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Research paper

Mental and physical health problems before and after detention: A matched cohort study

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ABSTRACT

Background: Individuals with poor health are largely overrepresented in prison populations. However, it remains unclear whether their poor health status already exists prior to their detention or reflects an effect of detention. We examined the health of detainees in the year before and after their detention and compared this with the health of matched non-detainees.

Methods: In this matched cohort study, we linked national data on all persons detained in the Netherlands in 2014/2015 to electronic health records (EHR's) of a representative sample of general practitioners in the Netherlands. Participants include 952 detained persons and 4760 matched non-detained persons (matched on age, sex and general practice). Prevalence rates of health problems in the year before and after detention and odds ratios with 95% confidence intervals were calculated. Rates for a variety of physical and mental health problems are presented.

Findings: Detainees and matched controls differed statistically significant in their pre-detention health status. Compared with controls, male detainees were more likely to report psychological (odds ratio [OR] 3·64 [95% CI 3·11−4·26]), social (1·96 [1·46−2·64]), neurological (1·34 [1·02−1·76]), digestive (1·23 [1·02−1·49]), genital system-related (1·36 [1·07−1·72]), and unspecified health problems (1·32 [1·10−1·59]) in the year before their detention. For example, 43·7% of detainees and 17·6% of controls reported psychological problems in this pre-detention year. To some extent these pre-detention health differences were related to socioeconomic differences. Nevertheless, after taking these characteristics into account, a number of pre-detention health differences between detainees and controls remained statistically significant. No statistically significant changes in prevalence rates from pre- to post-detention and no differences in the levels of change across detainees and controls were observed. For female detainees a similar pattern was found.

Interpretation: People who experience detention have high and complex health needs both pre- and post-detention. While this study did not show a health deteriorating effect of detention, it also did not show a health improving effect. This latter finding may indicate a missed opportunity for health care services to address detainees' health, especially since persons entering detention have elevated health problems. Knowledge on detainees' specific health problems may help health care providers in prisons and in the community to adequately address the health care needs of this vulnerable group.

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1. Introduction

Currently, more than ten million people are being held in penal institutions throughout the world [1]. The vast majority of them will be released at some point and a substantial part of them cycle in and out of prison repeatedly. This makes prisoners'

health and health care an important part of public health [2]. It is well-documented that individuals with poor health are largely overrepresented in prison populations [3−8]. Systematic reviews showed that compared with the general population, (former) prisoners are more likely to have a variety of both physical and mental health problems [5−8]. Moreover, several studies show that different types of health problems co-occur in (former) prison populations [9−11].

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However, it remains unclear whether the poor health status of (former) prisoners already exists prior to their detention or reflects an effect of detention. This lack of empirical research is unfortunate because different expectations exist regarding the effects of detention. For instance, the deprivations associated with prison life, exposure to stressful situations in prison, the communal life, and the stigma associated with imprisonment have been linked to health problems [12,13]. On the other hand, it has been argued that prisons may have health promoting effects, particularly for those with pre-existing health needs and social or economic hardships, and those out of reach of health care prior to their detention [14,15]. Correctional institutions may improve the health of these persons by offering more daily structure, regular and nutritious meals, fewer opportunities to use alcohol and drugs, and access to health care. While most research on health in prison is cross-sectional in nature, some longitudinal studies focusing on mental health showed mental health improvements during imprisonment [16]. At present, however, it remains unclear to what extent such health improvements will persist after release.

The gap in knowledge on the health effects of detention is related to methodological limitations of existing studies, including the absence of detailed information on health problems prior to the detention, a lack of longitudinal studies following prisoners and assessing their health before and after detention and including identical health measures for an adequate control group as well. Furthermore, relatively few studies examined the health of female prisoners. To the best of our knowledge, only a dozen studies had a research design that countered these limitations [13,17–27]. These studies, however, were all done in the United States or Australia, and only one used administrative health data instead of survey data, the latter being hampered by recall and social desirability biases.

The current study improves our understanding of the health effects of detention by using a matched cohort study design and detailed longitudinal data from the electronic health records (EHRs) of general practitioners (GPs) in the Netherlands, which were linked to the national prison registry. The aims of the study are to examine for both male and female detainees: (a) the extent to which detainees' health prior to their detention differs from that of non-detainees, and (b) the extent to which there are (differences in) changes in health problems over time for detainees and non-detainees.

2. Methods

2.1. Data sources and study participants

We conducted a matched cohort study, in which data from three sources were linked.

First, the System of Social Statistical Datasets (SSD) from Statistics Netherlands was used, which refers to a system of linked administrative data covering a wide range of demographic, household, and socio-economic characteristics for the entire Dutch population [28]. We used data for the years 2013−2016. Since in the Netherlands, citizens are legally obliged to register at the municipality they live in, the SSD includes (almost) the entire population.

Second, the NIVEL Primary Care Database (NIVEL-PCD) includes data from the EHRs of a representative national sample (about 7%) of all general practices in the Netherlands. The EHRs include routinely recorded data on consultations, morbidity, diagnostic tests, prescriptions, and referrals of all patients listed in the participating practices [29−31]. In the Netherlands, almost all Dutch citizens are registered with a specific general practice of their choice. GPs act as gatekeepers for specialized, secondary care and, therefore, are usually the first health care provider patients turn to. Moreover, general practice consultations are included in the national health insurance scheme, and are free of charge and available to everyone. Consequently, morbidity presented in general practice is generally a good indicator of morbidity in the population [29−31]. To ensure completeness and good quality of data, and following the practice of prior studies using the NIVEL-PCD, only data from practices meeting pre-set quality criteria were used, i.e. only GPs/practices were selected that (a) recorded data for more than 46 weeks a year, (b) coded more than 75% of the presented health problems with a code from the International Classification for Primary Care (ICPC), (c) coded more than 85% of the prescriptions with an ATC classification code, and (d) had at least 500 patients on their list [29-31]. For this study, we used data from patients aged 16 years or older for whom data were available in the period 2013−2016 and who could be linked to the SSD (in the Netherlands, in rare cases adolescents aged 16 and 17 can be tried according to adult criminal law and placed in an adult correctional facility).

Third, information from the Dutch National Prison Database was also available at Statistics Netherlands, and included administrative data on all detention spells of all individuals detained in an adult penitentiary institution in the Netherlands (both pre-trial detention centres and prisons). For this study, we selected people detained up to two years in 2014−2015 who could be linked to the SSD. This enabled us to examine health problems in a one-year period before and after detention. Note that in the Netherlands, time spent in detention is relatively short; in 2014, 97% of all adults leaving correctional facilities had been detained for two years or less [32].

