

**Pre-sentence mental health service use predicts post-sentence mortality in a
population cohort of first-time adult offenders**

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Abstract

Purpose: With the high risk of death associated with mental disorders and their increased prevalence in offenders, it is judicious to investigate the risk of post-sentence mortality with respect to offenders' psychiatric treatment history.

Methods: Using linked administrative data for a whole-population retrospective cohort of first-time adult offenders (n=25,537) sentenced to either prison or non-custodial orders in Western Australia, we determined the risk and baseline predictors of post-sentence mortality.

Results: Of 196 deaths within two years of sentence completion, deaths from injury/poisoning (55.6%), cancer (13.3%) and cardiovascular disorders (9.7%) were the most common. Pre-sentence history of mental health service (MHS) contact doubled the risk of post-sentence all-cause and injury/poisoning related mortality. Physical comorbidity was the strongest predictor of mortality irrespective of pre-sentence MHS contact. Baseline history of attempted self-harm and being an Indigenous male were associated with an elevated risk of death in offenders with a pre-sentence MHS contact. In offenders without a pre-sentence MHS contact, socio-economic disadvantage and incarceration almost doubled the risk of dying from any cause and injury/poisoning.

Conclusions: Mortality risk in the two years following sentence completion is associated with pre-sentence health service use and a range of socio-demographic factors for both incarcerated and non-custodial offenders. The opportunity afforded by imprisonment could be exploited by provision of funding to identify and treat mental illness, impart preventive health education addressing modifiable risk factors and provide throughcare to community-based services, all of which may help reduce preventable post-sentence deaths. Diversion to non-custodial sentences is also a plausible option.

Keywords: mortality, mental health service, re-entry, prison, non-custodial

Introduction

Mental illness, especially severe mental illness is a well-established risk factor for premature death [1-3] and there is evidence of an increasing gap in life expectancy between people with mental illness and the general population over time [4,5]. The high prevalence of mental illness in prisoners [6-9] has imposed a duty to care for these people both on corrective services providers as well as community-based mental health service (MHS) providers. About 30 million people transit through prisons world-wide every year [10]. In Australia, around 50,000 people pass through prisons annually [11], and an average of 55,000 offenders serve community correction (non-custodial) orders at any given time [12]. The high risk of death in ex-prisoners relative to the general population is well-established [13-18]. The risk is greatest in the first few months of being released from prison and dominated by deaths from drug-overdose, suicide, homicide and cardiovascular disorders [15-21]. An increased risk of death while serving non-custodial sentences relative to the incarcerated and general population has been found [22-24], but has rarely been compared after sentence completion [25].

Greater prevalence of mental disorders in prisoners has been implicated in their elevated mortality relative to the general population [14,18,26]. Hence, investigation of post-sentence mortality among both incarcerated and non-custodial offenders with respect to psychiatric morbidity is an important issue. Better understanding of baseline (pre-sentence) predictors is essential to identify vulnerabilities and develop targeted interventions that can potentially minimise preventable deaths in the post-sentence period.

This study aimed to examine the risk and baseline predictors of death within two years of their index (first-ever) sentence completion, comparing offenders' pre-sentence history of MHS use. We further compare the post-sentence mortality among offenders

serving prison and community correction orders using standard and sophisticated methods to control for potential selection biases.

Methods

Study population

The cohort included all adult (≥ 18 years) offenders who commenced their index sentence in Western Australia (WA) between 1st January 1985 and 31st December 1994, either on a community correction order or in one of WA's 13 prisons. Nineteen offenders who were still serving their index sentence on the follow-up censor date of 31st December 2008, and 81 offenders who died while serving their index sentence were excluded, leaving 25,537 offenders for analysis.

Data sources

Offenders' correctional records were provided by the WA Department of Corrective Services. These were probabilistically linked [27] through the WA Data Linkage System [28] to State-wide statutory health data collections namely, the Hospital Morbidity Data System for inpatient separations, the Mental Health Information System for all public non-admitted (outpatient, ambulatory or community-based) psychiatric services, and the Deaths Register comprising all deaths within WA.

Ascertainment of pre-sentence health service contact history

A pre-sentence MHS contact was defined as any public or private psychiatric inpatient admission or any recorded contact with public non-admitted MHSs in WA. Presence of diagnosed mental disorder was determined from a primary diagnosis in non-admitted data, or

the primary or any of the 21 secondary diagnostic fields in the hospital discharge records. Changes in diagnostic classification over time [29] were harmonised by transforming all psychiatric diagnostic codes to the 9th Revision of the International Classifications of Disease with clinical modifications (ICD-9-CM), effective from 1988 to July-1999, which corresponded closely to the timing of most MHS events in the pre-sentence period.

History of MHS contact in the 0-1 and 1-5 year pre-sentence periods was identified through MHS contacts (ICD-9-CM codes 290-319) during those times. For offenders with a MHS contact, the most recent pre-sentence psychiatric diagnosis in the five-year (0-5 year) period was used to define the nature of past psychiatric diagnosis. If the last MHS contact had multiple psychiatric diagnoses, then the most serious condition was chosen with psychotic disorders (ICD-9-CM-codes 295-298) taking precedence over substance use disorders (291, 292, 303-305), which were selected over other disorders (290, 293, 294, 299-302, 306-319) [30,31]; the latter consisting of psychiatric disorders insufficient frequency to be analysed separately. Similarly, a five-year pre-sentence history of attempted self-harm was identified by using the relevant ICD codes in the external cause of injury fields (E950.0-E959.9, E980.0-E980.6). The Charlson Comorbidity Index [32] was calculated for each offender to adjust the risk of mortality for one-year pre-sentence physical illness (identified from the 22 diagnostic and 11 procedure fields of the hospital discharge records), based on our previous work which found a one-year look-back period to be a more robust predictor of mortality than a five-year look-back period [33].

Ascertainment of post-sentence death

Deaths occurring within two years after index sentence completion were identified through the Deaths Register. Cause of death was available for all mortality records and was coded by the Australian Bureau of Statistics (ABS) according to the version of the ICD current at the

time of death. Analyses were restricted to deaths from all causes, from injury/poisoning (ICD-9-CM codes: E800-E999; ICD-10-AM codes: S00-T99, V01-Y34) and natural causes (ICD codes excluding those of injury/poisoning), due to insufficient deaths from other specific causes for reliable results. Most offenders had complete two year follow-up (84.2%). Follow-up was censored earlier if the offender died (0.75%), was resentenced (15.0%) or at the follow-up censor date of 31st December 2008 (0.01%), whichever came first.

Geographic accessibility and social disadvantage

Social disadvantage was measured through the Index of Relative Socio-Economic Disadvantage (IRSD) [34], a summary measure of Socio-Economic Index for Areas (SEIFA) focusing on disadvantage in terms of accessibility to education, employment and income [35]. The IRSD quintiles (ranging from most disadvantaged to least disadvantaged) from the national census year (1986, 1991 or 1996) closest to the year of index offence were used. Geographical accessibility was measured via the Accessibility and Remoteness Index of Australia (ARIA) [36] scores from the 1996 census, classified into highly accessible, accessible and remote categories. Residential postcode at the time of index sentence was used to determine both measures.

Offence type

Offences were classified using the Australian and New Zealand Standard Offence Classification (ANZSOC) [37]. In a person convicted of multiple offences at their index sentence, the severity of crime was ascertained through the National Offence Index [38], and the most serious crime determined. Offenders were thereafter categorised as violent (ANZSOC codes: 0111- 0621) and non-violent (0711-1695).

Custodial setting

Based on their index sentence, offenders were categorised as having either a prison or a community correction order. Some offenders who had served a part of their sentence in both settings (n=1776, 6.93%) were included in the prisoner group. Most of these had been transferred from prison to community corrections during the course of their sentence, with less than 1% being incarcerated after serving a community correction order. Offenders could be released to freedom, conditionally (eg. parole) or for other reasons requiring further legislative action.

Statistical analyses

Cohort characteristics for each gender-race demographic group namely, Indigenous females, Indigenous males, non-Indigenous females and non-Indigenous males were described using descriptive statistics. Kaplan-Meier estimates for the two-year risk of post-sentence death from any cause, natural cause and from injury/poisoning (the most common cause of death) were obtained in each ten-year age-group for the full cohort and separately for offenders with (n=4,092) and without (n=21,445) a five-year pre-sentence MHS contact. These were stratified by the nature of offence and custodial setting.

Multivariable Cox proportional hazards regression models were used to identify determinants of all-cause, natural cause and injury/poisoning related mortality separately for offenders (aged 18-64 years at sentence completion) with and without a five-year pre-sentence MHS contact. Offenders aged over 65 years at end of sentence were excluded from these risk factor analyses due to the larger risk of death from other competing age-related causes. Risk factors examined included socio-demographic variables (gender-race group, age at end of first-ever sentence, ARIA, SEIFA), index sentence characteristics (nature of

offence, custodial setting, sentence duration) and pre-sentence health history (MHS use, psychiatric diagnosis, attempted self-harm and physical comorbidity).

To diminish the potential effect of selection bias in the comparison of post-sentence mortality for offenders sentenced to a term of imprisonment versus community correction order, propensity score adjusted analyses were also performed [25,39]. A multivariable logistic regression model was fitted to determine the propensity (probability) [39] for each offender to be imprisoned (vs. sentenced to community correction order) based on all measured potential allocation characteristics including gender, race, age at index sentence, ARIA, SEIFA, history of health service use (MHS use, psychiatric diagnosis, attempted self-harm, physical illness), and the violence and severity of index offence. Thereafter, multivariable Cox models were used to compare the all-cause, natural cause and injury/poisoning related mortality between offenders in the two custodial settings over the two-year post-sentence period, after adjusting for the age at index sentence completion and sentence duration. This was done in two ways: (i) using the propensity probability as a covariate, and (ii) using inverse probability weights calculated as $1/(\text{propensity probability})$ for those who were imprisoned and $1/(1-\text{propensity probability})$ for those who received a community correction order [39], and conducting weighted Cox regression analyses [39]. All statistical analyses were performed using SAS version 9.3.

