

# Inpatient hospital use in the first year after release from prison: a Western Australian population-based record linkage study

## Abstract

**Objective:** To describe three aspects of inpatient use for ex-prisoners within the first 12 months of release from prison: the proportion of released prisoners who were hospitalised; the amount of resources used (bed days, separations and cost); and the most common reasons for hospitalisation.

**Methods:** Secondary analysis of whole-population linked prison and inpatient data from the Western Australian Data Linkage System. The main outcome measure was first inpatient admission within 12 months of release from prison between 2000 and 2002 and related resource use.

**Results:** One in five adults released from Western Australian prisons between 2000 and 2002 were hospitalised in the 12 months that followed, which translated into 12,074 inpatient bed days, 3,426 separations and costs of \$10.4 million. Aboriginals, females and those released to freedom were most at risk of hospitalisation. Mental health disorders such as schizophrenia and depression, and injuries involving the head or face and/or fractures, accounted for 58.9% of all bed days. Ex-prisoners were 1.7 times more likely to be hospitalised during a year than Western Australia's general adult population of roughly the same age.

**Conclusions:** Using whole-population administrative linked health and justice data, our findings show that prisoners are vulnerable to hospitalisation in the 12-month period following their release from prison, particularly Aboriginals, females and those with known mental health problems.

**Implications:** Further research is needed to assess whether contemporary services to support community re-entry following incarceration have led to a measurable reduction in hospital contacts, especially for the subgroups identified in this study.

**Key words:** prisoners, hospitalisation, health expenditures, health service use

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**Janine Alan**

*School of Population Health, The University of Western Australia*

**Melinda Burmas**

*Private contractor*

**David Preen**

*School of Population Health, The University of Western Australia*

**Jon Pfaff**

*School of Psychiatry and Clinical Neurosciences, The University of Western Australia*

The health needs of prisoners are complex and diverse. The limited data available suggest these include acute and long-standing physical, mental and social health issues such as: chronic disease (asthma, diabetes, cancer, cardiovascular disease); communicable disease (hepatitis B and C, HIV, herpes simplex virus Type 1); drug dependency (illicit, alcohol and tobacco); mental illness (depression, self-inflicted harm and suicide attempts); exposure to abuse (sexual, physical or emotional); risky health behaviour (smoking, lack of condom use, unsafe injecting); and a shorter life expectancy.<sup>1,2</sup>

Prisoners are not representative of the general population. They often live on the margins of the community before imprisonment, belong to migrant or minority groups, and are poorly educated and socio-economically disadvantaged.<sup>1</sup> Many of the social inequalities that precipitated the offending behaviour, such as unemployment, unstable accommodation, poverty, limited prospects and reluctance to use (or unavailability of) community support services, often prevail and potentially worsen

upon release.<sup>2</sup> Coupled with stigmatisation and limited prison-release services to ease the transition into the community, the risk of recidivism and vulnerability to adverse health outcomes is high.<sup>3</sup>

Latest census statistics (2010) from the Australian Bureau of Statistics (ABS) report that Australia has 29,700 prisoners, of which 21% (n=6,367) are on remand (charged with an offence but unconvicted and awaiting a court hearing or trial).<sup>4</sup> Prisoners are predominantly men (92%), aged less than 45 years, with a prior history of adult incarceration (55%), and a median sentence length of three years (excludes indeterminate, life term and periodic detentions). Aboriginal and Torres Strait Islander people are disproportionately represented, comprising over one quarter (n=7,584) of the prison population<sup>4</sup> compared with only 2.5% of the Australian estimated resident population.<sup>5</sup>

National data on the health status of Australian prisoners are currently unavailable. However, two recent reports produced by the Australian Institute of Health and Welfare (AIHW), working in

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**Correspondence to:**

Dr Janine Alan, School of Population Health, University of Western Australia, Perth, WA 6000;  
e-mail: c/o: david.preen@uwa.edu.au

collaboration with academia, health departments, corrective services and the ABS, concluded that nationally consistent information is needed to achieve effective health services planning for this vulnerable target group.<sup>6,7</sup> Data linkage of health and corrective services records has been recommended as a method of improving the availability of information.<sup>6,7</sup>

