

Prevalence and risk factors for suicide attempts in prison

Louis Favril^{a*}, Jenny Shaw^b, Seena Fazel^c

^a Faculty of Law and Criminology, Ghent University, Belgium

^b Division of Psychology and Mental Health, University of Manchester, UK

^c Department of Psychiatry, University of Oxford, UK

* Corresponding author. Email: louis.favril@ugent.be

ABSTRACT

Suicidal behaviour represents a substantial burden of morbidity and mortality in prisons worldwide. We aimed to synthesise the evidence on prevalence and risk factors for suicide attempts during incarceration. In this systematic review and meta-analysis, we searched four bibliographic databases for studies (published up to May 31, 2022) reporting on adults sampled from the general prison population who attempted suicide while incarcerated and an unselected comparison group. A total of 20 studies comprising 19,882 individuals (6.5% women) in 20 countries were eligible for inclusion. The pooled prevalence of suicide attempts during incarceration was 8.6% (95% CI 6.1–11.2) in men and 12.2% (95% CI 7.1–17.2) in women. Across all 36 risk factors studied, the strongest associations were found for suicidal ideation, previous self-harm, and markers of psychiatric morbidity. Prison-related risk factors included solitary confinement, victimisation, and poor social support while incarcerated. Sensitivity analyses indicate that risk factors for near-lethal suicide attempts are similar to those for suicide attempts more generally. In addition to providing a synthesis of previous work, our systematic review highlights several key limitations of the extant literature, which provide directions for future research.

1. INTRODUCTION

Suicidal behaviour is a global public health concern that disproportionately affects the most vulnerable members of society, including people who experience incarceration (Favril, 2021). Epidemiological studies indicate that one in five (19–22%) prisoners have attempted suicide at some point in their lives (Favril *et al.*, 2020a; Favril & O'Connor, 2021; Jenkins *et al.*, 2005; Khezri *et al.*, 2022; Larney *et al.*, 2012), which greatly exceeds the 3% lifetime prevalence among adults in the general population (Castillejos *et al.*, 2021; Nock *et al.*, 2008). Half of people who die by suicide in prison have previously attempted to do so, which increases the odds of suicide eight-fold (Zhong *et al.*, 2021). In addition to being one of the strongest predictors of suicide, a suicide attempt represents an important health concern in its own right—indicative of distress and associated with long-term psychosocial impairment (Goldman-Mellor *et al.*, 2014; Orri *et al.*, 2022). Comprehensive knowledge of what factors may increase risk of suicide attempts in prison can inform prevention efforts to reduce morbidity and mortality in this high-risk population. Although research has identified a wide range of individual and environmental risk factors, findings are inconsistent across primary studies. Previous systematic reviews (Lohner & Konrad, 2007; Marzano *et al.*, 2016) have narratively summarised the literature (**Table S1**) but lacked quantitative methods to evaluate the strength and consistency of the available evidence. Meta-analysis can overcome this limitation by accounting for methodological variations across the literature and providing pooled estimates of effect sizes. One meta-analysis reported on the association between childhood maltreatment and suicide attempts among 16,586 people involved in the criminal justice system, but this review included juvenile offenders, non-prisoners, and outcomes in the community (Angelakis *et al.*, 2020). Another meta-analysis, covering more than half a million adults, examined 40 risk factors for in-prison self-harm regardless of intent or underlying motive (Favril *et al.*, 2020b). Whilst this latter review was the first ever to quantitatively synthesise the overall evidence on risk factors among people in prison, it combined data for self-harm with and without suicidal intent. As there is evidence in the general population that suicidal and non-suicidal self-harm can be differentiated in terms of prevalence, predictors, and outcomes (Hamza *et al.*, 2012; Mars *et al.*, 2014a, 2014b; Muehlenkamp, 2014), in this review we specifically focus on suicide attempts (defined as non-fatal self-injurious behaviour with inferred or actual intent to die; Favril, 2021). In

addition, we aimed to examine the prevalence of suicide attempts during incarceration to map the scale of this health concern, which to our knowledge has not been done before. Findings could inform resource allocation and service development, and allow researchers to consider evidence gaps.

2. METHODS

This systematic review and meta-analysis was conducted in accordance with the Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) guidelines (Page *et al.*, 2021). The study protocol was pre-registered with PROSPERO, number CRD42018087915.

2.1 Search strategy

Our literature search was conducted as part of a broader systematic review and meta-analysis on risk factors for self-harm in prisons, in which we aggregated non-suicidal self-injury and suicide attempts into a single outcome (Favril *et al.*, 2020b). Four bibliographic databases (Web of Science, PubMed, Embase, and PsycINFO) were searched for primary studies published from database inception to October 31, 2019. Title, abstract, and keyword searches were conducted using terms that were inclusive of suicide (self-harm* OR suicid* OR attempt* OR NSSI OR self-injur* OR self-mutilat* OR self-destruct* OR poison* OR overdose) AND prison (inmate* OR penal OR correction* OR sentence* OR remand OR detainee* OR felon* OR incarcerat* OR prison*). No language restrictions were set. Electronic database searches were supplemented by hand-searching citations and reference lists of relevant articles and previous systematic reviews (Angelakis *et al.*, 2020; Lohner & Konrad, 2007; Marzano *et al.*, 2016). Targeted searches were also conducted to identify additional studies by first author names, and experts were contacted for any unpublished or ongoing investigations. Our initial search was updated (using the same keywords and databases) to identify new studies published up to May 31, 2022, which yielded an additional four investigations that were eligible for inclusion (Caravaca-Sanchez *et al.*, 2021; Carvalho *et al.*, 2021; Ford *et al.*, 2020; Howard & Wakeling, 2020).

2.2 Study eligibility

Publications were included if they met five eligibility criteria, which required that the study (1) had a quantitative observational (cross-sectional, case-control, or cohort) design, (2) collected individual-level data in general prison populations (remand and/or sentenced), (3) included predominantly (> 90%) adults, (4) examined suicide attempt inside prison as the outcome variable, and (5) provided data on an unselected comparison or control group of people who did not attempt suicide while in prison. Accordingly, we excluded studies (1) that provided no original data (such as reviews), (2) with qualitative, ecological, and case designs, (3) reporting on a lifetime history of suicide attempt or outcomes other than suicide attempt (e.g., suicide, suicide risk, suicidal ideation, self-harm, and non-suicidal self-injury), (4) targeting specific subgroups (e.g., sex offenders and clinical samples), and (5) without an appropriate comparison group (e.g., individuals who died by suicide) or not based on a general prison population.

We contacted authors of studies that collected data on suicide attempts in prison but did not provide information required for meta-analysis, including those that only reported prevalence (Dudeck *et al.*, 2011), analysed self-injury (Carvalho *et al.*, 2021) or a lifetime history of suicide attempt among prisoners with suicidal ideation (Favril & O'Connor, 2021; Larney *et al.*, 2012), and adopted a cluster analytical approach (Bani *et al.*, 2019). These five studies ($n = 4969$) were retained after the necessary unpublished data (associations with in-prison suicide attempts in the overall sample) were obtained from the study authors. Additional data on risk factors were also provided (upon request) by authors of two other studies (Ford *et al.*, 2020; Howard & Wakeling, 2020).

2.3 Data extraction

Data on prevalence, risk factors, and study characteristics were independently extracted by two researchers using a standardised form. Extraction sheets were cross-checked for consistency and any discordance was resolved by discussion between study authors. Corresponding authors were contacted for clarification when reported methodological details were unclear. To avoid duplication of samples, information on prevalence and risk factors was extracted only from the most comprehensive study when multiple publications

from the same study population were available. Data from overlapping publications were only extracted when a new risk factor was reported.

Prevalence data by sex were extracted from crude proportions reported in all studies, except for those with a case-control design. By their very nature, case-control studies are not appropriate to estimate prevalence as cases are matched to controls (e.g., 50% if matched 1:1). As the reporting of effect sizes varied between studies, data were converted into a common metric for the purposes of pooling and to enable comparisons across risk factors. Because all studies reported a dichotomous (yes or no) outcome, odds ratios (ORs) were selected as the preferred effect size across analyses. ORs and corresponding 95% confidence intervals (CI) were extracted as reported or calculated from raw prevalence data available in the paper (e.g., 2x2 contingency tables). Data were extracted from the least adjusted (mostly crude) model in order to maintain a consistent measure across studies.

2.4 Categorisation

Risk factors and outcomes were categorised after the data extraction. Consistent with prior reviews (**Table S1**), risk factors were grouped into five domains: sociodemographic, criminological, custodial, clinical, and historical. Regarding outcome, four studies reported in seven articles (Marzano *et al.*, 2010, 2011; Rivlin *et al.*, 2010, 2013; Sanchez *et al.*, 2018, 2019, 2021) examined *near-lethal* suicide attempts, defined as acts that could have been lethal had it not been for intervention or chance, involved methods that are associated with a reasonably high chance of death, or both (Marzano *et al.*, 2016). We included this outcome in our analysis since the other studies did not differentiate according to lethality of outcome, and may thus also include near-lethal attempts. However, sensitivity and meta-regression analyses were conducted to examine potential differences in associations by outcome.