Ethics

This study was approved by the Research and Evaluation Committee of the Department of Corrective Services (Reference Number: 2006/00276), and the Human Research and Ethics Committees of the WA Department of Health (Reference Number: 200623), and the University of Western Australia (Reference Number: RA/4/1/1347).

Results

Description of the offender cohort

Table 1 describes the socio-demographic profile, sentence details and pre-sentence history of health service use by the offender cohort. The offender cohort (n=25,537) comprised 65.8% non-Indigenous males, 17.8% non-Indigenous females, 12.3% Indigenous males and 4.1% Indigenous females. Most offenders were socio-economically highly disadvantaged (48.2%), lived in accessible areas (81.4%), were convicted of a non-violent offence (71.3%), served community correction orders (76.3%), and were released to freedom (80.1%). The mean age at the end of index sentence was 28.9 years (SD=10.2), with more than three-quarters aged 18-34 years in all demographic groups. The mean duration of index sentence was 1.2 years (SD=1.1). The mean length of post-sentence follow-up (maximum of 2.0 years) was 1.8 years (SD=0.5).

A total of 2,163 (8.5%) and 4,092 (16.0%) offenders, respectively, had a MHS contact in the one-year and five-year periods before their index sentence. Almost half of the offenders with a pre-sentence MHS contact had had a MHS contact in the 0-1 year (52.9%) and 1-5 year (47.1%) period. Substance use disorders were the predominant five-year diagnosis (56.1%) and psychotic disorders were present in 8.6% of offenders with a pre-sentence MHS contact; corresponding respectively to 9.0% and 1.4% of the full cohort. Overall, 43.8% and 4.5% of all offenders had a five-year pre-sentence history of any hospital admission for physical illness and attempted self-harm, respectively. However, compared with offenders without a pre-sentence MHS contact, those with a MHS contact had significantly greater five-year prevalence of hospitalisation for physical ailments (37.2% vs. 78.6%) and attempted self-harm (1.1% vs. 22.1%).

Cause of death

Table 2 shows the main causes of death and their distribution in various offender sub-groups. In the full cohort, 0.75% (n=192) people died within two years of index sentence completion; 1.6% (n=64) and 0.6% (n=128) respectively in offenders with and without a pre-sentence MHS contact. In all offender sub-groups, deaths from injury/poisoning (n=109, 56.8% overall) were more common than natural deaths (n=83, 43.2% overall); 60.9% (n=39) and 54.7% (n=70) of offenders with and without a pre-sentence MHS contact, respectively, dying from injury/poisoning. Suicide (24.0%), cancer (13.3%) and cardiovascular (9.7%) causes were the specific leading causes of deaths. Drug-related deaths (ICD-9-CM codes: 304, 305.2-305.9, E850-E858, E950.0-E950.5, E962.0, E980.0-E980.5; ICD-10-AM codes: F11-F16, F19, F55, X40-X44, X60-X64, X85, Y10-Y14) [40] constituted 18.8% (n=36) of all deaths; 23.4% and 16.4% respectively in offenders with and without a pre-sentence MHS contact. Nearly 60% of deaths were in those aged 18-35 years at sentence completion in both offenders with and without a pre-sentence MHS contact.

Estimated two-year risk of post-sentence mortality

The two-year crude risk of post-sentence death from any cause was 0.8% overall and increased from 0.6% in offenders aged 18-24 years to 8.5% in those aged over 65 years at the end of their sentence (Table 3). The crude risk was higher for offenders with a pre-sentence MHS history (1.7% vs. 0.6%), offenders convicted of a violent offence (1.1% vs. 0.7%) and offenders sentenced to prison (1.1% vs. 0.7%), compared with their counterparts. Similar patterns were observed for natural and injury/poisoning related deaths, except that there were no age-related trends in the latter.

Predictors of Two-year Post-sentence Mortality

The fitted multivariable Cox regression models for post-sentence mortality from all causes, natural causes and injury/poisoning in offenders aged 18-64 years at end of first sentence, stratified by the presence of pre-sentence history of MHS contact, are shown in Table 4.

Predictors of post-sentence mortality in offenders with a pre-sentence MHS contact

Among offenders with a pre-sentence MHS contact, Indigenous males had a greater risk of post-sentence death from any cause (HR:2.3, $p<0.05$) and from injury/poisoning (HR:3.4, $p<0.01$) than non-Indigenous males. A Charlson Index score of two or more was the strongest predictor of all-cause (HR:4.7, $p<0.05$) and natural (HR: 9.9, $p<0.01$) deaths. Similarly, a five-year pre-sentence history of attempted self-harm doubled ($p<0.05$) the risk of death from any cause compared with those with no such history. The HRs for both these variables (one-year comorbidity and five-year history of attempted self-harm) were also elevated for injury/poisoning related deaths but were not significant ($p>0.05$).

None of the examined offence or socio-demographic variables were strong determinants of any death outcome in offenders with a pre-sentence MHS contact with two exceptions. Offenders aged 18-24 years were less likely to die from any cause ($p<0.05$ for comparisons with offenders aged 25-34 and 45-54 years), from natural causes ($p<0.01$ for comparison with offenders aged 45-45 years) and from injury/poisoning related causes ($p<0.05$ for comparison with offenders aged 25-34 years). Also, prisoners had a lower risk of death from natural causes (HR:0.1, $p<0.05$) (Table 4).

Predictors of post-sentence mortality in offenders without a pre-sentence MHS contact

Among offenders without a pre-sentence MHS contact, physical comorbidity was the strongest predictor of all-cause (HR:36.7, $p<0.0001$) and natural cause (HR:65.6, $p<0.0001$) mortality. Also, prisoners were twice as likely ($p<0.01$) to die from any cause and natural

causes, and 1.8 times ($p>0.05$) more likely to die from injury/poisoning compared with offenders on community corrections.

Older age at sentence completion and socio-economic disadvantage were significant predictors of mortality in offenders without a pre-sentence MHS contact. The risk of death increased with age, being greatest for offenders aged 55-64 years compared with those aged 18-24 years for both all-cause (HR:3.2, $p<0.01$) and natural cause (HR: 14.3, $p<0.0001$) mortality, but was not associated with injury/poisoning related deaths ($p>0.05$). However, the risk of all-cause and injury/poisoning related deaths was significantly higher in offenders with highly disadvantaged socio-economic backgrounds, having more than twice the risk compared with offenders from least/less disadvantaged backgrounds. Violent offending and sentence duration were not significantly associated with any death outcome in offenders without a pre-sentence MHS contact.

Propensity adjusted comparison of post-sentence mortality with respect to custodial setting

Custodial setting was not related to all-cause or injury/poisoning deaths in offenders with a pre-sentence MHS contact. Consistent results were found after applying both methods of adjusting for the propensity to be imprisoned (Table 4). Likewise, in offenders without a pre-sentence MHS contact history, ex-prisoners had twice the risk of dying from all-cause, natural and injury/poisoning related causes compared with those who had been on community orders within two years of sentence completion. These results persisted after applying both methods of adjusting for the probability of being imprisoned.

Discussion

To our knowledge, this is the first population-based study investigating predictors of post-sentence mortality in both prisoners and non-custodial offenders with respect to their pre-sentence psychiatric treatment history. The increased risk of dying from both natural and unnatural causes in this period concurs with the literature [14,17,19,21] but is disconcerting considering their potential preventability. Importantly, our study results pertain only to first-time offenders who are known to have a lower risk of post-sentence mortality compared with recurrent offenders [20,21].

We found a pre-sentence history of MHS contact to be an independent and strong predictor of post-sentence mortality. In 16% (n=4,063) of the cohort, a five-year pre-sentence history of MHS contact nearly doubled the risk of death from any cause (HR:1.9, 95%CI: 1.3-2.7, $p<0.001$) and from injury/poisoning (HR:2.7, 95%CI: 1.7-4.1, $p<0.0001$) but had no effect on natural deaths (HR:1.1, 95%CI: 0.6 - 1.9, $p>0.05$) within two years of sentence completion(See Appendix I). This replicates similar findings of elevated risk of dying in recipients of psychiatric treatment in the general population [1-3,41], prisoners [18] and ex-prisoners [26]. It represents an important public health issue considering the high prevalence of mental disorders in offenders [6,8] and the large number of people transiting through the criminal justice system annually [10-12].

Several factors are considered to interact leading to an elevated post-sentence mortality in those receiving psychiatric treatment [3,41,42]. Being an Indigenous male, history of physical comorbidity and attempted self-harm were significantly associated with mortality in offenders with a pre-sentence MHS history, while physical comorbidity, increasing age, greater socio-economic disadvantage and being incarcerated were the strongest determinants in offenders without a pre-sentence MHS history. Also, a previous

attempt at self-harm nearly doubled the risk of death in those with a history of MHS contact; consistent with previous research in offenders with a history of inpatient psychiatric treatment [43] and the general population [44].

Indigenous men with a pre-sentence history of MHS contact were 2-3 times more likely to die from any cause and injury/poisoning within two years of sentence completion than non-Indigenous men. The poorer health profile and higher mortality rates of Indigenous people relative to their non-Indigenous counterparts is well-documented [20,45]. Although socio-economic disadvantage and nature of psychiatric disorder were not associated with death in offenders with a pre-sentence MHS contact collectively, the presence of substance use disorders and socio-economic marginalisation in Indigenous populations cannot be disregarded [45], and may in fact be responsible for their elevated risk of death despite receiving psychiatric treatment.