These three databases were linked, analysed, and stored in the highly secured remote access environment of Statistics Netherlands. The legal basis of Statistics Netherlands is the Statistic Netherlands Act, which authorizes Statistics Netherlands to use administrative data from government institutions for providing statistical information. Guaranteeing data security, privacy protection, and compliance with other data protection laws and regulations (e.g. General Data Protection Regulation) are important parts of this act. Under strict conditions, Statistics Netherlands can make anonymised data available to other institutions for scientific research purposes. For this study, Statistics Netherlands made all data unidentifiable by creating pseudonym codes; the researchers only had access to anonymised data. One-on-one linkage of health data, prison data, and socioeconomic data was performed using these pseudonyms.

In the National Prison Database, 48,287 persons were identified as having (at least) one detention spell in the years 2014−2015. After linkage, 2959 of these 48,287 detainees (6·1%) could be identified as patients in NIVEL-PCD (2013−2016) (see Fig. 1). Preferably, all these

2959 detainees could be used as the 'treatment group' in the analyses. However, some general practices did not provide data to NIVEL-PCD for the year before or after detention. In addition, data on some patients were missing in either the year before or after detention (e.g. because they moved and went to another GP who did not participate in NIVEL-PCD). Eventually, in NIVEL-PCD 966 detainees could be identified with complete pre- and post-detention data (33%). These detainees were registered as patients in 218 general practices.

To compare detainees' health with that of the general population, we constructed a matched control group of patients who were registered in NIVEL-PCD and who were not detained in 2014/2015. We considered it crucial that detainees and controls came from the same general practices because general practices may differ from each other with respect to treatment routines, medical practice, and organisational factors. Such differences may directly influence the registration of health problems presented at the general practice (i.e. the outcome measure in the present study). As the present study included persons from 218 general practices, we chose for a direct matching approach because including a variable for each general practice in regression or propensity score models would be problematic. Furthermore, since it is well-known that both ageing and sex differences are strongly related to health outcomes, we considered these two variable as crucial as well. Therefore, we matched five controls to each detainee and matched the controls on (a) being a patient in the same general practice, (b) age (plus and minus one year), and (c) sex. In this way, we adequately take into account differences between GP's and typical age and sex differences in health problems.

For 14 detained persons we were unable to identify five appropriate controls. Therefore, the final analytical sample of detainees consists of 952 detainees (846 men and 106 women), and the matched control group of 4760 persons (4230 men and 530 women).

The research proposal was reviewed positively by the Ethical Committee for Legal and Criminological Research of the VU University in Amsterdam (letter dated 26.03.2018), and the study design was approved by the Steering Committee of the NIVEL-PCD (NZR-003.18.017).

2.2. Outcomes: health problems

Information on health problems came from NIVEL-PCD. The GPs recorded information on presented symptoms and diagnoses according to the International Classification for Primary Care (ICPC). The ICPC reflects the frequency and distribution of the broad variety of health problems commonly encountered in primary care and includes around 700 individual codes for diagnoses and symptoms, grouped into 17 ICPC-chapters (see the general health chapters in Tables 2A and 2B) [33]. In addition, we focused on some specific groups of health problems (See also Supplementary Table S1).

The prevalence of health problems was calculated during the one-year period prior to the detention spell and during the one-year period post-detention. Note that for controls, we used the start and end date of the detention of the detainee they were matched to, to calculate identical one-year periods for controls and detainees. The health problems were measured dichotomously; with a score of 1 referring to persons who presented a specific health problem once or multiple times to the GP during that year, and a score of 0 referring to persons who did not present that health problem or did not visit their GP at all during that year. In order to avoid double counting, consultations referring to the same health problem were combined into episodes of disease [31]. Subsequently, prevalence rates were calculated based on these episodes.

2.3. Statistical analyses

Differences in socio-demographic characteristics between detainees and controls were tested with chi-square tests or independent t-

Figure 1. Data Linkage process
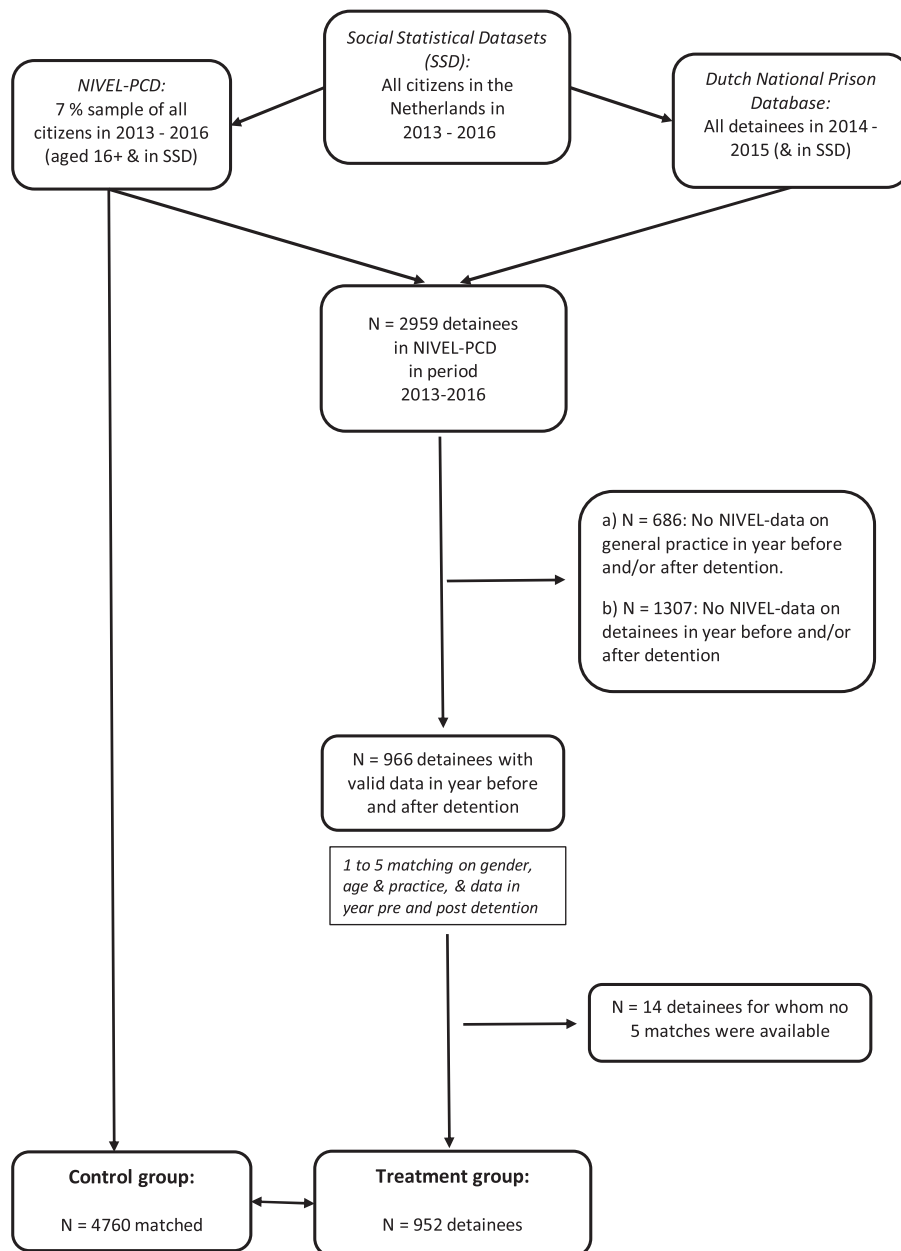
Fig. 1. Data Linkage process.

