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Severe mental illness and substance use disorders in prisoners in low-income and middle-income countries: a systematic review and meta-analysis of prevalence studies

Gergő Baranyi, Carolin Scholl, Seena Fazel, Vikram Patel, Stefan Priebe, Adrian P Mundt

Summary

Background Although more than two thirds of the world’s incarcerated individuals are based in low-income and middle-income countries (LMICs), the burden of psychiatric disorders in this population is not known. This review provides estimates for the prevalence of severe mental illness and substance use disorders in incarcerated individuals in LMICs.

Methods For this systematic review and meta-analysis, we searched 17 electronic databases to identify prevalence studies of psychiatric disorders in prison populations in LMICs, published between January, 1987, and May, 2018. We included representative studies from general prison samples, providing information about four major psychiatric diagnoses: psychosis, major depression, alcohol use disorders, and drug use disorders. We pooled data from studies using random-effects meta-analyses and assessed the sources of heterogeneity by meta-regression. We extracted general population estimates from the Global Burden of Diseases 2016 database to calculate comparative prevalence ratios. This study is registered with PROSPERO, number CRD42015020905.

Findings We identified 23 publications reporting prevalence estimates of severe mental illness and substance use disorders for 14 527 prisoners from 13 LMICs. In this population, the estimated pooled 1 year prevalence rates for psychosis were 6·2% (95% CI 4·0–8·6), 16·0% (11·7–20·8) for major depression, 3·8% (1·2–7·6) for alcohol use disorders, and 5·1% (2·9–7·8) for drug use disorders. We noted increased prevalence at prison intake and geographic variations for substance use disorders. For alcohol use disorders, prevalence was higher in the southeast Asian region than in the eastern Mediterranean region; and drug use disorders were more prevalent in the eastern Mediterranean region than in Europe. Prevalence ratios indicated substantially higher rates of severe mental illness and substance use disorders among prisoners than in the general population (the prevalence of non-affective psychosis was on average 16 times higher, major depression and illicit drug use disorder prevalence were both six times higher, and prevalence of alcohol use disorders was double that of the general population).

Interpretation The prevalence of major psychiatric disorders is high in prisoners in LMIC compared with general populations. As these findings are likely to reflect unmet needs, the development of scalable interventions should be a public health priority in resource-poor settings.

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Introduction

More than 7 million prisoners are based in low-income and middle-income countries (LMICs), comprising about 70% of the world’s total prison population.1 Conditions in these facilities are usually characterised by overcrowding, poor nutrition, and sanitation, and limited or complete lack of access to basic health care, which have raised public health and human rights concerns.2,3 However, apart from one review in 2012,4 which included only a few studies from LMICs, the prevalence of major psychiatric disorders is not reliably known.5 Over the past 5 years, several high-quality prevalence studies have been published from LMIC settings.6,7 Mental health and substance use disorders are common among people involved with the criminal justice system.8,9 Although prisoners with unmet mental health-care needs are at higher risk of suicide attempts,10 mortality,11 and recidivism after release,12 mental health disorders often remain undiagnosed and untreated in correctional settings.13 Up to now, most research on mental health problems in prisoners has focused on high-income countries (HICs). Establishing the prevalence rates of severe mental illness and substance use disorders in LMICs will provide a basis for service and policy developments in countries with resource-poor correctional settings.

We aimed to systematically review the literature of severe mental illness (psychotic disorders and major depression) and substance use disorders (alcohol use disorders and illicit drug use disorders) in prison...
Research in context

Evidence before this study
Although 70% of incarcerated men and women are residing in low-income and middle-income countries, almost all evidence on mental disorders among prisoners is based on studies from high-income countries, providing implications that are not applicable or generalisable to poorly resourced settings. The prevalence of psychiatric disorders in the penal justice systems of low-income and middle-income countries (LMICs) is likely to differ from high-income countries because of the scarcity of resources, as well as cultural and legal factors.

To fill this knowledge gap, we systematically searched for prison prevalence studies based in LMICs published between January, 1987, and May, 2018, in 17 electronic global databases, including sources of grey literature. Our search terms covered a range of key words and subject headings on mental health, prison conditions, and epidemiological investigations. We included representative studies from general prison samples from LMICs, providing information about four major psychiatric diagnoses: psychosis, major depression, alcohol use disorders, and drug use disorders, published in any language. Our search identified no systematic reviews focusing on the context of LMICs.

Methods
This systematic review and meta-analysis was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).13

Search strategy and selection criteria
We conducted a multistage search to identify relevant literature on the prevalence of severe mental illness and substance use disorders in prison populations from LMICs published between January, 1987, and May, 2018. The search strategy comprised a search of online databases (ASSIA; CAB Abstracts; CNKI; Criminal Justice Database; Embase; Global Health; IBSS; LILACS; MEDLINE; NCJRS; PAIS Index; PsyclNFO; Scopus; Social Services Abstracts) and the grey literature (Google Scholar; Open Grey; ProQuest Dissertations and Theses Global); screening of reference lists of identified papers and relevant reviews; and corresponding with authors to gain additional information or to clarify data. The appendix provides a full list of the search terms used for the online database searches. Articles from all languages were included.

We included studies in which the following criteria were met: data were collected in general prison populations; the sample was representative for the population of the assessed correctional facility; the study was conducted in a LMIC at the time of data collection or maximum 1 year after classification has changed; the prevalence of severe mental illness and substance use disorders were based on clinical examinations or established with validated questionnaires as part of a clinical or research interview; and diagnoses met the criteria of international diagnostic classifications (Diagnostic and Statistical Manual of Mental Disorders [DSM] or International Classification of Diseases [ICD]). Studies were excluded when: prevalence rates were established in selected subgroups of incarcerated individuals (eg, offender type); sampling strategy was convenient;14 data originated from a HIC;15 prevalence was reported based on measures and tools that used solely self-report, which did not fulfil diagnostic criteria. Finally, conference abstracts and duplicates were excluded. Two researchers (GB and CS) screened abstracts and full-texts and disagreements between the reviewers were resolved by consensus with APM.

Data analysis
Two reviewers (GB and CS) independently extracted year and country of data collection, sex, age, type of recruitment (from all prisoners or at admission), sampling strategy, non-response rate, time served in prison, interviewer (mental health professional or research assistant), diagnostic classification system (DSM or ICD), diagnostic instrument, and number of incarcerated individuals, for which 1 year prevalence was

Added value of this study
We identified 23 studies from 13 countries, most of which had not previously been included in reviews. Our analysis established the pooled 1 year prevalence rates of four major mental illnesses in prisoner populations in LMICs. Furthermore, our findings emphasise that on arrival to prisons in LMICs, mental disorders may be more prevalent than in samples that also represent later stages of imprisonment.

