

1       **Psychiatric disorders among older prisoners: A systematic review and comparison**  
2       **study against older people in the community.**

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51 **Abstract**

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53 *Title of manuscript:* Psychiatric disorders among older prisoners: A systematic review and  
54 comparison study against older people in the community.

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56 *Journal:* Aging and Mental Health

57

58 **Abstract text:**

59

60 *Objectives.* Despite emerging evidence that older prisoners experience poor mental health,  
61 literature in this area is still limited. In the present systematic review and meta-analysis, we  
62 report on the prevalence of psychiatric disorders among older prisoners and compare our  
63 findings against community studies on older people.

64

65 *Methods.* We searched on Assia, PsycInfo, MedLine, Embase, Web of Science, Google and  
66 Gov.uk. We carried out bias assessments, rated studies for quality and ran a heterogeneity  
67 test. We meta-analysed prevalence rates of psychiatric disorders through an aggregate  
68 weighted mean and calculated Relative Risk and statistical significance against community  
69 studies. Sensitivity analyses were further performed.

70

71 *Results.* We reviewed nine studies and obtained the following prevalence: “Any psychiatric  
72 disorder” 38.4%, depression 28.3%, schizophrenia/psychoses 5.5%, bipolar disorder 4.5%,  
73 dementia 3.3%, cognitive impairment 11.8%, personality disorder 22.9%, alcohol abuse  
74 15.9%, anxiety disorders 14.2%, PTSD 6.2%. Older prisoners were found to have higher RR  
75 for every single psychiatric disorder against older people in the community, with the sole  
76 exception of alcohol abuse (RR=1) and dementia (RR=.75). The prevalence rates were  
77 statistically significantly higher ( $p<.05$ ) among the prisoners for “Any psychiatric disorder”,  
78 depression and personality disorder. Overall, the sensitivity analyses confirmed our original  
79 results.

80

81 *Conclusion.* Our findings point at a high prevalence of every single psychiatric disorder  
82 among older prisoners, who also experience rates of dementia and alcohol abuse comparable  
83 to those reported in the community. Our results have relevant implications for policy and  
84 practice in this area. Further research is crucial to confirm findings from this study.

85

86 **Keywords**

87 Prison, older people, psychiatric disorder, dementia, meta-analysis.

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## 97 Introduction

98

99 In the last fifteen years, the overall number of prisoners has increased worldwide by about  
100 6% (Walmsley, 2016). This has been accompanied in many countries by a disproportionately  
101 higher increase in the prevalence of older prisoners. In Japan for example, the number of  
102 older inmates has doubled (Williams et al., 2012). A similar trend was experienced in the  
103 United Kingdom (UK), where male prisoners over 60 years doubled in the period 2002-2011,  
104 with an 8-fold increase since 1990 (Senior et al., 2013). In the United States of America  
105 (USA), over the same period, the older prison population grew by around 300% (Williams et  
106 al., 2012), in Australia from 21,714 to 29,696 individuals (+36%) from 2000 to 2010  
107 (Baidawi et al., 2011) and in Canada by more than 50% from 2001 to 2011 (Penal Reform  
108 International, 2015).

109

110 Today, prisoners over 50 years old represent an increasing percentage of the prison  
111 population. In Ireland, they constitute almost 10% of the total number of inmates (Joyce &  
112 Maschi, 2016) and in the UK around 13% (13,000 individuals) (Prison Reform Trust, 2014).  
113 The percentage raises to 18.8% in the USA, where more than 250,000 inmates were over 50  
114 years old in 2014 (Carson, 2015) and in Italy, where among 62,000 prisoners, one in five is  
115 aged over 50 (n=12,400) (ISTAT, 2015).

116

117 A number of factors have contributed to the accumulation of newly-incarcerated and long-  
118 term older prisoners (Frazer, 2003). The ageing of the general population and of baby-  
119 boomers (Senior et al., 2013) has been accompanied by cultural and societal changes.  
120 Behaviours that were once often condoned are now more frequently prosecuted, such as in  
121 the case of sexual offences, which are prevalent among older offenders (Yorston, 2015;  
122 Frazer, 2003). The technological and scientific advances in forensic evidence have led to an  
123 increase in charges for historical offences (+95% in the UK between 1995 and 2005) and in  
124 the conviction of past offenders in old age (RECOOP, 2015). In addition, the justice system  
125 has systematically implemented a tougher sentencing policy to discourage crime (HM  
126 Inspectorate of Prisons, 2008). This has resulted in an increase in longer and whole life  
127 sentences (Moll, 2013; Frazer, 2003), the implementation of indeterminate prison sentences  
128 with no fixed release date (RECOOP, 2015) and tougher approaches to breaches of  
129 supervision (+855% in the UK) and Bail Act offences (+746% in the UK).

130

131 Older prisoners have been identified by the United Nations as a special need population  
132 because of their unique physical, mental health and social care needs (Atabay, 2009).  
133 However, a recent international systematic review has evidenced that these needs are only  
134 being partially met at present time (Di Lorito, Völlm & Denning, 2016). While prisoners of all  
135 ages have been reported to experience poor mental and physical health (Cooney and  
136 Braggins, 2010; Baldwin and Leete, 2012; Moll, 2013), the added challenges of aging in the  
137 prison system and the neglect of health needs may expose the older prisoner to a high risk of  
138 developing psychiatric disorder or exacerbating pre-existing psychiatric morbidity.

139

140 Despite the increasing numbers of older prisoners worldwide and the accumulating evidence  
141 on their exposure to psychiatric disorders, epidemiological research in this area has been  
142 relatively scant thus far. While the phenomenon of an aging population has generated robust  
143 literature around the mental health of older people in the community, we were unable to  
144 retrieve a systematic review on the prevalence of psychiatric disorders among older prisoners.

145

146 The aim of the present systematic review is to bridge the existing research gap by  
147 investigating the prevalence of psychiatric disorders among older prisoners reported in the  
148 existing international literature and by comparing results against the prevalence rates of  
149 psychiatric disorders reported in community studies on older people.

