

## The health of prisoners

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More than 10 million people are incarcerated worldwide; this number has increased by about a million in the past decade. Mental disorders and infectious diseases are more common in prisoners than in the general population. High rates of suicide within prison and increased mortality from all causes on release have been documented in many countries. The contribution of prisons to illness is unknown, although shortcomings in treatment and aftercare provision contribute to adverse outcomes. Research has highlighted that women, prisoners aged 55 years and older, and juveniles present with higher rates of many disorders than do other prisoners. The contribution of initiatives to improve the health of prisoners by reducing the burden of infectious and chronic diseases, suicide, other causes of premature mortality and violence, and counteracting the cycle of reoffending should be further examined.

### Introduction

More than 10 million people are imprisoned worldwide, with 2·3 million in the USA, 1·6 million in prison and another 0·9 million in administrative detention in China, and 0·9 million in Russia. India, Thailand, Iran, Indonesia, Turkey, Brazil, Mexico, South Africa, and Ukraine all have prison populations exceeding 100 000 people.<sup>1</sup> The USA has the highest number of prisoners per head of population at 756 per 100 000 people, compared with a mean of 145 per 100 000 worldwide. The number of people in prisons has been increasing in more than two-thirds of countries worldwide in the past decade and rose by more than 1 million from the late 1990s to 2006–08 (figure 1).<sup>1,2</sup> Rates of imprisonment have also risen in north and central America, Asia, and Oceania (figure 1).

Prisoners bear a substantial burden of physical and psychiatric disorders relative to the general population. However, most evidence on the health of prisoners comes from high-income nations. Long-standing concerns about the care and treatment of prisoners, such as the use of capital punishment for mentally ill prisoners in some countries, are widespread.<sup>4–6</sup> The health disparity between prisoners and the general population has been attributed to various behavioural and socioeconomic factors, including high rates of intravenous drug use in prisoners, which leads to increased risk of infectious diseases and increased alcohol misuse and smoking.

### Search strategy and selection criteria

We searched Medline, PubMed, the Cochrane Library, EMBASE, and the National Criminal Justice Reference Service database for all article types from Jan 1, 1990, to Nov 31, 2009. All languages were included. Key search terms used were “prison”, “prisoner”, and “inmate”. These terms were combined with specific medical and psychiatric disorders and conditions. We largely selected articles published in the past 5 years in peer-reviewed journals, but did not exclude often referenced and highly regarded older publications. We also searched the reference lists of articles identified by this search strategy and selected additional publications that we deemed relevant.

These behaviours in turn raise the risk of cardiovascular disease and some cancers. Mental illness, which increases the risk of crime and repeat offending,<sup>7–9</sup> is common in prisoners. The extent to which the prison itself raises the risk of illness has only been investigated in relation to infectious diseases and is unknown in relation to most other disorders.

In this Review, we discuss the prevalence and risk factors for some of the major physical and psychiatric diseases in prisoners, and the challenges to provide health-care services for this population. We first discuss the prevalence of mental disorders and evidence-based treatments for them, the prevalence, transmission, and prevention of infectious diseases, and the prevalence of chronic diseases. We then review mortality rates in prisoners and discuss populations with particular health needs. Finally, we present information on health-care services and make several recommendations for improvements. Where possible, we use the term prison apart from in the USA, where jails (detention centres before trial or remand centres that house prisoners on sentences shorter than 1 year) and state prisons (for sentenced prisoners) are distinguished. Jails tend to have higher turnover rates than do prisons, and hence provide fewer opportunities to diagnose and treat disease.

