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Understanding extreme mortality among prisoners: a national cohort study in Scotland using data linkage

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Background: Mortality is known to be extremely high among people who have been imprisoned, but there is limited information about the factors that explain this increased risk. **Methods:** Standard record linkage methods were used to link Scottish prison records and mortality data for all individuals imprisoned in Scotland for the first time between 1 January 1996 and 31 December 2007. **Results:** Among 76 627 individuals there were 4414 deaths (3982 in men). When compared with the general population, the age-standardized mortality rate ratio for those imprisoned was 3.3 (95% CI: 3.2, 3.4) for men and 7.6 (6.9, 8.3) for women. Further adjustment for an area measure of deprivation accounted for part but not all of this excess risk [adjusted rate ratio 2.3 (2.2, 2.4) and 5.7 (5.1, 6.2) for men and women, respectively]. Relative risks were highest for drug and alcohol related causes, suicide and homicide and were markedly higher among women than men. Out of prison deaths were most frequent in the first 2 weeks after release from prison. Mortality rates were lower in those with longer total duration in prison and higher in those with multiple short episodes in prison. **Conclusion:** People who have been imprisoned in Scotland experience substantial excess mortality from a range of causes that is only partly explained by deprivation. The association of increased mortality with multiple periods in prison and the concentration of deaths in the early period after prison release both have implications for policy and practice.

Introduction

People who have been imprisoned experience much higher all-cause mortality than the general population, largely due to their increased risk of death from suicide, drug misuse and alcohol.[1] There is conflicting evidence about mortality experience while in prison, with some studies finding increased all-cause mortality compared with the general population[2–4] and others similar[5] or reduced[6–8] levels. However, there is consistent evidence that mortality outside prison is substantially higher than that in the

general population, particularly during the first few weeks after release.[1,3,9–14] Prisoners are more likely to come from a deprived area than the non-prison population,[15] but it is not clear whether this accounts for their increased mortality rates. Multiple episodes of imprisonment have been associated with a chaotic lifestyle and possibly with increased mortality, but there is limited evidence about whether total duration of imprisonment[5,16] or the numbers of episodes in prison[16–18] are the most relevant.

Our objectives were to examine the mortality of people who had been imprisoned in Scotland: to describe the pattern of causes of death; to examine the relative contribution of length and numbers of episodes of imprisonment and to estimate the contribution of socioeconomic status (using an area measure of deprivation as a proxy) to excess mortality.

Methods

We used a retrospective cohort design to examine mortality among those imprisoned in Scotland for the first time between 1996 and 2007. Data on those imprisoned in Scotland at any time between 1 January 1996 and 31 December 2007 were extracted from the Scottish Prison Service databases (PR1 and PR2), including dates of imprisonment, age at first imprisonment, marital status, religion and ethnic group. Postcode of residence prior to imprisonment was used to derive the Carstairs index, an area based measure of deprivation.[19] The Information Services Division (ISD) of NHS National Services Scotland routinely obtains data on all deaths in Scotland from the National Records of Scotland (NRS). Linkage of the prisoner dataset to these death records (using probabilistic linkage methods) was used to identify all those who had died up to 31 December 2007. Personal identifiers were removed to produce an anonymized analysis dataset. The sample size was based on data availability so a power calculation was not carried out.

Carstairs deprivation scores were divided into quintiles based on the whole Scottish population. The total time spent in prison was grouped into eight categories: <11 days; 11–28 days, 29–54 days, 55–109 days; 110–219 days; 220–447 days; 448–910 days and 911 and more days. The period of first imprisonment was grouped into 3-year periods: 1996–98; 1999–2001; 2002–04 and 2005–07. Causes of death were examined by chapter groupings from the International Classification of Disease, 9th revision (for deaths prior to 2000) and 10th revision (for subsequent deaths). Drug and alcohol related deaths were examined separately using the ICD9 and ICD10 codes shown in Table 3. Place of death (in or out of prison) was derived using the incarceration and death dates. Cases with missing data for a specific variable were excluded from analyses using that variable.

