Title: The accuracy and predictive value of incarcerated adults' accounts of their self-harm histories: findings from an Australian data linkage study

Authors:

Dr. Rohan Borschmann (lead author)
Centre for Adolescent Health, Murdoch Childrens Research Institute, Melbourne, VIC, Australia
Melbourne School of Population and Global Health, The University of Melbourne, Parkville, VIC, 3010, Australia

Mr. Jesse T. Young
Melbourne School of Population and Global Health, The University of Melbourne, Parkville, VIC, 3010, Australia
Centre for Health Services Research, School of Population and Global Health, The University of Western Australia, Perth, WA, 6009, Australia
National Drug Research Institute, Curtin University, Perth, WA, 6008, Australia

Dr. Paul Moran
Centre for Academic Mental Health, University of Bristol, UK

A/Prof. Matthew J. Spittal
Centre for Mental Health, Melbourne School of Population and Global Health, The University of Melbourne, Victoria 3010

Ms. Kathryn Snow
Melbourne School of Population and Global Health, The University of Melbourne, Parkville, VIC, 3010, Australia
Centre for International Child Health, Department of Paediatrics, University of Melbourne, Melbourne, Vic, Australia

Dr. Katherine Mok
The Black Dog Institute, Randwick, NSW, Australia

Prof. Stuart A. Kinner (senior author)
Melbourne School of Population and Global Health, The University of Melbourne, Parkville, VIC, 3010, Australia

Centre for Adolescent Health, Murdoch Childrens Research Institute, Melbourne, VIC, Australia
Mater Research Institute, University of Queensland, Brisbane, QLD, Australia
Griffith Criminology Institute, Griffith University, Brisbane, QLD, Australia
School of Public Health and Preventive Medicine, Monash University, Melbourne, VIC, Australia

Word count: 3221

ABSTRACT:

Background: Self-harm is prevalent in prison populations, and is a well-established risk factor for suicide. Researchers typically rely on self-report to measure self-harm, yet the accuracy and predictive value of self-report in prison populations is unclear. Using a large, representative sample of incarcerated men and women, we aimed to (a) examine the level of agreement between self-reported self-harm history and historical medical records, and (b) investigate the association between self-harm history and medically-verified self-harm after release from prison.

Methods: During confidential interviews with 1315 adults, conducted within six weeks of expected release from prison, participants were asked about the occurrence of lifetime self-harm. Responses were compared with prison medical records and linked both retrospectively and prospectively with ambulance, emergency department, and hospital records, to identify instances of medically-verified self-harm.

Results: Agreement between self-reported and medically-verified history of self-harm was poor, with just 64 of 170 participants (38%) with a history of medically-verified self-harm disclosing any history of self-harm at baseline. Participants with a medically-verified history of self-harm were more likely to self-harm during the follow-up period and, among those with prior medically-verified self-harm, those who disclosed this at baseline were more likely than those who did not disclose to have a subsequent self-harm event.

Interpretation: Self-reported history of self-harm should not be considered a sensitive indicator of prior self-harm, or of future self-harm risk, in incarcerated adults. In order to identify those who should be targeted for prevention, triangulation between multiple and verifiable data sources should be implemented whenever possible.

INTRODUCTION

The incidence of self-harm is markedly higher in incarcerated (1, 2) and formerly incarcerated (3, 4) adults than in the general population. Although one of the strongest predictors of future self-harm is a history of self-harm (5, 6), repetition of self-harm is often difficult to predict with any degree of accuracy (7, 8). In many prison settings internationally, screening for self-harm history at prison reception is conducted exclusively by self-report (9). One purpose of screening is to identify individuals who may benefit from access to mental health services during and after incarceration. However, the validity of self-reported self-harm in this population remains unknown. Accurate identification of previous self-harm events could help to minimise the risk to these individuals during the transition from custody, a period characterised by elevated rates of suicide and all-cause mortality (10-13). The small number of studies of community populations have reported poor agreement between self-reported and medically-verified self-harm (14), with participants providing conflicting accounts of their self-harm histories at different time points (15, 16).

Self-harm is highly stigmatised (17) and this may lead to under-reporting of the behaviour (18). Although most self-harm is not associated with help-seeking behaviour (19), medically severe events typically result in contact with health services such as ambulance, emergency department, or hospital (20). Further complicating disclosure of self-harm in correctional settings is the prospect that doing so may result in intrusive observations or monitoring. Self-reported self-harm may therefore fail to identify a proportion of individuals at risk of subsequent (and medically more severe) self-harm, and associated mental health problems. Under-reporting may be particularly pronounced among already marginalised subgroups such as Indigenous people (21), people with a mental illness (6), and those who identify as lesbian, gay, bisexual or transgender (LGBT) (22, 23). In Canada, historical under-ascertainment of self-harm events, combined with a sharp increase in such events in prisons (24, 25), has led to recent changes in reporting practices in the Correctional Service of Canada (CSC), such as allowing staff to report one incident under multiple incident categories (26, 27).