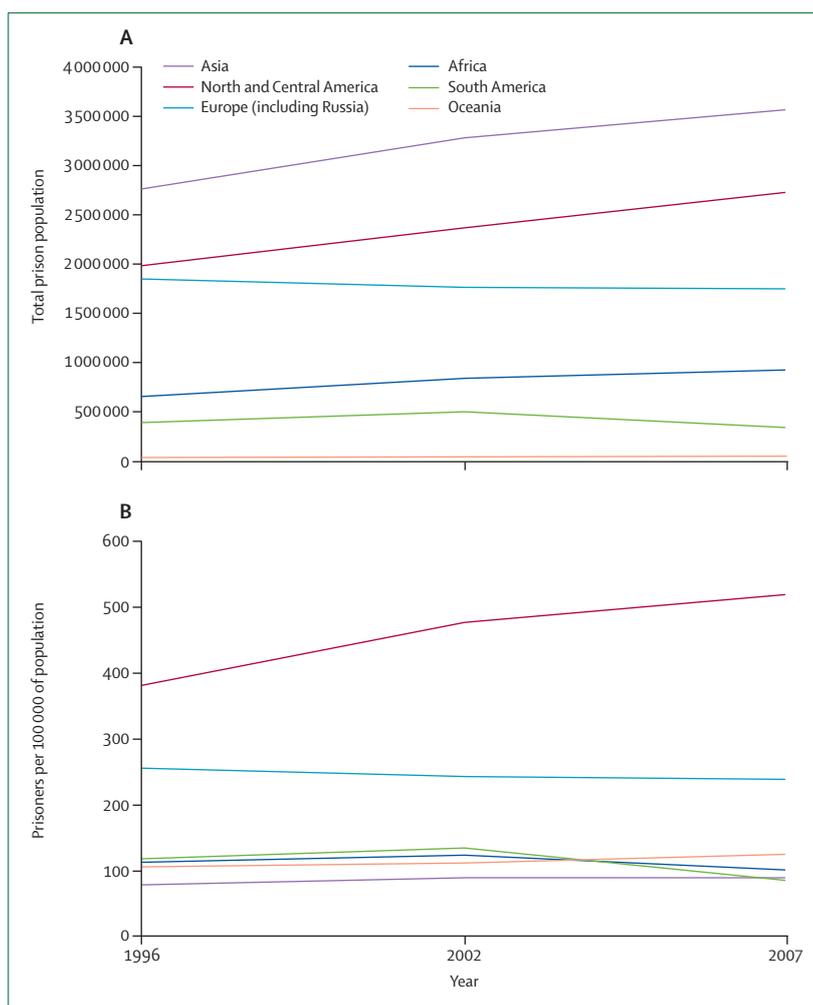
### Prevalence of mental disorders

Since a landmark study of admissions to Sing Sing prison in New York in 1918 highlighted the large number of mentally ill people in custody,<sup>10</sup> a great body of evidence has shown high rates of psychiatric morbidity, although these data are almost entirely based on research done in high-income countries. Around one in seven prisoners has a treatable mental illness. In a systematic review and meta-analysis of 62 surveys of 23 000 prisoners, the pooled prevalence of psychosis was around 4%, major depression 10–12%, and personality disorder 40–70%.<sup>11</sup> Drug and alcohol problems are also common. A review of reception studies noted that 17–30% of men and 10–24% of women were diagnosed with alcohol misuse or dependence.<sup>12</sup> 10–48% of men and 30–60% of women misused or were dependent on illegal drugs on reception to incarceration. Post-traumatic stress disorder is also thought to affect up to a fifth of prisoners,<sup>13</sup> and

prisoners of both sexes report histories of severe trauma and abuse.<sup>14</sup> Women seem to have higher rates of most psychiatric disorders than do men.<sup>15</sup> By comparison with the general population of similar ages, the highest proportionate risks are estimated to be for substance misuse and dependence, antisocial personality disorder, and psychosis (table 1).<sup>11,12,17</sup> Prevalence of intellectual disabilities is typically in the range of 0·5–1·5%,<sup>16</sup> much the same as that of many community surveys. Rates of deliberate self-harm in the year preceding imprisonment are 7–15% in men and 17–27% in women.<sup>18</sup> Solitary confinement seems to exacerbate symptoms of mental illness, and recommendations have been made to avoid its use in those with pre-existing psychiatric disorders.<sup>19</sup>

The high prevalences of mental illness and substance misuse in prisoners might result from an association with violent crime,<sup>7,8</sup> a shortage of inpatient psychiatric beds<sup>20</sup> and failure to divert appropriately from court to hospital,<sup>21</sup> high rates of mental illness in homeless people,<sup>22</sup> and failure to identify mental disorders on prison reception<sup>23</sup> and poor subsequent care. Some of these factors are clearly indications of the effectiveness of community mental health services. Cornford and colleagues<sup>24,25</sup> found that a third of English and Welsh prisons in 2005 were not able to offer any cognitive behavioural therapy, and that no systems were in place for transfer of medical information on admission or release in more than 70% of prisons.<sup>24</sup> Data from a national US survey from 2002–04 showed that a third of prisoners with diagnoses of schizophrenia and bipolar disorder were not treated with psychiatric drugs.<sup>26</sup> Of 80 jails in North Carolina, none used evidence-based screening tools for mental illness, 35% never contacted mental health services when mentally ill prisoners were released, and 42% had to transport prisoners to a community provider for mental health assessments.<sup>27</sup> Most prisoners with mental health problems return to their home communities, and treatment of their illnesses is therefore an important public health opportunity because treatment seems to decrease rates of repeat offending.<sup>9</sup> However, many patients have difficulty accessing appropriate medical care in the community, and prognosis is associated with the duration of untreated illness.