Implications of all the available evidence
In LMICs, the prevalence of psychiatric disorders in prison populations is higher than among people living in the community. Rates in prison populations of LMICs might be even higher than in high-income countries. Because correctional facilities often lack basic health care in low-income and middle-income economies, the implementation of cost-effective interventions and scalable treatments for individuals with mental health problems are needed. Since human rights violations, and physical and psychological abuse are more common in resource-poor correctional settings, protecting the rights and health of people with mental illnesses should be a priority for penal justice policies.

populations in LMICs, to estimate prevalence rates and prevalence ratios, and to examine sources of heterogeneity.
reported for psychotic illness (ICD-10 codes: F20–F29, F31, F32·3, F33·3) and major depression (F32–33, except F32·3, F33·3). We extracted both 1 year and lifetime prevalence rates of alcohol (F10) and drug use disorders (F11–19, except F17). Male and female samples were considered separately. Studies that did not report separate rates but included less than 10% of the study participants of one sex were included as representative for the other sex; otherwise they were described as mixed samples. When the year of data collection was not reported, we imputed a year based on the average mean difference between the year of publication and data collection derived from the other studies (4 years). We prespecified categories for sample size (n<500, n≥500) and average time served in prison (time <1 year, time ≥1 year). Countries were categorised into LMIC and HIC based on their per capita Gross National Income, calculated with the World Bank’s Atlas method for the year of data collection. To examine geographic variation of prevalence estimates within LMIC, we used WHO regional classification. If schizophrenia-spectrum, bipolar disorder (which can present with acute psychotic states), and psychotic depression were presented separately, we combined them, in order to create one estimate for overall psychotic disorders. By combining abuse and dependence disorders, we produced single rates for alcohol and drug use disorders.

To assess methodological quality, two reviewers (GB and CS) evaluated the internal and external validity of the included samples based on a modified scale of ten questions, which allowed a critical appraisal of prevalence rates in epidemiological investigations (appendix).

To account for the heterogeneity between studies, we performed random-effects meta-analysis by estimating the pooled mean of the distribution. For individual samples, we first calculated 95% score confidence intervals (CIs). Variance of the proportions was stabilised with Freeman-Tukey double arcsine transformation and pooled together with the DerSimonian and Laird method. The inconsistency between samples was quantified with I². As previous prevalence meta-analyses reported high between-sample heterogeneity, we also provided prevalence ranges. Sensitivity analysis was conducted pooling 6 month estimates of severe mental illness as reported in a review for HIC. Pooled rates for psychotic illness as reported in a review for HIC. Pooled rates for psychotic illness as reported in a review for HIC. Pooled rates for non-affective psychotic illness. Prevalence ratios were pooled with random-effects meta-analysis. Sensitivity analyses were conducted for studies reporting 6 month rates of severe mental illness; and for schizophrenia, without imputed values of psychotic disorders.

We extracted sex-specific and country-specific prevalence rates from the Global Burden of Diseases 2016 database for the year of data collection in the respective prison survey. The matching population size (N) was imputed from the 2017 Revision of World Population Prospects. Because a national reference for psychosis is not available, rates for schizophrenia were extracted and matched with prison study rates for schizophrenia, if available. If not, we used rates of non-affective psychotic illness. Prevalence ratios were pooled with random-effects meta-analysis. Sensitivity analyses were conducted for studies reporting 6 month rates of severe mental illness; and for schizophrenia, without imputed values of psychotic disorders.

For the Global Burden of Diseases database see http://ghdx.healthdata.org/gbd-results-tool
For more on the World Bank’s Atlas method see https://data.worldbank.org/
For the 2017 Revision of World Population Prospects see https://esa.un.org/unpd/wpp/DataQuery

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Figure 1: Study identification, screening and eligibility test, following the Preferred Reporting Items of Systematic Reviews (PRISMA)

DSM=Diagnostic and Statistical Manual of Mental Disorders. ICD=International Classification of Diseases.
Biased prevalence estimates might arise not only from the inclusion of studies with lower methodological quality but also from publication or small study bias. To assess publication bias, we drew funnel plots presenting prevalence estimates against their SEs and tested the asymmetry of the funnel plots with Egger’s test, when ten or more samples were available.

All analyses were done with STATA (version 13). This study is registered with PROSPERO, number CRD42015020905.

Role of the funding source
The funder of the study had no role in study design, data collection, data analysis, data interpretation, or writing of