2.5 Quality appraisal

The Newcastle-Ottawa Scale (NOS) was used to evaluate risk of bias (Wells *et al.*, 2014). The NOS assesses study quality in terms of selection of study groups (representativeness and sample size), comparability between groups, and ascertainment of exposure or outcome. The summary score categorised studies as being of low, moderate, or high quality.

2.6 Statistical analyses

In order to obtain a reliable estimate of pooled effect sizes, analyses were conducted only for risk factors examined in at least three distinct samples (Favril *et al.*, 2020b). Associations reported in only one or two studies were summarised using narrative synthesis (Campbell *et al.*, 2020). We aimed to examine risk factors for men and women separately. Meta-analysis was conducted in Stata IC (version 13) using the *metan* command, which generated a pooled OR and 95% CI for each risk factor. The *metaprop* command was used to calculate pooled prevalence estimates of attempted suicide in prison, stratified by sex. Random-effects models were used for all analyses to account for the anticipated heterogeneity between studies. Heterogeneity was estimated using the I^2 statistic, which specifies the percentage of variation in effect sizes underlying the different studies (Higgins *et al.*, 2003). Following Cochrane guidelines (Higgins *et al.*, 2019), I^2 values were considered to indicate low (0–40%), moderate (30–60%), substantial (50–90%), and considerable (75–100%) heterogeneity. Univariate meta-regression analyses (using the *metareg* command) were conducted to explore four possible sources of between-study heterogeneity for all risk factors: sample size ($n < \text{median} = 0$, $n > \text{median} = 1$), outcome (suicide attempt = 0, near-lethal suicide attempt = 1), inclusion of women in the sample (no = 0, yes = 1), and study design (case-control and cohort = 0, cross-sectional = 1). Since all (and only) cross-sectional studies relied on self-report of suicide attempts, the latter analysis is also applicable to examine the influence of outcome assessment on risk estimates (incident and record-based = 0, self-report = 1). The presence of publication bias was examined by visual inspection of funnel plots (Duval & Tweedie, 2000) and by applying Egger's (1997) test for risk factors examined in at least ten studies (Higgins *et al.*, 2019).

3. RESULTS

3.1 Study characteristics

The systematic literature search yielded 7436 unique records for screening, of which 454 full-text reports were examined for eligibility (**Figure S1**). Sixteen studies met our inclusion criteria, and an additional four were identified through the updated search, resulting in a total of 20 unique studies (reported in 23 publications).

The combined sample comprised 19,822 people in prison (1291 [6.5%] women), of whom 2922 (14.7%) had attempted suicide while incarcerated. Key characteristics of the studies are detailed in **Table 1**. Studies included data from 20 countries (16 [80%] in Europe) and were published over a 50-year period (1972–2021). Sample sizes ranged from 60 to 6947 individuals, with a median of 438 (IQR 150–1258). Eleven (55%) studies exclusively included men and three (15%) only women. Of the six studies with mixed-sex samples (mean proportion of women = 10%, range 3–20%), only one reported data disaggregated by sex. Most studies had a cross-sectional ($k = 11$) or case-control ($k = 8$) design, and there was one cohort study. Outcomes were assessed by retrospective self-report in all cross-sectional studies. Only one prospective study was identified, which had a case-control design. The other case-control studies either retrospectively examined official records (mostly medical files) of people who had attempted suicide ($k = 4$) or identified cases following an attempt who were interviewed within one month following the incident ($k = 3$).

3.2 Study quality

Each study was evaluated using the NOS quality assessment criteria. Of nine possible points, the median score for case-control and cohort studies was 6 (IQR 5–8). Risk of bias (less than 7 points) was found in 62.5% of case-control studies, with key limitations including case definition without independent validation and ascertainment of exposure. Of eight possible points, the median score for cross-sectional studies was 6 (IQR 5–6), none of which met full criteria (range 3–6). Overall, most studies were judged to be of moderate (55%) and high (35%) quality, with two studies categorised as being of low methodological quality (**Table 1**).

3.3 Prevalence estimates

Based on 10 cross-sectional studies with a combined sample of 12,262 male and 1097 female participants ($n = 13,359$ in total), the pooled prevalence of suicide attempts during incarceration was 8.6% (95% CI 6.1–11.2; $I^2 = 96\%$) in men, 12.2% (95% CI 7.1–17.2; $I^2 = 86\%$) in women, and 9.7% (95% CI 7.5–11.9; $I^2 = 94\%$) overall (**Figure 1**). The study by Sanchez *et al.* (2018) was considered an outlier and thus was excluded from this analysis, because it reported a prevalence of 27.1% (95% CI 25.3–29.0) for near-lethal suicide attempts in men

(possibly due to selective participation and outcome measurement error). There was insufficient data to examine prevalence for different timeframes (e.g., past-year) or by time served in prison because most studies only assessed incidents occurring *at some point* during the course of imprisonment, without further details. However, one cohort study reported a 12-month prevalence of 2.0% (95% CI 1.4–2.9) among 1406 men (Bani *et al.*, 2019).

For men and women combined, we recorded a lower prevalence in high quality studies (7.4%, 95% CI 4.9–9.9; $I^2 = 88\%$) compared to studies of moderate or low quality (12.1%, 95% CI 7.5–16.7; $I^2 = 97\%$). The limited number of samples precluded further analyses by geographical region and custodial status. In terms of outcome, excluding the single study that examined near-lethal attempts (8.7% in men; Sanchez *et al.*, 2019, 2021) did not materially alter the estimates, with a corresponding pooled prevalence of 8.6% (95% CI 5.8–11.4; $I^2 = 96\%$) in men and 9.8% (95% CI 7.5–12.2; $I^2 = 94\%$) overall.

3.4 Risk estimates

A summary of the 36 variables that were identified in at least three independent samples is presented in **Table 2**, categorised by risk factor domain and ranked in order of effect size. The 15 leading risk factors (characterised by $OR \geq 3$) across domains are shown in **Figure 2**.

We found overall small effect sizes for sociodemographic factors. Risk factors within this domain were unemployment before prison, low educational attainment, and single marital status (OR range 1.34–1.58). Age, sex, and ethnicity were not significantly related to attempted suicide while incarcerated. For criminological factors, violent offending (OR = 1.59, 95% CI 1.22–2.07) and a prior incarceration (OR = 1.57, 95% CI 1.12–2.19) showed positive albeit weak associations, with a 60% increase in the odds of in-prison suicide attempts. In terms of sentence length, serving a sentence of five years and over (*vs.* less than five years) and a life sentence (*vs.* determinate sentences) both increased the odds by factor 2.

Clinical factors had strong associations with suicide attempts in prison. A history of suicidal ideation was the strongest of all risk factors across domains (OR = 16.28, 95% CI 8.18–32.43). Having previously attempted suicide (OR = 5.95, 95% CI 3.17–11.16) and a lifetime history of non-suicidal self-injury (OR = 6.16, 95% CI 4.98–7.62) were both associated with a six-fold increase in the odds of suicide attempts in prison. Combining suicide attempt and non-suicidal self-injury into a composite measure (a history of self-harm) showed an

equally strong association (OR = 5.92, 95% CI 4.18–8.38). Similar large effects were observed for any (current or historical) psychiatric diagnosis (OR = 4.97, 95% CI 3.58–6.89) and psychological distress in prison (OR = 5.65, 95% CI 2.79–11.46). Treatment-related factors were also strongly associated with suicide attempt, including being prescribed psychotropic medication in prison. Other significant risk factors within this domain were high impulsivity, physical health problems, and drug abuse—but not alcohol abuse.

Several custodial factors were significantly associated with in-prison suicide attempts. Strong associations were found for solitary confinement (OR = 5.00, 95% CI 1.76–14.21), physical or sexual victimisation (OR = 3.86, 95% CI 2.18–6.82), and poor social support (OR = 2.94, 95% CI 1.47–5.90) during imprisonment. Being threatened with violence, disciplinary infractions, not working in prison, and a lack of social contacts or visits were moderately associated with suicide attempts, with effect sizes clustered around 2.

All historical life events studied were significant risk factors for suicide attempt in prison. Childhood sexual (OR = 3.57, 95% CI 2.19–5.82), physical (OR = 3.02, 95% CI 1.77–5.17), and emotional (OR = 3.00, 95% CI 1.85–4.86) abuse showed strong associations, as did a family history of suicide (OR = 3.04, 95% CI 1.42–6.49).

3.5 Sensitivity analyses

Potential differences in risk factors for near-lethal suicide attempts versus suicide attempts were examined in sensitivity analyses. We identified 10 risk factors which had at least three effect sizes for both outcomes. In terms of magnitude, risk factor estimates were comparable to those found in the main analysis, and were largely similar for near-lethal suicide attempts (OR range 1.26–2.76) and suicide attempts (OR range 1.31–1.84), with overlapping confidence intervals (**Table S2**). These findings should, however, be interpreted with caution for two reasons. First, it was not possible to include data on 26 (72%) of all 36 risk factors identified in the main analysis as these were examined in fewer than three studies for both outcomes. Second, we were unable to account for the possible overlap between both outcome groups because the studies that examined suicide attempts in general may have included near-lethal attempts as well, thereby masking potential differences in risk factors between outcomes.