tests. Subsequently, in a first step, the pre- and post-detention health problems of the detainees and their matched controls were examined. Based on the numbers presented in Tables 2A and 2B, odds-ratios (ORs) with 95% confidence intervals (CI) were calculated to test (a) differences in pre-detention prevalence rates between detainees and controls, and (b) the change in detainees' health problems from pre- to post-detention. To examine whether changes in prevalence rates from pre- to post-detention differed between detainees and controls, the ratios (and 95% confidence intervals) of the ORs comparing the pre- and post-detention rates of detainees and the ORs comparing the pre-and post-detention rates of controls were calculated (again based on the numbers in Tables 2A and 2B). In a next step, in order to gain more insight into pre-existing factors that may underlie pre-detention health differences between detainees and controls, logistic regression analyses were performed, in which we controlled for migration background, socio-economic position, income position, and partner situation. No adjustment was made for multiplicity.

All analyses were done separately for men and women and for each group of health problems. For women ($N_{detainees} = 106$), only a subset of more specific groups of health problems could be examined because Statistics Netherlands requires a cell minimum of 10 to avoid that data could be traced to individuals. Analyses were conducted using SPSS-25.

2.4. Role of funding source

There was no funding source for this study.

3. Results

3.1. Participants

Almost ninety percent of the 952 detainees were men, on average they were 36·5 years old, and about one fifth had a partner (see

Table 1). About half of them were born in the Netherlands and had no migration background, about half received social security benefits, and the majority had a relatively low income. In line with Dutch criminal justice policies and sentencing practices, the length of detention is – especially in an international context – relatively short: Fifty percent of the detainees in this sample were held shorter than two weeks in detention (for comparison: the median length for the entire Dutch adult detainee population in 2014 was 20 days) [32].

Compared with the total sample of 2959 detainees that were identified in the NIVEL-PCD in the period 2013−2016, the 952 detainees were quite similar on most characteristics (see Table 1). It is to be noted, however, that the 952 detainees, i.e. those with longitudinal data from general practice, experienced slightly shorter detention spells. Therefore, detainees with long(er) detention spells are somewhat underrepresented in this study.

The matched controls differed from the detained persons with respect to socioeconomic characteristics: They were more likely to have no migration background (68% versus 51%), to have a partner (50% versus 22%), to have a paid job (66% vs 22%), were less likely to receive welfare benefits (13% versus 55%), and were more likely to have an income in the highest quartile (27% versus 3%).

3.2. Detainees' health problems presented to the GP pre-detention

More than 80 percent of the 846 male detainees consulted their GP in the year prior to their detention for a health issue, while of the 106 female detainees, 95 percent saw their GP (See Table 2A and 2B). In the year prior to detention, male detainees were most likely to present psychological problems (44%), musculoskeletal problems (38%), skin related problems (33%), and respiratory problems (24%). Female detainees were most likely to report psychological problems (59%), musculoskeletal problems (51%), skin problems (43%), and digestive problems (39%). Furthermore, common specific health problems in the year prior to their detention were drug abuse (13% for men), chronic eczema (10% for men), chronic lung problems (9% for men; 14% for women), severe back complaints

(8% for men; 19% for women), and acute urinary tract infection (16% for women).

3.3. Differences in pre-detention health between detainees and matched controls

3.3.1. Males

Male detainees and controls were as likely to contact their GP in the year prior to the detention (82% versus 80%, respectively; see Table 2A and Supplementary Table S2). The prevalence rates for distinct health problems showed some statistically significant differences, however. In Fig. 2A, the ORs (and 95% confidence intervals) for the general health chapters are presented to illustrate differences between detainees and controls regarding their pre-detention health problems. Compared with their matched controls, male detainees were more likely to consult their GP for psychological, social, neurological, digestive, and genital system related health problems in the year before the start of their detention. For instance, compared with controls, male detainees were about 3·5 times as likely to report psychological problems (43·7% vs. 17·6%), and twice as likely to report social problems (7·7% vs. 4·1%) in the year leading up to their detention (See Supplementary Table S2 for all ORs and 95% confidence intervals). Detainees were also more likely to present general or unspecified health problems to their GP than controls did (OR = 1·32; 95% CI 1·10−1·59). Detainees were less likely to report eye-related health problems in the year prior to their detention (OR = 0·73; 95% CI 0·55−0·96).

Compared with their matched controls, detainees also had relatively high prevalence rates of a variety of specific mental health problems in the year prior to their detention (See Fig. 2B and Supplementary Table S2). They consulted their GP more often for alcohol and drug abuse, stress reactions (i.e. acute stress reactions and adjustment disorders), personality disorders, psychotic disorders, sleep problems, and depression. For instance, male detainees were 17 times as likely to report drugs-related problems, more than seven times as likely to report alcohol-related problems, and more than three times as likely to report stress reactions, personality disorders

Table 1
Descriptive characteristics of detainees and controls.

		All detainees in NIVEL-data (N = 2959)		Detainees in analyses (N = 952)		Controls in analyses (N = 4760)	
		N	%	N	%	N	%
Sex	Male	2672	(90)	846	(89%)	4230	(89%)
Age	Mean in years (SD)	36·0	(12·0)	36·5	(12·6)	36·5	(12·6)
	Median	34·0		35·0		35·0	
Age in categories	17−25	708	(24)	246	(26)	1231	(26)
	26−35	859	(29)	242	(25)	1197	(25)
	36−46	767	(26)	231	(24)	1162	(24)
	47+	625	(21)	233	(25)	1170	(25)
Migration background	No migration background	1430	(48)	487	(51)	3221	(68)
	1st Generation immigrant	879	(30)	242	(25)	833	(18)
	2nd Generation immigrant	650	(22)	223	(23)	705	(15)
Socioeconomic position	With paid job	563	(19)	210	(22)	3155	(66)
	Social security benefits	1540	(52)	522	(55)	634	(13)
	Not active on labour market	263	(9)	108	(11)	833	(18)
	Other	593	(20)	112	(12)	138	(3)
Income position	First quartile (highest)	52	(2)	24	(3)	1296	(27)
	Second quartile	165	(6)	73	(8)	1281	(27)
	Third quartile	890	(30)	337	(35)	925	(19)
	Fourth quartile (lowest)	1033	(35)	361	(38)	1054	(22)
	Other	819	(28)	157	(17)	204	(4)
Partner	With partner	565	(19)	207	(22)	2366	(50)
Length detention	Mean in days (SD)	42·6	(73·5)	30·5	(47·8)		
	1 week	770	(26)	266	(28)		
	2 weeks	640	(22)	231	(24)		
	3 to 4 weeks	637	(22)	203	(21)		
	5 to 8 weeks	399	(14)	140	(15)		
	2 - 6 months	373	(13)	94	(10)		
	6 - 22 months	140	(5)	18	(2)		

Table 2A
Prevalence of health problems for detainees and controls: MALES.

