

## Review article

# Severe mental illness in 33 588 prisoners worldwide: systematic review and meta-regression analysis

Seena Fazel and Katharina Seewald

**Background**

High levels of psychiatric morbidity in prisoners have been documented in many countries, but it is not known whether rates of mental illness have been increasing over time or whether the prevalence differs between low–middle-income countries compared with high-income ones.

**Aims**

To systematically review prevalence studies for psychotic illness and major depression in prisoners, provide summary estimates and investigate sources of heterogeneity between studies using meta-regression.

**Method**

Studies from 1966 to 2010 were identified using ten bibliographic indexes and reference lists. Inclusion criteria were unselected prison samples and that clinical examination or semi-structured instruments were used to make DSM or ICD diagnoses of the relevant disorders.

**Results**

We identified 109 samples including 33 588 prisoners in 24 countries. Data were meta-analysed using random-effects

models, and we found a pooled prevalence of psychosis of 3.6% (95% CI 3.1–4.2) in male prisoners and 3.9% (95% CI 2.7–5.0) in female prisoners. There were high levels of heterogeneity, some of which was explained by studies in low–middle-income countries reporting higher prevalences of psychosis (5.5%, 95% CI 4.2–6.8;  $P=0.035$  on meta-regression). The pooled prevalence of major depression was 10.2% (95% CI 8.8–11.7) in male prisoners and 14.1% (95% CI 10.2–18.1) in female prisoners. The prevalence of these disorders did not appear to be increasing over time, apart from depression in the USA ( $P=0.008$ ).

**Conclusions**

High levels of psychiatric morbidity are consistently reported in prisoners from many countries over four decades. Further research is needed to confirm whether higher rates of mental illness are found in low- and middle-income nations, and examine trends over time within nations with large prison populations.

**Declaration of interest**

None.

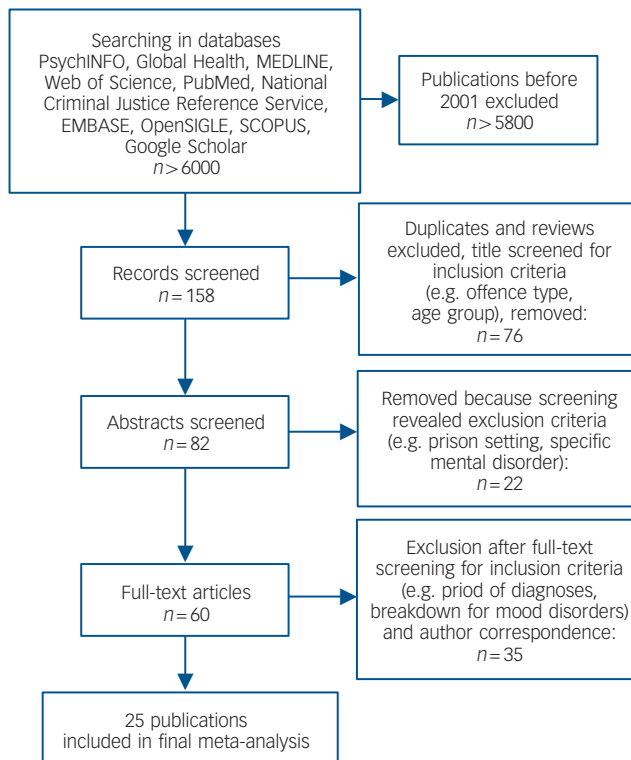
There are over 10 million prisoners worldwide,<sup>1</sup> a population that has been growing by about 1 million per decade. In 2008, the USA had the largest number of people imprisoned at 2.3 million and the highest rate per head of population (at 756 per 100 000 people compared with a median of 145 per 100 000 worldwide), and China, Russia, Brazil and India had more than a quarter of a million prisoners each.<sup>1</sup> It has been widely reported that prisoners have elevated rates of psychiatric disorders compared with the general population, including for psychosis, depression, personality disorder and substance misuse, which are risk factors for elevated suicide rates,<sup>2,3</sup> premature mortality on release from prison<sup>4</sup> and increased reoffending rates.<sup>5,6</sup> It is estimated that suicide rates within prison are increased four to five times<sup>7</sup> and deaths within the first week of release 29-fold higher<sup>8</sup> than rates in the general population. Further, a recent review found that reoffending rates are increased by 40% in offenders with psychotic disorders compared with non-mentally ill offenders.<sup>5</sup>

A previous systematic review estimated that the prevalence of psychosis was typically 4% in prisoners of both genders, and that of major depression was 10% in men and 12% in women.<sup>9</sup> However, this review is now a decade old, and, as many psychiatric institutions have continued to reduce their bed numbers,<sup>10</sup> a number of commentators have suggested that rates of severe mental illness have been increasing over time in prisoners,<sup>11</sup> although empirical evidence in support of this is inconsistent<sup>12</sup> and experts have suggested that measures introduced by the World Health Organization and other international humanitarian agencies have improved prison care.<sup>13</sup> In addition, there has been no review, to our knowledge, of the mental health of prisoners in low–middle-income countries, although the vast majority of

prisoners now live in such countries.<sup>1</sup> As there is a substantial body of new evidence,<sup>14</sup> we have conducted a new systematic review and meta-analysis of the prevalence of psychosis and major depression, and used subgroup analyses and meta-regression to explore possible sources of heterogeneity between studies. We hypothesise that there has been an increase in the rates of psychosis and major depression over time, and that low–middle-income countries have higher prevalences of these conditions due to their less resourced community and prison healthcare services.<sup>15</sup>

