6 (42.9%)	39 (76.5%)
Unsure/Unknown	5 (7.7%)	3 (21.4%)	2 (3.9%)
Total number of head injuries, Mean (SD)	4.85 (5.39)	3.21 (3.02)	5.29 (5.82)

Note. TBI = Traumatic Brain Injury; Percentages reflect column percentages within each group. [a] TBI risk factor = any loss of consciousness (LOC), OR (no LOC) but >2 head injuries with symptomatic effects following McMillan et al. (2025).

Risk factor

Total risk factor scores ranged from 0-6 across the sample (*M*=3.42, SD=1.37), no participant scored the maximum risk of 7. Four factors were present in more than 50% of participants (hazardous alcohol use, social deprivation, TBI and problematic substance use). TBI (77%) and problematic alcohol used (74%) were the most prevalent risk factors, while aged over 80 was rare (6%). Risk factor frequencies are displayed in Table 6.

Table 6

Risk Factor Profile (*N* = 65)

Risk Factor	All (*N*= 65) n (%)	No MCI (*n* = 14) n (%)	MCI (*n* = 51) n (%)
Problematic alcohol use (AUDIT-10)	48 (74%)	11 (79%)	37 (72%)
TBI risk factor[a]	50 (77%)	8 (57%)	42 (82%)
Socioeconomic deprivation (SIMD)[1]	42 (65%)	7 (50%)	35 (69%)
Problematic drug use (DAST-10)	35 (54%)	5 (36%)	30 (59%)
Probable PTSD (PCL-5)	28 (43%)	7 (50%)	21 (41%)
Cardiovascular disease (CVD)	15 (23%)	4 (29%)	11 (22%)
Age 80 or over	4 (6%)	0 (0%)	4 (8%)

Risk Factor	All (*N*= 65) n (%)	No MCI (*n* = 14) n (%)	MCI (*n* = 51) n (%)
Total Risk Factors *M* (SD)	**3.42 (1.37)**	**3.00 (1.30)**	**3.53 (1.38)**

Note. [1] (% calculated on n=63 as two missing values)

Prior to regression analysis, a Spearman's Rho correlation matrix was computed for all variables (Table 7). Years of education demonstrated significant positive associations with MoCA total score (*rs* = .290, *p* = .019) and MoCA MIS (*rs* = .397, *p* = .001), and significant negative associations between MoCA total score and with total risk factors (*rs* = −.361, *p* = <.01). Critically, total risk factors significantly negatively correlated with MoCA total score (*rs* = −.340, *p* = .006) but was not significantly correlated with binary MCI status (*rs* = .190, *p* = .129). DAST correlated negatively with MoCA total score (*rs* = −.269, *p* = .030) and positively with total risk factors (*rs* = .687, *p* < .01). HADS Depression was significantly negatively correlated with MIS (*rs* = −.356, *p* = .004), suggesting that higher scores for depression were associated with poorer delayed recall performance. The full correlation matrix is displayed in Table 7.

Table 7

Spearman's Rho Correlation Matrix for Study Variables (N = 65)

Variable	1	2	3	4	5	6	7	8	9	10	11	12	13
1. Age	—	.070	.054	-.059	.017	-.047	-.131	.007	-.462**	-.142	-.092	-.056	-.175
2. SIMD Score		—	.133	.186	.012	-.165	-.166	.064	-.380**	-.093	-.035	.038	-.429**
3. Years of Education			—	.290*	.397**	-.336**	-.363**	-.366**	-.433**	-.150	-.297*	-.356**	-.361**
4. MoCA Total Score				—	.447**	-.716**	-.332**	-.166	-.269*	-.104	-.164	-.245*	-.340*
5. MoCA MIS					—	-.324**	-.187	-.186	-.219	-.064	-.055	-.356**	-.130
6. MCI ≤23 (binary)						—	.175	.080	.291*	-.039	.130	.044	.190
7. CORE-10							—	.731**	.348**	.182	.647**	.739**	.448**
8. PCL-5								—	.383**	.127	.671**	.686**	.477**
9. DAST									—	.238	.368**	.290*	.687**
10. AUDIT										—	.075	.061	.427**
11. HADS Anxiety											—	.572**	.285*
12. HADS Depression												—	.350*
13. Total Risk Factors													—

Note. MIS=MoCA Memory Index Score; SIMD=Scottish Index of Multiple Deprivation; DAST=Drug Abuse Screening Test; AUDIT=Alcohol Use Disorders Identification Test; PCL-5=PTSD Checklist; HADS=Hospital Anxiety and Depression Scale; CORE-10=Clinical Outcomes in Routine Evaluation. SIMD based on 63 participants. * $p < .05$. ** $p < .01$.

Linear Regression

Following review of correlations in table 7 and given potential power loss from dichotomisation, a linear regression was conducted regressing MoCA total scores and total risk factors (range 0-7), this included years of education as a second predictor variable as this was highly correlated with MoCA scores as observed in table 7. The model was significant $F(2, 62) = 5.239$, $p = .008$, accounting for 14.5% of the variance ($R^2 = .145$, Adjusted $R^2 = .117$). Total risk factors was also a significant negative predictor of MoCA score (Table 8), indicating that each additional risk factor was associated with a .91 point reduction in MoCA score after controlling for education ($B = -.912$, 95% CI [−1.647, −.178]) years of education did not significantly predict MoCA score once total risk factors was accounted for ($B = .156$, 95% CI [−.154, .466], $p = .317$).

Assumption checks confirmed the model was valid. Collinearity diagnostics indicated no concerns (Tolerance = .862, VIF = 1.160 for both predictors). Casewise diagnostics noted no undue influence (Cook's D maximum = .252) and standardised residuals ranged from −2.63 to 2.22. The P-P plot indicated a reasonable approximation to normality, with some deviation from the expected diagonal consistent with the broader pattern of non-normality identified within this dataset. The Durbin-Watson statistic (1.593) fell within the acceptable range (1.5–2.5; (Field, 2018).

Table 8

Linear Regression Predicting MoCA Score from Total Risk Factor and Years of Education

Predictor	*B*	SE B	*β*	*t*	*p*	95% CI
Constant	21.822	2.646	—	8.246	<.001	[16.533, 27.112]
Total Risk Factor	−.912	.368	−.314	−2.482	.016*	[−1.647, −.178]
Years of Education	.156	.155	.128	1.008	.317	[−.154, .466]

Note. N = 65. Dependent variable: MoCA total score. $R^2 = .145$, Adjusted $R^2 = .117$, $F(2, 62) = 5.239$, $p = .008$. Durbin-Watson = 1.593. Tolerance = .862, VIF = 1.160 for both predictors (no multicollinearity). * $p < .05$.

Exploratory analyses

Following the primary analysis, exploratory analyses were conducted to examine whether individual risk factors and other variables were associated with MCI.

Assessment of Normality

Normality of continuous variables was assessed within MCI groups (Shapiro-Wilk, Q-Q plots, Histograms), using the Explore procedure in SPSS. To prevent listwise deletion from any

variables with missing data, normality was assessed in four batches: MoCA scores; psychological measures (HADS Anxiety, HADS Depression, AUDIT, DAST, PCL-5, CORE-10); head injury continuous variables; and the Total Risk Factor score. Normality was violated in at least one group for eight of eleven continuous variables, although HADS Anxiety, MoCA-MIS and CORE-10 met normality assumptions in both.

Furthermore, this informed the choice of test for each subsequent analysis. For the correlation matrix Spearman's *rho* was used in place of Pearson's *r* because several of the 14 variables entered into the matrix (e.g. MoCA score, Total Risk Factor, PCL-5, DAST) violated normality in at least one MCI group, so the non-parametric alternative was adopted for the full matrix. For between-group comparisons, Mann-Whitney *U* tests were used for the same reason and applied across all variables compared between the No MCI and MCI groups. For the regression analyses normality of residuals was assessed via scatterplots and P-P plots of standardised residuals which were generated as part of the regression.

Non-Parametric analyses

Supplementary non-parametric analyses of Chi-square tests and Mann-Whitney *U* were conducted to explore differences between the No MCI and MCI groups across all seven risk factors, psychological measures, and demographic variables (Tables 9 and 10). The majority of comparisons were non-significant although TBI had the strongest association with 84% in MCI group compared to 60% without TBI (Fisher's Exact $p = .072$), the associated effect size (Phi = .246, $\chi^2(1) = 3.933$) represented a small to medium but non-significant effect. No significant group differences emerged for the number of head injuries sustained ($U = 286.5$, $p = .256$) or age at first head injury ($U = 234.0$, $p = .957$), suggesting that it is not injury frequency or timing but whether an individual meets the threshold for a significant head injury that relates to MCI status in this sample. DAST risk was similar ($\chi^2(1) = 2.360$, $p = .124$, Phi= .191). DAST scores were significantly higher when treated continuously in the MCI group (Mann Whitney $U = 212.5$, $p = .020$, Table 10).

Previous occupation differed significantly between groups (p=.004, Cramér's $V = .485$) with unemployment prior to custody more prevalent in the MCI (62.7%) than in the no MCI group. A smaller percentage of those previously employed in technical occupations such as engineering (37%) scored below the MCI cut-off compared to those who had been unemployed (94%). Years of education was significantly lower in the MCI group (MCI mean rank = 29.73; no MCI mean rank = 44.93, $U = 190.00$, $Z = -2.684$, $p = .006$, r=.33) representing a medium effect.

