International Journal of Social Psychiatry

Mortality and psychiatric disorders among public mental health care clients in Utrecht: A register-based cohort study

Fabian Termorshuizen, Addi PL van Bergen, Ronald BJ Smit, Hugo M Smeets and Erik JC van Ameijden

Mortality and psychiatric disorders among public mental health care clients in Utrecht: A register-based cohort study

Fabian Termorshuizen,[1] Addi PL van Bergen,[2] Ronald BJ Smit,[3] Hugo M Smeets[1] and Erik JC van Ameijden[2]

Abstract

Background: Different studies have shown similar or even lower mortality among homeless persons with compared to homeless persons without a severe mental disorder.

Aims: To clarify the association between presence of a psychiatric diagnosis and mortality among the socially marginalized.

Methods: The Public Mental health care (PMHc) is a legal task of the municipal authority aiming at prevention and intervention in case of (imminent) homelessness among persons with a serious shortage of self-sufficiency. The data of PMHc clients (N=6,724) and personally matched controls (N=66,247) were linked to the registries of Statistics Netherlands and analysed in a Cox model.

Results: The increased mortality among PMHc clients, compared to the general population (HR=2.99, 95%-CI: 2.63-3.41), was associated with a broad range of death causes. Clients with a record linkage to the Psychiatric Case Registry Middle Netherlands ('PMHc+') had an increased risk of suicide (HR=2.63, 0.99-7.02, P=0.052), but a lower risk of natural death causes (HR=0.71, 0.54-0.92, P=0.011), compared to clients without this record linkage ('PMHc-'). Compared to controls, however, 'PMHc-' clients experienced substantially increased risks of suicide (HR=3.63, 1.42-9.26, P=0.007) and death associated with mental and behavioural disorders (ICD-10 Ch.V) (HR=7.85, 3.54-17.43, P<0.001).

Conclusion: Psychiatric services may deliver an important contribution to the prevention of premature natural death among the socially marginalized.

Keyphrases

The earlier observed lower mortality among vulnerably housed and homeless persons with a psychiatric diagnosis compared to vulnerably housed and homeless persons without a psychiatric diagnosis appears to be due to a significantly lower risk of natural causes of death.

Compared to controls from the general population, vulnerably housed and homeless persons without registered diagnosis at a local psychiatric service have a significantly increased mortality associated both with natural death causes and with suicide and death due to mental and behavioural disorders.

Services for mental health care may deliver an important contribution to the prevention of premature death due to somatic disorders among the socially marginalized.

Keywords

Mortality, psychiatry, homelessness, psychiatric case registry

[1]University Medical Center Utrecht, Utrecht, Netherlands
[2]Department of Health Promotion and Epidemiology, Municipal Health Service Utrecht, Utrecht, Netherlands
[3]Department of Social Health Care, Municipal Health Service Utrecht, Utrecht, Netherlands

Corresponding author:
Fabian Termorshuizen, Julius Center for Health Sciences and Primary Care, University Medical Center Utrecht, Heidelberglaan 100, PO Box 85500, Utrecht, 3508 GA, Netherlands.
Email: f.termorshuizen@umcutrecht.nl

Introduction

It is known that vulnerably housed and homeless persons have mortality rates of 2–5 times or higher than that of the general population (Barrow et al., 1999; Babidge et al., 2001; Nordentoft & Wandall-Holm, 2003; van Laere et al., 2009; Nielsen et al., 2011; Hwang et al., 2009) and a higher prevalence of psychiatric disorders (Reinking et al., 2001; Fazel et al., 2008; Beijer & Andreasson, 2010; Folsom et al., 2005). Various studies among the homeless consistently show that the presence of a substance abuse disorder is strongly associated with increased mortality (Nordentoft & Wandall-Holm, 2003; Nielsen et al., 2011; Hwang et al., 1998; Beijer et al., 2011). For other psychiatric disorders, however, there is less evidence for increased mortality. Within the group of marginalized persons, schizophrenia and other mental disorders were often linked to similar (Beijer et al., 2011) or even lower mortality (Barrow et al., 1999; Babidge et al., 2001; Nordentoft & Wandall-Holm, 2003; Hwang et al., 1998; Beijer et al., 2007). These findings are in clear contrast to studies showing increased mortality among psychiatric patients compared to the general population (Laan et al., 2011; Saha et al., 2007). Homeless persons with a severe mental illness may have more regular contacts with health care facilities and, thus, are more closely monitored also for somatic comorbidity (Barrow et al., 1999). In addition, a large group of marginalized persons with undiagnosed mental illnesses who lack self-sufficiency and avoid contacts with health care services may exist (Nielsen et al., 2011).

