

Suicide in Prisoners: A Systematic Review of Risk Factors

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Objective: To examine factors associated with suicide in prisoners.

Data Sources: Studies were identified through electronic searches of MEDLINE (1950–February 2007), PsycINFO (1806–February 2007), EMBASE (1974–February 2007), and CINAHL (1982–February 2007) without language restriction using the search terms *prison, jail, felon, detainee, penal, and custody* combined with *suicide*.

Study Selection: Included studies were investigations that reported on prisoners dying by suicide who were compared with prisoners in control groups (which were randomly selected or matched, or consisted of the total or average prison population). Sub-group analysis and meta-regression were used to explore sources of heterogeneity.

Data Synthesis: Thirty-four studies (comprising 4780 cases of prison suicide) were identified for inclusion in the review, of which 12 were based in the United States. Demographic factors associated with suicide included white race/ethnicity (OR = 1.9, 95% CI = 1.7 to 2.2), being male (OR = 1.9, 95% CI = 1.4 to 2.5), and being married (OR = 1.5, 95% CI = 1.3 to 1.7). Criminological factors included occupation of a single cell (OR = 9.1, 95% CI = 6.1 to 13.5), detainee/remand status (OR = 4.1, 95% CI = 3.5 to 4.8), and serving a life sentence (OR = 3.9, 95% CI = 1.1 to 13.3). Clinical factors were recent suicidal ideation (OR = 15.2, 95% CI = 8.5 to 27.2), history of attempted suicide (OR = 8.4, 95% CI = 6.2 to 11.4), having a current psychiatric diagnosis (OR = 5.9, 95% CI = 2.3 to 15.4), receiving psychotropic medication (OR = 4.2, 95% CI = 2.9 to 6.0), and having a history of alcohol use problems (OR = 3.0, 95% CI = 1.9 to 4.6). Black race/ethnicity was inversely associated with suicide (OR = 0.4, 95% CI = 0.3 to 0.4). Few differences were found in risk estimates when compared by study design or publication type.

Conclusions: Several demographic, criminological, and clinical factors were found to be associated with suicide in prisoners, the most important being occupation of a single cell, recent suicidal ideation, a history of attempted suicide, and having a psychiatric diagnosis or history of alcohol use problems. As some of these associations included potentially modifiable environmental and clinical factors, there is scope for targeting these factors in suicide prevention strategies for individuals in custody.

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Suicide rates in prisoners are considerably higher than in the general population, both in the United States¹ and the United Kingdom and internationally.^{2–6} In the United States, the rate of suicide in jails is estimated to be 8 times higher than in the general population,⁷ and in England and Wales, the age-standardized rate of suicide among all male prisoners is 5 times higher than in the general population—a proportionate excess that has been increasing since 1978.⁸ In addition, these rates remain high after leaving prison—a recent study of all inmates released in 1 U.S. state found an increased suicide risk 3- to 4-fold higher than in the general population after adjustment for age, sex, and race.⁹

Prevention of suicide in prisoners is highlighted in the United States' *National Strategy for Suicide Prevention*,¹⁰ and it is a key component of the *National Suicide Prevention Strategy for England*.¹¹ An important aspect of these strategies is detection of those at highest risk. It may not be possible to generalize from suicide research in the general population: specific risk factors may apply in prisoners, as they do for natural-cause mortality in male prisoners¹² and pregnancy outcomes in female prisoners.¹³

Several studies have compared factors associated with prison suicides with those in the general population and found that suicide risk is elevated in the first week of custody and in those with drug and alcohol problems, psychiatric disorders, suicidal thoughts, and long sentences.^{14–16} However, the results for some associations are conflicting, such as for gender,^{17,18} detainee or remand status,^{19,20} and race/ethnicity,^{6,18} and have not previously been synthesized. Use of meta-analysis for investigating the best evidence for risk factors is an important way of synthesizing relevant data.^{21,22} In keeping with this approach, we undertook a systematic review of all studies that evaluated factors associated with suicide in prisoners.

METHOD

Search Strategy and Inclusion Criteria

We searched MEDLINE (1950–February 2007), PsycINFO (1806–February 2007), EMBASE (1974–February 2007), and CINAHL (1982–February 2007) databases for articles that reported studies of risk factors for suicide in prisoners. The search terms were *suicid* combined with *prison* OR *felon* OR *detain* OR *jail* OR *custod* OR *HMP* [Her Majesty's Prison] OR *remand* OR *young/youth offender* OR *institution* OR *penal*. This search generated 592 articles. We obtained additional articles by citation tracking of review and original articles. Gray literature—theses and internally and externally published reports from correctional services—was included.

We included articles in all languages. Suicide cases had to be from a defined prison population, with information on prison suicides compared with a control prison population. Control groups were matched or randomly selected or were the total/average prison population. Absolute numbers of suicide cases had to be available or derivable from the data provided. If control data were derived from other prisons or from a different time period, these investigations were excluded.^{16,23–26} Investigations were also excluded if they reported case series,²⁷ selected populations (such as those with contact with mental health services²⁸), selected outcomes (such as hanging²⁹), reported deliberate self-harm,³⁰ compared suicides in public prisons with those in private penal institutions³¹ or the general population,^{8,9} or were literature reviews.²⁰

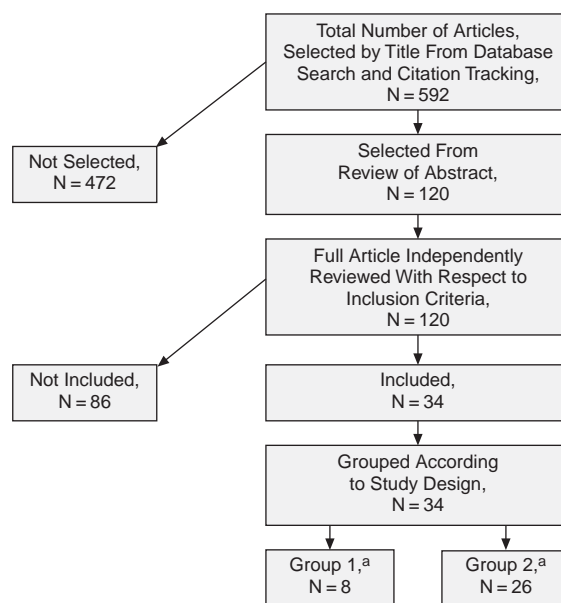
Design of Studies and Data Extraction

We divided included studies into 2 groups on the basis of the type of control group used: group 1 studies used a randomly selected or matched control group; group 2 studies used the total or average prison population from a matched time period.

