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SPECIAL THEME: SOCIAL EPIDEMIOLOGY

Extreme cause-specific mortality in a cohort of adult prisoners—1988 to 2002: a data-linkage study

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Objectives: Describe the standardized mortality ratio (SMR) and its trend in adults who have served time in prison.

Design: A retrospective cohort study of 85 203 adults imprisoned in New South Wales (NSW), Australia, between 1 January 1988 and 31 December 2002.

Methods: We obtained information on deaths by record linkage with the Australian National Death Index (NDI). Mortality rates were estimated using the person-time method. SMRs were calculated using sex, age, and calendar-specific death rates from the NSW population. Time trends in SMRs were assessed using the test for linear trends.

Results: The median overall follow-up of the cohort was 7.7 years. We identified 5137 deaths (4714 men, 423 women) among the cohort of which the vast majority (4834, 94%) occurred following release from custody. All-cause SMR was 3.7 (95% CI: 3.6–3.8) in men and 7.8 (95% CI: 7.1–8.5) in women. SMRs were substantially raised for deaths due to mental and behavioural disorders (men: 13.2, 95% CI: 12.3–14.0; women: 62.8, 95% CI: 52.7–74.9) and drug-related deaths (men: 12.8, 95% CI: 12.2–13.5; women: 50.3, 95% CI: 43.7–57.8). The SMR for death by homicide was 10.2 (95% CI: 8.9–11.7) in men and 26.3 (95% CI: 17.8–39.0) in women. Aboriginal men were 4.8 times, and Aboriginal women 12.6 times, more likely to die than the general NSW population. Over the study period on average all-cause SMR decreased significantly in men ($p = 0.003$) and women ($p = 0.05$) largely due to the decline in SMRs for drug-related deaths and suicide.

Conclusion: In the largest study so far reported, mortality of male and female offenders was far greater than expected for all major causes, especially deaths caused by drug overdose. Despite some indication of a reduction in excess mortality in recent years, there remains an overwhelming need for enhanced responses to mental health and drug problems for people who have been in prison.

Keywords Australia, cohort study, linkage, mortality, prisoners, standardized mortality ratio, suicide, trend

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Introduction

Prison inmates are recognized as a population with a high burden of disease from a wide range of physical and mental health problems. Studies have examined risky sexual and substance misuse behaviours among people who have served time in prisons, demonstrating their extreme vulnerability to sexually transmissible infections,[1] viral hepatitis,[2] drug dependence,[3] and mental ill health.[4]

A number of studies have addressed death as the ultimate consequence of these health problems. Most mortality studies have focused on deaths occurring while in custody and showed that prisoners are more likely to die prematurely especially of suicide, than people who have not been in custody.[5–8]

Several studies have assessed post-release death and provided an indication that those released from custody are at an increased risk of death.[9–12] These studies, however, have not reported on all major causes of death, mainly because of the small sample size or limited follow-up period. The present study is a comprehensive assessment of mortality among individuals who have been exposed to the prison environment. It aims to describe the relative importance of the main causes of death in people sentenced to full-time custody in New South Wales (NSW), Australia, to compare inmate mortality with that of the general NSW population, and to examine time trends in mortality during the 15 year study period.

Methods

Study population

We conducted a retrospective study using data linkage to examine the mortality risk and causes of death among a cohort of prisoners. The study cohort included all adults who had experienced full-time custody in NSW between 1 January 1988 and 31 December 2002. The prisoner cohort was identified by the NSW Department of Corrective Services (DCS) from their operational computer system, Offender Integrated Management System (OIMS). OIMS is used to manage information on the State's offender population throughout their sentence. Prisoners are assigned a unique identification number, which is also used for all subsequent imprisonments. The extracted list contained the unique identification number, full name, gender, date of birth, and country of birth. Importantly, it also contained information on any known aliases or pseudonyms used by prisoners. The list was used for the data linkage to the Australian National Death Index (NDI) and consisted of 145 979 records comprising 85 203 unique records.

We also received secondary information on the commencement and release dates (to community, parole, or home detention) of all episodes of incarceration (both sentenced and remand). This dataset was used to calculate the time spent in custody or in the community during the study period. Those imprisoned during the study period who first entered prison prior to 1 January 1988 were considered to be at risk from 1 January 1988.