Table 9

Chi-Square Tests of Association Between Individual Risk Factors and MCI Status

Risk Factor	No MCI (n = 14) n (%) at risk	MCI (n = 51) n (%) at risk	Test	Statistic	*p*
Age ≥80	0 (0.0%)	4 (7.8%)	Fisher's Exact	—	.569
SIMD deprivation	7 (50.0%)	35 (68.6%)	Fisher's Exact	—	.221
Cardiovascular disease	4 (28.6%)	11 (21.6%)	Fisher's Exact	—	.721
TBI risk factor	8 (57.1%)	42 (82.4%)	Fisher's Exact	—	.072
Probable PTSD (PCL-5)	7 (50.0%)	21 (41.2%)	Pearson χ^2	$\chi^2(1) = .349$	.555
Problematic drug use (DAST)	5 (35.7%)	30 (58.8%)	Pearson χ^2	$\chi^2(1) = 2.360$	.124
Problematic alcohol use (AUDIT)	11 (78.6%)	37 (72.5%)	Fisher's Exact	—	.745

Note. Grouping variable = MCI status (MoCA score of 23 or less). N = 65 for all variables. n (%) at risk reflects the count and column percentage of each group classified as 'at risk' on that factor. Fisher's Exact test used where any expected cell count was below 5; Pearson χ^2 used where all expected cell counts were ≥5, following Field (2018).

Table 10

Mann-Whitney U Tests Comparing Continuous Variables by MCI Status

Variable	Mean Rank No MCI	Mean Rank MCI	*U*	*p*
MoCA Score[1]	58.50	26.00	.000	<.001**
MoCA MIS	44.54	29.83	195.5	.009**
CORE-10	26.75	34.72	269.5	.162
PCL-5	30.14	33.78	317.0	.523
DAST	22.68	35.83	212.5	.020*
AUDIT	34.39	32.62	337.5	.755
HADS Anxiety	28.36	34.27	292.0	.298

HADS Depression	31.43	33.43	335.0	.725
Years of Education	44.93	29.73	190.0	.006*
Total Risk Factors	26.36	34.82	264.0	.128
Total number of head injuries	27.96	34.38	286.5	.256
Approximate age at first head injury[2]	27.27	27.56	234.0	.957

Note. Grouping variable = MCI status (MoCA score of 23 or less). N = 65 for all variables except [2]Approximate age at first head injury (N = 54; 11 missing). [1]MoCA Score is included as an internal consistency check rather than an independent risk factor comparison, since MCI status was derived directly from this variable (MoCA ≤23); near-total group separation is therefore expected by construction. * p < .05. ** p < .01.

Multiple Regression

An exploratory multiple regression was conducted, replacing the total risk factors score with its seven individual measures, to examine whether any single risk factor emerged as a predictor of MoCA score once education was accounted for. The overall model was not statistically significant, $F(8, 56) = 1.543$, $p = .163$, accounting for 18.1% of the variance ($R^2 = .181$, Adjusted $R^2 = .064$). No individual predictor reached statistical significance (Table 11); older age, deprivation, CVD, TBI, PTSD, substance use, and years of education all failed to independently predict MoCA score (all predictors $p > .10$).

Despite the larger number of predictors, collinearity diagnostics indicated no serious concerns (Tolerance ranged from .640 to .911; VIF ranged from 1.098 to 1.561). Casewise diagnostics noted no undue influence (Cook's D maximum = .224) and standardised residuals ranged from −2.61 to 2.10. As with the linear regression model, the P-P plot showed some deviation from the expected diagonal, consistent with the non-normality identified across this dataset. The Durbin-Watson statistic (1.728) fell within the acceptable range (1.5–2.5; (Field, 2018).

Table 11

Exploratory Multiple Regression Predicting MoCA Score from Individual Risk Factors and Years of Education

Predictor	***B***	**SE B**	***β***	***t***	***p***	**95% CI**
Constant	21.902	2.863	—	7.651	<.001	[16.167, 27.637]
Age (80+ years)	−3.317	2.183	−.202	−1.519	.134	[−7.691, 1.057]
SIMD deprivation	−1.156	1.137	−.140	−1.017	.313	[−3.433, 1.121]
Cardiovascular disease	−.997	1.187	−.106	−.840	.405	[−3.375, 1.381]

Predictor	*B*	SE B	*β*	*t*	*p*	95% CI
Significant head injury	−1.688	1.277	−.180	−1.322	.192	[−4.246, .871]
Probable PTSD (PCL-5)	−.747	1.038	−.094	−.720	.475	[−2.828, 1.333]
Drug use (DAST)	−.587	1.196	−.074	−.491	.626	[−2.983, 1.810]
Alcohol use (AUDIT)	−.608	1.154	−.068	−.526	.601	[−2.920, 1.705]
Years of Education	.187	.169	.153	1.107	.273	[−.152, .526]

Note. N = 65. Dependent variable: MoCA total score. R^2 = .181, Adjusted R^2 = .064, F(8, 56) = 1.543, p = .163 (model not significant). Durbin-Watson = 1.728. Tolerance ranged from .640 to .911; VIF ranged from 1.098 to 1.561 (no multicollinearity).

In summary, the pattern across both regression models suggests that the predictive value of the total risk factors score derives from the multifactorial and cumulative burden of risk factors rather than from any single factor, although the non-significant overall model and modest sample-to-predictor ratio (*N* = 65, 8 predictors) mean this exploratory analysis should be interpreted with appropriate caution.

Psychological status at testing

Current mental health was assessed via HADS, CORE-10 and PCL-5. Rates of clinical distress were high across all three measures (Table 12) and did not differ significantly by MCI group suggesting that elevated psychological distress was a feature of the full sample (Table 12).

Table 12

Psychological Wellbeing at Time of Assessment

Measure	Full Sample (N = 65)	No MCI (n = 14)	MCI (n = 51)	Group comparison
HADS Anxiety (0–21)				
M (SD)	9.17 (5.07)	7.79 (6.25)	9.55 (4.70)	*U = 292.0, p = .298*
Range	0–21	0–18	2–21	
Normal (0–7)	25 (38.5%)	6 (42.9%)	19 (37.3%)	
Borderline (8–10)	16 (24.6%)	3 (21.4%)	13 (25.5%)	
Abnormal (≥11)	24 (36.9%)	5 (35.7%)	19 (37.3%)	*χ^2(2) = .170, p = .918*

HADS Depression (0–21)				
M (SD)	7.75 (4.46)	7.07 (3.43)	7.94 (4.72)	*U = 335.0, p = .725*
Range	0–21	1–14	0–21	
Normal (0–7)	32 (49.2%)	8 (57.1%)	24 (47.1%)	
Borderline (8–10)	15 (23.1%)	3 (21.4%)	12 (23.5%)	
Abnormal (≥11)	18 (27.7%)	3 (21.4%)	15 (29.4%)	*$\chi^2(2) = .501$, p = .779*
CORE-10 (0–40)				
M (SD)	15.72 (7.43)	13.14 (6.98)	16.43 (7.46)	*U = 269.5, p = .162*
Range	3–32	4–26	3–32	
Above threshold (≥11)	48 (73.8%)	8 (57.1%)	40 (78.4%)	*Fisher's Exact, p = .167*
PCL-5 (0–80)				
M (SD)	29.11 (16.77)	25.64 (14.01)	30.06 (17.45)	*U = 317.0, p = .523*
Range	2–73	2–50	6–73	
Probable PTSD (>31)	28 (43.1%)	7 (50.0%)	21 (41.2%)	*$\chi^2(1) = .349$, p = .555*

Note. Group comparison column reports Mann-Whitney U tests for continuous scores (No MCI vs. MCI) and chi-square tests for classification group frequencies. Pearson's χ^2 used throughout except where Fisher's Exact test needed to be used due to was used cells with an expected count below 5.

Discussion

More than three-quarters of older prisoners screened positively for MCI on the MoCA, substantially exceeding estimates from England and Wales (Forsyth et al., 2025) and sitting at the upper end of the range (35-78%) reported in US prison samples (Ahalt et al., 2018; Baillargeon et al., 2023; Perez et al., 2021). Differences likely reflect variation in cut-offs and samples, but the fivefold difference from 15% in the general population is stark (Bai et al., 2022).

Given the uneven split between MCI and no MCI groups and the loss of information through dichotomising (Scottish Intercollegiate Guidelines Network (SIGN), 2023; Van Schependom & Cutter, 2025) the continuous MoCA score was further investigated as an outcome. Total risk factors significantly predicted MoCA performance after adjusting for years of education,

accounting for 14.5% of the variance with each additional risk factor associated with a 0.91 point reduction in MoCA score, while education itself did not significantly predict MoCA score once total risk factor was accounted for. A further exploratory model replaced the combined risk score with the seven individual risk factors along with years of education as an eighth, this was not significant overall and no single risk factor emerged as an independent predictor suggesting that the predictive values are derived from the cumulative burden of risk factors rather than one factor alone, supporting a concept that prisoner health is a 'weave' of interacting morbidities (McMillan et al., 2025).

The association between drug use (DAST-10) and cognitive performance is consistent with evidence that approximately 31% of individuals with substance use disorder show MoCA impairment (Bruijnen et al., 2019), reflecting acute and long-term cognitive effects (Mills, 2023). The absence of a finding for alcohol use (AUDIT) may reflect its high prevalence across the Scottish prison population generally (Toomey et al., 2022), obscuring group differences and the differing timescales that substances affect cognition, with chronic alcohol use linked to later-life decline (Topiwala & Ebmeier, 2018).

The high prevalence of significant head injury (77%) resembles that found in a larger Scottish prison sample (McMillan et al., 2025) and exceeds estimates from meta-analyses (46%) (Hunter et al., 2023). TBI risk showed the strongest, though non-significant, individual association with MCI of any risk factor, suggesting this group warrants further assessment (McGinley & McMillan, 2019), potentially broadened to include executive function given links to repeated symptomatic head injuries.

Cardiovascular disease showed no significant association with MCI status or MoCA score, despite evidence linking cardiovascular conditions to later-life cognitive decline and vascular dementia (Kauko et al., 2024; Luo et al., 2025). By relying on self-report, risk of underdiagnosis and that vascular contributions to cognition are better detected longitudinally complicates things (Farnsworth von Cederwald et al., 2022).

Psychological distress was high irrespective of MCI status, suggesting a pervasive feature of this population, and remains important when interpreting cognitive test performance, given evidence that mental health difficulties can affect cognitive scores (Kriesche et al., 2023; Tian et al., 2025).