In a large cohort of incarcerated adults in Australia, we aimed to determine the level of agreement between self-reported history of self-harm and medically-verified history of self-

harm. We also aimed to examine the extent to which self-reported history of self-harm, a medically-verified history of self-harm, and a combination of the two, predicted the occurrence of future medically-verified self-harm, following release from prison.

METHODS

Participants and survey data collection

Participants were 1325 adult prisoners recruited to the Passports study - a randomised controlled trial of a service brokerage intervention, but here analysed as a cohort study - within six weeks of expected release, from one of seven prisons in Queensland, Australia. Baseline data were collected during confidential, structured, face-to-face interviews that covered demographic characteristics, physical and mental health, self-harm history, substance use prior to and during incarceration, and other health-related risk behaviours. The Passports study is described in detail elsewhere (28).

Administrative and clinical data

We obtained emergency department (ED) records from June 1st 2002 to July 31st 2012, ambulance records from January 1st 2007 to January 1st 2014, and hospital records from July 1st 1999 to July 31st 2012. Data were linked probabilistically by the Queensland Health Data Linkage Unit using full name and any known aliases, sex, date of birth, and postcode of last residence; this method of linkage has previously been shown to produce a false positive error rate of <3% (29). Prison admission and release dates were identified from September 1st 2008 to December 31st 2013, from Queensland Corrective Services (QCS) records. QCS data also contained a dichotomous variable indicating whether or not each participant had been identified by any staff member at any time of being at risk of self-harm/suicide. Prison medical records for participants were coded by the research team using the International Classification for Primary Care Version 2 (ICPC-2; (30)). In addition, coders recorded relevant contextual information, including regarding instances of self-harm, in a free text field.

Measures

Self-harm (self-reported)

During the baseline interview (and after rapport had been established), participants were asked, "Have you ever attempted suicide?" Participants were then asked: "*Apart from suicide attempts*, have you ever deliberately harmed or injured yourself?" Participants who responded in the affirmative were asked a follow-up question: "If yes, how many times have you deliberately harmed or injured yourself?" Participants who responded in the affirmative to either of these stem questions (irrespective of the severity of harm) were recorded as having a self-reported history of self-harm.

Self-harm (medically-verified)

We searched ED and hospital records for International Classification of Diseases (ICD) diagnosis codes for self-harm (X60-X84), and searched the ICPC-2 (30) coding of the free-text field of prison medical records for self-harm events. Additionally, free text fields in ambulance and ED records, and free text notes made by the coding staff who abstracted the prison medical records, were screened by a member of the study team (KM) to increase case ascertainment. Free text data were coded using a system adapted from a recent large-scale epidemiological study of self-harm (31). Any health service contact prior to the baseline interview that was deemed to have resulted from self-harm was coded as a medically-verified self-harm event. Because participants may have self-harmed in the past without a) self-disclosing this at baseline, or b) presenting to medical services as a result, neither a failure to appear in the health records nor a failure to self-report a history of self-harm was taken as a definitive indication of absence of historical self-harm. Time-at-risk commenced at the initial prison release date and was censored on the last day of the follow-up period (January 1st 2014), return to custody, or death, whichever came first.

Self-harm history categorisation

Based on the combination of their baseline interview responses and retrospectively linked health records, participants were categorised into one of four mutually exclusive groups (see Table S1).

INSERT TABLE 1 HERE

Statistical analysis

Descriptive statistics were calculated for all measures. Differences in participants' baseline characteristics were compared across the self-harm categories using chi-square tests. To estimate the agreement between self-reported and medically-verified self-harm, we calculated prevalence-adjusted and bias-adjusted kappa (PABAK) statistics, as recommended when comparing administrative data as a reference standard and for low prevalence outcomes (32, 33). Additionally, we calculated the average positive and negative agreement, asserted as best practice when assessing agreement (34). Crude incidence rates and 95% confidence intervals (95%CIs) for medically-verified self-harm after release from custody were calculated overall and separately for each self-harm category. The conditional probability of survival to study end without evidence of medically verified self-harm after release from custody was estimated by fitting a Kaplan-Meier plot. The risk of medically-verified self-harm after release from custody for each self-harm agreement group was estimated by fitting univariate and multivariate Cox proportional hazards models (35). Standard errors and bias corrected 95%CIs of the Cox model parameters were calculated using the bootstrap method (N=1000 repetitions) (36). The multivariate model was adjusted for sex, age, Indigenous status, relationship status, years of education, sexual identity, QCS self-harm risk flag, prior suicide attempt, lifetime history of mental disorder, and whether the participant's most serious offence was violent (including sex offences) or non-violent (including offences against property, drug trafficking, driving offences, forgery/fraud). This coding was performed manually based on the Australian Standard Offence Classification (Queensland Supplement) (37). In light of the reported gender differences in self-harm prevalence (6), we examined the possibility of effect modification in the adjusted model by fitting interaction terms between self-harm category at baseline and demographic variables (gender, age, and Indigenous status). The Cox model was censored at date of death, the first medically-verified self-harm event, or the last day of the follow-up period, whichever occurred first. All analyses were conducted using STATA version 14.2 (38).