150  
151 We hypothesise that older prisoners experience higher rates of psychiatric morbidity  
152 compared to older people in the community.

## 153 Methods

154

### 155 Search strategy

156

157 The present review complies with the guidelines of the Preferred Reporting Items for  
158 Systematic Reviews and Meta-Analyses (PRISMA) Statement (Moher, Liberati, Tetzlaff &  
159 Altman, 2009). Our search strategy is based on the PICO (Patient, Intervention, Comparison,  
160 Outcome) worksheet for conducting systematic reviews, a widely used model to frame  
161 research questions (Sackett, Richardson, Rosenberg & Haynes, 1997). The PICO format was  
162 adopted to define the target population, context and outcomes of the review.

163

164 We undertook a systematic literature search on 5 electronic databases: Assia, PsycInfo,  
165 MedLine, Embase and Web of Science. The databases were accessed in December 2015 and  
166 again in December 2016 to ensure we retrieved up-to-date literature. Our search strategy  
167 combined terms from three domains:

168

- 169 1. The age domain, including the following terms: Age\*, old\*, aging, elderly, mature.
- 170 2. The prison domain, including the following terms: Prison\*, crim\*, imprison\*, offen\*,  
171 sentence\*, inmate\*, incarcerat\*, detain\*, detention\*, convict\*, felon\*, penitentiary\*,  
172 "locked up", "behind bars".
- 173 3. The psychiatric disorder domain, including the following terms: Mental\*, health\*,  
174 suicid\*, psychotic, psychos\*, psychiatr\*, psychologist\* depress\*, ill\*, disease\*,  
175 schizophreni\*, dement\*, Alzheimer\*, disorder\*, "alcohol abuse", "cognitive  
176 impair\*", "personality disorder\*", anxi\*, "Post-Traumatic Stress Disorder", PTSD.

177

178 The strategy was consistent across databases, except where minor modifications were needed  
179 to respond to different characteristics of the databases.

180

181 In order to identify any relevant grey literature, government reports (e.g. published from the  
182 Parliament and the Ministry of Justice) and campaigning literature from lobby groups and  
183 charities, we also ran a search on Google and Gov.uk and inspected the first 100 hits. The  
184 reference pages of the articles retrieved through the electronic searches were further screened  
185 for further relevant literature.

186

### 187 Study selection and appraisal

188

189 Title and abstract screening of all initial results was carried out by the main author (CDL),  
190 who dismissed the papers that were clearly ineligible for review. The remainders were  
191 checked for eligibility against the inclusion/exclusion criteria by two independent raters  
192 (CDL and BV).

193

#### 194 Inclusion criteria

195

196 • Studies on prisoners over 50 years old, male and/or female. Prisoners have been  
197 evidenced to experience a premature aging process of around ten years due to their  
198 poor health management and common history of substance abuse (Cooney &  
199 Braggins, 2010; Baldwin & Leete, 2012; Moll, 2013). Given that age 60 is generally  
200 used as inclusion criterion in old age research, it is common practice in old age  
201 forensics to apply a 50-year-old cut-off. Nonetheless, we acknowledge that feeling  
202 older is a subjective experience and that defining an age cut-off, albeit necessary, may  
203 present some limitations.

204 • Studies collecting primary data with a primary aim to calculate the prevalence of  
205 psychiatric disorder among older prisoners. In identifying studies on psychiatric  
206 disorder, we adopted the classification of mental disorder provided in the International  
207 Statistical Classification of Diseases and Related Health Problems 10th Revision  
208 (ICD-10) (WHO, 1992). Our rationale for choosing this classification system lies in  
209 the fact that its development is global, multidisciplinary and multilingual, thus being  
210 most suitable for a literature review with an international focus.

211 • Studies published in any language and any year.

212

#### 213 Exclusion criteria

214

215 • Given our focus on prisoners, we excluded studies about offenders awaiting sentence,  
216 prisoners held in temporary incarceration (jails or local prisons), ex-prisoners or older  
217 people in other forensic settings such as psychiatric facilities. We also excluded  
218 studies on offenders referred for psychiatric evaluation, on the ground that these may  
219 present with disproportionately higher rates of psychiatric disorders.

220 • We also excluded studies on the general population of prisoners and which do not  
221 report a subset of data on older prisoners, review papers and all types of non-  
222 empirical studies such as commentaries and editorials or papers discussing mental  
223 health, mental health needs, service provision or policy.

224

225 Given the small number of studies retrieved, we did not exclude any study on the grounds of  
226 methodological quality. However, two independent raters (CDL and BV) assessed the  
227 studies' risk of bias and quality in two ways (table 1). First, we used the guidelines for  
228 evaluating prevalence studies published in the journal Evidence-Based Mental Health (Boyle,  
229 1998), which assesses potential biases in sampling, measurement and analysis.

230

231 Secondly, we used a modified version of the appraisal strategy developed by Prince et al.  
232 (2013) in their systematic review on the global prevalence of dementia and scored the studies  
233 as follows: For participant sample size, we assigned one point if the study included up to 200  
234 participants, two points if it included between 200 and 300 participants and three points if it  
235 included more than 300 participants. For gender, one point if the study included male  
236 participants only and two points if it included both male and female participants. For the  
237 number of prisons, one point if the study was single-site, two if it was multi-site. For  
238 diagnostic assessments, one point for self-reports, two points for audits of medical records,  
239 three points for clinical assessments; for response rate, one point if up to 50%, two points if

240 between 50% and 80% and three points for more than 80%. Any discrepancies between the  
241 two raters in assessing bias and in attributing the quality score were resolved by consensus  
242 with the third author (TD).

