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# **Suicide in adults released from prison in Queensland, Australia: a cohort study**

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### **Author contributions**

SK devised the study and obtained funding. MS undertook the analysis and drafted the manuscript. SF constructed the study datasets. SK, SF, JP and RA contributed to the interpretation of the results and to the final version of the manuscript.

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### **Competing Interests**

None declared

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**What is already known on this subject?**

People released from prison are at higher risk of mortality than their peers in the general population. The leading causes of death are homicide, suicide, traffic accidents and drug-related events. To date, interventions have focused largely on preventing opioid overdose deaths, especially in the first few weeks after release from prison.

**What this study adds?**

The risk of suicide is similar to the risk of drug-related death, especially after the critical two week period after release from prison has passed. In comparison to the suicide rate among woman in the general population, released woman are at very high risk of suicide. We identify several system-level interventions that have been shown to reduce suicide rates in our populations.

## Abstract

**Background:** Previous research has demonstrated elevated mortality following release from prison. We contrasted the risk of opioid overdose death with the risk of suicide in a cohort of adults released from prison over 14 years in Queensland, Australia. We examine risk factors for suicide in the cohort, and make comparisons with the general population.

**Method:** We constructed a retrospective cohort of all adults released from prison between 1994-2007 and linked this to the National Death Index for deaths up to 31 December 2007.

**Results:** We identified 41 970 individuals released from prison. Of the 2 158 deaths in the community, 371 were suicide (CMR 13.7 per 10 000 person-years) and 396 were due to drug related causes (CMR 14.6 per 10 000 person-years). We observed a spike in drug-related deaths in the first two weeks after release from prison but no such pattern was observed for suicide. Being married (HR 0.40) and number of prior imprisonments (HR 3.1 for  $\geq 5$  prior incarcerations compared with none) independently predicted suicide. Age, sex, Indigenous status, length of incarceration and offence history were not associated with suicide. The SMRs indicated that released women were 14.2 times and released men 4.8 times more likely to die from suicide than would be expected in the population.

**Conclusions:** This study demonstrates that the rate of suicide in adults released from prison is similar to the rate of drug-related deaths. Strategies that provide support to vulnerable people after release may reduce suicide in this population.

## Introduction

A growing body of evidence has documented an elevated risk of mortality among adults released from prison.[1-5] Compared with the general population, young ex-prisoners (<25 years) have between 3 and 28 times the risk of mortality,[1,3,5,6] female ex-prisoners between 2 and 41 times and male ex-prisoners between 1 and 8 times the risk of mortality.[1,5-7] Homicide, suicide, traffic accidents and drug-related events have been identified as the leading causes of death.[1,4,7-9]

Much of the epidemiological work in this population has focused on opioid overdose deaths – particularly those that occur within the first four weeks after release from prison.[8,10] Less is known about suicide. There is conflicting evidence of elevated suicide risk immediately after release from prison[2,4,11] and some evidence suggests that men are at greater risk of suicide than women.[11] A recent case-control study identified older age ( $\geq 35$  years), release from a local prison, a history of previous imprisonment, and requiring contact with community mental health services after release from prison as risk factors for suicide.[12] If interventions to reduce suicide are to be successful, more information is needed to identify high-risk periods for suicide and modifiable risk and protective factors.

To address these issues, we undertook a cohort study of all adults released from prison in Queensland, Australia over a 14 year period. We compared observed mortality rates with population-level data from Queensland over the same period. Our first aim was to compare the mortality rates for drug-related deaths and suicide over the entire study period and in the first 6 months after release from prison. Second, using the available information, we aimed to identify risk and protective factors for suicide. Our final aim was to compare the suicide rate for adults released from prison with that of the general population, matched by age and sex. To address the first two aims we use data from the

cohort of released prisoners as the denominator; for the third aim, we use the general population as the denominator.

## **Method**

### **Study design**

In this retrospective cohort study, we identified all adults released from prison in Queensland, Australia, from 1 January 1994 to 31 December 2007 (N = 42 015). Using a probabilistic method with subsequent manual review, these data were linked to the National Death Index (NDI) by the Australian Institute of Health and Welfare (AIHW), for deaths up to 31 December 2007. We excluded individuals who died in prison during a subsequent imprisonment (n = 45), giving a sample of 41 970 individuals. We also obtained suicide and population counts for the Queensland population over the same period.