Ethics approval was granted by The University of Queensland's Behavioural and Social Sciences Ethical Review Committee (#2007000607), the Queensland Health Human Research Ethics Committee (HREC/11/QHC/40), and the Queensland Corrective Services Research Committee.

RESULTS

All analyses were conducted on the 1315 participants (99.2%) for whom linked health and correctional records were obtained. A total of 1037 participants (78.9%) were male, 336 (25.6%) were Indigenous, and the majority (681; 51.8%) were aged between 25 and 39 years.

Self-harm (historical)

One hundred and eighty-six participants (14.1%) disclosed a history of self-harm at baseline interview. One hundred and seventy (12.9%) had one or more medically-verified self-harm events recorded prior to their baseline interview. Of these 170 (119 males and 51 females), 64 (37.6%) disclosed a history of self-harm and were categorised as 'true positive' cases; the remaining 106 (62.4%) were categorised as 'false negatives'. Of the 1,145 participants (87.0%) who had no medically-verified record of self-harm prior to baseline, 122 (10.7%) reported a history of self-harm and were categorised as 'unconfirmed positives'; the remaining 1023 (89.3%) were categorised as 'unconfirmed negatives'. Table 2 displays the relationship between self-reported and medically-verified self-harm. Of the 170 participants with a medically-verified history of self-harm, most (106; 62.4%) did not disclose this at baseline. Disclosure of prior self-harm was uncommon regardless of participant gender, Indigenous status, education, or history of mental disorder. Supplementary appendix Table 1 displays the demographic and criminogenic characteristics of the cohort at baseline, according to self-harm category.

INSERT TABLE 2 HERE

Overall, PABAK agreement between self-reported and medically-verified self-harm was estimated at 0.65 (95%CI: 0.61-0.69). Average positive agreement was 0.36 (95%CI: 0.30-0.42) and average negative agreement was 0.90 (95%CI: 0.89-0.91).

Self-harm (post-baseline)

A total of 132 participants (10.0%) had one or more medically-verified self-harm events recorded after release from custody during a median of 854 days of follow-up (IQR: 219-1560). Table 3 displays the proportion of participants with one or more post-baseline medically-verified self-harm events across demographic groups. The crude incidence rates per 1000 person-years for the four self-harm categories were as follows: True positive: 431.8 (95%CI 326.3 – 571.3); False negative: 311.5 (95%CI 238.0 – 407.8); Unconfirmed positive: 105.1 (95%CI 71.6 – 154.4); Unconfirmed negative: 35.6 (95%CI 28.7 – 44.3).

INSERT TABLE 3 HERE

Almost half (45.3%) of participants in the true positive group had one or more subsequent medically-verified self-harms event during the follow-up period; more than twice as high as the proportion in any other self-harm category. The proportion of participants with medically-verified self-harm events during follow-up was higher among women than men, and higher among Indigenous than non-Indigenous participants. However, neither gender, age nor Indigenous status significantly modified the relationship between self-harm category at baseline and medically verified self-harm after release from custody (p=0.998; p=0.766; and p=0.651, respectively). Figure 1 shows the survival function for medically-verified self-harm events after release from custody, according to baseline self-harm category.

INSERT FIGURE 1 HERE

INTERPRETATION

We examined the level of agreement between self-reported history of self-harm and medically-verified history of self-harm in a representative cohort of incarcerated adults in Australia. Agreement regarding history of self-harm events between self-report and health service records was poor; just 38% of participants with a medically-verified history of self-harm disclosed this history during baseline interview. We also examined the extent to which self-reported and medically-verified self-harm predicted self-harm after release from prison. After adjustment for covariate effects, participants with both a medically-verified and self-reported history of self-harm were six times more likely to have self-harmed during the follow-up period than participants in the reference category (i.e. unconfirmed negative).

Those who had a medically verified history of self-harm but did not disclose this at baseline were four times more likely to have self-harmed during the follow-up period than participants in the reference category. Finally, participants who disclosed a history of self-harm but had no medically verified self-harm events in their records were twice as likely to have self-harmed during the follow-up period than participants in the reference category.

There are several potential explanations for the low prevalence of baseline self-reported self-harm observed. First, self-harm is still strongly stigmatised (17) and social desirability bias may have contributed to failure to disclose prior self-harm events. Although the research team was independent of corrective services and interviews were undertaken in private, it is possible that some participants with a history of self-harm may have incorrectly believed that a disclosure of self-harm would have had an adverse impact on their current incarceration and/or delayed their impending release. Second, participants may have had different perceptions about what constitutes self-harm or been unable to recall previous events. Although we may have been able to increase ascertainment through more detailed questioning, to the extent that our approach to questioning replicates intake screening in prison settings, this limitation is in fact an accurate assessment of routine practice.

