All-Cause and External Mortality in Released Prisoners: Systematic Review and Meta-Analysis

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Objectives. We systematically reviewed studies of mortality following release from prison and examined possible demographic and methodological factors associated with variation in mortality rates.

Methods. We searched 5 computer-based literature indexes to conduct a systematic review of studies that reported all-cause, drug-related, suicide, and homicide deaths of released prisoners. We extracted and meta-analyzed crude death rates and standardized mortality ratios by age, gender, and race/ethnicity, where reported.

Results. Eighteen cohorts met review criteria reporting 26 163 deaths with substantial heterogeneity in rates. The all-cause crude death rates ranged from 720 to 2054 per 100 000 person-years. Male all-cause standardized mortality ratios ranged from 1.0 to 9.4 and female standardized mortality ratios from 2.6 to 41.3. There were higher standardized mortality ratios in White, female, and younger prisoners.

Conclusions. Released prisoners are at increased risk for death following release from prison, particularly in the early period. Aftercare planning for released prisoners could potentially have a large public health impact, and further work is needed to determine whether certain groups should be targeted as part of strategies to reduce mortality. (*Am J Public Health.* 2012;102:e67–e75. doi:10.2105/AJPH.2012.300764)

The global prison population in 2008 was estimated at 9.8 million with a median rate of imprisonment of 145 prisoners per 100 000 persons, most of whom are aged between 18 and 44 years.[1] More than 2.3 million of these prisoners reside in the United States, which has the highest rate of imprisonment of 756 per 100 000 population. Natural cause mortality inside prison has been reported to be lower than that of the general population in France,[2] Russia,[3] England and Wales,[4] and the United States.[5] However, it is well-established that prisoner suicide rates are elevated compared with age-matched general populations.[6] For example, the suicide rate of male prisoners in England and Wales between 1973 and 2003 was found to be 5 times higher than that of the general population,[7] and in US jails, it has been reported to be 8 times higher.[8] The odds of chronic medical conditions are increased by up to 4 times in US prisons.[9] As prison populations are drawn from socioeconomically deprived backgrounds with reduced access to health care and health-seeking behavior when living in the community,[10] prison provides an opportunity to provide public health interventions including health education and improving engagement with health services following release.[11] For example, targeted health interventions such as medication review[12] and HIV health education[13,14] have been proposed.

The health of prisoners following release from prison is less understood. At the end of 2009 in the United States, 819 308 prisoners were on parole or release following a prison term,[15] and in England and Wales 20 895 offenders were released from prison in the first quarter of 2011.[16] Despite these high absolute numbers, research has demonstrated that most sampled US jails did not plan for release of prisoners with mental illness, cardiovascular disease, or HIV/AIDS even though they considered it important.[17] Mortality from suicide and drug-related causes has been reported to be particularly high in the immediate postrelease period,[18,19] and, thus, public health interventions to target this period for those with a history of substance misuse have been outlined.[20] The current review aims to synthesize evidence on mortality rates following release from prison and examine possible demographic and methodological factors associated with variation in these rates.

METHODS

We searched 5 computer-based literature indexes—Medline, EMBASE, PsycINFO, the US National Criminal Justice Reference Service, and SIGLE (the latter 2 for gray literature)—from January 1980 through January 2011. We scanned bibliographies of relevant studies. We used combinations of keywords relating to prisoners (prison*, incarce*, felon*, detain*, jail*, penal*, custod*, offend*), mortality (death, mortal*, suicid*, overdose, toxic*, homic*), and release (releas*, former, ex) within the title or abstract. There were no language restrictions. Two trainee psychiatrists independently extracted data (J. Z. and A. Topiwala) and the project supervisor (S. F.) resolved any discrepancies.

Inclusion criteria for studies were (1) sample of prisoners released from prison within a specified date range, (2) linkage of prisoner and mortality databases, (3) data reporting overall or cause-specific (drug-related, suicide, and homicide) deaths or mortality rates in the postrelease period for the whole sample, or a subset selected according to age, gender, or race/ethnicity. We excluded studies if samples were selected by a variable (e.g., substance misuse) other than age, gender, ethnicity, or geographical area.

We extracted data on geographical location, period of recruitment, period of follow-up, mortality and prison databases, numbers of prisoners and releases, total time at risk following release (person-years), and basic demographic statistics (age, gender, and race/ethnicity). We extracted outcome data on number of deaths overall, and for suicide, homicide, and drug-related causes. If studies reported various definitions of drug-related

deaths, we extracted all data. We extracted crude death rates (CDRs) and standardized mortality ratios (SMRs) by age bands, gender, and ethnicity where reported.

We calculated CDRs for all-cause deaths, suicides, drug-related deaths, and homicides if not reported directly by using number of deaths (N_d) and person-years at risk (PY_{total}):

$$(1)\quad CDR = N_d/PY_{total}$$

We contacted all authors to request total person-years at risk following release from prison if data were not reported in the original study. We calculated person-years at risk according to a stepped protocol if not reported:

$$(2)\quad PY_{total} = N_d/CDR$$

$$(3)\quad PY_{total} = N_p * PY_{med}$$

where N_p = number of prisoners released and PY_{med} = median period of prisoner follow-up.

We calculated total years at risk by summing PY_{total} for subpopulations in each study, e.g., male and female[21] or White and Black.[22] We calculated standard errors (SEs) of CDRs from the standard formula for SE of a proportion or rate[23]:

$$(4)\quad SE = \sqrt{(p*(1-p)/n)}$$

where p = CDR and n = PY_{total}.

Assuming that p is small and therefore (1-p)≈1, we derived the following formula:

$$(5)\quad SE = CDR/\sqrt{N_d}$$

The 95% confidence intervals (95% CIs) of CDR, assuming a normal distribution, which is reasonable given a large PY_{total}:

$$(6)\quad 95\%\ CI = CDR \pm 1.96 * SE$$

The SMR is defined as the ratio of observed deaths in the studied sample (i.e., released prisoners or prisoner subgroups) relative to the number of expected deaths in that sample as given by a larger reference population mortality rate (i.e., the general population)[24]:

$$(7)\quad SMR = O/E$$

where O = number of observed deaths and E = number of expected deaths.