Mortality data sources

Deaths in our study cohort were identified by record linkage with the NDI, a database managed by the Australian Institute of Health and Welfare (AIHW) containing information on all deaths reported in Australia since 1980. Source documentation for the NDI consists of death certificate information provided by the Registrar of Births Deaths and Marriages in each State and Territory. At the time of the linkage, the NDI was expected to contain information on all reported deaths up to 31 December 2002.

Information, including aliases, on 85 203 inmates was forwarded to the AIHW for linkage to the NDI records for the calendar years 1988–2002. Matching was performed using the integrity probabilistic record linkage software package.[13] Linkage was based on the common identifiers: full name, sex, date of birth, and date of last contact with the prison system. The NDI search algorithm generated many potential matches, which were reviewed by a blinded reviewer to decide if a match was a true one. Only highest level matches (matches on gender, surname, first name, middle name and date of birth) were accepted. Based on 311 deaths in prison, and 7558 offenders known to be alive in prison, the matching process was found to be 88.4% sensitive and 99.7% specific.[14]

For all matches the NDI returned information on death registration number, date of death, State or Territory in which death occurred, and the underlying cause of death. Deaths were coded using the International Classification of Diseases, 10th Revision, Australian Modification (ICD-10-AM), for deaths in 1997 or later, and using the International Classification of Diseases, Ninth Revision, Clinical Modification (ICD-9-CM) for deaths prior to 1997.

We analysed deaths from all major 'disease-related' and 'external' causes categories and subcategories. In addition, we examined death from smoking-related cancers (ICD-9 140, 141, 143–150, 157, 160–163, 188, 189; ICD-10 C00–C06, C09–C15, C25, C30–C34, C38, C64–C68), hepatitis C liver-related cancer (ICD-9 155.0; ICD-10 C22.0); hepatitis C liver-related diseases (ICD-9 571–573; ICD-10 K70, K73–K74); transport accidents (ICD-9 E800–E848; ICD-10 V01–V99); and accidental poisoning (ICD-9 E850–E858; ICD-10 X40–X44). We also established a separate category 'drug-related death' by combining those cases where the underlying cause of death was inferred to be directly related to drug use. These included deaths due to mental and behavioural disorders (ICD-9 304, 305.2–305.9; ICD-10 F11–F16, F19, F55); suicide (ICD-9 E950.0–E950.5; ICD-10 X60–X64); homicide (ICD-9 E962.0; ICD-10 X85); accidental (ICD-9 E850–E858; ICD-10 X40–X44); and undetermined intent (ICD-9 E980.0–E980.5; ICD-10 Y10–Y14). For deaths due to alcohol-related mental and behavioural disorder, we included (ICD-9 303, 305.0; ICD-10 F10).

Statistical analysis

The follow-up period was from the date of first imprisonment after 1 January 1988 until the date of death or the end date of the study (31 December 2002). Mortality rates were estimated using the person-time method (number of deaths divided by person-years of follow-up). We calculated standardized mortality ratios (SMRs) by comparing the observed and expected number of deaths. Expected mortality was calculated based on age, sex, and calendar-specific death rates for the entire NSW population for the years 1988–2002. The expected rate from the general NSW population was also used to calculate SMRs for the Aboriginal group, as accurate information on this population and their mortality was not available for the period of the study. Ninety five per cent confidence intervals for SMRs were based on the Poisson distribution. Time trends in mortality rates were assessed using the test for linear trends.[15] We used STATA Statistical Software, Release 8.0[16] for all statistical analyses.

Results

Cohort characteristics

The offender cohort consisted of 85 203 (76 383 men, 8820 women) individuals (Table 1). The median age at the study entry for men was 27.2 years (range = 18–86) and for women 27.3 years (range = 18–83). The majority (68%) were Australian born. Of 97% (82 807) of prisoners who reported Aboriginal status, 11% (9353) self-identified as Australian Aboriginal. The median overall follow-up period was 7.7 years for men and women (range = 1 day to 15 years). The average number of incarcerations during the study period was 2.5 (range = 1–78) for men and 2.5 (range = 1–38) for women.

Comparative mortality

In total, during the follow-up period we identified 5137 deaths (4714 men, 423 women). The median age at the time of death was 36.6 years for men and 32.7 years for women. Of the 5137 deaths, 303 (295 men, eight women) occurred in custody.