Additional sensitivity analyses suggest that risk estimates did not materially change (both in terms of significance and magnitude of effects) when low-quality studies were

excluded from the analysis. Our aim was to examine risk factors for men and women separately in subgroup analyses. However, since too few studies provided data for women, delineating risk factors stratified by sex was not possible.

3.6 Publication bias

Publication bias was examined for all risk factors where the analyses were based on at least 10 unique samples (i.e., single marital status, remand status, violent offending, and drug abuse). Neither visual inspection of asymmetry in funnel plots nor Egger's test (all $p \geq 0.341$) provided clear evidence of publication bias. *Post hoc* analyses were further conducted for the leading risk factors within each domain (i.e., unemployment, sentenced for 5 years or more, suicidal ideation, solitary confinement, and childhood sexual abuse), which again found no indication of publication bias (all $p \geq 0.062$).

3.7 Meta-regression

Four methodological characteristics (sample size, outcome, inclusion of women, and study design) were examined as possible sources of between-study heterogeneity in risk estimates (**Table S3**). Sample size was significantly associated with heterogeneity in meta-regression for custodial status ($B = -1.10, p = 0.031$) and psychological distress ($B = -1.51, p = 0.033$), in that larger studies ($n > 438$) found a weaker effect for these variables relative to studies with smaller samples ($n < 438$). Regarding outcome, psychological distress ($B = 1.71, p = 0.036$) and psychotropic medication ($B = 1.40, p = 0.014$) had stronger associations with near-lethal suicide attempts compared to suicide attempts. The inclusion of women was a moderator only for the relationship between suicide attempts and a sentence of one year or more ($B = 1.29, p = 0.018$), with samples including women showing a stronger effect than male-only samples. Regarding study design, meta-regression suggests that case-control and cohort studies found larger effect sizes for young age ($B = -1.29, p = 0.046$), psychological distress ($B = -1.51, p = 0.032$), and lack of social contacts or visits ($B = -0.70, p = 0.039$) compared with cross-sectional studies. In parallel, studies relying on a self-report measure of suicide attempts found weaker associations for these three variables relative to studies with incident or record-based data.

3.8 Narrative synthesis

Our quantitative summary of the literature pooled effect sizes of risk factors reported in at least three independent samples. However, in our systematic review we additionally identified several other risk factors that were reported infrequently ($k \leq 2$) and were therefore more suitable for narrative synthesis.

3.8.1 Personality traits

Based on the Temperament and Character Inventory, Godet-Mardirossian *et al.* (2011) found that low levels of self-directedness, cooperativeness, transcendence, and affective stability were associated with suicide attempts among 899 men in France. Regarding temperament variables, high scores for novelty seeking and harm avoidance were both associated with increased odds of suicide attempt, but reward dependence was not. Similarly, two case-control studies (Marzano *et al.*, 2011; Rivlin *et al.*, 2013) found higher levels of aggression and hostility, and lower levels of self-esteem, in cases compared with matched controls.

3.8.2 Previous self-harm

Two studies examined previous self-harm (irrespective of suicidal intent) as a risk factor for near-lethal suicide attempts in custody. In men (Rivlin *et al.*, 2010), attempted suicide while incarcerated was significantly associated with a history of self-harm in prison (OR = 23.7, 95% CI 8.2–68.9) and outside prison (OR = 3.3, 95% CI 1.5–7.2). Among incarcerated women (Marzano *et al.*, 2010), cases were more likely than controls to have self-harmed in prison (OR = 48.1, 95% CI 15.6–148.3) and outside prison (OR = 21.7, 95% CI 6.9–68.0). Together, findings from these two studies suggest that self-harm occurring in prison is a stronger risk factor for suicide attempts than self-harm prior to prison, and that such risk is especially pronounced among women compared with men.

3.8.3 Psychiatric disorders

While the current meta-analysis identified psychiatric diagnoses overall (current or historical) as a risk factor for suicide attempts in prison, there was insufficient data to

examine associations by specific diagnoses. Case-control studies in men (Rivlin *et al.*, 2010) and women (Marzano *et al.*, 2010) indicate that most current psychiatric disorders (assessed by the Mini International Neuropsychiatric Interview) were associated with suicide attempts in prison—especially depression, psychosis, and anxiety disorders (including posttraumatic stress disorder). Drug use disorder was associated with suicide attempts in men but not in women. For both sexes, comorbidity further compounded risk. Although cases were more likely than controls to meet diagnostic criteria for alcohol use disorder and antisocial personality disorder, this difference was not significant in both men and women. Anorexia and bulimia nervosa were also not associated with suicide attempts, although these case-control studies may have been underpowered to detect an effect given the low prevalence of eating disorders in prison populations (Marzano *et al.*, 2010; Rivlin *et al.*, 2010).

3.8.4 Prison-related factors

Day-to-day experiences of incarceration appear to be significantly more negative among cases than controls, particularly in relation to bullying and difficulties with staff (Liebling & Krarup, 1993; Marzano *et al.*, 2011; Rivlin *et al.*, 2013). People in prison who attempted suicide were less likely to be engaged in purposeful activities and have more problems with living conditions (Encrenaz *et al.*, 2014; Liebling & Krarup, 1993). Unpublished data of 1326 adults in Belgian prisons indicate that positive perceptions of autonomy, safety, and relationships with staff (as measured by the Measuring the Quality of Prison Life questionnaire) are negatively associated with risk of suicide attempt (Favril & O'Connor, 2021; Favril *et al.*, 2017). Similarly, among 6947 participants in England and Wales, experiencing treatment by prison staff to be 'procedurally just' was found to decrease the likelihood of attempting suicide in men, but not in women (Howard & Wakeling, 2020).

In two studies examining near-lethal attempts, cases were found to have spent less time in custody or in their current prison than controls (Marzano *et al.*, 2011; Rivlin *et al.*, 2013). In contrast, cross-sectional studies yielded a non-significant (Sanchez *et al.*, 2018) or positive (Encrenaz *et al.*, 2014) association between time spent in prison and risk of suicide attempt. This discrepancy might be attributable to differences in study design (case-control *vs.* cross-sectional), varying cut-offs (e.g., 30 days *vs.* 12 months), and sample characteristics (e.g., people on remand only).

Among 1462 men in Canada, placement in higher (compared to lower) security facilities at intake increased the risk of suicide attempt (Wichmann *et al.*, 2000). In this study, violence perpetration inside prison was also associated with having attempted suicide (Wichmann *et al.*, 2000), although another study suggests that this relationship may be confounded by in-prison victimisation (Encrenaz *et al.*, 2014).

4. DISCUSSION

Drawing on evidence published in the past 50 years, we have synthesised data on 19,822 adults incarcerated across 20 countries. Our review shows that suicide attempts are considerably more common among people in prison compared with the general population. One in ten (9.7%) individuals attempted suicide at some point during their incarceration, which is three times the *lifetime* prevalence (3%) among adults living in the community (Castillejos *et al.*, 2021; Nock *et al.*, 2008). Women (12.2%) had a higher prevalence of in-prison suicide attempts than men (8.6%), but this sex difference was not significant. These data highlight the substantial burden of suicide attempts in prison populations, which is important given its strong association with suicide mortality during imprisonment (Zhong *et al.*, 2021) and post-release (Haglund *et al.*, 2014).

Across the 36 risk factors under study, the largest effect sizes were found within the clinical domain—especially for suicidal ideation, previous self-harm, and markers of psychiatric morbidity (**Figure 2**). This relative importance of risk factors across domains is consistent with meta-analytic evidence in non-incarcerated individuals (Carrasco-Barrios *et al.*, 2020; Franklin *et al.*, 2017; Miranda-Mendizabal *et al.*, 2019). Other individual-level factors contributing to increased risk of suicide attempts in our review were childhood abuse and high impulsivity, which is indicative of a predisposition to suicidal behaviour that offenders import into prison. In addition to these risk factors shared with the general population, our findings also underscore the impact of the prison environment on suicide risk. Solitary confinement, victimisation, poor social support, disciplinary infractions, and lack of purposeful activity were all prison-related factors that increased the likelihood of attempting suicide during incarceration. Together, these data lend support for a theoretical framework of suicidal behaviour in prisons that incorporates both imported vulnerabilities and environmental stressors (Favril, 2021).

Compared with the wider literature, we note few differences in either the strength or direction of associations across suicide-related outcomes. Specifically, the risk factor profile and estimates observed for attempted suicide in this review are largely similar to those identified for non-suicidal self-harm (Knight *et al.*, 2017; Vinokur & Levine, 2019) and suicide mortality (Zhong *et al.*, 2021) in prison populations. Furthermore, in sensitivity analyses, we found no marked differences in risk factors for near-lethal suicide attempts and suicide attempts more generally. Collectively, these findings may reflect a shared vulnerability to self-harm irrespective of intent or lethality (Lim *et al.*, 2021; Mars *et al.*, 2014a), although future longitudinal studies that directly compare risk factors for multiple outcomes in the same prison population are needed to clarify this.