We calculated SMR from data provided if not stated in the study. We calculated the expected number of deaths from the reference population stated in the original study. We calculated 95% CIs for SMR with the following formula if not reported[23]:

$$(8)\quad 95\%\,CI = SMR \pm 1.96*(\sqrt{O}/E)$$

We performed random-effects meta-analyses on CDR and SMR data to calculate pooled estimates for all-cause deaths, drug-related deaths, suicide, and homicide, using the *metan* command (Stata version 10, StataCorp LP, College Station, TX). We assessed heterogeneity by using I^2, which reports the heterogeneity between studies as a percentage with 100% being the highest.[25] If SMR for a particular cause was only reported by subgroup (e.g., ethnicity), we reported rates for the largest subgroup by number of prisoners. We excluded studies reporting fewer than 20 overall deaths or with follow-up less than 6 months from meta-analysis. We performed meta-analyses of SMR by gender (overall male deaths and overall female deaths) and race/ethnicity (overall White, non-Black, or non-Aboriginal deaths and overall Black or Aboriginal deaths). We did not perform meta-analysis of SMR by age bands because of inconsistencies in age bands.

RESULTS

The final sample consisted of 18 independent cohorts of released prisoners reporting on more than 400 000 prisoners.[19,21,22,26–46] We excluded 7 cohorts because they reported on a selected sample of released prisoners with a history of substance misuse.[47–53] We excluded a further 5 cohorts as they were selected samples of convicts, parolees, or delinquents who may not have had a history of incarceration.[54–58] The majority of prisoners were incarcerated in the United States, a significant minority were from Australia and United Kingdom, and a small number were from France, Finland, the Netherlands, and Switzerland (Table A, available as a supplement to the online version of this article at http://www.ajph.org). Eleven studies reported average age,[22,28,31,33,34,35,37,38,42,44,46] but this was not uniform with some studies reporting age at study entry and others age at release (Table B, available as a supplement to the online version of this article at http://www.ajph.org). Most publications were on mainly male populations (Table A). Average follow-up ranged from 0.2 to 25 years (Table A).[22,26,28,31,33,34,36,44,46] Studies used a variety of sources to collect information on prisoners and deaths including local prison records, coroners' records, and regional and national databases (supplemental Table A).

Mortality Statistics

Thirteen cohorts reported all deaths,[21,22,28,31,33–37,39,42,44,46] 4 reported unnatural deaths only,[26,30,38,43] and 1 reported suicides only.[32] The total number of deaths reported was 26 136, which included 4718 (18%) drug-related deaths, 2389 (8%) suicides, and 2317 (9%) homicides (Table 1). All-cause CDR ranged from 720 to 1037 per 100 000 person-years, and an outlier at 2054 per 100 000 person-years, a study with a short follow-up of 0.2 years (Table 1).[36] Of studies reporting unnatural deaths, 2 had CDRs of 533[43] and 480[26] per 100 000 person-years, respectively, and 2 investigations did not report sufficient data to calculate CDR.[30,38] When we excluded the 2 studies reporting unnatural deaths,[26,43] the reports with small samples or short follow-up,[35,36] and those reporting insufficient data,[37,39,46] the pooled estimate of all-cause CDR (Figure 1) was 850 (95% CI = 815, 884) per 100 000 person-years (I^2 = 77%).

The SMR for all causes ranged from 1.0 for US Black men[22] to 41.3 for female Australian young offenders.[45] Many studies reported gender-specific SMR estimates ranging from 1.0[22] to 9.4[33] for men and 2.6[42] to 41.3[45] for women (Figure 2). Heterogeneity was high between estimates (I^2 > 95%). Only 1 of the studies had a sample for which the overall SMR 95% CI included 1.0, a sample of Black prisoners in North Carolina.[22] All other groups had overall SMRs that were higher than the matched population, except older age groups, who had SMRs below zero.[22,42]

There were lower SMRs in male; non-White, Black, or Aboriginal; and older groups (Figure 2 and Table 2). Confidence intervals for male and female prisoners did not overlap except for Aboriginals in one study and a study of young offenders.[34,44] All studies reported lower SMRs for Black and Aboriginal populations as opposed to White, non-Black, and non-Aboriginal populations. The SMRs ranged from 2.1[22,42] to

TABLE 1—Number of All-Cause, Drug-Related, Suicide, and Homicide Deaths; Time at Risk Following Release (Person-Years Release); and CDRs for All-Cause, Drug-Related, Suicide, and Homicide Deaths in Studies of Released Prisoners

Study	Total Deaths, No.	Drug-Related Deaths, No. (%)	Suicide Deaths, No. (%)	Homicide Deaths, No. (%)	Person-Years Release, No.	All-Cause CDR (95% CI)	Drug-Related CDR (95% CI)	Suicide CDR (95% CI)	Homicide CDR (95% CI)
Binswanger et al.[31]	443	103 (23)	40 (9)	54 (12)	57 049	777 (707, 852)	181 (149, 219)	70 (51, 96)	95 (73, 124)
Bird and Hutchinson[36]	78	57 (73)	9 (12)	4 (5)	3797	2054 (1598, 2510)[a]	. . .	. . .	. . .
Coffey et al.[b,33,45]	143	44 (31)	34 (24)	4 (3)	19 949	720 (610, 840)	330 (260, 420)	170 (120, 240)	20 (10, 50)
Dirkzwager et al.[c,46]	107	. . .	12 (11)	6 (6)	. . .	. . .	. . .	. . .	. . .
Farrell and Marsden[21]	442	252 (57)	36 (8)	. . .	48 578[a]	909 (825, 995)[a]	537 (472, 602)[a]	74 (50, 98)[a]	. . .
Graham[d,43]	820	479 (58)	279 (34)	. . .	153 810	533 (497, 570)[a]	311 (284, 339)[a]	177 (156, 199)[a]	. . .
Harding-Pink and Frye[d,26,27]	102	42 (41)	. . .	. . .	8200	480 (330, 630)	512 (357, 667)[a]	. . .	. . .
Joukamaa[37]	115	9 (8)	17 (15)	10 (9)	. . .	. . .	. . .	. . .	. . .
Kariminia et al.[19,28,29]	4834	1627 (34)	724 (15)	229 (5)[c]	556 447[a]	869 (844, 893)[a]	292 (278, 307)[a]	130 (121, 140)[a]	. . .
Krinsky et al.[d,30]	107	61 (57)	7 (7)	13 (12)	. . .	. . .	. . .	. . .	. . .
Pratt et al.[e,32]	382	. . .	382	. . .	245 029[a]	. . .	. . .	156 (140, 170)[a]	. . .
Rosen et al.[22]	15 673	1809 (12)	746 (5)	1714 (11)	1 822 869	860 (846, 873)[a]	99 (95, 104)[a]	41 (38, 44)[a]	94 (90, 98)[a]
Sattar[39,40]	249	46 (18)	34 (14)	6 (2)	. . .	. . .	. . .	. . .	. . .
Shewan et al.[d,38]	14	10 (71)	2 (14)	. . .	. . .	. . .	. . .	. . .	. . .
Spaulding et al.[42]	2244	80 (4)	. . .	215 (10)	276 850[a]	811 (777, 844)[a]	29 (23, 35)[a]	. . .	78 (67, 88)[a]
Stewart et al.[34,41]	326	95 (29)	64 (20)	. . .	31 433[a]	1037 (925, 1150)[a]	302 (241, 363)[a]	204 (154, 253)[a]	. . .
Teplin et al.[b,44]	65	. . .	1 (1)[f]	62 (95)[f]	12944	806 (520, 1171)	. . .	. . .	806 (605, 1007)[a]
Verger et al.[35]	19	4 (21)	2 (11)	. . .	. . .	. . .	. . .	. . .	. . .