The crude mortality rate was 797 per 100 000 person-years for men and 685 per 100 000 person-years for women. Compared with the NSW population, overall mortality was significantly higher in male (SMR = 3.7, 95% CI: 3.6–3.8) and female (SMR = 7.8, 95% CI: 7.1–8.5) prisoners (Table 2). SMRs were highest in the younger age groups (18–44 years), with greater SMRs among women than men. Mortality excess was higher for Aboriginals (men: SMR = 4.8, 95% CI: 4.4–5.3; women: SMR = 12.6, 95% CI: 10.0–15.8).

Cause-specific mortality

Overall, the two leading causes of death were accidental and mental and behavioural disorders (Table 3). The main cause of death in men was accidental (1028, 22%) and in women was mental and behavioural disorders (124, 29%). The high mortality from mental and behavioural disorders was principally due to a large number of deaths associated with drug overdose (971, 91%). Aggregating deaths due to drugs, we identified 1477 (31%) deaths in men and 197 (47%) deaths in women. Heroin was the major contributor to most drug-related deaths. Prisoner drug-related deaths accounted for 26% of all drug-related deaths in NSW. About 14% of deaths in men and 7% in women were due to a cardiovascular disease. HIV infection was the underlying cause of death for 24 men in the cohort. There were no deaths from HIV among women.

Table 3 shows that for all causes of death, except cancer in women, the mortality rate was significantly higher in the prisoner cohort in comparison with the NSW population. SMRs were substantially raised for deaths due to mental and behavioural disorders in men (13.2, 95% CI: 12.3– 14.0) and in women (62.8, 95% CI: 52.7–74.9). SMRs were also substantially raised for homicide in men (10.2, 95% CI: 8.9–11.7) and

Table 1 Demographic and imprisonment history of the study cohort (n = 85203)

Characteristic	Men (n = 76 383)	Women (n = 8820)
Age at study entry, median (range)	27.2 (18–86)	27.3 (18–83)
Country of birth		
Australia	51 524 (67.5%)	6223 (70.6)
Other countries	24 856 (32.5%)	2597 (29.4)
Unknown	3	0
Aboriginal status		
Australian Aboriginal	7980 (10.4%)	1373 (15.6%)
Non-Aboriginal	66 352 (86.9%)	7102 (80.5%)
Unknown	2051 (2.7%)	345 (3.9%)
Number of incarceration, median (range)	2.5 (1–78)	2.5 (1–38)
Follow-up time in years, median (range)	7.7 (1 day to 15 years)	7.7 (1 day to 15 years)

Table 2 Age-specific rates (per 1000 person-years) and SMRs for all-cause mortality in 85 203 adults imprisoned in NSW, Australia, 1988–2002

	Men (n = 76 383)			Women (n = 8820)		
Age at risk	No. of deaths	Rate	SMR (95% CI)	No. of deaths	Rate	SMR (95% CI)
18–19	63	6.0 (4.7–7.7)	6.0 (4.6–7.6)	9	9.9 (5.1–18.9)	28.6 (14.9–55.0)
20–24	497	5.5 (5.0–6.0)	4.9 (4.5–5.4)	77	8.8 (7.0–11.0)	24.7 (19.7–30.9)
25–29	735	5.9 (5.5–6.4)	4.9 (4.6–5.3)	68	5.0 (4.0–6.4)	14.1 (11.1–17.9)
30–34	828	7.1 (6.6–7.6)	5.3 (4.9–5.7)	88	6.5 (5.3–8.0)	13.1 (10.6–16.2)
35–39	725	7.9 (7.4–8.5)	5.3 (4.9–5.7)	59	5.5 (4.3–7.1)	8.1 (6.3–10.4)
40–44	536	8.3 (7.7–9.1)	4.4 (4.1–4.8)	57	8.4 (6.5–10.9)	8.3 (6.4–10.8)
45–49	407	10.0 (9.0–11.0)	3.7 (3.4–4.1)	24	6.6 (4.4–9.8)	4.2 (2.8–6.2)
50–54	293	11.5 (10.3–12.9)	2.8 (2.5–3.2)	16	8.2 (5.0–13.4)	3.2 (2.0–5.2)
55–59	196	14.1 (12.3–16.2)	2.0 (1.8–2.4)	9	9.2 (4.8–17.8)	2.3 (1.2–4.3)
60–64	184	25.1 (21.7–29.0)	2.1 (1.8–2.4)	7	13.9 (6.6–29.1)	2.1 (1.0–4.3)
65–69	121	33.5 (28.1–40.1)	1.7 (1.4–2.0)	5	19.0 (8.0–45.6)	1.8 (0.7–4.3)
70–74	63	36.2 (28.3–46.4)	1.1 (0.9–1.4)	1	7.9 (1.1–55.9)	0.4 (0.1–3.2)
75–79	43	64.9 (48.1–87.5)	1.2 (0.9–1.6)	1	27.8 (3.9–197.4)	0.9 (0.1–6.5)
>80	23	105.0 (69.8–158.0)	0.7 (0.5–1.1)	2	228.4 (57.1–913.0)	1.7 (0.4–6.8)
Total	4714	8.0 (7.7–8.2)	3.7 (3.6–3.8)	423	6.85 (6.2–7.5)	7.8 (7.1–8.5)