**Method**

We identified publications estimating the prevalence of psychotic disorders (including psychosis, schizophrenia, schizophreniform disorders, manic episodes) and major depression among prisoners that were published between 1 January 1966 and 31 December 2010. For the period 1 January 1966 to 31 December 2000, methods are described in a previous systematic review conducted by one of the authors (S.F.).<sup>9</sup> For the update and expanded review, from 1 January 2001 to 31 December 2010, we used the following databases: PsycINFO, Global Health, MEDLINE, Web of Science, PubMed, National Criminal Justice Reference Service, EMBASE, OpenSIGLE, SCOPUS, Google Scholar, scanned references and corresponded with experts in the field (Fig. 1). Key words used for the database search were the following: mental\*, psych\*, prevalence, disorder, prison\*, inmate, jail, and also combinations of those. Non-English language articles were translated. We followed PRISMA criteria.<sup>16</sup>



**Fig. 1** Flow diagram showing the different steps involved in searching for relevant publications (2001–2010).

Inclusion criteria were the: (a) study population was sampled from a general prison population; (b) diagnoses of the relevant disorders were made by clinical examination or by interviews using validated diagnostic instruments; (c) diagnoses met standardised diagnostic criteria for psychiatric disorders based on the ICD or the DSM; (d) prevalence rates were provided for the relevant disorders in the previous 6 months.

In order to include unselected, representative and generalisable prison samples we only selected studies that conducted a diagnostic interview with a general prison population. We excluded those studies that used a screening tool before conducting the diagnostic interview<sup>6,17,18</sup> (as this may lead to an underestimate if the screening tool had poor sensitivity or overestimates if the tool had poor specificity). We also excluded sampled selected populations, for example by offence type<sup>19,20</sup> (as there is evidence that selecting some offender groups may also lead to overestimates, which is particularly the case for murder and attempted murder<sup>21</sup>), or age group<sup>22</sup> (including solely juvenile prisoners<sup>23</sup> or prisoners who were in healthcare settings<sup>24</sup>). For example, one study that used a screening tool to identify mentally ill prisoners and was excluded reported a prevalence of 32% for schizophrenia.<sup>25</sup> Studies that did not separate sentenced from remand prisoners in their report<sup>26</sup> and duplicates were excluded. In this update, we did not include personality disorder due to the high heterogeneity reported in the previous work.<sup>9</sup> For substance misuse and post-traumatic stress disorder, there are more recent reviews<sup>27,28</sup> and a substantial body of new work has not emerged since their publication.<sup>29</sup>

### Data extraction

We extracted information on the year of interview, geographical location, gender, remand/detainee (including jail inmates) or

sentenced prisoner, average age, method of sampling, sample size, participation rate, type of interviewer, diagnostic instrument, diagnostic criteria (ICD *v.* DSM), numbers diagnosed with psychotic disorders (ICD-10: F20.xx–F29.xx, F30.xx; DSM-IV: 293.xx, 295.xx), and major depression (ICD-10, F 32.xx, F33.xx; DSM-IV: 296.2x, 296.3x). Where there was schizophrenia and other psychotic disorders reported separately, we combined them to produce a single prevalence. For one publication,<sup>30</sup> we collated ‘Dépression endogène-Mélancolie’, ‘Etat dépressif chronique’ and ‘Symptômes psychotiques contemporains des épisodes thymiques’ as indicating major depression. The data from each of the identified publications were subdivided into four samples (men *v.* women, remand/detainee *v.* sentenced prisoners). In contrast to our previous review, we included data on low–middle-income countries<sup>31</sup> and whether the clinical diagnostic interview was conducted within 2 weeks of arrival into the prison (which may influence prevalence rates and also provides an estimate of mental health needs on reception to prison). For the update, we examined rates of comorbidity with substance misuse. The data extraction was done by two researchers independently (K.S. and K.W.). For further clarification about specific studies, we corresponded directly with the authors of the studies.

### Data analysis

We analysed sources of heterogeneity by subgroup and meta-regression analysis using dichotomous and continuous variables. The year that the interview was conducted and the average age of the prisoners were analysed as continuous variables. Sample size and response rate were analysed as both dichotomous and continuous variables. As the median of reported response rates was 81%, we defined ‘low’ as  $\leq 80\%$  *v.* ‘high’ as  $> 80\%$ . The following were analysed only as dichotomous variables: gender, prisoner type (detainees/remand *v.* sentenced prisoners), reception status (interviewed in the first 2 weeks of reception *v.* the rest), type of interviewer (psychiatrist *v.* non-psychiatrist), diagnostic instrument (clinical examination *v.* semi-structured interview using a diagnostic tool) and classification criteria (ICD *v.* DSM). Geographical location was analysed as low–middle-income *v.* high-income country.<sup>31</sup> We included the US studies within the high-income country group. Also, we conducted an additional separate analysis of US studies (*v.* rest of world and *v.* rest of high-income countries) for three reasons: first, there are over 2 million prisoners there (around a fifth of the world prisoner population); second, they constituted 30% of the included studies in the review; and third, mentally disordered prisoners in the USA are less likely to be diverted because of judicial and legal reasons, and hence this may contribute to higher prevalence rates.<sup>6</sup>