This review highlights several modifiable factors that can be targeted by interventions and may improve suicide prevention in prisons. The importance of access to mental health care and psychosocial treatment (Fazel *et al.*, 2016) is clearly underscored by our data. Mental health services need to be adequately resourced and linked to evidence-based interventions (Malik *et al.*, 2021; Yoon *et al.*, 2017) to address the high level of unmet need among people in prison (Jakobowitz *et al.*, 2017). Psychosocial interventions following self-harm, particularly cognitive behavioural approaches, can reduce risk of repetition (Sobanski *et al.*, 2021; Witt *et al.*, 2021). Targeted strategies aimed at high-risk groups will rely on early identification of risk (Ryland *et al.*, 2020) and should be supplemented by organisational and establishment-wide interventions as part of a whole population approach. These include measures aiming to promote purposeful activity and meaningful social support, as well as those to reduce victimisation in prison (Favril, 2021; Marzano *et al.*, 2016). In view of the numerous factors associated with risk of suicide in prisons, a multilevel approach that addresses both clinical vulnerabilities and prison-specific stressors is likely to have the largest potential to prevent suicidal behaviour (Barker *et al.*, 2014; Stijelja & Mishara, 2022). Prevention efforts should be integrated and joined-up, as no singular approach will likely be able to impact on a complex behaviour as (attempted) suicide. This will require a cross-sectoral policy and service response that involves health, social care, and criminal justice agencies (Favril, 2021).

4.1 Strengths and limitations

Across 20 studies published over the past five decades, including previously unavailable data, nearly 20,000 individuals from 20 countries were included for meta-analysis. Our findings build on those of previous reviews in several important ways. Rather than narratively summarising the literature (Lohner & Konrad, 2007; Marzano *et al.*, 2016), this study is the first to quantitatively synthesise the evidence on a wide range of risk factors for attempted suicide in prison. In addition, we have for the first time provided pooled prevalence estimates of suicide attempts for men and women during their incarceration. Compared with our previous study that adopted a broad definition of self-harm (Favril *et al.*, 2020b), we have updated the literature by 2.5 years, conducted additional meta-regression analyses, examined associations for different outcomes in sensitivity analyses, assessed prevalence, presented a narrative review of infrequently reported risk factors, and summarised methodological limitations of the extant literature. Several limitations should also be noted.

First, the magnitude of reported effect sizes is likely to be overestimated because we did not account for confounding—however, it was not our aim to determine *independent* associations. Future work could provide adjusted estimates by synthesising individual participant data (Riley *et al.*, 2010). Second, we identified considerable heterogeneity ($I^2 > 75\%$) for over a quarter (28%) of all associations, so pooled effect sizes must be interpreted with caution, and ranges should be considered. Although we tested several methodological characteristics as possible sources of between-study heterogeneity, other moderators were not considered, including national differences in sentencing policies and prison regimes. Third, examination of institutional variables such as overcrowding, prisoner-staff ratio, and availability of health care services relies on ecological investigations which were not included in our study. However, a cross-national study spanning 24 high-income countries found no association between such prison-level factors and suicide rates (Fazel *et al.*, 2017). Fourth, we did not include prevalence data documented in the grey literature (e.g., government reports) or in studies that examined a lifetime history of suicide attempts but secondarily reported the proportion of in-prison incidents, which may have affected our estimates. Finally, our findings should be interpreted in light of the overall constraints that characterise the current evidence base, which we discuss below.

4.2 Future research directions

Four important methodological limitations of the extant literature were identified in our systematic review; the first of which relates to measurement. A large number of studies were excluded from our analysis because they investigated a lifetime history of suicide attempts or did not distinguish between incidents occurring before and during imprisonment (e.g., Favril *et al.*, 2020a; Gates *et al.*, 2017; Holley *et al.*, 1995; Jenkins *et al.*, 2005; Khezri *et al.*, 2022; Sarchiapone *et al.*, 2009; Stoliker, 2018). Though many of these studies are of high quality and collected data from unselected prison populations using representative sampling techniques, they essentially report on risk factors for suicide attempts *in prisoners* (at some point in their lives) rather than *in prison* (while incarcerated). Studies that examine outcomes on a lifetime basis cannot establish any meaningful associations with prison-related variables (e.g., Stoliker, 2018). Next, all included studies that assessed in-prison outcomes did so dichotomously, so it was not possible to investigate the frequency of suicide attempts. This could potentially explain our finding that suicide attempt prevalence did not significantly differ between sexes—in that the incidence might be similar for men and women but that repetition is more common in women (Hawton *et al.*, 2014). Future work should consider a more fine-grained assessment to examine whether and which risk factors differ between a first and repeat episode of suicide attempt during imprisonment (Larkin *et al.*, 2014; Liu *et al.*, 2022; Roy *et al.*, 2014; Stoliker, 2021). Furthermore, all included cross-sectional studies relied on retrospective self-report of suicide attempts using a single-item assessment, which is subject to misreporting and can lead to bias in prevalence estimates and measures of association (Borschmann *et al.*, 2017; Mars *et al.*, 2016; Millner *et al.*, 2015). In terms of scope, the majority (65%) of included studies focused solely on individual-level (e.g., clinical and historical) determinants of risk without consideration of environmental and prison-related variables. Finally, it is likely that there are additional risk factors for suicide attempts among people in prison (e.g., sexual minority status, traumatic brain injury, autism spectrum disorder, and intellectual disability) that were not examined in the included studies, and those outlined in our narrative synthesis require replication.

A second important finding was the lack of longitudinal data. Only one study had a (prospective) longitudinal design, which was a case-control study that focused on suicidal ideation only (Lekka *et al.*, 2006). In most other studies, the temporal relationship between

risk factors and outcome was poorly specified, so it was unclear whether the suicide attempt occurred *after* exposure to a given risk factor. Therefore, it is possible that some reported associations might be due to reverse causality (e.g., psychiatric treatment as a result of having attempted suicide). Future prospective studies are required to clarify this.

Third, few studies examined risk factors for suicide attempts in female samples. Only three investigations specifically focused on women (Caravaca-Sanchez *et al.*, 2021; Carvalho *et al.*, 2021; Marzano *et al.*, 2010, 2011) and all but one (Howard & Wakeling, 2020) of the studies that included both male and female individuals did not provide data disaggregated by sex. Consequently, although originally planned, we were not able to conduct subgroup analyses by sex, and so it remains uncertain whether the identified risk factors—based on predominantly male samples—equally relate to incarcerated women. For example, prison studies suggest that childhood sexual abuse among men (Rivlin *et al.*, 2013) may not be as important a risk factor for suicide attempts as it is for women (Marzano *et al.*, 2011). Thus, with much of the extant literature being dominated by male samples, risk factors for suicide attempts among women in prison remain little understood, and there is a clear need for future research to clarify differential associations by sex.

Fourth, despite our global literature search, we identified only one eligible study from a low or middle income country (Carvalho *et al.*, 2021). Therefore, caution should be exercised in generalising study findings to developing countries with resource-poor correctional systems, where some of the identified risk factors (e.g., psychiatric disorders) are common (Baranyi *et al.*, 2019). More global research is needed to examine prevalence and risk factor variation relating to cultural and institutional differences across prisons worldwide (Hill *et al.*, 2022).

Taken together, key limitations of the extant literature relate to *what* (suicide attempt as a dichotomous outcome with a dominant focus on individual-level risk factors), *how* (a lack of longitudinal data), and *who* (predominantly men from high-income countries) we have studied to date. The evidence gaps outlined above offer some directions for future research, which could advance our understanding of suicidal behaviour in prison populations. Such evidence will assist in more tailored assessment of risk, treatment allocation, and delivery of services.

5. CONCLUSION

This meta-analysis synthesised data on prevalence and risk factors for suicide attempts among nearly 20,000 people in prison across 20 countries. Our findings show that one in ten individuals had attempted suicide at some point during their incarceration. Suicidal ideation, a previous suicide attempt, non-suicidal self-injury, psychiatric morbidity, childhood abuse, and prison-related stressors were strongly associated with suicide attempts in prison, which provide actionable targets for suicide prevention. Interventions aimed at high-risk individuals in combination with population strategies that promote the health and wellbeing of all people in prison should be embedded within a comprehensive approach towards preventing suicide. Improving what, how, and who we study will advance our understanding of suicidal behaviour in prisons, which can inform policy and practice efforts aimed at reducing morbidity and mortality in this vulnerable population.

Competing interests

The authors declare no competing interests.

Funding

SF was funded by the NIHR HTA Programme (HTA Project: 16/159/09).

Author contributions

LF and SF conceived and designed the study. LF did the literature search, extracted the data, did the analyses, and drafted the manuscript. All authors contributed to the interpretation of the findings and subsequent edits of the manuscript, and approved the final manuscript. SF provided overall supervision to the project.

Acknowledgements

We thank Isabel Yoon (University of Queensland, Australia) for her assistance on data extraction and Rongqin Yu (University of Oxford, UK) for her assistance on data analysis. We are grateful to following authors who kindly provided us with additional data from their studies: Marco Bani (University of Milano-Bicocca, Italy), Eronyce Rayka de Oliveira Carvalho (Faculdade de Ciências Médicas da Santa Casa de São Paulo, Brazil), Manuela Dudeck (Ulm University, Germany), Kat Ford (Bangor University, UK), Flora Fitzalan Howard (Her Majesty's Prison and Probation Service, UK), Devon Indig (University of New South Wales, Australia), and Judith Streb (Ulm University, Germany).