Table 3 Observed and expected number of deaths and SMRs among the study cohort (NSW, Australia, 1988–2002)

	Men (n = 76 383)			Women (n = 8820)		
Cause of death (ICD-10), (ICD-9)	Observed	Expected	SMR (95% CI)	Observed	Expected	SMR (95% CI)
Disease-related						
Mental, behavioural (F00–F99), (290–319)	944	71.8	13.2 (12.3–14.0)	124	1.97	62.8 (52.7–74.9)
Drug overdose	855	58.6	14.6 (13.6–15.6)	116	1.5	77.8 (64.9–93.3)
Alcohol	58	3.2	18.1 (14.0–23.4)	6	0.1	103.3 (46.4–230.0)
Cardiovascular (I00–I99), (390–459)	639	269.9	2.4 (2.2–2.6)	29	9.2	3.2 (2.2–4.5)
Cancer (C00–C97), (140–208)	409	292.4	1.4 (1.3–1.5)	32	21.6	1.5 (1.0–2.1)
Smoking-related	184	108.9	1.7 (1.5–2.0)	10	4.1	2.4 (1.3– 4.5)
Hepatitis C liver-related	12	6.0	2.0 (1.1–3.5)	0	0.2	–
Digestive system (K00–K93), (520–579)	178	43.1	4.1 (3.6–4.8)	14	1.8	8.0 (4.7–13.5)
Hepatitis C liver-related	135	27.7	4.8 (4.1–5.7)	11	0.9	12.0 (6.6–21.6)
Respiratory system (J00–J99), (460–519)	106	46.0	2.3 (1.9–2.8)	8	2.6	3.1 (1.5–6.1)
Endocrine system (E00–E89), (240–279)	77	47.5	1.6 (1.3–2.0)	10	1.5	6.7 (3.6–12.5)
Infectious diseases (A00–B99), (001–139)	72	34.1	2.1 (1.7–2.7)	5	0.8	6.4 (2.7–15.5)
Nervous system (G00–G99), (320–389)	67	31.1	2.2 (1.7–2.7)	5	1.7	2.9 (1.2–7.1)
External						
Accidental (V01–X59), (E800–E949)	1028	209.1	4.9 (4.6–5.2)	96	5.5	17.5 (14.3–21.4)
Transport	360	113.9	3.2 (2.9–3.5)	33	11.8	2.8 (2.0–4.0)
Poisoning	482	41.1	11.7 (10.7–12.8)	56	4.5	12.4 (9.5–16.1)
Suicide (X60–X84), (E950–E959)	797	167.6	4.8 (4.4–5.1)	49	4.0	12.2 (9.2–16.2)
Homicide (X85–Y09), (E960–E969)	204	20.1	10.2 (8.9–11.7)	25	1.0	26.3 (17.8–39.0)
Other causes[a]	193	36.1	5.3 (4.6–6.2)	26	3.0	8.7 (5.9–12.8)
Total	4714	1268.7	3.7 (3.6–3.8)	423	54.5	7.8 (7.1–8.5)
Drug-related	1477	115.3	12.8 (12.2–13.5)	197	3..9	50.3 (43.7–57.8)

[a] Includes other disease-related (ICD-9: 210–239, 280–289, 580–677, 680–759, 780–799; ICD-10: D00–D48, D50–D89, L00 –N99, R00–R99); other external causes of deaths: (ICD-9: 970–999; ICD-10: Y10–Y34) and 35 deaths reported as unknown.

in women (26.3, 95% CI: 17.8–39.0). Mortality from Hepatitis C liver-related diseases was considerably higher among the cohort (men: SMR = 4.8, 95% CI: 4.1–5.7; women: SMR = 12.0, 95% CI: 6.6–21.6).