The linked dataset was used to calculate indirectly standardized mortality ratios (SMRs) for the prison cohort for men and women separately using a person-years approach which took account of the time each individual spent in different age categories. The whole Scottish population was used as the reference standard. For the deprivation-adjusted analyses the 2001 Carstairs quintile population estimates by age-band and sex were assigned across the whole period. All-cause and disease-specific SMRs were calculated for men and women, adjusting for age (in 5-year bands) and for Carstairs index quintile. Those with missing postcode (and therefore Carstairs) information were assigned to the most deprived quintile. A sensitivity analysis was carried out excluding all those with missing postcodes. SMRs were calculated separately for deaths occurring in and out of prison using the person-years method described earlier. Poisson regression was used to obtain adjusted mortality rate ratios. A series of models were explored and model fit assessed by examining standardized residual plots and the Akaike Information Criterion. Models were checked for over-dispersion. All analyses were carried out using Stata 12.0 (Stata Corp, College Station, TX).

The data linkage was approved by the Scottish Privacy Advisory Committee, which provides ethical advice to ISD and NRS.

Results

The Scottish Prison Service database recorded 92 383 people who were in prison at some time between 1 January 1996 and 31 December 2007. Individuals already in prison on 1 January 1996 or known to have been in prison at any time before this date were excluded (15 756), leaving 76 627 people imprisoned in Scotland for the first time between 1996 and 2007.

Of these, 89% were male (Table 1). The median age at study entry (first imprisonment) was 26.7 years for men and 27.0 years for women. The mean number of imprisonments during 10 years of follow up was 2.8 for men and 2.4 for women, although around half had only one imprisonment. The median follow up time was 6.9 years for men and 6.1 years for women. Similar proportions of men and women were married, divorced or separated. The majority reported their religion as Christian, and the overwhelming majority described their ethnic group as white (92.4% of men, 93.8% of women). Among those with non-missing postcodes, 24.2% of men and 24.5% of women were living in an area in the most deprived Carstairs deprivation quintile at the time of their first imprisonment. However, postcodes were unknown for a substantial proportion of both men (42.0%) and women (43.7%).

Data linkage identified 4414 deaths during the study period (3982 in men). The highest age-specific rate ratios were at younger ages for both men and women (Table 2). The overall SMR (standardized for age and year of death) for prisoners compared with the general population was 3.3 (95% CI 3.2, 3.4) for men and 7.6 (6.9, 8.3) for women. After further standardization for deprivation the corresponding figures were 2.3 (2.2, 2.4) and 5.7 (5.1, 6.2), so that

Table 1 Demographic and other characteristics of 76 627 adults imprisoned in Scotland for first time between 1 January 1996 and 31 December 2007

	Males (*N* = 68 315)	Females (*N* = 8312)
Age at first imprisonment: median (range)	26.7 (14.1–89.9)	27.0 (14.1–75.6)
Number of incarcerations: mean, median (range)	2.8, 1 (1–61)	2.4, 1 (1–34)
Follow-up time in years: median (range)	6.9 (1 day– 2 years)	6.1 (15 days–12 years)
Marital status		
Common Law/Married: number (percentage)	11 223 (16.4)	1453 (17.5)
Divorced/Separated: number (percentage)	7472 (10.9)	1051 (12.6)
Other (Single/Widowed): number (percentage)	47 770 (69.9)	5489 (66.0)
Missing: number (percentage)	1850 (2.7)	319 (3.8)
Religion		
Roman Catholic	14 813 (21.7)	2019 (24.3)
Other Christian	25 324 (37.1)	2731 (32.9)
None	22 915 (33.5)	3013 (36.2)
Other	3081 (4.5)	175 (2.1)
Missing	2182 (3.2)	374 (4.5)
Ethnicity		
White	63 129 (92.4)	7797 (93.8)
Other	3520 (5.2)	276 (3.3)
Missing	1666 (2.4)	239 (2.9)
Deprivation quintile		
1 (least deprived)	1910 (2.8)	196 (2.4)
2	4192 (6.1)	430 (5.2)
3	7182 (10.5)	819 (9.9)
4	9837 (14.4)	1201 (14.4)
5 (most deprived)	16 502 (24.2)	2037 (24.5)
Unknown	28 692 (42.0)	3629 (43.7)