Three NSW Inmate Health Surveys (1996, 2001 and 2009) have resulted in the compilation of considerable cross-sectional data about the morbidity of prisoners based on self-reported health-related behaviours from a partial random sample of the NSW prison population, conditions and service contacts, physical examination and blood samples.<sup>8-10</sup> Using census data, AIHW has also released a report into the health of prisoners at the time of entry and while in prison.<sup>11</sup> However, longitudinal, whole-of-population data linkage studies are rare, primarily due to the lack of comprehensive, validated data linkage systems, such as that operating in WA since 1995.<sup>12</sup> While there is a growing body of evidence that shows the immediate period post-release from prison is associated with considerable mortality, especially from suicide and substance abuse,<sup>13-15</sup> there is a lack of baseline morbidity data.<sup>16</sup> Loss to follow-up in prospective studies on ex-prisoners is also problematic.<sup>17</sup> The purpose of our whole-population, record linkage study was to describe the inpatient hospital use of all prisoners in Western Australia (WA) during the 12 months post-release. We describe three specific aspects of inpatient use that are of relevance to effective health service planning for ex-prisoners: the proportion of released prisoners who were hospitalised; the amount of resources used (bed days, separations and cost); and the most common reasons for hospitalisation.

## Materials and methods

### *Data sources and population selection*

The study cohort comprised all adults ( $\geq 18$  years) who were released from a WA prison between 1 January 2000 to 31 December 2002. This cohort was used because the data linkages between the WA Department of Health (WADoH) and the WA Department of Corrective Services (DCS, formerly the Department of Justice) had been established previously as part of another study.<sup>16</sup> Persons with a prison discharge code of deportation, extradition, Australian Protective Services, transfer (to another adult prison or detention centre) or death were excluded from the study as they did not exit into the WA community.<sup>16</sup> Escapees were also excluded. The Human Research Ethics Committee of the University of Western Australia approved the conduct of this study.

The primary outcome of interest was inpatient admission for injury and illness within 12 months of release from prison. In the event of multiple imprisonments, only the first prison release during 2000-02 was included. Follow-up was stopped at death or reincarceration if this occurred prior to 12 months. Hospitalisation data from all WA private and public hospitals were retrieved via record linkage through the WA Data Linkage System (WADLS), which is a comprehensive, population-based linkage system that connects together up to 40 years of data from more than 30 collections for residents of WA.<sup>12</sup> Linked deaths were also ascertained from the WADLS.

Separations due to pregnancy-related conditions, borders (defined as individuals accompanying an admitted patient during a hospital stay) and duplicated records were excluded. Pregnancy-related admissions were excluded to avoid artificial inflation of hospital service use due to illness/morbidity and improve gender comparisons. Overlapping hospital separations, such as occurs when patients are transferred within or between hospitals without leaving the inpatient setting, were reclassified as a single hospital separation to avoid inflating the number of inpatient contacts.

For bed day calculations, same day hospital separations were counted as a length of stay of one day. Costs were estimated by assuming that hospitalisations had the average costs for patients in the relevant Australian Refined Diagnosis Related Group (AR-DRG), as reported in the National Hospital Cost Data Collection, WA Cost Weights Round 4 (1999-2000) to Round 8 (2003-04),<sup>18</sup> and then aggregating all costs related to the same patient. Using the primary admitting diagnosis, a major diagnostic category was constructed for each person, as per the International Statistical Classification of Diseases and Related Health Problems 10<sup>th</sup> Revision, Australian Modification (ICD-10-AM). People with multiple separations were assigned the major diagnostic category associated with the most bed days, or the diagnostic category associated with the earliest separation when multiple diagnostic groups shared equal numbers of bed days.<sup>19</sup>