We used a standard form to extract data on type of study, design, and criteria for case selection (completed suicide, completed suicide and open verdicts, or not recorded). Data on demographic, criminological, and clinical variables in case and control groups were extracted. Offenses were nonoverlapping in order to avoid duplication from a particular study. This meant that information on “violent offense,” “murder/manslaughter,” and “sexual offense” was also recorded separately—thus the category “violent offense” did not include individuals charged with or sentenced for murder/manslaughter or sexual offenses. Data on prisoners who had a history of alcohol dependence or were intoxicated on reception were pooled and classified as indicating an alcohol use problem.

For each of the group 2 studies, the size of the control group was calculated to be proportional to that of the case group in order to avoid bias toward studies in which the control group was the total prison population.

Figure 1. Results of Search for Articles Reporting Risk Factors for Suicide in Prisoners



^aGroup 1 studies used a randomly selected or matched control group; group 2 studies used the total or average prison population from a matched time period.

Authors J.C. and A.N. independently assessed the articles according to the inclusion criteria. Uncertainties were clarified by contacting investigators directly and in discussion with the other authors (S.F. and K.H.).

Ethics review was not required; however, the Declaration of Helsinki guidelines were followed.

Statistical Analysis

Meta-analyses of risk factors were carried out using Review Manager (RevMan) software version 4.2 (The Cochrane Collaboration; Oxford, United Kingdom; 2000), generating pooled odds ratios (ORs) with 95% confidence intervals (CIs). Heterogeneity was estimated using Cochran Q and the I^2 statistic, which describes the percentage of variation across studies that is due to heterogeneity rather than chance.^{32,33} The I^2 statistic, unlike the Cochran Q, does not inherently depend upon the number of studies considered. When significant heterogeneity was found among the studies ($I^2 > 75\%$), random effects estimates of summary ORs were made. Otherwise, fixed effects estimates were used.

Subgroup analyses were conducted to see if there were significant differences in outcomes according to study design (group 1 vs. group 2) and type of publication (gray literature vs. published in a peer-reviewed journal). For the latter, we examined the 3 risk factors for which there was uncertainty in the literature—gender, detainee/remand status, and race/ethnicity. There was

Table 1. Risk Factors Associated With Suicide in Prisoners (ranked in order of effect size)

Risk Factor	Study Group ^a	Number of Studies	Number of Cases		Number of Controls		Pooled Estimate (Odds Ratio)	95% CI	z Statistic	p Value
			Total	Exposed to Risk Factor	Total	Exposed to Risk Factor				
Suicidal ideation	1	2	250	93	401	15	15.2	8.5 to 27.2	9.2	<.001
Single cell occupancy	1	2	217	153	309	64	9.1	6.1 to 13.5	10.8	<.001
History of attempted suicide	1	4	400	198	750	81	8.4	6.2 to 11.4	13.5	<.001
Current psychiatric diagnosis ^b	1	4	423	175	603	63	5.9	2.3 to 15.4	3.6	<.001
Psychotropic medication	1	2	264	106	427	59	4.2	2.9 to 6.0	7.5	<.001
Detainee/remand status	1 and 2	11	1593	867	1789	485	4.1	3.5 to 4.8	17.5	<.001
Life sentence ^b	2	6	562	114	562	23	3.9	1.1 to 13.3	2.2	.03
Murder/manslaughter offense ^b	1 and 2	10	605	121	795	53	3.6	1.6 to 8.3	3.0	.003
Violent offense ^{b,c}	1 and 2	5	418	121	572	58	3.5	1.4 to 9.0	2.6	<.009
Alcohol use problems	1	2	158	61	340	54	3.0	1.9 to 4.6	4.9	<.001
White race/ethnicity	1 and 2	16	2245	1606	2585	1510	1.9	1.7 to 2.2	9.6	<.001
Male gender	1 and 2	17	2343	2264	2526	2371	1.9	1.4 to 2.5	27.1	<.001
Poor physical health	1	2	86	31	125	32	1.8	1.0 to 3.3	1.9	.06
Previous convictions ^b	1	4	558	388	931	596	1.8	0.8 to 4.2	1.3	.19
Employed ^b	1	4	516	281	1073	456	1.7	0.7 to 4.7	1.1	.27
Length of sentence ≥ 18 mo but not life	2	4	300	173	399	140	1.6	1.1 to 2.2	2.7	.007
Married	1 and 2	9	1596	465	2073	460	1.5	1.3 to 1.7	5.1	<.001
Sexual offense	2	6	1225	118	1225	101	1.2	0.9 to 1.6	1.2	.23
Homeless ^b	1	4	318	55	851	104	1.2	0.8 to 1.7	0.9	.35
Hispanic race/ethnicity	2	4	187	63	187	55	1.2	0.8 to 1.9	0.9	.37
Age 21–30 y	2	4	565	263	565	259	1.0	0.8 to 1.3	0.2	.81
Age 31–40 y	2	5	626	152	626	150	1.0	0.8 to 1.3	0.1	.89
Age 41–50 y	2	5	622	71	622	71	1.0	0.7 to 1.4	0.0	1.00
Age 50+ y	2	5	622	37	622	36	1.0	0.6 to 1.7	0.1	.90
Previous incarceration	1 and 2	2	97	43	97	46	0.9	0.5 to 1.6	0.5	.65
Education, not continued after age 16 ^b	1 and 2	3	449	235	850	430	0.9	0.4 to 2.4	0.2	.87
Age 16–20 y	2	5	617	91	617	103	0.9	0.6 to 1.2	0.9	.35
Burglary/robbery/theft ^b	2	4	704	253	704	284	0.7	0.4 to 1.3	1.0	.30
Black race/ethnicity	1 and 2	11	2170	317	2176	633	0.4	0.3 to 0.4	11.9	<.001
Length of sentence < 18 mo ^b	2	4	300	77	300	148	0.4	0.2 to 0.9	2.1	.04
Sentenced	2	5	653	301	653	519	0.2	0.2 to 0.3	12.1	<.001