We used a recent method for further examination of heterogeneity, which involves removing up to four outliers and testing whether this reduces  $I^2$  values to below 50%, and then investigating in more detail the study characteristics of these outliers.<sup>32</sup>

We calculated pooled prevalence estimates and their 95% confidence intervals and transformed the zero cells to 0.5 in order to calculate prevalences as per standard methods.<sup>33</sup> Meta-analyses for prevalences were conducted by gender and prisoner status. We measured the heterogeneity between studies with Cochran’s  $Q$  (reported with a chi-squared value and  $P$ -value) and the  $I^2$  statistic (with 95% confidence intervals)<sup>34</sup> and used random-effects models for summary statistics as heterogeneity was high ( $I^2 > 75\%$ ).<sup>35,36</sup> The  $I^2$  is an estimate of the proportion of the total variation across studies that is beyond chance. In situations with high between-study heterogeneity, the use of random-effects

models is recommended as it produces study weights that primarily reflect the between-study variation and thus provide close to equal weighting. Univariate and multivariate meta-regression analyses were used to explore possible sources of heterogeneity among studies.<sup>37</sup> Factors in univariate meta-regression with  $P$ -values of  $<0.1$  were included in the final model. We also conducted a test of funnel plot asymmetry (Egger's test) for publication bias using the publication (rather than the sample) as the unit of measurement. A funnel plot is a plot of the estimated prevalence against the sample size of the included studies. Egger's test can reveal a symmetric or asymmetric funnel plot. The latter indicates the existence of a significant publication bias or a systematic heterogeneity between studies.<sup>38</sup> All analyses were done in STATA statistical software, version 11.1 on Windows.

## Results

### Study characteristics

The final data-set consisted of 81 publications, 56 based on the previous review from the period 1966–2001<sup>39–94</sup> and 25 new ones (online Table DS1).<sup>30,95–118</sup> These publications provided data on 109 samples that included a total of 33 588 prisoners. Of these, 28 361 (84.4%) were male. The overall weighted mean age was 30.5 years. The studies were conducted in 24 different countries, 8 of which are classified as low–middle-income countries: Brazil,<sup>108</sup> Dubai,<sup>93</sup> India,<sup>95,109</sup> Iran,<sup>96</sup> Kuwait,<sup>92</sup> Malaysia,<sup>116</sup> Mexico<sup>97</sup> and Nigeria.<sup>91</sup>

There were 72 studies from high-income countries. There were 25 studies from the USA,<sup>41,48,51,52,54–57,59,62–64,67,73,75,76,79,82,83,85–88,104,112</sup> 3 from Canada,<sup>42,72,80</sup> 5 from Australia,<sup>40,50,60,61,99</sup> and 1 from New Zealand.<sup>44</sup> The remaining studies were conducted in Europe including eight in England and Wales,<sup>45,53,69,70,78,89,90,106</sup> six in Ireland,<sup>71,84,100,102,105,115</sup> three in Scotland,<sup>43,47,49</sup> and a number in The Netherlands,<sup>46,74,81,98</sup> Finland,<sup>58,65,66</sup> Germany,<sup>101,113,114</sup> Denmark,<sup>39,94</sup> Italy,<sup>107,117</sup> Greece,<sup>103,118</sup> Austria,<sup>110</sup> France,<sup>30</sup> Norway,<sup>77</sup> Spain<sup>111</sup> and Sweden.<sup>68</sup>

Nine studies reported results from interviews carried out within 2 weeks of arrival into the prison,<sup>98–100,102,104,106,110,112,115</sup> two of them without giving information about the prisoner type (remand/detainee or sentenced).<sup>99,115</sup>

### Psychotic illnesses

We identified 99 samples from 74 studies that reported rates of psychotic illnesses and included a total of 30 635 prisoners.<sup>30,39–51,53–57,59–63,65–87,89–92,94–96,98,100–118</sup> Overall, we calculated a random-effects pooled prevalence of 3.6% (95% CI 3.1–4.2) in male prisoners (1120 of 26 814 individuals), and 3.9% (95% CI 2.7–5.0) in female prisoners (182 of 3821 individuals) (Table 1). There was significant heterogeneity among these studies in the male ( $\chi^2 = 416$ ,  $P < 0.0001$ ,  $I^2 = 83\%$ , 95% CI 79–86) and female prisoners ( $\chi^2 = 86$ ,  $P < 0.0001$ ,  $I^2 = 68\%$ , 95% CI 54–79).