Approval for the study was granted by The University of Queensland's Behavioural and Social Sciences Ethical Review Committee, the Australian Institute of Health and Welfare Ethics Committee and the Queensland Corrective Services (QCS) Research Committee.

### **Data sources and matching procedures**

QCS administers all adult correctional facilities in Queensland and provided data for the cohort on sentence details, basic demographics and offence-related information. The NDI records name, date of birth and death, location of death and underlying and contributing causes of death. Causes of death are classified according to the World Health Organization's International Classification of Diseases and Related Problems (ICD). The process used to classify causes of death in Australia is described elsewhere.[13]

Only one cause of death field was available for coding between 1994-1996, when ICD-9 was used; multiple fields were available from 1997 onwards using ICD-10 coding. AIHW linked the two datasets using routine, well-established linkage methods. Probabilistic matching was undertaken using prisoners' names (and any aliases), sex, date of birth, and date of last release from prison or most recent admission to a community order. Any remaining unmatched names were then assessed against possible matches using manual review. Probabilistic linkage between corrective services data and the NDI is sensitive and highly specific[14] and the inclusion of aliases improves sensitivity of the match without adversely affecting specificity.[15]

Comparison data for the general population were also obtained from AIHW, who maintains counts of all deaths in Australia by age, sex, state and year, classified by ICD codes.[16] From these data we identified the annual number of suicides and the mid-year population estimates for Queensland for those aged  $\geq 17$  years.

For the cohort of people released from prison, we classified cause of death using a system proposed by Randall et al.[17] into those whose underlying cause of death was suicide (ICD-9: E950-E959; ICD-10 X60-X84) and those whose underlying or contributing cause of death was drug-related (ICD-9: 304, 305.2-305.9, E850-E858, E962.0, E980.0-E980.5; ICD-10: F11-F16, F19, F55, I42.7, I43.6, R78-R78.5, T39-T48, T96, X40-X44, X85, Y10-Y14).

### **Statistical Analysis**

We calculated cause-specific mortality (the number of deaths divided by the person-years at risk) for suicide and drug-related death over the whole period of follow-up and during the first six months after any release from prison (aim 1). Consistent with previous studies, we report mortality rates per 10 000 person-years. For this and all subsequent analyses,

time at risk was defined as the period of time living in the community until death or the end of the study. For any individuals with repeated incarcerations, subsequent time in prison was excluded from the person-time calculation.

Using survival analysis, we examined predictors of suicide among people released from prison (aim 2). Individuals were censored if they died due to any cause except suicide (censoring occurred on the date they died). We parameterized our model as a flexible parametric survival model.[18] We included predictors for sex, age, marital status, Indigenous status, length of incarceration ( $\leq 90$  days, 91-180 days, 181-365 days,  $\geq 366$  days), number of prior imprisonments (0, 1, 2, 3, 4,  $\geq 5$ ), and whether their most serious offence per incarceration was a drug-related offence, a violent offence, or was committed in custody (each coded yes or no). We tested interactions between marital status and age, sex and Indigenous status. All predictors except sex and Indigenous status were entered as time-varying covariates; their values represented the individual's status at each release from prison.

Finally, we calculated age-specific suicide rates stratified by sex and compared these with the Queensland population (aim 3). To account for the long follow-up time in the cohort that could distort the allocation of person-time in each age category, we first split the data for each individual into a person-year dataset and calculated his or her age for each year he or she was under observation. We then categorized age into three groups (17-24, 25-39,  $\geq 40$ ) and used these categories to calculate the person-time in each age and sex group. This information was used as the denominator to calculate suicide rates in the cohort. We compared these rates with the suicide rates in the Queensland population, stratified by the same categories. The numerator was the number of suicides in the population. For the denominator we used mid-year Queensland population estimates from 1994-2007 as proxies for person-years in this population. We estimated the rate ratio

between these two populations and the standardized mortality ratio (SMR), using indirect standardization,[19] for males, females and both groups combined.