Few studies of psychiatric morbidity, however, have been done in non-western countries, and whether prevalences of mental illness are different elsewhere is unknown. Data suggest potentially important differences that merit further examination. In Iran, with the ninth largest prison population worldwide, Assadi and colleagues<sup>28</sup> reported that around 70% of male prisoners were dependent on opioids, which is a substantially higher proportion than in western prison populations. High rates of drug addiction in prisoners might be a feature of countries that form part of the illegal drug trade. In China, the prevalence of post-traumatic stress disorder, although common in female prisoners,<sup>29</sup> was lower than that estimated in imprisoned women in western countries. In India,



**Figure 1: Prison population by continent**  
Data is collated from national prison administrations.<sup>1-3</sup>

however, rates of severe mental illness seem to be close to those in other countries.<sup>30</sup>

Randomised controlled trial evidence for treatment of mental health disorders in prisoners is scarce. For substance misuse, trial evidence suggests that therapeutic community interventions with aftercare programmes might decrease rates of repeat offending, and results from one trial of methadone maintenance treatment showed some evidence of lowered drug use after a few months.<sup>31</sup> To be effective the dose of methadone should be high (eg, >60 mg) and prescribed for the whole duration of imprisonment.<sup>32</sup> Furthermore, prisons should assess all new inmates for drug withdrawal and provide detoxification services. Relapse prevention courses should be developed for inmates before release, and linking with community services should be prioritised.<sup>33</sup> Evidence from a randomised controlled trial in prisoners with a history of heroin addiction before incarceration has underlined the importance of methadone maintenance in prison and continued on release.<sup>34</sup> The

	Male prisoners (%)	Male general population estimates (%)	Female prisoners (%)	Female general population estimates (%)
Psychosis <sup>11</sup>	4%	1%	4%	1%
Depression <sup>11</sup>	10%	2–4%	12%	5–7%
Any personality disorder <sup>11</sup>	65%	5–10%	42%	5–10%
Antisocial personality disorder <sup>21</sup>	47%	5–7%	21%	0.5–1%
Alcohol misuse/dependence <sup>12</sup>	18–30%	14–16%	10–24%	4–5%
Drug misuse/dependence <sup>12</sup>	10–48%	4–6%	30–60%	2–3%
Intellectual disability <sup>16</sup>	0.5–1.5%	1%	0.5–1.5%	1%
Post-traumatic disorder <sup>3</sup>	4–21%	2%	10–21%	3%

\*General population estimates are based on individuals of similar ages where possible.

**Table 1: Prevalence of mental disorders in prisoners in western countries in comparison with the general population\***

	Year	Sample (n)	Men (%)	HBsAg+ (%)	HBc IgG+ (%)
Australia <sup>45</sup>	2004	435–457*	89%	3.0%	20.0%
Brazil <sup>46</sup>	1994	63	100%	17.5%	..
France <sup>47</sup>	1995	391	79%	1.3%	28.1%
Ghana <sup>48</sup>	2004–05	1336	91%	25.5%	..
India <sup>49</sup>	..	249	96%	11.7%	..
Italy <sup>39</sup>	2001–02	973	87%	6.7%	52.6%
Nigeria <sup>50</sup>	2007	300	100%	23.0%	..
Portugal <sup>51</sup>	1999–2003	788	89%	3.0%	40.0%

\*Number varies because of missing data. HBsAg=hepatitis B surface antigen; HBc IgG=IgG antibody to hepatitis B core antigen.

**Table 2: Seroprevalence of markers for infection of hepatitis B virus in prisoners in selected countries**

criminal activity and the number of days of drug use decreased in the treatment group of this trial.

### Infectious diseases

#### HIV infection

Since the first reports of HIV/AIDS in prisoners were published more than 25 years ago,<sup>35</sup> this prison health issue has been the most highly researched worldwide. Epidemiological studies of prison populations in most countries have consistently reported rates of HIV infection that exceed those in the general population.<sup>36,37</sup> A review of HIV prevalence in prisons in low-income and middle-income countries reported that, of the 75 countries for which such data were available (of a total of 152), the prevalence of the disease exceeded 10% in the prisons of 20 countries.<sup>36</sup> However, variation in HIV prevalence between the prison populations of the 75 countries was substantial, with several countries reporting no cases of HIV. Female prisoners generally had higher HIV infection rates than male prisoners.

HIV prevalence in prison populations of high-income countries also varies greatly. Since 1991, when the US Government began collecting data on the number of HIV-infected inmates in prisons and jails, the overall prevalence

has ranged from 2.5% in 1992 to 1.5% in 2007–08.<sup>38</sup> In other high-income countries, prevalence of HIV in prisoners ranges from 7.5% in Italy<sup>39</sup> to 0% in Denmark.<sup>40</sup> Since routine HIV surveillance is not done in the prisons of many countries (or in 24 of the 50 US state prison services<sup>41</sup>), reported rates are probably underestimates. In the USA, evidence suggests that the concentration of the disease in prisoners has diminished since the early stages of the epidemic. An analysis of population flow in and out of US prisons and jails estimated a 29% decrease in the proportional share of HIV infection borne by the incarcerated population between 1997 and 2006.<sup>42</sup> Several factors might have contributed to this downturn, including a decreasing rate of HIV infection in people entering prisons, a reduction in the number of cases of HIV/AIDS in intravenous drug users, and the expansion of discharge planning programmes for HIV-infected prisoners.<sup>42</sup>