In the above-mentioned studies, it remained unclear which causes of death were involved in the altered mortality. The Public Mental Health care (PMHc, 'Openbare Geestelijke Gezondheidszorg' in Dutch) is a legally appointed task of the municipal authority aimed at persons who have a serious lack of self-sufficiency and/ or who avoid social and financial support, and medical and/ or psychiatric care. Rather than a housing problem, homelessness in the Netherlands is considered a social and medical problem. Most of the PMHc target group are homeless or at risk of becoming homeless without adequate support and care. In this article we use the term 'vulnerably housed' to refer to this situation. (Street) outreach, guidance towards facilities for social, mental, and physical health care, housing and intervention in case of imminent homelessness, are important objectives. In the present record linkage study, we analysed the risk of premature death among clients of the PMHc in Utrecht city, the Netherlands. We assessed the relationship between presence of a psychiatric diagnosis and all-cause and cause-specific mortality.

Methods

Databases

A retrospective cohort study was performed using data from three different sources.

The databases of PMHc clients were the starting point of the data extraction. A definition of the PMHc target group is provided in the framed text below.

In Utrecht, as part of the 2006-2009 action plan to combat homelessness, a central registration of PMHc clients was established in 2006. All major organizations offering services and accommodation for PMHc clients in Utrecht, such as homeless shelters, mobile outreach teams, housing accommodation for socially vulnerable persons and programs for prevention of housing eviction, became affiliated. From January 2006 till July 2010, 8,453 clients were registered. From one program that became affiliated in 2010, i.e. the social medical care program for homeless, we separately retrieved the client records covering the years 2002-2010, totaling 2,439 clients. With this addition an estimated 90-95% of the clients are monitored. To include PMHc clients from the period before 2006, we used a database compiled in 2006 for earlier research (Smit et al., 2012). This database contained 2,450 clients from 14 registration systems of various providers and with various starting dates. The three databases represent the entire group of PMHc clients in Utrecht over the period 2002 until 2010. Some but not all databases include civil service number. Name, date of birth, and gender were available in all databases for record linkage. The three files were merged and duplicates of client records were removed. The number of unique persons with registration until July 1st, 2010 was 8,741. In the databases, demographic information was registered together with a list of problems for which intervention is needed.

Care inclusion criteria for the Public Mental Healthcare (PMHc)

Access to services is restricted to adults who fulfil all of the following criteria:
* having problems in more than one aspect of life such as (imminent) homelessness, insufficient self-care, anti-social behaviour or serious debts,
* having psychiatric problems and/or being addicted, having cognitive problems and/or inadequate coping strategies,
* displaying care-avoiding behaviour or being unable to find the way to social services, and
* in need of care that is not available in the standard care packages

---

The second data source was the database with registered diagnoses of the Psychiatric Case Registry Middle Netherlands (PCR-MN). Since 1999, the PCR-MN receives information on psychiatric treatment of all patients who attend any of the in- or out-patient facilities for mental health care (including addiction clinics) in the city of Utrecht and surrounding municipalities (Smeets et al., 2011).

The third data source was the population register (GBA, 'Gemeentelijke Basisadministratie' in Dutch) and the linked causes of death register of Statistics Netherlands (CBS, 'Centraal Bureau voor de Statistiek' in Dutch).

Physicians in the Netherlands are obliged to report the cause of death to the civil register of the municipality where the person died. This information is forwarded to the CBS, where the death report is ICD-10 coded and entered into the database. In the GBA, all legally residing citizens of the Netherlands are registered with date of birth, gender, country of birth, and place of residence.