| Country       | WHO region | Sex   | Sampling          | Sample size | Non-response rate (%) | Interviewer | Diagnostic instrument | Diagnostic criteria | Quality appraisal score |
|---------------|------------|-------|-------------------|-------------|------------------------|-------------|------------------------|----------------------|------------------------|
| Adesanya et al | Nigeria    | Male  | Population        | 153         | 21.7                   | Not stated  | MINI-Plus              | ICD-10               | 7                      |
| Andreoli et al | Brazil     | Male  | Stratified random | 455         | 5.5                    | Physician   | MINI-Plus              | ICD-10               | 6                      |
| Andreoli et al | Brazil     | Female| Stratified random | 455         | 5.5                    | Physician   | MINI-Plus              | ICD-10               | 6                      |
| Assadi et al  | Iran       | Male  | Stratified random | 555         | 5.5                    | Physician   | MINI-Plus              | ICD-10               | 6                      |
| Ayyolmeethal et al | India | Male  | Population        | 155         | 21.7                   | Not stated  | MINI-Plus              | ICD-10               | 7                      |
| Canazaro and Argimone | Brazil | Female | Stratified random | 455         | 5.5                    | Physician   | MINI-Plus              | ICD-10               | 6                      |
| El-Gilany et al | Egypt     | Mixed | Stratified random | 555         | 5.5                    | Physician   | MINI-Plus              | ICD-10               | 7                      |
| Goyal et al   | India      | Male  | Random            | 455         | 5.5                    | Not stated  | MINI-Plus              | ICD-10               | 7                      |
| Joshi et al   | India      | Female| Population        | 455         | 5.5                    | Not stated  | MINI-Plus              | ICD-10               | 7                      |
| Kaya et al    | Turkey     | Male  | Random            | 455         | 5.5                    | Psychiatrist, trainee psychiatrist | MINI-Plus              | ICD-10               | 7                      |
| Kumar and Daria | India     | Male  | Random            | 455         | 5.5                    | Psychiatrist | MINI-Plus              | ICD-10               | 7                      |
| Majekodunmi et al | Nigeria | Male  | Random            | 455         | 5.5                    | Psychiatrist | MINI-Plus              | ICD-10               | 7                      |
| Math et al    | India      | Male  | Population        | 455         | 5.5                    | Not stated  | MINI-Plus              | ICD-10               | 6                      |
| Mundt et al   | Chile      | Male  | Random            | 455         | 5.5                    | Field worker | MINI-Plus              | ICD-10               | 6                      |
| Mundt et al   | Chile      | Female| Random            | 455         | 5.5                    | Field worker | MINI-Plus              | ICD-10               | 6                      |
| Mundt et al   | Chile      | Male  | Consecutive       | 455         | 5.5                    | Clinical psychologist | MINI-Plus              | ICD-10               | 6                      |
| Mundt et al   | Chile      | Female| Consecutive       | 455         | 5.5                    | Clinical psychologist | MINI-Plus              | ICD-10               | 6                      |
| Naidoo and Mkize | South Africa | Male  | Stratified random | 455         | 5.5                    | Psychiatrist | MINI-Plus              | ICD-10               | 6                      |
| Nanema et al  | Burkina Faso | Male  | Systematic random | 455         | 5.5                    | Medical student | MINI-Plus              | ICD-10               | 6                      |
| Ndeitei et al | South Sudan | Mixed | Population        | 455         | 5.5                    | Clinical psychologist | MINI-Plus              | ICD-10               | 6                      |
| Ninella et al | Sri Lanka  | Male  | Random            | 455         | 5.5                    | Not stated  | MINI-Plus              | ICD-10               | 6                      |
| Ninella et al | Sri Lanka  | Female| Random            | 455         | 5.5                    | Not stated  | MINI-Plus              | ICD-10               | 6                      |
| Bondé et al   | Brazil     | Male  | Random, population | 455         | 5.5                    | Medical student | MINI-Plus              | ICD-10               | 6                      |
| Salifou et al | Togo       | Female| Population        | 455         | 5.5                    | Psychiatrist, psychologist | MINI-Plus              | ICD-10               | 6                      |
| Silva et al   | Brazil     | Male  | Consecutive       | 455         | 5.5                    | Not stated  | MINI-Plus              | ICD-10               | 6                      |
| Silva et al   | Brazil     | Female| Consecutive       | 455         | 5.5                    | Not stated  | MINI-Plus              | ICD-10               | 6                      |
| Zarnam and Hatta | Malaysia | Female| Population        | 455         | 5.5                    | Not stated  | MINI-Plus              | ICD-10               | 6                      |

CIDI=Composite International Diagnostic Interview. DSM=Diagnostic and Statistical Manual of Mental Disorders. ICD=International Classification of Diseases. IPS=Indian Psychiatric Interview Schedule. MINI=Mini-International Neuropsychiatric Interview. PSE=Present State Examination. SCID=Structured Clinical Interview for DSM Disorders. *Results are based on 1 year coverage. †Study reported separate rate for schizophrenia. ‡Authors provided additional data.
the report. The corresponding author had full access to all the data in the study and had final responsibility for the decision to submit for publication.

**Results**

We identified 23 publications with 30 samples published between 1997 and 2018 (figure 1). They provided data from 13 different LMICs: Burkina Faso, Brazil, Chile, Egypt, Indonesia, Iran, Malaysia, Nigeria, South Africa, South Sudan, Sri Lanka, Togo, and Turkey. Five studies were written in languages other than English: two in French, two in Portuguese, and one in Turkish. Of 14527 imprisoned individuals, 85% were men and the weighted mean age was 31.8 years. Approximately 93% of the participants were prisoners in wards, while 7% arrived at prison (table 1; appendix).

1 year prevalence rates of psychotic disorders were reported in 22 samples involving 13135 individuals. The random-effects pooled prevalence was 6.2% (95% CI 4.0–8.6) with very high between-sample heterogeneity (I²=96; p<0.001; figure 2). We noted 18 times (95% CI 8.7–28.9) higher rates of non-affective psychosis than in the general population (table 2). Meta-regression indicated lower prevalence of psychosis in studies with smaller sample sizes (β=0.076; p=0.004), decreasing rates with longer time spent in prison (β=0.146; p=0.001), and higher estimates in samples recruited at prison intake (β=0.186; p<0.001). In the multivariate model, only the elevated prevalence of admission samples remained significant (β=0.138; p=0.026; appendix). The pooled prevalence of psychosis was 3.9% (95% CI 2.8–5.8) in non-admission samples. For this subgroup, prevalence rates ranged from 0.7% to 10.4% with substantial heterogeneity (I²=96; p<0.001; figure 2). We noted 15.8 times (95% CI 8.7–28.9) higher rates of non-affective psychosis than in the general population (table 2).

### Table A

| Region          | n/N     | Prevalence (95% CI) | Weight (%) |
|-----------------|---------|---------------------|------------|
| Male samples    |         |                     |            |
| Elle-Gilany et al²⁰ | Americas | 121/466            | 26.6 (22.8–30.8) | 4.85 |
| Mundt et al²⁰ | Americas | 51/239             | 22.3 (17.4–28.1) | 4.63 |
| Nanemá et al²⁰ | Africa   | 21/419             | 5.0 (3.7–6.3)    | 4.82 |
| Naidoo and Mikoë²⁰ | Africa   | 12/193             | 6.2 (3.6–10.6)   | 4.55 |
| Andreoli et al²⁰ | Americas | 56/1192             | 4.7 (3.6–6.1)    | 4.99 |
| Pondi et al²⁰ | Americas | 39/497             | 7.8 (5.8–10.5)   | 4.86 |
| Mundt et al²⁰ | America   | 6/825               | 0.7 (0.3–1.5)    | 4.95 |
| Assadi et al²⁰ | Eastern Mediterranean | 15/351 | 4.3 (0.6–9.6) | 4.77 |
| Kaya et al²⁰ | Europe    | 16/315              | 5.2 (3.8–7.4)    | 4.73 |
| Math et al²⁰ | Southeast Asia | 116/5024             | 2.6 (1.7–3.8)    | 4.68 |
| Goyal et al²⁰ | Southeast Asia | 13/500             | 2.6 (1.5–4.4)    | 4.86 |
| Kumar and Dana²⁰ | Asia     | 8/118               | 0.8 (0.6–1.0)    | 4.27 |
| Ayrolimeethal et al²⁰ | Southeast Asia | 16/222             | 7.2 (4.5–11.4) | 4.61 |
| Subtotal (F<95%, p<0.001) |          |                     | 6.0 (5.7–6.3) | 61.95 |
| Female samples  |         |                     |            |
| Elle-Gilany et al²⁰ | Americas | 23/91              | 25.3 (17.5–35.1) | 4.08 |
| Mundt et al²⁰ | Americas | 12/198             | 8.6 (5.4–13.3)  | 4.56 |
| Andreoli et al²⁰ | Americas | 21/617             | 3.4 (2.5–5.1)    | 4.90 |
| Mundt et al²⁰ | America   | 2/753               | 13.0 (4.4–4.6)   | 4.43 |
| Joshi et al²⁰ | Southeast Asia | 250          | 4.0 (1.3–11.3)   | 3.52 |
| Ayrolimeethal et al²⁰ | Southeast Asia | 2/733 | 6.1 (1.7–4.9) | 3.04 |
| Zamzam and Hatta²⁰ | Western Pacific | 1/80  | 1.3 (0.6–2.7) | 3.97 |
| Subtotal (F<98%, p<0.001) |          |                     | 5.7 (5.9–11.0) | 28.51 |
| Mixed samples   |         |                     |            |
| Ndeite et al²⁰ | Africa    | 20/192              | 10.4 (6.8–15.5)  | 4.93 |
| El-Gilany et al²⁰ | Eastern Mediterranean | 27/1350 | 2.0 (1.4–2.9) | 5.00 |
| Overall (F<96%, p<0.001) |          |                     | 6.2 (4.0–8.6) | 100.00 |