There was a significant difference in the prevalences in low–middle-income countries (5.5%, 95% CI 4.2–6.8) compared with high-income countries (3.5%, 95% CI 3.0–3.9) (Fig. 2), confirmed by meta-regression ( $\beta = 0.0204$ ,  $s.e.(\beta) = 0.0095$ ,  $P = 0.035$ ) (Table 2). We did not find any difference in prevalences between male and female prisoners, between detainees/remand and sentenced prisoners, and no statistically significant change in prevalence over time ( $\beta = -0.0001$ ,  $s.e.(\beta) = 0.0002$ ,  $P = 0.84$ ) (Fig. 3). When we looked specifically at US studies (17 samples), there also appeared to be no change over time ( $\beta = -0.0006$ ,  $s.e.(\beta) = 0.0005$ ,  $P = 0.24$ ). There was evidence of an asymmetric funnel plot (Egger's test,  $t = 239.32$ ,  $s.e.(t) = 0.0044$ ,  $P < 0.001$ ).

### Major depression

We identified 54 publications that reported rates of major depression in 20 049 prisoners.<sup>30,39,42,44–46,48,50–54,58,60–62,64,71,73,75–77,79–83,87–93,96–108,110,111,113–116,118</sup> Overall, 10.2% (95% CI 8.8–11.7) of male prisoners (1686 of 16 021 individuals) and 14.1% (95% CI 10.2–18.1) of female prisoners (605 of 4028) were diagnosed with major depression (Fig. 4). There was significant heterogeneity among these studies in males ( $\chi^2 = 541$ ,  $P < 0.0001$ ,  $I^2 = 91\%$ , 95% CI 89–93) and also in females ( $\chi^2 = 307$ ,  $P < 0.0001$ ,  $I^2 = 93\%$ , 95% CI 90–94). Even after the exclusion of four outliers in both genders, the  $I^2$  remained above 50%.

There was no significant difference in the prevalence of depression between men and women. However, there appeared to be higher prevalences in those studies using DSM criteria and in low–middle-income countries, confirmed on univariate meta-regression (Table 2). Whereas there was no evidence for rates of major depression changing over time in the non-US samples, the prevalence of depression appeared to be increasing over time in the US samples, of which there were 17 from 1970 to 2010 ( $\beta = 0.0038$ ,  $s.e.(\beta) = 0.0013$ ,  $P = 0.008$ ) (Fig. 5).

In a multivariate meta-regression analysis combining both income group and classification criteria, the finding of a higher prevalence rate in low–middle-income countries remained significant only for women prisoners and was based on a single Mexican study.<sup>97</sup> In the US studies, multivariate meta-regression was not possible as all the samples that reported information on classification criteria used DSM criteria. However in the non-US and high-income samples, classification criteria still remained significant when income group was included in the model and DSM studies reported higher prevalences of depression ( $\beta = -0.0645$ ,  $s.e.(\beta) = 0.0282$ ,  $P = 0.026$ ). There was evidence of an asymmetric funnel plot ( $t = 27.78$ ,  $s.e.(t) = 0.0452$ ,  $P < 0.001$ ).

### Comorbidity

There were five publications since 2001 that reported rates of comorbidity in prisoners.<sup>96,97,99,102,107</sup> These rates ranged from 20.4 to 43.5% in those with any mental disorder who had comorbid substance misuse, from 13.6 to 95.0% in prisoners with psychotic illnesses with comorbid substance misuse, and 9.2 to 82.5% in individuals with mood disorders and major depression with concurrent substance misuse.