Clients and data extraction

From the files of the PMHc database in the period 1999-2010, 8,741 unique clients' records remained. Using the clients' date of birth, sex and the first 4 characters of the family name, the records were linked to the PCR-MN. In the next step, the staff of the CBS performed the linkage to the GBA, using the date of birth, sex and part of the postal code (extracted either from the database of the PMHc or database of the PCR-MN), and, if present, the civil registration number. The civil registration number is a personal identification number assigned to all legal residents in the Netherlands. Out of the 8,741 records, 6,724 records (76.9%) were used for the analysis. Reasons for exclusion of the other 2,017 records are given in the framed box below. The present analysis was restricted to the data of those aged 15 years and older and with earliest PMHc registration from 2002 until July 1st, 2010, which form the greater part of the PMHc database (see framed box below). Albeit those younger than 18 years do not fulfill the official criteria for the PMHc, a few number of persons younger than 18 at the time of registration were found in the PMHc databases. Out of the 6,724 PMHc clients, a record linkage to the diagnosis file of the PCR-MN could be established for 4,104 ('PMHc+' clients) and for 2,620 no such record linkage was established ('PMHc-' clients). Presence of a record linkage implies having received any treatment for a registered psychiatric diagnosis at a local mental health facility during the years 1999-2009, including both acute or time-limited disorders and chronic mental illnesses.

Comparison of clients who were selected for the analysis with those not selected showed no important differences in the distribution of age at the earliest date of PMHc registration or ethnic origin. Among those selected, a slightly lower percentage of male gender (67.1% vs. 75.7%) and higher percentages of registered homelessness (36.6% vs. 19.4%) and of record linkage to the PCR-MN (61.0% vs. 14.3%) were found. This overrepresentation of clients with PCR-MN linkage and registered homelessness should be taken into account (see Discussion).

Controls

The reference group consisted of a random sample from the GBA of inhabitants who were alive during (a part of) the period 2002-2010 and with Utrecht city as last registered place of residence. Ten unique control persons were personally matched to a PMHc client using year of birth, gender, and ethnic origin (on the basis of the registered country of birth of the person and his/ her parents). The earliest date of PMHc registration of the PMHc client was transferred to his/ her matched controls, who were also followed from this date onwards. Those controls who were not alive or not legally residing in the Netherlands at that time were excluded, necessarily, and replaced by another control.

Reasons for exclusion of extracted records	N, %
Total number of records	10,495
Unique clients' records before July 1st, 2010 after de-duplicating	8,741 100%
Insufficient data present for record linkage to CBS data	1,187 13.6%
Sufficient data, but no match found	355 4.1%
Duplicates appearing after identification in the CBS	110 1.3%
No registered date of start in the PMHc	46 0.5%
Conflicting data/ other reasons	207 2.3%
Age at earliest PMHc registration < 15 years and/ or year of earliest registration < 2002	112 1.3%
Number of unique clients' records eligible for analysis	6,724 76.9%

Analysis

The duration of follow-up started at the earliest date of registration in the PMHc of the (matched) client and ended at the date of death or was censored at 31/12/2010, whichever came first. In case of disappearing from the population registry before 31/12/2010 (4.9% for PMHc clients, e.g. in case of emigration), the follow-up time was censored at the final date of the last registered episode. In the first step of the analysis, rates of all-cause mortality (Number of death events per 10,000 years of observation) were calculated separately for clients and control persons, by age and gender.

In the second step of the analysis, the effect of the presence of a record linkage to the PCR-MN ('PMHc+' vs 'PMHc-' clients vs controls) on all-cause and cause-specific death rates was tested using a multivariable Cox regression model. Primary death causes with ICD-10 codes related to physical disorders (A00-E90, G00-R99) were categorized as 'natural death causes'. Death causes with ICD-10 codes of Chapter XX ('External causes of morbidity and mortality') such as suicide, accidents and homicide were categorized as 'external death causes'. Death causes with ICD-10 codes for 'Mental and behavioural disorders' (Chapter V) (e.g., non-intended heroin overdose following waning tolerance after a period of imprisonment, or vascular dementia) were regarded as separate category, neither related to physical disorders in a narrower sense nor to accidents, suicide or homicide. Next, 'PMHc+' clients

Table 1. Study group.

