

Ageing Prisoners' Disease Burden: Is Being Old a Better Predictor than Time Served in Prison?

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Key Words

Ageing · Older prisoners · Disease burden · Health · Prison

Abstract

Background: The number of older prisoners entering and ageing in prison has increased in the last few decades. Ageing prisoners pose unique challenges to the prison administration as they have differentiated social, custodial and healthcare needs than prisoners who are younger and relatively healthier. **Objective:** The goal of this study was to explore and compare the somatic disease burden of old and young prisoners, and to examine whether it can be explained by age group and/or time served in prison. **Methods:** Access to prisoner medical records was granted to extract disease and demographic information of older (>50 years) and younger (≤49 years) prisoners in different Swiss prisons. Predictor variables included the age group and the time spent in prison. The dependent variable was the total number of

somatic diseases as reported in the medical records. Results were analysed using descriptive statistics and a negative binomial model. **Results:** Data of 380 male prisoners from 13 different prisons in Switzerland reveal that the mean ages of older and younger prisoners were 58.78 and 34.26 years, respectively. On average, older prisoners have lived in prison for 5.17 years and younger prisoners for 2.49 years. The average total number of somatic diseases reported by older prisoners was 2.26 times higher than that of prisoners below 50 years of age (95% CI 1.77–2.87, $p < 0.001$). **Conclusion:** This study is the first of its kind to capture national disease data of prisoners with a goal of comparing the disease burden of older and younger prisoners. Study findings indicate that older inmates suffer from more somatic diseases and that the number of diseases increases with age group. Results clearly illustrate the poorer health conditions of those who are older, their higher healthcare burden, and raises questions related to the provision of healthcare for inmates growing old in prison.

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Introduction

The prison population has increased due to more stringent and longer sentences, resulting not only in a greater number of prisoners, but also more prisoners becoming old in prison [1–3]. An increasing and ageing population of prisoners is evident in many countries, and the most prominent changes are seen among the prisons in the USA [2] and the UK [4]. Due to accelerated ageing, older prisoners are defined as those who are aged 50 years and over [5, 6], rather than 65 years and older in the community; because a 50-year-old prisoner tends to represent the health burden of someone who is 10–15 years older in the community [7, 8].

The ageing of the prison population poses unique challenges to the prison administration as older prisoners present varied social, custodial and healthcare needs compared to those who are younger and relatively healthier [1, 6, 9]. Literature on the healthcare of prisoners, and older prisoners in particular, is limited [5], although a gradual increase is evident from studies published in medical [1, 3], gerontology [8–12] and public health journals [13–15]. These and other studies provide new knowledge pertaining to disease burden and the quality of healthcare received by prisoners. For instance, two US national studies concluded that prisoners have a higher disease burden than the general population and that prisons fail to meet prisoners' healthcare needs [15, 16]. A recent study examining whether time served in prison contributes to mortality among parolees highlighted the negative consequences of imprisonment [14]. Study findings showed a positive relationship between time in prison and mortality; however, it also reported that the higher mortality is recoverable once a person is released and continues to live in the community. It should nevertheless be pointed out that literature assessing the effect of imprisonment on health and mortality remains scarce, and the findings are inconclusive because studies have shown both negative and positive effects of imprisonment [17–19].

Several studies report on older prisoners' health burden associated with incarceration. Colsher et al. [20] interviewed 119 older prisoners (>50 years), capturing their health and functional status. They noted that older prisoners suffer from arthritis, hypertension, ulcers, prostate problems and myocardial infarction. Study results also revealed that those who are older (>60 years) are more likely to report these conditions than those younger (50–59 years). Another study of 203 older prisoners (>60 years) from the UK concluded, similar to the US national

studies above, that the health of older prisoners is worse than younger prisoners and older adults in the community [8]. Older prisoners reported suffering from psychiatric, cardiovascular, musculoskeletal and respiratory diseases [8, 21]. Similar to the UK study comparing the health of older and younger prisoners, a literature review on prisoner health drew the same conclusion that older prisoners have poorer health outcomes than younger prisoners [1]. Another literature review also found that older prisoners tend to report a greater decline in health subsequent to imprisonment [5].