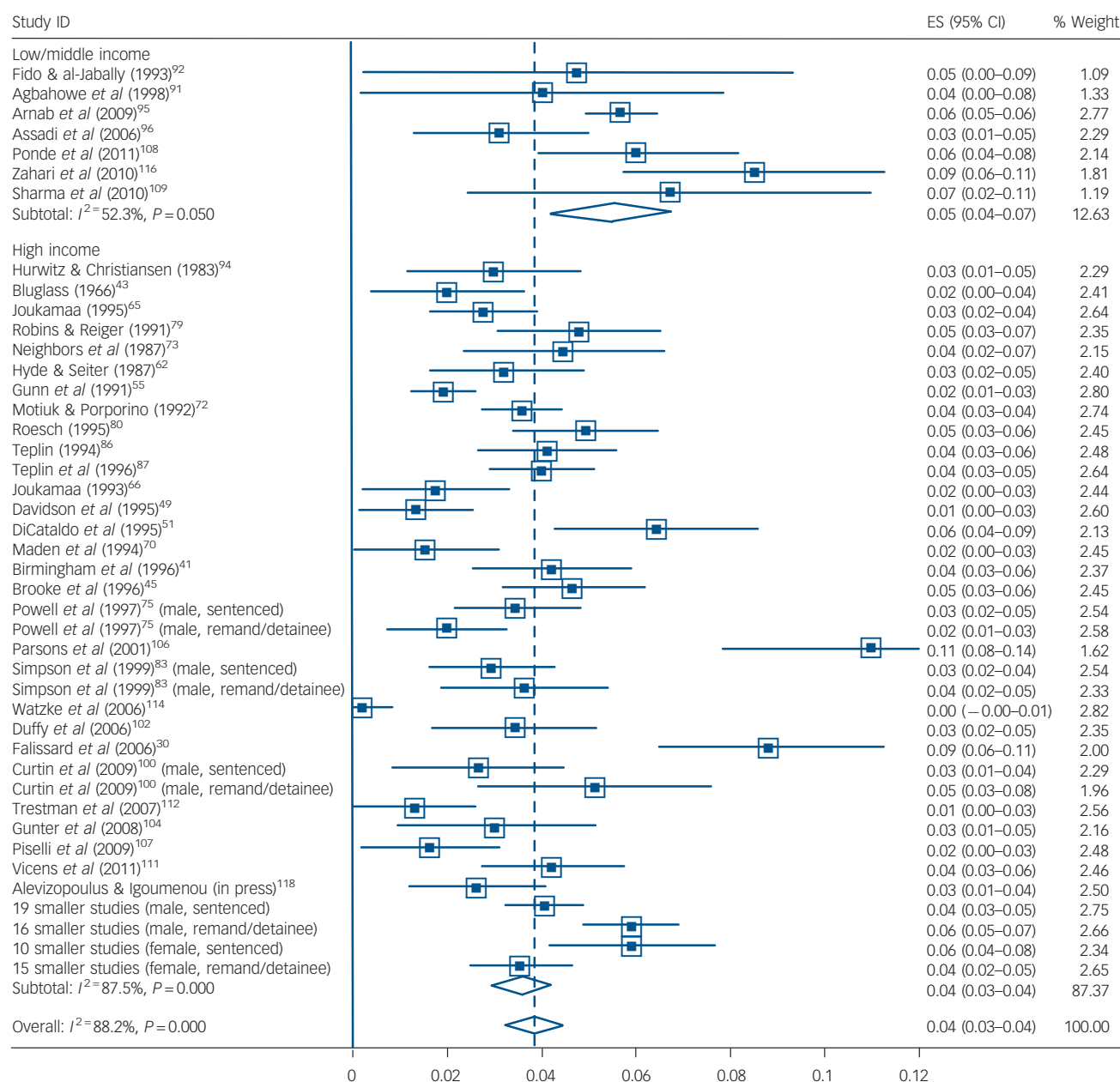
## Discussion

### Main findings

We report a systematic review of the prevalence of psychosis and depression in prisoners based on 109 separate samples (from 81

**Table 1** Pooled prevalences for psychosis and major depression in prisoners

Variable	Psychosis, % (95% CI)	Major depression, % (95% CI)
Overall	3.7 (3.2–4.1)	11.4 (9.9–12.8)
Gender of inmates		
Male	3.6 (3.1–4.2)	10.2 (8.8–11.7)
Female	3.9 (2.7–5.0)	14.1 (10.2–18.1)
Prisoner status		
Sentenced prisoners	3.7 (3.0–4.2)	10.5 (8.8–12.1)
Remand prisoners (detainees)	3.5 (4.2–6.8)	12.3 (9.5–15.1)
Country		
Low/middle income	5.5 (4.2–6.8)	22.5 (10.6–34.4)
High income	3.5 (3.0–3.9)	10.0 (8.7–11.2)



**Fig. 2** Meta-analysis of the prevalence of psychotic illnesses in prisoners by country group (low-middle income v. high income).

Weights are from random-effects analysis. Smaller studies:  $n < 250$ . ES, prevalence.

publications) based on 33 588 prisoners. In addition, we have, for the first time to our knowledge, reviewed research in low- and middle-income countries (based on 5792 prisoners) and employed meta-regression analyses to explore sources of heterogeneity between studies. In particular, we have examined whether rates of mental illness in prisoners have been increasing over time.

Our main findings were that rates of psychosis in prisoners were significantly higher in low- and middle-income countries than in high-income ones (5.5% in low-middle- v. 3.5% in high-income nations). Contrary to expert opinion,<sup>119</sup> there were no significant differences in rates of psychosis and depression between male and female prisoners or between detainees (or remand) and sentenced prisoners. In the 17 US samples included, there appeared to be an increasing prevalence of depression over the 31 years covered by these particular studies (1974–2005). In

addition, we found no differences in depression rates between men and women, detainees (or remand) and sentenced prisoners, or other study characteristics that may have explained heterogeneity. The overall prevalences of 3.7% of male and female prisoners with a psychotic illness, and 11.4% with major depression have not materially changed since a 2002 review based on 56 publications of mental illness.<sup>9</sup>

In contrast to one of our initial hypotheses, we did not find an increase in rates of psychosis and depression over time. The reasons for this are unclear but improvements in psychiatric care in prison, increased diversion of mentally disordered offenders from prison to hospital, and better living conditions may have contributed.<sup>120</sup> The role of international organisations, over the past two decades, in improving prison health has also been suggested to have played a part.<sup>121</sup>

**Table 2** Meta-regression analyses of sources of heterogeneity in the prevalence of psychosis and major depression in prisoners