Poor physical health associated with modifiable lifestyle related risk factors like lack of physical activity, dietary indiscretion, obesity, smoking, substance use and treatment non-compliance or medication side-effects are very common in people with serious mental disorders [3,41,42,46]; in Indigenous people [45] who are over-represented in Australian prisons [47], and in offenders generally [6]. Moreover, prisoners on psychiatric medications are known to have a greater prevalence of risky health behaviours including smoking and substance use than those without [48], associated with common causes of mortality like some cancers and cardiovascular disorders. While inadequacies in effective communication of symptoms by people with serious mental illness may exist, nevertheless, those expressed may not always receive adequate physician attention [49,50].

Moreover, the quality of healthcare provided to patients with mental disorders and comorbid physical illness has often been found to be compromised in the community [3,42,51,52]. For example, under-detection and inequitable management of physical

comorbidities for critical conditions like ischaemic heart disease, one of the most important causes of death in people with mental disorders [1,53] has been reported [41,52,54], as has disruption in continuity of psychiatric medications upon incarceration [55]. Additionally, fragmented organisation of health services with segregated specialist treatments for various comorbidities leading to dissociated management of co-occurring medical conditions [4,41] may be especially challenging for people with serious mental illness [52] and offenders who sparingly engage with health services [56,57], further hindering treatment-seeking behaviour and service provision after sentence completion [4,41]. In addition, metabolic syndrome, obesity, diabetes and dyslipidaemia are some of the undesirable consequences of psychotropic medications used to treat serious mental disorders [3,5]; all strong risk factors of cardiovascular disease and related deaths [3,41] which were the third most common cause of death in our cohort.

The association of socio-economic hardship and poor physical health with absence of pre-sentence MHS contact and post-sentence mortality is evident from our results. The highly marginalised background of offenders including low educational attainment, unemployment, poor health and reduced access to social support and health services is well-known [6]. Comorbid physical and mental disorders are also more likely to be present in people with greater levels of socio-economic hardship, as are health risk factors like smoking and substance use [58].

Comparisons of mortality between prisoner and general populations have been suggested to be biased due to the greater aforementioned risk factors in prisoners [24,25]. While some studies found higher mortality risk in people serving non-custodial sentences, followed by prisoners and the general population [22-24], they failed to take into account the possible selection bias associated with being imprisoned [25]. To date, only one study in the Netherlands has compared post-sentence mortality in first-time prisoners with non-custodial

offenders after matching on their susceptibility to being imprisoned based on baseline socio-demographic and offence characteristics [25]. It found no significant differences between custodial and non-custodial offenders, although generalizability was reduced by limitations including restriction to mild-to-moderate offenders, lack of baseline health information and small sample size (n=816 offenders with 109 deaths) [25]. Also, any perceptible short-term differences in post-sentence mortality may have converged over the long 25 year follow-up period.

A key finding of our study was that exclusively in offenders without a pre-sentence MHS contact, incarceration doubled the risk of death after sentence completion. These effects were reproduced by the more methodologically robust propensity score analyses, thereby confirming the 'reality' of the difference after adjusting for all measured confounders. This suggests that the imprisonment experience may actually increase the risk of death within two years of sentence completion compared to non-custodial sentences in offenders without a pre-sentence MHS contact. It emphasises the importance of strengthening measures for screening and treatment for mental disorders upon entry and prior to release from prison to ensure service provision commensurate with their greater prevalence of mental and physical disorders [14,59], including the provision of adequate financial and trained human resources. On the contrary there were no significant differences in the mortality risk between incarcerated and non-incarcerated offenders with baseline MHS contact, except for a protective effect of imprisonment observed for natural deaths. However, since this effect was observed for only 21 deaths in this group (n=4,063), they need to be interpreted with caution due to the reduced power and accuracy, requiring further investigation.

Incarceration is known to be associated with social exclusion [60] and stressful living conditions including poor hygiene, overcrowding, strict discipline, lack of privacy or enforced solitude, minimal social networks, abrupt relocations, potential of violence and

victimisation, and inadequate healthcare facilities [61-64]. These factors are not conducive to maintaining physical or mental health, and have been acknowledged to develop and exacerbate mental illness [62-66]. For Indigenous offenders, separation from land and family is associated with emotional distress [67], sometimes with fatal consequences [61,68]. Furthermore, frequent and abrupt relocation of prisoners may occur without prior medical consultation, leading to discontinuity of medical treatment due to poor record sharing amongst different prisons and their healthcare providers [59,69], which may affect their engagement with health services, thereby impacting their health negatively. Prison is also stressful in terms of adapting to a new place with restricted contact with family and friends [64,70]. Reviews of the Australian and WA prison system over the last two decades have also identified a marked deficiency in the provision of adequate general and mental healthcare to the inmates [61,62,71,72] and deficiencies in ensuring continuity of care after release [72]. Inadequate throughcare services addressing health, employment, housing and financial needs in offenders leaving prison [69,73,74] may in turn lead to low use of healthcare services [73] and poor health outcomes [69,75], including death [26]. On the other hand, being sentenced to non-custodial orders may have shielded offenders from these experiences and provided them with a greater opportunity for maintaining their normal life circumstances, with minimal impact on their mental health.

Incarceration offers an opportunity for providing health education and implementation of preventive health programmes for the leading causes of post-sentence mortality in this hard to reach group. This is especially relevant to prisoners on psychiatric medications who are known to have a greater prevalence of risky health behaviours than those without [48]. The potential of preventive health efforts is recognised by prison authorities worldwide, especially for communicable diseases, suicides and drug-overdose deaths [10,76,77]. Benefits of preventive and therapeutic measures initiated during imprisonment may be

sustained through appropriate pre-release protocols directed towards the implementation of specific transitional care services ('throughcare'), whereby ex-prisoners receive on-going community-based healthcare upon release [69,77,78], by overcoming barriers related to access and stigma which may play a less dominant role in offenders completing non-custodial sentences. Again, while the utility of such approaches is recognised, the reality of restrictive health budgets for health service delivery for prisoners limits services to primary care interventions.

Ex-prisoners encounter various personal, socio-economic and environmental challenges associated with returning to the community after release [78], possibly deterring engagement with psychiatric services. Importance of multi-sectoral interventions during the transitional and post-sentence periods aimed at alleviating post-release socio-economic hardships is emphasised. Important issues relate to securing stable housing, employment, social security and accessing and receiving adequate and conjunctive mental and physical healthcare [51,79] in ex-prisoners [69,78].

Analysis of routinely-collected linked administrative data for a whole-population cohort of first-time imprisoned and community correction offenders overcame methodological limitations of previous studies including issues related to sample size, loss to follow-up, selection and numerator bias [15,25]. However, some limitations exist with our study. Despite a whole-population offender cohort, few cause-specific deaths (eg. drug-related deaths) limited reliable analyses of baseline predictors for these outcomes. Lack of national mortality data may have led to an under-estimation of post-sentence mortality risk [15] and shifted the bias towards the null as some offenders may have died outside WA, although WA is known to have a stable population with low emigration [80].

Other limitations included lack of information on people who had sought mental healthcare exclusively from general practitioners, private psychologists or private

psychiatrists. However, people in the general population have reported the unaffordability of private psychiatric services despite having private health insurance [81]. It is therefore even less likely in offenders due to their greater social disadvantage relative to the general population [48]. Also, no information was available on the provision or use of prison healthcare services and specific transitional care services ('throughcare') received by each offender while transiting from the criminal justice system to the community.

In conclusion, pre-sentence health service contacts for psychiatric and physical conditions were strong independent predictors of post-sentence mortality. Simply stated, it implies that offenders at a greater risk of dying after sentence completion had been in contact with the mental or general health services before being sentenced. This supports the argument that community-based health service contacts for both mental and physical disorders should be viewed as an important opportunity to identify and treat other comorbidities [42,69,79]. Likewise, upon sentencing, a known history of MHS contact in custodial and non-custodial offenders should alert correctional authorities to their greater risk of post-sentence mortality and direct adequate resources towards identifying and treating underlying comorbidities to allow provision of health services at par with their greater level of need, in an attempt to improve health outcomes upon sentence completion. Again, in those without a known MHS contact, the association of physical illness, incarceration and socio-economic deprivation with increased risk of death emphasises the importance of strengthening detection and initiating treatment of mental disorders upon entry into prison, implementing preventive health programmes, and improving funding and access to prison-based healthcare services. Provision of individually tailored transitional support services addressing socio-economic and health vulnerabilities to allow community integration, and improving continuity of MHS care at community-based healthcare services may be beneficial in reducing preventable mortality

in offenders with undetected mental disorders. Non-custodial sentences for such offenders could also be a plausible solution.

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Disclaimer

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Conflict of interest

On behalf of all authors, the corresponding author states that there is no conflict of interest.