Table 2 Age-specific mortality rate ratios and age SMRs for all-cause mortality; overall SMRs without and with adjustment for deprivation (missing deprivation status allocated to the most deprived category)

	Males (*N* = 68 315)				Females (*N* = 8312)			
Age at death (years)	Observed deaths	Person-years at risk (thousands)	Expected deaths	adjusted rate ratio (95% CI)	Observed deaths	Person-years at risk (thousands)	Expected deaths	adjusted rate ratio (95% CI)[a]
15–19	139	26.3	22.5	6.2 (5.2, 7.3)	12	2	0.8	15.9 (8.2, 27.8)
20–24	485	84	127.2	3.8 (3.5, 4.2)	46	8.9	3.9	11.8 (8.7, 15.8)
25–29	466	90.9	159.9	2.9 (2.7, 3.2)	73	11.5	6.1	12.0 (9.4, 15.1)
30–34	444	78.5	181.6	2.4 (2.2, 2.7)	75	9.8	7.7	9.8 (7.7, 12.3)
35–39	486	63.4	188.4	2.6 (2.4, 2.8)	68	7.7	10.1	6.7 (5.2, 8.5)
40–44	474	44.8	195.6	2.4 (2.2, 2.7)	51	5.4	11.5	4.4 (3.3, 5.8)
45–49	431	28.5	179.7	2.4 (2.2, 2.6)	39	3	11	3.5 (2.5, 4.8)
50–54	334	17.1	156.1	2.1 (1.9, 2.4)	31	1.6	8.1	3.8 (2.6, 5.4)
55–59	263	10.7	161.5	1.6 (1.4, 1.8)	16	0.8	6.8	2.3 (1.3, 3.8)
60–64	197	5.9	134.3	1.5 (1.3, 1.7)	15	0.3	4.1	3.7 (2.0, 6.0)
65–69	148	3	96.8	1.5 (1.3, 1.8)	5	0.2	3	1.7 (0.5, 3.9)
70–74	75	1.3	64.5	1.2 (0.9, 1.5)	1	0.1	2.2	0.5 (0.0, 2.5)
75–79	24	0.4	27.8	0.9 (0.6, 1.3)	0	0	1	0.0 (0.0, 3.7)
80–84	8	0.1	13.8	0.6 (0.3, 1.1)	0	0	0	
85+	8	0.1	13.8	0.6 (0.2, 1.1)	0	0	0	
Overall[b]	3982	454.8	1209.6	3.3 (3.2, 3.4)	432	51.2	57.2	7.6 (6.9, 8.3)
Overall[c]	3982	454.8	1723.5	2.3 (2.2, 2.4)	432	51.2	76.3	5.7 (5.1, 6.2)

CI, confidence interval.

a: Adjusted for age (in 5-year bands), period of first imprisonment and quintile of deprivation category at first imprisonment (using Carstairs 2001 score).

b: Mortality rate ratio standardized for age and period (but not for deprivation category).

c: Mortality rate ratio standardized for age, period and quintile of deprivation score.

adjustment for deprivation accounted for 43% of the excess risk in men and 29% in women. When records with missing deprivation information were excluded, the SMR was 3.2 for males and 7.5 for females, falling to 2.6 for males and 6.3 for females after additional standardisation for deprivation, 26 and 18% of the excess risk respectively (data not shown).

In absolute terms, the most common cause of death for both men and women was mental and behavioural disorders, (24% of male deaths and 40% of female deaths) which were almost exclusively due to drug and alcohol related causes (Table 3). The second most common cause of death was from suicide and deaths of undetermined intent, but cardiovascular and alcoholic liver disease also accounted for substantial numbers of deaths among both men and women.

Mortality rates among those who had been imprisoned were higher than the general population for almost all causes with differences more extreme among women. Compared with the general population, men who had been imprisoned were more than four times as likely to die from a mental and behavioural disorder and women 24 times as likely to die. Men were 3.7 times more likely and women 16.9 times more likely to die of accidental poisoning. Men were 3.5 times more likely than the general population to die from suicide and deaths of undetermined intent, and women 11.7 times more likely to do so. Substantially increased mortality rates were also apparent for homicide among men (SMR 4.3) and women (22.5), for all drug related deaths among men (4.4) and women (19.6) and for all causes directly related to alcohol among men (2.8) and women (9.1).