243

244 Further, in order to assess whether the studies were meta-analysable, we ran a heterogeneity  
245 test through the  $I^2$  statistic, which calculates the percentage of variation across studies due to  
246 heterogeneity rather than chance (Higgins and Thompson, 2002; Higgins et al., 2003). We  
247 carried out heterogeneity tests for depression and schizophrenia/psychoses, as these disorders  
248 included the largest number of studies.

249

## 250 Data extraction

251

252 Data were extracted independently by two authors (CDL and BV) through a piloted form  
253 derived from the data extraction software for reviews developed by the Cochrane  
254 Collaboration (2000). Data on prevalence were retrieved and extracted for “any psychiatric  
255 disorder”, depression, schizophrenia/psychoses, bipolar disorder, personality disorder,  
256 dementia, cognitive impairment, alcohol abuse, anxiety disorders and Post-Traumatic Stress  
257 Disorder (PTSD).

258

## 259 Data analysis

260

### 261 Meta-analysis of data on psychiatric disorders

262

263 We meta-analysed prevalence data by means of an aggregate mean -weighted by the number  
264 of subjects in the study- of the percentage of patients who met the criteria for each psychiatric  
265 disorder. Aggregate weighted mean is recommended for good practice in meta-analysis, as it  
266 factors the study sample size into the calculation of prevalence, enabling studies with a larger  
267 number of participants to have more weight than smaller ones (Rothstein, Higgins, Hedges &  
268 Borenstein, 2009).

269

270 For dementia, we differentiated between: 1) Weighted prevalence rate of dementia, diagnosed  
271 through clinical assessments only and 2) Weighted prevalence rate of cognitive impairment,  
272 detected through the use of the Mini-Mental State Examination (MMSE) (Folstein, Folstein  
273 & McHugh, 1975). This was deemed necessary to obtain more accurate prevalence rates, as  
274 some studies used the term “dementia” indiscriminately to report diagnoses based on the  
275 MMSE (Folstein, Folstein & McHugh, 1975), which in fact only detects cognitive  
276 impairment.

277

### 278 Comparisons against data from community studies

279

280 We compared results from our meta-analysis against prevalence rates from community  
281 studies on older people through Relative Risk (RR) and Chi-Square test for statistical  
282 significance.

283

284 In contrast with the population of older prisoners, there is a large amount of international  
285 literature around the prevalence of psychiatric disorders in older people in the community.  
286 The studies are extremely diverse in samples, methodologies, geographical location, and  
287 assessments. Although a meta-analysis of community studies would derive accurate



288 comparable data, the capacity needed for such investigation fell beyond the scope of our  
289 review.

290

291 We therefore identified suitable comparable data through existing systematic reviews (i.e.  
292 depression, schizophrenia/psychoses, and personality disorder), large epidemiological  
293 governmental surveys (i.e. anxiety disorders and alcohol abuse) or prevalence data reported  
294 by governmental agencies (i.e. “Any psychiatric disorder”) and relevant third sector  
295 organisations (i.e. dementia). Alternatively, we selected studies which reflected the  
296 geographical location, cultural background, legal system and/or aging trends of the studies  
297 included in our review (i.e. bipolar disorder, cognitive impairment and PTSD).

298

299 For “Any psychiatric disorder” in the community (15%), we used prevalence rates published  
300 by the US Department of Health and Human Services (1999) and the World Health  
301 Organisation (2016). For depression in the community (10.3%) we compared against data  
302 published in a recent systematic review of 132 international studies (Barua, Ghosh, Kar and  
303 Basilio, 2011). This rate is in line with other community studies on depression among older  
304 people (Denihan et al., 2000; Kay et al., 1985; Schoevers et al., 2000; Newman, Bland &  
305 Orn, 1998; Liu et al., 1997).

306

307 For schizophrenia/psychoses, we used a prevalence rate of 0.5%, as reported in a systematic  
308 review and international consensus study (Howard et al., 2000). For bipolar disorder, we  
309 compared against a community prevalence rate of 1%. This was obtained through  
310 combination of data from Hirschfeld et al. (2003), who reported a 1.6% rate for older people  
311 aged 55 to 64 and 0.5% for older people aged 65 and older. For dementia (3.5%), we  
312 obtained the prevalence rate for the community population through combination of data  
313 published by AgeUK (2016) and the Alzheimer’s Society (2016). For cognitive impairment,  
314 we compared against a prevalence of 6%, obtained through calculating the mean of the values  
315 by age group reported by Rait et al. (2005).

316

317 For personality disorder, we compared against a prevalence rate of 10%, reported in a meta-  
318 analysis by Abrams and Horowitz (1996). For alcohol abuse (11%), we calculated the mean  
319 of the prevalence for older people aged 50–64 years and 65 years old and over reported in the  
320 National Surveys on Drug Use and Health (NSDUH) (Blazer & Wu, 2009). For anxiety  
321 disorders, we used a prevalence rate of 10.5%, reported in the Longitudinal Aging Study  
322 Amsterdam (LASA) (Beekman et al., 1998). For PTSD, existing prevalence rates range from  
323 2.5% to 3.9% (Böttche, Kuwert & Knaevelsrud, 2012). We combined data from two large  
324 German studies (Spitzer et al., 2008; Maercker et al., 2008) and obtained a prevalence of  
325 3.2%.

326

### 327 Sensitivity analyses

328

329 To assess the robustness of our results, we carried out sensitivity analyses by sequentially  
330 excluding each study. We then re-calculated the prevalence weighted mean for each disorder  
331 and re-ran the comparison study against community prevalence rates.

332

333 Additionally, in order to test whether any study bias affected our results, we conducted post-  
334 hoc sensitivity analyses by removing:

335

- 336 • Studies with only male participants, on the ground of gender bias.

- Studies with a high non-response rate - set at 40% (Fincham, 2008) - on the ground of poor representativeness.
- Retrospective studies, as they could be based on poor data collection.
- Single-site studies, based on the ground of selection bias.
- Studies with participants' age below 55. The reason for this analysis was that although the majority of prison studies set 50 years old as inclusion in the category "old age", there is no consensus on this age cut-off. We therefore repeated our analysis by slightly raising the age criterion.