	Detainees (N = 846)		Controls (N = 4230)	
	PRE N (%)	POST N (%)	PRE N (%)	POST N (%)
Total				
Any health problem from any chapter	697 (82·4)	712 (84·2)	3391 (80·2)	3444 (81·4)
General health chapters				
A General and unspecified	175 (20·7)	178 (21·0)	696 (16·5)	682 (16·1)
B Blood	33 (3·9)	34 (4·0)	140 (3·3)	141 (3·3)
D Digestive	160 (18·9)	161 (19·0)	673 (15·9)	717 (17·0)
F Eye	62 (7·3)	80 (9·5)	415 (9·8)	450 (10·6)
H Ear (Hearing)	67 (7·9)	50 (5·9)	413 (9·8)	465 (11·0)
K Circulatory	109 (12·9)	142 (16·8)	563 (13·3)	608 (14·4)
L Musculoskeletal	321 (37·9)	336 (39·7)	1472 (34·8)	1530 (36·2)
N Neurological	70 (8·3)	66 (7·8)	267 (6·3)	319 (7·5)
P Psychological	370 (43·7)	374 (44·2)	744 (17·6)	775 (18·3)
R Respiratory	202 (23·9)	198 (23·4)	1126 (26·6)	1158 (27·4)
S Skin	282 (33·3)	290 (34·3)	1421 (33·6)	1516 (35·8)
T Endocrine, metabolic & nutritional	88 (10·4)	99 (11·7)	497 (11·7)	564 (13·3)
U Urology	40 (4·7)	37 (4·4)	163 (3·9)	188 (4·4)
X/Y Genital system	99 (11·7)	98 (11·6)	376 (8·9)	403 (9·5)
Z Social problems	65 (7·7)	78 (9·2)	172 (4·1)	166 (3·9)
Specific health problems				
Circulatory				
Hypertension/high blood pressure	46 (5·4)	58 (6·9)	293 (6·9)	335 (7·9)
Cardiac disease	27 (3·2)	33 (3·9)	88 (2·1)	101 (2·4)
Coronary heart disease	28 (3·3)	34 (4·0)	70 (1·7)	73 (1·7)
Musculoskeletal				
Severe back problem	69 (8·2)	90 (10·6)	323 (7·6)	331 (7·8)
Severe neck/shoulder problem	44 (5·2)	52 (6·1)	249 (5·9)	267 (6·3)
Severe elbow, wrist, hand problem	41 (4·8)	39 (4·6)	150 (3·5)	142 (3·4)
Osteoarthritis	21 (2·5)	25 (3·0)	76 (1·8)	88 (2·1)
Arthritis	20 (2·4)	22 (2·6)	116 (2·7)	128 (3·0)
Psychological				
Sleep problems	30 (3·5)	35 (4·1)	64 (1·5)	69 (1·6)
Depression	47 (5·6)	47 (5·6)	130 (3·1)	141 (3·3)
Anxiety	32 (3·8)	32 (3·8)	137 (3·2)	140 (3·3)
Drug abuse	108 (12·8)	110 (13·0)	36 (0·9)	44 (1·0)
Alcohol abuse	56 (6·6)	63 (7·4)	40 (0·9)	40 (0·9)
Stress reaction	28 (3·3)	29 (3·4)	37 (0·9)	44 (1·0)
Psychotic disorder	25 (3·0)	27 (3·2)	39 (0·9)	44 (1·0)
Personality disorder	33 (3·9)	38 (4·5)	50 (1·2)	60 (1·4)
Respiratory				
Chronic lung problem	79 (9·3)	84 (9·9)	418 (9·9)	433 (10·2)
Upper tract respiratory infection	38 (4·5)	49 (5·8)	268 (6·3)	299 (7·1)
Bronchitis/pneumonia	27 (3·2)	24 (2·8)	75 (1·8)	83 (2·0)
Neurological				
Migraine/severe headache	17 (2·0)	14 (1·7)	109 (2·6)	120 (2·8)
Digestive				
Severe intestinal problem	16 (1·9)	19 (2·2)	87 (2·1)	102 (2·4)
Miscellaneous				
MUPS	189 (22·3)	201 (23·8)	868 (20·5)	956 (22·6)
Chronic eczema	83 (9·8)	87 (10·3)	516 (12·2)	537 (12·7)
Acute urinary tract infection				
Diabetes	30 (3·5)	34 (4·0)	136 (3·2)	142 (3·4)
Cancer	12 (1·4)	16 (1·9)	87 (2·1)	103 (2·4)
Teeth/gums problem	22 (2·6)	26 (3·1)	37 (0·9)	32 (0·8)
Chest symptoms	39 (4·6)	40 (4·7)	119 (2·8)	134 (3·2)

MUPS = medically unexplained physical symptoms.
Notes: PRE and POST for controls refer to the one-year periods corresponding to the year pre- and post-detention of the detainee they were matched to.

or psychotic problems. Compared with controls, male detainees also consulted their GP more often for physical health problems, i.e. teeth problems, coronary heart disease, cardiac disease, bronchitis or pneumonia, and chest symptoms. Male detainees were less likely to have upper tract respiratory infections in the year prior to their detention (OR = 0·70; 95% CI 0·49−0·98).

Detainees did not differ from their matched controls with respect to a number of other physical health problems, such as chronic lung problems, diabetes, severe back problems, severe headache, severe intestinal complaints, arthritis, and hypertension.

3.3.2. Females

For female detainees we find a similar pattern (See Fig. 2A and Supplementary Table S3). In the year prior to their detention, female detainees reported higher prevalence rates for social, psychological, digestive and urology problems. For instance, female detainees were about five times more likely to report social as well as mental health problems (OR's 5·50 and 4·51, respectively) and about 1·7 times more likely to report digestive and urology-related problems (OR's 1·71 and 1·74, respectively) when compared with their matched controls.

Table 2B
Prevalence of health problems for detainees and controls: FEMALES.