Social deprivation (SIMD quintile) was associated with total risk factor score; almost two-thirds of the sample were from highly deprived backgrounds, reflecting the wider Scottish prison

population (Gilling McIntosh et al., 2023; Scottish Government, 2025). Deprivation likely contributes to cognitive vulnerability both directly and indirectly across the lifespan, community studies link greater deprivation to faster decline (Aartsen et al., 2019; Hofbauer & Rodriguez, 2021), through intersecting pathways including poorer health, lifestyle risk, reduced healthcare access, educational disadvantage (Cai et al., 2024; Foster et al., 2018; Harms & Garrett-Ruffin, 2023).

Although not part of the total risk score, years of education showed a significant association with cognitive test scores, those scoring >23 on the MoCA had significantly more years of education than those scoring ≤23, and education correlated significantly with binary and continuous MoCA and MIS score. Particularly, since MoCA scoring adds a 1-point adjustment for ≤12 years of education (which benefits the MCI group), the association may still underestimate the true effect. However, when explored alongside total risk factor in the linear regression, education no longer significantly predicted MoCA score, and it did not emerge as a significant independent predictor in the exploratory regression model. This pattern suggests that while education is associated with cognitive performance, which is consistent with cognitive reserve theory, whereby education builds cognitive resilience against ageing (Stern & Barulli, 2019), and replicating findings in French prisoners linking higher educational attainment to higher MMSE scores (Combalbert et al., 2018). This unique contribution once other risk factors are accounted for appears more limited in this sample, potentially reflecting shared variance with other risk factors or the sample size available for a model with multiple predictors.

Limitations

Several limitations warrant consideration. The achieved sample size fell short of the target and combined with unequal MCI/No MCI groups, likely limited power and contributed to difficulty in running a regression using the cut off score of 23 or less, because imbalanced binary outcomes are harder to model reliably (Field, 2018).

Recruitment from only two Scottish prisons housing adult men limits generalisability to other establishments and to older women in prison who were unrepresented. The capacity requirement may have excluded those with the most severe impairment, alongside those who were illiterate, had poor eyesight or read English as a second language, introducing selection bias.

More than ninety percent of the sample was White Scottish or White British. These contrasts with literature in the US studies where Black and Hispanic prisoners are overrepresented in the prison population and have shown to have higher prevalence of cognitive impairment

(Baillargeon et al., 2023). It also differs from the England and Wales sample of Forsyth et al, (2025) where 79% of participants who screened positive for MCI and dementia were White British. These figures align with national prison demographics, as the prison system in England and Wales is far more ethnically diverse than that of Scotland. Specifically, around 27% of inmates in England and Wales come from non-White backgrounds, whereas Scotland's non-White prison population sits at just 6–8% (House of Commons, July, 2020; Scottish Government, 2025). The near absence of diversity in the present sample reflects the demographic profile of the Scottish prison population and it is important to contextualise differences when drawing on findings from the US and other areas of the UK such as England and Wales.

No effort measure accompanied the MoCA, so variable engagement due to mental state, medication or testing on a busy prison wing cannot be ruled out. Cognitive performance was assessed at a single time point using a screening tool rather than a diagnostic assessment, limiting reliability in distinguishing stable impairment from transient states linked to medication, withdrawal, poor sleep, or mental health difficulties. The Scottish sample may differ compared to other UK countries (Forsyth et al., 2025).

Additionally, individual risk factors were not tested within a single multivariate model adjusting for all risk factors simultaneously a larger sample size would permit this. Comparisons with community-dwelling estimates warrant caution as no matched comparator was included.

Implications for practice

These findings have several implications for prison healthcare policy in Scotland and the UK. The 78.5% prevalence estimate substantially exceeds general population and England and Wales estimates (Forsyth et al., 2025), and supports routine screening for older prisoners in Scotland consistent with national dementia policy (Public Health Scotland, 2024; Scottish Government, 2023). As cognitive symptoms may go unnoticed or be misattributed to mental health or behavioural difficulties, a brief validated tool such as the MoCA should become a standard part of older prisoners' healthcare pathway, with re-testing supporting diagnostic clarification and care planning.

Findings support a holistic approach to cognitive vulnerability, as difficulties reflect accumulating morbidities associated with cognitive performance. Prison healthcare services should avoid siloed approaches to individual risk factors in favour of integrated care and treatment.

The association between years of education and MCI is best understood as a marker of past vulnerability. Education may indicate screening priorities and inform occupational activities within prison care consistent with cognitive reserve theory, and points to long-term policy implications of educational disadvantage beyond the custodial context.

The literature points to a range of care models that could inform Scottish practice beyond screening alone. In England and Wales, staff training has been developed and piloted specifically for prison contexts, using a tiered model in which all prison-facing staff receive basic dementia and MCI awareness training, with more intensive training for those directly involved in delivering a care pathway (Perryman et al., 2023). In the US, where similar gaps have been identified, a consensus has called for correctional staff training, dedicated geriatric housing units, and clearer medical early release pathways as priority areas for policy reform (Williams et al., 2012). A scoping review of care approaches for prisoners with dementia identified eight themes, including specialised units, structured activity programmes, and early release or parole for those at low risk of reoffending (du Toit et al., 2019). This could be supportive to the Scottish context with reviewing sentences supported by risk assessment and introducing specialist wings in prisons with high numbers of older prisoners to better support those with additional needs or cognitive impairment. Adapting parts of each of these possible approaches, in particular staff training and clear pathways to assessment could support the Scottish prison service in the care and management of aging prisoners.

Finally, the high level of psychological distress found reinforces the need for mental health support across the older prison population, with staff likely to benefit from training in recognising both potential cognitive impairment and psychological distress in this population.

Future directions

Future research should replicate these findings in a larger, multi-site Scottish sample to allow for highly powered multivariate modelling of risk factors. Effort measures, robust neuropsychological assessment, and longitudinal follow-up would clarify whether MoCA performance reflects stable impairment or fluctuating states, while qualitative research could illuminate the lived experience of those ageing in custody.

Conclusions

The study found a high prevalence of MCI in older Scottish prisoners, exceeding rates reported in previous research. Total risk factor and years of education were associated with cognition, and this coupled with substance use and head injury constitutes a risk profile often seen in the prison

population. Psychological distress was pervasive across the sample, highlighting a broader mental health need among older prisoners that extends beyond those identified with or without cognitive impairment. Together, these findings suggest that MCI is a significant and previously undocumented feature of the older prison population in Scotland with clear implications for policymakers, healthcare providers and future planning for the ageing prison population.

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Appendix 1

Appendix 1.1 PRISMA 2020 Checklist

Section and Topic	Item #	Checklist item	Location where item is reported (No. are pages)
TITLE			
Title	1	Identify the report as a systematic review.	9
ABSTRACT			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	10 (structured abstract present) – recommend a final check against the separate PRISMA 2020 for Abstracts checklist, which has its own 12 items
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	11-12
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	12-13 (Aims of the study)
METHODS			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	134 (Eligibility Criteria)
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	14 (seven databases and grey literature, search conducted 2nd May 2026, developed search terms with a librarian)
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	14; full search terms in Appendix 1.2
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	14-17 (Rayyan.ai; lead reviewer CDC; second reviewer RO screened 10% and then 2 full texts, discrepancies resolved by discussion)
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	14-17 (structured extraction form, 49 fields across 7 sections; authors contacted for missing data); full extraction data in Appendix 1.3, Tables 1a-1b
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	14-21 (extraction form sections listed)
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	17 (extraction form sections: participant characteristics, study design/setting, context and generalisability)
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	17-21 (JBI cross-sectional and prevalence checklists; second reviewer RO appraised 14% of studies independently; one

Section and Topic	Item #	Checklist item	Location where item is reported (No. are pages)
			discrepancy on item 3 resolved by discussion); ratings in Appendix 1.4, Tables 2a-2b
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	Means/SDs and prevalence rates used throughout (p.15 screening cut-offs; MMSE plot)
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	22 (three-tier data hierarchy)
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	22 (tiered narrative)
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	24 (Figure 2 methods: R v4.6.0, metafor package, dplyr)
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	22-24 (narrative synthesis rationale, meta-analysis criterion k≥3 studies, I^2, and R v4.6.0
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	Unable to do meta regression due to heterogeneity
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	Not conducted
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	Not addressed, no formal reporting/publication bias assessment method described
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	Not addressed, no GRADE or equivalent certainty assessment used
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	17-19 (search/selection numbers: 6,916 records, 3,754 duplicates removed, 3,162 screened, 3,061 excluded, 101 sought, 6 unretrievable, 95 assessed, 81 excluded, 14 included); Figure 1 PRISMA flow diagram page 19.
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	19 (aggregate exclusion reasons and counts: no older adult population n=40, no valid tool n=14, wrong design n=6, duplicated datasets n=6)
Study characteristics	17	Cite each included study and present its characteristics.	20 (study characteristics paragraph: countries, years, design); full table in Appendix 1.3, Tables 1a-1b

Section and Topic	Item #	Checklist item	Location where item is reported (No. are pages)
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	20-22 (JBI quality scores reported per study, e.g. high/moderate ratings with specific scores); full ratings in Appendix 1.4, Tables 2a-2b
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	17-28 (tiered reporting of means/SDs/prevalence per study)
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	20-22
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	24 (MMSE k=5, descriptive means plot, Figure 2)
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	N/A – no subgroup/heterogeneity exploration was conducted (see row above)
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	N/A – no sensitivity analyses were conducted
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	Not addressed
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	Not addressed
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	28-31 (Discussion)
	23b	Discuss any limitations of the evidence included in the review.	31 (quality appraisal limitations, inconsistent confounder adjustment across included studies)
	23c	Discuss any limitations of the review processes used.	31 (Limitations: cross-sectional designs, heterogeneity precluding meta-analysis, single-reviewer appraisal, English-only restriction)
	23d	Discuss implications of the results for practice, policy, and future research.	31-32 (Policy implications; Conclusion/future research)
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	13 (PROSPERO CRD420251237225, registered 5th May 2026)
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	13 (PROSPERO ID given) – implicit only; consider adding an explicit statement/link on where the protocol itself can be accessed

Section and Topic	Item #	Checklist item	Location where item is reported (No. are pages)
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	13 (two protocol amendments submitted 3rd June 2026: quality appraisal tool changed to JBI; title refined to reflect cognitive screening focus)
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	9 (Disclosure statement: no specific funding, no competing interests to declare)
Competing interests	26	Declare any competing interests of review authors.	9 (Disclosure statement)
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	N.A

Appendix 1.2 Search Terms Across Databases

Searches combined three concepts: custodial settings, cognitive screening/cognitive impairment, and older age.