In addition to the high proportion of people with a medically-verified history of self-harm who did not disclose this at baseline, we also observed the inverse phenomenon: one in nine participants (11%) reported a history of self-harm at baseline that did not appear in their medical records (i.e. the unconfirmed positive group). The most likely explanation for this finding is that most self-harm does not lead to formal help-seeking behaviour (39), thereby making it more difficult than other clinical phenomena to measure accurately through medical records (40). Our finding that people in the unconfirmed positive group were at increased risk of self-harm following release from incarceration suggests that their self-reported histories were accurate. As such, although self-reported self-harm and medically verified self-harm had low agreement in our sample, there is merit in inquiring about prior self-harm as it can identify a subgroup of people who may not yet have come to the attention of mental health services, but who may nevertheless be at increased risk of further self-harm.

There are other potential explanations for the high proportion of participants found to be in the unconfirmed positive group. First, in some cases clinicians may have failed to document the detection of self-harm, leading to under-ascertainment of self-harm in medical records. Second, some participants may have reported incidents that they considered self-harm but which would not have been identified as such by health professionals.

Clinical implications

Accurately ascertaining self-harm events is vital for determining the morbidity and mortality associated with this set of behaviours (41, 42). Our findings indicate that relying solely on a self-reported history of self-harm in incarcerated adults substantially under-ascertains actual history, suggesting that many vulnerable individuals will be missed if this is the sole method for screening in prison settings. Scrutiny of retrospective medical records increased ascertainment considerably; we found that 25% more cases in the community were identified by screening medical records compared to self-report only. Similarly, 12% more cases were identified by considering self-report data and medical records, compared to medical records only. Considerably greater agreement between self-report and medical records was observed when identifying negative cases than when identifying positive cases (90% vs. 36%). Agreement of >0.8 is considered 'almost perfect' in the literature, whilst 0.21-0.4 is considered 'fair' (43).

One clear implication of our findings is that a more comprehensive method of identifying people at risk of self-harm is to triangulate data from multiple sources including self-report, clinician/observer ratings (for example, from prison medical records), and community medical records (44). Consistent with this, our findings suggest that incarcerated adults who disclose a history of self-harm *and* have a medically-verified record of self-harm are at considerably increased risk of further self-harm in the community (almost one in two in our study), and may require additional community-based support to prevent these events. Identifying these individuals to provide such support is likely to require access to historical medical records. People who disclose a history of self-harm, even without a medically-verified history, are at moderately increased risk of engaging in self-harm after release from

prison (about one in five in our study), and are also likely to require targeted support and preventive strategies.

Since 2005, the Correctional Service of Canada (CSC) has invested approximately $90 million in new funding to strengthen mental health care service delivery for prisoners with mental health disorders (45). The prevention and management of suicide and self-injury is one of the seven 'key elements' in the CSC's mental health strategy (46). Despite this, a number of key policy, capacity, operational and infrastructure challenges remain (45), as reflected by the closure in 2013 of the country's only prison program dedicated solely to inmates who harm themselves (47). Similar financial and governance issues are experienced in corrective services in Australia, suggesting both shared challenges and, potentially, generalizable solutions.

Strength and Limitations

Most limitations of this study would have resulted in under-ascertainment of self-harm events, and thus rendered our estimates conservative. First, whilst the true positive and false negative categories could be objectively verified, the same cannot be said for the unconfirmed positive and unconfirmed negative categories. Because prior self-harm events that did not result in medical treatment (and were not disclosed) would not have been recorded in any of the four self-harm categories, our estimates of the proportion of participants with a history of self-harm would be correspondingly conservative. Second, we did not have complete historical information from medical records for all participants and, as such, it is likely that we under-ascertained such events. Third, neither a failure to appear in the medical records data nor a failure to self-report a history of self-harm was taken as an indication of absence of historical self-harm; consequently, the specificity of self-reported self-harm could not be calculated.

Fourth, we did not have a sufficient number of events to examine the possibility of a dose-response relationship between episodes of re-incarceration and patterns of self-harm, similar to that which exists between episodes of incarceration and mortality (48). It is recommended that future studies treat re-incarceration as a time-varying covariate, instead of censoring at re-incarceration. Fifth, although we used January 1st 2014 as our censoring

date, the ambulance and hospital records ended on July 31st 2012. This would have resulted in under-ascertainment of medically verified self-harm events, and likely attenuated the observed associations between self-harm history and medically verified self-harm. Finally, presentations to health services outside the state of Queensland would not have appeared in the data to which we had access. However, additional linked data relating to study participants indicate that fewer than 5% of the sample accessed health services solely outside of Queensland (mirroring recent research; (49)), and as such, the number of health presentations due to self-harm outside of Queensland is likely to be small (50).

This study also had several important strengths. First, to our knowledge, it is the first study internationally to examine the level of agreement between incarcerated adults' own accounts of prior self-harm and their medical records. Second, it utilised four separate and unique data sources to ascertain episodes of medically-verified self-harm. Third, it is, to our knowledge, the first study ever to prospectively examine the association between self-reported and medically-verified self-harm history, and medically-verified self-harm after release from prison.