All data were analysed through IBM SPSS Statistics version 22 (IBM, 2013).

## Results

The initial search retrieved 3,222 papers, of which 3,200 were identified through the databases and 23 through Google and Gov.uk. Following title or abstract screening, 3,120 studies were dismissed, as they were clearly ineligible. The remaining 103 papers were screened for duplicates and assessed for eligibility against the inclusion criteria. Nine studies were selected for full review. The selection process is shown in figure 1 through a PRISMA (Moher, Liberati, Tetzlaff & Altman, 2009) flow diagram.

### Study characteristics

Study characteristics are shown in table 2. In brief, the studies were carried out in the UK (n=4) (Fazel et al., 2001; Murdoch, Morris & Holmes, 2008; Kingston, Le Mesurier, Yorston, Wardle & Heath, 2011; Hayes et al., 2012), in the USA (n=4) (Koenig, Johnson, Bellard, Denker & Fenlon, 1995; Regan, Alderson & Regan, 2002; Caverley, 2006; Williams et al., 2010) and in France (n=1) (Combalbert et al., 2016).

All the studies report point prevalence, which is the prevalence of psychiatric disorders at census date. The studies from France (Combalbert et al., 2016), the UK (Fazel et al., 2001; Hayes et al., 2012; Kingston et al., 2011; Murdoch et al., 2008) and one study from the USA (Koenig et al., 1995) were cross-sectional, while three studies from the USA were retrospective cohort studies (Caverley, 2006; Regan et al., 2002; Williams et al., 2010). The number of participants ranged from 95 to 671 (Mdn= 237; IQR=230.5). The age cut-off for inclusion in the "older" group varied: Caverley (2006), Combalbert et al. (2016), Hayes et al. (2012), Kingston et al. (2011) and Koenig et al. (1995) included inmates over 50 years old; Murdoch, Morris and Holmes (2008), Williams et al. (2010) and Regan, Alderson and Regan (2002) examined prisoners aged over 55 years old and Fazel et al. (2001) prisoners over 60 years old.

There was variation also in terms of the sites of the investigation: Three studies from the USA were single-site (Caverley, 2006; Regan, Alderson & Regan, 2002; Koenig et al., 1995), whereas the remaining studies were multi-site, focusing on two to fifteen prisons. In two studies (Combalbert et al., 2016; Williams et al., 2010), the number of establishments was not specified. All the studies were published literature.

The assessment tools included: An audit of the prisoner's health records (n=5), the MMSE (Folstein, Folstein & McHugh, 1975) (n=4), the Structured Clinical Interview for Diagnostic and Statistical Manual of Mental Disorders-IV (SCID) (First, Spitzer, Gibbon & Williams,



385 2002) (n=2), the Computerised Diagnostic Schedule for Geriatric mental scale (GMS-  
386 AGECAT) (Copeland et al., 1976) (n=2), the Geriatric Depression Scale (GDS) (Yesavage et  
387 al., 1982) (n=1), the Camberwell Assessment of Need Forensic Short Version (CANFOR-S)  
388 (Thomas et al., 2003) (n=1), the Short-Form 12 (SF-12) (Ware, Kosinski, & Keller, 1996)  
389 (n=1), the Diagnostic Interview Schedule (DIS) (Robins, Helzer, Croughan, & Ratcliff, 1981)  
390 (n=1), self-reports (n=1), the Symptom Checklist-90 (Pearson Assessments) (Derogatis et al.,  
391 1973) (n=1), the Mini International Neuropsychiatric Interview (MINI DSM-IV) French  
392 Version (Lecrubier et al., 1998) (n=1) and the Frontal Assessment Battery (Batterie Rapide  
393 d'Efficiency Frontale) (Dubois, Slachevsky, Litvan, & Pillon, 2000) (n=1).

394

395 For dimensional questionnaires, assessment cut-offs were based on standard practice. For the  
396 Symptom Checklist-90, a T-score above 60 was considered abnormal (Holi, 2003); for the  
397 Short-Form 12, a score below 45.6 identified morbidity (Vilgut et al., 2013). A  
398 GMS/AGECAT score of 3 or above was indicative of depression (Yohannes, Baldwin &  
399 Connelly, 2003). For the MMSE, a cut-off score of 24 or below identified cognitive  
400 impairment (O'Bryant et al., 2008); for the GDS a score of 10 and above identified  
401 depression (Yesavage et al., 1982). For the Frontal Assessment Battery, a score below 16  
402 points was considered symptomatic of reduced executive functioning (Dubois, Slachevsky,  
403 Litvan, & Pillon, 2000).

404

405 In regard to study outcomes, all the studies looked at depression, eight at  
406 schizophrenia/psychoses, seven at "any psychiatric disorder", five at anxiety disorders, four  
407 at dementia, and three at bipolar disorder, personality disorder, alcohol abuse, cognitive  
408 impairment and PTSD. The operational definition of the category "Any psychiatric disorder"  
409 varied across studies. Most notably, it differed as to whether alcohol misuse was included.

410

411 Our test for heterogeneity evidenced combinability of the studies for statistical analysis ( $I^2=$   
412 0% for schizophrenia/psychoses;  $I^2= 1%$  for depression).

413

#### 414 Quality/bias assessment

415

416 Results are reported in full in Table 1. Briefly, the assessment evidenced the studies had  
417 mixed quality. Little attention was often paid to features of the sampling design that may  
418 have affected the results. In regard to the representativeness of samples for example, six  
419 studies included only male participants and three were single-site investigations. In addition,  
420 response rates were sometimes low or unreported. In most cases, the special features of  
421 sampling design were not addressed in the analysis.