^aGroup 1 studies used a randomly selected or matched control group; group 2 studies used the total or average prison population from a matched time period.

^bRandom effects model.

^cNot including murder, manslaughter, or sexual offenses.

insufficient power to examine other risk factors. As many of the studies combined remand and sentenced prisoners, we were unable to analyze risk factors by these subgroups. Meta-regression was conducted for those variables for which there was significant heterogeneity using Stata software, version 8 (StataCorp; College Station, Tex.; 2001).

RESULTS

Search Results

From the initial search, 592 relevant studies were identified, of which 34 met the inclusion criteria (Figure 1). The total number of suicide cases in the included studies was 4780. Publications were from 12 countries: 12 from the United States (1416 cases; percentage of total suicides studied, 29.6%),^{2,7,34-43} 8 from England and Wales (2123 cases, 44.4%),^{6,19,44-49} 2 from Canada (101 cases, 2.1%),^{3,50} 2 from the same study in Austria (440 cases, 9.2%),^{4,15} 2 from Australia (97 cases, 2.0%),^{51,52} 2 from The Netherlands (139 cases, 2.9%),^{14,53} 2 from Scotland

(116 cases, 2.4%),^{54,55} and 1 each from France (179 cases, 3.7%),⁵⁶ Italy (100 cases, 2.1%),⁵⁷ New Zealand (39 cases, 0.8%),⁵⁸ and Germany (30 cases, 0.6%).⁵⁹ Suicides were defined in 25 articles as completed suicide verdicts and in 3 studies as suicide plus open verdicts; no definition was recorded in 6 investigations (see Appendix 1 for details of the studies).

Risk Factors for Suicide

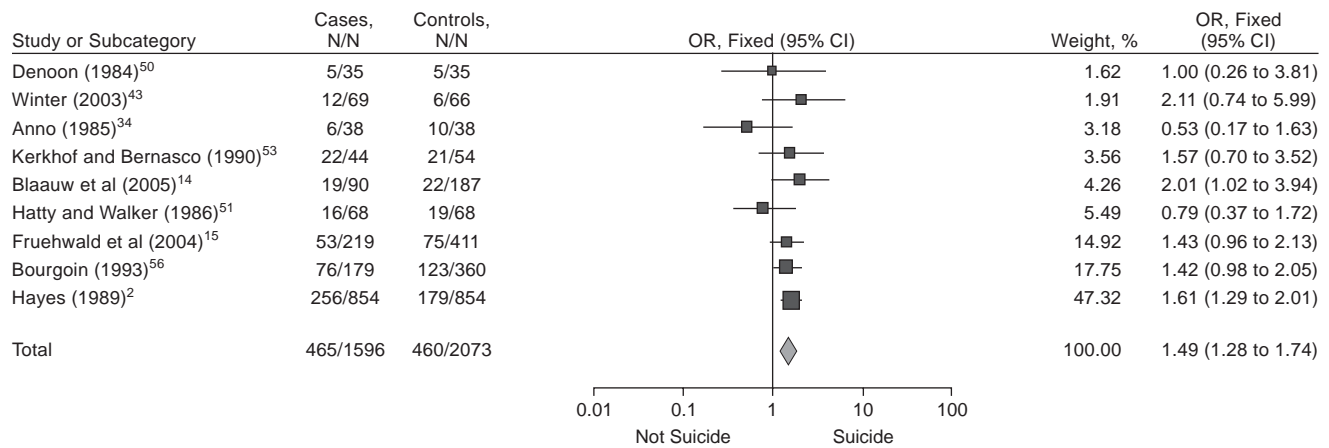
A summary of all the risk factors that appeared in more than 1 study is presented in Table 1, ranked in order of effect size.

Demographic factors. Factors significantly associated with suicide risk included male gender (OR = 1.9, 95% CI = 1.4 to 2.5),* white race/ethnicity (OR = 1.9, 95% CI = 1.7 to 2.2),† and being married (OR = 1.5,

*References 2–4, 6, 36, 39–42, 48, 50, 51, 55, 57.