### Table B

| Region          | n/N     | Prevalence (95% CI) | Weight (%) |
|-----------------|---------|---------------------|------------|
| Male samples    |         |                     |            |
| Elle-Gilany et al²⁰ | Americas | 64/466            | 13.7 (10.9–17.2) | 4.06 |
| Mundt et al²⁰ | Americas | 124/228            | 54.4 (44.5–64.6) | 4.63 |
| Nanemá et al²⁰ | Africa   | 118/419            | 28.2 (24.1–32.7) | 4.05 |
| Majekodunmi et al²⁰ | Africa   | 62/196             | 31.6 (25.8–38.4) | 3.94 |
| Naidoo and Mikoë²⁰ | Africa   | 20/753             | 10.4 (6.8–15.5) | 3.94 |
| Pondi et al²⁰ | Americas | 39/497             | 6.0 (4.3–8.5)    | 4.07 |
| Andreoli et al²⁰ | Americas | 82/1192            | 6.9 (5.6–8.5)    | 4.12 |
| Mundt et al²⁰ | America   | 54/855             | 6.1 (4.7–7.9)    | 4.10 |
| Assadi et al²⁰ | Eastern Mediterranean | 68/351 | 7.2 (5.6–9.7) | 4.13 |
| Boggelone et al²⁰ | Europe   | 4/30               | 13.3 (5.3–29.7) | 3.09 |
| Kaya et al²⁰ | Europe    | 6/315              | 22.0 (17.7–26.9) | 4.02 |
| Ayrolimeethal et al²⁰ | Southeast Asia | 6/122  | 2.7 (1.2–5.1) | 3.97 |
| Math et al²⁰ | Southeast Asia | 457/5024          | 9.1 (8.3–9.9) | 4.15 |
| Kumar and Dana²⁰ | Southeast Asia | 19/118 | 16.1 (10.6–23.8) | 3.82 |
| Goyal et al²⁰ | Southeast Asia | 81/500 | 16.2 (13.2–19.7) | 4.07 |
| Subtotal (F<98%, p<0.001) |          |                     | 5.9 (5.1–11.4) | 59.39 |
| Female samples  |         |                     |            |
| Elle-Gilany et al²⁰ | Americas | 25/91              | 27.5 (19.4–37.4) | 3.73 |
| Mundt et al²⁰ | Americas | 86/298             | 43.4 (36.7–50.4) | 3.94 |
| Salifou et al²⁰ | Africa   | 19/61              | 31.1 (20.9–43.6) | 3.55 |
| Andreoli et al²⁰ | Americas | 116/617            | 18.8 (15.9–22.1) | 4.08 |
| Mundt et al²⁰ | Africa   | 37/1253            | 11.1 (7.1–17.3)  | 3.89 |
| Boggelone et al²⁰ | Europe   | 3/30               | 10.0 (3.5–25.6) | 3.09 |
| Ayrolimeethal et al²⁰ | Southeast Asia | 1/33 | 3.0 (0.5–15.3) | 3.16 |
| Joshi et al²⁰ | Southeast Asia | 16/500 | 5.0 (2.0–8.4) | 3.44 |
| Subtotal (F<91%, p<0.001) |          |                     | 19.4 (11.7–28.5) | 32.55 |

### Table Figures

**Figure 2:** Random-effects meta-analyses of 1-year prevalence studies reporting psychotic disorders (A) and major depression (B) in prison populations in low-income and middle-income countries.

*Samples were recruited at intake to prison.*
Findings of our sensitivity analysis on non-admission samples showed no significant variation in prevalence rates or prevalence ratios for severe mental illness in samples reporting only 6 month estimates. The prevalence ratio for samples reporting solely schizophrenia was 7·9 (95% CI 4·9–12·7) compared with the general population (appendix).

For substance use disorders, we considered admission and non-admission samples separately because the former were likely to be higher and more comparable to the literature coming from HIC. At prison intake, the 1 year prevalence of alcohol use disorders ranged from 13·6% to 42·3%, and for drug use disorders estimates were between 27·3% and 68·1%.

We identified 12 non-admission samples reporting 1 year prevalence of alcohol use disorders (n=9491). The pooled prevalence was 3·8%.