422

423 We also found great diversity in terms of screening tools. Most investigations (n=7) were  
424 based on solid screening methodology, which included clinical assessment. However, while  
425 some of the diagnostic tools were designed for the assessment of older people specifically  
426 (e.g. GMS-AGECAT, GDS), the majority were developed for use with the general population  
427 and do not include items related to old age and/or to forensic settings. We observe that in one  
428 study (Williams et al., 2010) the use of self-reports only might have generated biased results  
429 and that one study (Regan, Alderson & Regan, 2002) did not report its screening  
430 methodology at all. Confidence Intervals for prevalence rates were not reported in most  
431 studies (n=7).

432

433

## 434 Prevalence of psychiatric disorders

435

436 The prevalence rates of psychiatric disorders for each study are reported in table 3. The  
437 calculation of the weighted prevalence yielded the following results: “Any psychiatric  
438 disorder” 38.4%, 95 CI [37.4, 39.6]; depression 28.3%, 95 CI [27.8, 28.8];  
439 schizophrenia/psychoses 5.5%, 95 CI [5.3, 5.7]; bipolar disorder 4.5%, 95 CI [4.4, 4.6];  
440 dementia 3.3%, 95 CI [3.2, 3.4]; cognitive impairment 11.8%, 95 CI [11.4, 12.1]; personality  
441 disorder 22.9%, 95 CI [22.4, 23.4]; alcohol abuse 15.9%, 95 CI [14.6, 17.2]; anxiety  
442 disorders 14.2%, 95 CI [13.6, 14.7]; PTSD 6.2%, 95 CI [6.0, 6.4].

443

## 444 Comparison studies

445

446 Results from our comparison study evidenced that the RR for an older inmate to have “any  
447 psychiatric disorder” is more than double (2.5) compared to an older person living in the  
448 community. The Chi-Squared tests evidenced statistical significance between the two groups  
449 ( $p < .05$ ). For depression, we obtained a RR (prison against community) of 2.8. The Chi-  
450 Squared tests evidenced statistical significance between the two groups ( $p < .05$ ).

451

452 For schizophrenia/psychoses, we obtained a RR (prison against community) of 6. The  
453 difference in prevalence rates was not statistically significant ( $p > .05$ ). Similar results were  
454 obtained for bipolar disorder (RR=4.9;  $p > .05$ ). The RR for dementia in prison against the  
455 community was .75. The result bore no statistical significance ( $p > .05$ ). For cognitive  
456 impairment, we found a two-fold RR for older prisoners against older people in the  
457 community. The difference in prevalence rates however was not statistically significant  
458 ( $p > .05$ ).

459

460 For personality disorder, we obtained a RR of 2.3 (prison against community) and the  
461 prevalence rate was statistically significantly higher in the prison group ( $p < .05$ ). Similar  
462 prevalence rates in the two populations were obtained for alcohol abuse (RR=1.4;  $p > .05$ ) and  
463 anxiety disorders (RR=1.3;  $p > .05$ ). For PTSD, we found a two-fold RR (prison against  
464 community). The prevalence rates bore no statistically significant difference ( $p > .05$ ).

465

## 466 Sensitivity analyses

467

468 Sensitivity analyses carried out by excluding each study confirmed the results from our  
469 prevalence and comparison studies with two exceptions. When we sequentially excluded the  
470 studies by Combalbert et al. (2016) and Koenig et al. (1995), the prevalence rate for alcohol  
471 abuse increased to 22% and 19.6% respectively, thus gaining statistical significance against  
472 the community studies ( $p > .05$ ).

473

474 When we excluded the study by Fazel et al. (2001), we obtained a prevalence rate for  
475 personality disorder of 18.9% (22.9% in the original analysis), resulting in a p-value just  
476 slightly over the threshold for statistical significance ( $p = .053$ ) against the community studies.

477

478 The post-hoc sensitivity analyses confirmed our original results. We observed that the  
479 prevalence of “any psychiatric disorder” among older prisoners increased to 57.6% (RR=3.9  
480 against community studies) when we excluded retrospective studies and to 44.7% (RR= 3)  
481 when we excluded single-site investigations. For alcohol abuse, the difference against  
482 community studies raised just above the threshold for statistical significance ( $p = .04$ ; RR=1.9)  
483 when we removed studies with a high non-response rate.

## 484 Discussion

485

486 The present study aimed to review the existing literature around the prevalence of psychiatric  
487 disorders among older prisoners and to compare the results with prevalence rates reported in  
488 studies on older people in the community.

489

490 Our findings evidenced that more than one third of older prisoners (38.4%) suffers from “any  
491 psychiatric disorder”, with more than double the prevalence reported in community studies  
492 (15%). The difference is statistically significant. In comparison with older people in the  
493 community, older prisoners also experience higher RR for every single psychiatric disorder,  
494 with the sole exception of alcohol abuse (RR=1) and dementia (RR=.75). This confirms our  
495 hypothesis that overall, older prisoners are more exposed to psychiatric disorders than older  
496 people in the community.

497

498 We observe that in fact our aggregated prevalence rates may even be underestimated, as  
499 several studies were based on retrospective data and medical records collected from staff  
500 rather than researchers, thus bearing reduced reliability. In relation to “any psychiatric  
501 disorder” for example, when we excluded studies based on poorer methodologies (i.e.  
502 retrospective and single-site investigations) in our sensitivity analyses, we obtained even  
503 higher prevalence rates (and RR) for the prison population against community studies.

504

505 Interestingly, for the most severe disorders like schizophrenia/psychoses and bipolar disorder,  
506 the gap in prevalence rates (and the RR) between the two groups was extremely marked,  
507 showing how older prisoners tend to lie at the most severe end of the spectrum of psychiatric  
508 morbidity.

509

510 In regard to dementia, we obtained similar prevalence rates (3.3%) as in community studies  
511 (3.5%). Our findings suggest that dementia is present in the prison population and diagnosed  
512 at rates comparable to the community, despite the difficulties in the diagnostic process in the  
513 prison setting, which may be hindered by the use of inadequate screening procedures/tools  
514 (Moll, 2013) and the lack of geriatric training among prison staff (Senior et al., 2013). In  
515 addition, the comparison study on cognitive impairment found a two-fold RR for the prison  
516 population against older people in the community. This suggests that when older prisoners  
517 with cognitive impairment eventually develop full-blown dementia, the number of prisoners  
518 with dementia might potentially match or even surpass community rates.