Database / Source	Search Terms	Filters Applied / Notes
PsycINFO EBSCOhost	((DE "Prisons" OR "Correctional Institutions" OR "Reformatories") OR (XB (prison* OR incarcerat* OR jail OR gaol OR inmate* OR offender* OR detainee* OR custod* OR remand OR "correctional facilit*" OR "detention centre*")) OR (DE correctional facilities) OR (DE "Correctional Institutions")) AND ((XB (cognit* OR "cognitive impairment" OR "cognitive decline" OR "cognitive dysfunction" OR "cognitive deficit*" OR "cognitive disorder*" OR "neurocognitive disorder*" OR neurocognitive OR "neuropsychological" OR "executive function" OR "executive dysfunction" OR "processing speed" OR memory OR "working memory" OR MCI OR "mild cognitive impairment" OR MMSE OR "Mini-Mental State Examination" OR MoCA OR "Montreal Cognitive Assessment" OR ACE-III OR ACE-3 OR "Addenbrooke's Cognitive Examination" OR AMTS OR "Abbreviated Mental Test Score" OR "6-CIT" OR "Six Item Cognitive Impairment Test" OR "Mini-Cog" OR GPCOG OR "GP-Cog" OR "General Practitioner Assessment Cognition" OR screen*)) OR (DE "Dementia") OR (DE "Cognitive Impairment" OR DE "Mild Cognitive Impairment") OR (DE executive dysfunction) OR (DE (mild cognitive impairment)) OR (DE (neuropsychological tests))) AND ((XB (older OR aging OR ageing OR elderly OR "older adult*" OR "middle aged" OR midlife OR "older prisoner*" OR "ageing prisoner*" OR geriatric*)) OR (DE (aged)) OR (DE (middle aged)) OR (DE (frail elderly)) OR (DE (geriatrics or older adults or elderly)))	Records retrieved: 970 Filters: English language; published studies.
SocINDEX EBSCOhost	((DE "Prisons" OR "Correctional Institutions" OR "Reformatories") OR (XB (prison* OR incarcerat* OR jail OR gaol OR inmate* OR offender* OR detainee* OR custod* OR remand OR "correctional facilit*" OR "detention centre*")) OR (DE correctional facilities) OR (DE "Correctional Institutions")) AND ((XB (cognit* OR "cognitive impairment" OR "cognitive decline" OR "cognitive dysfunction" OR "cognitive deficit*" OR "cognitive disorder*" OR "neurocognitive disorder*" OR neurocognitive OR "neuropsychological" OR "executive function" OR "executive dysfunction" OR "processing speed" OR memory OR "working memory" OR MCI OR "mild cognitive impairment" OR MMSE OR "Mini-Mental State Examination" OR MoCA OR "Montreal Cognitive Assessment" OR ACE-III OR ACE-3 OR "Addenbrooke's	Records retrieved: 112 Filters: English language; published studies.

Database / Source	Search Terms	Filters Applied / Notes
	Cognitive Examination" OR AMTS OR "Abbreviated Mental Test Score" OR "6-CIT" OR "Six Item Cognitive Impairment Test" OR "Mini-Cog" OR GPCOG OR "GP-Cog" OR "General Practitioner Assessment Cognition" OR screen*)) OR (DE "Dementia") OR (DE "Cognitive Impairment" OR DE "Mild Cognitive Impairment") OR (DE executive dysfunction) OR (DE (mild cognitive impairment)) OR (DE (neuropsychological tests))) AND ((XB (older OR aging OR ageing OR elderly OR "older adult*" OR "middle aged" OR midlife OR "older prisoner*" OR "ageing prisoner*" OR geriatric*)) OR (DE (aged)) OR (DE (middle aged)) OR (DE (frail elderly)) OR (DE (geriatrics or older adults or elderly)))	
CINAHL EBSCOhost	((XB (prison* OR incarcerat* OR jail OR gaol OR inmate* OR offender* OR detainee* OR custod* OR remand OR "correctional facilit*" OR "detention centre*")) OR (MH (prisoners+)) OR (MH (correctional facilities))) AND ((XB ((cognit* OR "cognitive impairment" OR "cognitive decline" OR "cognitive dysfunction" OR "cognitive deficit*" OR "cognitive disorder*" OR "neurocognitive disorder*" OR neurocognitive OR "neuropsychological" OR "executive function" OR "executive dysfunction" OR "processing speed" OR Memory OR MCI OR "mild cognitive impairment" OR MMSE OR "Mini-Mental State Examination" OR MoCA OR "Montreal Cognitive Assessment" OR ACE-III OR ACE-3 OR "Addenbrooke's Cognitive Examination" OR AMTS OR "Abbreviated Mental Test Score" OR "6-CIT" OR "Six Item Cognitive Impairment Test" OR "Mini-Cog" OR GPCOG OR "GP-Cog" OR "General Practitioner Assessment Cognition" OR Screen*))) OR (MH (dementia)) OR (MH (mild cognitive impairment)) OR (MH (neuropsychological tests)) OR (MH (cognition))) AND ((XB (older OR aging OR ageing OR elderly OR "older adult*" OR "middle aged" OR midlife OR "older prisoner*" OR "ageing prisoner*" OR geriatric*)) OR (MH (aged)) OR (MH (geriatrics)) OR (MH (frail elderly)))	Records retrieved: 376 Filters: English language; published studies.
Embase Ovid	1. (prison* or incarcerat* or jail or gaol or inmate* or offender* or detainee* or custod* or remand or "correctional facilit*" or "detention centre*").ti,ab. 2. exp prison/ 3. exp prisoners/ 4. exp jail/ 5. exp correctional facilities/ 6. 1 or 2 or 3 or 4 or 5	Records retrieved: 2,126 Filter applied: English language.

Database / Source	Search Terms	Filters Applied / Notes
	7. (cognit* or "cognitive impairment" or "cognitive decline" or "cognitive dysfunction" or "cognitive deficit*" or "cognitive disorder*" or "neurocognitive disorder*" or neurocognitive or "neuropsychological" or "executive function" or "executive dysfunction" or "processing speed" or Memory or MCI or "mild cognitive impairment" or MMSE or "Mini-Mental State Examination" or MoCA or "Montreal Cognitive Assessment" or ACE-III or ACE-3 or "Addenbrooke's Cognitive Examination" or AMTS or "Abbreviated Mental Test Score" or "6-CIT" or "Six Item Cognitive Impairment Test" or "Mini-Cog" or GPCOG or "GP-Cog" or "General Practitioner Assessment Cognition" or Screen*).ti,ab. 8. exp dementia/ 9. exp cognitive impairment/ 10. exp cognitive disorder/ 11. exp executive function/ 12. exp neuropsychological test/ 13. 7 or 8 or 9 or 10 or 11 or 12 14. (older or aging or ageing or elderly or "older adult*" or "middle aged" or midlife or "older prisoner*" or "ageing prisoner*" or geriatric*).ti,ab. 15. exp aged/ 16. exp geriatrics/ 17. exp middle aged/ 18. exp frail elderly/ 19. 14 or 15 or 16 or 17 or 18 20. 6 and 13 and 19 21. limit 20 to english language	
MEDLINE EBSCOhost	((XB (prison* OR incarcerat* OR jail OR gaol OR inmate* OR offender* OR detainee* OR custod* OR remand OR "correctional facilit*" OR "detention centre*")) OR (MH (prison OR jail OR incarceration OR imprisonment OR correction facilities OR prisoners OR inmates OR criminals OR offenders OR incarcerated people))) AND ((XB (cognit* OR "cognitive impairment" OR "cognitive decline" OR "cognitive dysfunction" OR "cognitive deficit*" OR "cognitive disorder*" OR "neurocognitive disorder*" OR neurocognitive OR "neuropsychological" OR "executive function" OR "executive dysfunction" OR "processing speed" OR Memory OR MCI OR "mild cognitive impairment" OR MMSE OR "Mini-Mental State Examination" OR MoCA OR "Montreal Cognitive Assessment" OR ACE-III OR ACE-3 OR "Addenbrooke's Cognitive Examination" OR AMTS OR "Abbreviated Mental Test Score" OR "6-CIT" OR "Six Item Cognitive Impairment Test" OR "Mini-Cog" OR GPCOG OR "GP-Cog" OR "General Practitioner Assessment Cognition" OR Screen*)) OR (MH (cognition)) OR ((MH "Cognitive Dysfunction")) OR (MH (cognition disorders)) OR (MH (neuropsychological tests)) OR (MH (executive function OR executive dysfunction OR executive functioning)))	Records retrieved: 823 Filters: English language; published studies.