#### Hepatitis B and C

Present and past infection of hepatitis B virus is common in prison populations,<sup>43,44</sup> with wide variations between countries (table 2) and within countries.<sup>52</sup> For example, in US prisons 0.9–11.4% of prisoners have hepatitis B virus surface antigen (indicating present infection) and 6.5–42.6% have hepatitis B virus core antibody (past or present infection).<sup>52</sup> Estimates of the prevalence of chronic infection of hepatitis B virus in US prisoners are in the range 1.0–3.7%, compared with about 0.4–0.5% for the general population.<sup>44</sup> Studies from several countries have reported that female prisoners have a higher prevalence of serological markers for present or past infection of hepatitis B virus than do male prisoners.<sup>44,45,48</sup>

The large number of prisoners infected with hepatitis C virus worldwide is a major public health concern. A review of 30 seroprevalence studies of hepatitis C virus of prison populations in 14 countries reported that most of the studies noted antibodies to hepatitis C virus in about 30–40% of prisoners.<sup>53</sup> However, prevalence estimates varied widely, ranging from 2% to 58%, which can be attributable to the proportion of intravenous drug users. In the USA, estimates of prevalence of hepatitis C virus from prison systems in individual states range from 23% to 34%.<sup>54,55</sup>

#### Risk factors and transmission in prison

In many prisons, the proportion of inmates reporting a history of injected drug use exceeds 20%.<sup>36,53</sup> In a survey of 1600 prisoners in Quebec prisons, 45% of women and 26% of men reported having sex before incarceration with a partner who injected drugs; in most cases sex was unprotected.<sup>56</sup> The use of non-sterile injecting equipment seems to be the most important independent risk factor for transmission within prison of both HIV and viral hepatitis.<sup>57</sup> A study of male inmates in a US prison system showed that HIV was transmitted predominantly through sexual networks.<sup>58</sup> Tattooing is also a risk factor.<sup>59</sup> Opioid

substitution seems to decrease injection drug use and needle sharing, and can have a role in reduction of transmission of HIV in prison.<sup>60</sup> The most convincing evidence of HIV transmission in prison via intravenous drug use is based on documented outbreaks in Australia, Lithuania, Russia, and Scotland.<sup>57</sup> Transmission of viral hepatitis within prison is also linked to needle sharing, as reported in Australia, Germany, and Scotland.<sup>57</sup> The extent of transmission within prison remains unknown, mainly because of the challenges of obtaining direct evidence of seroconversions during incarceration (such as an insufficient time-window between infection and antibody appearance on testing).<sup>59</sup> Research is needed to obtain reliable estimates of transmission of bloodborne viruses within prison and to gain a better understanding of risk factors.

### Tuberculosis

Although direct comparison between prison and community is difficult because of differences in data collection methods, prisoners typically have a high prevalence of tuberculosis.<sup>61,62</sup> Prevalence in many low-income countries is high (table 3). Various studies have reported high infection rates in Europe and the USA. The median notification rate of tuberculosis in 13 western European countries in 2002 was 90 cases per 100 000 prisoners (ranging from 0 in Cyprus, Malta, and Norway to 1167 in Latvia).<sup>63</sup> National surveillance data for tuberculosis between 1993 and 2003 showed that estimated prevalence in US federal prisons was 29.4 per 100 000 prisoners and in state prisons 24.2 per 100 000, compared with just 6.7 cases per 100 000 in the general population.<sup>71</sup>

These high rates are attributable to, in large part, the high concentration of risk factors for tuberculosis in incoming prisoners, including HIV infection, a history of intravenous drug use, low socioeconomic status, malnutrition, homelessness, and inability to access community-based health care.<sup>62,71,72</sup> Additional risk factors, such as poor ventilation and overcrowding, promote transmission of tuberculosis in prisons.<sup>62,71</sup> The concentration of these risk factors along with lapses in diagnosis or treatment of prisoners with tuberculosis in a timely way have resulted in various disease outbreaks, including multidrug-resistant tuberculosis.<sup>73,74</sup> Prisons can serve as important reservoirs of infection, and transmission into surrounding communities has been documented.<sup>73,75</sup>

### Non-infectious diseases and cancer

In contrast to infectious diseases, few studies have assessed the prevalence of non-infectious diseases in prisoners. Most chronic disorders seem to be more common in prisoners than in the general population, although epilepsy prevalence seems to be similar in both.<sup>76</sup> Results from a US survey have shown higher age-adjusted rates of hypertension, diabetes, asthma, and arthritis in prisoners than in the general population,<sup>26</sup>

findings replicated in other developed countries (figure 2), even though prisoners use primary medical services more than do people in the community.<sup>80</sup>