REFERENCES

- Angelakis, I., Austin, J.L., & Gooding, P. (2020). Childhood maltreatment and suicide attempts in prisoners: a systematic meta-analytic review. *Psychological Medicine*, 50(1), 1-10. <https://doi.org/10.1017/S0033291719002848>
- Bani, M., Travagin, G., Monticelli, M., Valsecchi, M., Truisci, E., Zorzi, F., et al. (2019). Pattern of self-injurious behavior and suicide attempts in Italian custodial inmates: a cluster analysis approach. *International Journal of Law and Psychiatry*, 64, 1-7. <https://doi.org/10.1016/j.ijlp.2018.12.008>
- Baranyi, G., Scholl, C., Fazel, S., Patel, V., Priebe, S., & Mundt, A.P. (2019). Severe mental illness and substance use disorders in prisoners in low-income and middle-income countries: a systematic review and meta-analysis of prevalence studies. *Lancet Global Health*, 7(4), 461-471. [https://doi.org/10.1016/S2214-109x\(18\)30539-4](https://doi.org/10.1016/S2214-109x(18)30539-4)
- Barker, E., Kolves, K., & De Leo, D. (2014). Management of suicidal and self-harming behaviors in prisons: systematic literature review of evidence-based activities. *Archives of Suicide Research*, 18(3), 227-240. <https://doi.org/10.1080/13811118.2013.824830>
- Beigel, A., & Russell, H.E. (1972). Suicide attempts in jails: prognostic considerations. *Hospital and Community Psychiatry*, 23(12), 361-363. <https://doi.org/10.1176/ps.23.12.361>
- Borschmann, R., Young, J.T., Moran, P., Spittal, M.J., Snow, K., Mok, K., et al. (2017). Accuracy and predictive value of incarcerated adults' accounts of their self-harm histories: findings from an Australian prospective data linkage study. *CMAJ Open*, 5(3), e694-701. <https://doi.org/10.9778/cmajo.20170058>
- Campbell, M., McKenzie, J.E., Sowden, A., Katikireddi, S.V., Brennan, S.E., Ellis, S., et al. (2020). Synthesis without meta-analysis (SWiM) in systematic reviews: reporting guideline. *BMJ*, 368, l6890. <https://doi.org/10.1136/bmj.l6890>
- Caravaca-Sanchez, F., Barry, T.J., Aizpurua, E., & Ricarte, J.J. (2021). Mental health, substance abuse, prison victimization and suicide attempts amongst incarcerated women. *European Journal of Criminology*, published online July 2. <https://doi.org/10.1177/14773708211028471>
- Carrasco-Barrios, M.T., Huertas, P., Martin, P., Martin, C., Castillejos, M.C., Petkari, E., et al. (2020). Determinants of suicidality in the European general population: a systematic review and meta-analysis. *International Journal of Environmental Research and Public Health*, 17(11), 4115. <https://doi.org/10.3390/ijerph17114115>
- Carvalho, E.R.O., Mateus, K.S., Lima, K.S., Silva, J.B., & Uchida, R.R. (2021). Self-injury and suicide attempt in incarcerated women: prevalence and risk factors. *Research, Society and Development*, 10(7), e9710715788. <https://doi.org/10.33448/rsd-v10i7.15788>
- Castillejos, M.C., Huertas, P., Martin, P., & Moreno Kustner, B. (2021). Prevalence of suicidality in the European general population: a systematic review and meta-analysis. *Archives of Suicide Research*, 25(4), 810-828. <https://doi.org/10.1080/13811118.2020.1765928>
- Dudeck, M., Drenkhahn, K., Spitzer, C., Barnow, S., Kopp, D., Kuwert, P., et al. (2011). Traumatization and mental distress in long-term prisoners in Europe. *Punishment & Society*, 13(4), 403-423. <https://doi.org/10.1177/1462474511414782>
- Duval, S., & Tweedie, R. (2000). Trim and fill: a simple funnel-plot-based method of testing and adjusting for publication bias in meta-analysis. *Biometrics*, 56(2), 455-463. <https://doi.org/10.1111/j.0006-341X.2000.00455.x>
- Egger, M., Smith, G.D., Schneider, M., & Minder, C. (1997). Bias in meta-analysis detected by a simple, graphical test. *BMJ*, 315(7109), 629-634. <https://doi.org/10.1136/bmj.315.7109.629>
- Encrenaz, G., Miras, A., Contrand, B., Galera, C., Pujos, S., Michel, G., et al. (2014). Inmate-to-inmate violence as a marker of suicide attempt risk during imprisonment. *Journal of Forensic and Legal Medicine*, 22, 20-25. <https://doi.org/10.1016/j.jflm.2013.11.009>
- Favril, L. (2021). Epidemiology, risk factors, and prevention of suicidal thoughts and behaviour in prisons: a literature review. *Psychologica Belgica*, 61(1), 341-355. <https://doi.org/10.5334/pb.1072>

- Favril, L., Indig, D., Gear, C., & Wilhelm, K. (2020a). Mental disorders and risk of suicide attempt in prisoners. *Social Psychiatry and Psychiatric Epidemiology*, 55(9), 1145-1155. <https://doi.org/10.1007/s00127-020-01851-7>
- Favril, L., & O'Connor, R.C. (2021). Distinguishing prisoners who think about suicide from those who attempt suicide. *Psychological Medicine*, 51(2), 228-235. <https://doi.org/10.1017/S0033291719003118>
- Favril, L., Vander Laenen, F., Vandeviver, C., & Audenaert, K. (2017). Suicidal ideation while incarcerated: prevalence and correlates in a large sample of male prisoners in Flanders, Belgium. *International Journal of Law and Psychiatry*, 55, 19-28. <https://doi.org/10.1016/j.ijlp.2017.10.005>
- Favril, L., Yu, R., Hawton, K., & Fazel, S. (2020b). Risk factors for self-harm in prison: a systematic review and meta-analysis. *Lancet Psychiatry*, 7(8), 682-691. [https://doi.org/10.1016/S2215-0366\(20\)30190-5](https://doi.org/10.1016/S2215-0366(20)30190-5)
- Fazel, S., Hayes, A.J., Bartellas, K., Clerici, M., & Trestman, R. (2016). Mental health of prisoners: prevalence, adverse outcomes, and interventions. *Lancet Psychiatry*, 3(9), 871-881. [https://doi.org/10.1016/S2215-0366\(16\)30142-0](https://doi.org/10.1016/S2215-0366(16)30142-0)
- Fazel, S., Ramesh, T., & Hawton, K. (2017). Suicide in prisons: an international study of prevalence and contributory factors. *Lancet Psychiatry*, 4(12), 946-952. [https://doi.org/10.1016/S2215-0366\(17\)30430-3](https://doi.org/10.1016/S2215-0366(17)30430-3)
- Ford, K., Bellis, M.A., Hughes, K., Barton, E.R., & Newbury, A. (2020). Adverse childhood experiences: a retrospective study to understand their associations with lifetime mental health diagnosis, self-harm or suicide attempt, and current low mental wellbeing in a male Welsh prison population. *Health & Justice*, 8, 13. <https://doi.org/10.1186/s40352-020-00115-5>
- Franklin, J.C., Ribeiro, J.D., Fox, K.R., Bentley, K.H., Kleiman, E.M., Huang, X., et al. (2017). Risk factors for suicidal thoughts and behaviors: a meta-analysis of 50 years of research. *Psychological Bulletin*, 143(2), 187-232. <https://doi.org/10.1037/bul0000084>
- Gates, M.L., Turney, A., Ferguson, E., Walker, V., & Staples-Horne, M. (2017). Associations among substance use, mental health disorders, and self-harm in a prison population: examining group risk for suicide attempt. *International Journal of Environmental Research and Public Health*, 14(3), 317. <https://doi.org/10.3390/ijerph14030317>
- Godet-Mardirossian, H., Jehel, L., & Falissard, B. (2011). Suicidality in male prisoners: influence of childhood adversity mediated by dimensions of personality. *Journal of Forensic Sciences*, 56(4), 942-949. <https://doi.org/10.1111/j.1556-4029.2011.01754.x>
- Goldman-Mellor, S.J., Caspi, A., Harrington, H., Hogan, S., Nada-Raja, S., Poulton, R., et al. (2014). Suicide attempt in young people: a signal for long-term health care and social needs. *JAMA Psychiatry*, 71(2), 119-127. <https://doi.org/10.1001/jamapsychiatry.2013.2803>
- Haglund, A., Tidemalm, D., Jokinen, J., Langstrom, N., Lichtenstein, P., Fazel, S., et al. (2014). Suicide after release from prison: a population-based cohort study from Sweden. *Journal of Clinical Psychiatry*, 75(10), 1047-1053. <https://doi.org/10.4088/jcp.13m08967>
- Hamza, C.A., Stewart, S.L., & Willoughby, T. (2012). Examining the link between nonsuicidal self-injury and suicidal behavior: a review of the literature and an integrated model. *Clinical Psychology Review*, 32(6), 482-495. <https://doi.org/10.1016/j.cpr.2012.05.003>
- Hawton, K., Linsell, L., Adeniji, T., Sariaslan, A., & Fazel, S. (2014). Self-harm in prisons in England and Wales: an epidemiological study of prevalence, risk factors, clustering, and subsequent suicide. *Lancet*, 383(9923), 1147-1154. [https://doi.org/10.1016/S0140-6736\(13\)62118-2](https://doi.org/10.1016/S0140-6736(13)62118-2)
- Higgins, J.P.T., Thomas, J., Chandler, J., Cumpston, M., Li, T., Page, M.J., et al. (2019). *Cochrane handbook for systematic reviews of interventions, second edition*. John Wiley & Sons. <https://doi.org/10.1002/9781119536604>
- Higgins, J.P.T., Thompson, S.G., Deeks, J.J., & Altman, D.G. (2003). Measuring inconsistency in meta-analyses. *BMJ*, 327(7414), 557-560. <https://doi.org/10.1136/bmj.327.7414.557>
- Hill, K., Wainwright, V., Stevenson, C., Senior, J., Robinson, C., & Shaw, J. (2022). Prevalence of mental health and suicide risk in prisons in low- and middle-income countries: a rapid review. *Journal of Forensic Psychiatry & Psychology*, 33(1), 37-52. <https://doi.org/10.1080/14789949.2021.2016891>