	PMHc[1] clients		Controls	
Total: N, %	6,724	100%	66,247	100%
Age (years): mean (SD)	39.4 (13.7)		39.2 (13.7)	
Gender: N, % Male	4,484	66.7%	43,916	66.3%
Female	2,240	33.3%	22,331	33.7%
Ethnic origin: N, % Native Dutch	4,019	59.8%	40,099	60.5%
Turkish/ Moroccan Surinamese/ Antillean Dutch	1,505	22.3%	14,334	21.7%
Other	1,200	17.8%	11,814	17.8%
Duration of follow-up (years): mean (SD)	3.67 (2.02)		3.72 (2.03)	
All death causes: N, %	295	100%	986	100%
Natural death causes:				
ICD 10 Ch.I Certain infectious and parasitic diseases	9	3.1%	13	1.3%
Ch. II Neoplasms	63	21.4%	368	37.3%
Ch. IX Diseases of the circulatory system	64	21.7%	255	25.9%
Ch. X Diseases of the respiratory system	24	8.1%	63	6.4%
Other chapters for natural death causes	62	21.0%	186	18.9%
Ch. V Mental and behavioural disorders:				
Organic (F00-09)	4	1.3%	20	2.0%
Psychoactive substance use (F10-F19)	16	5.4%	2	0.2%
Other (F20-F99)	3	1.0%	3	0.3%
External causes of morbidity and mortality:				
Ch. XX Suicide (X60-84, Y10-34)	26	8.8%	36	3.7%
Ch. XX Other external causes	24	8.1%	40	4.1%

[1]Public Mental Health care

were categorized in mutually exclusive broad categories of psychiatric diagnoses and the presence of a comorbid substance abuse and/ or dependence disorder (SAD). Diagnoses were defined on the basis of registered DSM-IV codes (see footnotes of Table 3). As the presence of SAD is often associated with the presence of another axis-I mental disorder, and the effects on mortality were often different for these factors (see introduction), SAD was not included as independent factor in the analysis but evaluated within categories of other axis-I disorders (see Table 3).

The estimated hazard ratios (HRs) were adjusted for age at the start of follow-up, gender, and ethnic origin.

Data management, record linkage, preparation of the analysis files, and the Cox regression analyses were performed using SPSS, version 14.0. Testing of the mortality rates assuming a Poisson distribution was done in STATA, version 10.0.

All authors certify their full responsibility for the manuscript and state that they have no conflicts of interest.

Results

Study group and outcome (Table 1)

In Table 1, the characteristics of the study group are given. Also for PMHc clients and controls, the numbers of registered death events (N=295 vs 986) and causes of death (natural: N=222 vs N=885, Mental and behavioural: N=23

vs N=25, and external: N=50 vs N=76) are given. Compared to controls, deaths were less often caused by physical disorders (75.2% vs 89.7%), and more often by mental and behavioural disorders (7.8% vs 2.5%) or external causes (16.9% vs. 7.7%) among PMHc clients.

Crude mortality rates (Table 2)

In Table 2, the numbers of death events per 10,000 person years of follow-up are given per stratum by age and gender. Among males and females aged ≥25 years, significantly higher mortality rates were found for PMHc clients compared to controls and the estimated incidence rate ratios (IRRs) were all significantly higher than 1.00. The highest IRRs were found in the age category 25-45 years (5.6 for males and 4.7 for females) with a trend towards lower IRRs at higher age categories (e.g., >75 years: 1.7 and 1.9). In terms of differences, however, the gap between PMHc clients and the general population clearly increased, from 34.4 (males) and 19.6 (females) at age category 25-45 until 598.5 (males) and 620.7 (females) at age category >75. The overall IRR as estimated after collapsing the age-gender strata was 2.9.

Cause-specific mortality (Figure 1 and Figure 2)

The significantly increased all-cause mortality among PMHc clients compared to controls (HR=2.99, 95%-CI:

Table 2. The number of person years of follow-up (pyrs.), the number of registered death events (evts.) and the number of events per 10,000 person years (evts./ 10,000 pyrs.). The incidence rate ratio (IRR) is the ratio of rates for PMHc[1] clients vs. controls.