### *Statistical methods*

The prevalence of having at least one hospitalisation was calculated as a proportion of total adults released from WA prisons during 2000-02, and disaggregated by age, sex and Indigenous status (yes/no). Cox proportional hazards regression was used to examine the effect of sex, Aboriginality and type of prison discharge (freedom, bail, conditional release, other) on the risk of first hospitalisation, after adjusting for the potential confounding effects of age (fitted as a continuous variable). The proportionality assumption was tested by including time-dependent covariates in the Cox model and plotting the Schoenfeld residuals against time.<sup>20</sup>

Total and average annualised bed days and costs were calculated. Average annualised inpatient costs and bed days were expressed as both an arithmetic mean and median. Linear regression was performed for mean annualised resource use (bed days and cost) to examine the association with sex and Aboriginality while adjusting for age. In large samples, least-squares linear regression is valid for any distribution, even those with very non-normal data, when the purpose of the analysis is to make inferences about the association between variables rather than to predict outcomes for individuals.<sup>21</sup> Statistical analyses were performed using SAS (Version 9.1).

## Results

### *Cohort characteristics*

During 2000 to 2002, 7,414 adults were released from WA prisons. Of these, 2,461 (33.2%) were released to freedom, 4,426 (59.7%) were released conditionally (e.g. on parole, work release orders, home detention), 386 (5.2%) were released on bail and 141 (1.9%) were released for other reasons (e.g. immigration order).

The majority of released prisoners were men ( $n=6,524$ , 88.0%) and aged under 35 years ( $n=5,254$ , 70.9%). Aboriginals comprised 44.4% of the cohort ( $n=3,291$ ) and 1,649 people (22.2%) were reincarcerated during the 12-month follow-up period.

### Risk of first hospitalisation (for any reason)

After a mean follow-up of 276 days (95% CI 273-279), 1,511 adults (20.4%) were admitted to hospital at least once in the 12-month period following their release from prison (Table 1). Men accounted for the majority of these hospitalisations (1,246, 82.5%). However, the adjusted relative risk (hazard ratio) of first hospitalisation was 1.6 times (95% CI 1.4-1.8) higher for women compared with men. Additionally, the adjusted relative risk of first hospitalisation among Aboriginals was 1.2 times higher than their non-Aboriginal counterparts (95% CI 1.1-1.4,  $p=0.0064$ ). Prisoners released on conditions were at lower risk of hospitalisation compared with prisoners released to freedom (HR=0.8, 95% CI 0.7-0.9,  $p=0.001$ ). There were no noticeable violations of the Cox proportionality assumption, and therefore no need for time-dependent variables. The mean time to first hospitalisation was 142 days (95% CI 137-147), and did not differ significantly by age, sex, Aboriginality or type of prison discharge.

### Use of inpatient services

The cohort of released prisoners had a total of 3,426 separations and 12,074 bed days, which cost \$10.4 m (Table 2). Men consumed more than 80% of total hospital resources, regardless of the measurement unit. Neither sex nor Aboriginality was significantly related to mean annualised bed days (8 bed days, 95% CI 7-9) or mean annualised inpatient costs (\$6,876, 95% CI \$6,308-7,443),

after adjusting for age. The corresponding median bed days and costs were two days (IQR 1-7) and \$3,098 (IQR \$1,907-7,069), respectively. The distribution for both measures was positively skewed (range of skewness coefficient, 4.5-7.2).

### Reasons for hospitalisation

As shown in Table 3, hospital admissions for mental and behavioural disorders accounted for the most bed days for both men (3,948 bed days) and women (499 bed days). Schizophrenia, depressive episode and disorders resulting from alcohol or other drug use were common primary diagnoses. Mental and behavioural disorders represented 36.8% of total bed days and were the primary cause of hospitalisation for 5.2% ( $n=338$ ) of men and 7.9% ( $n=70$ ) of women released from prison. Four out of five of these people were known to have a prior history of mental and behavioural disorder(s) requiring hospitalisation.