Further studies have also examined the disease burden of prisoners comparing the results among prisoners of different age groups [22–26], concluding that multiple morbidity is high among prisoners, with mental illnesses, infectious diseases and drug abuse as common health problems [15, 27, 28]. Aday [29] and Deaton et al. [30] pointed out that older prisoners report suffering from 3–4 chronic conditions. Baillargeon et al. [24] explored the prevalence of major diseases using a cohort of 170,215 prisoners between 1997 and 1998. The diseases most often reported according to International Classification of Diseases (ICD-10) were infective and parasitic diseases, followed by disease of the musculoskeletal system and connective tissue, and disease of the circulatory system. Among male prisoners, increased prevalence by age was reported for hypertension, low back pain, diabetes, arthritis, hernia and heart disease. Specifically, hypertension and diabetes were more frequently present among those who were aged >50 years than those who were younger. A similar investigation was done a decade later with a cohort of 234,031 prisoners from 2006–2007, with an emphasis on specific chronic medical conditions [25]. These authors also found hypertension, diabetes, ischemic heart disease and chronic obstructive pulmonary disease to be common, with prevalence increasing with age.

In the context of Switzerland, a few studies exist on the health problems of prisoners [31–33]; however, the emphasis was not specific to older prisoners and they did not capture national data. Therefore, a national project entitled 'Agequake in Prisons' was designed to understand the overall health and healthcare circumstances of ageing prisoners in Switzerland. In order to be able to compare the health of old and young prisoners, information was gathered for both on different health variables, such as disease burden, medications, visits to GPs and nurses, and general healthcare access. In this manuscript, we explore the somatic disease burden of old and young prisoners and examine whether this disease burden can be explained by age and/or time served in prison.

Methods

To capture the disease burden of prisoners, the study recorded the reported diseases from the medical records of 406 prisoners. These records belonged to 203 older prisoners (>50 years) and 203 younger prisoners (≤ 49 years). Older prisoners were defined as those 50 years and older in accordance with available literature [5, 7, 8]. Research ethics commission (REC) approval was sought and obtained from 10 regional RECs in Switzerland, where the relevant prisons are located. Permission to extract data from prisoners' medical records was also obtained from the federal commission for medical confidentiality.

Selection of Prisons

There are 109 prisons in Switzerland with capacity for 6,978 inmates. Of these prisons, 26 provide space for a total of 2,879 inmates (41.3%) and fulfilled our inclusion criteria of: (i) long-term imprisonments, i.e. prisons incarcerating those who have a sentence of 1.5 years or more, (ii) more than 20 places and (iii) housing older prisoners at the time of request. Excluded prisons were those which housed juvenile prisoners, were semi-detention or remand prisons or deportation centres, had a capacity for 20 individuals or less, and did not have any older prisoners. A total of 11 prisons refused participation due to a lack of time and resources. Ultimately, 15 out of 26 prisons, holding 2,198 prisoners (76.35% of the eligible population) in 11 different cantons representing two linguistic regions of the country (German speaking and French speaking), agreed to participate.

Data Collection

Data collection took place on a rolling basis starting from November 2011 and ending in April 2014. Before embarking on data collection, we requested prison health service staff to advertise the study and collection of information from medical records to prisoners. Most prisons informed prisoners about their rights to opt out of data collection using flyers with a description of the study and information about how to opt out. These flyers were made available in different languages: German, English, French, Spanish and Italian. In a few prisons, the opt out option was communicated to the prisoners either by a nurse, the prison administration or one of the researchers. A medical record was made available by the prison health service if no opt out request was made. During the study period, we received a total of 14 opt out requests.

Medical records of all prisoners aged over 50 years were obtained from the participating prisons, except for 1 prison. This exception was made because the prison housed many older prisoners but could only provide the researchers with limited space and time availability in which to gather data. For this prison, a decision was made to randomly select approximately half of the older prisoners' medical records. From all prisons, an equal volume of data belonging to younger prisoners was randomly collected. The data gathered relevant for this paper included demographic and all somatic disease information recorded in the medical records. Thus, psychiatric diseases falling into the ICD-10 category of 'mental and behavioral health' are excluded from the analysis and will be presented in another paper. If noted in the medical records, information on smoking, alcohol and drug use was also obtained.