Suicide was a significant component of the mortality among offenders. The crude mortality rate for suicide was 135 per 100 000 person-years for men (SMR = 4.8) and 79 per 100 000 person-years for women (SMR = 12.1). Hanging was the most common method, implicated in 56% of suicides.

The overall SMR was substantially raised following release from prison into the community in both men (4.0, 95% CI: 3.9–4.2 vs. 1.7, 95% CI: 1.5–1.9) and women (8.2, 95% CI: 7.4–9.0 vs. 2.1, 95% CI: 1.0–4.2). The excess all-cause mortality increased with increasing number of imprisonments (Table 4). Our estimated all-cause SMR was not dependent on the total length of previous imprisonments. In men the SMR for drug-related mortality was 14.5 (95% CI: 13.8–15.3) after release and 2.7 (95% CI: 2.0–3.6) while in custody. In women, all drug-related deaths except one occurred in the community. In men the risk of suicide was the same for released prisoners (SMR: 4.8, 95% CI: 4.4–5.2) and those still in custody (SMR: 4.6, 95% CI: 3.8–5.5). The risk of homicide was slightly higher after release (SMR: 10.4, 95% CI: 9.0–12.1 vs. 8.8, 95% CI: 6.1–12.9). The majority of deaths in men and women from all the other causes occurred after release from prison.

Time trends (1988–2002)

SMRs over time for all-cause mortality, drug-related deaths, suicide and all disease-related deaths excluding mental and behavioural are shown separately for men and women in Figure 1. In both men and women there was a large decrease in the overall SMR and SMR for drug-related deaths between 1989 and 1990, possibly related to changes in the prison population in NSW at this time. Over the entire period all-cause SMR, on average, decreased significantly in men (p = 0.003; Figure 1a) and women (p = 0.05; Figure 1b). In men this decrease was largely due to a decrease in both drug-related SMR (Figure 1c) and SMR for suicide (Figure 1e) and in women due to a decrease in the drug-related SMR (Figure 1d). The disease-related SMR increased over the study period in both men and women (Figure 1g and 1h). This increase was only significant in men (p = 0.003).

Discussion

This study is, by far the largest investigation ever conducted of mortality in people who have been imprisoned. We found elevated cause-specific SMRs among adults who had been in full-time custody in NSW, particularly in those aged 18–44 years. There was a decreasing trend over time in the overall SMR almost entirely due to decreases in drug-related

Table 4 All-cause SMRs by number of previous imprisonments

	Men			Women		
	Observed	Expected	SMR (95% CI)	Observed	Expected	SMR (95% CI)
After release						
Once	2301	735.8	3.1 (3.0–3.3)	209	35.5	5.9 (5.1–6.8)
2–3 times	1321	260.5	5.1 (4.8–5.4)	114	10.5	10.9 (9.0–13.0)
4 or more	797	96.6	8.3 (7.7–8.8)	92	4.8	19.4 (15.8–23.8)
Total	4419	1092.9	4.0 (3.9–4.2)	415	50.7	8.2 (7.4–9.0)
In prison						
No previous imprisonment	129	90.7	1.4 (1.2–1.7)	1	1.9	0.5 (0.1–3.8)
Once	62	34.4	1.8 (1.4–2.3)	2	0.8	2.6 (0.7–10.4)
2–3 times	54	28.5	1.9 (1.5–2.5)	1	0.6	1.7 (0.2–12.3)
4 or more	50	22.2	2.3 (1.7–3.0)	4	0.6	6.6 (2.5–17.7)
Total	295	175.8	1.7 (1.5–1.9)	8	3.8	2.1 (1.0–4.2)

and suicide deaths. By contrast, the SMRs for disease-related deaths excluding those related to mental disorders increased between 1988 and 2002.