Variable and study characteristic <sup>a</sup>	Psychosis			Major depression		
	$\beta$	s.e.( $\beta$ )	<i>P</i>	$\beta$	s.e.( $\beta$ )	<i>P</i>
Gender of inmates: male v. female	0.0016	0.063	0.800	0.0323	0.0222	0.151
Mean age of inmates (continuous)	-0.0009	0.0009	0.334	0.0011	0.0033	0.735
Year of study (continuous)	<0.0001	0.0003	0.889	0.0015	0.0013	0.340
Country						
Low/middle v. high income	0.0204	0.0095	<b>0.035</b>	0.1157	0.0318	<b>0.001</b>
USA v. rest of the world	0.0007	0.0060	0.902	-0.0043	0.0241	0.859
Within the USA, over time	-0.0006	0.0005	0.241	0.0038	0.0013	<b>0.008</b>
Prisoner status: sentenced prisoners v. detainees	0.0025	0.0038	0.504	0.0136	0.0159	0.396
On reception: first 2 weeks of reception v. rest	-0.0016	0.0058	0.778	-0.0131	0.0241	0.588
Participation rate						
Continuous	-0.0184	0.0333	0.585	-0.0778	0.0998	0.441
Low ( $\leq 80\%$ ) v. high ( $> 80\%$ )	-2.637	3.0964	0.400	-0.2786	1.1458	0.809
Sample size						
Continuous	<0.0001	0.0000	0.337	<0.0001	0.0000	0.577
$\leq 500$ v. $> 500$	0.0088	0.0062	0.156	-0.0147	0.0275	0.594
Interviewer: psychiatrist v. other	-0.0015	0.0053	0.784	0.0199	0.0231	0.391
Diagnostic criteria: ICD v. DSM	-0.0021	0.0055	0.706	-0.0590	0.025	<b>0.021</b>

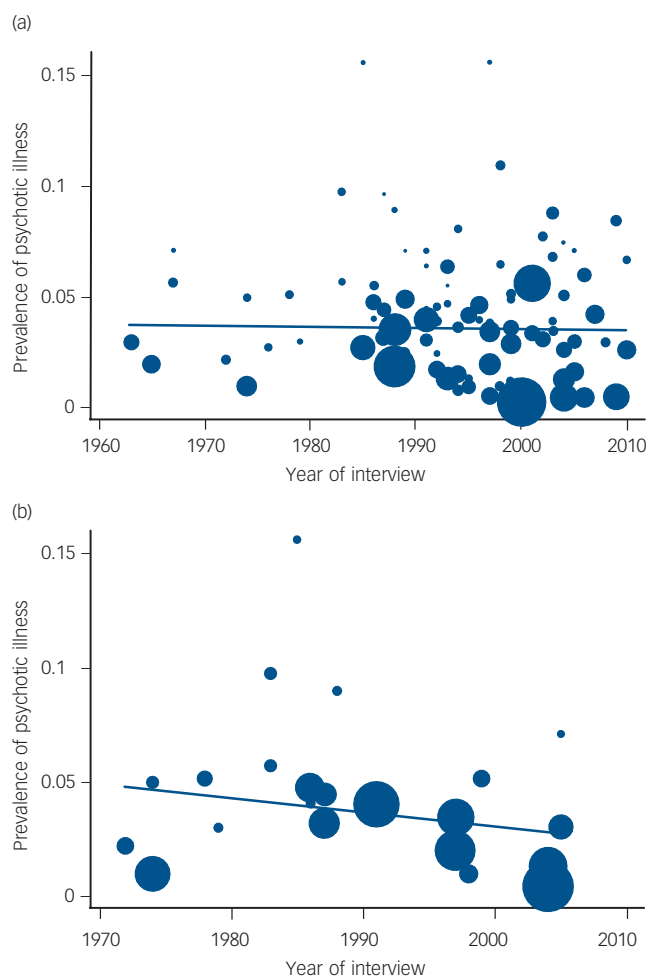
Significant associations ( $P < 0.05$ ) are in bold.  
a. For comparisons the reference category is given first.

## Implications

Three main implications arise from these findings. First, the substantial burden of treatable psychiatric morbidity is confirmed by these findings. One in seven prisoners has depression or psychosis, and treatment may confer additional benefits such as reducing the risks of suicide<sup>3</sup> and self-harm<sup>122</sup> within custody, and suicide<sup>123,124</sup> and drug-related deaths on release<sup>4</sup> as well as reoffending.<sup>5,6</sup> As reoffending rates are high (at 50% in the USA and UK within 2 years of release),<sup>125,126</sup> treatment of prisoners may have a potentially large impact on public safety. In this context, the lack of good-quality treatment evidence remains concerning.<sup>127</sup> The role of diversion away from prison at early stages of the criminal process and other collaborations between mental health and the justice system is underscored by our findings,<sup>18,128,129</sup> particularly as repeat incarcerations are associated with mental illness.<sup>6</sup>