| Study | Sex | Psychotic disorders | Major depression |
|-------|-----|---------------------|------------------|
|       |     | Population prevalence | Prevalence ratio | Population prevalence | Prevalence ratio |
|       |     | Estimate | 95% CI | Estimate | 95% CI |
| Africa |     |           |       |           |       |
| Burkina Faso | Nanéma et al | Men | 0·12 | 41·6* | 27·48–62·28 | 1·48 | 19·05 | 16·35–22·20 |
| Nigeria | Majekodunmi et al | Men | ... | ... | ... | 1·74 | 18·16 | 14·78–22·32 |
| South Africa | Naidoo and Mkize | Men | 0·19 | 24·74* | 13·30–46·70 | 2·21 | 4·71 | 3·11–7·12 |
| South Sudan | Ndetei et al | Mixed | 0·13 | 32·31 | 16·44–63·50 | 1·97 | 7·16 | 5·05–10·15 |
| Togo | Salifou et al | Women | ... | ... | ... | 2·45 | 12·69 | 8·74–18·44 |
| Americas |     |           |       |           |       |
| Brazil | Andreoli et al | Men | 0·22 | 8·64 | 5·74–12·99 | 1·95 | 3·54 | 2·87–4·36 |
| Brazil | Pondé et al | Men | 0·22 | 27·27* | 19·26–38·63 | 2·02 | 2·97 | 2·10–4·21 |
| Brazil | Silva et al | Men | 0·22 | 120·91* | 103·98–140·60 | 1·95 | 7·03 | 5·59–8·82 |
| Brazil | Andreoli et al | Women | 0·20 | 7·50 | 3·96–14·22 | 4·26 | 4·37 | 3·70–5·15 |
| Brazil | Silva et al | Women | 0·20 | 126·50* | 88·37–180·07 | 4·26 | 6·46 | 4·62–9·01 |
| Chile | Mundt et al | Men | 0·23 | 3·04* | 1·37–6·76 | 2·13 | 2·86 | 2·20–3·73 |
| Chile | Mundt et al | Men | 0·23 | 96·96* | 76·10–123·52 | 2·16 | 25·05 | 22·23–28·22 |
| Chile | Mundt et al | Women | 0·21 | 6·19* | 1·56–24·63 | 3·79 | 2·93 | 1·87–4·59 |
| Chile | Mundt et al | Women | 0·22 | 39·09* | 24·82–61·57 | 3·61 | 12·02 | 10·25–14·10 |
| Eastern Mediterranean |     |           |       |           |       |
| Iran | Assadi et al | Men | 0·18 | 11·11 | 5·34–23·11 | 3·15 | 8·86 | 7·49–10·48 |
| Egypt | El-Gilany et al | Mixed | 0·18 | 4·44 | 2·45–8·05 | 2·28 | 0·42 | 0·25–0·72 |
| Europe |     |           |       |           |       |
| Turkey | Bösgelmez et al | Men | ... | ... | ... | 2·05 | 6·49 | 2·60–16·18 |
| Turkey | Kaya et al | Men | 0·19 | 5·26* | 1·72–16·08 | 2·02 | 10·88 | 8·80–13·44 |
| Turkey | Bösgelmez et al | Women | ... | ... | ... | 3·66 | 2·73 | 0·93–7·99 |
| Southeast Asia |     |           |       |           |       |
| India | Ayirolimeethal et al | Men | 0·24 | 28·33* | 17·41–46·11 | 1·82 | 1·48 | 0·67–3·27 |
| India | Goyal et al | Men | 0·23 | 1·74 | 0·44–6·94 | 1·91 | 8·47 | 5·61–12·79 |
| India | Kumar and Daria | Men | 0·23 | 14·78 | 5·65–38·68 | 1·90 | 8·47 | 5·61–12·79 |
| India | Math et al | Men | 0·24 | 4·58 | 3·35–5·96 | 1·82 | 5·00 | 4·58–5·46 |
| India | Ayirolimeethal et al | Women | 0·23 | 13·04* | 1·87–90·78 | 2·64 | 1·14 | 0·16–7·91 |
| India | Joshi et al | Women | 0·23 | 17·39* | 4·47–67·62 | 2·62 | 12·21 | 8·15–18·30 |
| Western Pacific |     |           |       |           |       |
| Malaysia | Zamzam and Hatta | Women | 0·26 | 5·00 | 0·74–33·75 | 1·57 | 4·78 | 2·21–10·31 |
| Pooled prevalence ratio I | ... | 15·83 | 8·68–28·87 | 5·95 | 4·11–8·03 |
| Pooled prevalence ratio II (non-admission samples) | ... | 1·10 | 6·05–20·37 | 6·30 | 4·35–9·13 |
| Pooled prevalence ratio II (non-admission samples) | ... | 8·26 | 5·03–13·58 | 5·26 | 3·10–8·93 |
| Pooled prevalence ratio II (non-admission samples) | ... | 10·68 | 6·68–17·06 | 5·31 | 3·94–7·19 |

*Admission samples. †Sample reported non-affective psychotic disorders; otherwise, prevalence of schizophrenia was extracted. Population prevalence refers to the sex-specific, country-specific, and year-specific rates in the general population retrieved from the Global Burden of Disease database 2016.

Table 2: Prevalence ratios of severe mental illness in prison populations in low-income and middle-income countries
### A. Prevalence at Intake to Prison

| Study              | Sex | Region                      | n/N       | Prevalence Rate (95% CI) | Weight (%) |
|--------------------|-----|-----------------------------|-----------|--------------------------|------------|
| Silva et al        | Male| Americas                    | 197/466   | 42.3 (37.9–46.8)         | NA         |
| Mundt et al        | Male| Americas                    | 77/229    | 33.6 (27.8–40.0)         | NA         |
| Silva et al        | Female| Americas                  | 30/91     | 33.0 (24.2–43.3)         | NA         |
| Mundt et al        | Female| Americas                  | 27/198    | 13.6 (9.5–19.1)          | NA         |

#### Life Table 1 (p=0.8%, p<0.001)

| Study              | Sex | Region                      | n/N       | Prevalence Rate (95% CI) | Weight (%) |
|--------------------|-----|-----------------------------|-----------|--------------------------|------------|
| Andreoli et al     | Male| Americas                    | 221/1192  | 18.5 (16.4–20.8)         | 12.79      |
| Pondé et al        | Male| Americas                    | 167/497   | 33.6 (29.6–37.9)         | 12.63      |
| Assadi et al       | Male| Eastern Mediterranean       | 0/351     | 0.0 (0.0–1.1)            | 8.61       |
| Math et al         | Male| Southeast Asia              | 70/3502   | 11.38 (11.1–11.6)        | 7.17       |
| Salfi et al        | Female| Africa                     | 2/61      | 2.5 (0.7–8.7)            | 7.68       |
| Nefsi et al        | Female| Americas                  | 15/617    | 1.0 (0.3–3.7)            | 8.36       |
| Zaman and Hatta    | Female| Western Pacific             | 2/192     | 3.8 (1.2–11.1)           | 100.00     |
| Subtotal           |     |                             | 27.6 (18.6–37.7) | 100.00     |

### B. Prevalence in Non-admission Samples

| Study              | Sex | Region                      | n/N       | Prevalence Rate (95% CI) | Weight (%) |
|--------------------|-----|-----------------------------|-----------|--------------------------|------------|
| Silva et al        | Male| Americas                    | 220/466   | 47.2 (42.7–51.7)         | NA         |
| Mundt et al        | Male| Americas                    | 155/229   | 68.1 (61.8–73.8)         | NA         |
| Silva et al        | Female| Americas                 | 45/91     | 49.5 (39.4–59.5)         | NA         |
| Mundt et al        | Female| Americas                 | 54/198    | 27.3 (21.5–33.9)         | NA         |