Conclusions

Self-report appears to be an insensitive method for documenting prior self-harm in incarcerated adults, despite the fact that self-report is the sole method for intake screening in many prison settings (9) and is subsequently relied on heavily to identify those at risk. The findings of this study support the use of linked medical records to supplement self-reported indicators of self-harm wherever feasible (with appropriate participant consent), particularly when ascertainment of such events informs allocation of scarce mental health resources in and after release from prison. It is likely that, as with the measurement of violent behaviour, the most accurate way of ascertaining self-harm events would involve triangulating data from multiple sources.

Funding

The Passports study was funded through an Australian National Health and Medical Research Council (NMHRC) Strategic Award (#409966) and Project Grant (#1002463). RB is supported by an NHMRC Early Career Fellowship (#1104644). SK is supported by an NHMRC

Senior Research Fellowship (#1078168). JY is supported by a Melbourne International Research Scholarship (PhD) from the University of Melbourne.

Acknowledgements

The authors wish to thank Queensland Corrective Services for assistance with data collection and all Passports study participants for sharing their experiences. The views expressed herein are solely those of the authors and in no way reflect the views or policies of Queensland Corrective Services.

References

1. Hawton K, Linsell L, Adeniji T, Sariaslan A, Fazel S. Self-harm in prisons in England and Wales: an epidemiological study of prevalence, risk factors, clustering, and subsequent suicide. The Lancet. 2013.

2. Lohner J, Konrad N. Deliberate self-harm and suicide attempt in custody: distinguishing features in male inmates' self-injurious behavior. International Journal of Law and Psychiatry. 2006;29(5):370-85.

3. Borschmann R, Thomas E, Moran P, Carroll M, Heffernan E, Spittal MJ, et al. Self-harm following release from prison: A prospective data linkage study. Australian and New Zealand Journal of Psychiatry. 2016:0004867416640090.

4. Borschmann R, Young JT, Moran P, Spittal M, Heffernan E, Mok K, et al. Ambulance attendances resulting from self-harm after release from prison: a prospective data linkage study (submitted).

5. Glenn CR, Klonsky ED. Prospective prediction of nonsuicidal self-injury: a 1-year longitudinal study in young adults. Behavior Therapy. 2011;42:751-62.

6. Skegg K. Self-harm. Lancet. 2005;366:1471-83.

7. Quinlivan L, Cooper J, Meehan D, Longson D, Potokar J, Hulme T, et al. Predictive accuracy of risk scales following self-harm: multicentre, prospective cohort study. British Journal of Psychiatry. 2017;DOI: 10.1192/bjp.bp.116.189993.

8. Bilén K, Ponzer S, Ottosson C, Castrén M, Pettersson H. Deliberate self-harm patients in the emergency department: who will repeat and who will not? Validation and development of clinical decision rules. Emergency medicine journal. 2013;30(8):650-6.

9. Perry AE, Marandos R, Coulton S, Johnson M. Screening tools assessing risk of suicide and self-harm in adult offenders: a systematic review. International journal of offender therapy and comparative criminology. 2010;54(5):803-28.

10. Binswanger IA, Blatchford PJ, Mueller SR, Stern MF. Mortality after prison release: opioid overdose and other causes of death, risk factors, and time trends from 1999 to 2009. Annals of internal medicine. 2013;159(9):592-600.

11. Karaminia A, Law MG, Butler TG, Levy MH, Corber SP, Kaldor JM, et al. Suicide risk among recently released prisoners in New South Wales, Australia. Medical Journal of Australia. 2007;187(7):387-90.

12. Pratt D, Piper M, Appleby L, Webb R, Shaw J. Suicide in recently released prisoners: a population-based cohort study. Lancet. 2006;368(9530):119-23.

13. Spittal MJ, Forsyth S, Pirkis J, Alati R, Kinner SA. Suicide in adults released from prison in Queensland, Australia: a cohort study. Journal of epidemiology and community health. 2014;68(10):993-8.

14. Mitchell AJ, Hussain S, Leaver J, Rajan C, Jones A, Malcolm N, et al. Is there a difference between hospital-verified and self-reported self-harm? Implications for repetition. General hospital psychiatry. 2016;43:12-6.

15. Mars B, Cornish R, Heron J, Boyd A, Crane C, Hawton K, et al. Using Data Linkage to Investigate Inconsistent Reporting of Self-Harm and Questionnaire Non-Response. Archives of Suicide Research. 2016;20(2):113-41.

16. Velting DM, Rathus JH, Asnis GM. Asking Adolescents to Explain Discrepancies in Self-Reported Suicidality. Suicide and Life-Threatening Behavior. 1998;28(2):187-96.

17. Mackay N, Barrowclough C. Accident and emergency staff's perceptions of deliberate self-harm: attributions, emotions and willingness to help. British Journal of Clinical Psychology. 2005;44(2):255-67.

18. Rowe SL, French RS, Henderson C, Ougrin D, Slade M, Moran P. Help-seeking behaviour and adolescent self-harm: A systematic review. Australian and New Zealand journal of psychiatry. 2014:0004867414555718.

19. Nada-Raja S, Morrison D, Skegg K. A population-based study of help-seeking for self-harm in young adults. Australian and New Zealand Journal of Psychiatry. 2003;37:600-5.