The vast majority (98%) of deaths occurred outside prison. Compared with the general population, mortality among men was significantly lower while in prison (SMR 0.6, 95% CI 0.5, 0.7). Mortality among women in prison was higher (SMR 1.9, 95% CI 0.9, 3.5) although the confidence interval was wide. Compared with the general population, the risk of death while outside prison was substantially raised for both men (SMR 2.5, 95% CI: 2.4, 2.6) and women (SMR 5.9 95% CI: 5.4, 6.5) and in both cases the out of prison mortality rate was substantially higher than the in-prison rate. Out-of-prison deaths were most likely to occur in the first month after release, particularly in the first 2 weeks; of 1715 deaths in the first year after release 477 (28%) occurred in the first 4 weeks after release; of these 232 (49%) occurred in the first week and a further 121 (25%) in the second week.

Consistent with the finding of lower in-prison mortality, adjusted mortality rates fell with increasing time in prison (Figure 1). In contrast, after controlling for other factors including total length of time in prison, mortality rose with increasing numbers of short prison episodes (defined as <6 months in duration), with the highest mortality seen in those with 3–7 short prison episodes. Mortality rates were not significantly raised in the highest category (8–60 episodes), though the CI was wide. Compared with 1996–98, there was a slight reduction in mortality in 2002–04 but no significant change between the start and the end of the study period. Those who were married or in common-law partnerships had the lowest mortality and mortality was also significantly lower among those of no or non-Christian religion or from non-White ethnic groups.

Discussion

We found substantially increased all-cause mortality among those who had been in prison in Scotland. Excess mortality was largely confined to the time out of prison, particularly the immediate period after release, and relative mortality was increased among women and those with multiple short episodes of detention. The relative mortality excess was largest for accidental poisoning, suicide, homicide and alcohol and drug related causes but was also raised for cardiovascular and respiratory causes, infections and (in women) lung cancer. The mortality risk was largest among younger age groups, with the highest relative risks seen among younger women. In absolute terms, drug-related deaths and suicides were the most important single causes of death. Adjustment for socio-economic status (using area deprivation as a proxy) accounted for less than half of the observed mortality excess. Longer duration of imprisonment was associated with lower mortality. There was little change in mortality over time.

Table 3 Observed and expected numbers of deaths and SMRs for specific causes of death