#### Life Table 1 (p=99%, p<0.001)

| Study              | Sex | Region                      | n/N       | Prevalence Rate (95% CI) | Weight (%) |
|--------------------|-----|-----------------------------|-----------|--------------------------|------------|
| Andreoli et al     | Male| Americas                    | 315/1192  | 26.5 (24.1–29.3)         | 9.21       |
| Pondé et al        | Male| Americas                    | 148/497   | 29.8 (25.9–33.9)         | 12.17      |
| Assadi et al       | Male| Eastern Mediterranean       | 265/351   | 75.5 (70.7–79.7)         | 9.14       |
| Math et al         | Male| Southeast Asia              | 53/500    | 10.4 (8.0–13.4)          | 9.17       |
| Salfi et al        | Male| Southeast Asia              | 322/504   | 6.4 (5.8–7.1)            | 9.24       |
| Nefsi et al        | Male| Southeast Asia              | 143/235   | 4.40 (3.9–4.9)           | 9.13       |
| Zaman and Hatta    | Female| Americas                | 112/287   | 39.4 (33.9–45.5)         | 12.12      |
| Subtotal           |     |                             | 51/198    | 5.1 (2.9–7.8)            | 100.00     |

**Figure 3:** Random-effects meta-analysis of prevalence studies reporting alcohol use disorders (A) and drug use disorders (B) in prison populations in low-income and middle-income countries

NA = not applicable.
(95% CI 1·2–7·6; figure 3), 2.4 times higher than (1·1–5·2) in the general population (table 3). The estimates ranged from 0·0% to 18·0% (I²=98%, p<0·001), and were similar for men (3·7%, 95% CI 0·5–9·4) and women (4·4%, 1·5–8·4; figure 3). Meta-regression indicated geographical variation, with elevated prevalence in the southeast Asian region in comparison to the eastern Mediterranean region (β=0·140; p=0·038; appendix). We recorded higher estimates in lower quality studies (β=–0·024; p=0·001), which could be attributed to two lower quality studies with high prevalence estimates from the southeast Asian region. 34,35 The lifetime prevalence rate of alcohol use disorders (eight samples; n=8566) 6,26,32,34,36,37 was 27·6% (95% CI 18·6–37·7; men: 32·2%, 22·3–43·0, and women: 15·2%, 12·6–18·0) and varied between 13·8% and 75·5% (I²=99%; p<0·001; figure 3). Findings of meta-regression did not show any significant explanation for heterogeneity (appendix).

| Study          | Sex          | Alcohol use disorders | Drug use disorders |
|----------------|--------------|-----------------------|--------------------|
|                |              | Population prevalence| Prevalence ratio    | Population prevalence| Prevalence ratio |
|                |              | Estimate              | 95% CI             | Estimate              | 95% CI         |
| Africa         |              |                       |                    |                      |
| Burkina Faso   | Nanéma et al25 | Men 1.00              | 4.50               | 2.90–7.00            | 0.39           | 11.03          | 7.02–17.13 |
| Nigeria        | Adestanya et al26 | Men                  | –                  | –                    | 0.37           | 7.57           | 4.23–13.53 |
| South Sudan    | Ndetei et al28 | Mixed 1.11            | 0.90               | 0.22–3.68            | –              | –              | –          |
| Togo           | Salifou et al29 | Women 0.96            | 5.10               | 1.69–15.42           | 0.30           | 11.00          | 2.83–42.80 |
| Americas       |              |                       |                    |                      |
| Brazil         | Andreoli et al30 | Men 4.28             | 0.44               | 0.30–0.67            | 1.30           | 1.00           | 0.61–1.64 |
| Brazil         | Pondé et al31 | Men 4.29              | 0.70               | 0.42–1.15            | 1.27           | 7.01           | 5.29–9.28 |
| Brazil         | Silva et al32  | Men 4.28              | 9.88               | 8.89–10.99           | 1.30           | 36.31          | 22.98–59.97 |
| Brazil         | Andreoli et al33 | Women 1.38           | 1.74               | 1.05–2.88            | 0.72           | 2.22           | 1.20–4.13 |
| Brazil         | Silva et al34  | Women 1.38             | 23.91              | 17.84–32.05          | 0.72           | 68.75          | 55.87–84.61 |
| Chile          | Mundt et al35  | Men 3.78               | 1.32               | 0.99–1.77            | 1.38           | 4.86           | 3.78–6.24 |
| Chile          | Mundt et al36  | Men 3.60               | 9.32               | 7.78–11.20           | 1.44           | 47.29          | 43.27–51.68 |
| Chile          | Mundt et al37  | Women 1.46              | 1.78               | 0.68–4.70            | 0.78           | 8.33           | 4.57–15.20 |
| Chile          | Mundt et al38  | Women 1.40              | 9.71               | 6.84–13.80           | 0.80           | 34.13          | 27.18–42.84 |
| Eastern Mediterranean |              |                       |                    |                      |
| Iran           | Assadi et al39 | Men 0.64               | 0.22               | 0.01–3.58            | 2.50           | 4.44           | 3.30–5.97 |
| Southeast Asia |              |                       |                    |                      |
| India          | Math et al40  | Men 2.03               | 6.90               | 6.44–7.39           | –              | –              | –          |
| India          | Joshi et al41 | Men 0.43               | 41.86              | 23.17–75.64          | 0.37           | 16.22          | 5.41–48.58 |
| Western Pacific |              |                       |                    |                      |
| Malaysia       | Zamzam and Hatta42 | Women 0.32          | 7.81               | 1.99–30.70          | 0.54           | 20.83          | 11.26–38.56 |
| Pooled prevalence ratio (non-admission samples) | – Men | 1.40 | 0.45–4.36 | 1.40 | 0.45–4.36 | 1.40 | 0.45–4.36 |
| Pooled prevalence ratio (non-admission samples) | – Women | 5.54 | 1.23–24.92 | 5.54 | 1.23–24.92 | 5.54 | 1.23–24.92 |
| Pooled prevalence ratio (non-admission samples) | – Total | 2.43 | 1.12–5.24 | 2.43 | 1.12–5.24 | 2.43 | 1.12–5.24 |

Table 3: Prevalence ratios of substance use disorders in prison populations in low-income and middle-income countries

For the 11 samples reporting 1-year prevalence rates of drug use disorders (n=4670),3.7,25,28,30–8,43 the pooled estimate was 5–1% (95% CI 2·9–7·8), 5·3% (2·5–9·0) in male and 5·0% (1·6–9·8) in female samples—ie, 6·1 times (95% CI 4·0–9·4) higher than in the general population (table 3). The 1 year prevalence of drug use disorders ranged from 1·3% to 11·3% (I²=94%; p<0·001; figure 3). Findings of meta-regression did not show any significant explanation for heterogeneity (appendix). Studies on lifetime prevalence of drug use disorders (11 samples; n=9246)3.7,25,28,30–8,42 indicated a pooled estimate of 30·6% (95% CI 18·1–44·8; men: 27·2%, 95% CI 12·1–45·7, and women: 36·7%, 95% CI 25·9–48·2), ranging between 6·4% and 75·5% (I²=99%; p<0·001; figure 3). Meta-regression results showed geographical variation between samples with elevated prevalence in the eastern Mediterranean in comparison to the European region (β=0·627; p=0·019; appendix).
Egger’s test of asymmetric funnel plot indicated small sample bias for psychotic illnesses \( (p=0.027) \), current alcohol use disorders \( (p=0.025) \) and for lifetime drug use disorders \( (p=0.013) \) in non-admission studies. After excluding the study with the lowest quality score, which also had the largest sample size, evidence for publication bias did not remain significant (appendix).