20. Lloyd B, Gao C, Heilbronn C, Lubman D. Self-harm and mental health-related ambulance attendances in Australia: 2013 Data. Fitzroy, Victoria: Turning Point. 2015.

21. Farrelly T, Francis K. Definitions of suicide and self-harm behavior in an Australian Aboriginal community. Suicide and Life-Threatening Behavior. 2009;39(2):182-9.

22. Deliberto TL, Nock MK. An exploratory study of correlates, onset, and offset of non-suicidal self-injury. Archives of Suicide Research. 2008;12(3):219-31.

23. Liu RT, Mustanski B. Suicidal ideation and self-harm in lesbian, gay, bisexual, and transgender youth. American Journal of Preventive Medicine. 2012;42(3):221-8.

24. CIC. Risky business: an investigation into the treatment and management of chronic self-injury among federally sentenced women. Office of the Correctional Investigator, Canada. 2013.

25. Gordon A. Self-injury incidents in CSC institutions over a thirty-month period: Correctional Service of Canada; 2010.

26. Martin MS, Dorken SK, Colman I, McKenzie K, Simpson AI. The incidence and prediction of self-injury among sentenced prisoners. The Canadian Journal of Psychiatry. 2014;59(5):259-67.

27. CSC. Management of inmate self-injurious and suicidal behaviour. Correctional Service Canada (downloaded on 19 November 2016 from http://www.csc-scc.gc.ca/acts-and-regulations/843-cd-eng.shtml#s2a). 2013. 2013.

28. Kinner SA, Lennox N, Williams GM, Carroll M, Quinn B, Boyle FM, et al. Randomised controlled trial of a service brokerage intervention for ex-prisoners in Australia. Contemporary Clinical Trials. 2013;36(1):198-206.

29. Brameld KJ, Thomas MA, Holman CAJ, Bass AJ, Rouse IL. Validation of linked administrative data on end-stage renal failure: application of record linkage to a 'clinical base population'. Australian and New Zealand journal of public health. 1999;23(5):464-7.

30. O'Halloran J, Miller GC, Britt H. Defining chronic conditions for primary care with ICPC-2. Family Practice. 2004;21(4):381-6.

31. Moran P, Coffey C, Romaniuk H, Olsson C, Borschmann R, Carlin JB, et al. The natural history of self-harm during adolescence and young adulthood: population-based cohort study. Lancet. 2012;379(9812):236-43.

32. Looney SW, Hagan JL. Handbook of statistics: epidemiology and medical statistics. Amsterdam: Elsevier; 2007.

33. Chen G, Faris P, Hemmelgarn B, Walker RL, Quan H. Measuring agreement of administrative data with chart data using prevalence unadjusted and adjusted kappa. BMC Med Res Methodol. 2009;9(1):5.

34. Cicchetti DV, Feinstein AR. High agreement but low kappa: II. Resolving the paradoxes. J Clin Epidemiol. 1990;43(6):551-8.

35. Cox DR. Regression Models and Life-Tables. Journal of the Royal Statistical Society Series B (Methodological). 1972;34(2):187-220.

36. Efron B, Tibshirani R. Bootstrap methods for standard errors, confidence intervals, and other measures of statistical accuracy. Statistical science. 1986:54-75.

37. OESR. Australian standard offence classification (Queensland extension). Brisbane, Australia: Office of Economic and Statistical Research, Queensland Government; 2008.

38. StataCorp. Stata Statistical Software: Release 13. College Station, TX: StataCorp LP; 2013.

39. Whitlock J, Eckenrode J, Silverman D. Self-injurious behaviors in a college population. Pediatrics. 2006;117(6):1939-48.

40. Fliege H, Kocalevent R, Walter O, Beck S, Gratz KL, Guttierez PM, et al. Three assessment tools for deliberate self-harm and suicide behavior: evaluation and psychopathological correlates. Journal of Psychosomatic Research. 2006;61:113-21.

41. Rockett IR, Caine ED. Self-injury is the eighth leading cause of death in the United States: it is time to pay attention. JAMA psychiatry. 2015;72(11):1069-70.

42. Rockett IR, Lilly CL, Jia H, Larkin GL, Miller TR, Nelson LS, et al. Self-injury mortality in the United States in the early 21st century: a comparison with proximally ranked diseases. Jama psychiatry. 2016;73(10):1072-81.

43. Landis JR, Koch GG. The measurement of observer agreement for categorical data. biometrics. 1977:159-74.

44. Borschmann R, Hogg J, Phillips R, Moran P. Measuring self-harm in adults: a systematic review. European Psychiatry. 2011;27:176-80.

45. OCI. Risky business: an investigation of the treatment and management of chronic self-injury among federally sentenced women - final report. Office of the Correctional Investigator, Canada. CAT. No.: PS104-7/2013E-PDF; ISSN: 978-1-100-22730-6. . 2013.