Cause of death (ICD10, ICD9 codes)	Males (*N* = 68 315)			Females (*N* = 8312)		
	Observed deaths	Expected deaths	SMR (95% CI)	Observed deaths	Expected deaths	SMR (95% CI)[a]
Mental and Behavioural (F00-F99, 290–319)	967	220.7	4.4 (4.1, 4.7)	138	5.7	24.0 (20.2, 28.4)
Alcohol related (F10)	207	57.0	3.6 (3.2, 4.2)	24	1.7	13.9 (8.9, 20.6)
Drug related (F11–16, F19)	758	159.3	4.8 (4.4, 5.1)	114	3.8	30.2 (24.9, 36.3)
Cardiovascular (I00-I99, 390–459)	533	375.3	1.4 (1.3, 1.5)	32	13.1	2.4 (1.7, 3.4)
Cancer (C00-C97, 140–208)	279	298.7	0.9 (0.8, 1.1)	30	22.3	1.3 (0.9, 1.9)
Lung cancer (C34, 162)	107	89.4	1.2 (1.0, 1.4)	13	4.8	2.7 (1.4, 4.7)
Digestive System (K00-K93, 520–579)	470	204.5	2.3 (2.1, 2.5)	62	9.6	6.4 (4.9, 8.3)
Alcoholic liver disease (K70, 571.0–571.3)	336	139.4	2.4 (2.2, 2.7)	46	6.1	7.5 (5.5, 10.0)
Respiratory system (J00-J99, 460–519)	166	92.2	1.8 (1.5, 2.1)	14	5.1	2.8 (1.5, 4.6)
Endocrine system (E00–E89, 240–279)	30	28.0	1.1 (0.7, 1.5)	2	1.7	1.2 (0.1, 4.4)
Infectious disease (A00–B99, 001–139)	60	29.5	2.0 (1.6, 2.6)	13	1.6	8.3 (4.4, 14.2)
Nervous System (G00–G99, 320–389)	53	43.3	1.2 (0.9, 1.6)	2	2.6	0.8 (0.1, 2.8)
Accidental (V01–X59, E800–E949)	271	109.9	2.5 (2.2, 2.8)	16	2.6	6.2 (3.6, 10.1)
Transport (V01–V99, E800–E849)	106	51.3	2.1 (1.7, 2.5)	1	1.0	1.0 (0.0, 5.6)
Poisoning (X40–X49, E850–E858)	54	14.7	3.7 (2.8, 4.8)	4	0.2	16.9 (4.6, 43.3)
Suicide (X60–X84, E950–E959) and Undetermined Intent (Y10–34, E980–E989)	783	220.9	3.5 (3.3, 3.8)	87	7.4	11.7 (9.4, 14.5)
Homicide (X85–Y09, E960–E969)	225	51.9	4.3 (3.8, 4.9)	17	0.8	22.5 (13.1, 36.0)
Other causes	145	48.6	3.0 (2.5, 3.5)	19	3.8	4.9 (3.0, 7.7)
All causes	3982	1723.5	2.3 (2.2, 2.4)	432	76.3	5.7 (5.1, 6.2)
All Drug Related[b]	1112	250.3	4.4 (4.2, 4.7)	163	8.3	19.6 (16.7, 22.9)
All Alcohol Related[c]	559	200.9	2.8 (2.6, 3.0)	72	8.0	9.1 (7.1, 11.4)

CI, confidence interval.

a: Standardized for age at risk, period at risk and deprivation category at admission (Carstairs 2001 quintile).

b: Based on the following codes: ICD9: 304, E85, E95, E98; ICD10 F11.2, F13.2, F14.2, F15.2, F16.2 F19.2, X40, X41, X42, X60-X64, Y10-Y14.

c: Based on the following codes: ICD9 291.8, 303.9, 305.0, 571.0, 571.1, 571.2, 571.3; ICD10 F10, G31.2, I42.6, K70.0, K70.1, K70.3, K70.4, K70.9, K86.0, X65

This study is among the larger studies of prisoner health internationally and includes a substantial period of follow up. It is the first comprehensive report of cause-specific mortality in a large sample of prisoners in Scotland. The accuracy of linkage by probability matching is limited by the quality of the identifiers in the datasets being linked and the range of identifiers available. Personal identifiers on the deaths and prison datasets are of high quality, and full name and date of birth were available. Based on validation studies of hospital data linked to deaths in Scotland, we estimate that our matching procedures should be around 98% accurate.[20] We were able to assess the contribution of deprivation to the observed mortality excess seen in our study, which, to our knowledge, has not been previously reported on. The complete national coverage of the prison database means that these results are generalisable to the Scottish prisoner population.

The postcode of previous residence was unknown at study entry for over 40% of the cohort, limiting our ability to adjust for deprivation. We assigned all prisoners with a missing postcode to the most deprived quintile, which has the effect of increasing the estimate of 'expected' mortality and providing a conservative (or maximum) estimate of the contribution of deprivation to the observed excess of mortality in prisoners. As expected, excluding records with missing postcodes reduced the extent to which deprivation accounted for the prisoner mortality excess.

Individual measures of socio-economic status were not available. The area measure of deprivation used in this study is an ecological measure of socioeconomic status and therefore the possibility of residual confounding remains. No information was available on the number of released prisoners who died outside Scotland; such deaths would lead to an underestimate of mortality but we do not think that this number is likely to be substantial.

Population estimates by deprivation category are only available at census years, so we used Carstairs 2001 population estimates as the denominator for deprivation-adjusted analyses across the whole study time period. The population size is therefore slightly underestimated, particularly in more recent time periods. This slightly overestimates national death rates and expected deaths and so underestimates relative mortality for prisoners. However we believe that this effect is likely to be small.