Injuries due to external causes, particularly involving the head and neck, accounted for the second highest number of bed days for both men (2,313 bed days) and women (356 bed days). Injuries accounted for 22.1% of total bed days, and affected 7.6% of men and 11.2% of women released from prison. Hospital admission for digestive diseases, often alcohol-related and/or inflammatory in nature (e.g. acute pancreatitis, gastritis, duodenitis), was also common for both sexes.

### Discussion

One in five adults released from WA prisons between 2000 and 2002 were hospitalised in the 12 months that followed (excluding pregnancy-related events, boarders and duplicated records), which

**Table 1: Age, sex and Aboriginality of adult ex-prisoners hospitalised at least once in the 12 months following release from prison, Western Australia 2000-02.**

Age (years)	Hospitalised Aboriginal ex-prisoners n (% of total ex-prisoners)			Hospitalised non-Aboriginal ex-prisoners n (% of total ex-prisoners)			Hospitalised (total) n (% of total ex-prisoners)		
	Male	Women	All	Male	Women	All	Male	Women	All
18-24	128 (17.5)	46 (34.6)	174 (20.1)	141 (14.0)	26 (25.7)	167 (15.1)	269 (15.5)	72 (30.8)	341 (17.3)
25-29	138 (18.1)	53 (36.0)	191 (21.0)	138 (15.8)	19 (22.6)	157 (16.4)	276 (16.8)	72 (31.2)	348 (18.6)
30-34	129 (24.3)	37 (30.3)	166 (25.4)	126 (18.2)	19 (27.9)	145 (19.0)	255 (20.8)	56 (29.5)	311 (22.0)
35-39	98 (27.9)	14 (18.4)	112 (26.2)	92 (20.0)	14 (34.2)	106 (21.2)	190 (23.4)	28 (23.9)	218 (23.5)
≥40	93 (24.0)	14 (17.4)	107 (24.4)	163 (22.4)	23 (34.3)	186 (23.4)	256 (23.0)	37 (31.4)	293 (23.8)
Total	586 (21.2)	164 (31.0)	750 (22.8)	660 (17.5)	101 (28.0)	761 (18.4)	1,246 (19.1)	265 (29.8)	1,511 (20.4)

**Table 2: Total separations, bed days and expenditure (A\$) of adult ex-prisoners hospitalised within 12 months of release from prison, Western Australia 2000-2002.**

	Aboriginal ex-prisoners Total (% Aboriginal total)			Non-Aboriginal ex-prisoners Total (% non-Aboriginal total)			Grand total Total (% grand total)		
	Male	Women	All	Male	Women	All	Male	Women	All
Total no. of separations	1,341 (79.7)	341 (20.3)	1,682 (100.0)	1,591 (91.2)	153 (8.8)	1,744 (100.0)	2,932 (85.6)	494 (14.4)	3,426 (100.0)
Total no. of bed days	4,741 (80.0)	1,184 (20.0)	5,925 (100.0)	5,696 (92.6)	453 (7.4)	6,149 (100.0)	10,437 (86.4)	1,637 (13.6)	12,074 (100.0)
Total expenditure (A\$)	4.2m (77.8)	1.2m (22.2)	5.4m (100.0)	4.5m (0.9)	0.5m (0.1)	5.0m (100.0)	8.7m (83.6)	1.7m (16.4)	10.4m (100.0)

translated into 12,074 inpatient bed days, 3,426 separations and costs of \$10.4m. Most at risk of hospitalisation were Aboriginals, females and ex-prisoners released to freedom or bail. However, this did not translate into higher (or lower) hospital costs for Aboriginals or females. Consequently, while more likely to be admitted, upon admission the level of care and health services consumed by these individuals is commensurate with their non-

Indigenous and male counterparts. Mental health disorders such as schizophrenia and depression, and injuries involving the head/face and/or fractures, accounted for 27% and 39% of hospitalisations respectively, more than half of all bed days (58.9%), or 7,116 bed days in total. These population-based results confirm that prisoners are particularly vulnerable to adverse health outcomes in the 12-month period following their release from prison.