Data from the medical records were extracted by 2 research assistants using a data extraction document developed by the research team. Recorded data on these documents were then entered into an EpiData file. Disease information was coded using ICD-10, which allows classification of diseases into 22 different diagnosis categories and is a standard tool used in epidemiological, clinical and health settings [34]. Data entry was supported by several assistants and independent assistants checked the entered data for errors.

Data Analysis

To explain disease burden in prisoners, two predictor variables were established: an age group factor distinguishing between older and younger prisoners, and time spent in prison, defined as the time in years between a prisoner's date of entry into prison and the date of data collection. Demographic variables were also recorded. The dependent variable of total number of diseases was defined as the total number of somatic diseases reported in the prisoner's medical record.

Descriptive statistics were used to situate the demography of the sample studied, the disease prevalence and the disease burden by ICD-10 categories. To understand the impact of age group and time spent in prison on disease burden, we used a negative binomial model which is typically used for count data exhibiting over dispersion (the observed variance is larger than the observed mean) [35]. Coefficients were reported as the incidence rate ratio (IRR), i.e. a one-unit increase in the predictor value leads to an increase/decrease of the outcome by a factor of e^b , whereby b is the estimated parameter [36]. The model contained age group and years in prison (linear and quadratic polynomial) as predictors of interest, correcting for the following covariates: prison and marital status. The same model was also analysed without covariates but the results were comparable to the adjusted model and are hence not reported here. All analyses were performed using IBM SPSS 21.0.

Results

Participant Characteristics

Of the 406 collected medical records, 26 were female prisoners (13 older and 13 younger) belonging to 2 prisons. Their data were excluded due to small numbers. The remaining data of 380 male prisoners from 13 different prisons are presented here. By linguistic regions, 266 (70%) prisoners were from German-speaking cantons and 114 (30%) from French-speaking cantons. The lower number of prisoners from the latter region is because of the smaller size of the French-speaking region. From both age groups, two thirds characterised themselves as a current smoker, with the mean number of cigarettes smoked per day being 20.42 (SD 12.54). A similar percentage acknowledged consuming alcohol in the past, with the amount ranging from very little to a lot. Less than half (43.6%) reported having used drugs (from them, 69.8% were younger prisoners). The drugs consumed included one or a combination of the

Table 1. Sample descriptives by age group of prisoners

Demographic and disease information	Younger prisoners (≤49 years)	Older prisoners (>50 years)	All prisoners
Age (n = 380), years	34.26±7.38	58.78±5.82	46.52±13.96
Imprisonment (n = 340), years	2.49±2.48	5.17±6.31	3.84±4.98
Marital status (n = 358)			
Single	70.1	29.9	43.9
Married/divorced/widowed/other	33.8	66.2	56.1
Religion (n = 294)			
Christian	39.7	60.3	51.4
Non-Christian	60.8	39.2	48.6
Nationality (n = 359)			
Swiss	31.5	68.5	49.6
Other	70.7	29.3	50.4
Total different diseases ^a	1.62±1.83	4.27±3.78	2.94±3.25

Values are mean ± SD or percentages. The total study population was 380, divided equally between the two age groups. Values of n differ since they do not include missing data.

^aTotal number of different diseases includes all diseases reported in the medical records, except for psychiatric conditions.

Table 2. Characteristics of prisoners by prison

Prison No.	Linguistic region	Prisoners, n	Age, years	Imprisonment, years	Total diseases reported, n
1	German	24	47.54±12.78	6.85±5.92	2.96±2.27
2	German	26	46.23±13.22	2.00±1.67	1.92±1.65
3	German	30	45.00±15.11	2.94±2.63	3.17±3.22
4	German	42	46.55±13.94	2.67±3.65	3.60±4.21
5	German	14	45.79±18.40	1.48±2.38	5.21±5.15
6	French	80	47.32±13.30	4.13±4.55	3.30±3.15
7	French	20	43.20±12.85	1.36±0.93	2.05±2.11
8	German	34	45.18±13.75	1.22±0.94	2.09±2.78
9	German	14	47.00±15.83	1.51±0.90	2.36±2.90
10	German	4	51.50±8.35	2.95±-	5.25±5.56
11	German	72	47.44±13.80	6.15±7.19	2.90±3.22
12	French	14	46.36±17.95	2.57±5.09	1.00±1.47
13	German	6	45.67±17.97	7.01±4.25	4.33±4.18

Values are number or mean ± SD

following: cannabis, cocaine, opiates and benzodiazepines. The age range of the entire sample was between 20 and 75 years, and the mean ages of older and younger prisoners were 58.78 and 34.26 years, respectively (table 1). On average, older prisoners had lived in prisons more than twice as long as those who belonged to the younger group. The prisoner demographic information is presented in table 1 and the characteristics by prison in table 2.