**Discussion**

Our findings suggest that incarcerated individuals in LMICs have a higher prevalence of psychiatric disorders than the general population and that rates at arrival to prison are elevated. Furthermore, our results show that there is geographical variation in the prevalence of substance use disorders.

The study had several limitations. Our findings are based on only 13 of more than 100 LMICs, and we could not identify any studies meeting our criteria from China, which has the largest prison population among LMICs. Additionally, there was high heterogeneity between studies. This was not unexpected as the included countries are substantially different in terms of their criminal and health-care systems.

Consistent with systematic reviews from prisoners in HICs, our findings provide evidence for higher prevalence of psychiatric disorders in incarcerated people than in the general population.\(^4\)\(^-\)\(^6\) Imprisoned individuals often have a low socioeconomic background, belong to minority groups, and have histories of childhood victimisation and substance abuse, which make them vulnerable to psychiatric disorders.\(^7\)\(^-\)\(^8\) While in prison, poor living conditions,\(^9\) physical assault\(^10\) and psychological abuse\(^1\) can further contribute to mental health disorders.

Although general population reviews indicate a lower prevalence of schizophrenia\(^a\) and major depression\(^a\) in LMICs than in HICs, we did not find this among prisoners.\(^1\) A high prevalence of severe mental illness in prisoners in LMICs could relate to poorly developed community mental health-care systems that do not yet reach socially deprived and marginalised populations in these countries. Human rights violations among individuals with mental health problems during imprisonment, especially for those with psychotic conditions, have been reported to be more common in poorly resourced settings.\(^1\)

Upon arrival to prison, we found similar 1 year prevalence estimates of alcohol and drug use disorders as those reported for individuals in HICs.\(^4\) These are comparable to lifetime rates and provide information about the substance use problems before imprisonment. However, the estimates on current prevalence among non-intake samples represent the average disease burden during imprisonment, which might be relevant for service planning. Even though addictive substances are available outside of prison. We found regional variation in the prevalence of substance use disorders, possibly linked to regional differences of the substances used.\(^4\) The highest rates of alcohol use disorders were found in studies from India,\(^4\)\(^-\)\(^6\)\(^1\) while the highest rate for drug use disorders was reported in a study from Iran.\(^4\) While lower rates of substance use disorders in women are found in the general population,\(^4\) this is typically not the case for prison populations. The rates of substance use disorders among prisoners start considerably higher than population comparisons independent of sex, likely due to substance use being a major driver of criminality.\(^4\) In HICs, incarcerated women have similar rates of alcohol use disorders as incarcerated men and a higher prevalence of illicit drug use disorders than men.\(^4\) This difference can be explained by lower rates of female incarceration and hence women in prison being a more selected group of high-risk individuals with elevated rates of substance use problems.

Admission studies indicated higher rates of psychosis and major depression at arrival to prison compared with investigations that included prisoners at later stages of imprisonment, which is consistent with longitudinal studies from HICs reporting high rates of psychiatric disorders at intake to prison.\(^4\)\(^-\)\(^5\)\(^1\) However, this finding was based on only two intake studies conducted in Latin American countries. The very high prevalence of severe mental illness at intake to prison in those countries could be linked to the use of cocaine products before imprisonment.\(^4\)\(^-\)\(^5\)\(^1\) There are several possible explanations for lower rates of mental health symptoms at later stages of imprisonment in spite of the harsh conditions of LMICs prisons including: reduced access to substances during imprisonment, protection or removal from adverse social environments outside of prisons, development of coping mechanisms,\(^5\) availability of treatment services, and diversion of mentally ill prisoners.\(^5\) However, the literature points to substantial unmet health-care needs.\(^5\)

Our findings have several implications. First, the low number of included samples emphasises the paucity of epidemiological investigations in LMICs. Although more than 100 high quality samples provide reliable evidence of psychiatric disorders in prisons in LMICs,\(^4\)\(^-\)\(^5\)\(^1\) we found only 30 samples from a much more diverse group of countries. Further evidence is needed to adequately plan interventions for prisoners with mental disorders in LMICs, especially from regions underrepresented in research such as central and east Asia, and Central America. Second, cost-effective interventions and scalable treatments should be prioritised, either by adapting existing programmes from HICs to local conditions or by developing new programmes on a large scale (eg, interventions at the transition from prison to the community for individuals with mental illness).\(^3\)\(^-\)\(^5\)\(^1\) Effective psychological treatments in prison settings have been reported for HICs\(^3\)\(^-\)\(^5\) and some might be transferable to resource-poor settings. Furthermore, community interventions in LMICs, such as enhancing health literacy,\(^5\) using digital technologies in prevention,\(^5\) as well as...
treatments of severe mental disorders,\textsuperscript{39} have shown promising ways of addressing the mental health treatment gap. Some of these interventions could also be used to prevent and treat psychiatric disorders in prison populations.

Finally, imprisonment could present an opportunity to treat people with mental health and substance use problems who otherwise would be difficult to reach for health services;\textsuperscript{41} however, neither the funding nor qualified staff for such treatments are usually available in prisons. National governments in LMICs should move the responsibility for prison health care from prison administrations to the national health services.\textsuperscript{1} In conclusion, our findings of high prevalence estimates for major mental health and substance use disorders among prisoners in LMICs present an important global mental health challenge, indicate a treatment gap, and might raise concerns about human rights violations.

Contributors
GB, APM, SF, VP, and SP conceived, planned, and oversaw the study. GB and CS searched the literature, applied inclusion and exclusion criteria, extracted data, and conducted quality assessment. Disagreements between reviewers were resolved by consensus with GB. GB searched the literature, applied inclusion and exclusion criteria, extracted data, and conducted quality assessment. GB and APM drafted the manuscript; all authors reviewed, commented on, and approved it.