We excluded 15 756 prisoners who had an imprisonment recorded prior to, or were already imprisoned, on 1 January 1996 in order to avoid bias caused by including a selected group at low mortality risk who had survived to this date. A sensitivity analysis examining relative mortality by year of first imprisonment produced findings similar to those presented here (data available from authors).

As with all mortality studies, these results rely on the quality of death certification. However the large mortality excesses we observed seem unlikely to be explained by death certification inaccuracies. The lack of modifiable risk factor information is an additional weakness of this and most previous similar studies, and an important point to address in future research.

Our findings are consistent with previous studies of prisoner mortality, which have reported SMRs ranging from 1.0 to 9.4 in men and 2.6 to 41.3 in women.[9] Others have also noted increased mortality for mental and behavioural disorders, particularly alcohol and drug related deaths, suicide and homicide.[2–4,9,10,12] In keeping with our findings, other studies have also reported increases in cardiovascular[5,11,13] and respiratory[2,9,11] mortality and lung cancer.[11] Our results are also consistent with many studies that have found higher mortality immediately following release.[1,3,9–11,13,21]

Other studies have reported either lower mortality in prison than in the general population[6,7] or a lower mortality excess while in prison than out, for all cause mortality,[5] natural causes[1,2,5] or specifically for homicide and suicide.[8] Although a 20-year study of the mortality of those in prison in England and Wales found a lower risk of mortality from deaths from natural causes, (SMR 0.7) overall mortality was higher than the general population (SMR 2.93).[2] A data linkage study of prisoners in Australia found a higher mortality risk in prison than in the general population,[3] while mortality among prisoners in Tennessee in the early 1970s was 20 times