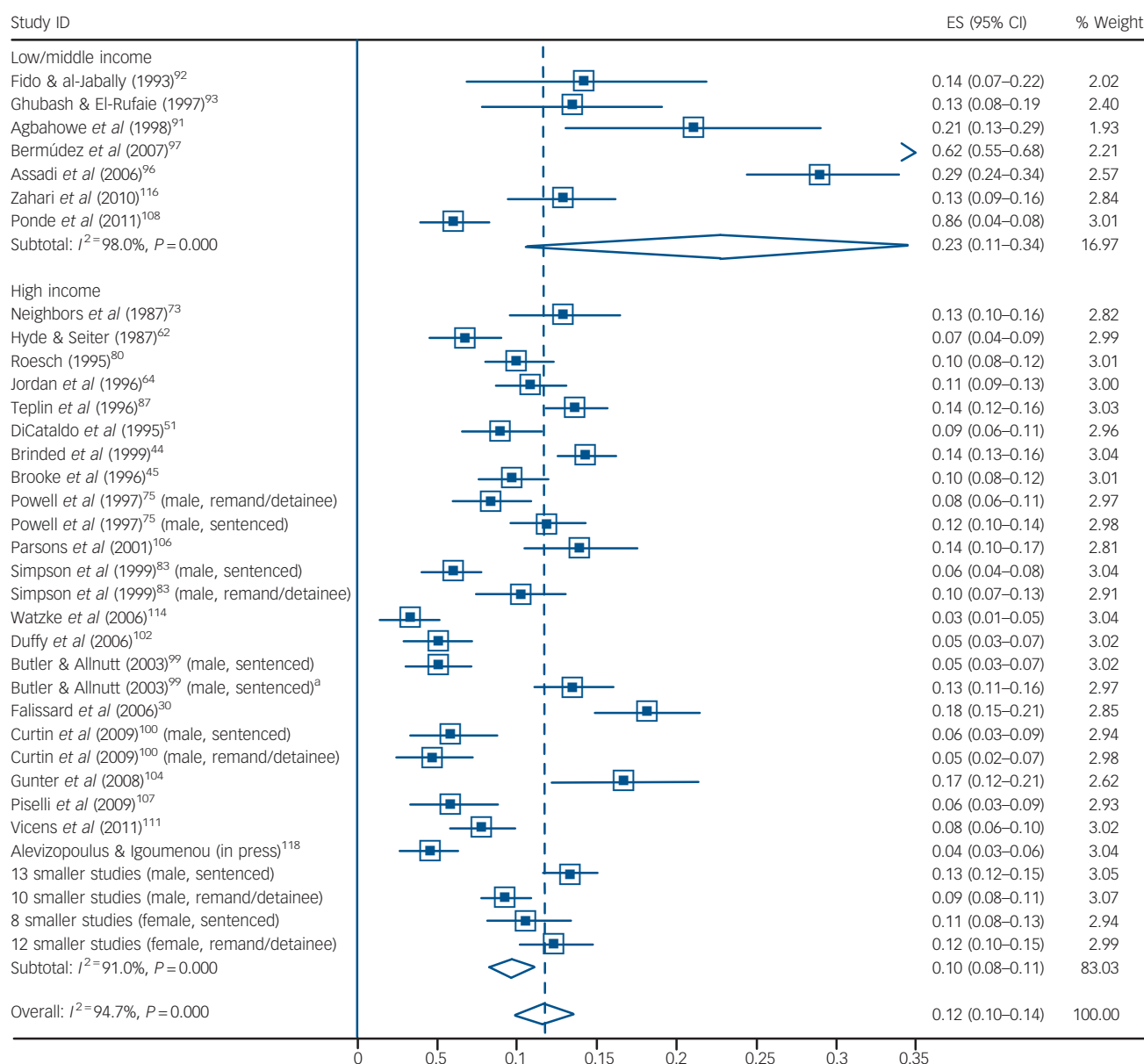
Second, the higher prevalence of psychosis in prisoners in low- and middle-income countries is notable as rates of imprisonment are increasing in more of these countries than in high-income ones,<sup>1</sup> and possibly faster; also service provision is likely to be worse. Health services in such countries can potentially use the estimates reported in this review in developing prison medical services, particularly in countries where resources are unlikely to allow for local prevalence studies to be conducted. In poorer countries, the role of explicit mental health budgets in ongoing health programmes could be considered, particularly for marginalised populations such as prisoners.<sup>130</sup> Our report does not provide information on the causes of higher prisoner rates of psychosis in low- and middle-income nations but possibilities include fewer opportunities and services for diverting offenders to health services, a stronger relationship between mental illness and criminality, and different sociocultural factors that mean more mentally ill people end up in prison. Poorer legal representation for the mentally ill may be one such factor. The increased comorbidity with opioid use in prisoners found in some countries and that form part of the illegal drug trade may be another.<sup>96</sup>

A final implication from this review is that, although internationally the prevalence of depression does not appear to be increasing in prisoners, in the USA, which has the largest prison



**Fig. 3** Prevalence of psychotic illness in prisoners over time in (a) individual studies from all countries (including the USA) and (b) studies conducted in the USA only.

The size of the circles is proportional to the sample size of each study.