Database / Source	Search Terms	Filters Applied / Notes
	AND ((XB (older OR aging OR ageing OR elderly OR "older adult*" OR "middle aged" OR midlife OR "older prisoner*" OR "ageing prisoner*" OR geriatric*)) OR (MH (geriatrics)) OR (MH (aged)) OR (MH (frail elderly)))	
Web of Science Core Collection	TOPIC (prison* OR incarcerat* OR jail OR gaol OR inmate* OR offender* OR detainee* OR custod* OR remand OR "correctional facilit*" OR "detention centre*") AND TOPIC (cognit* OR "cognitive impairment" OR "cognitive decline" OR "cognitive dysfunction" OR "cognitive deficit*" OR "cognitive disorder*" OR "neurocognitive disorder*" OR neurocognitive OR neuropsychological OR "executive function" OR "executive dysfunction" OR "processing speed" OR memory OR "working memory" OR MCI OR "mild cognitive impairment" OR MMSE OR "Mini-Mental State Examination" OR MoCA OR "Montreal Cognitive Assessment" OR ACE-III OR ACE-3 OR "Addenbrooke's Cognitive Examination" OR AMTS OR "Abbreviated Mental Test Score" OR "6-CIT" OR "Six Item Cognitive Impairment Test" OR "Mini-Cog" OR GPCOG OR "GP-Cog" OR "General Practitioner Assessment Cognition" OR screen* OR dementia) AND TOPIC (older OR aging OR ageing OR elderly OR "older adult*" OR "middle aged" OR midlife OR "older prisoner*" OR "ageing prisoner*" OR geriatric*)	Records retrieved: 2,395 Editions searched: Science Citation Index Expanded (SCI-EXPANDED); Social Sciences Citation Index (SSCI); Arts & Humanities Citation Index (A&HCI); Emerging Sources Citation Index (ESCI). Search field: Topic.
ASSIA ProQuest	(TI,AB(prison* OR incarcerat* OR jail OR gaol OR inmate* OR offender* OR detainee* OR custod* OR remand OR "correctional facilit*" OR "detention centre*")) AND (TI,AB(cognit* OR "cognitive impairment" OR "cognitive decline" OR "cognitive dysfunction" OR "cognitive deficit*" OR "cognitive disorder*" OR "neurocognitive disorder*" OR dementia OR "mild cognitive impairment" OR MCI OR neurocognitive OR memory OR "working memory" OR "executive function" OR "executive dysfunction" OR "processing speed" OR MMSE OR MoCA OR "ACE-3" OR AMTS OR "6-CIT" OR "GP-COG" OR "Mini-Cog" OR "Addenbrooke's Cognitive Examination" OR "Abbreviated Mental Test" OR screen*)) AND (TI,AB(older OR aging OR ageing OR elderly OR "older adult*" OR "middle aged" OR midlife OR "ageing prisoner*" OR "older prisoner*" OR geriatric*))	Records retrieved: 114 Search fields: Title and Abstract. Final eligibility required English-language papers.

Database / Source	Search Terms	Filters Applied / Notes
Google Scholar Supplementary search	Google Scholar searches conducted 11 May 2026 and 3 June 2026. Where stated, the first five pages of results were screened. Completed Google Scholar search terms: • cognitive impairment older prisoners (approximately 42,100 results) • cognitive screening older incarcerated adults (approximately 56,400 results) • cognitive function aging prisoners jail (approximately 25,200 results) • MoCA older prisoners (approximately 2,370 results) • MMSE older prisoners (approximately 3,020 results) • Addenbrooke's Cognitive older prisoners (approximately 1,120 results) • RBANS test older prisoners (approximately 837 results) • Six Item Cognitive Test older prisoners (approximately 53,900 results) • cognitive assessment correctional facility older adults (approximately 42,600 results) No additional eligible studies were identified beyond database records.	Search dates: 11 May 2026 and 3 June 2026. Screening: first five pages screened. Purpose: supplementary checking and eligibility confirmation.
Grey literature and public sources	Grey literature and relevant public sources searched: • Gov.UK: searched "older prisoners cognitive" on 11 May 2026; no relevant results on first five pages. • Gov.Scot: searched for older prisoners/cognitive material; no relevant results on first five pages. Results related to mental and physical health issues/challenges, but not cognition screening. • NIHR Evidence: searched 11 May 2026; no relevant prisoner and cognitive screening results. • NI Direct / Northern Ireland Executive sources: searched 11 May 2026 using older prisoner cognitive terms; dementia information found, but not specific to cognitive testing or older prisoners. • HMPPS / Gov.UK documents: checked 14 May 2026. Older prisoner health and social care needs assessment guidance identified as background; no additional eligible cognitive screening study identified. • Criminal Justice Joint Inspection: searched 14 May 2026 using "older prisoners cognitive"; no relevant results after page five. • ClinicalTrials.gov: searched 11 May 2026. One cognitive impairment/jail record identified but not relevant to this review. • Bureau of Justice Statistics: searched 11 May 2026 for cognitive/incarcerated/older prisoner terms; no eligible cognitive screening studies identified.	Search dates: 11 May 2026 and 14 May 2026 where recorded. Purpose: identify potentially missed eligible studies and relevant background documents.

Records were uploaded to Rayyan.ai for duplicate removal and screening.

Appendix 1.3 Table 1a - Data Extraction Tables

Table 1a – Study characteristics

Study	Country/ Region	Data collection	N prisons	Prison type/ security	N	Age criterion	Mean age (SD)	% Male	% Female	Education (M yrs)	Ethnicity	Prisoner type	Diagnosis noted in sample	Sentence type
Ahalt et al. (2018)	USA	May–Nov 2012; Mar–Jun 2015	1	County jail (NR security)	310	≥55	59.2 (7.4)	95	5	NR	75% non-White	NR	NR	NR
Baidawi et al. (2016)	Australia	2011–2012	8	Public and private; mixed security	173	≥50	63.1 (8.3)	86.7	13.3	Yr 10 or below: 58%	73.3% Aus-born; 6.4% Indigenous	SO, H, T, DO, VO	NR	NR (mostly sentenced)
Baillargeon et al. (2023)	USA	2019	83	NR	143	≥55	61.3 (5.5)	92.3	7.7	<HS: 20.6%; >HS: 79.4%	White, Black, Hispanic	GP	Depression, diabetes, hypertension, HIV (medical records)	NR
Combalbert et al. (2018)	France	Sep 2013– Jul 2014	7	Mixed (remand & sentenced)	138	≥50	59.72 (8.02)	100	0	NR	NR	GP	NR	Sentenced; M=13.5 yrs
Fazel et al. (2002)	England and Wales	Apr 1999– Mar 2000	15	NR; within 100mi Oxford	203	≥60	SO: 65.9 (4.7); NSO: 65.1 (4.9)	100	0	NR	24 Non-White; 179 White	SO vs NSO	2 with dementia; 15 depression.	Sentenced
Forsyth et al. (2025)	England and Wales	Nov 2016– Feb 2018	21	Mixed; national sample	869	≥50	NR	68.6	31.4	NR	79% White British	Mixed	Dementia/MCI screened via ACE-III; prior diagnosis via e-records	Mixed; M=18 months
Hayes et al. (2012)	England (NW)	NR	13	NR security; NW England	262	≥50	NR	100	0	NR	97% White;	VO, SO, DO, A, F	NR (SCID-I & II administered)	Mixed
Kingston et al. (2011)	England (Staffs)	Oct 2008– Mar 2009	4	NR; Staffordshire	121	≥50	58.4 (6.3)	100	0	NR	NR	SO, VO, DO, F, T	Depression noted; 2 with dementia identified	Sentenced; 80% serving 4+ yrs
Modini et al. (2025)	Australia (Victoria)	2022	3	1 low + 2 max; rural/metro	114	≥50	67.86 (8.53)	100	0	11.35 (3.93)	102 Caucasian;	52.7% HSO	Brain injury due to alcohol abuse noted	Sentenced; M=9.7 yrs

Study	Country/ Region	Data collection	N prisons	Prison type/ security	N	Age criterion	Mean age (SD)	% Male	% Female	Education (M yrs)	Ethnicity	Prisoner type	Diagnosis noted in sample	Sentence type
Perez et al. (2021)	USA (Connecticut)	Nov 2016– Dec 2019	1	Connecticut DOC (NR)	239	≥50	56.4 (6.07)	100	0	12.04 (2.25)	White 38%, Black 41%, Hispanic/ Other 21%	GP	Self-reported head injuries	Sentenced; 3+ yrs
Rodriguez et al. (2017)	Australia (Sydney)	Dec 2008– Sep 2011	1	Long Bay Prison Sydney	64*	≥50	61.2 (7.1)	100	0	FTSO: 9.6 (3.0); NSO: 10.8 (3.0)	NR	FTSO vs NSO	NR	Sentenced
Tucker et al. (2021)	England (NW)	May 2015– Jul 2016	5	Mixed (Cat B/C/D)	75°	≥55	NR	100	0	NR	96.2% White;	VO, T, DO, SO	NR	Sentenced; 66%+ serving 10+ yrs
Verhülsdonk et al. (2021)	Germany (NRW)	May 2018– Mar 2019	5	Mixed; NRW prisons	57•	≥60	65.52 (6.03)	82.8	17.2	11.78 (2.47)	NR	SO, H, T	NR	Mixed; M=84.1 months
Verhülsdonk et al. (2023b)	Germany	Sep 2021– Sep 2022	2	Prisons with older wings	18	≥55	66.17 (5.64)	100	0	6.44 (5.7)	NR	NR	DemTect <8 (used as exclusion criterion	Sentenced; M=6.93 yrs

Note from 2a. NR = not reported. SO = sex offenders; NSO = non-sex offenders; FTSO = first-time sex offenders; HSO = historic sex offenders; VO = violent offenders; DO = drug offenders; H = homicide; T = theft; F = fraud; A = arson; GP = general population prisoners. * 64 of 100 enrolled; 36 excluded (community programme). °75 of 80 enrolled completed the 6-CIT. •57 of 58 enrolled completed the MMSE