Total	Detainees (N = 106)		Controls (N = 530)	
	PRE N (%)	POST N (%)	PRE N (%)	POST N (%)
Any health problem from any chapter	101 (95·3)	102 (96·2)	507 (95·7)	501 (94·5)
General health chapters				
A General and unspecified	40 (37·7)	52 (49·1)	166 (31·3)	145 (27·4)
B Blood	12 (11·3)	11 (10·4)	33 (6·2)	47 (8·9)
D Digestive	41 (38·7)	41 (38·7)	143 (27·0)	151 (28·5)
F Eye	11 (10·4)	10 (9·4)	80 (15·1)	94 (17·7)
H Ear (Hearing)	13 (12·3)	15 (14·2)	58 (10·9)	62 (11·7)
K Circulatory	23 (21·7)	27 (25·5)	117 (22·1)	114 (21·5)
L Musculoskeletal	54 (50·9)	55 (51·9)	232 (43·8)	239 (45·1)
N Neurological	19 (17·9)	18 (17·0)	75 (14·2)	63 (11·9)
P Psychological	63 (59·4)	63 (59·4)	130 (24·5)	137 (25·8)
R Respiratory	35 (33·0)	36 (34·0)	186 (35·1)	180 (34·0)
S Skin	45 (42·5)	47 (44·3)	235 (44·3)	256 (48·3)
T Endocrine, metabolic & nutritional	33 (31·1)	32 (30·2)	119 (22·5)	119 (22·5)
U Urology	23 (21·7)	20 (18·9)	73 (13·8)	73 (13·8)
X/Y Genital system	40 (37·7)	40 (37·7)	174 (32·8)	179 (33·8)
Z Social problems	27 (25·5)	25 (23·6)	31 (5·8)	34 (6·4)
Specific health problems				
Circulatory				
Hypertension/high blood pressure	10 (9·4)	13 (12·3)	52 (9·8)	58 (10·9)
Musculoskeletal				
Severe back problem	20 (18·9)	15 (14·2)	57 (10·8)	66 (12·5)
Psychological				
Depression	13 (12·3)	14 (13·2)	28 (5·3)	34 (6·4)
Personality disorder	12 (11·3)	14 (13·2)	12 (2·3)	13 (2·5)
Respiratory				
Chronic lung problem	15 (14·2)	17 (16·0)	67 (12·6)	69 (13·0)
Upper tract respiratory infection	10 (9·4)	14 (13·2)	72 (13·6)	49 (9·2)
Miscellaneous				
MUPS	49 (46·2)	46 (43·4)	193 (36·4)	199 (37·5)
Chronic eczema	11 (10·4)	13 (12·3)	93 (17·5)	93 (17·5)
Acute urinary tract infection	17 (16·0)	13 (12·3)	46 (8·7)	40 (7·5)

MUPS = medically unexplained physical symptoms.
Notes: For females, fewer specific health problems could be examined due to cell counts of less than 10. PRE and POST for controls refer to the one-year periods corresponding to the year pre- and post-detention of the detainee they were matched to.
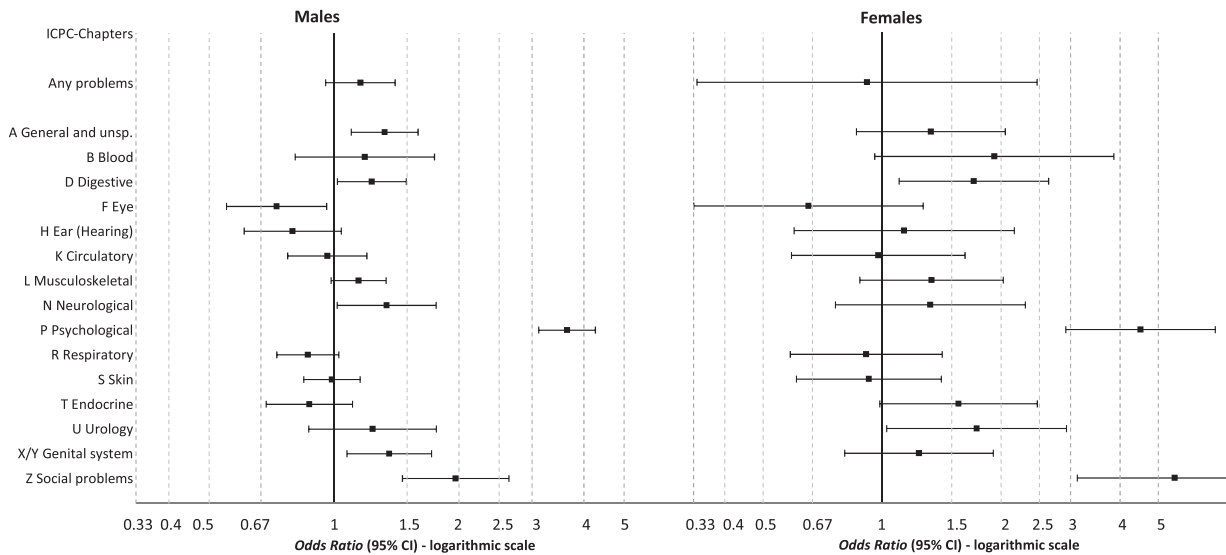
Fig. 2A. Difference in pre-detention prevalence rates between detainees and controls - General health chapters.

More specifically, female detainees had a substantially elevated risk of personality disorders and depression compared to non-detained females (OR's 5·51 and 2·51, respectively); and they were about twice as likely to report acute urinary tract infection and severe back problems in the year leading up to their detention (see Fig. 2B and Supplementary Table S3).

3.4. Differences in pre-detention health between detainees and matched controls: models controlled for socio-economic characteristics

In order to gain more insight into factors that may underlie pre-detention health differences between detainees and controls, logistic regression analyses were conducted, which included the socio-

Fig. 2B. Difference in pre-detention prevalence rates between detainees and controls - Specific health problems.

economic factors listed in Table 1. As could be expected, for a number of health problems, pre-detention differences between detainees and controls were no longer statistically significant when we controlled for these socio-economic factors (See Figs. 3A and 3B, and Supplementary Table S4). For instance, after taking socio-economic characteristics into account, male detainees and controls no longer differed statistically significant with respect to digestive and neurological problems, cardiac disease, depression, sleep problems, psychotic and personality disorders, bronchitis, teeth problems, and chest symptoms. Amongst females, detainees and controls no longer differed in a statistically significant way with respect to depression, and digestive and urology problems. Therefore, socio-economic factors – i.e. migration background, socio-economic position, income position, and partner situation – were important drivers of these pre-detention health differences between detainees and controls.