Although a large proportion of prisoners have major risk factors for cancer, results from US and Australian studies have reported rates of 0.2–0.7%,<sup>77,81,82</sup> similar to the age-adjusted yearly incidence rate of about 0.5% in the general population.<sup>83</sup> Women in prison typically have a higher cancer rate than do men. Data on specific cancers suggest that skin cancer is the most common cancer in men<sup>77,81</sup> and cervical cancer the most common in women.<sup>81</sup> In the USA, hepatocellular carcinoma rates are seven times higher (54 per 100 000) in prisoners than in the general population (7 per 100 000);<sup>84</sup> lung cancer and non-Hodgkin lymphoma are also more common than in demographically matched controls.<sup>85</sup>

### Mortality

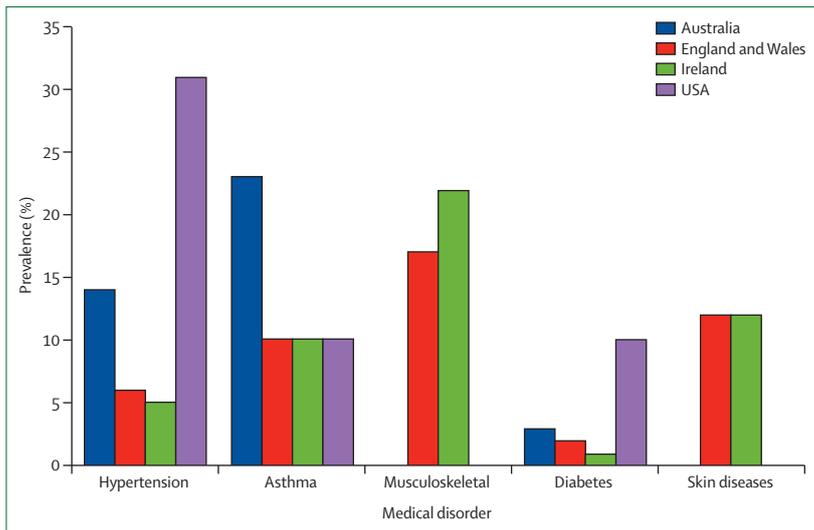
#### During custody

Suicide is the leading cause of death in prisons, accounting for about half of all prison deaths. National suicide prevention strategies from the UK,<sup>86</sup> USA,<sup>87</sup> and some other countries have highlighted the importance of suicide prevention in prisons. In a study of 12 western countries in 2003–07, rates of suicide were estimated to be between 50 and 150 suicides per 100 000 male prisoners per year on average, with higher rates in northern European countries and lower rates in Canada, Australia, and New Zealand.<sup>88</sup> Suicide is typically less common in women than in men,<sup>88–91</sup> although numbers vary greatly because of low base rates. For example, in England and Wales, there were about 165 suicides per 100 000 women compared with 107 per 100 000 men in 2003–07.<sup>88</sup> Data of suicides by age-band provide no consistent evidence of rate differences.<sup>89</sup> Compared with the general population, however, a different picture emerges, and age-standardised mortality ratios are higher in juveniles and female prisoners<sup>92</sup> than in male prisoners, for which they are two to eight times higher<sup>90,93,94</sup> than for the general male population. These mortality ratios are typically estimated with the assumption that the

	Year	Sample (n)	Men (%)	Tuberculosis per 100 000 prisoners
Kazakhstan <sup>63</sup>	2002	..	..	17 808
Georgia <sup>64</sup>	1997–98	7473	..	5995
Zambia <sup>65</sup>	2000–01	1080	98%	4005
Russia (St Petersburg) <sup>66</sup>	2000	..	..	3199
Brazil (São Paulo) <sup>67</sup>	2000–01	1052	100%	2065
Iran (Qazvin province) <sup>68</sup>	2004–05	768	95%	910
Pakistan (Karachi) <sup>69</sup>	2002	4870	100%	657
Thailand <sup>70</sup>	2004–05	22 132*	91%	363

\*Number of prisoners (of 71 594 who were screened) identified as having suspected tuberculosis by WHO criteria.