All analyses were undertaken in Stata 13.1.[20]

## Results

There were 41 970 individuals released from Queensland prisons from 1994-2007 for a total of 292 957 person-years (median 7.5 years follow-up). Our analysis focuses on the 270 394 person-years the sample spent in the community (median follow-up 6.8 years). The majority of the sample was male (88.1%) and at baseline, aged less than 40 years (79.6%, mean age 31 years) and unmarried (70.5%) (Table 1). Indigenous people were over-represented (19.1% of released individuals compared with 2.8% in the population[21]). Eight percent of individuals were released from prison five or more times during the observation period. Eleven percent of the cohort had a conviction for a drug-related offence, 36% for a violent offence and 8% for an offence committed in custody.

There were 2 158 deaths in the community following release from prison (crude mortality rate [CMR] 79.8 deaths per 10 000 person-years; 95% CI 76.5 to 83.2) – 371 deaths were suicide and 396 deaths were due to drug-related causes. The CMR for suicide was 13.7 per 10 000 person-years (95% CI 12.4 to 15.2) and for drug-related deaths 14.6 per 10 000 person-years (95% CI 13.3 to 16.2). The difference between these two rates was not significant (difference = 0.9 deaths per 10 000 person-years, 95% CI -1.1 to 2.9,  $p = 0.37$ ).

The rate of death varied by cause and time since release (Figure 1). The rate of drug-related death was higher in the first two weeks after any release (CMR 114.0 per 10 000 person years, 95% CI 70.9 to 183.4), than in the subsequent 24 weeks (CMR 27.2 per 10 000 person years, 95% CI 20.6 to 35.7). By contrast, the rate of suicide was similar in the

first two weeks after any release (CMR 20.1 per 10 000 person years, 95% CI 6.5 to 62.4) to the subsequent 24 weeks (CMR 25.6 per 10 000 person years, 95% CI 19.3 to 33.9).

For both drug-related deaths and suicide, the rate of death was significantly higher in the first six months after any release than subsequently. For drug-related deaths, the CMR was 33.9 deaths per 10 000 person-years (95% CI 26.6 to 43.1) in the first six months after any release, and 13.2 per 10 000 person-years (95% CI 11.8 to 14.7) thereafter. For suicide deaths, the CMR was 23.1 per 10 000 person-years (95% CI 17.3 to 30.9) in the first six months after any release, and 13.0 per 10 000 person-years (95% CI 11.7 to 14.5) thereafter.

In survival analysis, being married and having a higher number of prior imprisonments independently predicted suicide (Table 2). Those who were married had 40% lower risk of suicide than those who were unmarried (95% CI 0.4 to 0.7,  $p < 0.001$ ). The risk of suicide increased as the number of imprisonments increased. Compared with a person who was imprisoned only once during the study period, the risk of suicide was 1.4 times greater for a person with one additional imprisonment (95% CI 1.0 to 1.8). A person with five or more imprisonments had 3.1 times the risk (95% CI 2.0 to 4.6). We found no evidence that sex, age, Indigenous status, length of incarceration, or convictions for drug-related offences, violent offences or offences committed in custody were associated with the risk of suicide. Similarly, we found no evidence of an interaction between marital status and age ( $p = 0.43$ ), marital status and sex ( $p = 0.21$ ) or marital status and Indigenous status ( $p = 0.58$ ).

In comparison to the Queensland population, people released from prison were at greater risk of suicide in all age and sex groups (Table 3). The age-specific rates indicate that young women (17-24 years) released from prison were 30.3 times more likely to die from suicide than those from the general population (95% CI 14.2 to 64.7). This risk

declined with age but remained greater than the risk in the general population. Young males (17-24 years) released from prison were also at markedly elevated risk of suicide when compared with their peers in the general population (RR = 8.5, 95% CI 6.8 to 10.7). For older males, this risk was attenuated but still greater than in the general population. According to the SMRs, released women were 14.2 times (95% CI 9.6 to 20.3) and released men 4.8 times (95% CI 4.3 to 5.4) more likely to die from suicide than would be expected in their respective subgroups in the population. For the released prisoner population as a whole, the SMR for suicide was 7.6 times (95% CI 6.8 to 8.4) that which would be expected in the population.

## Discussion

In this 14 year cohort study of people released from prison in Queensland, we found that the overall rate of suicide was similar to the rate of death for drug-related causes. However, there were differences in how the mortality rate was distributed across time. Consistent with other studies we found a spike in the rate of drug-related deaths immediately after release from prison, after which the rate declined. For suicide, there was no such spike, but the rate still declined over time. These findings, which differ from those found elsewhere,[1,11] suggest that while the focus on avoiding opioid-related deaths after release from prison is clearly warranted, attention should also be given to preventing suicide after release from prison (although we acknowledge that more is known about preventing opioid-related deaths than suicide).