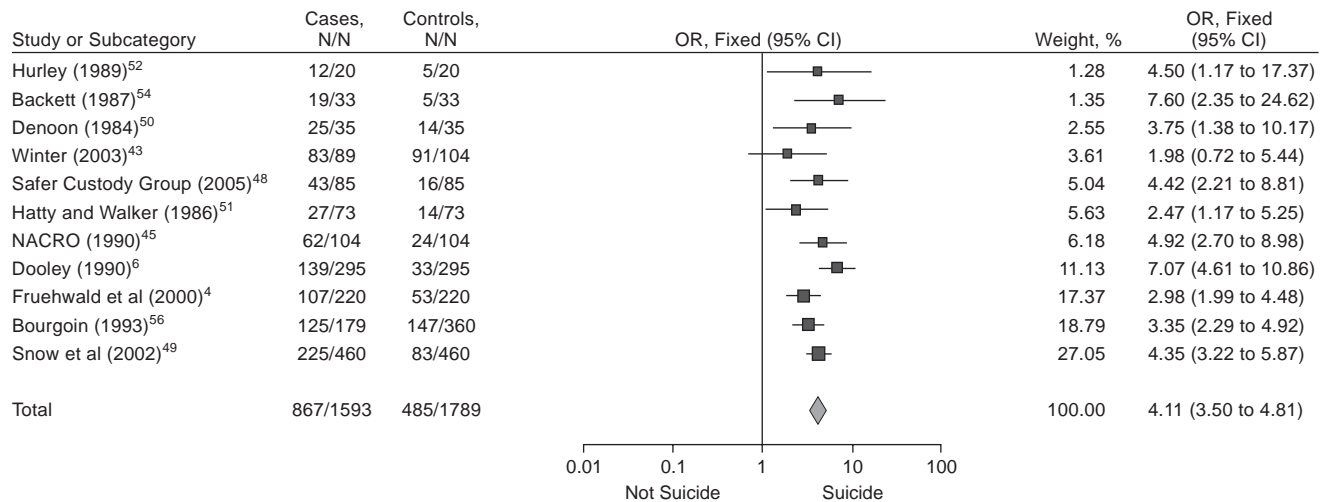
†References 2, 3, 34–37, 39–42, 48, 49.

Figure 2. Risk of Suicide in Prison and Being Married^a



^aTest for heterogeneity: $\chi^2 = 7.97$, $df = 8$, $p = .44$, $I^2 = 0\%$; test for overall effect: $z = 5.06$, $p < .001$.

Figure 3. Risk of Suicide in Prison and Detainee/Remand Status^a



^aTest for heterogeneity: $\chi^2 = 15.03$, $df = 10$, $p = .13$, $I^2 = 33.5\%$; test for overall effect: $z = 17.48$, $p < .001$.
Abbreviation: NACRO = National Association for the Care and Resettlement of Offenders.

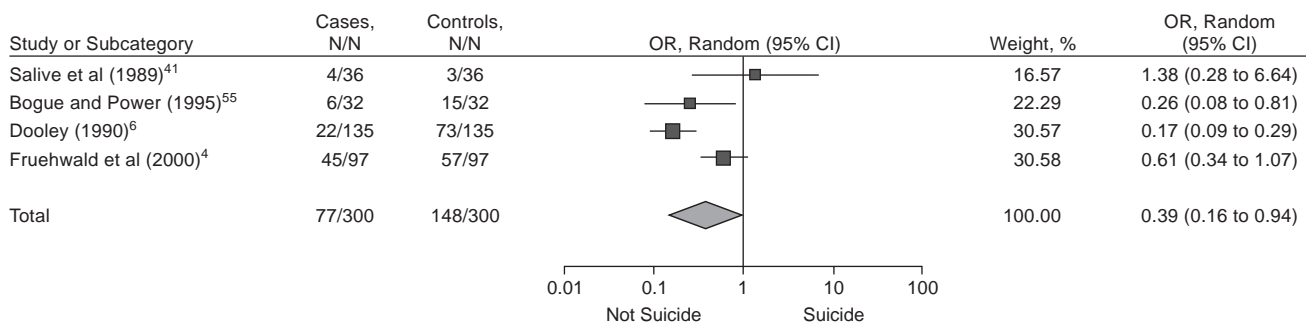
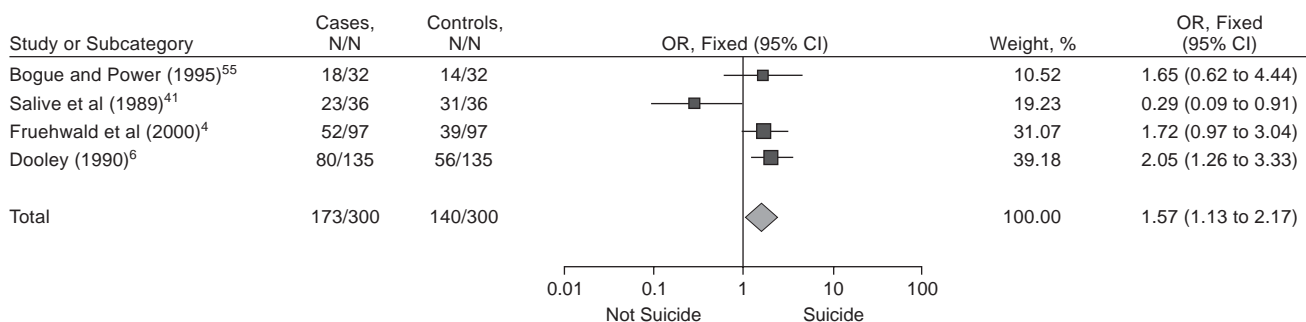
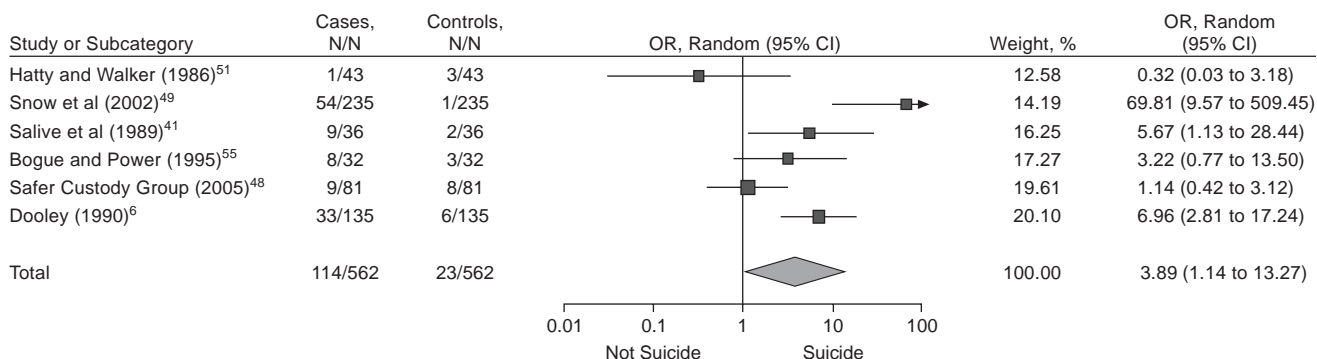
95% CI = 1.3 to 1.7; Figure 2).^{14,15,43,53,56} Black race/ethnicity (OR = 0.4, 95% CI = 0.3 to 0.4)^{2,34-37,39,41,42,48,49} was inversely associated with suicide. Employment was not significantly associated with suicide risk (OR = 1.7, 95% CI = 0.7 to 4.7), and the heterogeneity was partly explained by a high rate of previous convictions (studies with > 70% previous convictions having higher ORs; $p < .001$).