46. CSC. Mental Health Strategy for Corrections in Canada. Correctional Service of Canada (downloaded on 19 November 2016 from http://www.csc-scc.gc.ca/health/092/MH-strategy-eng.pdf). . 2010.

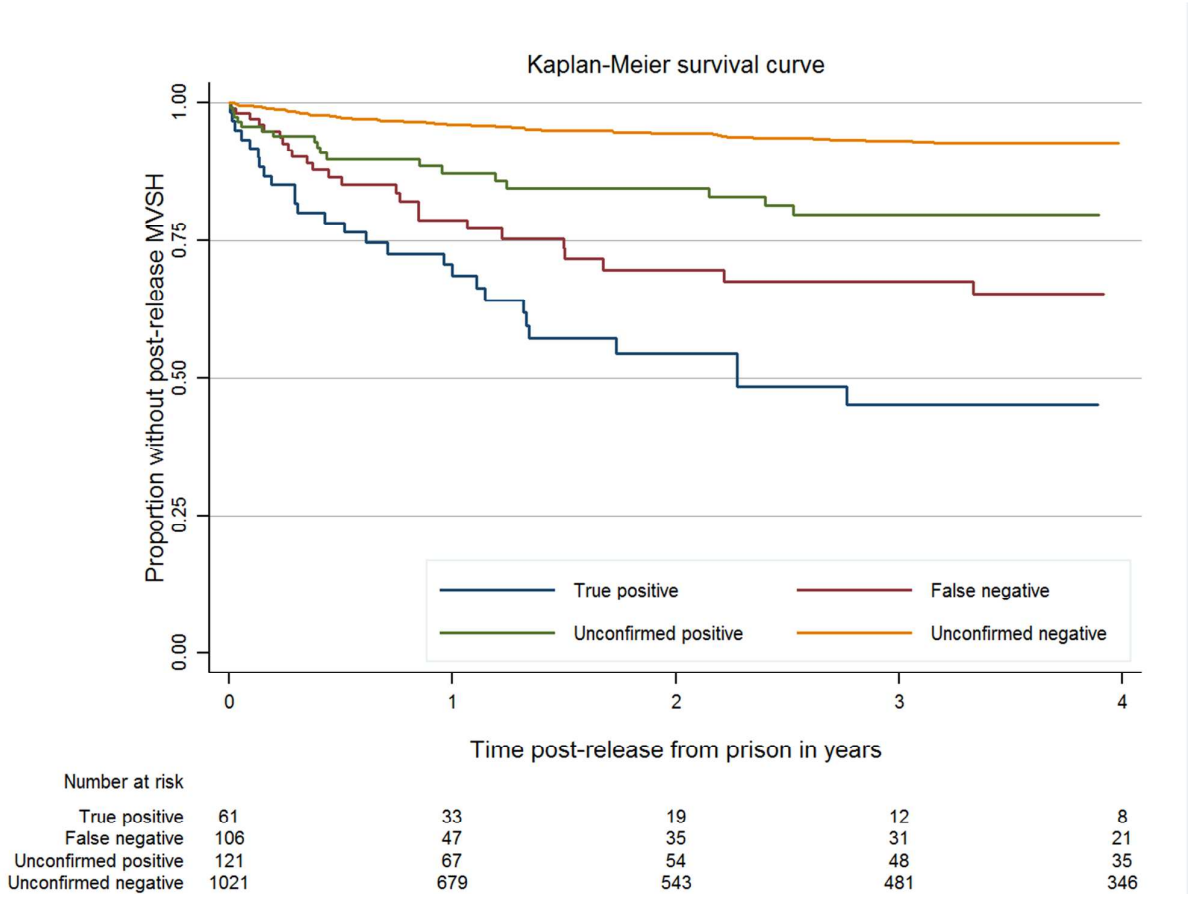
47. Stone L. CSC closing country's only prison program for inmates who self-harm (downloaded on 19 November 2016 from http://ipolitics.ca/2013/02/07/csc-closing-countrys-only-prison-program-for-inmates-who-self-harm/). 2013.

48. Kariminia A, Law MG, Butler TG, Corben SP, Levy MH, Kaldor JM, et al. Factors associated with mortality in a cohort of Australian prisoners. European journal of epidemiology. 2007;22(7):417-28.

49. Spilsbury K, Rosman D, Alan J, Boyd JH, Ferrante AM, Semmens JB. Cross-border hospital use: analysis using data linkage across four Australian states. Medical Journal of Australia. 2015;202(11):582-5.

50. Rosman D, Spilsbury K, Alan J, Ferrante A, Young A, Fuller E, et al. Multi-jurisdictional linkage in Australia: proving a concept. Australian and New Zealand journal of public health. 2016;40(1):96-7.

Figure 1. Kaplan-Meier curve of medically verified self-harm events in the first four years following release from prison according to self-harm category.



Number at risk

True positive	61	33	19	12	8
False negative	106	47	35	31	21
Unconfirmed positive	121	67	54	48	35
Unconfirmed negative	1021	679	543	481	346

Table 1. Classification system for assigning participants to a self-harm category based on baseline interview responses and linked health records.