References

1. Harris EC, Barraclough B. Excess mortality of mental disorder. *Br J Psychiatry*. 1998;173(1):11-53.
2. Lawrence D, Jablensky AV, Holman CDJ, Pinder TJ. Mortality in Western Australian psychiatric patients. *Soc Psychiatry Psychiatr Epidemiol*. 2000;35(8):341-347.
3. Lawrence D, Kisely S, Pais J. The epidemiology of excess mortality in people with mental illness. *Can J Psychiatry*. 2010;55(12):752-760.
4. Lawrence D, Hancock KJ, Kisely S. The gap in life expectancy from preventable physical illness in psychiatric patients in Western Australia: Retrospective analysis of population based registers. *BMJ*. 2013;346:1-14.
5. Saha S, Chant D, McGrath J. A systematic review of mortality in schizophrenia: is the differential mortality gap worsening over time? *Arch Gen Psychiatry*. 2007;64(10):1123-1131.
6. Australian Institute of Health and Welfare. *The Health of Australia's Prisoners*. Canberra: AIHW; 2013.
7. Fazel S, Danesh J. Serious mental disorder in 23000 prisoners: a systematic review of 62 surveys. *The Lancet*. 2002;359(9306):545-550.
8. Fazel S, Seewald K. Severe mental illness in 33,588 prisoners worldwide: systematic review and meta-regression analysis. *Br J Psychiatry*. 2012;200(5):364-73.
9. Butler T, Andrews G, Allnut S, Sakashita C, Smith N, Basson J. Mental disorders in Australian prisoners: a comparison with a community sample. *Aust N Z J Psychiatry*. 2006;40(3):272-276.
10. United Nations Office on Drugs and Crime. *Prevention of Spread of HIV Amongst Vulnerable Groups in South Asia*. Regional Office for South Asia, New Delhi: United Nations Office on Drugs and Crime; 2008.
11. Martire K, Larney S. Inadequate data collection prevents health planning for released prisoners. *Med J Aust*. 2009;191(7):408-409.
12. Steering Committee for the Review of Commonwealth State Service Provision. *Report on Government Services 2009*. Melbourne: Productivity Commission; 2009. p. 164.
13. Stewart LM, Henderson CJ, Hobbs MST, RIdout SC, Knuiman MW. Risk of death after release from jail. *Aust N Z J Public Health*. 2004;28(1):32-36.
14. Zlodre J, Fazel S. All-cause and external mortality in released prisoners: systematic review and meta-analysis. *Am J Public Health*. 2012;102(12):e67-e75.
15. Kinner SA, Forsyth S, Williams G. Systematic review of record linkage studies of mortality in ex-prisoners: why (good) methods matter. *Addiction*. 2013;108(1):38-49.
16. Merrall EL, Kariminia A, Binswanger IA, Hobbs MS, Farrell M, Marsden J, et al. Meta-analysis of drug-related deaths soon after release from prison. *Addiction*. 2010;105(9):1545-1554.
17. Rosen DL, Schoenbach VJ, Wohl DA. All-cause and cause-specific mortality among men released from state prison, 1980-2005. *Am J Public Health*. 2008;98(12):2278-2285.

18. Kariminia A, Law MG, Butler TG, Corben SP, Levy MH, Kaldor JM, et al. Factors associated with mortality in a cohort of Australian prisoners. *Eur J Epidemiol.* 2007;22(7):417-428.
19. Binswanger I, Stern M, Deyo R, Heagerty P, Cheadle A, Elmore J, et al. Release from prison - a high risk of death for former inmates. *N Engl J Med.* 2007;356:157-165.
20. Hobbs M, Krazlan K, Ridout S, Mai Q, Knuiman M, Chapman R. Mortality and morbidity in prisoners after release from prison in Western Australia 1995-2003. Canberra: AIC; 2006. p. 68.
21. Kariminia A, Butler TG, Corben SP, Levy MH, Grant L, Kaldor JM, et al. Extreme cause-specific mortality in a cohort of adult prisoners - 1988 to 2002: a data-linkage study. *Int J Epidemiol.* 2007;36:310-316.
22. Biles D, Harding R, Walker J. The deaths of offenders serving community corrections orders. *Trends and Issues in Crime and Criminal Justice.* 1999;107(Mar).
23. Fleming J, McDonald D, Biles D. Deaths in non-custodial corrections, Australia and New Zealand, 1987 and 1988. In: Biles D, McDonald D, editors. *Deaths in Custody, Australia, 1980-1989.* Canberra: AIC; 1992.
24. Sattar G. Rates and Causes of Death among Prisoners and Offenders under Community Supervision. London: Home Office Research Study 231; 2001. p. 78.
25. Dirkzwager A, Dirkzwager P, Nieuwbeerta A. Effects of first-time imprisonment on postprison mortality: a 25-year follow-up study with a matched control group. *The Journal of Research in Crime and Delinquency.* 2012;49(3):383-419.
26. Pratt D, Appleby L, Piper M, Webb R, Shaw J. Suicide in recently released prisoners: a case-control study. *Psychol Med.* 2010;40(5):827-835.
27. Kelman C, Bass A, Holman C. Research use of linked health data- a best practice protocol. *Aust N Z J Public Health.* 2002;26(3):251-255.
28. Holman C, Bass J, Rouse I, Hobbs M. Population-based linkage of health records in Western Australia: development of a health services research linked database. *Aust N Z J Public Health.* 1999;23(5):453-459.
29. Morgan V, Jablensky A. From inventory to benchmark: quality of psychiatric case registers in research. *Br J Psychiatry.* 2010;197(1):8-10.
30. Lawrence D, Holman C, Jablensky A. *Duty to Care: Preventable Physical Illness in People with Mental Illness.* Perth: The University of Western Australia; 2001.
31. Wallace C, Mullen P, Burgess P, Palmer S, Ruschena D, Browne C. Serious criminal offending and mental disorder - Case linkage study. *Br J Psychiatry.* 1998;172:477-484.
32. Romano PS, Roos LL, Jollis JG. Adapting a clinical comorbidity index for use with ICD-9-CM administrative data: differing perspectives. *J Clin Epidemiol.* 1993;46(10):1075-79.
33. Preen D, Holman C, Spilbury K, Semmens J, Brameld K. Length of comorbidity lookback period affected regression model performance of administrative health data. *J Clin Epidemiol.* 2006;59(9):940-946.
34. Australian Bureau of Statistics. *Census of Population and Housing: Socio-Economic Indexes for Areas (SEIFA), Australia - Data only, 2006.* Catalogue No. 2033.0.55.001. Canberra: ABS; 2006.

35. Australian Institute of Health and Welfare. Socio-Economic Indexes for Areas (SEIFA) cluster. Canberra: Metadata Online Registry (METeOR), AIHW; 2012.
36. Department of Health and Aged Care. Measuring Remoteness: Accessibility/Remoteness Index of Australia (ARIA). Occasional Paper New Series No. 14. Canberra: Department of Health and Aged Care; 2001.
37. Australian Bureau of Statistics. Australian Standard Offence Classification. Catalogue No. 1234.0. Canberra: ABS; 1997.
38. Australian Bureau of Statistics. Appendix 5: National Offence Index - Technical Paper. In: Criminal Courts, Australia, 2001-02. Catalogue No. 4513.0. Canberra: ABS, Commonwealth of Australia; 2003.
39. Heinze G, Juni P. An overview of the objectives of and the approaches to propensity score analyses. *Eur Heart J*. 2011;32:1704-1708.
40. Australian Bureau of Statistics. Information Paper: Drug-induced deaths: a guide to ABS causes of death data. Catalogue No. 4809.055.001. Canberra: ABS; 2002.
41. Morden NE, Mistler LA, Weeks WB, Bartels SJ. Health care for patients with serious mental illness: family medicine's role. *The Journal of the American Board of Family Medicine*. 2009;22(2):187-195.
42. Galletly CA, Foley DL, Waterreus A, Watts GF, Castle DJ, McGrath JJ, et al. Cardiometabolic risk factors in people with psychotic disorders: the second Australian national survey of psychosis. *Aust N Z J Psychiatry*. 2012;46(8):753-761.
43. Hanna K. Mortality in the South Australian Community Corrections Population: January 1998-2000: University of South Australia; 2001. Available from: http://ura.unisa.edu.au/R/?func=dbin-jump-full&object_id=unisa43519
44. Graham A, Reser J, Scuderi C, Zubrick S, Smith M, Turley B. Suicide: An Australian Psychological Society Discussion Paper. *Australian Psychologist*. 2000;35(1):1-28.
45. Australian Institute of Health and Welfare, Australian Bureau of Statistics. The Health and Welfare of Australia's Aboriginal and Torres Strait Islander Peoples. Catalogue No. AIHW 21. Commonwealth of Australia: AIHW & ABS; 2008.
46. Australian Bureau of Statistics. National Survey of Mental Health and Wellbeing: Summary of Results. Catalogue No. 4326.0. Canberra: ABS; 2007.
47. Australian Bureau of Statistics. Prisoners in Australia, 2012 Reissue. Catalogue No. 4517.0. Canberra: ABS; 2013.
48. Australian Institute of Health and Welfare. The mental health of prison entrants in Australia 2010. Bulletin no. 104. Catalogue No. AUS 158. Canberra: AIHW; 2012.
49. Goff DC. Integrating general health care in private community psychiatry practice. *J of Clinical Psychiatry*. 2007;68(Suppl 4):49-54.
50. Goldman LS. Medical illness in patients with schizophrenia. *J Clin Psychiatry*. 1999;60 (Supplement 21):10-15.
51. Jones S, Howard L, Thornicroft G. 'Diagnostic overshadowing': worse physical health care for people with mental illness. *Acta Psychiatr Scand*. 2008;118(3):169-171.
52. Lawrence D, Kisely S. Inequalities in healthcare provision for people with severe mental illness. *J Psychopharmacol*. 2010;24(11):Supplement 4: 61-8.