However, a number of pre-detention health differences remained statistically significant after controlling for differences in socio-economic factors. These health problems include psychological and social problems (men and women), genital system related problems (men), eye-related problems (men and women), coronary heart disease (men), stress reactions (men), alcohol and drug abuse (men), chronic eczema (women), severe back problems (women), and personality disorders (women). For example, compared to male controls, male detainees were about seven times more likely to report drug abuse, about four times more likely to report alcohol abuse and stress reactions, and about three time more likely to report coronary heart disease in the year prior to their detention. Furthermore, after controlling for socio-demographic characteristics, female detainees were four times as likely to report social problems, about three times as likely to report personality disorders, and about twice as likely to report severe back problems when compared with their matched

controls. For these pre-detention health differences, other underlying explanatory mechanisms play a role.

3.5. Changes in health problems from pre- to post-detention

3.5.1. Males

We observed hardly any statistically significant changes in male detainees' health problems over time (see Supplementary Table S2). Only for circulatory problems, a statistically significant change was observed. In the year after their detention, male detainees were somewhat more likely to report circulatory problems when compared with the year prior to their detention (16·8 versus 12·9%, respectively; OR = 1·36; 95% CI = 1·04−1·79).

Subsequently, we tested whether the change in prevalence rates from pre- to post-detention differed for detainees and controls (see last three columns of Supplementary Table S2). No statistically significant differences in changes in health problems between male detainees and controls were observed.

3.5.2. Females

The findings for the females mirror those for the males. We found no statistically significant changes in female detainees' health problems over time (See Supplementary Table S3). In addition, only for one group of health problems we observed a statistically significant difference in the change in health problems between female detainees and controls. Female detainees differed from their matched controls with respect to changes in general and unspecified health problems (OR = 1·92; 95% CI = 1·05−3·53). While the prevalence of general and unspecified health problems increased over time for female detainees (from 38% to 49%), the prevalence of such health problems decreased for the female controls (from 31% to 27%).
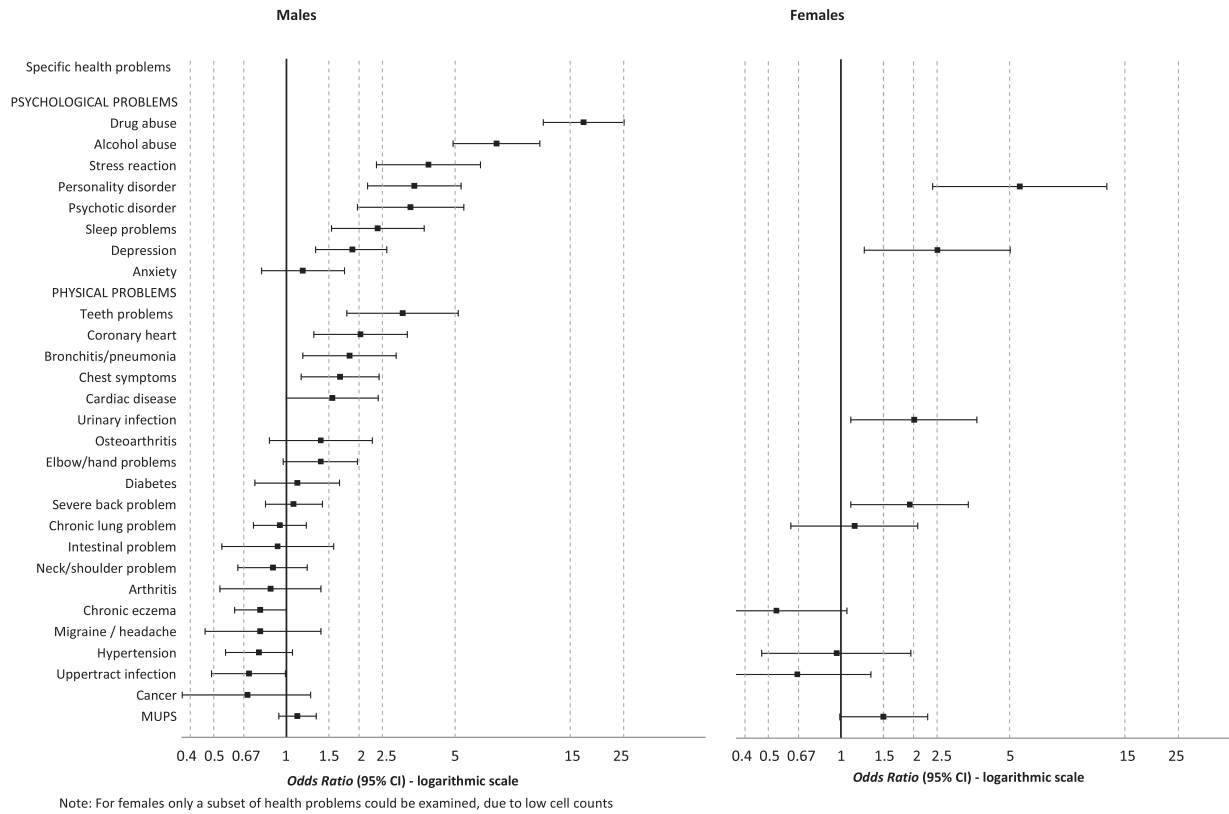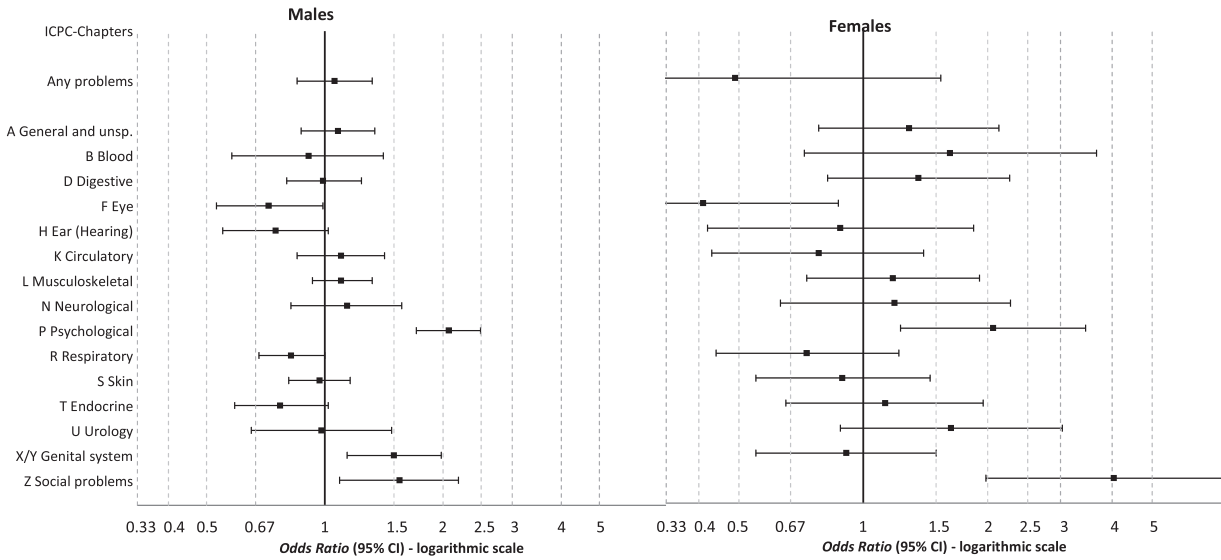
Fig. 3A. Difference in pre-detention prevalence rates between detainees and controls - General health chapters - Controlled for sociodemographic characteristics.
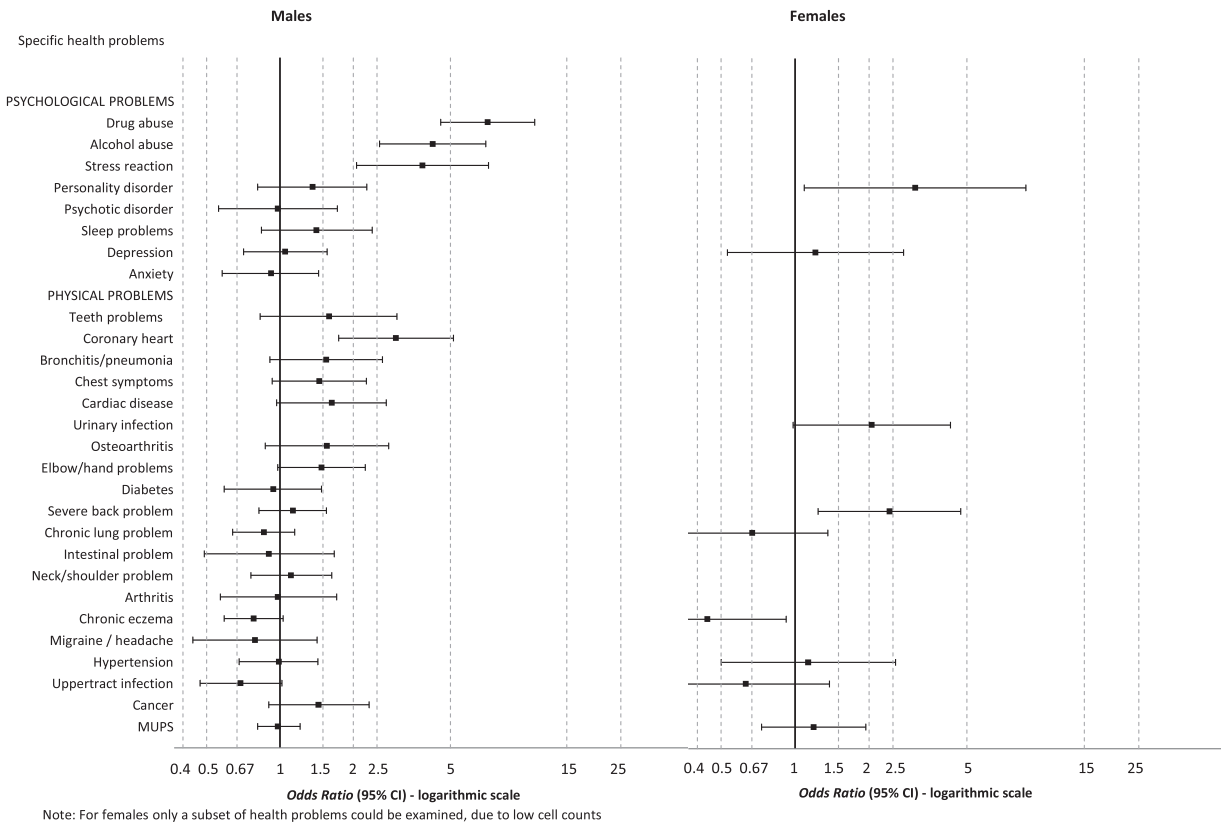
Note: For females only a subset of health problems could be examined, due to low cell counts