**Table 3: Top five diagnostic categories responsible for the most hospital bed days for adult ex-prisoners within 12 months of release from prison, Western Australia 2000-2002.**

Primary diagnostic category (ICD-10 chapter in parentheses)	No. of ex-prisoners (%)	No. of bed days	Most frequent ICD-10 subcategory	No. of ex-prisoners in ICD subcategory	No. of bed-days in ICD subcategory (% ICD-10 chapter)
<b>Hospitalised men (n=1,246)</b>					
Mental and behavioural disorders (5)	338 (27.1%)	3,948	Schizophrenia (F20)	48	1,508 (38.2%)
			Mental and behavioural disorders due to use of alcohol (F10)	87	343 (8.7%)
			Depressive episode (F32)	35	309 (7.8%)
Injury, poisoning and certain other consequences of external causes (19)	495 (39.7%)	2,313	Dislocation, sprain and strain of joints and ligaments at neck level (S13)	<10	311 (13.4%)
			Intracranial injury (S06)	32	250 (10.8%)
			Fracture of lower leg, including ankle (S82)	19	131 (5.7%)
Factors influencing health status and contact with health services (21)	54 (4.3%)	889	Care involving dialysis (Z49)	<10	746 (83.9%)
			Other medical care (e.g. chemotherapy) (Z51)	<10	27 (3.0%)
			Problems related to medical facilities and other healthcare (e.g. unavailability and inaccessibility of healthcare facilities) (Z75)	<10	27 (3.0%)
Diseases of the circulatory system (9)	51 (4.1%)	669	Subarachnoid haemorrhage (I60)	<10	228 (34.1%)
			Intracerebral haemorrhage (I61)	<10	105 (15.7%)
			Heart failure (I50)	<10	71 (10.6%)
Diseases of the digestive system (11)	155 (12.4%)	488	Cholelithiasis (K80)	<10	62 (12.7%)
			Acute pancreatitis (K85)	12	57 (11.7%)
			Gastritis and duodenitis (K29)	29	54 (11.1%)
<b>Hospitalised women (n=265)</b>					
Mental and behavioural disorders (5)	70 (26.4%)	499	Depressive episode (F32)	11	77 (15.4%)
			Mental and behavioural disorders due to multiple drug use and use of other psychoactive substances (F19)	<10	74 (14.8%)
			Schizophrenia (F20)	<10	56 (11.2%)
Injury, poisoning and certain other consequences of external causes (19)	100 (37.7%)	356	Concussive injury (S06)	<10	41 (11.5%)
			Fracture of rib(s), sternum and thoracic spine (S22)	<10	40 (11.2%)
			Fracture of skull and facial bones (S02)	<10	29 (8.1%)
Diseases of the digestive system (11)	28 (10.6%)	196	Alcoholic liver disease (K70)	<10	78 (39.8%)
			Other diseases of pancreas (K86)	<10	35 (17.8%)
			Acute pancreatitis (K85)	<10	27 (13.8%)
Diseases of the respiratory system (10)	35 (13.2%)	118	Pneumonia, organism unspecified (J18)	15	56 (47.4%)
			Unspecified acute lower respiratory infection (J22)	<10	16 (13.6%)
			Bacterial pneumonia, not elsewhere classified (J15)	<10	12 (10.2%)
Diseases of the genitourinary system (14)	35 (13.2%)	108	Other disorders of urinary system (e.g. urinary tract infection, site not specified) (N39)	<10	19 (17.6%)
			Tubulo-interstitial nephritis, not specified as acute or chronic (N12)	<10	17 (15.7%)
			Other renal tubule-interstitial diseases (N15)	<10	13 (12.0%)

The prevalence of hospitalisation among ex-prisoners in their first year post-release can be compared only broadly with the WA general population, as linked data regarding the latter were not within the scope of our study. Aggregated statistics from the WADoH (Information Management and Reporting, 11 May 2010) gave the initial impression that our cohort of ex-prisoners was only slightly more likely to be admitted to hospital during a year than the general adult population ( $\geq 18$  years) of WA (20.4% vs ~18.3%). However, differences in the age structure of the ex-prisoner cohort and the general population possibly concealed differences.<sup>22</sup> A fairer basis was to restrict the comparison to adults aged 18 to 34 years,<sup>22</sup> which reflected the age of the majority of ex-prisoners ( $n=5,254$ , 70.9%). This approach suggested that the ex-prisoners in our study were 1.7 times more likely to be hospitalised during a year than the general adult population of WA of roughly the same age (19.0% vs 11.4%).