Age (years) and gender		PMHc[1] clients			Controls			PMHc[1] clients vs. Controls
		pyrs.	evts.	evts./ 10,000 pyrs.	pyrs.	evts.	evts./ 10,000 pyrs.	IRR, [95%-CI], P value
<25	Male	1462.5	1	6.8	14611.0	6	4.1	1.6 [0.2-13.8], 0.63
	Female	1064.6	0	0.0	10454.0	1	0.9	0.0
25-45	Male	8850.6	37	41.8	87177.0	65	7.4	5.6 [3.7-8.3], <0.001
	Female	3617.3	9	24.8	36143.0	19	5.2	4.7 [2.1-10.4], <0.001
45-55	Male	4055.6	66	162.7	39491.2	119	30.1	5.4 [3.9-7.2], <0.001
	Female	1643.3	15	91.2	15993.7	43	26.8	3.3 [1.8-6.1], <0.001
55-65	Male	2019.5	62	307.0	21032.1	207	98.4	3.1 [2.3-4.1], <0.001
	Female	806.4	17	210.8	8655.5	47	54.3	3.8 [2.2-6.7], <0.001
65-75	Male	551.8	26	471.1	6206.2	145	233.6	2.0 [1.3-3.0], 0.001
	Female	227.4	10	439.7	2788.4	34	121.9	3.6 [1.7-7.2], <0.001
>75	Male	176.9	24	1356.4	2084.4	158	757.9	1.7 [1.1-2.7], 0.008
	Female	215.5	28	1299.1	2092.8	142	678.4	1.9 [1.2-2.8], 0.002
All	Male	17117.2	216	126.1	170602.3	700	41.0	3.0 [2.6-3.5], <0.001
	Female	7574.6	79	104.2	76127.7	286	37.5	2.7 [2.1-3.5], <0.001
Total		24691.9	295	119.47	246730.0	986	39.96	2.9 [2.6-3.4], <0.001

[1]Public Mental Health care

Table 3. PMHc[1] clients: HRs of all-cause and cause-specific mortality by different diagnostic categories.

	PMHc[1] clients without record link= Reference	PMHc[1] clients with record link PCR-MN[7] (N=4,104)						P value(df=6)
		Mood disorder[3] and/ or Non-affective psychotic disorder[4]		Personality disorder[5]		Other[6] or no axis I Diagnosis		
	(N=2,620)	No SAD[2] (N=1,041)	SAD (N=850)	No SAD (N=213)	SAD (N=526)	No SAD (N=637)	SAD (N=837)	
All death causes	n[8]=133 1.00	n=25 0.48 0.31-0.74	n=41 1.18 0.83-1.68	n=12 1.32 0.73-2.38	n=17 0.66 0.39-1.10	n=22 0.84 0.53-1.33	n=45 1.04 0.74-1.47	0.007
Natural death causes	n=111 1.00	n=17 0.38 0.22-0.63	n=15 0.55 0.32-0.95	n=11 1.41 0.76-2.63	n=11 0.55 0.29-1.03	n=18 0.79 0.48-1.30	n=39 1.14 0.78-1.65	<0.001
V. Mental and behavioural	n=8 1.00	n=1 0.33 0.041-2.67	n=6 2.76 0.94-8.14	n=1 1.87 0.23-15.10	n=3 1.99 0.51-7.68	n=1 0.67 0.08-5.41	n=3 1.13 0.29-4.32	0.362
XX. Suicide	n=5 1.00	n=3 1.58 0.37-6.72	n=14 8.56 3.04-24.08	n=0 -	n=1 0.79 0.09-6.89	n=2 2.24 0.42-11.73	n=1 0.52 0.06-4.56	<0.001 (df=5)
XX. Other external	n=9	n=4 1.45 0.43-4.79	n=6 1.84 0.65-5.23	n=0 -	n=2 0.82 0.17-3.83	n=1 0.67 0.084-5.37	n=2 0.50 0.10-2.35	0.613 (df=5)