Fig. 3B. Difference in pre-detention prevalence rates between detainees and controls - Specific health problems - Controlled for sociodemographic characteristics
Note: For females only a subset of health problems could be examined, due to low cell counts.

4. Discussion

Scholars have repeatedly called for the urgent need of more longitudinal studies to more adequately examine the relationship between detention and health [6,8]. The current study addresses this call and makes progress by examining detailed and reliable data from electronic health records of detainees (and of a matched group of non-detainees) in the year before and after their detention.

The current study has two main findings. First, detainees' pre-detention health status is inferior to that of matched non-detainees. These pre-existing health differences are documented for a variety of mental and physical health problems, and for both sexes. To some extent these pre-detention health differences were due to other socio-economic conditions that differed beforehand between detainees and controls. For instance, compared with controls, more detainees had a migration history, received social security befits and had a low income position. This finding is in line with prior evidence

suggesting that a selective group of persons − i.e. those coming from disadvantaged backgrounds − is more likely to enter detention. Nevertheless, also after taking these socioeconomic differences into account, we observed pre-detention health differences between detainees and controls for a number of health problems, such as psychological, alcohol-related, and drugs-related health issues. The fact that detainees were in relatively poor health prior to their detention, and as such imported their poor health into detention, is in line with findings from some existing (review) studies, and illustrate the important opportunity of correctional facilities to address unmet health care needs [6,17,34,35].

Second, for both males and females, hardly any changes in health problems from pre- to post-detention were observed. Furthermore, no statistically significant differences in the levels of changes in health across detainees and controls were found. Therefore, the present study did not document an adverse nor positive health effect of detention but instead corroborates the idea that persons entering correctional facilities are already in relatively poor health prior to their detention spell. Given that persons entering detention already have elevated health problems, the lack of a positive health effect may illustrate a missed opportunity for health care services to address detainees' health needs.

It could, however, be that the absence of changes in health problems from pre- to post-detention masks differences between subgroups within the heterogeneous detainee population. As mentioned in the introduction, health effects of detention can be hypothesized to range from health deteriorating effects to health promoting effects for persons with pre-existing health needs and social hardships. It may be that subgroups of detainees experience different − and opposing − health changes, which may then result in an aggregate null effect of detention. In order to further explore this idea, additional exploratory analyses were conducted, in which we compared the change in health problems from pre- to post-detention between detainees who presented (a) drug- or alcohol problems, (b) other psychological problems, or (c) social problems to their GP in the year prior to their detention and detainees who did not present these problems prior to their detention. Amongst these three subgroups, we analysed their change in health problems from pre- to post-detention for both their overall health problems and for each of the separate general health chapters. Obviously, we excluded the chapters related to psychological and social problems because these were used to define the comparison groups. These exploratory analyses did not show any statistically significant differences in change in health problems between the groups with and without pre-existing psychological or social problems. Thus, these exploratory analyses do not support the idea of differential health effects for detainees with and without pre-existing problems.