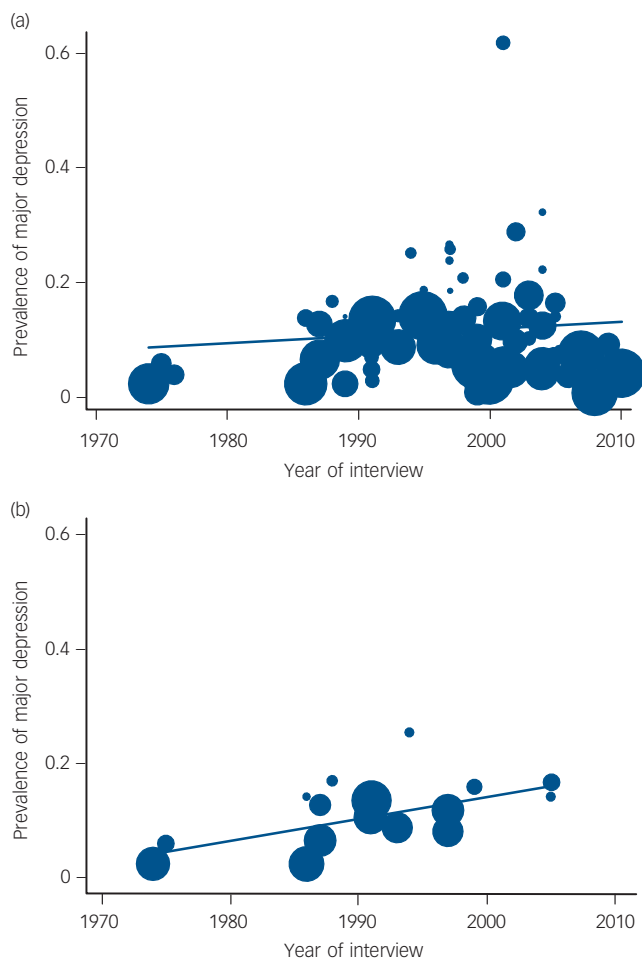
**Fig. 4** Meta-analysis of the prevalence of major depression in prisoners by country group (low–middle income v. high income).

Weights are from random-effects analysis. Smaller studies:  $n < 250$ . ES, prevalence. a. On early reception.

population worldwide, the rate of depression appears to have been increasing over time. This was not found for psychosis in prisoners internationally or in the USA, which may be partly because the incidence of psychotic disorders has not increased in the general population either.<sup>131</sup> In relation to increased depression in US prisoners, further work could investigate the possible contributions of the closure of large psychiatric hospitals, the provision of community care, the funding of mental health and the reported increase in major depression rates in the general population.<sup>132</sup> Whatever the causes, the US houses more than three times more mentally ill people in prison than in all psychiatric hospitals,<sup>133</sup> and undertreatment for mental illness in US prisons exacerbates these problems.<sup>134</sup> Simple measures, including having policies and guidelines for the transfer of severely mentally ill people to psychiatric hospitals, training of prison staff and discharge planning, may improve these rates.<sup>133</sup>

### Strengths and limitations

The high levels of heterogeneity between the studies are to be expected as the studies were conducted by different groups in a large variety of prisons using differing methods,<sup>135</sup> and this may simply reflect real differences in prevalences over time and by region. This may also be an explanation for the asymmetric funnel plots we reported in addition to possible publication bias.<sup>38</sup> Also, publication bias may explain the small number of studies in low- and middle-income countries, and such bias is thought to contribute in all mental health research from these countries.<sup>136</sup> Our approach to this was to identify causes of heterogeneity, and two possible explanations were found. In depression, we found that studies using DSM criteria had higher rates than those using ICD criteria. Although such differences have occasionally been found in community studies, and a lower congruence between the two diagnostic systems for depression diagnoses compared with some other psychiatric disorders has also been



**Fig. 5** Prevalence of major depression in prisoners over time in (a) individual studies from all countries (including the USA) and (b) studies conducted in the USA only.

The size of the circles is proportional to the sample size of each study.

reported,<sup>137</sup> particular reasons for this difference in prisoners are unclear. Possibilities include that in the diagnostic systems, fatigability is included in the core criteria for depression in ICD, but it is an associated (rather than a core) feature in DSM. In addition, it may be that the distinction between melancholic and non-melancholic forms of depression<sup>138</sup> is more important in prisoners as the overlap between sadness and clinical depression is more difficult to determine.

The strengths of this review include the large number of samples and prisoners included, and therefore the ability to examine prevalences by clinically relevant subgroups with some degree of precision. However, we identified only eight studies in low- and middle-income countries, and our findings should be interpreted with caution. Furthermore, we have examined heterogeneity using subgroup analyses and meta-regression, which allowed us to investigate dichotomous and continuous variables such as age, sample size and the date when the study was conducted. One of the limitations of the review is that there may be other explanations for the heterogeneity that we did not test, such as comorbidity with other mental disorders, but systematic data on this were lacking. Furthermore, the statistical power of testing trends within nations was limited, and even our findings on US trends were based on 17 studies.

## Avenues for future research

A number of research implications arise from this review. First, studying the epidemiology of mental illness and criminality in low- and middle-income countries and how it compares with high-income countries may provide some reasons for the difference in psychosis prevalence. A recent review found no such studies in low- and middle-income countries.<sup>139</sup> More research into the treatment of mentally ill prisoners and the most effective models of service delivery is pressing, and further comparison of novel approaches needs closer examination.<sup>140</sup> Future prison surveys should include information on comorbidity and psychiatric history, suicide attempts within custody, treatment received in prison and adherence to treatment, and length of custody. In addition, the relationship between mental illness in prisoners and recidivism rates needs further examination.

In summary, prison provides a unique public health opportunity to treat mental illnesses that otherwise may not be treated in the community. Almost all prisoners return to their communities of origin, and effective treatment of mentally ill prisoners will have potentially substantial public health benefits and possibly reduce reoffending rates.

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