Disease Distribution

Excluding psychiatric diseases, older prisoners reported on average 4.27 diseases with a range of 0–19, and younger prisoners reported 1.62 diseases with a range of 0–9 (table 1). The total number of diseases by prison is provided in table 2. Of the total sample of prisoners, 24.2% (n = 92) did not report any somatic diseases. Forty-six percent (n = 175) had 1–3 diseases, and

Table 3. ICD-10 diagnosis characteristics by younger and older prisoners

Most reported ICD-10 diagnosis ^a	Younger prisoners (n = 308 diseases)	Older prisoners (n = 811 diseases)	All prisoners (n = 1,119 diseases)
Certain infectious and parasitic diseases	30 (9.7)	33 (4.1)	63 (5.6)
Neoplasms	8 (2.5)	16 (1.9)	24 (2.1)
Disease of the blood and blood-forming organs	3 (0.9)	11 (1.3)	14 (1.3)
Endocrine, nutritional and metabolic diseases	20 (6.5)	94 (11.6)	114 (10.2)
Disease of the nervous system	20 (6.5)	38 (4.7)	58 (5.2)
Diseases of the eye and adnexa	17 (5.5)	47 (5.8)	64 (5.7)
Diseases of the ear and mastoid process	2 (0.6)	14 (1.7)	16 (1.4)
Diseases of the circulatory system	17 (5.5)	129 (15.9)	146 (13.0)
Diseases of the respiratory system	28 (9.1)	49 (6.0)	77 (6.9)
Diseases of the digestive system	33 (10.7)	74 (9.1)	107 (9.6)
Diseases of the skin and subcutaneous tissue	23 (7.5)	33 (4.1)	56 (5.0)
Diseases of the musculoskeletal system and connective tissue	55 (17.8)	151 (18.6)	206 (18.4)
Diseases of the genitourinary system	10 (3.2)	32 (3.9)	42 (3.8)
Certain conditions originating in the perinatal period	0 (0)	2 (0.2)	2 (0.2)
Congenital malformations, deformations and chromosomal abnormalities	1 (0.3)	2 (0.2)	3 (0.3)
Symptoms, signs and abnormal clinical and laboratory findings, not elsewhere classified	22 (7.1)	62 (7.6)	84 (7.5)
Injury, poisoning and other consequences of external causes	16 (5.2)	7 (0.9)	23 (2.1)
Factors influencing health status and contact with health services	3 (0.9)	17 (2.1)	20 (1.8)

Data are n with percentage in parentheses. A total of 288 prisoners reported 1,119 medical conditions.

^a From the ICD-10 categories, excluding mental and behavioral health.

29.7% (n = 113) had 4 diseases or more. Of those reporting 4 or more diseases, approximately 4/5 were older prisoners, and only 22.1% were younger prisoners. From the different ICD-10 categories, among older prisoners, the following were the five most prevalent: (i) diseases of the musculoskeletal system and connective tissue; (ii) diseases of the circulatory system; (iii) endocrine, nutritional and metabolic diseases; (iv) diseases of the digestive system, and (v) symptoms, signs and abnormal clinical and laboratory findings (table 3). Similar to older prisoners, younger prisoners mostly suffered from: (i) diseases of the musculoskeletal system and connective tissue; however, the other ICD-10 categories differed: (ii) diseases of the digestive system; (iii) certain infectious and parasitic diseases; (iv) diseases of the respiratory system, and (v) diseases of the skin and subcutaneous tissue. Specific disease conditions reported by older prisoners included hypertension, back pain, diabetes, obesity, and disorders of lipoprotein metabolism and other lipidemias. Younger prisoners reported suffering from back pain, acne, migraine, allergy and asthma.