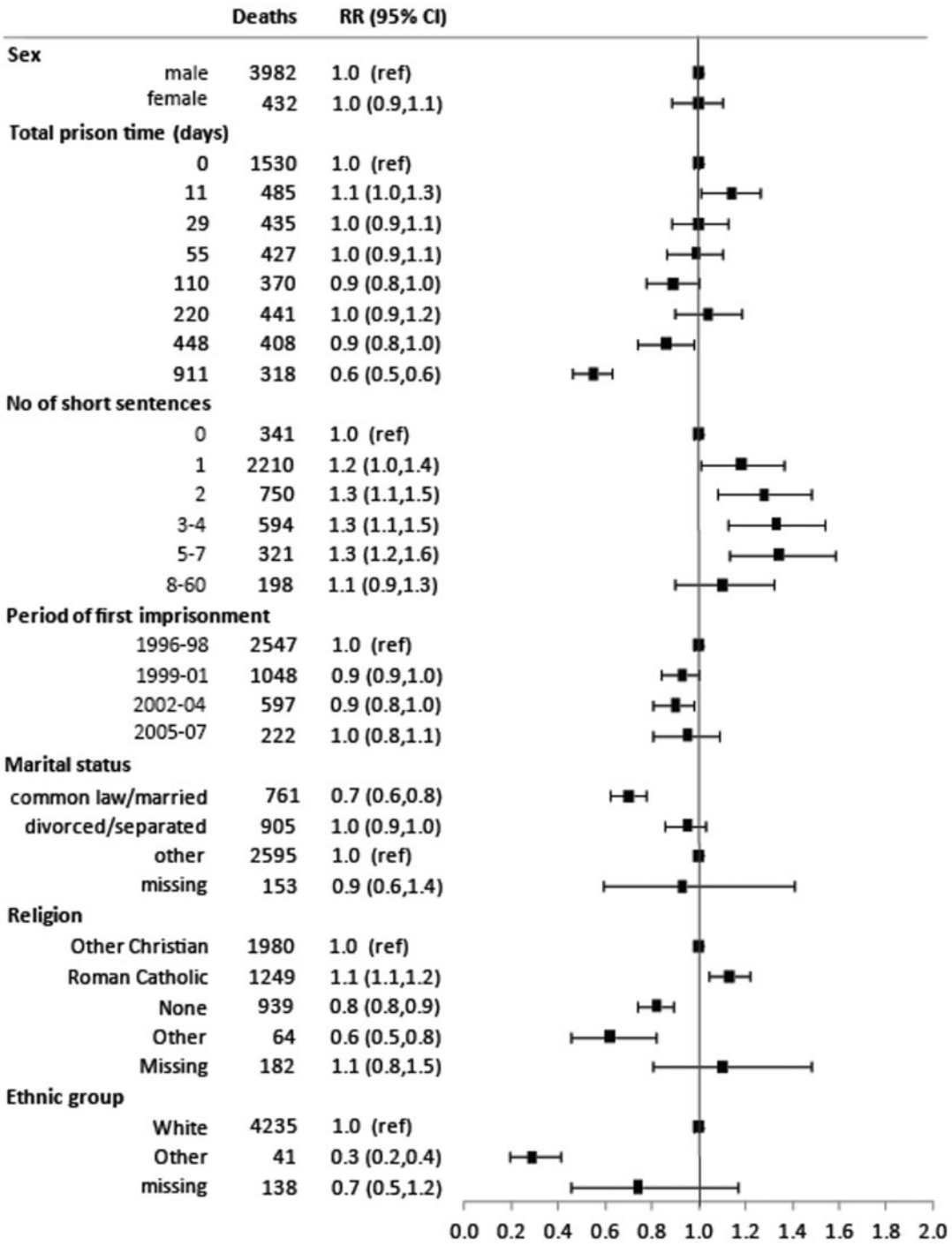

Figure 1 Deaths and mutually adjusted mortality rate ratios (and 95% **CIs**) by selected characteristics among adults imprisoned in Scotland for the first time between 1996 and 2007

higher than among the general population.[22] In keeping with our findings, Binswanger reported that increasing years of incarceration was associated with lower risk of mortality[23] though Kariminia reported increased mortality with increasing duration of incarceration.[16]

After controlling for length of time in prison, we found higher mortality in those with multiple short prison episodes. Kariminia[16] reported stronger associations with number of imprisonments; being imprisoned four or more times more than doubled the risk of all-cause mortality; others have reported similar findings.[24]

The high mortality from drugs, alcohol and suicide is likely to relate to the known levels of substance misuse[25] and mental health problems in the Scottish prison population.[26] However, elevated risks of mortality are observed across nearly all causes of death, suggesting risk factors are not confined to a narrow range.

The security arrangements, daily routine and limited availability of drugs and alcohol together with relative protection from accidental death or homicide whilst in prison may contribute to the reduced in-prison mortality. The successful introduction of suicide prevention strategies and enhanced drug services in the Scottish Prison Service in the early 2000's are also likely to have had a positive effect.[27] Another relevant factor may be the higher consultation rate of prisoners compared with the general population,[28] some of which may be attributed to prison policies

such as routine medical examination on admission. Prisoners who are terminally ill are normally released to die in the community; adjustment for such compassionate release may contribute to lower in-prison mortality.[21]

There was little change in mortality rates over time during a period when drug and alcohol related mortality was increasing in the Scottish population as a whole,[29,30] suggesting that prison health services may have helped mitigate the impact on prisoners.

Others have noted the striking health inequalities associated with the prison population and the opportunities to tackle health inequalities by providing support and supervision in prison and after release.[1] Although numbers are small, the substantially elevated mortality among women and in younger age groups suggests the need for targeted interventions and consideration of community sentences when appropriate.

The very high mortality rates immediately after release may be due to the problems of adjustment to freedom on release or to particularly high levels of risky behaviour. Drug deaths, suicide and homicide all make substantial contributions to post-release mortality. Opiate substitution therapy has been shown to be an effective measure to reduce drug deaths following liberation[31] and the provision of naloxone (an opiate antagonist) to prisoners at release has the potential to make an additional contribution. Sustained suicide prevention strategies are vital, from the point of reception to release and beyond. A range of suicide risk factors have been identified in prisoner populations, in particular a previous psychiatric history; substance misuse, previous suicide attempts and key psychological characteristics.[32,33] Violence reduction measures in prison and more widely in the community are also important. However, elevated risks of mortality are observed across nearly all causes of death, indicating the need for a comprehensive approach to risk factor reduction such as pre-release assessment and planning and facilitating the transition to life outside prison.