We found particularly high and significant SMRs for deaths due to mental and behavioural disorders, suicide and drug-related deaths, which suggest high levels of co-morbid psychiatric illnesses and drug use among this population. The homicide rate for men and women in our cohort was many times higher than that for the general population which is an indication of the risky lives lead by this group. Significantly elevated risk for disease-related causes is consistent with greater exposure among this population to risk behaviours such as drug-injection, excess alcohol use, smoking and poor diet.[17]

The excess mortality was higher among ex-prisoners compared with prisoners; drug-overdose was responsible for much of this excess. It has been suggested that reduced tolerance to certain drugs following periods of abstinence or reduced intake during incarceration may be the reason for the higher risk of drug-related deaths following release.[10,18,19] A possible explanation for the higher disease-related deaths among ex-prisoners is that these deaths most often occur later in life when offenders have reached the end of their criminal career and thus are more likely to be living in the community.

The finding that male and female Aborigines had a higher overall SMR than the cohort as a whole is of significant public health importance. Aboriginal people are hugely over represented in the Australian prisoner population[20] (11% of this cohort), but constitute around 2% of the NSW population.[21] Detailed analysis on these data is needed to make meaningful conclusions about the findings.

Several studies have reported on significant excess mortality among people with a history of imprisonment.[6,9–12] Although differences exist in the methods used to define study cohorts and the follow-up of individuals to determine vital status, the results were broadly similar to those from our study. The higher SMRs found for our study population are in line with the findings of studies on other socially disadvantaged populations such as those with a severe mental illness,[22] homeless people,[23] and a cohort of women prostitutes.[24]

Mortality declined in both men and women between 1988 and 2002 relative to the trend in the NSW population, largely due to a decline in drug-related deaths and suicide. It is unclear whether this trend represents improved provision and access to treatments programmes for drug addicts and mentally ill prisoners over the study period. Specific projects addressing actual services received by prisoners are necessary before any conclusion regarding this finding is possible.

We observed a sharp decrease in drug-related mortality between 1989 and 1990. This may be related to the introduction of the Sentencing Act in NSW in 1989.[25] Following this legislative change, the average number of days in custody increased for most offences, resulting in a decrease in the number of prisoners released from custody. We also observed a continuing decline in drug-related mortality between 2001 and 2002. This may be due to the well-documented reduction in heroin availability in Australia—the so-called 'heroin drought'.[26,27]

Our analyses are based on a large linkage study of more than 85 000 male and female offenders. It covers 15 years of follow-up to enable investigation of long-term trends in mortality in a period in which intervention programmes, such as the methadone maintenance treatment, started in prisons and in communities.[28,29] It is likely that we underestimated SMRs among our study cohort. Based on applying our linkage procedure to prisoners with known vital status, we were able to estimate the sensitivity of the linkage procedure to be 88.4% and the specificity to be 99.7%.[15] Assuming that any misclassification was not differential in this study, these rates of sensitivity and specificity would lead to underestimation of the SMRs by around 7%.[30] Sensitivity and specificity were also calculated for drug-related deaths (92.3% and 99.6% respectively); suicide (93.8% and 98.1%); homicide (100.0% and 100.0%); cardiovascular (98.2% and 100.0%) and cancer (100% and 100%). These figures would probably lead to the slight underestimatation of the SMRs. The only exception is suicide for which we would have probably overestimated the SMR by 4%. Further overestimation of suicide was prevented by not including 'undermined intent deaths' among suicide deaths.

It is highly unlikely that misclassification in the linkage procedure could have caused the decreasing trend in SMR for drug-related deaths. This could only have been caused by a