53. Lawrence D, Holman CD, Jablensky A. Death rate from ischaemic heart disease in Western Australian psychiatric patients 1980-1988. *Br J Psychiatry*. 2003;182:31-36.
54. Kiseley S, Smith M, Lawrence D, Cox M, Campbell LA, Maaten S. Inequitable Access for Mentally Ill Patients to Some Medically Necessary Procedures. *Can Med Assoc J*. 2007;176(6):779-784.
55. Bowen RA, Rogers A, Shaw J. Medication management and practices in prison for people with mental health problems: a qualitative study. *Int J Ment Health Syst*. 2009;3:24-34.
56. Thornicroft G. Most people with mental illness are not treated. *The Lancet*. 2007;370(9590):807-808.
57. Andrews DA, Bonta J. *The Psychology of Criminal Conduct*. 5th ed. New Providence, NJ: LexisNexis; 2010. p. 672.
58. Australian Institute of Health and Welfare. Comorbidity of mental disorders and physical conditions 2007. Catalogue No. PHE 155. Canberra: AIHW; 2011.
59. Ogloff J, Davis MR, Rivers G, Ross S. The identification of mental disorders in the criminal justice system. *Trends and Issues in Crime and Criminal Justice*. 2007;334(Mar).
60. Spooner C, Hetherington K. Social Determinants of Drug Use. Technical Report Number 228. Sydney, Australia: National Drug and Alcohol Research Centre, University of New South Wales; 2004. p. 219.
61. Burdekin B. Human Rights and Mental Illness: Report of the National Inquiry into the Human Rights of People with Mental Illness. 1993 [cited 10th Aug 2012]. Available from: <http://www.humanrights.gov.au/news/speeches/burdekin-national-inquiry>
62. Human Rights Law Resource Centre. Australia's Compliance with the Convention against Torture. Report to the United Nations Committee against Torture. Melbourne: Human Rights Law Resource Centre; 2008.
63. Abramsky S, Fellner J. Ill-Equipped: U.S. Prisons and Offenders with Mental Illness. New York, NY: Human Rights Watch, USA; 2003. p. 215.
64. Atabay T. United Nations Handbook on Prisoners with Special Needs. New York: United Nations Office on Drugs and Crime; 2009. p. 182.
65. World Health Organisation. Health in Prisons: A WHO Guide to the Essentials in Prison Health. Copenhagen, Denmark: WHO Regional Office for Europe; 2007. p. 180.
66. World Health Organisation. Women's Health in Prison, Correcting Gender Inequity in Prison Health. Copenhagen, Denmark: United Nations Office on Drugs and Crime, WHO; 2009. p. 57.
67. Zubrick SR, Dudgeon P, Gee G, Glaskin B, Kelly K, Paradies Y, et al. Social determinants of Aboriginal and Torres Strait Islander social and emotional wellbeing. In: Purdie N, Dudgeon P, Walker R, editors. *Working Together: Commonwealth of Australia*; 2010.
68. Johnston EC. Royal Commission into Aboriginal Death in Custody: National Report. Canberra: Australian Government; 1991.
69. Hammett TM, Roberts C, Kennedy S. Health-related issues in prisoner reentry. *Crime & Delinquency*. 2001;47(3):390-409.

70. Action for Prisoners' Families. Involving Prisoners' Families in Mentoring of Ex-offenders; [cited 5th Nov 2013]. Available from: <http://www.prisonersfamilies.org.uk/News/NewsPage.aspx?id=2090>
71. Office of the Inspector of Custodial Services. Thematic Review of Offender Health Services. Perth, WA: Office of the Inspector of Custodial Services; 2006.
72. United Nations. Report of the Special Rapporteur on the Right of Everyone to the Enjoyment of the Highest Attainable Standard of Physical and Mental Health (Anand Grover). Geneva: United Nations General Assembly Human Rights Council 14th Session; 2010.
73. Wilson A. How people with serious mental illness seek help after leaving jail. *Qual Health Res.* 2013;23(12):1575-1590.
74. Mallik-Kane K, Visher C. Health and Prisoner Reentry: How Physical, Mental and Substance Abuse Conditions Shape the Process of Reintegration. Washington DC: Justice Policy Centre, Urban Institute; 2008.
75. Frank J, Andrews C, Green T, Samuels A, Trinh T, Friedmann P. Emergency department utilization among recently released prisoners: a retrospective cohort study. *BMC Emergency Medicine.* 2013;13:16.
76. Federal Bureau of Prisons. Preventive health care: clinical practice guidelines. Washington, DC: US Department of Justice; 2013.
77. Stover H, Weilandt C, Zurhold H, Hartwig C, Thane K. Final Report on Prevention, Treatment, and Harm Reduction Services in Prison, on Reintegration Services on Release from Prison and Methods to Monitor/Analyse Drug use among Prisoners. Germany: Directorate - General for Health and Consumers; 2006. p. 281.
78. Borzycki M, Baldry E. Promoting Integration: The Provision of Prisoner Post-release Services. *Trends and Issues in Crime and Criminal Justice.* 2003;262(Sep).
79. Organ B, Nicholson E, Castle D. Implementing a physical health strategy in a mental health service. *Australas Psychiatry.* 2010;18(5):456-459.
80. Australian Bureau of Statistics. Migration Australia 2010-11. Catalogue No. 3412.0. Canberra: ABS; 2012.
81. Substance Abuse and Mental Health Services Administration. Results from the 2011 National Survey on Drug Use and Health: Mental Health Findings, NSDUH Series H-45, HHS Publication no. (SMA) 12-4725. Rockville, MD: Substance Abuse and Mental Health Services Administration; 2013.

Table 1. Baseline demographic, offence and health characteristics & follow-up details at the end of first-ever sentence in all adult offenders (≥18 years) (expressed as a percentage of the number of people within each group)

Description	Full offender cohort					Pre-sentence MHS contact		
	ALL	IF	IM	NF	NM	Present	Absent	
Total number of people in each group:	25537	1050	3155	4537	16795	4092	21445	
Gender-Race	Indigenous females	4.1	100	0.0	0.0	0.0	5.6	3.8
	Indigenous males	12.4	0.0	100	0.0	0.0	10.4	12.7
	Non-Indigenous females	17.8	0.0	0.0	100	0.0	23.1	16.7
	Non-Indigenous males	65.7	0.0	0.0	0.0	100	60.8	66.7
Age at end of first sentence	18-24 years	48.7	50.0	62.2	42.1	47.8	37.7	50.8
	25-34 years	28.6	31.0	23.6	33.3	28.1	33.5	27.7
	35-44 years	14.4	15.1	9.8	16.5	14.6	18.3	13.6
	45-54 years	5.6	2.8	3.3	5.8	6.1	6.8	5.4
	55-64 years	2.1	1.0	0.8	1.8	2.4	3.1	1.9
	≥ 65 years	0.7	0.2	0.2	0.4	0.9	0.7	0.7
	Median age (in years)	25.3	25.0	22.7	26.7	25.6	28.3	24.8
	Mean age (SD) (in years)	28.9 (10.2)	27.7 (8.4)	26.0 (8.5)	29.6 (9.7)	29.3 (10.6)	30.9 (10.6)	28.0 (10.0)
ARIA category	Highly accessible	69.5	40.7	30.5	81.6	75.3	78.9	67.7
	Accessible	11.9	18.3	18.6	8.6	11.2	11.1	12.1
	Remote	11.6	37.4	46.0	4.1	5.6	9.6	12.0
	Missing	7.0	3.6	5.0	5.6	7.9	0.4	8.2
SEIFA category	Most disadvantaged	29.5	45.9	47.4	26.9	25.7	35.4	28.3
	More disadvantaged	18.7	20.5	18.2	19.5	18.5	20.7	18.4
	Average disadvantaged	14.0	13.0	12.8	14.5	14.2	14.3	14.0
	Less disadvantaged	10.9	7.5	6.8	11.5	11.7	11.0	10.9
	Least disadvantaged	19.5	9.3	9.3	21.9	21.4	18.0	19.8
	Missing	7.4	3.7	5.5	5.7	8.4	0.5	8.7
Nature of offence	Violent	28.7	33.1	45.5	15.1	28.9	33.3	27.8
	Non-violent	71.3	66.9	54.5	84.9	71.1	66.7	72.2
Custodial setting	Prison order	23.7	25.8	38.3	7.6	25.1	21.8	24.0
	Community correction order	76.3	74.2	61.7	92.4	74.9	78.2	76.0
Release type	Released to freedom	80.1	77.5	75.6	87.3	79.2	80.2	80.1
	Conditional release	6.3	2.6	7.0	2.3	7.5	5.6	6.5
	Other release	13.5	19.9	17.4	10.3	13.3	14.2	13.4
Duration of first sentence	< 0.5 year	28.2	36.5	43.5	22.0	26.5	23.8	29.1
	0.5-1 years	27.1	29.6	22.2	33.8	26.0	27.1	27.1
	1-1.5 years	17.7	16.1	15.1	19.7	17.7	18.6	17.5
	1.5-2 years	11.7	9.8	8.3	12.1	12.3	13.3	11.4
	2-3 years	10.3	6.5	6.7	9.9	11.4	10.9	10.2
	≥ 3 years	5.0	1.5	4.2	2.5	6.1	6.4	4.8
	Median (in years)	1.0	1.0	0.7	1.0	1.0	1.0	1.0
	Mean (SD) (in years)	1.2 (1.1)	0.9 (0.7)	0.9 (1.0)	1.1 (0.8)	1.2 (1.2)	1.3 (1.2)	1.1 (1.1)
5-year h/o MHS use	No MHS use in 0-5 years	84.0	78.1	86.5	79.1	85.2	0.0	100
	Used MHS in 0-1 year	8.5	9.6	6.6	11.3	8.0	52.9	0.0
	Used MHS in 1-5 years	7.5	12.3	6.9	9.6	6.8	47.1	0.0
Past psychiatric diagnosis (5-year)	Psychotic disorders	1.4	0.8	0.7	1.4	1.5	8.6	0.0
	Substance use disorders	9.0	16.2	10.7	9.3	8.1	56.1	0.0
	Other disorders	5.7	5.0	2.1	10.1	5.2	35.3	0.0
5-year h/o other health service use	Attempted self-harm	4.5	7.8	2.8	8.4	3.5	22.1	1.1
	Any physical illness	43.8	78.9	46.1	59.8	36.9	78.6	37.2
Censoring reason	Died	0.8	0.4	0.8	0.4	0.9	1.6	0.6
	Re-sentenced	15.0	21.8	33.2	8.0	13.1	18.6	14.3
	Complete two-year follow-up	84.2	77.8	66.0	91.6	86.1	79.9	85.1
Follow-up time	Mean (SD) (in years)	1.8 (0.5)	1.7 (0.6)	1.6 (0.7)	1.9 (0.4)	1.8 (0.5)	1.8 (0.6)	1.8 (0.5)

IF: Indigenous Females; IM: Indigenous Males; NF: Non-Indigenous Females; NM: Non-Indigenous Males; h/o: Pre-sentence history of; MHS: Mental Health Service; Rounding-off errors exist where totals exceed 100.0%.