The higher rate of psychiatric disorders in correctional settings compared with that found in the Australian general community has been demonstrated previously.<sup>23</sup> Mental illness has been associated with both increased mortality<sup>22</sup> and recidivism among ex-prisoners.<sup>24</sup> Given that the majority of those with a psychiatric illness within this milieu fail to receive adequate treatment,<sup>25,26</sup> it is of little surprise that the greatest proportion of hospital separations by ex-prisoners within our study were related to psychiatric disorders. These findings highlight the importance of mental health services that target both those who are incarcerated and recently released. This requires co-operation between correctional and health authorities to ensure that adequate discharge planning and continuity of care arrangements are put in place before mentally ill inmates are released into the community,<sup>24</sup> especially for those in need of crisis hospitalisation.

Prisoners released into the community 'conditionally' had a lower risk of hospitalisation, suggesting that the leverage of continued contact with the community corrections system in the immediate period following release from prison may have some protective effects. Conditions generally include supervision from a community corrections officer, although additional requirements can be imposed, for example, curfews, electronic monitoring, unpaid community work, participation in a personal development program, a ban on drinking alcohol, or engagement with local mental health services, depending on the severity of the offence, the risk of re-offending and issues of public safety.<sup>27</sup> Perhaps the risk of reincarceration for breaching the conditions of release serves as a deterrent to risk-taking behaviours that may result in hospitalisation (e.g. alcohol and drug use, violence). Alternatively, it may improve social integration and reduce socio-economic disadvantage, for example, by supporting ex-prisoners to find secure housing, participate in employment or vocational training, and become involved in community-based treatment.

Unfortunately, our data did not include information about what, if any, support services were available to the study cohort during, or upon leaving, the custodial setting (e.g. screening processes for mental illness in WA prisons). However, on the basis of WA DCS literature,<sup>28-30</sup> it appears that a concerted movement toward

gender-tailored and culturally appropriate rehabilitation/reform strategies to lessen the economic and social disadvantage of WA prisoners post-release, particularly for Aboriginal women, did not commence until towards the end of our study timeframe. At the time, WA had only one dedicated women's prison (maximum security), plus a 'temporary', 'over-flow' low-security prison for adult women, that have been described as grossly 'inadequate', 'masculinist' in orientation, and preoccupied by containment and security issues over service delivery.<sup>30</sup> Since 2001/02, there has been a WA investigation into international best practice in women's corrections,<sup>29</sup> a comprehensive survey that has profiled the needs of WA women prisoners,<sup>28</sup> and the development of a purpose-built low-security WA prison for women that recognises their diverse needs.<sup>30</sup>

Today in WA, the DCS, working in partnership with other government and community agencies, provides a range of services to support community re-entry. These services include transitional accommodation, assistance finding permanent accommodation, justice mediation, and comprehensive drug management, education, training, employment and relationship support.<sup>27</sup> These services complement a range of education, training, rehabilitation and counselling programs made available to prisoners while in custody.<sup>27</sup> To what extent these services lead to measurable improvements in health outcomes after prison release is currently unknown, but a priority for future research. Assessing whether current drug and alcohol services have reduced mental health-related hospitalisations since the time of our study should be accorded high importance.

While we believe that our data on WA prison separations can assist with the future development of public health responses to the post-release needs of prisoners, there are limitations to the present study that should be considered. First, this study did not include a direct comparison group from the general population due to unavailability of such linked individual level data for this study; thus only broad comparisons with the health outcomes of the ex-prisoner cohort were possible.