Self-reported self-harm		Medically verified self-harm	
		NO	**YES**
	NO	**Unconfirmed negative:** Participant did not disclose self-harm at baseline interview and had no medically verified self-harm events prior to baseline	**False negative:** Participant did not disclose self-harm at baseline interview but had ≥1 medically verified self-harm events prior to baseline
	YES	**Unconfirmed positive**: Participant disclosed self-harm at baseline interview but had no medically verified self-harm events prior to baseline	**True positive:** Participant disclosed self-harm at baseline interview and had ≥1 medically verified self-harm events prior to baseline

Table 2. The proportion of participants assigned to the four mutually exclusive self-harm categories.

Self-reported self-harm		Medically verified self-harm		TOTAL
		NO	YES	
	NO	**Unconfirmed negative:** 1023 (77.8%)	**False negative:** 106/1315 (8.1%)	1129/1315 (85.9%)
	YES	**Unconfirmed positive**: 122/1315 (9.3%)	**True positive:** 64/1315 (4.8%)	186/1315 (14.1%)
	TOTAL	1145/1315 (87.1%)	170/1315 (12.9%)	1315 (100%)

Table 3. Post-baseline medically verified self-harm events by participants according to self-harm category.

		No events recorded		≥1 events recorded		Total		HR (95%CIs)	AHR (95%CIs)
		N	%	N	%	N	%		
Self-harm validation diagnostic test group indicator	True positive	35	54.7	29	45.3	64	100.0	10.6 (6.5 - 17.2)	6.2 (3.5 - 10.8)
	False negative	82	77.4	24	22.6	106	100.0	5.8 (3.5 - 9.5)	4.0 (2.3 - 7.0)
	Unconfirmed positive	101	82.8	21	17.2	122	100.0	3.4 (2.0 - 5.9)	2.2 (1.2 - 4.1)
	Unconfirmed negative	965	94.3	58	5.7	1023	100.0	ref.	ref.

FOOTNOTE: The multivariate model was adjusted for sex, age, Indigenous status, relationship status, years of education, sexual identity, Queensland Corrective Services self-harm risk flag, prior suicide attempt, lifetime history of mental disorder, and violent offence (Y/N).

SUPPLEMENTARY APPENDIX

Table S1. Pre-baseline self-harm according to self-report and medical records, according to self-harm category, demographic and criminogenic characteristics.

		Total (N)	Self-harm category				p-value
			True positive (N, %)	Unconfirmed positive (N, %)	False negative (N, %)	Unconfirmed negative (N, %)	
Gender	Male	1037	41 (4.0)	93 (9.0)	78 (7.5)	825 (79.6)	0.005
	Female	278	23 (8.3)	29 (10.4)	28 (10.1)	198 (71.2)	
Age at index release (yrs)	18-24	336	17 (5.1)	41 (12.2)	15 (4.5)	263 (78.3)	<0.001
	25-39	681	38 (5.6)	67 (9.8)	70 (10.3)	506 (74.3)	
	40+	298	9 (3.0)	14 (4.7)	21 (7.0)	254 (85.2)	
Indigenous status[$]	Non-Indigenous	979	47 (4.8)	87 (8.9)	74 (7.6)	771 (78.8)	0.509
	Indigenous	336	17 (5.1)	35 (10.4)	32 (9.5)	252 (75.0)	
In a relationship[$]	No	863	45 (5.2)	85 (9.8)	77 (8.9)	656 (76.0)	0.184
	Yes	452	19 (4.2)	37 (8.2)	29 (6.4)	367 (81.2)	
Years of education[$]	≥10 years	741	28 (3.8)	66 (8.9)	56 (7.6)	591 (79.8)	0.124
	<10 years	574	36 (6.3)	56 (9.8)	50 (8.7)	432 (75.3)	
Sexual identity[$]	Heterosexual	1234	51 (4.1)	107 (8.7)	98 (7.9)	978 (79.3)	<0.001
	LGBT	80	13 (16.3)	15 (18.8)	10.0	44 (55.0)	
QCS self-harm flag	No	1010	26 (2.6)	60 (5.9)	63 (6.2)	861 (85.2)	>0.001
	Yes	292	37 (12.7)	59 (20.2)	43 (14.7)	153 (52.4)	
Previous suicide attempt[$]	No	1035	19 (1.8)	62 (6.0)	66 (6.4)	888 (85.8)	<0.001
	Yes	280	45 (16.1)	60 (21.4)	40 (14.3)	135 (48.2)	

Lifetime history of mental disorder[$]	No	742	12 (1.6)	29 (3.9)	48 (6.5)	653 (88.0)	<0.001
	Yes	572	52 (9.1)	93 (16.2)	58 (10.1)	369 (64.5)	
Most serious offence violent	No	615	29 (4.7)	60 (9.8)	38 (6.2)	488 (79.3)	0.095
	Yes	687	34 (4.9)	59 (8.6)	68 (9.9)	526 (76.6)	

LGBT: Lesbian, gay, bisexual, transgender; QCS: Queensland Corrective Services; [$]Self-reported