Table 2. Distribution of deaths within two years of end of first sentence within each offender sub-group by the leading causes of death and age at end of first sentence (expressed as the number and proportion of deaths)

Description	Full offender cohort					Pre-sentence MHS contact		
	All	Violent	Non-violent	Prison	Community correction	Present	Absent	
Offenders at risk:	25537	7321	18216	6041	19496	4092	21445	
Cause of Death●○	All cause deaths	192	78	114	61	131	64	128
	• Natural causes*	83 (43.2 %)	45 (57.7 %)	38 (33.3 %)	30 (49.2 %)	53 (40.5 %)	25 (39.1 %)	58 (45.3 %)
	Cancer	26 (13.5 %)	16 (20.5 %)	10 (8.8 %)	9 (14.8 %)	17 (13.0 %)	8 (12.5 %)	18 (14.1 %)
	Cardiovascular	19 (9.9 %)	13 (16.7 %)	6 (5.3 %)	8 (13.1 %)	11 (8.4 %)	<5 (6.3 %)	15 (11.7 %)
	• Injury / Poisoning	109 (56.8 %)	33 (42.3 %)	76 (66.7 %)	31 (50.8 %)	78 (59.5 %)	39 (60.9 %)	70 (54.7 %)
	Suicide	46 (24.0 %)	13 (16.7 %)	33 (28.9 %)	12 (19.7 %)	34 (26.0 %)	18 (28.1 %)	28 (21.9 %)
• Drug-related	36 (18.8 %)	6 (7.7 %)	30 (26.3 %)	11 (18.0 %)	25 (19.1 %)	15 (23.4 %)	21 (16.4 %)	
Age at end of first ever sentence for all deaths	18-24 years	65 (33.9 %)	16 (20.5 %)	49 (43.0 %)	17 (27.9 %)	48 (36.6 %)	13 (20.3 %)	52 (40.6 %)
	25-34 years	51 (26.6 %)	15 (19.2 %)	36 (31.6 %)	14 (23.0 %)	37 (28.2 %)	24 (37.5 %)	27 (21.1 %)
	35-44 years	28 (14.6 %)	13 (16.7 %)	15 (13.2 %)	10 (16.4 %)	18 (13.7 %)	11 (17.2 %)	17 (13.3 %)
	45-54 years	20 (10.4 %)	12 (15.4 %)	8 (7.0 %)	10 (16.4 %)	10 (7.6 %)	9 (14.1 %)	11 (8.6 %)
	55-64 years	13 (6.8 %)	9 (11.5 %)	<5 (3.5 %)	5 (8.2 %)	8 (6.1 %)	<5 (4.7 %)	10 (7.8 %)
	>= 65 years	15 (7.8 %)	13 (16.7 %)	<5 (1.8 %)	5 (8.2 %)	10 (7.6 %)	<5 (6.3 %)	11 (8.6 %)

*Natural Deaths: ICD codes excluding deaths from injury / poisoning

●: ICD-9-CM codes (deaths from 1985-1998): Cancer: 140-208; Cardiovascular: 390-459; Injury / Poisoning: E800-E999; Suicide: E950-E959; Drug-related: 304, 305.2-305.9, E850-E858, E950.0-E950.5, E962.0, E980.0-E980.5

○: ICD-10-AM codes (deaths from 1999 onwards): Cancer: C00-C97; Cardiovascular: I00-I99; Injury / Poisoning: S00-T99, V01-Y34; Suicide: X60-X84; Drug-related: F11-F16, F19, F55, X40-X44, X60-X64, X85, Y10-Y14

Table 3. Two-year unadjusted risk of mortality from any cause and injury/poisoning after completion of first-ever sentence in offender subgroups stratified by ten-year age-group and history of mental health service use (expressed as a percentage)

Age-group		Death risk from all causes					Death risk from natural causes					Death risk from injury / poisoning				
Offender sub-groups:		All	Vio	Nvio	Pri	Com	All	Vio	Nvio	Pri	Com	All	Vio	Nvio	Pri	Com
Total offenders at risk:		25537	7321	18216	6041	19496	25537	7321	18216	6041	19496	25537	7321	18216	6041	19496
Full cohort (N=25,537)	All	0.8	1.1	0.7	1.1	0.7	0.4	0.7	0.2	0.5	0.3	0.5	0.5	0.5	0.6	0.4
	18-24	0.6	0.6	0.6	0.9	0.5	0.1	0.0	0.1	0.1	0.1	0.5	0.6	0.5	0.8	0.4
	25-34	0.7	0.7	0.8	0.8	0.7	0.2	0.2	0.2	0.2	0.2	0.5	0.5	0.6	0.6	0.5
	35-44	0.8	1.0	0.7	1.0	0.7	0.5	0.6	0.4	0.7	0.4	0.3	0.4	0.3	0.3	0.4
	45-54	1.5	2.3	1.0	2.1	1.2	1.3	2.1	0.7	1.9	0.9	0.2	0.2	0.2	0.2	0.2
	55-64	2.5	4.0	1.4	2.6	2.5	2.2	3.5	1.1	2.6	1.9	0.4	0.4	0.4	0.0	0.6
	≥ 65	8.5	11.3	3.2	8.1	8.7	7.9	10.5	3.2	8.1	7.9	0.6	0.9	0.0	0.0	0.9
Pre-sentence history of MHS contact present (N=4,092)	All	1.7	2.1	1.5	1.6	1.7	0.7	1.2	0.4	0.4	0.8	1.0	0.9	1.1	1.3	1.0
	18-24	0.9	1.3	0.8	1.3	0.8	0.2	0.0	0.3	0.0	0.2	0.7	1.3	0.5	1.3	0.6
	25-34	1.9	1.5	2.1	2.1	1.9	0.3	0.5	0.2	0.0	0.4	1.6	1.0	1.9	2.1	1.4
	35-44	1.5	1.4	1.7	0.6	1.8	0.8	0.7	1.0	0.6	0.9	0.7	0.7	0.7	0.0	0.9
	45-54	3.5	4.7	2.3	1.4	4.3	2.3	4.0	0.7	0.0	3.2	1.2	0.8	1.6	1.4	1.1
	55-64	2.5	1.8	3.1	0.0	3.5	1.7	1.8	1.5	0.0	2.3	0.8	0.0	1.5	0.0	1.2
	≥ 65	14.6	25.0	0.0	19.2	11.8	14.6	25.0	0.0	19.2	11.8	0.0	0.0	0.0	0.0	0.0
Pre-sentence history of MHS contact absent (N=21,445)	All	0.6	0.9	0.5	1.0	0.5	0.3	0.5	0.2	0.6	0.2	0.4	0.4	0.3	0.5	0.3
	18-24	0.5	0.5	0.5	0.8	0.5	0.1	0.0	0.1	0.1	0.1	0.4	0.5	0.4	0.8	0.4
	25-34	0.5	0.5	0.5	0.5	0.5	0.2	0.2	0.2	0.2	0.2	0.3	0.3	0.3	0.3	0.3
	35-44	0.6	0.9	0.4	1.1	0.4	0.4	0.6	0.2	0.7	0.2	0.2	0.3	0.2	0.4	0.2
	45-54	1.0	1.5	0.7	2.2	0.3	1.0	1.5	0.7	2.2	0.3	0.0	0.0	0.0	0.0	0.0
	55-64	2.6	4.7	0.9	3.3	2.1	2.3	4.1	0.9	3.3	1.7	0.3	0.6	0.0	0.0	0.4
	≥ 65	7.4	9.1	4.0	5.9	8.2	6.7	8.1	4.0	5.9	7.2	0.7	1.1	0.0	0.0	1.1

Injury / Poisoning: ICD-9-CM: E800-E999, ICD-10AM: S00-T99, V01-Y34; Natural Deaths: All deaths excluding those from injury / poisoning

MHS: Mental Health Service; IF: Indigenous Females; IM: Indigenous Males; NF: Non-Indigenous Females; NM: Non-Indigenous Males; Vio: Violent; Nvio: Non-violent; Pri: Prison; Com: Community Correction

Table 4. Multivariable analysis of all predictors of two-year post-sentence mortality from any cause and injury/poisoning in adult offenders (18-64 years) and stratified by the pre-sentence history of mental health service contact (Hazard Ratios)