Appendix 1.3 Table 1b - Data Extraction Tables

Table 1b – Continued characteristics

Study	Tool(s)	Tier	Prevalence/% below threshold	Testing conditions	Other measures administered	JBI score	Funding source	Generalisability (author-stated)	Key Limitations
Ahalt et al. (2018)	MoCA	3	78% <26; 70% <25; 49% <23; 25% <20 (education-adjusted)	Private rooms	DAST-10; Modified AUDIT; ADL self-report	7/8	National Palliative Care Research Center Grant; Uni California -San Fran	Findings should be viewed in context of underdeveloped literature; may overestimate prevalence in racial minorities and those with low education	No formal limitations reported; no description of private room location
Baidawi et al. (2016)	MMSE	1	15.3% ≤23 (OAP); 14.1% MMSE 18–23; 1.2% MMSE 10–17	Private areas (office/program room; no prison staff)	K10 Psychological Distress Scale	6/8	Australian Research Council Dept of Justice	Difficult to generalise to wider population; focus mostly on distress; younger prisoner sample broadly reflective of state prison populations	Low Indigenous representation, not all prisons accessed; older SO over-represented in sample
Baillargeon et al. (2023)	MoCA	3	35% <23; 25.9% MCI range (18–22); 15.4% dementia <18	NR	Depression, diabetes, hypertension, HIV (medical record)	7/8	None	Prevalence higher than general US population; findings should inform healthcare planning and resource allocation	Small female subsample (n=11); no SD reported; possible mediating variables
Combalbert et al. (2018)	MMSE (+FAB)	1	18.8% ≤23 (prisoners) vs 0.72% (community) p<.0001	NR	MINI DSM-IV (psych screen); FAB/BREF	7/8	Ministère de la Justice	21.3% participation rate; most cognitively deteriorated may not have participated; males only; not generalisable beyond 7 French prisons	21.3% participation rate; males only; no women; community group not matched on education
Fazel et al. (2002)	MMSE	2	NR (MMSE secondary outcome)	Private; specialist registrar psychiatrist; all instruments trained	Geriatric Mental State; SCID-II personality; NART	5/8	Wellcome Trust	Findings may not generalise to all sex offenders; sample represents severe end of sex criminals; not generalisable beyond 100-mile Oxford region	Non-SO may not be ideal comparator; all types of SO combined; not generalisable beyond Oxford region
Forsyth et al. (2025)	MoCA (+ACE-III)	3	12% ≤23 (MoCA); 8% dementia (ACE-III <88); 7% dementia (weighted prev)	Prison healthcare unit/interview rooms	GDS-15; PrisonQuest; Rivermead PCQ (brain injury)	7/9	NIHR	Representative national sample (sex, age, geography, prison type) — high generalisability for England and Wales	ACE-III not validated for prison; MoCA cut-off adjusted; no clinical diagnosis confirmed
Hayes et al. (2012)	MMSE	3	7% <24 (95% CI 4–11%)	Prison rooms/wings, workshop, or healthcare centre	SCID-I and -II (psychiatric)	8/9	Mersey Care NHS Trust; Dept of Health	66% of NW older prisoners included — relatively generalisable within NW England; NW has no dispersal prisons which may affect morbidity	NW England only (no dispersal prisons); no women; no control group

Study	Tool(s)	Tier	Prevalence/% below threshold	Testing conditions	Other measures administered	JBI score	Funding source	Generalisability (author-stated)	Key Limitations
Kingston et al. (2011)	MMSE	3	13% <26	Prison rooms on wings or prisoners' cells	Geriatric Mental State; Short Form 12	6/9	NIHR	Low uptake (51%); one Staffordshire PCT area; represents approx. 4.7% of over-50s prisoners in England & Wales at time	Low uptake (51%); one Primary Care Trust (NHS) area; no MMSE mean/SD NR limitations
Modini et al. (2025)	ACE-III +M-ACE	3	7.89% confirmed dementia. PPV 23–25% for ACE-III/M-ACE cut-offs *(<82; <81 age>75; <79 edu<11yrs)*	Single clinician; face-to-face; prison interview rooms	Brain injury due to alcohol use (self-report)	8/9	None	Limited by small sample and homogeneity; lacked cultural and linguistic diversity; no female participants	Small sample; lack of cultural diversity; no females; geriatrician not blind to screening scores, high false positives
Perez et al. (2021)	MoCA	2	38.5% <23 (education and race adjusted); 62.6% unadjusted <26	NR	Trail Making Test; self-reported head injuries	6/8	National Institute of Mental Health	Approx. 30% responded to recruitment letters; one US state only; may not be widely generalisable	Low uptake (30% responded); one US state only; not collected head injury cause data
Rodriguez et al. (2017)	ACE-R	2	10.4% impaired (FTSO; ACE-R ≤88); FTSO M=87.7 (10.4); NSO M=92.5 (4.1)	NR	Extensive executive function battery (TMT, verbal fluency, stroop etc.)	4/8	NHMRC (Australia)	88% prison-based; community SO group (HSO; 12%) excluded; limits generalisability beyond Long Bay Prison Sydney	HSO community group excluded (12% of original sample); small N; one prison; no power calculation
Tucker et al. (2021)	6-CIT	3	20% ≥8 (dementia threshold; n=15/75)	Private location in prison	GHQ; PriSnQuest; Psychosis Screening Q; DAST; MAST	6/9	NIHR	Absence of women's prisons means results cannot be generalised to female prisoners; Manchester area only	No women; Manchester area; recruitment letter may have excluded poor literacy; primary outcome is social care needs
Verhülsdonk et al. (2021)	MMSE (+DemTect, TMT, FAB)	2	24% <26 (MMSE); 45% below normal (if DemTect included)	NR	PHQ-9 (depression); Trail Making Test; FAB	5/8	NR	Heterogeneity in sample; small sample size; under-representation of women; Germany (NRW) only	Small sample; under-representation of women; screening battery only; heterogeneity in sample
Verhülsdonk et al. (2023b)	MMSE (+DemTect)	2	NR (feasibility design; MMSE M=28.11, SD=1.71)	NR	FAB; TMT; PHQ-9; (DemTect <8 exclusion criterion)	5/9	Open Access Projekt DEAL	Small N (n=18); feasibility design; 2 specialist prisons only — low generalisability	Small N (n=18); feasibility design; 2 specialist prisons only; need for larger RCT confirmed

Note 2b. JBI = Joanna Briggs Institute Critical Appraisal Tools. Tool scores: /8 = JBI cross-sectional checklist; /9 = JBI prevalence checklist. High quality: ≥6/8 or ≥7/9. Moderate: 4–5/8 or 5–6/9. MoCA = Montreal Cognitive Assessment; MMSE = Mini-Mental State Examination; ACE-R = Addenbrooke's Cognitive Examination — Revised; ACE-III = Third Edition; M-ACE = Mini-ACE; 6-CIT = Six-Item Cognitive Impairment Test; FAB = Frontal Assessment Battery; DAST = Drug Abuse Screening Test; MAST = Michigan Alcoholism Screening Test; AUDIT = Alcohol Use Disorders Identification Test; GDS = Geriatric Depression Scale; PHQ-9 = Patient Health Questionnaire; TMT = Trail Making Test; SCID = Structured Clinical Interview for DSM; NART = National Adult Reading Test; GHQ = General Health Questionnaire; ADL = Activities of Daily Living.

Appendix 1.4 Table 2a Critical Appraisal (JBI Cross-Sectional)

Table 2a - JBI Critical Appraisal Results for 8 of 14 studies (Cross-Sectional)

JBI Cross-Sectional Checklist (8 items)										
Study	**Q1 – Were the criteria for inclusion in the sample clearly defined?**	**Q2 – Were objective, standard criteria used for the measurement of the condition?**	**Q3 – Was the exposure measured in a valid reliable and way?**	**Q4 – Were the outcomes measured in a valid and reliable way?**	**Q5 – Were confounding factors identified?**	**Q6 – Were strategies to deal with confounding factors stated?**	**Q7 - Was appropriate statistical analysis used?**	**Q8 – Were the study subjects and setting described in detail?**	**Score**	**Quality**
Ahalt et al. (2018)	Y	Y	U	Y	Y	Y	Y	Y	7/8	High
Baidawi et al. (2016)	Y	Y	U	Y	Y	U	Y	Y	6/8	High
Baillargeon et al. (2023)	Y	Y	U	Y	Y	Y	Y	Y	7/8	High
Combalbert et al. (2018)	Y	Y	U	Y	Y	Y	Y	Y	7/8	High
Fazel et al. (2002)	Y	Y	N	Y	Y	N	U	Y	5/8	Moderate
Perez et al. (2021)	Y	Y	U	U	Y	Y	Y	Y	6/8	High
Rodriguez et al. (2017)	Y	Y	U	U	U	U	Y	Y	4/8	Moderate
Verhülsdonk et al. (2021)	Y	Y	U	U	Y	U	Y	Y	5/8	Moderate

Note. Y = Yes; N = No; U = Unclear. High quality: ≥6/8; Moderate quality: 4–5/8.

Appendix 1.4 Table 2b Critical Appraisal (JBI Prevalence)

Table 2b - JBI Critical Appraisal Results for 6 of 14 studies (Prevalence)

JBI Prevalence Checklist (9 items)											
Study	**Q1 – Was the sample frame appropriate to address the target population?**	**Q2 – Were study participants sampled in an appropriate way?**	**Q3 – Was the sample size adequate?**	**Q4 – Were the study subjects and the setting described in detail?**	**Q5 – Was the data analysis conducted with sufficient coverage of the identified sample?**	**Q6 – Were valid methods used for the identification of the condition?**	**Q7 – Was the condition measures in a standard, reliable way for all participants?**	**Q8- Was there appropriate statistical analysis?**	**Q9 – Was the response rate adequate, and if not, was the low response rate managed appropriately?**	**Score**	**Quality**
Forsyth et al. (2025)	Y	Y	Y	Y	U	Y	U	Y	Y	7/9	High
Hayes et al. (2012)	Y	Y	U	Y	Y	Y	Y	Y	Y	8/9	High
Kingston et al. (2011)	Y	U	Y	Y	Y	Y	Y	U	U	6/9	Moderate
Modini et al. (2025)	Y	Y	U	Y	Y	Y	Y	Y	Y	8/9	High
Tucker et al. (2021)	Y	Y	U	Y	U	Y	Y	U	Y	6/9	Moderate
Verhülsdonk et al. (2023b)	Y	Y	N	U	Y	Y	U	U	Y	5/9	Moderate

Note. Y = Yes; N = No; U = Unclear. High quality: ≥7/9; Moderate 5–6/9. No studies were rated as low quality.