**Table 3: Rates of tuberculosis in prisoners in low-income countries**



**Figure 2: Self-reported chronic medical disorders in prison**

Data for Australia were for 914 men and women prisoners and age-adjusted.<sup>77</sup> England and Wales, 992 men prisoners.<sup>78</sup> Ireland, 718 men prisoners.<sup>79</sup> USA, 14 499 men and women state prisoners, age-adjusted.<sup>25</sup>

numbers of prisoners on one census day indicate the yearly numbers at risk, and similar standardised mortality ratios are reported when person-years at risk have been calculated.<sup>90</sup> The little available evidence on period trends suggests that suicide during custody is a growing problem in some countries. In England and Wales, standardised mortality rates have increased steadily in the past quarter of a decade.<sup>92,94</sup> In France, crude rates doubled in 10 years (1990–2000), from 123 to 239 per 100 000 prisoners;<sup>95</sup> rates have also increased in Austria in the past 30 years.<sup>96</sup> However, in Scotland, possibly in relation to the introduction of standardised treatments for substance misuse, suicide rates decreased between 1994 and 2003.<sup>97</sup> In the USA, suicide rates also seem to have decreased from 1983 to 2002.<sup>91</sup>

A systematic review of 34 studies showed that clinical factors have clear correlations with suicide in custody,<sup>89</sup> including recent suicidal ideation, a history of attempted suicide, a present psychiatric diagnosis (especially psychosis and depression),<sup>98</sup> and alcohol misuse; and screening on the basis of these associations has been recommended.<sup>99</sup> The contribution of environmental factors is unknown, although single cell occupancy (which could be correlated with psychiatric diagnosis) might be important.<sup>89</sup>

By contrast with suicide rates, natural death rates seem to be lower in prisoners than in the general population,<sup>100–102</sup> although results from a study in the UK showed that standardised mortality ratios for respiratory pneumonia and other infectious diseases were higher in prisoners than in the general population.<sup>100</sup> The overall mortality advantage is counterintuitive, but prisoners with serious physical illnesses are more likely to receive an early release for compassionate reasons, might be at a lower risk of committing crimes, or be granted either a community

sentence or a shorter prison sentence than their healthy peers.<sup>100,102</sup> Incarceration might also actually confer a health benefit to prisoners by decreasing behavioural and social risk factors—eg, drug use, violence, and prostitution—or by provision of better access to health care than in the community. A French study reported that mortality rates decreased with increased duration of incarceration.<sup>102</sup> The extent to which this finding is attributable to the aforementioned selection biases or to a protective effect of prisons, or some combination of both, is not clear.

### On leaving prison

Results from studies in Europe, Australia, and the USA have shown that inmates have a high mortality after their release from prison.<sup>93,103,104</sup> Male prisoners leaving Washington state prisons were 29 times more likely to die from all causes in the first week after release than the age, gender, and race adjusted general population, whereas female prisoners were 69 times more likely to die.<sup>93</sup> The transition back to the community from prison is a stressful period, as released prisoners attempt to secure housing and employment, to re-establish connections with family, and in many cases to cope with substance use and mental health disorders. During this transitional period, they are especially likely to engage in high-risk sexual activities and illicit substance use.<sup>93</sup> Most deaths of released prisoners are from non-natural causes, particularly homicide, suicide, and drug overdose.<sup>90,93,103</sup> In the study of Washington state prisons, ex-prisoners were 13 times more likely to die from any cause during the first 2 weeks after release, and 129 times more likely to die from drug overdose than their general population counterparts. The high risk of drug overdose might be a result of relative abstinence during incarceration, leading to diminished physiological tolerance to drugs.<sup>93</sup> Little information exists on the extent to which demographic and imprisonment characteristics predict mortality after release from prison. However, results from a study of Australian former prisoners showed that history of violent criminal offence, multiple incarcerations, and psychiatric hospital admission during incarceration were associated with an increased risk of all-cause mortality after release from prison.<sup>104</sup> High suicide rates have also been reported: 1 year after release the standardised mortality ratio was estimated to be 36 in women and 8 in men in England and Wales.<sup>105</sup> Clinical factors independently predictive of suicide include a history of alcohol misuse or self-harm, and any psychiatric diagnosis.<sup>106</sup>

The risk of death by some natural causes is also slightly increased after release from prison, particularly from cardiovascular disease, liver disease, cancer, and HIV.<sup>90,93,103</sup> The risk is lower for black Americans than for white Americans. Black men aged 50 years and older released from prison have lower death rates than do age-matched black men who have not been in prison.<sup>103</sup> Although these mortality excesses probably indicate the underlying social and behavioural risk profile of prison

populations, many prisoners have difficulty accessing medical care after release.<sup>107</sup>