Five-year pre-sentence history of MHS use:		Present			Absent		
Parameter	Group	All-cause deaths	Natural deaths	Injury/Poisoning deaths	All-cause deaths	Natural deaths	Injury/Poisoning deaths
Proportion of offenders with outcome:		60 / 4063	21 / 4063	39 / 4063	117 / 21295	48 / 21295	69 / 21295
Demographic group (REF: Non-Indigenous males)	p-value	*		*			
	Indigenous females	na	na	na	0.9 (0.3 - 2.6)	2.6 (0.7 - 9.1)	0.3 (0.0 - 2.4)
	Indigenous males	2.3 * (1.0 - 4.9)	1.2 (0.2 - 5.6)	3.4 ^ (1.4 - 8.6)	1.1 (0.6 - 2.1)	1.5 (0.6 - 4.3)	0.9 (0.4 - 2.0)
	Non-Indigenous females	0.5 (0.3 - 1.1)	0.4 (0.1 - 1.5)	0.6 (0.3 - 1.5)	0.4 * (0.2 - 0.9)	0.4 (0.1 - 1.4)	0.4 (0.2 - 1.0)
Age at sentence completion (REF: 18-24 years)	p-value		*		^	‡	
	55-64 years	2.5 (0.7 - 9.0)	5.3 (0.8 - 36.1)	1.3 (0.2 - 10.3)	3.2 ^ (1.5 - 6.6)	14.3 ‡ (5.0 - 41)	0.6 (0.1 - 4.1)
	45-54 years	3.7 ^ (1.5 - 9.0)	9.2 ^ (2.2 - 39.0)	1.9 (0.5 - 7.0)	1.4 (0.7 - 2.8)	8.5 ‡ (3.3 - 22.0)	na
	35-44 years	1.6 (0.7 - 3.7)	3.7 (0.9 - 15.4)	1.0 (0.3 - 3.0)	1.0 (0.5 - 1.7)	3.2 * (1.2 - 8.3)	0.6 (0.3 - 1.3)
	25-34 years	2.1 * (1.0 - 4.1)	1.7 (0.4 - 7.7)	2.2 * (1.0 - 4.9)	0.8 (0.5 - 1.3)	1.9 (0.7 - 4.9)	0.7 (0.4 - 1.2)
ARIA category (REF: Remote)	p-value						
	Highly accessible	2.1 (0.7 - 6.2)	2.5 (0.3 - 21.0)	2.0 (0.5 - 7.4)	1.9 (0.9 - 3.8)	2.6 (0.8 - 7.9)	1.6 (0.6 - 3.9)
	Accessible	1.4 (0.4 - 5.6)	2.2 (0.2 - 27.2)	1.2 (0.2 - 6.1)	2.0 (0.9 - 4.3)	2.3 (0.6 - 8.1)	1.8 (0.6 - 5.0)
SEIFA category (REF: Least disadvantaged)	p-value				*		
	Most disadvantaged	1.2 (0.6 - 2.5)	1.6 (0.4 - 6.1)	1.0 (0.4 - 2.5)	2.4 ^ (1.3 - 4.5)	2.1 (0.8 - 5.0)	2.8 * (1.2 - 6.5)
	More disadvantaged	0.9 (0.4 - 2.2)	0.8 (0.2 - 4.0)	1.0 (0.4 - 2.8)	2.4 ^ (1.2 - 4.5)	1.8 (0.7 - 4.7)	2.9 * (1.2 - 7.0)
	Average disadvantage	0.9 (0.3 - 2.3)	1.0 (0.2 - 5.4)	0.7 (0.2 - 2.5)	1.9 (1.0 - 3.8)	1.2 (0.4 - 3.4)	2.7 * (1.1 - 6.7)
	Less disadvantaged	1.2 (0.4 - 3.1)	1.1 (0.2 - 6.9)	1.2 (0.4 - 3.8)	1.1 (0.5 - 2.5)	0.7 (0.2 - 2.6)	1.3 (0.4 - 4.1)
Nature of offence	p-value						
	Violent vs. Non-violent	1.0 (0.5 - 1.6)	1.3 (0.5 - 3.1)	0.7 (0.4 - 1.5)	1.2 (0.8 - 1.9)	1.5 (0.8 - 2.8)	1.1 (0.6 - 1.9)
Custodial setting	p-value		*		^	^	
	Prison vs. Com correction	0.7 (0.3 - 1.3)	0.1 * (0.0 - 0.9)	1.2 (0.5 - 2.6)	2.0 ^ (1.3 - 3.0)	2.3 ^ (1.2 - 4.3)	1.8 (1.0 - 3.1)
Length of sentence (REF: 0-0.5 year)	p-value						
	>3 years	0.6 (0.2 - 2.1)	0.6 (0.1 - 5.3)	0.6 (0.1 - 3.1)	0.7 (0.3 - 1.9)	1.4 (0.5 - 4.2)	na
	2-3 years	0.7 (0.2 - 1.9)	0.3 (0.0 - 3.0)	0.9 (0.3 - 3.0)	1.3 (0.7 - 2.5)	1.0 (0.3 - 3.3)	1.4 (0.6 - 3.2)
	1.5-2 years	1.0 (0.4 - 2.4)	0.9 (0.2 - 3.6)	1.0 (0.3 - 3.1)	1.4 (0.7 - 2.6)	0.7 (0.2 - 2.5)	1.8 (0.8 - 3.7)
	1-1.5 years	1.0 (0.5 - 2.3)	0.9 (0.3 - 3.2)	1.1 (0.4 - 3.0)	1.6 (1.0 - 2.7)	2.0 (0.9 - 4.5)	1.4 (0.7 - 2.7)
	0.5-1 year	0.9 (0.4 - 2.0)	0.5 (0.1 - 2.0)	1.2 (0.5 - 2.9)	0.8 (0.4 - 1.4)	0.9 (0.4 - 2.2)	0.7 (0.3 - 1.5)
1-year comorbidity score (REF: Score=0)	p-value	*	*		‡	‡	
	Score ≥ 2	4.7 * (1.4 - 15.6)	9.9 ^ (2.0 - 50.1)	2.2 (0.3 - 16.6)	36.7 ‡ (17.2 - 79)	65.6 ‡ (28.5 - ∞)	na
	Score = 1	1.0 (0.3 - 3.4)	2.3 (0.6 - 8.9)	na	1.3 (0.2 - 9.7)	2.6 (0.3 - 19.4)	na
5-year h/o attempted self-harm	p-value	*					
	Yes vs. No	1.9 * (1.1 - 3.3)	1.8 (0.7 - 5.0)	2.0 (1.0 - 3.9)	na	na	na
5-year h/o MHS use	p-value						
	0-1 year vs. 1-5 years	1.5 (0.9 - 2.7)	1.2 (0.4 - 3.0)	1.7 (0.9 - 3.5)			
Nature of psychiatric diagnosis (REF: Other disorders)	p-value				These variables are not relevant to these models		
	Psychotic disorders	1.3 (0.5 - 3.2)	na	2.0 (0.8 - 5.2)			
	Substance use disorders	1.2 (0.7 - 2.3)	1.6 (0.6 - 4.7)	1.0 (0.5 - 2.1)			
Propensity adjusted analyses comparing mortality in offenders sentenced to prison and community correction orders (Hazard Ratios) ¶							
Separate models using propensity score of being incarcerated • (Prison vs. Community correction)	Covariate adjustment for propensity probability	0.66 (0.32 - 1.36)	0.11 * (0.01 - 0.90)	1.14 (0.51 - 2.55)	2.02 ^ (1.31 - 3.11)	2.30 ^ (1.22 - 4.33)	1.81 (0.99 - 3.32)
	Inverse probability of imprisonment weighting	0.62 (0.34 - 1.14)	0.05 * (0.01 - 0.52)	1.13 (0.57 - 2.25)	2.12 ‡ (1.47 - 3.06)	2.10 * (1.18 - 3.75)	2.20 ^ (1.36 - 3.55)

h/o: Pre-sentence history of; MHS: Mental Health Service; REF: Reference group; ‡: p<0.0001; †: p<0.001; ^: p<0.01; *: p<0.05; ∞: Infinity

¶: Propensity score of being incarcerated (vs. sentenced to community correction) for each offender was derived from logistic regression models after adjusting for all measured confounders prior to being sentenced.

•: Both Cox models were adjusted for the length of sentence and age at sentence completion to derive the Hazard Ratios comparing mortality in those imprisoned to those serving community correction orders.

Appendix I. Multifactorial analysis of all potential predictors of post-sentence mortality in all adult offenders (18-64 years) (Hazard Ratios) ¶

Parameter	Group	All-cause deaths	Natural deaths	Injury/ Poisoning deaths
Proportion of offenders with outcome:		177 / 25358	69 / 25358	108 / 25358
	p-value	^		*
Demographic group (REF: Non-Indigenous males)	Indigenous females	0.5 (0.2 - 1.3)	0.9 (0.3 - 3.1)	0.2 (0.0 - 1.4)
	Indigenous males	1.4 (0.8 - 2.2)	1.2 (0.5 - 2.9)	1.5 (0.8 - 2.7)
	Non-Indigenous females	0.5 ^ (0.3 - 0.8)	0.4 (0.2 - 1.0)	0.5 * (0.3 - 0.9)
	p-value	^	‡	
Age at sentence completion (REF: 18-24 years)	55-64 years	3.0 † (1.6 - 5.6)	12.9 ‡ (5.2 - 31.8)	0.7 (0.2 - 2.9)
	45-54 years	2.0 ^ (1.2 - 3.4)	9.4 ‡ (4.3 - 20.7)	0.4 (0.1 - 1.3)
	35-44 years	1.1 (0.7 - 1.8)	3.5 ^ (1.6 - 7.8)	0.6 (0.3 - 1.2)
	25-34 years	1.1 (0.8 - 1.7)	1.9 (0.8 - 4.1)	1.0 (0.7 - 1.5)
	p-value			
ARIA category (REF: Remote)	Highly accessible	1.8 * (1.0 - 3.3)	2.1 (0.8 - 5.4)	1.7 (0.8 - 3.7)
	Accessible	1.7 (0.9 - 3.4)	1.8 (0.6 - 5.5)	1.6 (0.7 - 3.9)
	p-value			
SEIFA category (REF: Least disadvantaged)	Most disadvantaged	1.9 ^ (1.2 - 3.0)	1.9 (0.9 - 4.0)	1.9 * (1.0 - 3.5)
	More disadvantaged	1.7 * (1.0 - 2.8)	1.3 (0.6 - 2.9)	1.9 * (1.0 - 3.7)
	Average disadvantage	1.5 (0.8 - 2.5)	1.2 (0.5 - 2.8)	1.6 (0.8 - 3.4)
	Less disadvantaged	1.1 (0.6 - 2.2)	1.0 (0.3 - 2.6)	1.3 (0.6 - 2.8)
	p-value			
Nature of offence	Violent vs. Non-violent	1.1 (0.8 - 1.5)	1.4 (0.8 - 2.3)	0.9 (0.6 - 1.4)
	p-value	*		
Custodial setting	Prison vs. Com correction	1.5 * (1.0 - 2.1)	1.4 (0.8 - 2.4)	1.5 (1.0 - 2.4)
	p-value			
Length of sentence (REF: 0-0.5 year)	>3 years	0.7 (0.3 - 1.6)	1.2 (0.5 - 3.1)	0.3 (0.1 - 1.4)
	2-3 years	1.1 (0.6 - 1.9)	0.8 (0.3 - 2.4)	1.2 (0.6 - 2.4)
	1.5-2 years	1.4 (0.8 - 2.2)	1.1 (0.4 - 2.7)	1.5 (0.8 - 2.8)
	1-1.5 years	1.5 (1.0 - 2.4)	2.0 (1.0 - 3.8)	1.3 (0.7 - 2.3)
	0.5-1 year	0.9 (0.6 - 1.4)	0.9 (0.4 - 1.9)	0.9 (0.5 - 1.6)
	p-value	‡	‡	
1-year comorbidity score (REF: Score=0)	Score>=2	13.3 ‡ (7.0 - 25.3)	27.9 ‡ (13.3 - 58.3)	2.2 (0.3 - 15.8)
	Score=1	1.3 (0.5 - 3.6)	3.0 * (1 - 8.9)	na
	p-value			
5-year h/o attempted self-harm	Yes vs. No	1.6 (1.0 - 2.8)	1.8 (0.7 - 4.4)	1.7 (0.9 - 3.2)
	p-value	†		‡
5-year h/o MHS use	Yes vs. No	1.9 † (1.3 - 2.7)	1.1 (0.6 - 1.9)	2.7 ‡ (1.7 - 4.1)
	p-value	^		‡
Nature of psychiatric diagnosis (REF: No mental disorder)	Psychotic disorders	2.7 * (1.2 - 5.8)	na	5.9 ‡ (2.6 - 13.3)
	Substance use disorders	1.9 ^ (1.3 - 2.9)	1.3 (0.7 - 2.4)	2.4 ^ (1.4 - 4.1)
	Other disorders	1.7 (1.0 - 2.9)	0.9 (0.3 - 2.5)	2.3 * (1.2 - 4.4)