Our analysis identified several important risk and protective factors for suicide. There was evidence that being married was a protective factor for suicide, and this effect did not appear to be modified by age, sex or Indigenous status. There was also evidence that number of previous imprisonments was a strong risk factor for suicide, resembling a

dose-response relationship. Marriage is likely to be protective for at least two reasons. First, marriage is likely to indicate stable accommodation, which is associated with better post-release outcomes,[22] whereas a history of homelessness is a risk factor for suicide in people released from prison[4]. Second, marriage is likely to be a key source of practical and emotional support for ex-prisoners,[23] and spouses are well placed to recognize warning signs for suicide and facilitate access to care. Consistent with this, lower levels of social support have been associated with higher levels of suicide ideation in prison.[24]

Focusing on the comparison between the cohort and the general population, we found that people released from prison were at markedly higher risk of suicide. Young people, especially young women, appeared to be at particularly high risk of suicide. Men, who make up the bulk of the prison population, were also at increased risk. The remarkably high SMR for released women is consistent with evidence of high rates of mental disorder in female prisoners,[25] and provides further evidence that this group is at very significant risk of suicide after release from custody. These findings are in concordance with several other studies that have examined mortality after release from prison. Pratt et al.[2] found SMRs for suicide of 8 for released men and 36 for released women in the first year after release from prison. These values are higher than those found in our sample but consistent with the patterns we observed. A US study found that the risk of suicide among people released from prison was 3.4 times the risk in the population after controlling for age, sex and race.[1] Finally, a recent meta-analysis found that the risk of suicide in people released from prison was 6.8 times that of the general population.[26]

Our knowledge of ways to minimize the risk of suicide for people released from prison is limited. However, there are some system-level strategies that show promise, and further work is needed to build the evidence for these in ex-prisoner populations. The

evidence for this comes from a recent before-and-after observational study which found three system-level strategies associated with a reduction in suicide among people who use community mental health services.[27] The first strategy was the availability of 24 hour teams to provide a single point of access to people in crisis. The purpose of this service is to respond promptly to mental health crises and provide short-term support until other services become available. Given the high prevalence of mental disorder in prison populations,[24,25,28] the same service could be offered to vulnerable prisoners at release. The second strategy was the implementation of a dual diagnosis policy (for the management of people with co-occurring psychiatric illness and drug or alcohol misuse/dependence). Substance use is a strong risk factor for suicide and substance dependence is common in prisoners,[29] so it seems likely that this strategy may be beneficial to people released from prison. The third strategy was a multidisciplinary review after each suicide with the findings shared with the deceased's family. The evidence from Australia suggests that fewer than six percent of coronial investigations consider past history of imprisonment as a factor in the cause of death.[30] Therefore, routine data-linkage between the NDI and correctional data may be a better way of flagging cases for review. We acknowledge that the evidence for these three strategies is drawn from a different population to ex-prisoners and that the prison context is very different to inpatient/outpatient care. Nonetheless, these strategies do point to system-level approaches that might be helpful in minimizing the suicide risk. Research is needed to assess the extent to which these recommendations could be implemented in a criminal justice context, especially where no single agency is responsible for care after release from prison.

**Strengths and limitations**

The main strengths of this study are the 14 years of follow-up time, the large sample size, the use of person time to calculate risk, and the ability to match death records from a national data system (as opposed to linking to a regional database which may not identify death occurring in other jurisdictions). This study has several limitations. First, in the analysis of risk and protective factors, we were restricted to those variables that were reliably collected by QCS. Other studies, for example Pratt et al.[12], were able to include a broader range of variables. However, unlike many other studies, we accounted for changes over time in the value of potential risk factors, reflecting changing circumstances (e.g., changing from being unmarried to married). Second, our comparison with the general population relied on a relatively small number of suicides for women. These estimates, especially for the youngest and oldest age groups, should be interpreted with some caution (as evidenced by the wide confidence intervals). Third, consistent with other countries, the number of suicides reported here may be an underestimate because of difficulties in determining suicidal intent in some cases (especially where there is no suicide note[13]). It is possible that some drug-related suicides have been misclassified as accidental deaths, although the extent to which this has happened is unknown. Finally, there was a change in the ICD version during the study (from ICD-9 to ICD-10 in 1997). Less than 5% of the deaths were coded using ICD-9 so any effects are likely to be minimal. However, to guard against this, we used an established coding system for drug-related deaths[17] which has been used widely[31-34] and we note that the comparability of the suicide codes is excellent.[35]