## Special populations

### Older adults

In this section, the term older adults mostly refers to people aged 55 years and older, although some studies, particularly those from the UK, have used 60 years as the age threshold. The number of older men in prison has greatly increased in many developed countries. In the USA, for example, about 74 000 men and 3700 women aged 55 years or older were being held in prisons at the end of 2008.<sup>108</sup> This trend has been attributed to various factors such as the imposition of longer sentences, more restrictive parole policies, and an increasing number of ageing adults committing serious crimes.<sup>109</sup> Information about the health status of older prisoners suggests that these individuals have much higher rates of major illnesses and functional impairments than do either younger prisoners or older community-based dwellers.<sup>82,110</sup> Alcohol misuse,<sup>111</sup> underdiagnosed depression,<sup>112</sup> and liver diseases<sup>84</sup> are particular problems, and quality of life seems to be adversely affected by unmet social and emotional needs.<sup>113</sup> Unmet treatment needs are high, particularly for psychiatric disorders.<sup>114</sup> Female prisoners aged 55 years and older self report higher rates of hypertension, respiratory disease, and arthritis than do women older than 65 years in the general population.<sup>115</sup> Thus, older prisoners use a disproportionate amount of health-care services, and data from several sources suggest that the US prison system spends an average of \$70 000 yearly per older prisoner, two to three times more than that for a younger prisoner.<sup>109</sup>

### Juveniles

Adolescents younger than 19 years constitute nearly 5% of all those detained in custody in developed countries, including about 100 000 individuals in the USA;<sup>108</sup> they are usually detained in separate closed facilities or prisons. By comparison with their non-incarcerated peers, juvenile prisoners are more likely to have smoked, used alcohol or illegal drugs, engaged in high-risk sexual behaviours with multiple partners, and experienced violence.<sup>116</sup> Consequently, they are at higher risk of sexually transmitted diseases (at rates two-to-ten times higher than non-incarcerated peers), trauma and injury, premature pregnancy, respiratory disease, and oral health issues.<sup>116</sup> A synthesis of prevalence studies in 17 000 boys and girls aged 10–19 years showed that rates of psychosis and conduct disorder were at least ten times higher in those in custody than in age-matched community comparisons, and rates of depression and attention-deficit hyperactivity disorder at least two times higher.<sup>117</sup> These results add support to recommendations that young people should be screened for mental disorder and suicide risk on entering custody.<sup>118</sup> Rates of depression were estimated to be 29% for girls in detention, around three times those for incarcerated boys and at least two times higher than

for adult women in prison.<sup>119</sup> Research on the determinants and outcomes of physical and psychiatric disease in juvenile populations is pressing.

### Pregnant women

More than half a million women are incarcerated in penal institutions throughout the world, representing 2–9% of the total prison population; the proportion of women prisoners has been increasing steadily in many countries.<sup>1</sup> Most imprisoned women are of childbearing age.<sup>120</sup> In the USA, about 6% of the female prison population are pregnant at the time of their incarceration.<sup>121</sup> Compared with similar women in the general population, pregnant prisoners are more likely to have many risk factors associated with poor perinatal outcomes and less likely to receive adequate prenatal care.<sup>120</sup> Concern has also been raised about the adequacy of prenatal services available in prisons.<sup>122</sup> Despite this poor quality of services, and although pregnant prisoners have a higher risk of a premature delivery or having a low birthweight baby than do population controls, these prisoners seem to be less likely to have a stillbirth or low birthweight baby than similarly disadvantaged controls, which could be attributable to protection from abusive partners, the provision of shelter and nutritious meals, restricted access to alcohol and illicit drugs, and improved access to prenatal care.<sup>123</sup> Nevertheless, outcomes in the long term for these children are poor, and children of prisoners are twice as likely to have antisocial outcomes and mental health issues than are their peers without imprisoned parents, although causal mechanisms are unclear.<sup>119</sup> Additional research on pregnancy outcomes for imprisoned women is needed, particularly in low-income and middle-income countries.

### Ethnic minorities

Minority groups have different patterns of morbidity and mortality. High rates of chronic mental illness are noted in some minority groups. Aboriginal Australian female prisoners are more likely to misuse alcohol and to have affective disorders than are non-aboriginal female prisoners, although men do not differ.<sup>124,125</sup> Results from a study of the Texas prison system showed that African Americans had higher age-standardised rates of hypertension and asthma than did white people (including Hispanic people). Moreover, they had higher rates of diabetes than did non-Hispanic white inmates.<sup>126</sup> However, such disparities seem to portray disease patterns of the general population. In fact, by comparison with the US general population, African American inmates in the Texas prison system had lower age-standardised rates of all the aforementioned diseases.<sup>126</sup> However, rates of suicide in custody are lower in black and ethnic minority groups compared with white prisoners in many countries.<sup>89</sup> In the USA, suicide in Hispanic inmates is less common than in non-Hispanic white prisoners in local jails but not in state prisons.<sup>91</sup>

### Medical services

As a result of burgeoning prison populations and an increasing number of disease epidemics, prison health-care services have become increasingly complex. According to WHO recommendations, national and regional governments should provide prisoners with the best possible health care free of charge, even in times of substantial economic difficulty.<sup>127</sup> The UN Basic Principles for the Treatment of Prisoners<sup>128</sup> states that prisoners “shall have access to the health services available in the country without discrimination on the grounds of their legal situation”.<sup>128</sup> The quality, comprehensiveness, and organisational infrastructure of health-care delivery within prisons vary substantially by region.