Note. CDR = crude death rate; CI = confidence interval.
[a]Estimates indicate CDR = number of deaths/person-years release.
[b]Young offenders only.
[c]Includes deaths in prison.
[d]Unnatural deaths only.
[e]Suicides only.
[f]As calculated from percentage.

7.3[44] for White, non-Black, or non-Aboriginal men whereas for Black or Aboriginal men the range was from 1.0[22] to 4.8[28] (Table 2). Heterogeneity between SMR estimates was high, so we did not report pooled estimates. All studies that reported all-cause SMR by age groups showed higher SMR for younger age groups (Table 2) with the highest all-cause SMR for a cohort of young offenders (aged 10–20 years at entry).[33]

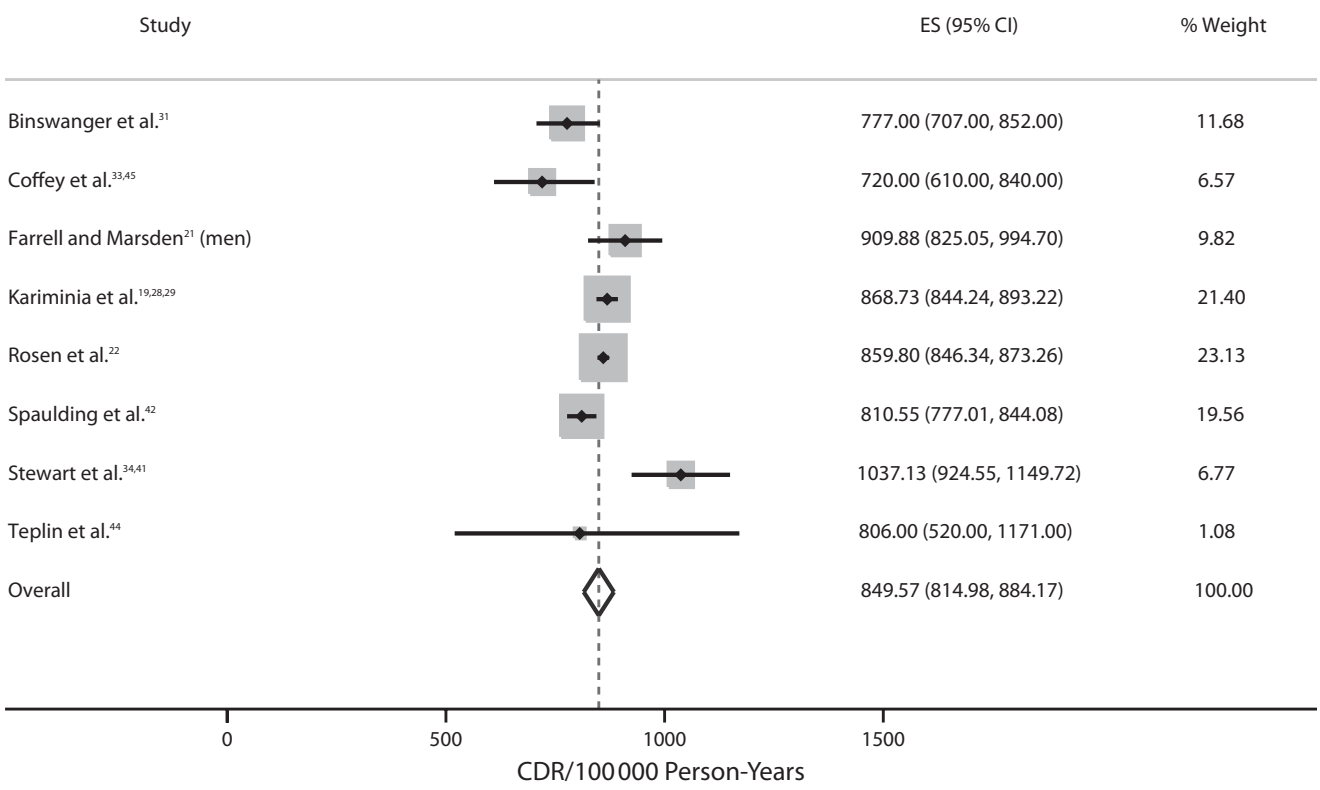
Cause-Specific Crude Death Rates and Standardized Mortality Ratios

Drug-related CDRs for 10 studies ranged from 29[42] to 537[21] per 100 000 person-years (Table 1). For suicide, the 8 included studies varied from 41[22] to 204[34] per 100 000 person-years. Four studies reported homicide CDRs between 20 and 95 per 100 000 person-years[22,31,33,42] and there was 1 outlier at a rate of 806[44] (Table 1). There was substantial heterogeneity among studies for cause-specific CDR; therefore, we did not report pooled estimates.