[1]Public Mental Health care; [2] SAD, substance abuse and/ or dependence disorder: DSM IV codes: 305.xx, 303.90, 303.00, 291.xx, 304.xx, 292.xx; [3] depressive disorder: DSM-IV codes 300.40, 296.2x, 296.3x, 311.00; bipolar disorder: 296.80, 296.0x, 296.4x, 296.5x, 296.6x, 296.70, 296.89, 301.13, 296.89; other mood disorders: 293.83, 296.90; [4] DSM-IV codes 295.xx, 297.xx, 298.xx, 293.xx; [5] if no mood and/ or psychotic disorder is registered: DSM-IV codes 301.xx; [6] other than personality disorder, mood disorder, and/ or psychotic disorder; [7] Psychiatric Case Register Middle Netherlands; [8] Number of death events

2.63-3.41, P<0.001) was associated with a broad range of natural and external causes of death (Figure 1). Except for death from infectious diseases among 'PMHc+' clients, a significantly increased cause-specific mortality was found
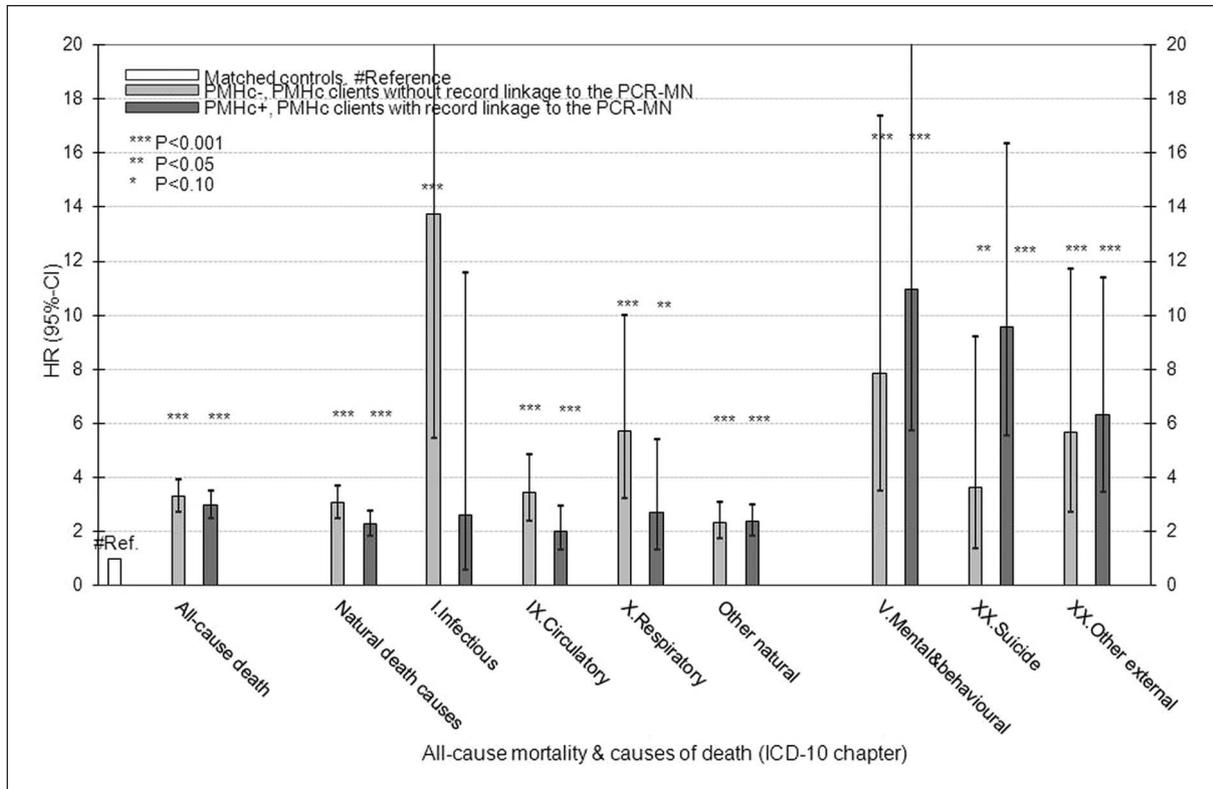