Appendix 2

Appendix 2.1

STROBE Statement—Checklist of items that should be included in reports of ***cross-sectional studies***

	Item No	Recommendation	Page No
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	41 (states cross-sectional)
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	41
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	42-45
Objectives	3	State specific objectives, including any prespecified hypotheses	44 (Aims and hypotheses)
Methods			
Study design	4	Present key elements of study design early in the paper	45 (Study design)
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	45-46 (Setting: Dec 2025-May 2026, HMP Low Moss/Shotts, capacities and over-50 population estimates given)
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	46 (Participants, Inclusion/Exclusion Criteria)
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	48-49 (Measures)

Data sources/ measurement	8	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	48-49 *MCI above and below cut-off comparisons when looking at risks and variables which may be associated.
Bias	9	Describe any efforts to address potential sources of bias	36-48 (ethics approval, informed consent procedures); 40 (recruitment bias minimisation); see also Limitations p.
Study size	10	Explain how the study size was arrived at	46 (Sample Size Estimation)
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	48-49 Risk factors and cut offs as per psychometric measures and existing evidence
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	50 (Statistical Analysis overview). Confounding control: Linear regression was sig with Year of Edu not sig (see Limitations 65)
		(*b*) Describe any methods used to examine subgroups and interactions	52-54 (exploratory analyses paragraph) along with MCI above and below cut-off comparisons
		(*c*) Explain how missing data were addressed	Individual missing-data counts reported per-variable in Results (see key/note on each table)
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	Not reported, there was no plan to compare

			people between the two sites
		(*e*) Describe any sensitivity analyses	Not conducted – but normality was assessed throughout
Results			
Participants	13	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	51 (20 volunteers unable to take part, with breakdown). also comparisons between MCI and No MCI groups
		(b) Give reasons for non-participation at each stage	51 (reasons given: n=11 under 50, n=6 liberated/transferred, n=3 opted out)
		(c) Consider use of a flow diagram	Not used as this was reported narratively (optional STROBE)
Descriptive data	14	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	51-52 (demographics narrative), 44-45 (Table 3, full demographic characteristics) also comparisons between MCI and No MCI groups
		(b) Indicate number of participants with missing data for each variable of interest	Reported per-variable where relevant in results (e.g. head injury/ SIMD) – all variables with any missing data were consistently reported
Outcome data	15	Report numbers of outcome events or summary measures	51-55 (MCI 78.5%), Results and regression sections. Also reported comparing those scoring in impairment range

Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	Regression results reported with 95% CI throughout. Adjusted estimates: Years of Education was adjusted for as a confounding variable (see 52-54)
		(*b*) Report category boundaries when continuous variables were categorized	55 (MoCA ≤23), Table 6 (individual risk factor cut-offs)
		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	N/A – odds ratios and regression coefficients reported
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	52-54 (exploratory occupation/education analyses); Tables 9 and 10 and 11 Appendix 2.10 (Supplementary Data Output)
Discussion			
Key results	18	Summarise key results with reference to study objectives	63 (Discussion, Implications for practice)
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	65 (Limitations)
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	63-64 (dichotomisation/power and sample size discussed)

Generalisability	21	Discuss the generalisability (external validity) of the study results	65 (two-site recruitment, self-selection through adverts in the prisons)
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	39 (Disclosure statement: no specific funding, no competing interests to declare)

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article. Information on the STROBE Initiative is available at www.strobe-statement.org.

Appendix 2.2 NHS REC Ethical Approval

WoSRES
West of Scotland Research Ethics Service

NHS
Greater Glasgow and Clyde

Dr Alexander Fradera
University of Glasgow
School of Mental Health and Wellbeing
90 Byres Road
University of Glasgow
Glasgow
G12 8TB

West of Scotland REC 5
West of Scotland Research Ethics Service
Admin Building, Level 2
Gartnavel Royal Hospital
1055 Great Western Road
Glasgow G12 0XH
www.nhsggc.org.uk
Date 18 September 2025
e-mail ggc.wosrec5@nhs.scot

Dear Dr Fradera

Study title:	**Getting older in prison: Prevalence, impact and disability of Mild Cognitive Impairment**
REC reference:	**25/WS/0143**
Protocol number:	**353388**
IRAS project ID:	**353388**

The Research Ethics Committee (REC) reviewed the above application at the meeting held on 17 September 2025. Thank you for attending to discuss the application.

Ethical opinion

The members of the Committee present gave a favourable ethical opinion of the above research on the basis described in the application form, protocol and supporting documentation, subject to the conditions specified below.

Good practice principles and responsibilities

The UK Policy Framework for Health and Social Care Research sets out principles of good practice in the management and conduct of health and social care research. It also outlines the responsibilities of individuals and organisations, including those related to the four elements of research transparency:

1. registering research studies
2. reporting results
3. informing participants
4. sharing study data and tissue

Conditions of the favourable opinion

The REC favourable opinion is subject to the following conditions being met prior to the start of the study.

Confirmation of Capacity and Capability (in England, Northern Ireland and Wales) or NHS management permission (in Scotland) should be sought from all NHS organisations involved in the study in accordance with NHS research governance arrangements. Each NHS organisation must confirm through the signing of agreements and/or other documents that it

has given permission for the research to proceed (except where explicitly specified otherwise).

Guidance on applying for HRA and HCRW Approval (England and Wales)/ NHS permission for research is available in the Integrated Research Application System.

For non-NHS sites, site management permission should be obtained in accordance with the procedures of the relevant host organisation.

Sponsors are not required to notify the Committee of management permissions from host organisations.

Registration of Clinical Trials

All research should be registered in a publicly accessible database and we expect all researchers, research sponsors and others to meet this fundamental best practice standard.

It is a condition of the REC favourable opinion that **all clinical trials are registered** on a public registry before the first participant is recruited and no later than six weeks after. For this purpose, 'clinical trials' are defined as:

- clinical trial of an investigational medicinal product
- clinical investigation or other study of a medical device
- combined trial of an investigational medicinal product and an investigational medical device
- other clinical trial to study a novel intervention or randomised clinical trial to compare interventions in clinical practice.

A 'public registry' means any registry on the WHO list of primary registries or the ICMJE list of registries provided the registry facilitates public access to information about the UK trial.

Failure to register a clinical trial is a breach of these approval conditions, unless a deferral has been agreed by the HRA (for more information on registration and requesting a deferral see: Research registration and research project identifiers).

Where a deferral is agreed we expect the sponsor to publish a minimal record on a publicly accessible registry. When the deferral period ends, the sponsor should publish the full record on the same registry, to fulfil the condition of the REC favourable opinion.

If you have not already included registration details in your IRAS application form you should notify the REC of the registration details as soon as possible.

Where the study is registered on ClinicalTrials.gov, please inform deferrals@hra.nhs.uk and the Research Ethics Committee (REC) which issued the final ethical opinion so that our records can be updated.

Publication of Your Research Summary

We will publish your research summary for the above study on the research summaries section of our website, together with your contact details, no earlier than three months from the date of this favourable opinion letter. Where a deferral is agreed, a minimum research summary will still be published in the research summaries database. At the end of the deferral period, we will publish the full research summary.

Should you wish to provide a substitute contact point, make a request to defer, or require further information, please visit: Research summaries - Health Research Authority (hra.nhs.uk)

It is the responsibility of the sponsor to ensure that all the conditions are complied with before the start of the study or its initiation at a particular site (as applicable).

After ethical review: Reporting requirements

The attached document "After ethical review – guidance for researchers" gives detailed guidance on reporting requirements for studies with a favourable opinion, including:

- Notifying substantial amendments
- Adding new sites and investigators
- Notification of serious breaches of the protocol
- Progress and safety reports
- Notifying the end of the study, including early termination of the study
- Final report
- Reporting results

The latest guidance on these topics can be found at https://www.hra.nhs.uk/approvals-amendments/managing-your-approval/.

Ethical review of research sites

NHS/HSC Sites

The favourable opinion applies to all NHS sites taking part in the study, subject to confirmation of Capacity and Capability (in England, Northern Ireland and Wales) or NHS management permission (in Scotland)being obtained from the NHS/HSC R&D office prior to the start of the study (see "Conditions of the favourable opinion" below).

Non-NHS/HSC sites

I am pleased to confirm that the favourable opinion applies to any non-NHS/HSC sites if applicable listed in the application, subject to site management permission being obtained prior to the start of the study at the site.

Approved documents

The documents reviewed and approved at the meeting were:

Document	*Version*	*Date*
Copies of materials calling attention of potential participants to the research [Study Advertisement]	4	25 August 2025
Copies of materials calling attention of potential participants to the research [Study Poster]	4	25 August 2025
Evidence of Sponsor insurance or indemnity (non NHS Sponsors only) [Insurance]		28 July 2025
IRAS Application Form [IRAS_Form_25082025]		25 August 2025
Non-validated questionnaire [Demographic Questionnaire]	4	25 August 2025
Other [Cover Letter RE SPS Ethics]	1	25 August 2025
Other [Email trail about SPS Ethics]	1	25 August 2025
Participant consent form [Study Consent Form]	4	25 August 2025

Document	*Version*	*Date*
Participant consent form [Consent to Contact Form]	4	25 August 2025
Participant information sheet (PIS) [Participant Privacy Notice]	4	19 August 2025
Participant information sheet (PIS) [Participant Information Sheet]	4	29 August 2025
Research protocol or project proposal [Research Protocal]	4	25 August 2025
Summary CV for Chief Investigator (CI) [Dr A Fradera Research CI + Supervisor CV]	1	20 August 2025
Summary CV for student [Claire DC Researcher CV]	1	24 July 2025
Summary CV for student [Courtney S Researcher CV]	1	11 August 2025
Summary CV for supervisor (student research) [Dr A Fradera Research CI + Supervisor CV]	1	20 August 2025
Validated questionnaire [Montreal Cognitive Assessment (MoCA) English]		
Validated questionnaire [OSU TBI]		
Validated questionnaire [PCL-5]		
Validated questionnaire [HADS]		
Validated questionnaire [CORE-10]		
Validated questionnaire [AUDIT]		
Validated questionnaire [DAST-10]		
Validated questionnaire [CANFOR-S]	I	
Validated questionnaire [PADL]	1	25 August 2025

Membership of the Committee

The members of the Ethics Committee who were present at the meeting are listed on the attached sheet.

The Committee is constituted in accordance with the Governance Arrangements for Research Ethics Committees and complies fully with the Standard Operating Procedures for Research Ethics Committees in the UK.