Single studies showed an association between suicide and being Catholic (OR = 3.1, 95% CI = 1.1 to 8.5)³⁴ but showed no association with non-Christian religious affiliations or having no religion (OR = 0.5, 95% CI = 0.0 to 5.6).¹⁵

Criminological factors. The following factors were significantly associated with risk of suicide: occupation of a single cell (OR = 9.1, 95% CI = 6.1 to 13.5),^{15,38} being

a detainee or on remand (OR = 4.1, 95% CI = 3.5 to 4.8; Figure 3),^{4,6,45,48-52,54} and a sentence length equal to or greater than 18 months but not life (OR = 1.6, 95% CI = 1.1 to 2.2).^{4,6,41,55} Also associated with suicide were the offense of murder/manslaughter (OR = 3.6, 95% CI = 1.6 to 8.3)^{3,6,7,34,41,51,55} and violent offenses (not murder/manslaughter/sexual) (OR = 3.5, 95% CI = 1.4 to 9.0),^{6,41,51,55} but these analyses showed significant heterogeneity ($I^2 = 75\%$ and 83% , respectively). Length of sentence less than 18 months was inversely associated with suicide (OR = 0.4, 95% CI = 0.2 to 0.9), but there was significant heterogeneity ($I^2 = 78\%$).^{4,6,41,55} When the findings on length of sentence were taken together, increasing length of sentence was associated with increasing risk of suicide, with possible evidence of a dose-response effect

Figure 4. Risk of Suicide in Prison and Length of Sentence

A. Length of Sentence < 18 Months^aB. Length of Sentence ≥ 18 Months but Not Life^bC. Life Sentence^c

^aTest for heterogeneity: $\chi^2 = 13.42$, $df = 3$, $p = .004$, $I^2 = 77.6\%$; test for overall effect: $z = 2.11$, $p = .04$.

^bTest for heterogeneity: $\chi^2 = 9.53$, $df = 3$, $p = .02$, $I^2 = 68.5\%$; test for overall effect: $z = 2.71$, $p = .007$.

^cTest for heterogeneity: $\chi^2 = 22.88$, $df = 5$, $p = .0004$, $I^2 = 78.2\%$; test for overall effect: $z = 2.17$, $p = .03$.

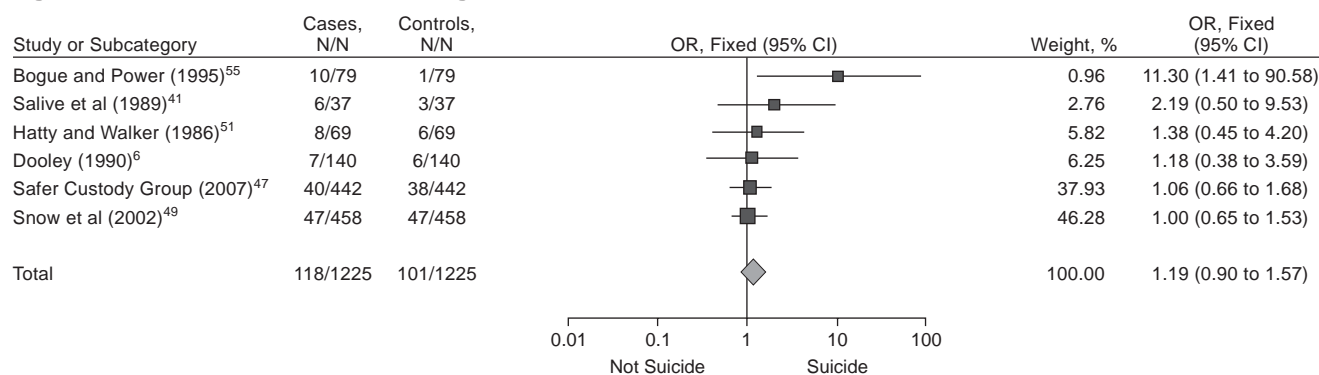
(Figure 4). Life-sentenced prisoners had a higher risk of suicide (OR = 3.9, 95% CI = 1.1 to 13.3), but there was significant heterogeneity ($I^2 = 78\%$).

On meta-regression, some of the heterogeneity in the murder/manslaughter studies was explained by race/ethnicity (studies with higher rates of white prisoners having higher ORs; $p = .005$) and marital status (studies with higher rates of married prisoners having lower ORs; $p = .007$). There was no difference on meta-regression in suicide risk between those studies conducted in English-speaking countries and those conducted in other countries

($p = .4$). None of the factors that were examined were significantly associated with the heterogeneity of risk estimates for violent offense and for length of sentence less than 18 months. In the studies that reported on life-sentenced prisoners, the heterogeneity was partly explained by gender (studies with > 95% men reporting higher ORs; $p = .003$).