Disease Prevalence and Its Relation to Age Group and Time Spent in Prison

The estimated average total number of somatic diseases reported by older prisoners was 2.26 times higher than that of prisoners below 50 years of age (IRR 2.26, 95% CI 1.77–2.87, $p < 0.001$). There was a curvilinear relationship between years spent in prison and the average total number of diseases reported. Thus, the number of diseases increased more strongly during the first years in prison compared to subsequent ones. The corresponding IRR values were 1.05 (95% CI 1.01–1.08, $p = 0.010$) and 0.998 (95% CI 0.996–0.999, $p = 0.005$) for the linear and quadratic trend, respectively. Note that the linear trend was tested as the average number of years in prison, which was 3.84 years. The parameter values were all conditional on the covariates included and also on the respective other predictor. Table 4 depicts the descriptive mean values of the total number of diseases reported by age group and for four classes of years spent in prison. This table shows that the total number of diseases reported was higher in the older age group irrespective of the class of years spent in prison. Hence, the

Table 4. Number of diseases by age group and time spent in prison

Imprisonment, years	Younger prisoners			Valid, n	Older prisoners			Valid, n	Total			Valid, n
	total diseases, n	age, years	imprisonment, years		total diseases, n	age, years	imprisonment, years		total diseases, n	age, years	imprisonment, years	
0–2	1.60	33.46	0.98	96	3.79	58.81	0.91	67	2.50	43.88	0.95	163
2–4	1.80	34.12	2.79	41	3.82	59.50	2.69	40	2.80	46.65	2.74	81
4–8	1.17	36.04	5.46	24	4.94	58.58	6.06	31	3.29	48.75	5.80	55
>8	3.75 ^a	39.50	10.21	8	5.06	59.39	15.97	33	4.80	55.51	14.85	41
Total	1.69	34.27	2.49	169	4.25	59.04	5.17	171	2.98	46.73	3.84	340

All prisoner data are mean values.

^a The greater number of diseases here could be due to the small number of younger prisoners who fitted this category.

age group effect was not due to older prisoners having spent more time in prison. It also highlights that within the older age group the total number of diseases more strongly increased during the first years in prison but less so later on, whereas in the younger age group there was no apparent trend.

Discussion

Studies examining the disease burden of prisoners mostly hail from the USA. It should thus be noted that the results presented here may not be directly comparable with US or other European studies due to the different healthcare and penal systems. However, it is important to ground the current findings in light of those which are already available. Our study sample, like other studies [24, 25], constituted mostly male prisoners. Additionally, our older sample, similar to other studies [8, 20, 24, 25], reported diseases of the musculoskeletal system and connective tissue, the circulatory system and endocrine, nutritional and metabolic diseases. When comparing different disease distributions by age group, infectious and parasitic diseases (e.g. sexually transmitted diseases, TB or hepatitis/HIV) were 2.5 times more common among the younger compared to older prisoners. Infectious diseases were found to be the most prevalent disease in the Texas study [24, 26]. An in-depth analysis of particular chronic diseases, such as hypertension, heart disease, diabetes, arthritis and chronic pain, that occur more frequently among older prisoners [1, 8, 20, 25] were not considered in the analysis of this Swiss study, but will be a goal for future analyses from the dataset.

On average older prisoners reported 4.27 somatic diseases, indicating a high disease burden relative to the younger prisoners reporting only 1.62 somatic diseases. The disease burden of older prisoners is comparable to what is known from available studies [29, 30]. Since the older group has on average lived in prison for double the amount of time, one might be quick to assume that the higher disease burden is due to the time effect. This, however, was not the case for our sample. Results indicate that the age group had a significant effect on the total number of diseases even when controlling for time spent in prison. This finding is different from studies which have indicated a link between the deteriorating health of older prisoners and their incarceration [5, 20]. This varying result could be explained by different data sources (i.e. use of self-reported health perception) and comparison groups included. Moreover, an important factor could also be the healthcare system of a nation, which certainly needs further examination. Similar to the UK study [8], our study also indicates that the health of older prisoners is poorer than that of younger prisoners. However, we cannot state whether the health of older prisoners or all prisoners is worse than that of the general population [8, 15, 16] since this comparison was not examined and this would be an area of interest for future manuscripts.