- Holley, H.L., Arboleda-Flórez, J., & Love, E.J. (1995). Lifetime prevalence of prior suicide attempts in a remanded population and relationship to current mental illness. *International Journal of Offender Therapy and Comparative Criminology*, 39(3), 191-209. <https://doi.org/10.1177/0306624x9503900302>
- Howard, F.F., & Wakeling, H. (2020). People in prisons' perceptions of procedural justice in England and Wales. *Criminal Justice and Behavior*, 47(12), 1654-1676. <https://doi.org/10.1177/0093854820964501>
- Jakobowitz, S., Bebbington, P., McKenzie, N., Iveson, R., Duffield, G., Kerr, M., *et al.* (2017). Assessing needs for psychiatric treatment in prisoners: 2. Met and unmet need. *Social Psychiatry and Psychiatric Epidemiology*, 52(2), 231-240. <https://doi.org/10.1007/s00127-016-1313-5>
- Jenkins, R., Bhugra, D., Meltzer, H., Singleton, N., Bebbington, P., Brugha, T., *et al.* (2005). Psychiatric and social aspects of suicidal behaviour in prisons. *Psychological Medicine*, 35(2), 257-269. <https://doi.org/10.1017/S0033291704002958>
- Kerkhof, A.J.F.M., & Bernasco, W. (1990). Suicidal behavior in jails and prisons in the Netherlands: incidence, characteristics, and prevention. *Suicide and Life-Threatening Behavior*, 20(2), 123-137. <https://doi.org/10.1111/j.1943-278X.1990.tb00095.x>
- Khezri, M., Sharifi, H., Mirzazadeh, A., Mehmandoost, S., Hosseini-Hooshyar, S., Ghalekhani, N., *et al.* (2022). A national study of suicidal ideation and suicide attempt among incarcerated people in Iran. *International Journal of Mental Health and Addiction*, published online February 14. <https://doi.org/10.1007/s11469-022-00773-6>
- Knight, B., Coid, J., & Ullrich, S. (2017). Non-suicidal self-injury in UK prisoners. *International Journal of Forensic Mental Health*, 16(2), 172-182. <https://doi.org/10.1080/14999013.2017.1287139>
- Larkin, C., Di Blasi, Z., & Arensman, E. (2014). Risk factors for repetition of self-harm: a systematic review of prospective hospital-based studies. *Plos One*, 9(1), e84282. <https://doi.org/10.1371/journal.pone.0084282>
- Larney, S., Topp, L., Indig, D., O'Driscoll, C., & Greenberg, D. (2012). A cross-sectional survey of prevalence and correlates of suicidal ideation and suicide attempts among prisoners in New South Wales, Australia. *BMC Public Health*, 12, 14. <https://doi.org/10.1186/1471-2458-12-14>
- Lekka, N.P., Argyriou, A.A., & Beratis, S. (2006). Suicidal ideation in prisoners: risk factors and relevance to suicidal behaviour. A prospective case-control study. *European Archives of Psychiatry and Clinical Neuroscience*, 256(2), 87-92. <https://doi.org/10.1007/s00406-005-0606-6>
- Liebling, A., & Krarup, H. (1993). *Suicide attempts and self-injury in male prisons*. Institute of Criminology. <https://www.prc.crim.cam.ac.uk/publications/research-findings/>
- Lim, K.X., Krebs, G., Rimfeld, K., Pingault, J.B., & Rijdsdijk, F.V. (2021). Investigating the genetic and environmental aetiologies of non-suicidal and suicidal self-harm: a twin study. *Psychological Medicine*, published online February 9. <https://doi.org/10.1017/S0033291721000040>
- Liu, B.P., Jia, C.X., Qin, P., Zhang, Y.Y., Yu, Y.K., Luo, X., *et al.* (2022). Associating factors of suicide and repetition following self-harm: a systematic review and meta-analysis of longitudinal studies. *EClinicalMedicine*, 49, 101461. <https://doi.org/https://doi.org/10.1016/j.eclinm.2022.101461>
- Lohner, J., & Konrad, N. (2007). Risk factors for self-injurious behaviour in custody: problems of definition and prediction. *International Journal of Prisoner Health*, 3(2), 135-161. <https://doi.org/10.1080/17449200701321654>
- Malik, N., Facer-Irwin, E., Dickson, H., Bird, A., & MacManus, D. (2021). The effectiveness of trauma-focused interventions in prison settings: a systematic review and meta-analysis. *Trauma, Violence, & Abuse*, published online October 28. <https://doi.org/10.1177/15248380211043890>
- Mars, B., Cornish, R., Heron, J., Boyd, A., Crane, C., Hawton, K., *et al.* (2016). Using data linkage to investigate inconsistent reporting of self-harm and questionnaire non-response. *Archives of Suicide Research*, 20(2), 113-141. <https://doi.org/10.1080/13811118.2015.1033121>
- Mars, B., Heron, J., Crane, C., Hawton, K., Kidger, J., Lewis, G., *et al.* (2014a). Differences in risk factors for self-harm with and without suicidal intent: findings from the ALSPAC cohort. *Journal of Affective Disorders*, 168, 407-414. <https://doi.org/10.1016/j.jad.2014.07.009>

- Mars, B., Heron, J., Crane, C., Hawton, K., Lewis, G., Macleod, J., *et al.* (2014b). Clinical and social outcomes of adolescent self harm: population based birth cohort study. *BMJ*, 349, g5954. <https://doi.org/10.1136/bmj.g5954>
- Marzano, L., Fazel, S., Rivlin, A., & Hawton, K. (2010). Psychiatric disorders in women prisoners who have engaged in near-lethal self-harm: case-control study. *British Journal of Psychiatry*, 197(3), 219-226. <https://doi.org/10.1192/bjp.bp.109.075424>
- Marzano, L., Hawton, K., Rivlin, A., & Fazel, S. (2011). Psychosocial influences on prisoner suicide: a case-control study of near-lethal self-harm in women prisoners. *Social Science & Medicine*, 72(6), 874-883. <https://doi.org/10.1016/j.socscimed.2010.12.028>
- Marzano, L., Hawton, K., Rivlin, A., Smith, E.N., Piper, M., & Fazel, S. (2016). Prevention of suicidal behavior in prisons. *Crisis*, 37(5), 323-334. <https://doi.org/10.1027/0227-5910/a000394>
- Millner, A.J., Lee, M.D., & Nock, M.K. (2015). Single-item measurement of suicidal behaviors: validity and consequences of misclassification. *Plos One*, 10(10), e0141606. <https://doi.org/10.1371/journal.pone.0141606>
- Miranda-Mendizabal, A., Castellvi, P., Pares-Badell, O., Alayo, I., Almenara, J., Alonso, I., *et al.* (2019). Gender differences in suicidal behavior in adolescents and young adults: systematic review and meta-analysis of longitudinal studies. *International journal of public health*, 64(2), 265-283. <https://doi.org/10.1007/s00038-018-1196-1>
- Muehlenkamp, J.J. (2014). Distinguishing between suicidal and nonsuicidal self-injury. In M. K. Nock (Ed.), *The Oxford handbook of suicide and self-injury* (pp. 23-46). Oxford University Press. <https://doi.org/10.1093/oxfordhb/9780195388565.013.0005>
- Nock, M.K., Borges, G., Bromet, E.J., Alonso, J., Angermeyer, M., Beautrais, A., *et al.* (2008). Cross-national prevalence and risk factors for suicidal ideation, plans and attempts. *British Journal of Psychiatry*, 192(2), 98-105. <https://doi.org/10.1192/bjp.bp.107.040113>
- Orri, M., Vergunst, F., Turecki, G., Galera, C., Latimer, E., Bouchard, S., *et al.* (2022). Long-term economic and social outcomes of youth suicide attempts. *British Journal of Psychiatry*, 220(2), 79-85. <https://doi.org/10.1192/bjp.2021.133>
- Page, M.J., McKenzie, J.E., Bossuyt, P.M., Boutron, I., Hoffmann, T.C., Mulrow, C.D., *et al.* (2021). The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ*, 372, n71. <https://doi.org/10.1136/bmj.n71>
- Riley, R.D., Lambert, P.C., & Abo-Zaid, G. (2010). Meta-analysis of individual participant data: rationale, conduct, and reporting. *BMJ*, 340, c221. <https://doi.org/10.1136/bmj.c221>
- Rivlin, A., Hawton, K., Marzano, L., & Fazel, S. (2010). Psychiatric disorders in male prisoners who made near-lethal suicide attempts: case-control study. *British Journal of Psychiatry*, 197(4), 313-319. <https://doi.org/10.1192/bjp.bp.110.077883>
- Rivlin, A., Hawton, K., Marzano, L., & Fazel, S. (2013). Psychosocial characteristics and social networks of suicidal prisoners: towards a model of suicidal behaviour in detention. *Plos One*, 8(7), e68944. <https://doi.org/10.1371/journal.pone.0068944>
- Roy, A., Carli, V., Sarchiapone, M., & Branchey, M. (2014). Comparisons of prisoners who make or do not make suicide attempts and further who make one or multiple attempts. *Archives of Suicide Research*, 18(1), 28-38. <https://doi.org/10.1080/13811118.2013.801816>
- Ryland, H., Gould, C., McGeorge, T., Hawton, K., & Fazel, S. (2020). Predicting self-harm in prisoners: risk factors and a prognostic model in a cohort of 542 prison entrants. *European Psychiatry*, 63(1), e42. <https://doi.org/10.1192/j.eurpsy.2020.40>
- Sanchez, F.C., Aizpurua, E., Ricarte, J.J., & Barry, T.J. (2021). Personal, criminal and social predictors of suicide attempts in prison. *Archives of Suicide Research*, 25(3), 582-595. <https://doi.org/10.1080/13811118.2020.1738293>
- Sanchez, F.C., Fearn, N., & Vaughn, M.G. (2018). Risk factors associated with near-lethal suicide attempts during incarceration among men in the Spanish prison system. *International Journal of Offender Therapy and Comparative Criminology*, 62(6), 1452-1473. <https://doi.org/10.1177/0306624X16689833>