There was variability in drug-related SMRs with male or combined ratios ranging from 4.1 to 26.0 and substantially higher results in females (Table 2).[21,22,28,31,33,34,42] One outlier with a small sample reported SMRs of more than 100 for drug-related deaths.[35] The highest male drug-related SMR occurred in Australian young offenders.[33] There was a smaller range of SMRs for suicide from 2.6 to 13.5 with higher ratios in Australian[28,33,34,43] and European[32,46] cohorts than American ones[22,31] (Table 2). Suicide SMRs were higher for women. The highest overall suicide SMR, 13.5, was in a study considering suicide deaths exclusively in England and Wales.[32] The ratios for homicides were reported by 4 studies and ranged from 2.8 to 10.4 (Table 2).[22,28,31,42] One study that did not report cause-specific SMR reported that 95.5% deaths were attributed to homicide,[44] this being highly uncharacteristic with 9 other studies reporting the percentage of homicide deaths in the range of 2% to 12% (Table 1). Heterogeneity was high among studies; therefore, we did not report pooled estimates.

DISCUSSION

We systematically reviewed studies reporting on mortality following release from prison, with a focus on suicide, homicide, and drug-related deaths. We identified 18 cohorts with information on more than 400 000 released prisoners resulting in 26 163 deaths. Approximately 18% of deaths were attributed to drug-related causes, 8% to suicide, and 9% to homicide. The all-cause pooled CDR was



Note. CI = confidence interval; CDR = crude death rate; ES = effect size. Weights are from random effects analysis. For the overall rates, $I^2 = 76.6\%$ ($P < .001$).

FIGURE 1—Forest plot of all-cause crude death rates per 100 000 person-years of released prisoners with pooled estimate in a review of studies that reported all-cause, drug-related, suicide, and homicide deaths.

850 deaths per 100 000 person-years of follow-up, and the all-cause male SMRs ranged from 1.0 to 9.4. We did not report pooled SMRs because of high heterogeneity. Higher SMRs were reported for younger, female, and White prisoners in studies reporting on all-cause mortality.

We found evidence that mortality was increased relative to matched general populations in younger, female, and White or non-Aboriginal populations. This is consistent with studies that used regression models to investigate subgroups[29,31] or examined subgroups within the cohort.[22,33,42] The finding of higher SMRs in White or non-Aboriginal prisoners may reflect decreased mortality in the different reference populations, such as White people compared with Black people.[22,44] Nevertheless, these findings suggest that some populations could be prioritized with public health interventions as part of any national strategy to reduce premature mortality in released prisoners.

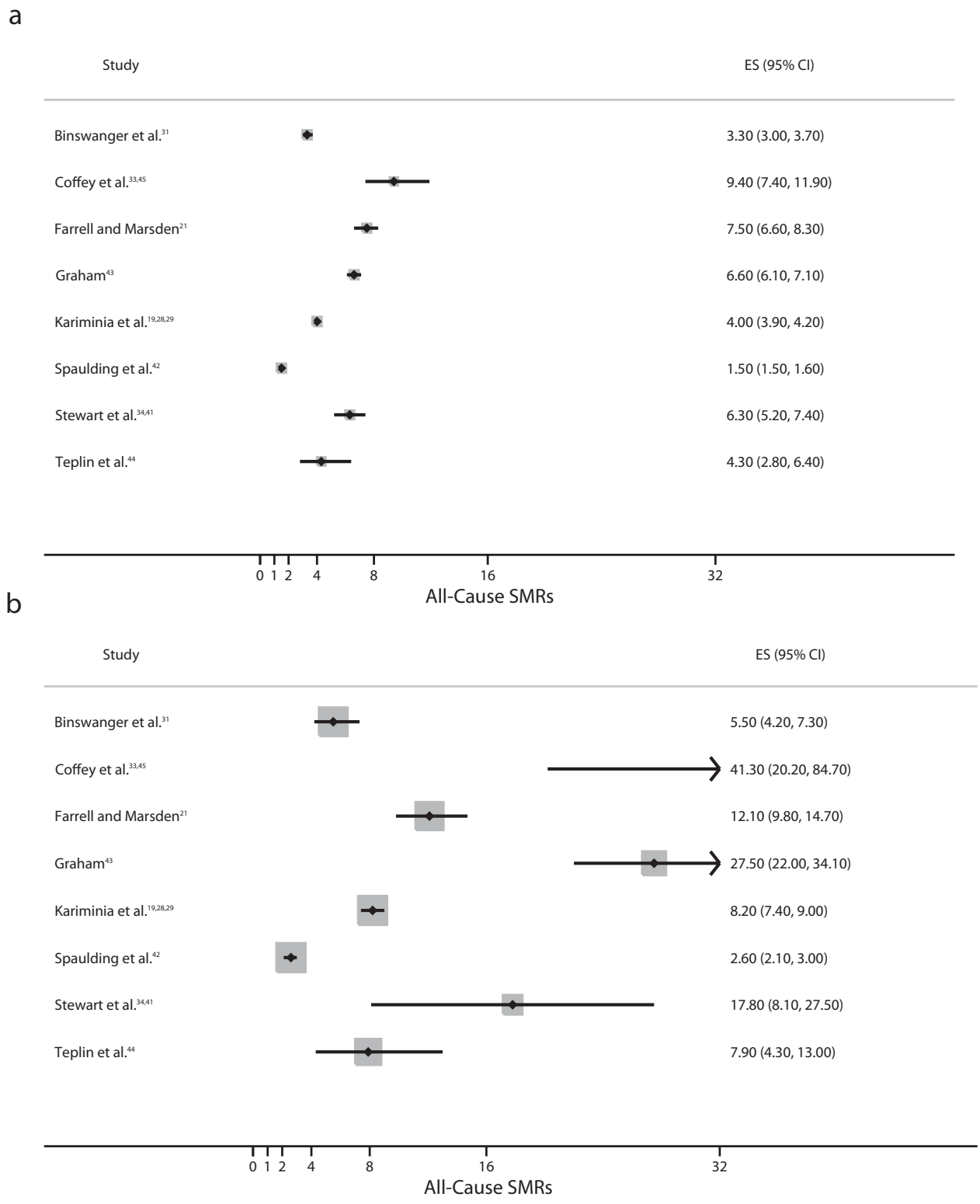
Differences in Individual Study Setting and Methodology

Estimates of ex-prisoner mortality varied considerably among studies. Some of this variability may have been associated with differences in study design. For example, if prisoner numbers were included in the denominator for calculating general population mortality, the SMR may be raised. Some studies subtracted periods of subsequent imprisonment when calculating time at risk[28,31,36,42,43] potentially leading to higher estimates of crude mortality compared with studies that did not report doing so.[21,22,26,32–34,39] We used indirect standardization to calculate SMR as defined in the Methods section, which involved calculating expected prisoner deaths by using a matched reference population. Methods of matching populations varied among studies (Table A, available as a supplement to the online version of this article at http://www.ajph.org).