The fact that older prisoners suffer from more somatic diseases and that the number of diseases increases with age group is significant and raises questions about prison conditions and the adequacy of the prison healthcare system. The outcomes of this study identify the poorer health conditions of older prisoners, their higher healthcare burden, and raises questions related to the provision of healthcare for aging prisoners. Although this issue has

been raised by several authors [1, 10, 13], our empirical data contributes new information supporting this concern. With an increasing number of sentences resulting in imprisonment, and for longer periods of time, it is expected that the prison system will house more ageing prisoners. Conditions in prison need to ensure that proper, timely and necessary healthcare is delivered to prisoners in order to enable them to maintain good health, remain independent for as long as possible and experience health equal with those in the community. There is a significant cost implication too – maintaining good health and preventing disease is cheaper than responding to deteriorations in health, both for the prison system and society at large.

As with all studies, there could be errors associated with data entry and coding in our analysis. We sought to reduce these errors through independent data checking. The medical details of 11 prisons fulfilling the inclusion criteria remain unknown, but they composed only 23.65% of the eligible sample. Certain types of prison, such as remand prisons and short-term prisons, were excluded. However, this was done purposely since the study aimed at understanding the overall consequences

of ageing in prison, which could only be implemented if the individuals surveyed spend a considerable amount of time there. Finally, in this paper we focused on somatic diseases only. Thus, diseases included in the ICD-10 category of ‘mental and behavioural health’ were excluded from our analysis. We know that 28.4% of the sample was serving indeterminate security measures as their prison sentence, implying mandatory psychiatric treatment and/or evaluation. Despite these limitations, this study is the first of its kind to capture the somatic disease data of prisoners at the national level with a goal of comparing the health of older and younger prisoners.

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References

- 1 Fazel S, Baillargeon J: The health of prisoners. *Lancet* 2011;377:956–965.
- 2 Human Rights Watch: Old Behind Bars: The Aging Prison Population in the United States. New York, HRW, 2012.
- 3 Ginn S: Elderly prisoners. *BMJ* 2012;345:e6263.
- 4 Ministry of Justice: Statistical Bulletin: Offender Management Caseload Statistics 2009. London, Ministry of Justice, 2010.
- 5 Loeb SJ, Abudagga A: Health-related research on older inmates: an integrative review. *Res Nurs Health* 2006;29:556–565.
- 6 Hayes AJ, Burns A, Turnbull P, Shaw JJ: The health and social needs of older male prisoners. *Int J Geriatr Psychiatry* 2012;27:1155–1162.
- 7 Loeb SJ, Steffensmeier D, Lawrence F: Comparing incarcerated and community-dwelling older men's health. *West J Nurs Res* 2008;30:234–249.
- 8 Fazel S, Hope T, O'Donnell I, Piper M, Jacoby R: Health of elderly male prisoners: worse than the general population, worse than younger prisoners. *Age Ageing* 2001;30:403–407.
- 9 Hayes AJ, Burns A, Turnbull P, Shaw JJ: Social and custodial needs of older adults in prison. *Age Ageing* 2013;42:589–593.
- 10 Maschi T, Viola D, Sun F: The high cost of the international aging prisoner crisis: well-being as the common denominator for action. *Gerontologist* 2013;53:543–554.
- 11 Fazel S, Hope T, O'Donnell I, Jacoby R: Unmet treatment needs of older prisoners: a primary care survey. *Age Ageing* 2004;33:396–398.
- 12 Bretschneider W, Elger B, Wangmo T: Ageing prisoners' health care: analysing the legal settings in Europe and the United States. *Gerontology* 2013;59:267–275.
- 13 Williams BA, Stern MF, Mellow J, Safer M, Greifinger RB: Aging in correctional custody: setting a policy agenda for older prisoner health care. *Am J Public Health* 2012;102:1475–1481.
- 14 Patterson EJ: The dose-response of time served in prison on mortality: New York State, 1989–2003. *Am J Public Health* 2013;103:523–528.
- 15 Wilper AP, Woolhandler S, Boyd JW, Lasser KE, McCormick D, Bor DH, Himmelstein DU: The health and health care of US prisoners: results of a nationwide survey. *Am J Public Health* 2009;99:666–672.
- 16 Binswanger IA, Krueger PM, Steiner JF: Prevalence of chronic medical conditions among jail and prison inmates in the USA compared with the general population. *J Epidemiol Community Health* 2009;63:912–919.
- 17 Krinsky CS, Lathrop SL, Brown P, Nolte KB: Drugs, detention, and death: a study of the mortality of recently released prisoners. *Am J Forensic Med Pathol* 2009;30:6–9.
- 18 Pratt D, Appleby L, Piper M, Webb R, Shaw J: Suicide in recently released prisoners: a case-control study. *Psychol Med* 2010;40:827–835.
- 19 Kjelsberg E, Laake P: Is the high mortality risk in sentenced offenders independent of previous imprisonment? *Eur J Epidemiol* 2010;25:237–243.
- 20 Colsher PL, Wallace RB, Loeffelholz PL, Sales M: Health status of older male prisoners: a comprehensive survey. *Am J Public Health* 1992;82:881–884.
- 21 Fazel S, Hope T, O'Donnell I, Jacoby R: Hidden psychiatric morbidity in elderly prisoners. *Br J Psychiatry* 2001;179:535–539.
- 22 Baillargeon J, Penn JV, Thomas CR, Temple JR, Baillargeon G, Murray OJ: Psychiatric disorders and suicide in the nation's largest state prison system. *J Am Acad Psychiatry Law* 2009;37:188–193.
- 23 Harzke AJ, Baillargeon JG, Goodman KJ, Pruitt SL: Liver cancer mortality among male prison inmates in Texas, 1992–2003. *Prev Med* 2009;48:588–592.
- 24 Baillargeon J, Black SA, Pulvino J, Dunn K: The disease profile of Texas prison inmates. *Ann Epidemiol* 2000;10:74–80.
- 25 Harzke AJ, Baillargeon JG, Pruitt SL, Pulvino JS, Paar DP, Kelley MF: Prevalence of chronic medical conditions among inmates in the Texas prison system. *J Urban Health* 2010;87:486–503.