Risk of suicide was not associated with sexual offenses (OR = 1.2, 95% CI = 0.9 to 1.6) (Figure 5).^{6,41,47,49,51,55}

Single studies showed an association of suicide with length of imprisonment greater than 1 year (OR = 12.7,

Figure 5. Risk of Suicide in Prison and Being Convicted of a Sexual Offense^a

^aTest for heterogeneity: $\chi^2 = 6.10$, $df = 5$, $p = .30$, $I^2 = 18.0\%$; test for overall effect: $z = 1.20$, $p = .23$.

95% CI = 4.5 to 36.1)⁵³ and an inverse association with visits while incarcerated (OR = 0.6, 95% CI = 0.4 to 0.9).¹⁵

Clinical factors. The following clinical factors were significantly associated with risk of suicide: recent suicidal ideation (OR = 15.2, 95% CI = 8.5 to 27.2),^{15,59} a history of attempted suicide (OR = 8.4, 95% CI = 6.2 to 11.4),^{14,15,43,59} having a psychiatric diagnosis (OR = 5.9, 95% CI = 2.3 to 15.4),^{14,15,43,59} being on psychotropic medication (OR = 4.2, 95% CI = 2.9 to 6.0),^{15,53} and having an alcohol use problem (OR = 3.0, 95% CI = 1.9 to 4.6).^{14,43} A high prevalence of previous attempted suicide in 1 study explained some of the heterogeneity in the studies that reported on psychiatric diagnosis (the 1 study¹⁴ with the highest prevalence of history of attempted suicide [62%] had a higher risk estimate than the other 3 studies; $p < .001$); no significant differences were found by country location. In single studies, suicide was associated with a diagnosis of depression (OR = 6.6, 95% CI = 1.5 to 29.4),³⁸ multiple drug abuse (OR = 3.1, 95% CI = 1.0 to 9.7),⁵⁹ and substance misuse (OR = 2.3, 95% CI = 1.6 to 3.2)¹⁵ but not with a diagnosis of personality disorder (OR = 0.6, 95% CI = 0.3 to 1.6).⁴⁵ There was no association with the presence of tattoos (OR = 1.1, 95% CI = 0.8 to 1.5)⁴ or with visiting the primary care doctor in the previous month (OR = 2.5, 95% CI = 0.2 to 28.8).⁵³

Effect of study design. There were no significant differences between pooled estimates for group 1 and group 2 studies for the following factors associated with suicide: male gender, black race/ethnicity, being married, educational level, remand status, and murder/manslaughter offense. There were significant differences for white race/ethnicity (group 1 studies: OR = 3.0, 95% CI = 2.2 to 3.9 vs. group 2 studies: OR = 1.6, 95% CI = 1.4 to 1.8; $\chi^2 = 15.6$, $df = 1$, $p < .001$) and violent offenses (group 1 studies: OR = 10.8, 95% CI = 6.0 to 19.4 vs. group 2 studies: OR = 2.4, 95% CI = 1.5 to 3.7; $\chi^2 = 16.2$, $df = 1$, $p < .001$). We investigated the effect of the type of publica-

tion (gray literature vs. peer-reviewed journal) for 3 risk factors: gender, detainee/remand status, and white race/ethnicity. For gender, there was a significant difference between the estimates pooled from reports in the gray literature and those from peer-reviewed literature: in the gray literature, the OR for male gender was 0.6 (95% CI = 0.3 to 1.1), while in the peer-reviewed studies it was 2.4 (95% CI = 1.7 to 3.2) ($\chi^2 = 12.8$, $df = 1$, $p < .001$). For white race/ethnicity, the OR was 1.4 (95% CI = 0.9 to 2.0) in the gray literature, compared with 1.8 (95% CI = 1.6 to 2.1) in the peer-reviewed studies ($\chi^2 = 2.1$, $df = 1$, $p = .15$). For detainee/remand status, there was no difference between the groups ($\chi^2 = 0.6$, $df = 1$, $p = .43$).

DISCUSSION

In this systematic review, we have examined demographic, criminological, and clinical factors associated with suicide in prisoners. Thirty-four studies from 12 countries comprising 4780 suicides were included. The strongest associations with suicide were recent suicidal ideation, being accommodated in a single cell, a history of attempted suicide, evidence of mental disorder, and detainee or remand status.

With the reduction of prison suicides being a target in the United States' *National Strategy for Suicide Prevention*¹⁰ and in England's *National Suicide Prevention Strategy for England*,¹¹ as well as featuring in strategies in other countries,^{10,60} these findings have potentially important implications. The first is that some factors associated with suicide in prisoners differ from those associated with suicide in the general population. Although being married is associated with lower risk in the general population,⁶¹ this review suggests that this may not be the case in prisoners. A likely explanation is that loss of important social connections may increase vulnerability to suicide in prisoners, although this may apply only to sentenced prisoners.⁶² This possibility is supported by the finding from

1 study that receiving visits while incarcerated was inversely associated with risk of suicide.¹⁵ Such differences in factors associated with suicide between prisoners and the general population, together with the unique environmental and criminological influences in prisoners, highlight the need for prison suicide prevention strategies to be based on appropriate evidence.