The fact that we did not find evidence for changes in health problems from pre- to post- detention may also be related to different effects amongst detainees with shorter and longer detention spells. It could be expected that longer detention spells have a stronger impact on health (changes). Therefore, we performed additional analyses for all general health clusters, separately for detainees with a detention period shorter than 14 days and those with a longer detention period (due to the small number of detainees with a long detention period, we were unable to do these analyses using cut-off scores distinguishing longer detention spells; see also Table 1). The findings for both groups were very similar to the results presented for the entire group. The analyses showed no significant changes from pre- to post-detention in detainees' health, and no significant differences in health changes between short and longer detained persons. Thus, these exploratory analyses do not seem to support the idea of different health effects between detained persons with short and longer detention periods.

The fact that we did not seem to find a health effect of detention is contrary to the findings from existing longitudinal survey-based studies, which did suggest detrimental health effects [13,17−27]. These studies showed that incarceration was associated with mental health problems (e.g. depression), functional impairments, sleep problems, hypertension, self-reported general health status, infectious diseases and stress-related health symptoms. However, these longitudinal survey-based studies were limited in number and − with the exception of one − were all based on data from the United States, with its own characteristic situation with high imprisonment rates, specific prison conditions, long prison sentences, and a distinct health care system. The current study is the first that uses a quasi-experimental approach to examine the detention-health relationship in a European context; and more specifically in a country with relatively short prison sentences and a welfare system including a universal health care system.

Our study has several important strengths. First, using routinely recorded administrative data on health care utilization overcomes some of the limitations of survey-based studies, such as recall and social desirability biases, and a limited focus on specific physical or mental health problems. Second, using data from primary care is to be preferred above data from secondary care because GPs are usually the first point of contact with the health care system. Therefore, their registrations provide a more complete source of health information, including less serious health problems. Using primary care data may be particular useful in the Netherlands, because almost all Dutch citizens are registered with a specific GP, GPs act as gatekeepers to specialized care, health care provided by GPs is free of charge, and all GPs use EHRs to manage patient care [29−31]. Third, additional strengths of the study are: the availability of longitudinal data on detainees' health before and after their detention; the availability of the same health data for a matched control group of non-detainees, and the inclusion of both detained men and women.

Nevertheless, some methodological concerns merit discussion as well. Most of these concerns may result in an underestimation of the health problems of detainees. First, the study focused only on health problems for which people consult their GP. Second, it is possible that people who get incarcerated are more often the ones out of reach of general health care. Our findings, however, showed that detainees and controls were equally likely to contact their GP in the year prior to their detention for any health problem. The organization of the Dutch health care system may further minimize such bias because general practice consultations are free of charge. Third, while we included migration background as a proxy for ethnicity in the controlled analyses, information on ethnic background was unfortunately unavailable. Future research should examine whether including ethnicity will affect the findings.

A fourth concern is the representativeness of the study sample. Detainees are − in terms of where they live − not the most stable population. Consequently, for a number of them we did not have data available in the year before and after the detention. So, in our data, detainees with relative stable housing situations are overrepresented. In addition, the current study sample refers to people who were registered with a GP. While in the Netherlands the far majority of persons is registered with a GP, some are not. For instance, people in nursing homes are not registered with a GP because they are cared for by the nursing home doctor. However, it is also conceivable that people with more unstable lives characterised by homelessness, poverty, or mental health issue − characteristics that are also common in prison populations − are somewhat overrepresented in this small group that is unknown to the GP.

A fifth concern refers to the generalisability of our findings. The present study refers to detainees held in Dutch correctional facilities. Obviously countries differ with respect to sentencing practices and prison conditions. The Netherlands is known for its relatively mild penal climate with rather humane conditions of confinement. In addition, time spent in detention in the Netherlands is relatively short compared to other countries like the USA or the United

Kingdom [36,37]. Since these characteristics may affect individual's health, it remains unclear to what extent we would have found similar results using data from countries with longer detention spells and harsher prison conditions. However, our results are relevant for countries other than the Netherlands because many countries rely on systems like bail and remand, which results in a large part of the prison population being detained for weeks or months rather than years [38]. More specifically, the Dutch situation – with relatively short prison sentences, a mild penal climate and a welfare system – may be particularly comparable to Nordic European countries, like Denmark and Norway. For instance, the average length of imprisonment in months in 2019 was 3·7 for the Netherlands, 3·9 for Denmark, and 5·3 for Norway and these countries also have relatively mild penal climates [39]. Future studies should replicate the study in other countries to test the generalisability of our findings and to test whether the length of detention makes a difference.

Finally, an important avenue for future research would be to incorporate information on detainees' health care use during detention. At present, no study examined detainees' health before and after detention, and included information on their general medical or psychological care during detention.

In conclusion, this study showed that people who experience detention have high and complex health needs both before and after their detention. Therefore, their health is relevant for health professionals working both inside and outside the prison walls. Inside prisons, health care professionals have an important opportunity to identify and address (unmet) health issues and offer high-quality health care to a disadvantaged, vulnerable, and often underserved group of persons. Even if the time spent in detention is relatively short and may limit actual health care strategies, these health care professionals still have an important opportunity to address detainees' health by referring them to appropriate community health care services after their release. Outside prisons, health care professionals should be aware that they will have future and former detainees amongst their clients. Knowledge on (former) detainees' specific health problems may help them to adequately recognize and address the health care needs of this particularly vulnerable group. Health care professionals both inside and outside prison can make an important contribution to ensuring the continuity of care when persons transition either into prison or back into the community.

Addressing and improving the health of people who experience detention is important not only for their individual health and well-being but also for society at large. For example, poor health of (former) detainees is associated with high economic costs, either directly through the increased use of (acute) health services amongst former detainees or indirectly through costs associated with poor health (e.g. problems with finding a job or stable housing). Moreover, poor health outcomes in ex-detainees have been linked to risks of reoffending as well [40].

Contributors

All authors contributed substantially to the conception of the project and the study design. AJED played a primary role in the data linkage process and data analyses with contributions from PN. AJED wrote the initial draft of the manuscript. All authors participated in interpretation of data and findings, made critical revisions to the manuscript, and approved the final version of the manuscript.

Availability of data

Data sharing is not possible because data are not allowed to be exported from the protected environment of Statistics Netherlands. For more information on data access, see Supplementary Table S5.

Declaration of Competing Interest

We declare no competing interests.

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None.

Supplementary materials

Supplementary material associated with this article can be found in the online version at doi: https://doi.org/10.1016/j. lanepe.2021.100154.

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