Second, we did not use a contemporary cohort, so the extent to which our results are generalisable within the current context requires confirmation. However, given the lack of currently available population-based findings on this issue, the results provide a useful preliminary baseline against which future analyses can be compared.

A third limitation is that our study of morbidity was restricted to inpatient contact, a decision based solely on data availability. We hypothesise that ex-prisoner contact with hospital emergency departments (ED) is also significant. Once routine linkages (most are currently ad hoc) between existing offender and health administrative data are possible, WA will have an unparalleled source of information for examining the healthcare pathways of offenders (prison and other sentences) across multiple environments (e.g. inpatient, ED, General Practitioner, mental health contacts, prescribed medication use).

Lastly, the use of linked administrative data lacked the richness of information that is possible using prospective study designs

and primary data collection methods. For example, it does not tell us the reason(s) why those with schizophrenia were admitted to hospital. Additionally, we limited our analysis to the primary diagnosis responsible for the most days in hospital, as distinct from other co-morbidities that may have been present and could have exhibited a higher risk of hospitalisation. Furthermore, we cannot confirm whether there was any selection bias caused by prisoners migrating interstate post-release, but we have no reason to believe that WA departures are higher in ex-prisoners than observed in the general population; less than 2% of the WA population migrated interstate during 2000 to 2002 (~33,300 persons annually).<sup>31</sup> Other limitations of administrative data have been documented elsewhere.<sup>32</sup>

## Conclusion

Prisoners are some of the most marginalised members of the Australian population, whose complex needs result in a greater burden of morbidity and mortality than is found in the general community. This study has demonstrated the value of data linkage for understanding the health outcomes of offenders in the year after release from prison. Apart from being a population-based method, it relies on existing databases, and so it overcomes problems of selection bias due to non-participation and difficulties tracing individuals over time. Timely, relatively inexpensive, high-quality and contemporary results can be expected if these methods become part of a routine population-based surveillance system for monitoring the health outcomes of offenders. Our results provide a useful preliminary baseline for further Australian studies and can augment existing census and survey endeavours.