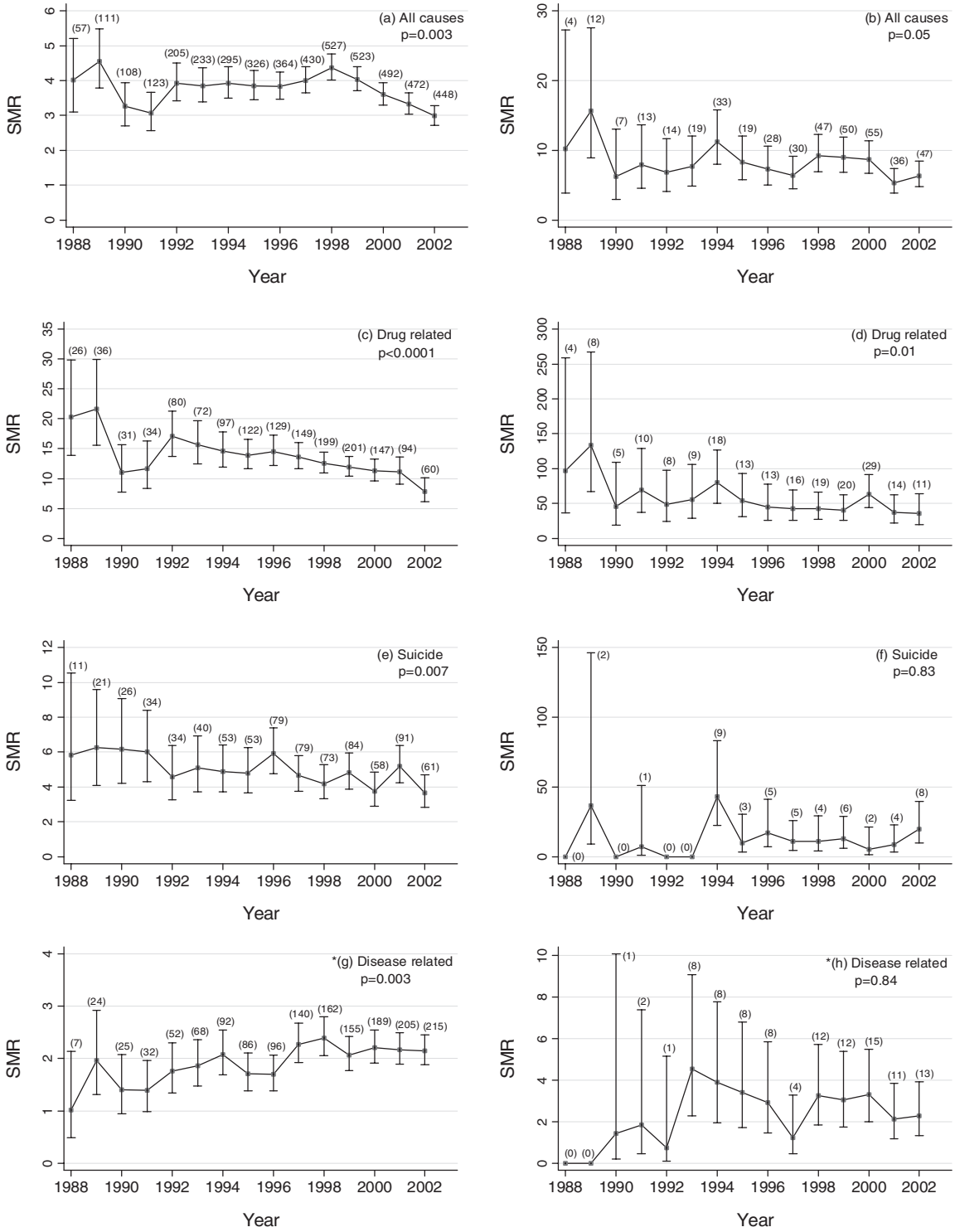

Figure 1 Time trend in SMRs (bars represent 95% CIs) between 1988 and 2002 for 76 383 men (left panels) and 8820 women (right panels) who served time in NSW prisons. Values in brackets show the actual number of deaths in different years. (*includes causes listed in Table 3 under 'disease-related', except mental and behavioural disorders).

large decrease in sensitivity and specificity in the linkage procedure over time. We were unable to assess time trends in sensitivity and specificity empirically, but improvements to the NDI over this time period would suggest that increasing sensitivity and specificity would seem more likely.

In summary, this is the largest study to date on mortality among offenders and is based on data linkage with the Australian National Death Index. We have shown that people with a history of imprisonment, particularly at younger ages, are at a considerably greater than expected risk of death. The

high mortality was attributable primarily to mental health problems and drug use. We observed a decreasing trend in all-cause mortality, drug-related and suicide between 1988 and 2002. The underlying reason for this decline remains to be established. It is important that programmes and support in the post-release period are available to assist this disadvantaged and marginalized group to obtain a quality life. Problems of particular concern to this group are mental health and those related to drug abuse.

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Competing interests

We declare that we have no competing interest.

Ethical approval

Approval for the study was obtained from the Justice Health, the NSW Department of Corrective Services, the University of New South Wales, and the Australian Institute of Health and Welfare.

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