In addition, the choice of databases used to estimate deaths would likely have had an effect on crude mortality rates. For example, regional and national mortality databases may underestimate prisoner mortality if released prisoners are relatively more mobile upon release and deaths occur outside the jurisdiction. Most of the studies reporting mortality ratios used the same geographic areas for prisoner and population deaths (supplemental Table A).

There was variation in the definitions for drug-related deaths that may explain some of the differences in drug-related SMRs. Some studies had broad definitions including deaths from "drug psychoses," "drug dependency," "accidental poisoning," transport accidents, and drug-related suicides,[21] whereas others had narrower definitions, only considering "accidental poisoning" as overdose,[31,42] whereas some used terms such as "drug toxicity"[43] and "drug related"[33] without specifying exact International Classification of Diseases (ICD)[59] definitions.

Various factors such as racial, age, and gender distributions; length of follow-up;



Note. CI = confidence interval; ES = effect size. Weights are from random effects analyses separately for men and women.

FIGURE 2—Forest plots of all-cause standardized mortality ratios (SMRs) for released prisoners in studies reporting on both genders for (a) men and (b) women.

TABLE 2—Standardized Mortality Ratios (SMRs) as Reported by Specified Ethnicity, Age Band, and Cause of Death in Studies of Released Prisoners That Reported All-Cause, Drug-Related, Suicide, and Homicide Deaths

Study	Cause of Death			
	All-Cause, SMR (95% CI)	Suicide, SMR (95% CI)	Drug-Related, SMR (95% CI)	Homicide, SMR (95% CI)
Binswanger et al.[31]		3.4 (2.5, 4.7)	12.2 (10.2, 14.9)[a]	10.4 (8.0, 13.6)
White	3.8 (3.4, 4.3)	. . .	. . .	. . .
Black	2.3 (1.9, 2.9)	. . .	. . .	. . .
Aged 18–24 y	3.4 (2.5, 4.7)	. . .	. . .	. . .
Aged > 44 y	2.7 (2.3, 3.2)	. . .	. . .	. . .
Coffey et al.[33,45]				
Overall	. . .	9.2 (5.8, 14.7)	. . .	. . .
Men	9.4 (7.4, 11.9)	. . .	26.0 (17.9, 36.9)[b]	. . .
Dirkzwager et al.[46]	2.8 (2.3, 3.3)	6.7 (2.9, 10.5)	. . .	. . .
Farrell and Marsden[21]	. . .	. . .		
Men	. . .	. . .	4.1 (3.5, 4.8)[c]	. . .
Women	. . .	. . .	8.7 (6.7, 10.9)[c]	. . .
Kariminia et al.[19,28,29]				
All men	4.0 (3.9, 4.2)	4.8 (4.4, 5.2)	14.5 (13.8, 15.3)[d]	10.4 (9.0, 12.1)
Aboriginal men	4.8 (4.4, 5.3)	. . .	. . .	. . .
Men aged 20–24 y	4.9 (4.5, 5.4)	. . .	. . .	. . .
Men aged 55–59 y	2.0 (1.8, 2.4)	. . .	. . .	. . .
Women	8.2 (7.4, 9.0)	12.2 (9.2, 16.2)	50.3 (43.7, 57.8)[d]	. . .
Pratt et al.[32]				
Men	. . .	4.3 (2.9, 6.1)	. . .	. . .
Women	. . .	35.8 (25.4, 50.2)	. . .	. . .
Rosen et al.[22]				
All White men	2.1 (2.0, 2.1)	2.6 (2.4, 2.8)	12.6 (8.0, 18.9)[e]	6.7 (6.1, 7.3)
All Black men	1.0 (1.0, 1.1)	1.2 (1.0, 1.4)	3.3 (2.3, 4.5)[e]	2.7 (2.6, 2.9)
White men aged 20–29 y	3.6 (3.3, 3.9)	. . .	. . .	. . .
Black men aged 20-29 y	2.7 (2.5, 2.8)	. . .	. . .	. . .
White men aged 50–59 y	1.9 (1.8, 1.9)	. . .	. . .	. . .
Black men aged 50-59 y	0.8 (0.8, 0.8)	. . .	. . .	. . .
Spaulding et al.[42]		. . .	3.5 (2.8, 4.3)[f]	2.8 (2.5, 3.2)
All non-Blacks	2.1 (2.0, 2.3)	. . .	. . .	. . .
All Blacks	1.3 (1.3, 1.4)	. . .	. . .	. . .
Non-Black men	2.1 (1.9, 2.2)	. . .	. . .	. . .
Black men	1.3 (1.2, 1.4)	. . .	. . .	. . .
Aged < 65 y[j]	1.6 (1.5, 1.7)	. . .	. . .	. . .
Aged ≥ 65 y[j]	0.6 (0.5, 0.8)	. . .	. . .	. . .
Stewart et al.[34,41]				
Non-Aboriginal men	6.3 (5.2, 7.4)	4.9 (3.0, 6.7)	20.1 (15.1, 25.2)[g]	. . .
Non-Aboriginal women	17.8 (8.1, 27.5)	17.4 (0, 41.5)	115.9 (40.2, 191.6)[g]	. . .
Aboriginal men	2.9 (2.2, 3.5)	. . .	. . .	. . .
Aboriginal women	3.4 (1.2, 5.6)	. . .	. . .	. . .

Continued

sample size; total time at risk; reporting period; and changes in prison and population death rates over time could all have an effect on reported death rates and ratios. Over 5 years of postrelease follow-up, CDR was found to fall by a factor of 3 (homicide) to 1.5 (suicide) from year 1 to year 5 in one study.[22] All-cause SMR in another cohort decreased significantly between 1988 and 2002 because of a decrease in drug-related and suicide deaths.[28] The strength of matching algorithms between prisoner and mortality databases could also affect reported death rates.[60] In our review, publication bias was not tested but it seems unlikely that reporting would be biased depending on particular crude death rates, although underreporting of samples without significantly raised SMRs is a possibility. We judged meta-regression not to be appropriate because of the small number of studies.[61]

The Context of Released Prisoner Mortality

This is the first study to have synthesized data from a systematic review of prisoner mortality over the longer term, and examined the data for basic demographic trends as expressed by SMR. A previous meta-analysis examined deaths in the first 12 weeks following release.[18] It found that 59% of deaths were drug-related in this period. Given that our review found that 18% of deaths were drug-related in the longer-term, this suggests that targeting drug-related deaths in the transition from prison to community could have a substantial effect in reducing mortality. The transition into the community is also a high-risk period for suicide[19]; however, in the longer term, other causes of mortality may present a greater burden.