A second implication is that there appear to be associations between suicide in prisoners and potentially modifiable institutional and clinical risk factors. Although these factors have been examined in relatively few studies, there is a strong association between being accommodated in a single cell and self-inflicted deaths, although this may be confounded by mental illness (prisoners with psychiatric diagnoses may be placed in single cells because of disturbed behavior). The use of shared accommodation for those thought to be vulnerable is an important prevention strategy.⁶³ Clinical interventions for those with alcohol use problems and mental illnesses should also be given priority.⁶⁴⁻⁶⁶

Methodological Issues

One of the strengths of this review is that it included 9 studies with 1074 suicides (22% of the total number of suicides) published in the gray literature. This fact highlights the importance in reviews of forensic mental health issues to incorporate search strategies that aim to include this material. We examined whether there was a trend for the gray literature to report higher or lower effect sizes than the studies published in peer-reviewed journals. We were able to investigate 3 factors, for which there was uncertainty in previous reviews, and found that for male gender, the reports in the gray literature reported significantly lower effect sizes, and for white race/ethnicity, there was a nonsignificant trend in a similar direction. There was no difference for detainee/remand status by publication type. Therefore, at least for some associated factors, gray literature appears to report lower effect sizes, and this finding underlines the importance of including gray literature in reviews of observational or intervention studies in the field of forensic psychiatry.

A number of variables associated with suicide demonstrated significant heterogeneity in their risk estimates, and their pooled estimates reported in this study must be interpreted with caution. The heterogeneity might be expected because of the differing nature of prison regimes, environments, and sentencing policies. Most of the suicide cases in this review were from the United States and the United Kingdom, which potentially limits the generalizability of the data. However, there was no evidence that risk estimates were different when comparing studies based in English-speaking countries with those from other countries. The heterogeneity reported in this review may also be a product of confounding and selection biases that we were unable to test without individual participant data.

We explored some of these differences by subgroup analysis and meta-regression. In those investigations that reported on current psychiatric diagnosis, we found that 1 study with a high rate of previous deliberate self-harm yielded a higher risk estimate. This finding suggests that the combination of these 2 factors, psychiatric disorder and previous deliberate self-harm, is particularly important in increasing risk of suicide, a finding consistent with a study of deliberate self-harm in the community.⁶⁷ In the case of those charged with or convicted of murder/manslaughter, those studies with a high proportion of white prisoners were associated with a greater risk of suicide.

Limitations and Potential Biases

Problems inherent in studies of suicide may affect the validity of our results. Several authors have commented on the problems of suicide registration and classification.^{2,68,69} In our review, cases were variously classified as completed suicides with or without inclusion of open verdict cases. Some studies relied on case registers, while other sought verification from death certificates. All the included studies were retrospective in design, usually indicating they were subject to incomplete recording of previous events. This was particularly the case with clinical variables. There was inconsistency of diagnostic measures and reporting of psychosocial variables such as bullying and history of childhood trauma, the latter being reported in a moderate or severe form in 50% of prisoners in 1 recent study.⁷⁰ Another important example is drug abuse, for which pooling of data was not possible because of the various classifications used. Nevertheless, a number of reports have found strong associations between drug abuse and prison suicide,¹⁶ particularly in remand prisoners.⁵⁹ Prospective cohort studies are a more reliable way of investigating a relationship between potential risk factors and prison suicide. However, as suicide is a statistically rare event, the numbers needed for such a study would be infeasibly large. An alternative design, that of interviewing prisoners with near-lethal suicide attempts, is likely to overcome some of the problems with the retrospective data reported here.^{71,72} This approach would address another limitation in this review, the lack of information on factors associated with suicide in female prisoners, which may be partly due to the relative rarity of suicide in women prisoners. One case series reporting on 13 female deaths found that 73% were located in a single cell, all had histories of alcohol and drug abuse, and the majority of deaths occurred in women who were unsentenced and had mental health problems.²⁷ Most of the reports included in this review pooled data for detainees and sentenced prisoners. It remains uncertain whether associations with suicide vary by custodial status, although there is little evidence for such differences from the 1 study that reported them.¹⁵

Studies also varied with regard to control group populations, with randomly selected or matched control groups, annual average prison population, average daily prison population, and total prison population being variously used. Some researchers have commented on the advantages and disadvantages of these population measures,⁴⁹ although they are unlikely to alter the estimation of risk estimates. Our decision to combine these various designs appeared to have been justified—we found little evidence of differences in risk estimates based on study design apart from 2 risk factors, white race/ethnicity and violent offenses, for which the direction of the association was similar but the strength was different (with the better designed studies demonstrating increased effect sizes).

The nature of our review also precluded investigation of institutional variables such as size of institution, availability of purposeful activity, and overcrowding. Studies looking at such variables have found a negative association between prison suicide and purposeful activity⁷³ and per capita expenditure.⁷⁴

CONCLUSION

This study has highlighted demographic, criminological, and clinical risk factors that can be used to improve suicide screening and prevention programs in prisons. Such interventions should include better identification and treatment of mental illnesses and alcohol use problems and avoidance of placing those prisoners at high risk, especially those with mental disorders and a history of suicide attempts, in single accommodation.

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Appendix 1 appears on pages 1730–1731.

Appendix 1. Characteristics of the Included Studies Reporting on Risk Factors Associated With Suicide in Prison