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## References

- Levy M. Prison health services. *Br Med J*. 1997;315(7120):1394-5.
- Baldry E, McDonnell D, Maplestone P, Peeters M. Ex-prisoners, homelessness and the state in Australia. *Australian and New Zealand Journal of Criminology*; 2006;39(1):20-33.
- Borzycki M, Makkai T. *Prisoner Reintegration Post-release*. Canberra (AUST): Australian Institute of Criminology; 2007.
- Australian Bureau of Statistics. *4517.0 - Prisoners in Australia, 2010*. Canberra (AUST): ABS; 2010.
- Australian Bureau of Statistics. *3238.0.55.001 - Experimental Estimates of Aboriginal and Torres Strait Islander Australians, Jun 2006*. Canberra (AUST): ABS; 2006.
- Australian Institute of Health and Welfare. *Towards a National Prisoner Health Information System*. Canberra (AUST): AIHW; 2006. Catalogue No.: PHE 79.
- Australian Institute of Health and Welfare. *Prisoner Health in Australia: Contemporary Information Collection and A Way Forward*. Canberra (AUST): AIHW; 2007. Catalogue No. PHE 94.
- Butler T. *Preliminary Findings of the NSW Inmate Health Survey*. Sydney (AUST): NSW Corrections Health Service; 1997.
- Butler T, Milner L. *The 2001 New South Wales Inmate Health Survey*. Sydney (AUST): NSW Corrections Health Service; 2003.
- Indig D, Topp L, Ross B, Mamoon H, Border B, Kumar S, et al. *2009 NSW Inmate Health Survey: Key Findings Report*. Sydney (AUST): Justice Health; 2010.
- Australian Institute of Health and Welfare. *The Health of Australia's Prisoners 2009*. Canberra (AUST):AIHW;2010.Catalogue No.PHE 123.
- Holman CD, Bass AJ, Rosman DL, Smith MB, Semmens JB, Glasson EJ, et al. A decade of data linkage in Western Australia: strategic design, applications and benefits of the WA data linkage system. *Aust Health Rev*. 2008;32(4):766-77.
- 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(2):310-6.
- 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.
- Stewart LM, Henderson CJ, Hobbs MS, Ridout SC, Knuiman MW. Risk of death in prisoners after release from jail. *Aust N Z J Public Health*. 2004;28(1):32-6.
- Hobbs MS, Krazlan K, Ridout S, Mai Q, Knuiman MW, Chapman R. *Mortality and Morbidity in Prisoners After Release from Prison in Western Australia, 1995-2003*. Canberra (AUST): Australian Institute of Criminology; 2006. Research and Public Policy Series No.: 71.
- Kinner SA. *The Post-release Experience of Prisoners in Queensland*. Canberra (AUST): Australian Institute of Criminology; 2006. Trends and Issues in Crime and Criminal Justice No.: 325.
- Department of Health and Ageing. *National Hospital Cost Data Collection (NHCDC) [cost weight data on the Internet]*. Canberra (AUST):Commonwealth of Australia; 2009 [cited 2010 May 12]. Available from: [http://www.health.gov.au/internet/main/publishing.nsf/Content/health-casemix-data-collections-about\\_NHCDC](http://www.health.gov.au/internet/main/publishing.nsf/Content/health-casemix-data-collections-about_NHCDC)
- Roos N, Burchill C, Carriere K. Who are the high hospital users? A Canadian case study. *J Health Serv Res Policy*. 2003;8(1):5-10.
- Kleinbaum DG, Klein M. *Survival Analysis - A Self-learning Text*. 2nd ed. New York (NY): Springer-Verlag; 2005.
- Lumley T, Diehr P, Emerson S, Chen L. The importance of the normality assumption in large public health data sets. *Annu Rev Public Health*. 2002;23:151-69.
- Australian Bureau of Statistics. *3201.0 - Population by Age and Sex, Australian States and Territories, Jun 2009* [statistics on the Internet]. Canberra (AUST): ABS; 2009 [cited 2010 May 12]. Available from: <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3201.0Jun%202009?OpenDocument>
- Kariminia A, Law MG, Butler T, Corben SP, Levy MH, Kaldor JM, et al. Factors associated with mortality in a cohort of Australian prisoners. *Eur J Epidemiol*. 2007;22(7):417-28.
- Baillargeon J, Binswanger IA, Penn JV, Williams BA, Murray OJDO. Psychiatric disorders and repeat incarcerations: the revolving prison door. *Am J Psychiatry*. 2009;166(1):103-9.
- Brinded PMJ, Simpson AIF, Laidlaw TM, Fairley N, Malcolm F. Prevalence of psychiatric disorders in New Zealand prisons: a national study. *Aust N Z J Psychiatry*. 2001;35(2):160-5.
- White P, Whiteford H. Prisons: mental health institutions of the 21st century? *Med J Aust*. 2006;185(6):302-3.
- Department of Correctives Services. *2009 Handbook: A Guide to Services Provided by the Department of Corrective Services*. Perth (AUST): State Government of Western Australia; 2009.
- Community and Juvenile Justice Division. *Executive Summary: Profile of Women*. Perth (AUST): Western Australia Department of Justice; 2002.
- McGinty J. *Report on a Visit to Canada, Minnesota and England*. Perth (AUST): State Government of Western Australia; 2001.
- Salomone J. *Towards Best Practice in Women's Corrections: The Western Australian Low Security Prison for Women*. Perth (AUST): Western Australia Department of Justice; 2004.
- Australian Bureau of Statistics. *3101.0 - Australian Demographic Statistics, Sep 2009* [statistics on the Internet]. Canberra: ABS; 2010 [cited 2010 May 12]. Available from: <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/3101.0Sep%202009?OpenDocument>
- Iezzoni LI. Assessing quality using administrative data. *Ann Intern Med*. 1997;127(8 Pt 2):666-74.