The results of this review suggest that the SMRs for released prisoners are comparable to those of other high-risk populations. The SMRs reported in this review are similar to those of English community offenders,[40] Dutch convicts,[57] and a study of US homeless people,[62] but lower than that for opioid-dependent individuals.[63] In relation to population impact, the reviewed studies did not examine this, but we calculated that around 2% of deaths in individuals aged 15 to 44 years in Washington State between 1999 and 2003 could be attributed to released prisoners.[31,64] Offenders,

TABLE 2—*Continued*

Teplin et al.[44]				
Non-Hispanic White men	7.3 (2.4, 13.8)	. . .	. . .	. . .
Non-Hispanic White women	14.1 (0.0, 40.4)	. . .	. . .	. . .
African American men	3.9 (2.2, 6.1)	. . .	. . .	. . .
African American women	5.5 (0.8, 10.7)	. . .	. . .	. . .
Verger et al.[35]				
Aged 15–34 y[i]	5.0 (2.3, 9.6)	. . .	124.1 (25.6, 362.7)[h]	. . .
Aged 35–54 y[i]	3.8 (1.8, 6.9)	. . .	. . .	. . .

Note. CI = confidence interval.
[a]Accidental poisoning and exposure to noxious substances.
[b]Codes including drug involvement including nonintentional injury with drug involvement.
[c]Mental and behavioral disorders because of drug use, accidental poisoning, poisoning where intention could not be determined, intentional poisoning, external injury or poisoning.
[d]Drug-related mental and behavioral disorders, suicide, homicide, accidental, and undetermined intent.
[e]Mental and behavioral disorders because of drug use.
[f]Accidental poisoning (drug overdose).
[g]Drug- and alcohol-related.
[h]Overdose.
[i]No other age bands reported.

patients with substance misuse and mental illness, and socioeconomically deprived populations are likely to overlap and the contribution of various factors to increased mortality is currently unclear.

The Importance of Mental Illness

Prisoners have been found to have high rates of mental health problems compared with the general population,[65] and this may explain higher mortality rates. The SMR for patients with schizophrenia is between 2 and 3.[66] However, only 3 of the studies in the current review reported data on psychiatric comorbidity: 8% of prisoners were reported to have a serious mental health problem in one of the reports,[31] 5% of prisoners had been admitted to a prison psychiatric hospital in another study,[28] and 21% had a psychiatric history in a further investigation.[37] In keeping with this, higher SMRs are reported in mentally disordered offender populations. The SMRs following release from secure hospitals in England were 6 overall and 32 for suicide,[67] and 23 for men and 43 for women for suicide in a similar investigation.[68] As the cumulative use of antipsychotic drugs may be protective for premature mortality in patients with schizophrenia,[69] decreased use of medication for prisoners with mental illness[70] in prison may contribute to increased mortality.

Some standardization of approaches may be helpful for future research. Future studies should attempt to subtract prisoner deaths and populations when calculating SMRs and attempt to control for subsequent periods of imprisonment when calculating time-at-risk. Deaths should be classified according to the most recent ICD criteria.[59] Drug-related death rates should be reported according to individual ICD categories. Ethnicity data may be difficult to compare internationally; however, age bands could be reported according to those used by the World Health Organization for mortality data.[71] The impact of prisoner status (pretrial or remand or sentenced), socioeconomic factors, probation and transition programs, mental and physical health, previous incarceration and offending history, and length of incarceration needs further examination.

Limitations

The main limitation was the variation in the design of the original studies included in the review, and, hence, the high heterogeneity of reported death rates. Therefore, we investigated heterogeneity carefully and, despite it, found some interesting trends. Given the heterogeneity and that CDR is not adjusted by age for the demographic structure of the population, the pooled estimate of CDR must be interpreted with caution.

All of the studies reported on North American, European, and Australian cohorts. As the majority of the world's prison population lies outside these jurisdictions, further work on ex-prisoner populations in other countries is necessary.

Conclusions

We have systematically reviewed research examining the mortality of released prisoners, and found that released prisoners are at substantially increased risk of death from all causes, and from drugs, suicide, and homicide in particular. In addition, we found some evidence that younger, female, and White populations are at increased risk of death compared with their matched general population controls. Further work needs to examine the contribution of mental and physical illness, treatment, and provision of aftercare services on postrelease mortality. ■

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Contributors

J. Zlodre conceptualized the study; performed the search; collected, interpreted, and analyzed data; and drafted the article. S. Fazel conceptualized the study, interpreted and analyzed data, participated in writing the draft, and critically revised the article. Both authors agreed on the final version of the article.

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Study protocol approval was not needed as there was no direct human participation in the study.

References

1. Walmsley R. *World Prison Population List, Eighth Edition.* King's College London International Centre for Prison Studies; 2009. Available at: http://www.prisonstudies.org/info/downloads/wppl-8th_41.pdf. Accessed August 14, 2012.

2. Clavel F, Benhamou S, Flamant R. Decreased mortality among male prisoners. *Lancet.* 1987;2(8566): 1012–1014.

3. Bobrik A, Danishevski K, Eroshina K, McKee M. Prison health in Russia: the larger picture. *J Public Health Policy.* 2005;26:30–59.

4. Fazel S, Benning R. Natural deaths in male prisoners: a 20-year mortality study. *Eur J Public Health.* 2006;16 (4):441–444.

5. Novick LF, Remmlinger E. A study of 128 deaths in New York City correctional facilities (1971–1976): implications for prisoner health care. *Med Care.* 1978;16 (9):749–756.

6. Fazel S, Grann M, Kling B, Hawton K. Prison suicide in 12 countries: an ecological study of 861 suicides during 2003–2007. *Soc Psychiatry Psychiatr Epidemiol.* 2011;46(3):191–195.

7. Fazel S, Benning R, Danesh J. Suicides in male prisoners in England and Wales, 1978–2003. *Lancet.* 2005;366(9493):1301–1302.