## **Summary**

In recent years there has been a focus on averting drug-related deaths after release from prison. This study demonstrates that the rate of suicide in adults released from prison is similar to the rate of drug-related deaths. We identified being married as a protective factor for suicide and number of prior imprisonments as a risk factor. Although the evidence base is small, strategies focusing on system-level interventions may be a useful avenue for minimizing suicide risk.

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Figure 1: Cause-specific crude mortality rate in the first six months after release from prison

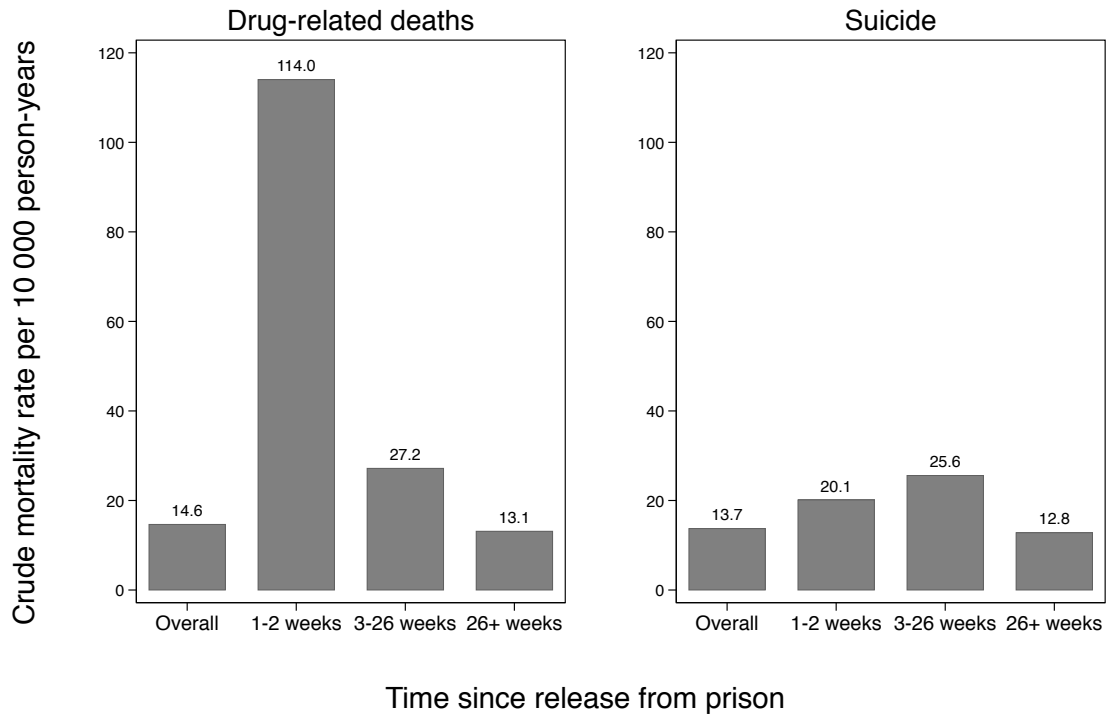


Table 1: Characteristics of the 41 970 individuals released from Queensland prisons, 1994-2007, and follow-up time

<b>Characteristic</b>	<b>Value</b>
<b>Male - n (%)</b>	36 994 (88.1)
<b>Age in years at baseline -n (%)</b>	
17-24	14 907 (35.5)
25-39	18 480 (44.0)
40+	8 583 (20.5)
<b>Indigenous Australian - n (%)</b>	8 015 (19.1)
<b>Married at any release - n (%)</b>	12 390 (29.5)
<b>Number of releases during the study period - n (%)</b>	
1	26 027 (62.0)
2	7 209 (17.2)
3	3 353 (8.0)
4	1 970 (4.7)
5 or more	3 411 (8.1)
<b>Drug-related offence* - n (%)</b>	4 681 (11.2)
<b>Violent offence* - n (%)</b>	14 994(35.7)
<b>Offence committed in custody* - n (%)</b>	3 204 (7.6)
<b>Follow-up time - person-years (median, range)</b>	
Total	292 957 (7.5, 0-14)
In custody	22 563 (0.2, 0-13)
In community	27 0394 (6.8, 0-14)