519

520 This study has several limitations and any conclusions should be viewed in perspective.  
521 Despite our effort to include a diverse range of literature, we were not able to retrieve suitable  
522 grey literature (e.g. unpublished studies), thus potential incurring in publication bias. In  
523 addition, we excluded studies which did not set the prevalence of psychiatric disorder as their  
524 primary outcome and those reporting data on the general prison population and not by age  
525 groups. This was because the availability and the quality of the data was not sufficient to  
526 allow for accurate extraction and meta-analysis. This may have led to selection bias.

527

528 Another limitation of our review pertains to external validity, as we were only able to retrieve  
529 studies in English, despite we placed no restrictions on publication language. In addition,  
530 nearly all of the studies were carried out in the UK (n=4) or the USA (n=4). This may reflect  
531 a longer tradition in prison literature in the case of the USA or the fact that in these two  
532 countries the increased number of older prisoners over the last years (Walmsley, 2016) has  
533 deepened the interest of researchers, resulting in a larger amount of scientific investigations.

534 The recent publication of the first study on psychiatric disorders among older prisoners in  
535 France (Combalbert et al., 2016) which we were able to include in our review, potentially  
536 indicates that the interest in older prisoners is extending to other countries.  
537

538 The lack of relevant literature from other countries evidences that the phenomenon of an  
539 aging prison population is experienced very differently, owing to the specificity of legal  
540 systems, cultural/societal views/approaches against older offenders, aging trends and  
541 sentencing policies. In Spain for instance, prisoners are released at 80 years old and in  
542 Azerbaijan and Russia courts do not give life sentences to people over the age of 65 (Penal  
543 Reform International, 2015). We therefore urge caution in interpreting and generalising our  
544 findings, which may not reflect the condition of older prisoners in other countries.  
545

546 Some limitations pertain to the quality of the studies we included. In relation to sex  
547 representation, only the US studies included a sample of women, potentially resulting in an  
548 underestimation of psychiatric disorders that are most typically diagnosed among females,  
549 such as depression. There was quality disparity also in the screening tools that each study  
550 used, even to diagnose the same psychiatric disorder. In several instances, the instruments  
551 were not specific for the assessment of older people and this may have resulted in less than  
552 accurate evaluations, carrying substantial biases. For example, the CANFOR-S investigates  
553 needs in the general forensic population. The scale includes some items which are hardly  
554 applicable to older prisoners, such as caring for a child under 18. In this case, consideration  
555 of the Camberwell Assessment Needs for the Elderly (CANE) (Orrell & Hancock, 2004),  
556 which investigates needs relevant in older age, would have been appropriate.  
557

558 Another limitation was that although some studies were affected by poor response rates, the  
559 authors did not report non-responder analyses and missing data. This may have resulted in  
560 unrepresentative prevalence rates. Although our sensitivity analyses evidenced that this  
561 generally did not impact on our original findings, results for alcohol abuse were substantially  
562 altered when we excluded the two studies with the lowest response rate (Combalbert et al.,  
563 2016; Kingston et al., 2011). In this case, we found statistically significantly higher rates for  
564 alcohol abuse in the prison sample. The same result was obtained when we performed  
565 sensitivity analysis by removing the study by Koenig et al. (1995). Given the results of these  
566 sensitivity analyses and the fact that only three studies reported on alcohol abuse, we urge  
567 careful consideration when interpreting our findings around the condition.  
568

569 In relation to personality disorder, although statistical significance against community studies  
570 was lost when we performed sensitivity analysis by excluding the study by Fazel et al.  
571 (2001), the p-value found ( $p=.053$ ) was only just above the threshold for statistical  
572 significance. Given that statistically significantly higher rates of personality disorder among  
573 older prisoners were confirmed by all other sensitivity analyses, we conclude that the findings  
574 from our original analysis are accurate.  
575

576 In regard to the comparison studies specifically, given that the research methodologies and  
577 assessment tools adopted in prison and community studies vary according to the specificity of  
578 the population under investigation, making comparisons presents some limitations. It is also  
579 crucial to highlight the fact that prevalence rates around psychiatric disorders in older people  
580 vary quite substantially across studies (Volker et al., 2013) and that therefore despite our  
581 efforts to select representative studies for the comparison studies, they may not fully reflect  
582 this diversity. Unfortunately, we were not able to make comparisons against the prevalence

583 rates of psychiatric disorders among prisoners under age 50 because of a lack of suitable  
584 studies to compare.

585

586 Qualitative evidence suggests that compared to the younger inmates, older prisoners may be  
587 more exposed to psychological distress given factors related to reduced mobility, physical  
588 health issues, increased social isolation, lack of suitable age-friendly recreational and  
589 vocational activities and increased risk of victimisation (Smyer, Gragert & LaMere, 1997;  
590 Lemieux et al., 2002; Aday, 1994). The emotional burden generated by the unique  
591 combination of age-related and prison-related factors may also partially explain the higher  
592 prevalence rates of psychiatric disorders against older people in the community. However,  
593 further research is needed to establish whether there are significant differences in the genesis  
594 and presentation of psychiatric disorders among older prisoners in comparison to different  
595 age groups of prisoners and peers living in the community.

## 596 Conclusion

597

598 The present study is the first to systematically review the existing evidence-base around the  
599 prevalence of psychiatric disorders among older prisoners and to compare data on a prison  
600 population against community studies on older adults. We feel that our findings have relevant  
601 implications for policy and practice.