8. DuRand CJ, Burtka GJ, Federman EJ, Haycox JA, Smith JW. A quarter century of suicide in a major urban jail: implications for community psychiatry. *Am J Psychiatry.* 1995;152(7):1077–1080.

9. Binswanger IA, Krueger PM, Steiner JF. Prevalence of chronic medical conditions among jail and prison inmates in the USA compared with the general population. *J Epidemiol Community Health.* 2009;63(11):912–919.

10. Duhamel A, Renard JM, Nuttens MC, Devos P, Beuscart C, Archer E. Social and health status of arrivals in a French prison: a consecutive case study from 1989 to 1995. *Rev Epidemiol Sante Publique.* 2001;49(3): 229–238.

11. Williamson M. *Improving the Health and Social Outcomes of People Recently Released From Prisons in the UK.* London, UK: Sainsbury Centre for Mental Health; 2008. Available at: http://www.centreformentalhealth.org.uk/pdfs/scmh_health_care_after _prison.pdf. Accessed September 26, 2011.

12. Griffiths E, Willis J, Spark MJ. A systematic review of psychotropic drug prescribing for prisoners. *Aust N Z J Psychiatry.* 2012;46(5):407–421.

13. Bryan A, Robbins RN, Ruiz MS, O'Neill D. Effectiveness of an HIV prevention intervention in prison among African Americans, Hispanics, and Caucasians. *Health Educ Behav.* 2006;33(2):154–177.

14. Braithwaite RL, Arriola KRJ. Male prisoners and HIV prevention: a call for action ignored. *Am J Public Health.* 2003;93(5):759–763.

15. Glaze LE. *Correctional Populations in the United States, 2009.* Washington, DC: Bureau of Justice Statistics; 2010. Available at: http://bjs.ojp.usdoj.gov/index.cfm?ty=pbdetail&iid=2316. Accessed August 14, 2012.

16. *Offender Management Statistics Quarterly Bulletin.* London, England: Ministry of Justice; 2011. Available at: http://www.justice.gov.uk/downloads/publications/statistics-and-data/mojstats/omsq-q1-2011-bulletin.pdf. Accessed September 29, 2011.

17. Wolff N, Plemmons D, Veysey B, Brandli A. Release planning for inmates with mental illness compared with those who have other chronic illnesses. *Psychiatr Serv.* 2002;53(11):1469–1471.

18. Merrall ELC, Kariminia A, Binswanger IA, et al. Meta-analysis of drug-related deaths soon after release from prison. *Addiction.* 2010;105(9):1545–1554.

19. Kariminia A, Law MG, Butler TG, et al. Suicide risk among recently released prisoners in New South Wales, Australia. *Med J Aust.* 2007;187(7):387–390.

20. *Prevention of Acute Drug-Related Mortality in Prison Populations During the Immediate Post-release Period.* Copenhagen, Denmark: World Health Organization; 2010. Available at: http://www.euro.who.int/__data/assets/pdf_file/0020/114914/E93993.pdf. Accessed September 29, 2011.

21. Farrell M, Marsden J. Acute risk of drug-related death among newly released prisoners in England and Wales. *Addiction.* 2008;103(2):251–255.

22. Rosen DL, Schoenbach VJ, Wohl DA. All-cause and cause-specific mortality among men released from state prison, 1980–2005. *Am J Public Health.* 2008;98 (12):2278–2284.

23. Bland M. *An Introduction to Medical Statistics.* 3rd ed. Oxford, UK: Oxford University Press; 2000.

24. Liddell FD. Simple exact analysis of the standardised mortality ratio. *J Epidemiol Community Health.* 1984;38 (1):85–88.

25. Higgins JPT, Thompson SG, Deeks JJ, Altman DG. Measuring inconsistency in meta-analyses. *BMJ.* 2003; 327(7414):557–560.

26. Harding-Pink D. Mortality following release from prison. *Med Sci Law.* 1990;30(1):12–16.

27. Harding-Pink D, Fryc O. Risk of death after release from prison: a duty to warn. *BMJ.* 1988;297(6648):596.

28. Kariminia A, Butler TG, Corben SP, et al. Extreme cause-specific mortality in a cohort of adult prisoners—1988 to 2002: a data-linkage study. *Int J Epidemiol.* 2007;36(2):310–316.

29. Kariminia A, Law MG, Butler TG, et al. Factors associated with mortality in a cohort of Australian prisoners. *Eur J Epidemiol.* 2007;22(7):417–428.

30. Krinsky CS, Lathrop SL, Brown P, Nolte K. Drugs, detention, and death: a study of the mortality of recently released prisoners. *Am J Forensic Med Pathol.* 2009;30 (1):6–9.

31. Binswanger IA, Stern MF, Deyo RA, et al. Release from prison—a high risk of death for former inmates. *N Engl J Med.* 2007;356(2):157–165.

32. Pratt D, Piper M, Appleby L, Webb R, Shaw J. Suicide in recently released prisoners: a population-based cohort study. *Lancet.* 2006;368(9530):119–123.

33. Coffey C, Wolfe R, Lovett AW, Moran P, Cini E, Patton GC. Predicting death in young offenders: a retrospective cohort study. *Med J Aust.* 2004;181(9):473–477.

34. Stewart LM, Henderson CJ, Hobbs MST, Ridout SC, Knuiman MW. Risk of death in prisoners after release from jail. *Aust N Z J Public Health.* 2004;28(1):32–36.

35. Verger P, Rotily M, Prudhomme J, Bird S. High mortality rates among inmates during the year following their discharge from a French prison. *J Forensic Sci.* 2003;48(3):614–616.

36. Bird SM, Hutchinson SJ. Male drugs-related deaths in the fortnight after release from prison: Scotland, 1996–99. *Addiction.* 2003;98(2):185–190.

37. Joukamaa M. The mortality of released Finnish prisoners; a 7 year follow-up study of the WATTU project. *Forensic Sci Int.* 1998;96(1):11–19.

38. Shewan D, Hammersley R, Oliver J, MacPherson S. Fatal drug overdose after liberation from prison: a retrospective study of female ex-prisoners from Strathclyde region (Scotland). *Addict Res Theory.* 2000;8:267–278.

39. Sattar G. The death of offenders in England and Wales. *Crisis.* 2003;24(1):17–23.

40. Sattar G. *Rates and Causes of Death Among Prisoners and Offenders Under Community Supervision. Research, Development and Statistics Directorate.* London, UK: Home Office; 2001.