Author, Date, and Country of Study	Time Period	Population Studied	Control Group	Cases, N	Controls, N ^a
Group 1 studies (used a randomly selected or matched control group)					
Blaauw et al (2005) ¹⁴ The Netherlands	1987–1998	Detained and sentenced prisoners in the penal system (including jails, prisons, and 10 treatment institutions)	Randomly selected from inmates in 10 jails for adults	95	247
Bourgoin (1993) ⁵⁶ France	1990–1992	Pretrial and sentenced prisoners in all prisons	Randomly selected from the national prison dossier of all those imprisoned on French territory	179	360
Dahle et al (2005) ⁵⁹ Germany	1991–2000	Pretrial detainees in a Berlin prison	Matched by same date of reception into the same prison	30	30
Fruehwald et al (2004) ¹⁵ Austria	1975–1999	Pretrial, sentenced, or mentally disordered prisoners in all 29 correctional institutions	Two matched controls per case (matched for age, gender, nationality, institution, and custodial status)	220 ^b	440
Kerkhof and Bernasco (1990) ⁵³ The Netherlands	1973–1984	Detained or sentenced prisoners in the prison system	Randomly selected from the prison and jail population	44	54
Lupe (1981) ³⁸ United States	1977–1979	Detainees in Oklahoma state jails	For each case, a control was selected from the last prisoner released prior to the day of suicide	21	21
Phillips (1986) ⁴⁶ United Kingdom	1973–1983	Male prisoners in a London prison (Brixton)	One in 200 sample of nominal index cards from prison population, from 1975 onward	34	214
Winter (2003) ⁴³ United States	1980–1998	Detained or sentenced prisoners in a county jail in a Midwestern state	Random sample of prisoners admitted to 5 county jails	103	104
Group 2 studies (used total or average prison population from a matched time period)					
Anno (1985) ³⁴ United States	1980–1985	All prisoners in the Texas department of corrections	Average daily department of corrections prison population	38	ADP
Backett (1987) ⁵⁴ Scotland	1970–1982	Remand and sentenced prisoners	Total prison population	33	TPP
Bogue and Power (1995) ⁵⁵ Scotland	1976–1993	All prisoners	Average daily prison population in 1976–1979 and 1980–1983	83	TPP
Crighton and Towl (1997) ⁴⁴ England and Wales	1988–1990 and 1994–1995	Remand and sentenced prisoners	Average daily prison population	197	ADP
Denoon (1984) ⁵⁰ Canada	1970–1980	Remand and sentenced prisoners in British Columbia correctional facilities	Total prison population	35	TPP
Dooley (1990) ⁶ England and Wales	1972–1987	Prisoners in all prisons (including remand and youth custody centers)	Average annual prison population of England and Wales	295	AAP
DuRand et al (1995) ⁷ United States	1967–1992	Prisoners in a large (1700-bed) jail in Detroit	Four census counts of total prison population	37	TPP
Frickey (1999) ³⁵ United States	1993–1997	Remand and sentenced prisoners in federal prisons	Total US prison population in 1997	61	TPP
Fruehwald et al (2000) ⁴ Austria	1975–1997	Remand and sentenced prisoners in all correctional facilities	Average daily prison population	220	ADP
Hatty and Walker (1986) ⁵¹ Australia	1980–1985	All prisoners	Total prison population	77	TPP
Hayes (1989) ² United States	1979–1986	Detainees in all county jails and city and police department lockups	Jail inmate profile in 1983	854	JIP
Hurley (1989) ⁵² Australia	1973–1987	Remand and sentenced prisoners in Brisbane	Annual average prison population	20	AAP
Kovaszny et al (2004) ³⁷ United States	1993–1999	All prisoners in New York State prisons	Total prison population	76	TPP

(continued)

Appendix 1 (continued). Characteristics of the Included Studies Reporting on Risk Factors Associated With Suicide in Prison

Author, Date, and Country of Study	Time Period	Population Studied	Control Group	Cases, N	Controls, N
Group 2 studies (used total or average prison population from a matched time period)					
Laishes (1997) ³ Canada	1992–1996	All prisoners in federal institutions	Total prison population in 1994	66	TPP
New York State Medical Review Board (1998) ³⁹ United States	1993–1997	All prisoners in state correctional facilities in New York	Total prison population	50	TPP
National Association for the Care and Resettlement of Offenders (1990) ⁴⁵ England and Wales	1980–1989	Remand and sentenced prisoners	Average daily prison population of England and Wales	242	ADP
Safer Custody Group (2005) ⁴⁸ England and Wales	2004–2005	Remand and sentenced prisoners	Total prison population of England and Wales	85	TPP
Safer Custody Group (2007) ⁴⁷ England and Wales	1999–2004	Remand and sentenced prisoners	Total prison population	442	TPP
Salive et al (1989) ⁴¹ United States	1979–1987	Maryland prison system, Baltimore—prisoners convicted and sentenced to ≥ 1 year of detention	Census of total prison population	37	TPP
Snow et al (2002) ⁴⁹ England and Wales	1996–2001	All prisoners	Total prison population	451	AAP
Tatarelli et al (1999) ⁵⁷ Italy	1996–1997	All prisoners	Total prison population 1996–1997	100	TPP
Towl and Crighton (1998) ¹⁹ England and Wales	1988–1995	All prisoners	Total prison population	377	ADP
White et al (2002) ⁴² United States	1993–1997	All remand and sentenced prisoners in all federal prisons	Total prison population	62	TPP
He et al (2001) ³⁶ United States	1996–1997	Prisoners in 20 of 107 institutional division prison units of the Texas criminal justice system	Total prison population	25	TPP
Stegg and Cox (1993) ⁸⁵ New Zealand	1973–1988	Remanded and sentenced prisoners received in all prisons	Total prison population receptions	39	TPP receptions ^c
Novick and Remmlinger (1978) ⁴⁰ United States	1971–1976	Prisoners in New York City correctional facilities	1420 admissions to correctional facilities in 1975	52	New admissions

^aFor group 2 studies, the control group was the rest of the prison population (variously defined—see below). In the analysis, the size of the control group was calculated to be proportional to that of the case group in order to avoid bias toward group 2 studies.

^bThe number of suicides contributing to some of the risk estimates is less than the total number reported in this study due to missing data.

^cReceptions equal the number of prisoners entering prison.

Abbreviations: AAP = average annual prison population (population at a predefined date in the year), ADP = average daily prison population (mean prison population), JIP = jail inmate profile, TPP = total prison population (total population at specific timepoint [time of study]).