*h/o: Pre-sentence history of; MHS: Mental Health Service; REF: Reference group; ‡: p<0.0001; †: p<0.001; ^: p<0.01; *: p<0.05*

¶: After including all other variables, the last two variables (history of previous MHS use and nature of last diagnosed mental illness) were separately included in separate different models due to their high correlation.

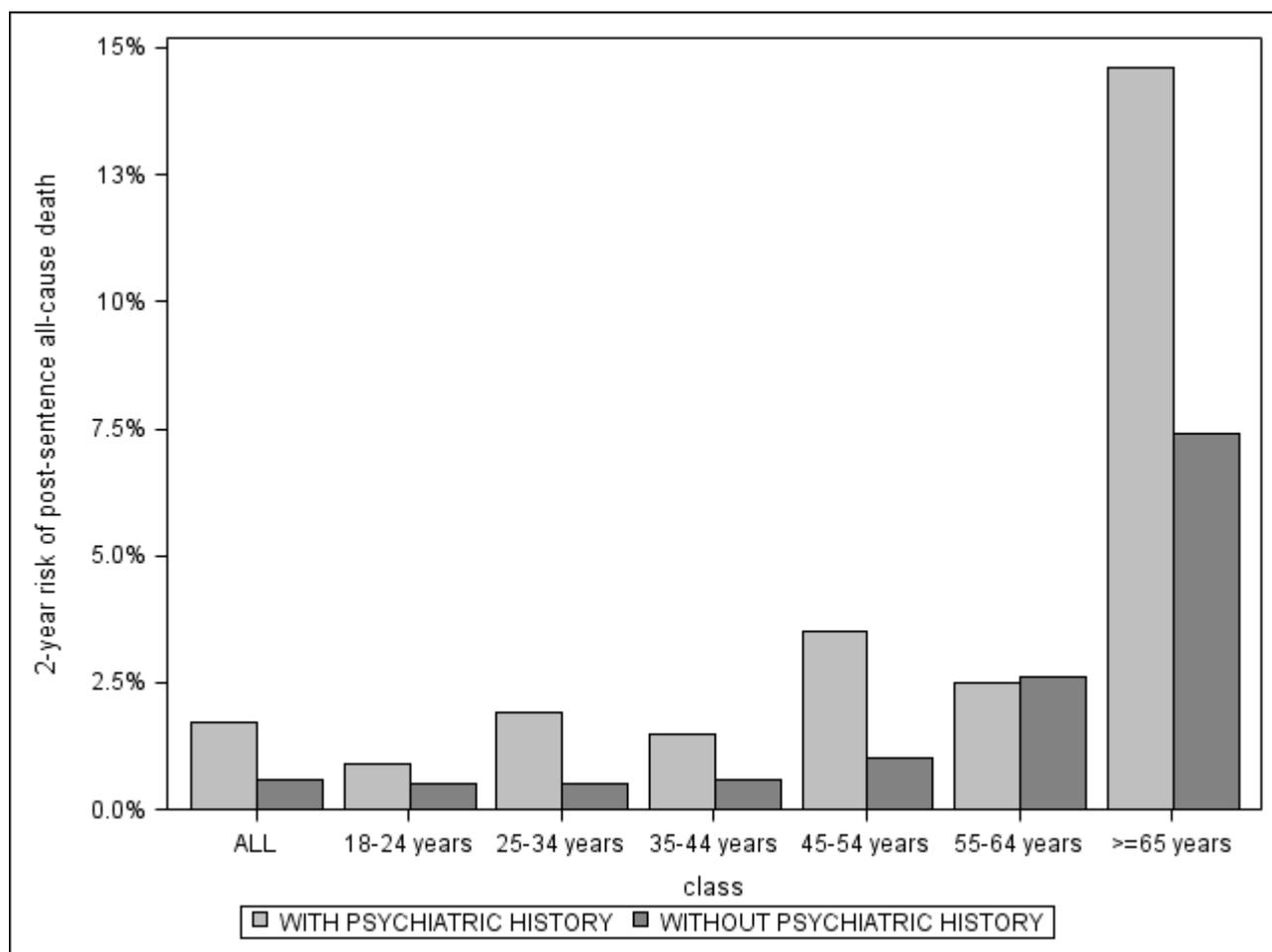
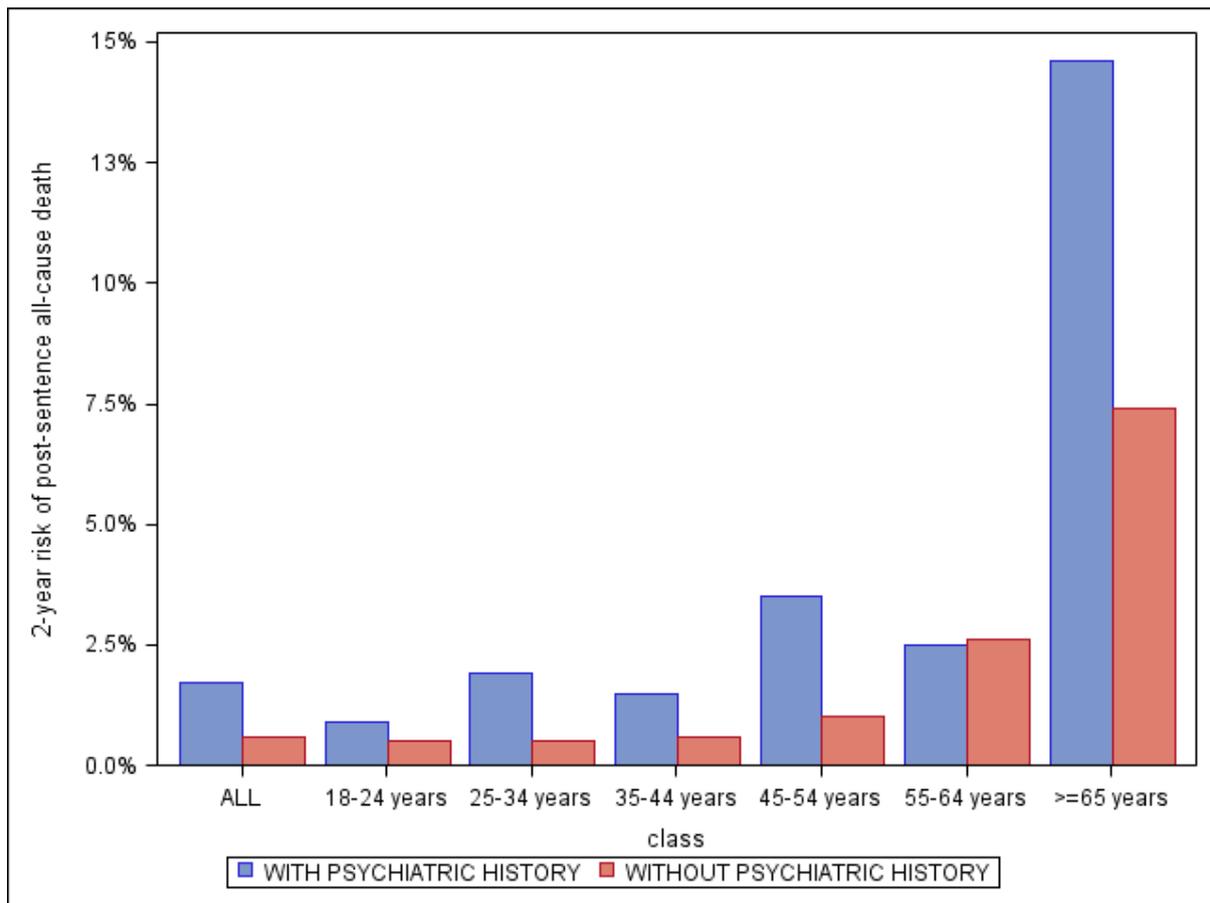


Figure 1: Two-year unadjusted risk of post-sentence all-cause mortality in offenders with or without a pre-sentence MHS contact



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Figure 1: Two-year unadjusted risk of post-sentence all-cause mortality in offenders with or without a pre-sentence MHS contact