Multiple episodes of short-term imprisonments can result in loss of continuity of key relationships, housing and employment opportunities which may be important risk factors for mental and other health problems. The escalating risk of mortality associated with this pattern of imprisonment supports criminal justice approaches that limit repeated short periods of detention, promote alternatives to custody and provide closer supervision and support immediately following release.

Addressing the healthcare needs of prisoners has the potential to reduce re-offending. More generally, these findings support a broader public health approach to prevention, early detection and intervention in offending lifestyles to prevent imprisonment.

The data linkage methods used by this study offer an efficient and low cost method of collecting further information on this population. This could provide information on long term trends in overall and cause-specific mortality which could be used as baseline and follow up indicators for intervention studies. Mortality rates could also act as health care performance outcome indicators for prison based health services.

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Conflicts of interest: Dr Andrew Fraser was Director of Health and Care for the Scottish Prison Service from 2003 to 2012. Dr Lesley Graham was seconded to the Scottish Prison Service from April 2006 to March 2008 as a public health adviser. We have no other conflicts of interest to declare.

Key points

- Using a large linked database with complete national coverage, this study confirms the strikingly high mortality previously observed among people who have been in prison
- Although this group is from a substantially socially disadvantaged background, the mortality excess can only partly be explained by material deprivation
- Multiple short periods in prison are associated with increased mortality risk, which may relate to disruption of key relationships, housing and employment opportunities as well as repeated exposure to the high risk of death in the immediate period following prison release
- In addition to the need for wider use of opiate substitution and naloxone provision these results suggest the need to consider community sentences where appropriate

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Media use, cancer knowledge and lifestyle choices: a cross-sectional analysis

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Background: Both media use and cancer knowledge have been identified as important predictors of a healthy lifestyle. However, little is known about the interplay between these two variables, and about differences between cancer diagnosed and non-diagnosed consumers of media and knowledge. This study investigated the relationship between media use (television and internet exposure) and lifestyle choices of cancer diagnosed and non-diagnosed individuals, and looked at the influence of cancer knowledge on this relationship. **Methods:** A cross-sectional, quantitative survey (the Leuven Cancer Information Survey) was administered to 621 cancer diagnosed and 1387 non-diagnosed individuals, aged 16–88 years old in Flanders (Belgium). Bivariate analyses, hierarchical linear regression analyses and advanced moderation and mediation analyses were conducted. **Results:** Internet exposure was not a predictor of lifestyle choices. Television exposure, however, was a negative predictor of healthy lifestyle choices. Moreover, television exposure was a direct negative predictor of cancer knowledge, which in turn positively predicted lifestyle choices. However, no differences were found in the investigated relationships between the two subsamples. **Conclusion:** These results indicate that higher levels of television exposure coincide with less cancer knowledge and with less healthy lifestyle choices. It offers a pathway for intervention by suggesting that improving cancer knowledge through television might positively affect lifestyle choices.

Introduction

Research suggests that 4 out of 10 cancers could be prevented by healthier lifestyle choices (e.g. fruit and vegetable consumption, increased physical activity) and by early detection.[1,2] Increased physical activity, for instance, has been linked to a decreased breast cancer risk.[2] Several predictors of lifestyle choices have been identified in the literature. This study will examine two communication-related predictors of lifestyle choices: media use and cancer knowledge.

One of the media most commonly associated channels with unhealthy lifestyle choices is television. Exposure to television has been linked to a more sedentary lifestyle,[3,4] snacking,[5] insufficient consumption of fruits and vegetables[4] and earlier smoking onset.[6] In comparison to television, relatively little is known about the relationship between internet use and lifestyle choices, despite the enormous amount of health information available on the internet.[7]

While television exposure is usually identified as a predictor of unhealthy lifestyle choices, knowledge has been identified as a predictor of healthy lifestyle choices.[8] One study reported that a low level of cancer knowledge was one of the most crucial predictors of insufficient cancer screening.[9] A study among Latin-American women found that cancer knowledge was positively associated with perceived self-efficacy for cancer screening.[10] Other research also found a positive relationship between cancer knowledge and screening behaviour.[11]