602

603 For example, the high rates of psychiatric morbidity reported among older prisoners evidence  
604 the need for specialised healthcare service provision in the prisons system of those countries  
605 where this has not been adequately addressed yet. For example, research reports that at  
606 present time in English and Welsh prisons only about half of the institutions (53%) offer  
607 clinics specialised in old age medicine (Senior et al., 2013). The lack of adequate care  
608 provision is particularly evident in regard to psychiatric health needs (Fazel et al., 2001).

609

610 In this sense, our findings indicate the cruciality to deliver effective staff training and at the  
611 importance of adequate screening procedures, which should be undertaken at regular intervals  
612 throughout imprisonment by means of standardised and age-specific assessment tools.  
613 Ideally, administration should be carried out by a qualified/trained medical professional  
614 specialised in old-age psychiatry.

615

616 Given that around 95% of older prisoners are eventually released in the community  
617 (Williams, Stern, Mellow, Safer & Greifinger, 2012), addressing effectively psychiatric  
618 health needs during incarceration would also contribute to decrease the risk of re-offence  
619 upon release, to the safety of the community and the public. In addition, addressing older  
620 prisoners' needs would prevent relapse and further need for psychiatric treatment (e.g. GP  
621 appointments, referrals to specialists) contributing to reduced public spending in healthcare  
622 costs.

623

624 In regard to dementia, highlighting that older prisoners experience similar rates of the  
625 condition as older people in the community will potentially contribute to draw the attention of  
626 policy makers and healthcare professionals on the emerging issue of dementia in the prison  
627 system, which has been thus far neglected, compared to the profusion of initiatives in health  
628 care and social services available to people with dementia living in the community.

629

630 In terms of policy implications, our findings support the accumulating evidence on the need  
631 to develop specific national strategies to address older prisoners' needs. Some governments

632 have committed to these initiatives. It is the case of Ireland, which is in the process of  
633 creating a national strategy on older prisoners as per the Prison Service Strategic Plan 2016-  
634 2018 (Joyce & Maschi, 2016). Conversely, in several other countries experiencing high  
635 prevalence of older prisoners, principles and guidelines on health care provision for older  
636 prisoners are still based on general policies around older people, such as the UK NICE  
637 guidelines on mental wellbeing and independence in older people (NICE, 2015). These  
638 policies however, seem insufficient to grant adequate health care at the national level,  
639 rendering provision for older prisoners still sparse and mostly relying on the commitment on  
640 individual institutions (Yorston, 2015). We therefore advocate that national initiatives be  
641 systematically taken to adequately address the psychiatric needs of older prisoners.

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1027 Figure 1. Selection of papers

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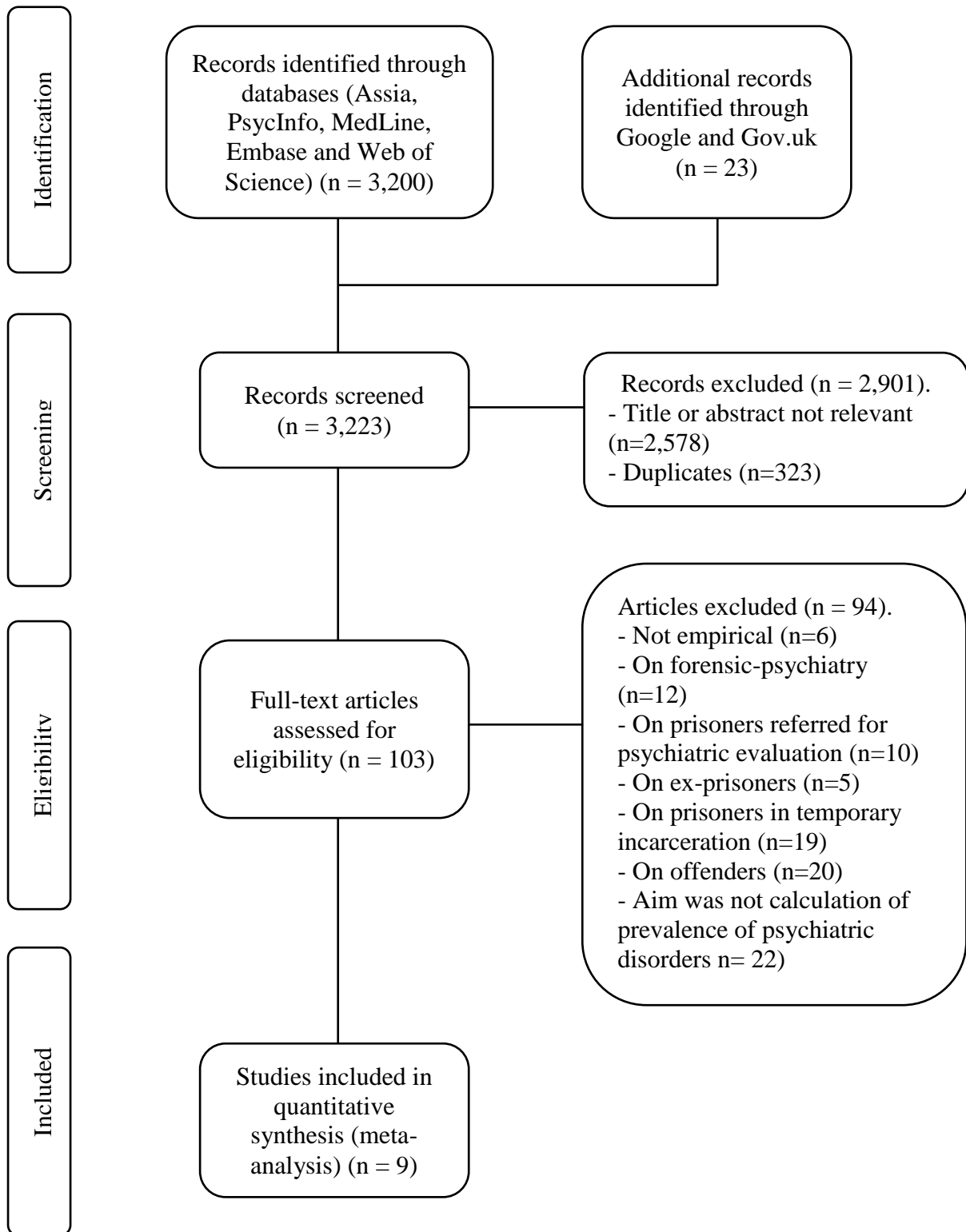


Table 1. Basic quality assessment (Boyle, 1998) and quality scores derived from Prince et al. (2013).