- 26 Baillargeon J, Black SA, Leach CT, Jenson H, Pulvino J, Bradshaw P, Murray O: The infectious disease profile of Texas prison inmates. *Prev Med* 2004;38:607–612.
- 27 Wolff H, Sebo P, Haller DM, Eytan A, Niveau G, Bertrand D, Gétaz L, Cerutti B: Health problems among detainees in Switzerland: a study using the ICPC-2 classification. *BMC Public Health* 2011;11:245.
- 28 Rosen DL, Wohl DA, Schoenbach VJ: All-cause and cause-specific mortality among black and white North Carolina state prisoners, 1995–2005. *Annals Epidemiol* 2011;21:719–726.
- 29 Aday RH: Aging prisoners' concerns toward dying in prison. *OMEGA* 2005–2006;52:199–216.
- 30 Deaton D, Aday RH, Wahidin A: The effect of health and penal harm on aging female prisoners' views of dying in prison. *Omega* 2009–2010;60:51–70.
- 31 Eytan A, Haller DM, Wolff H, Cerutti B, Sebo P, Bertrand D, Niveau G: Psychiatric symptoms, psychological distress and somatic comorbidity among remand prisoners in Switzerland. *Int J Law Psychiatry* 2011;34:13–19.
- 32 Elger BS, Bindschedler M, Goehring C, Revaz SA: Evaluation of drug prescription at the Geneva prison's outpatient service in comparison to an urban outpatient medical service. *Pharmacoepidemiol Drug Saf* 2004;13:633–644.
- 33 Elger BS: Prison life: television, sports, work, stress and insomnia in a remand prison. *Int J Law Psychiatry* 2009;32:74–83.
- 34 WHO: International classification of diseases (ICD). 2013. <http://www.who.int/classifications/icd/en/>.
- 35 Agresti A: *Categorical Data Analysis*, ed 2. Hoboken, John Wiley & Sons, 2002.
- 36 Hilbe JM: *Negative Binomial Regression*, ed 2. Cambridge, Cambridge University Press, 2011.