\* Variable refers to whether the event ever occurred during the study period

Table 2: Crude mortality rates and adjusted hazard ratios from flexible parametric survival analysis model for ex-prisoners, N = 41 970

	Number of suicides	Number of person-years	Crude rate (per 10000 person-years)	Adjusted Hazard Ratio (95% CI)	p value
<b>Sex</b>					0.059
Women	30	31 134	9.6	1.0	
Men	341	239 260	14.3	1.4 (1.0 to 2.1)	
<b>Age in years</b>					0.39
17-24	127	78 982	16.1	1.0	
25-39	185	135 051	13.7	0.9 (0.7 to 1.2)	
40+	59	56 361	10.5	0.8 (0.6 to 1.1)	
<b>Married</b>					<0.001
No	301	189 630	15.9	1.0	
Yes	70	80 764	8.7	0.6 (0.4 to 0.7)	
<b>Indigenous Australian</b>					0.23
No	280	218 673	12.8	1.0	
Yes	91	51 721	17.6	1.2 (0.9 to 1.5)	
<b>Length of incarceration</b>					0.22
≤90 days	206	148 586	13.9	1.0	
91-180 days	55	44 825	12.3	0.9 (0.6 to 1.1)	
181-365 days	60	34 850	17.2	1.2 (0.9 to 1.6)	
≥366 days	50	42 132	11.9	0.8 (0.6 to 1.2)	
<b>Number of prior imprisonments</b>					<0.001
0	194	162 286	12.0	1.0	
1	71	49 969	14.2	1.4 (1.0 to 1.8)	
2	40	23 753	16.8	1.7 (1.2 to 2.5)	
3	22	13 330	16.5	1.8 (1.2 to 2.8)	
4	12	8 183	14.7	1.7 (0.9 to 3.1)	
5 or more	32	12 872	24.9	3.1 (2.0 to 4.6)	
<b>Drug-related offence</b>					0.54
No	344	244 263	14.1	1.0	
Yes	27	25 145	10.7	0.9 (0.6 to 1.3)	
<b>Violence related offence</b>					0.95
No	260	204 644	12.7	1.0	
Yes	111	64 764	17.1	1.2 (1.0 to 1.5)	
<b>Offence committed in custody</b>					0.99
No	350	250 025	14.0	1.0	
Yes	21	19 383	10.8	1.0 (0.6 to 1.6)	

Note: All variables except sex and Indigenous status refer to any release from prison

## Suicide in adults released from prison

Table 3: Comparison of suicide rates between those released from prison and the Queensland population (1994-2007)

	Released population			General Population			Rate ratios (95% CI)
	Number of person years	Number of suicides	Crude rate (per 10 000 person-years)	Number of person years	Number of suicides	Crude rate (per 10 000 person-years)	
<b>Women</b>							
17-24	4 281	7	16.4	2 913 000	157	0.5	30.3 (14.2 to 64.7)
25-39	17 640	17	9.6	5 716 000	433	0.8	12.7 (7.8 to 20.7)
40+	9 213	6	6.5	10 934 000	649	0.6	11.0 (4.9 to 24.5)
All women $\geq 17$ years	31 134	30	9.6	19 563 000	1,239	0.6	14.2 (9.6 to 20.3) *
<b>Men</b>							
17-24	35 766	80	22.4	3 007 000	791	2.6	8.5 (6.8 to 10.7)
25-39	129 760	185	14.3	5 662 000	1,907	3.4	4.2 (3.6 to 4.9)
40+	73 733	76	10.3	10 500 000	2,500	2.4	4.3 (3.4 to 5.4)
All men $\geq 17$ years	239 260	341	14.3	19 169 000	5,198	2.7	4.8 (4.3 to 5.4) *
<b>All individuals</b>							
$\geq 17$ years	270 394	371	13.7	38 732 000	6,437	1.7	7.6 (6.8 to 8.4) *

\* Standardized mortality ratio