Author(s)	Basic quality assessment				Quality score					
	Sampling	Measurement	Analysis		Participants <sup>a</sup>	Sex <sup>b</sup>	Prisons <sup>c</sup>	Measures <sup>d</sup>	Response <sup>e</sup>	Tot.
	Representative?	Was it reliable and valid?	Features of sampling design addressed in analysis?	Are Confidence Intervals reported?						
Caverley	Yes	Yes	Not mentioned	No	3	2	1	3	-	9*
Combalbert et al.	No (Only males)	Yes	Yes	No	1	1	2	3	1	8
Fazel et al.	No (Only males)	Yes	Yes	Yes	2	1	2	3	3	11
Hayes et al.	No (Only males)	Yes	Not mentioned	Yes	2	1	2	3	2	10
Kingston et al.	No (Only males)	Yes	Not mentioned	No	2	1	2	3	1	9
Koenig et al.	No (Only males)	Yes	Yes	No	1	1	1	3	3	9
Murdoch et al.	No (Only males)	Yes	Yes	No	1	1	2	3	3	10
Regan et al.	Yes	Not reported	Not mentioned	No	3	2	1	-**	-	6*
Williams et al.	Yes	No (Self-reports only)	Not mentioned	No	3	2	2	1	-	8*

<sup>a</sup> = Up to 200, one point; 200-300, two points; 300+, three points.

<sup>b</sup> = Males only, one point; males and female, two points.

<sup>c</sup> = Single-site, one point; multi-site, two points.

<sup>d</sup> = Self-reports, one point; audits of medical records, two points; clinical assessments, three points.

<sup>e</sup> = Up to 50%, one point; 50–80%, two points; more than 80%, three points.

\*Total is missing response rate score as these were retrospective studies.

\*\* Tests score not assigned as screening assessment used in the study are not reported in the paper.

Table 2. Study characteristics.

Author(s)	Year	Country	Design	Site	Sample demographics	Did not consent to participate	Diagnostic assessments
Caverley	2006	USA	Retrospective cohort study	Single site: Utah State Prison	318 males and 42 females aged 50+	Not applicable	Interview, health records, Pearson Assessments
Combalbert et al.	2016	France	Cross-sectional	Multi-site	138 males aged 50+	n=510; 78.7%	MINI DSM-IV, Frontal Assessment Battery, MMSE
Fazel et al.	2001	UK	Cross-sectional study	Multi-site: 15 prisons in England and Wales	203 males aged 59+	n=30; 12.87%	GMS-AGECAT, SCID-II, health records
Hayes et al.	2012	UK	Cross-sectional study	Multi-site: 13 prisons in North West England	262 males aged 50+	n=40, 20%	SCID-I, SCID-II, MMSE, CANFOR-S, health records
Kingston et al.	2011	UK	Cross-sectional study	Multi-site: 4 prisons in Staffordshire	237 males aged 50+	n=121; 49.95%	GMS-AGECAT, MMSE, SF-12, health records
Koenig et al.	1995	USA	Cross-sectional study	Single-site: 1 prison in North Carolina	95 males aged 50+	n=11; 10%	DIS, health records, interview
Murdoch et al.	2008	UK	Cross-sectional study	Multi-site: 2 prisons in England	121 males aged 55+	n=0; 0%	GDS, MMSE
Regan et al.	2002	USA	Retrospective cohort study	Single site: Tennessee State Prison	671 (males and female) aged 55+	Not applicable	Not mentioned
Williams et al.	2010	USA	Retrospective cohort study	Multi-site: US federal or state prisons	360 (males and females) aged 55+	Not applicable	Self-report survey

Table 3. Prevalence rates from individual studies (out of total population of older prisoners).

Author(s)	Any psychiatric disorder	Depression	Schizophrenia Psychoses	Bipolar disorder	Dementia	Cognitive impairment MMSE score < 24	Personality disorder	Alcohol abuse	Anxiety disorders	PTSD
Caverley	13.6% (n=49)	7.7% (n=28)	3.3% (n=12)	5% (n=18)	-	-	-	-	-	-
Combalbert et al.	68.4% (n=95)	39.9% (n=55)	1.45% (n=2)	-	-	18.84% (n=26)	-	0% (n=0)	39.1% (n=54)	9.4 (n=13)
Fazel et al.	53.2% (n=108)	29.6% (n=60)	4.9% (n=10)	-	1% (n=2)	-	30% (n=61)	-	-	-
Hayes et al.	64% (n=160)	34% (n=87)	3% (n=8)	-	-	7% (n=17)	20% (n=51)	30% (n=77)	19% (n=48)	-
Kingston et al.	49.6% (n=60)	41.3% (n=50)	1.6% (n=2)	-	1.6% (n=1)	13.2% (n=15)	-	-	1.65% (n=2)	-
Koenig et al.	53.7% (n=51)	35.8% (n=34)	1.1% (n=1)	1.1% (n=1)	1.1% (n=1)	-	15.8% (n=15)	0% (n=0)	4.2% (n=4)	1.1% (n=1)
Murdoch et al.	-	51.2% (n=62)	-	-	-	-	-	-	-	-
Regan et al.	-	33% (n=36)	12% (n=13)	-	5% (n=5)	-	-	-	13% (n=14)	-
Williams et al.	13.6% (n=49)	12.9% (n=46)	3% (n=11)	4.9% (n=18)	-	-	-	-	-	6.3% (n=22)

Blank boxes indicate data were not reported.