Many countries have created links between prison health and public health services. In Norway, France, and the UK, for example, the delivery of prison health care has been placed under the authority of the national public health department. The Committee of Ministers of the Council of Europe has urged for prison health to be integrated into and compatible with national health policy, stating that such integration is in the best interests of the population at large, particularly for policies relating to infectious diseases.<sup>129</sup>

In the USA—where prison health care is overseen by both national and regional governments—various health-care delivery models have been used. These models range from health-care services being entirely run by prison staff to those in which contractual relations are established with outside health-care providers. In a few US prison systems, academic medical centres have had an important role in health-care delivery with evidence of improved outcomes.<sup>130</sup> In Europe, mental health care is under the administrative responsibility of the national health system in five of 24 countries (Cyprus, England and Wales, France, Iceland, and Norway).<sup>131</sup> Although whether this form of health-care delivery favours mental health outcomes is not known, very few countries provide systematic data on the effectiveness of prison mental health care.

Poor integration between prison and public health systems results in poor continuity of care for individuals transitioning to community-based health care after release from prison.<sup>132</sup> Such fragmentation of care affects prisoners with various disorders, such as HIV, mental illness, diabetes, and asthma, and can result in delayed treatment and costly use of health care.<sup>133</sup>

### Improvement of prison medical services

Prison medical services need improvement. First, greater health-care resources should be targeted at prisons since they provide a rare public health opportunity to screen and treat a young, marginalised, and diseased group.<sup>134,135</sup> Second, where public health systems are adequately resourced, the administrative responsibility for health in prisons should be handed over to public health systems because the values of the criminal justice system, which prioritise security, are unlikely to sufficiently overlap with

health values. Third, screening for physical and mental illness in prisoners seems to be worthwhile and should be done by trained individuals. Screening for mental illness should use a standardised instrument, incorporate identification of suicide risk, and lead to referral to mental health professionals in screen-positive individuals. Fourth, yearly statistics on prison suicides, undetermined deaths, and infectious disease rates (particularly for tuberculosis, HIV, and hepatitis C) should be publicly available. National suicide prevention strategies should include prison suicide. Fifth, several national prison-specific policies and guidelines should be developed. Minimum standards and goals for improvement in relation to the health care of incarcerated women (including pregnancy), older adult prisoners, and juveniles in detention should be developed. Treatment guidelines for prisoners with psychosis (including thresholds and recommended waiting times for transfer to hospital), infectious diseases, and chronic medical disorders (particularly diabetes and hypertension) should be outlined. Policies should be developed to eliminate unhealthy living conditions in prisons, with particular emphasis on reduction of overcrowding, rape and other violence, poor sanitation, unsafe sexual practices, and other activities that spread infection such as intravenous drug use and tattooing. Sixth, prisons should provide discharge-planning programmes that allow linkage to community-based health systems among released prisoners. Continuum of treatment between prisons and the community should be ensured to improve effective treatments for mental health, addiction, and infectious diseases. Seventh, prisons should become more research-friendly environments. Whereas protection of prisoners from abusive and coercive research practices is important, prisoners have been systematically excluded from important clinical studies.<sup>136</sup> Finally, the medical profession should take the lead in reforming prison health care, even if this reform means refusing to send prisoners who are in hospital back to prison, where they will suffer inhuman and degrading treatment.<sup>5</sup> Where the dual ethical obligations of health professionals are in conflict—towards the patients and to wider society—solutions that seek justice should be sought in consultation with national medical associations, non-governmental agencies, or both.<sup>137</sup>

### Conclusion

From a public health viewpoint, the disproportionate burden of physical and psychiatric disease in prisoners presents both a challenge and an opportunity. In many countries throughout the world, prisons are an important venue of contact with millions of individuals who are out of the reach of conventional community-based health systems. For these individuals, prison provides an opportunity for diagnosis, disease management education, counselling, and treatment that they would not receive in the general community. Most prisoners return to their communities with their physical and psychiatric morbidity occasionally untreated and sometimes worsened. These prisoners act as

reservoirs of infection and chronic disease, increasing the public health burden of poor communities. Psychiatric morbidity leads to high suicide rates, both in custody and after release, and contributes to repeat offending. More than one in three offenders, whether given custodial or community sentences, are reconvicted within 2 years for a violent crime.<sup>138,139</sup> Counteracting this cycle of reoffending would benefit from more research into alternative sentences than prison, treatment, and services for mentally ill prisoners.<sup>140</sup> Tackling the mental and physical illnesses of prisoners will improve public health.

#### Contributors

Both authors contributed equally to the Review.

#### Conflicts of interest

We declare that we have no conflicts of interest.

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