User Feedback

The Health Research Authority is continually striving to provide a high quality service to all applicants and sponsors. You are invited to give your view of the service you have received and the application procedure. If you wish to make your views known please use the feedback form available on the HRA website: http://www.hra.nhs.uk/about-the-hra/governance/quality-assurance/

HRA Learning

We are pleased to welcome researchers and research staff to our HRA Learning Events and online learning opportunities– see details at: https://www.hra.nhs.uk/planning-and-improving-research/learning/

IRAS project ID: 353388 Please quote this number on all correspondence

With the Committee's best wishes for the success of this project.

Yours sincerely



On behalf of
Dr James Dale
Chair

Enclosures: List of names and professions of members who were present at the meeting and those who submitted written comments

After ethical review guidance for sponsors and investigators – Non CTIMP Standard Conditions of Approval

Copy to: Mrs Sinead Traynor

Appendix 2.3 SPS Ethical Approval

West of Scotland REC 5

Attendance at Committee meeting on 17 September 2025

Committee Members:

Name	*Profession*	*Present*	*Notes*
Ms Maxine Arnott	Senior Research Nurse Manager (Vice-Chair)	Yes	
Ms Janet Bell	Biomedical Scientist	Yes	
Mrs Linda Boyle	Retired Company Secretary	No	
Dr Stephen Corson	Statistician	No	
Dr James Curran	GP	Yes	
Dr James Dale	Consultant Rheumatologist (Chair)	Yes	Chair of Meeting
Dr Kirsteen Goodman	Trial Manager/Research Fellow	No	
Dr Eleanor Jarvie	Consultant Obstetrician	Yes	
Ms Maisie Keogh	Research Assistant & Doctorate Researcher	No	
Dr Stefanie Lip	Honorary Consultant in Clinical Pharmacology & Therapeutics and General Internal Medicine	Yes	
Ms Amanda Minns	Head of Evidence	No	
Mr George Monaghan	Photographer	No	
Mrs Karen Mowbray	Records Services Manager (Alternate Vice-Chair)	Yes	
Miss Olayide Olajuyin	Research Funding/Scholarship Administrator	No	
Mrs Tracy Taylor	Retired Veterinary Nurse	Yes	
Mrs Eilidh Wright	Senior QA Auditor (GCP)	Yes	
Miss Constantina Yiannakis	Consultant Head and Neck Surgeon	No	

Also in attendance:

Name	*Position (or reason for attending)*
Mrs Abibat Adewumi-Ogunjobi	REC Manager
Mrs Kirsty Burt	REC Manager
Dr Judith Godden	Scientific Officer/Manager

Written comments received from:

Name	*Position*
Dr Stephen Corson	Statistician

REGULATIONS CONCERNING RESEARCH ACCESS TO PRISON ESTABLISHMENTS FOR THE PURPOSES OF CONDUCTING RESEARCH

All access to prison establishments for the purposes of conducting research is conditional on the researcher(s) agreeing to abide by the undernoted requirements.

1. All data and research material arising out of the study must be dealt with on an anonymous, unattributable and confidential basis. No individual should be named or identified. Researchers must comply with the Data Protection Act (1998).

2. If the study is to involve interviewing respondents, all such respondents must give voluntary consent and be informed of the purpose of the study; anticipated uses of data; identity of funder(s) (if applicable); and the identity of the interviewer.

3. All research data and material of whatever kind (i.e. interview notes, questionnaires, tapes, transcripts, reports, documents, specifications, instructions, plans, drawings, patents, models, designs, whether in writing or on electronic or other media) obtained from the Scottish Prison Service shall remain the property of the Crown. Information collected during the course of a research project must not be supplied to another party or used for any other purpose other than that agreed to and contained in the original research proposal. All confidential research data obtained from SPS must be held securely for up to a maximum of 60 months on completion of the research and destroyed thereafter.

4. All researchers must abide by the ethical guidelines of their profession or discipline and must nominate below the guidelines to which they will adhere. (e.g. Social Research Association, British Sociological Association etc.) All researchers must arrange to be cleared with Enhanced Disclosure if contact with prisoners in envisaged.

5. Where appropriate, research proposals may require to be submitted to the Ethics Committee of the Area Health Board (or MREC) and to receive its approval before access is granted.

6. The Chair of the SPS Research Access and Ethics Committee (RAEC) must be informed in writing and agree to any changes to the project which involve alterations to the essential nature of the agreed work.

7. The Scottish Prison Service reserves the right to terminate access to SPS establishments at any time for any Operational reason that may arise or for any breach by the researcher of the Access Regulations or for any failure on the part of the researcher to conduct the study as agreed with the RAEC. In the event of access being terminated for any reason whatsoever, all data obtained from SPS during the course of the research shall be returned to the Scottish Prison Service.

8. The Scottish Prison Service has a duty of care to staff and visitors on its premises and has public liability indemnity.

9. It is a condition of access that a copy of any final report or dissertation or other written output arising from the research MUST be submitted to SPS to be lodged in its Research Library. Any material resulting from access which is intended to be presented publicly must also be submitted to SPS. In principle, the Scottish Prison Service supports the publication and dissemination of research findings arising from approved work, but the Service reserves the right to amend factual inaccuracies.

10. Reports and presentations should be sent to SPSResearchTeam@prisons.gov.scot

Ethical guidelines nominated_____

I have read the above regulations and agree to be bound by them.

[redacted] (Signature) 6 November 2025 (Date)

SPS – Ethical Approval sent via Email

Correspondence removed

Correspondence removed

Correspondence removed

Correspondence removed

Appendix 2.4 MRP Proposal - https://osf.io/h6erp/files/6y8rp

Appendix 2.5 Participant information sheet - https://osf.io/h6erp/files/bu8rw

Appendix 2.6 Consent Form - https://osf.io/h6erp/files/fzmh9

Appendix 2.7 Data Analysis plan - https://osf.io/qsnxb

Appendix 2.8 Syntax - https://osf.io/h6erp/files/4h3wg

Appendix 2.9 Data availability statement

Due to the sensitive nature of the data, collected from a vulnerable population in a prison setting, and in accordance with the ethical approval granted for this study (West of Scotland REC 5, REC reference 25/WS/0143), the raw dataset generated during this research is not publicly available. All data were anonymised prior to analysis; the SPSS dataset used for analysis contains no direct identifiers, with participants identified only by a unique participant number, in compliance with GDPR and the Data Protection Act (2018). Data will be stored securely on the University of Glasgow's Enlighten research data repository for a minimum of 10 years following study completion, with access restricted to the research team and study custodian (Dr Alexander Fradera, University of Glasgow). Reasonable requests for access to the anonymised dataset for legitimate research purposes may be considered by the study custodian, subject to an appropriate data sharing agreement and any further ethical approval that may be required.

Appendix 2.10 Supplementary Data Output

Appendix 2.10 Table 1

Group Profile Descriptives by MCI Status

Variable	**No MCI** ***M (SD)***	**No MCI** **Mdn (IQR)**	**MCI** ***M (SD)***	**MCI** **Mdn (IQR)**
MoCA Score	25.14 (1.17)	25.00 (1)	19.33 (3.53)	20.00 (4)
MoCA MIS	10.29 (3.34)	10.00 (5)	7.22 (3.54)	6.00 (5)
HADS Anxiety	7.79 (6.25)	7.50 (11)	9.55 (4.71)	9.00 (7)
HADS Depression	7.07 (3.43)	7.00 (5)	7.94 (4.72)	7.00 (7)
AUDIT	17.00 (12.07)	16.50 (22)	15.94 (11.13)	15.00 (19)
DAST	2.14 (2.60)	1.00 (4)	4.92 (3.86)	4.00 (8)
PCL-5	25.64 (14.01)	27.00 (16)	30.06 (17.46)	26.00 (27)
CORE-10	13.14 (6.98)	12.50 (10)	16.43 (7.46)	16.00 (10)
Years of Education	13.36 (2.27)	13.00 (3)	11.65 (3.39)	11.00 (3)
Total Risk Factors	3.00 (1.30)	3.00 (2)	3.53 (1.38)	4.00 (3)

Note. N = 65 for all variables. No MCI n = 14; MCI n = 51.

Appendix 2.11 Reflexivity Statement

As I shared in my Module 9 reflexivity statement, my interest in this research was rooted in a long-standing curiosity about forensic psychology and a wish to give voice to a population often overlooked in both research and wider society. Having now completed recruitment, data collection, and analysis, I have been able to reflect on how these initial motivations held up against the realities of conducting research in a prison setting.

Meeting participants directly brought home the inherent power imbalance in the research relationship in a way that was more immediate than I had anticipated at proposal stage. I remained conscious that participation, while voluntary, occurred in an environment where autonomy is already significantly constrained, and I made deliberate efforts to reinforce throughout that not taking part would have no bearing on sentencing or parole, to safeguard against steering consent. Hearing participants' accounts of early trauma and adversity was a stark reminder of how systemic failures in childhood can carry lifelong consequences, and reinforced for me the importance of framing these findings within a trauma-informed understanding of the population rather than in isolation from their broader life histories.

Working alongside my fellow researcher has not been without challenges in dividing and navigating shared tasks including ethical approval, but it also gave rise to the peer reflection I had hoped for. Discussing scoring and then later statistical analysis decisions together meant decisions were shaped through joint discussion rather than either one of our assumptions alone. I found this supported a more transparent and defensible process.

As anticipated, I remained mindful throughout of the people behind the data. Encountering the actual prevalence of MCI within this sample, which was surprisingly and substantially higher than I had even expected from earlier stages, reinforced my sense of responsibility in how these findings are framed and disseminated to allow the cogs of change to start moving. I have aimed throughout the write-up to present the cognitive vulnerability in a way that highlights healthcare needs, rather than reinforcing risk-focussed narratives already common in forensic settings.

Regular supervision, alongside my research log, provided ongoing space to examine these reflections as they arose, particularly around ensuring that analytic decisions were driven by methodological rigour rather than a wish for particular findings.