- Sanchez, F.C., Ignatyev, Y., & Mundt, A.P. (2019). Associations between childhood abuse, mental health problems, and suicide risk among male prison populations in Spain. *Criminal Behaviour and Mental Health*, 29(1), 18-30. <https://doi.org/10.1002/cbm.2099>
- Sarchiapone, M., Carli, V., Di Giannantonio, M., & Roy, A. (2009). Risk factors for attempting suicide in prisoners. *Suicide and Life-Threatening Behavior*, 39(3), 343-350. <https://doi.org/10.1521/suli.2009.39.3.343>
- Schaller, G., Zimmermann, C., & Raymond, L. (1996). Facteurs de risque des gestes auto-agressifs dans une prison suisse. *Sozial- und Präventivmedizin*, 41(4), 249-256. <https://doi.org/10.1007/bf01299485>
- Sobanski, T., Josfeld, S., Peikert, G., & Wagner, G. (2021). Psychotherapeutic interventions for the prevention of suicide re-attempts: a systematic review. *Psychological Medicine*, 51(15), 2525-2540. <https://doi.org/10.1017/S0033291721003081>
- Stijelja, S., & Mishara, B.L. (2022). Preventing suicidal and self-injurious behavior in correctional facilities: a systematic literature review and meta-analysis. *EClinicalMedicine*, 51, 101560. <https://doi.org/10.1016/j.eclinm.2022.101560>
- Stoliker, B.E. (2018). Attempted suicide: a multilevel examination of inmate characteristics and prison context. *Criminal Justice and Behavior*, 45(5), 589-611. <https://doi.org/10.1177/0093854818754609>
- Stoliker, B.E. (2021). The heterogeneity of suicide attempters: an analysis of single- and repeat-suicide attempters among people in custody. *Criminal Justice and Behavior*, 48(8), 1127-1147. <https://doi.org/10.1177/0093854820983853>
- Vinokur, D., & Levine, S.Z. (2019). Non-suicidal self-harm in prison: a national population-based study. *Psychiatry Research*, 272, 216-221. <https://doi.org/10.1016/j.psychres.2018.12.103>
- Wells, G.A., Shea, B., O'Connell, D., Peterson, J., Welch, V., Losos, M., et al. (2014). *The Newcastle-Ottawa Scale (NOS) for assessing the quality of nonrandomised studies in meta-analyses*. Ottawa Health Research Institute. http://www.ohri.ca/programs/clinical_epidemiology/oxford.asp
- Wichmann, C., Serin, R., & Motiuk, L. (2000). *Predicting suicide attempts among male offenders in federal penitentiaries*. Correctional Service of Canada. https://www.csc-scc.gc.ca/research/092/r91_e.pdf
- Witt, K.G., Hetrick, S.E., Rajaram, G., Hazell, P., Taylor Salisbury, T.L., Townsend, E., et al. (2021). Psychosocial interventions for self-harm in adults. *Cochrane Database of Systematic Reviews*, 4(4), CD013668. <https://doi.org/10.1002/14651858.CD013668.pub2>
- Yoon, I.A., Slade, K., & Fazel, S. (2017). Outcomes of psychological therapies for prisoners with mental health problems: a systematic review and meta-analysis. *Journal of Consulting and Clinical Psychology*, 85(8), 783-802. <https://doi.org/10.1037/ccp0000214>
- Zhong, S., Senior, M., Yu, R., Perry, A., Hawton, K., Shaw, J., et al. (2021). Risk factors for suicide in prisons: a systematic review and meta-analysis. *Lancet Public Health*, 6(3), e164-174. [https://doi.org/10.1016/S2468-2667\(20\)30233-4](https://doi.org/10.1016/S2468-2667(20)30233-4)

Table 1. Key characteristics of the 20 included studies.

Study	Country	Design	Mean age (years)	n (women)	Cases	Assessment	Quality ^a
Bani et al. (2019)	Italy	Cohort	37.8 (range 18–64)	1406 (0)	28	Incident	Moderate
Beigel and Russell (1972)	United States	Case-control	22.6 (ca), 28.6 (co)	60 (4)	30	Records	Low
Caravaca-Sanchez et al. (2021)	Spain	Cross-sectional	37.7 (range 18–58)	174 (174)	27	Self-report	Moderate
Carvalho et al. (2021)	Brazil	Cross-sectional	33.4	186 (186)	35	Self-report	Moderate
Dudeck et al. (2011)	11 countries ^b	Cross-sectional	39.9	1055 (0)	170	Self-report	Low
Encrenaz et al. (2014)	France	Cross-sectional	36 (range 18–75)	365 (0)	37	Self-report	High
Favril and O'Connor (2021)	Belgium	Cross-sectional	37.7 (range 18–77)	1326 (123)	126 ^c	Self-report	High
Ford et al. (2020)	Wales	Cross-sectional	33.2 (range 18–69)	468 (0)	50	Self-report	Moderate
Godet-Mardirossian et al. (2011)	France	Cross-sectional	37 (range 19–84)	899 (0)	43	Self-report	High
Howard and Wakeling (2020)	England & Wales	Cross-sectional	35.1 (range 18–89)	6947 (415)	332	Self-report	Moderate
Kerkhof and Bernasco (1990)	Netherlands	Case-control	26.9 (ca), 29.5 (co)	408 (14)	198	Records	Moderate
Larney et al. (2012)	Australia	Cross-sectional	35.5 (range 19–84)	996 (199)	58 ^c	Self-report	High
Lekka et al. (2006)	Greece	Case-control	33.9 (ca), 33.7 (co)	134 (0)	5	Incident	High
Liebling and Krarup (1993)	England	Case-control	Range 16–54	142 (0)	62	Incident	Moderate
Marzano et al. (2010, 2011)	England & Wales	Case-control	25.5 (ca), 26.0 (co)	120 (120)	60 ^d	Incident	High
Rivlin et al. (2010, 2013)	England & Wales	Case-control	27 (range 18–57)	120 (0)	60 ^d	Incident	High
Sanchez et al. (2018)	Spain	Cross-sectional	36.8 (ca), 36.7 (co)	2270 (0)	616 ^d	Self-report	Moderate
Sanchez et al. (2019, 2021)	Spain	Cross-sectional	37.2 (range 19–83)	943 (0)	82 ^d	Self-report	Moderate
Schaller et al. (1996)	Switzerland	Case-control	Not reported	341 (56)	172	Records	Moderate
Wichmann et al. (2000)	Canada	Case-control	26.0 (ca), 29.9 (co)	1462 (0)	731	Records	Moderate

Note. ca, cases; co, controls. ^a Study quality assessed by the Newcastle-Ottawa Scale. ^b Belgium, Croatia, Denmark, England, Finland, France, Germany, Lithuania, Poland, Spain, and Sweden. ^c Additional data provided by study authors on in-prison outcomes. ^d Near-lethal suicide attempt.