Declaration of interests
We declare no competing interests.

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References
1. Wahlström J, Svensson P, Almqvist C, et al. Prevalence of mental disorders among prisoners in Sweden. Scand J Psychol 2018; 59: 101–08.
2. Cochrane Collaboration. The Cochrane Library. 2018. (Accessed February 15, 2020).
3. Bejer U, Wolf A, Fazel S. Prevalence of tuberculosis, hepatitis C virus, and HIV in homeless people: a systematic review and meta-analysis. Lancet Infect Dis 2012; 12: 839–50.
4. Egger M, Davey Smith G, Schneider M, Minder C. Bias in meta-analysis detected by a simple, graphical test. BMJ 1997; 315: 629–34.
5. Jackson D, Law M, Rucker G, Schwarzer G. The Hartung-Knapp-Sidik-Jpatrick approach to meta-analysis. J Stat Softw 2009; 31: 1–18.
6. Higgins JP, Green S. Cochrane handbook for systematic reviews of interventions version 5.1.0. Updated March 2011. The Cochrane Collaboration, 2011. http://handbook.cochrane.org (accessed July 20, 2018).
7. Mundt AP, Kastner S, Larrain S, Fritsch R, Pribe S. Prevalence of mental disorders among prisoners in the state of Sao Paulo, Brazil. PLoS One 2014; 9: e88836.
8. Mundt AP, Alvarado R, Forsselt S, et al. Prevalence of mental disorders among prisoners in the state of Sao Paulo, Brazil. PLoS One 2013; 8: e69909.
9. Mundt AP, Alvarado R, Forsselt S, et al. Prevalence of mental disorders among prisoners in the state of Sao Paulo, Brazil. PLoS One 2013; 8: e69909.
10. Mundt AP, Alvarado R, Forsselt S, et al. Prevalence of mental disorders among prisoners in the state of Sao Paulo, Brazil. PLoS One 2013; 8: e69909.
11. Spittal MJ, Forsyth S, Borschmann R, Young JT, Kinner SA. Modifiable risk factors for external cause mortality after release from prison: a nested case-control study. Epidemiol Psychiatr Sci 2017; 28: 1–10.
35 Joshi P, Kukreja S, Desousa A, Shah N, Shrivastava A. Psychopathology and other contributing stressful factors in female offenders: an exploratory study. *Indian J Forensic Med Toxicol* 2014; 8: 149–55.

36 Assadi SM, Noroozian M, Pakravanejad M, et al. Psychiatric morbidity among sentenced prisoners: prevalence study in Iran. *Br J Psychiatry* 2006; 188: 159–64.

37 Zamzam R, Hatta SM. Specific psychiatric disorders among convicted female offenders in a Malaysian prison. *Malaysian J Psychiatry* 2004; 5: 122–27.

38 Adesanya A, Ohaeri JU, Ogunlesi AO, Adamson TA, Odejide OA. Psychoactive substance abuse among inmates of a Nigerian prison population. *Drug Alcohol Depend* 1997; 47: 39–44.

39 Majekodunmi O, Obadeji A, Oluwole I, Oyelami R. Depression in prison population: Demographic and clinical predictors. *J Forensic Sci Med* 2017; 3: 122–27.

40 Ndetei D, Khasakhala L, Mutiso V, Harder V. Mental disorders and HIV risk behaviors among prisoners in South Sudan. *Nairobi, Kenya: United Nations Office On Drugs And Crime (UNODC)*, 2008.

41 Nieziu NL, Mzike DL. Prevalence of mental disorders in a prison population in Durban, South Africa. *Afr J Psychiatry* 2012; 15: 30–35.

42 Niriella MA, Hapangama A, Luke HP, Pathmeswaran A, Kuruppuwarachchi KA, de Silva HJ. Prevalence of hepatitis B and hepatitis C infections and their relationship to injectable drug use in a cohort of Sri Lankan prison inmates. *Ceylon Med J* 2015; 60: 46–50 (in French).

43 Niriella MA, Hapangama A, Luke HP, Pathmeswaran A, Kuruppuwarachchi KA, de Silva HJ. Prevalence of hepatitis B and hepatitis C infections and their relationship to injectable drug use in a cohort of Sri Lankan prison inmates. *Ceylon Med J* 2015; 60: 18–20.

44 Steel Z, Marmar C, Iranpour C, et al. The global prevalence of common mental disorders: a systematic review and meta-analysis 1980-2013. *Int J Epidemiol* 2014; 43: 676–93.

45 Saha S, Chant D, Welham J, McGrath J. A systematic review of the prevalence of schizophrenia. *PLoS Med* 2005; 2: e141.

46 Mundt AP, Baranyi G, Gabrys C, Fazel S. Substance use during imprisonment in low- and middle-income countries. *Epidemiol Rev* 2018; 40: 70–81.

47 Bennett T, Holloway K. The causal connection between drug misuse and crime. *Br J Criminol* 2009; 49: 513–31.

48 Walker J, Illingworth C, Canning A, et al. Changes in mental state associated with prison environments: a systematic review. *Acta Psychiatr Scand* 2014; 129: 427–36.

49 Baier A, Fritsch R, Ignatyev Y, Priebe S, Mundt AP. The course of major depression during imprisonment—a one year cohort study. *J Affect Disord* 2016; 189: 207–13.

50 Baier A, Fritsch R, Ignatyev Y, Priebe S, Mundt AP. The course of major depression during imprisonment—a one year cohort study. *J Affect Disord* 2016; 189: 207–13.

51 Yoon IA, Slade K, Fazel S. Outcomes of psychological therapies for prisoners with mental health problems: a systematic review and meta-analysis. *J Consult Clin Psychol* 2017; 85: 783–802.

52 Hopkin G, Evans-Lacko S, Forrester A, Shaw J, Thornicroft G. Interventions at the transition from prison to community for prisoners with mental illness: a systematic review. *Adm Policy Ment Health* 2018; 45: 623–34.

53 Shidhaye R, Murhar V, Gangale S, et al. The effect of VISHRAM, a grass-roots community-based mental health programme, on the treatment gap for depression in rural communities in India: a population-based study. *Lancet Psychiatry* 2017; 4: 128–35.

54 Naslund JA, Aschbrenner KA, Araya R, et al. Digital technology for treating and preventing mental disorders in low-income and middle-income countries: a narrative review of the literature. *Lancet Psychiatry* 2017; 4: 486–500.

55 de Jesus MJ, Razzezouk D, Thara R, Eaton J, Thornicroft G. Packages of care for schizophrenia in low- and middle-income countries. *PLoS Med* 2009; 6: e1000165.