41. Hobbs M, Krazlan K, Ridout S, Mai Q, Knuiman M, Chapman R. *Mortality and Morbidity in Prisoners After Release From Prison in Western Australia, 1995–2003.* Canberra, Australia: Australian Institute of Criminology; 2006. Available at: http://aic.gov.au/documents/6/7/3/%7B6731BD68-AD7F-48CF-B527-2D3C4FA71E13%7Dtandi320.pdf. Accessed September 29, 2011.

42. Spaulding AC, Seals RM, McCallum VA, Perez SD, Brzozowski AK, Steenland NK. Prisoner survival inside and outside of the institution: implications for health-care planning. *Am J Epidemiol.* 2011;173(5): 479–487.

43. Graham A. Post-prison mortality: unnatural death among people released from Victorian prisons between January 1990 and December 1999. *Aust N Z J Criminol.* 2003;36:94–108.

44. Teplin LA, McClelland, Abram KM, Mileusnic D. Early violent death among delinquent youth: a prospective longitudinal study. *Pediatrics.* 2005;115(6):1586–1593.

45. Coffey C, Veit F, Wolfe R, Cini E, Patton GC. Mortality in young offenders: retrospective cohort study. *BMJ.* 2003;326(7398):1064.

46. Dirkzwager A, Nieuwbeerta P, Blokland A. Effects of first-time imprisonment on postprison mortality: a 25-year follow-up study with a matched control group. *J Res Crime Delinq.* 2012;49(3):383–419.

47. Seaman SR, Brettle RP, Gore SM. Mortality from overdose among injecting drug users recently released from prison: database linkage study. *BMJ.* 1998;316 (7129):426–428.

48. Christensen PB, Hammerby E, Smith E, Bird SM. Mortality among Danish drug users released from prison. *Int J Prison Health.* 2006;2:13–19.

49. Graß H, Sticht G. Drug-related death after release from prison—investigation of the example of the city of Cologne [in German]. *Suchtmed.* 2001;3:97–100.

50. Wakeman SE, Bowman SE, McKenzie M, Jeronimo A, Rich JD. Preventing death among the recently incarcerated: an argument for naloxone prescription before release. *J Addict Dis.* 2009;28(2): 124–129.

51. Ødegård E, Amundsen EJ, Kielland KB, Kristoffersen R. The contribution of imprisonment and release to fatal overdose among a cohort of Norwegian drug abusers. *Addict Res Theory.* 2010; 18:51–58.

52. Chen CY, Wu PN, Su LW, Chou YJ, Lin KM. Three-year mortality and predictors after release: a longitudinal study of the first-time drug offenders in Taiwan. *Addiction.* 2010;105(5):920–927.

53. Seymour A, Oliver JS, Black M. Drug-related deaths among recently released prisoners in the Strathclyde Region of Scotland. *J Forensic Sci.* 2000; 45(3):649–654.

54. Sattar G, Killias M. The death of offenders in Switzerland. *Eur J Criminol.* 2005;2:317–340.

55. Laub JH, Vaillant GE. Delinquency and mortality: a 50-year follow-up study of 1,000 delinquent and nondelinquent boys. *Am J Psychiatry.* 2000;157 (1):96–102.

56. Lattimore PK, Linster RL, MacDonald JM. Risk of death among serious young offenders. *J Res Crime Delinq.* 1997;34:187–209.

57. Nieuwbeerta P, Piquero AR. Mortality rates and causes of death of convicted Dutch criminals 25 years later. *J Res Crime Delinq.* 2008;45:256–286.

58. Yeager CA, Lewis DO. Mortality in a group of formerly incarcerated juvenile delinquents. *Am J Psychiatry.* 1990;147(5):612–614.

59. *International Statistical Classification of Diseases and Related Health Problems, 10th Revision.* Geneva, Switzerland: World Health Organization; 2007. Available at: http://apps.who.int/classifications/apps/icd/icd10online. Accessed September 19, 2011.

60. Kariminia A, Butler T, Corben S, Kaldor J, Levy M, Law M. Mortality among prisoners: how accurate is the Australian National Death Index? *Aust N Z J Public Health.* 2005;29(6):572–575.

61. Thompson SG, Higgins JPT. How should meta-regression analyses be undertaken and interpreted? *Stat Med.* 2002;21(11):1559–1573.

62. Hibbs JR, Benner L, Klugman L, et al. Mortality in a cohort of homeless adults in Philadelphia. *N Engl J Med.* 1994;331(5):304–309.

63. Degenhardt L, Bucello C, Mathers B, et al. Mortality among regular or dependent users of heroin and other opioids: a systematic review and meta-analysis of cohort studies. *Addiction.* 2011;106(1):32–51.

64. Death rates by 10-year age groups: United States and each state, 1999–2007. Atlanta, GA: Centers for Disease Control and Prevention; 2011. Available at: http://www.cdc.gov/nchs/nvss/mortality/gmwk23r.htm. Accessed September 19, 2011.

65. Fazel S, Seewald K. Severe mental illness in 33,588 prisoners worldwide: systematic review and meta-regression analysis. *Br J Psychiatry.* 2012;200(5):364–373.

66. Saha S, Chant D, McGrath J. A systematic review of mortality in schizophrenia: is the differential mortality gap worsening over time? *Arch Gen Psychiatry.* 2007;64(10):1123–1132.

67. Davies S, Clarke M, Hollin C, Duggan C. Long-term outcomes after discharge from medium secure care: a cause for concern. *Br J Psychiatry.* 2007;191:70–74.

68. Jones RM, Hales H, Butwell M, Ferriter M, Taylor PJ. Suicide in high security hospital patients. *Soc Psychiatry Psychiatr Epidemiol.* 2011;46(8):723–731.

69. Tiihonen J, Lonnqvist J, Wahlbeck K, et al. 11-year follow-up of mortality in patients with schizophrenia: a population-based cohort study (FIN11 study). *Lancet.* 2009;374(9690):620–627.

70. Wilper AP, Woolhandler S, Boyd JW, et al. The health and health care of US prisoners: results of a nationwide survey. *Am J Public Health.* 2009;99(4):666–672.

71. Life tables for WHO member states. Geneva, Switzerland: World Health Organization; 2011. Available at: http://www.who.int/healthinfo/statistics/mortality_life_tables/en/index.html. Accessed September 19, 2011.