Table 2. Pooled estimates of risk factors for suicide attempts in prison, by domain.

	<i>k</i>	<i>N</i>	<i>n</i>	OR (95% CI)	<i>z</i>	<i>p</i>	<i>I</i> ²
<i>Sociodemographic domain</i>							
Unemployed before prison	7	4300	1211	1.58 (1.23–2.03)	3.60	< 0.001	37
White ethnicity	7	9319	1325	1.39 (0.93–2.09)	1.61	0.108	63
Low educational attainment	8	5359	975	1.35 (1.10–1.65)	2.91	0.004	15
Single marital status	15	11,091	2442	1.34 (1.14–1.57)	3.61	< 0.001	37
Female sex	6	10,078	916	1.34 (0.86–2.10)	1.29	0.196	63
Having children	7	3394	452	1.26 (0.88–1.82)	1.25	0.210	51
Nationality (country of study)	6	6694	1222	1.20 (0.58–2.49)	0.48	0.631	92
Young age (< 25 years)	6	9589	779	1.10 (0.58–2.09)	0.30	0.763	87
<i>Criminological domain</i>							
Sentence length							
> 1 year	7	6549	1131	1.41 (0.72–2.77)	1.01	0.314	82
> 4 years	3	2510	736	1.24 (0.82–1.86)	1.01	0.311	36
> 5 years	4	5093	928	2.35 (1.91–2.88)	8.11	< 0.001	0
Life sentence	4	3028	977	2.32 (1.23–4.38)	2.59	0.010	69
Violent offence	12	10,106	2243	1.59 (1.22–2.07)	3.47	0.001	70
Prior incarceration	11	7295	1311	1.57 (1.12–2.19)	2.64	0.008	77
Remand status	12	15,720	1536	1.05 (0.70–1.58)	0.23	0.817	86
<i>Clinical domain</i>							
Suicidal ideation	5	3497	294	16.28 (8.18–32.43)	7.94	< 0.001	70
Psychiatric treatment							
During imprisonment	4	2652	798	8.03 (3.20–20.18)	4.43	< 0.001	83

Before imprisonment	7	4507	1269	4.63 (2.81–7.63)	6.03	< 0.001	66
Non-suicidal self-injury	6	3825	511	6.16 (4.98–7.62)	16.78	< 0.001	0
Previous suicide attempt	9	11,435	1610	5.95 (3.17–11.16)	5.56	< 0.001	89
Current psychological distress	7	5388	539	5.65 (2.79–11.46)	4.80	< 0.001	91
Psychiatric diagnosis	5	2220	331	4.97 (3.58–6.89)	9.61	< 0.001	15
Current psychotropic medication	7	3298	599	4.58 (3.12–6.71)	7.80	< 0.001	62
High impulsivity	4	2011	185	3.42 (1.96–5.96)	4.33	< 0.001	57
Drug abuse/dependence	10	5176	665	2.23 (1.51–3.28)	4.06	< 0.001	68
Physical health problems	6	4212	1003	2.19 (1.53–3.13)	4.29	< 0.001	43
Alcohol abuse/dependence	8	3432	526	1.09 (0.70–1.69)	0.38	0.700	66
<i>Custodial domain</i>							
Solitary confinement	4	2652	798	5.00 (1.76–14.21)	3.02	0.002	85
Physical or sexual victimisation	4	779	184	3.86 (2.18–6.82)	4.64	< 0.001	39
Poor social support	3	2852	214	2.94 (1.47–5.90)	3.04	0.002	75
Threatened with violence	3	2510	736	2.21 (1.84–2.65)	8.49	< 0.001	0
Disciplinary infractions	5	3796	818	2.02 (1.67–2.46)	7.11	< 0.001	5
Not working in prison	4	4637	847	1.86 (1.57–2.19)	7.33	< 0.001	0
No social contact/visits	6	4423	863	1.82 (1.25–2.65)	3.14	0.002	53
Single cell accommodation	3	382	182	1.54 (0.36–6.62)	0.58	0.560	87
Exposure to self-harm	4	1708	308	1.32 (0.51–3.41)	0.57	0.570	88
<i>Historical domain</i>							
Childhood abuse							
Sexual abuse	5	1793	314	3.57 (2.19–5.82)	5.11	< 0.001	46
Physical abuse	4	1651	252	3.02 (1.77–5.17)	4.04	< 0.001	63

Emotional abuse	4	3453	818	3.00 (1.85–4.86)	4.48	< 0.001	71
Any abuse	4	4232	801	2.18 (1.68–2.83)	5.91	< 0.001	32
Family history of suicide	3	382	182	3.04 (1.42–6.49)	2.87	0.004	0
Out-of-home care	3	1161	165	2.37 (1.59–3.53)	4.22	< 0.001	0
Family history of self-harm	4	1708	308	1.87 (1.38–2.54)	4.01	< 0.001	0

Note. Risk factors are categorised by domain and ranked in order of effect size. *k*, number of studies analysed; *N*, total number of individuals in pooled analyses; *n*, number of prisoners who attempted suicide; OR, pooled odds ratio; CI, confidence interval; *I*², between-study heterogeneity (%).

Figure 1. Prevalence of suicide attempts in prison, by sex.

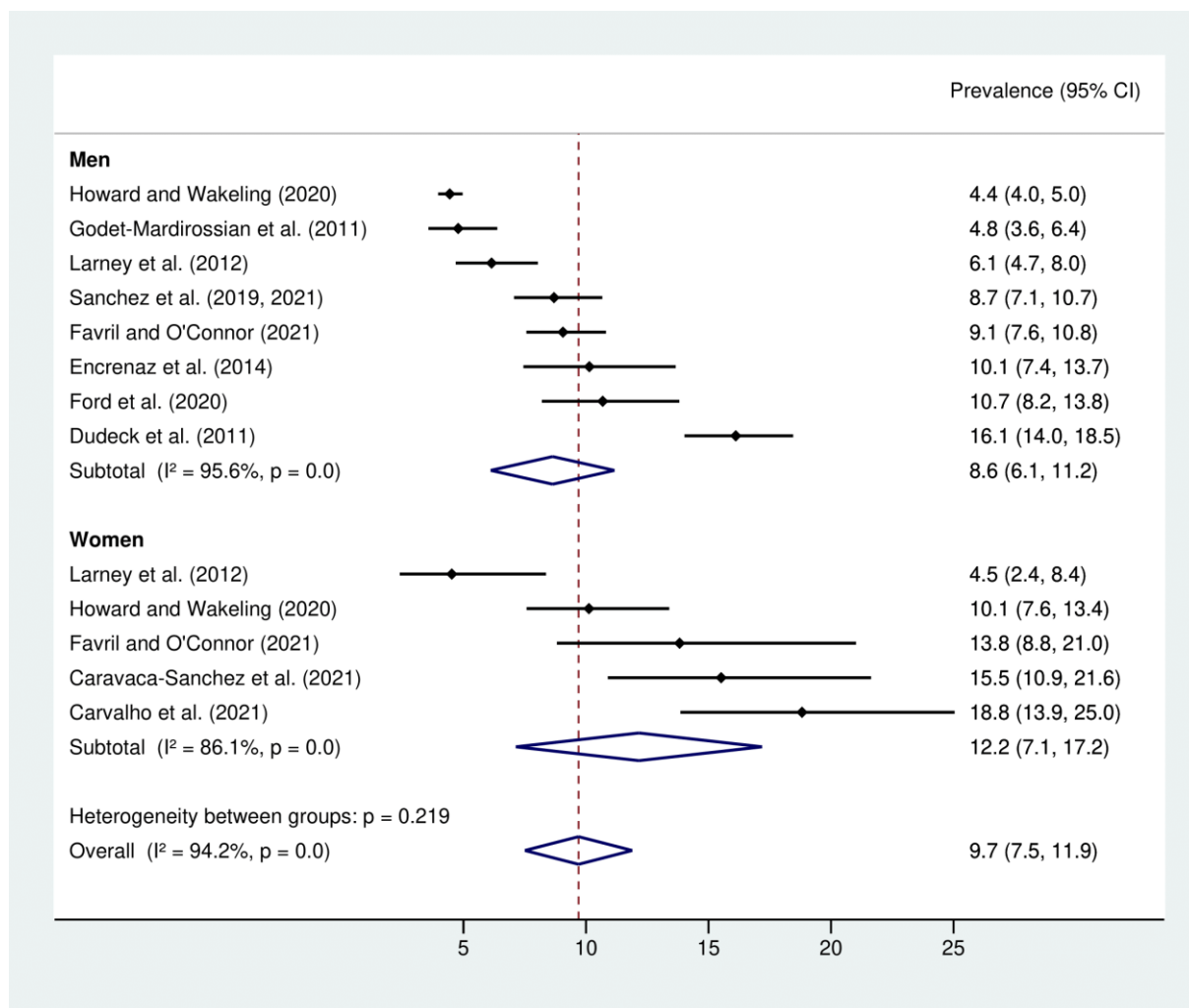


Figure 2. Leading risk factors for suicide attempts in prison.