Figure 1. HRs of all-cause and cause specific mortality for PMHc clients with ('PMHc+') and without ('PMHc-') record linkage to the PCR-MN compared to matched controls (=Reference).
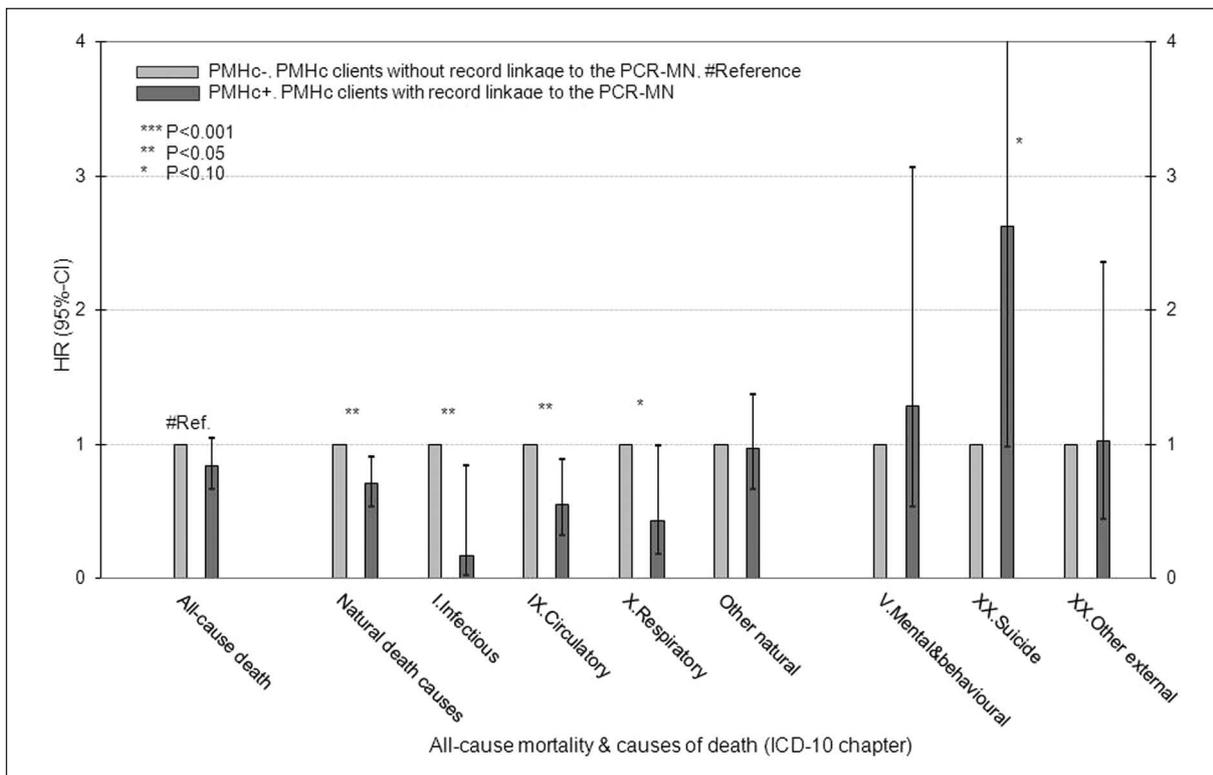

Figure 2. HRs of all-cause and cause specific mortality for 'PMHc+' clients compared to 'PMHc-' clients (=Reference).

among both 'PMHc+' and 'PMHc-' clients, compared to controls (Figure 1).

However, when directly comparing 'PMHc+' and 'PMHc-' clients, important differences in cause-specific mortality were found (Figure 2). Compared to 'PMHc-' clients, a lower all-cause mortality among 'PMHc+' clients was found which did not reach the level of statistical significance (HR=0.84, 95%-CI: 0.67-1.06, P=0.162). After breaking down all-cause mortality into different categories of causes of death, however, the HR of natural causes of death appeared to be significantly lower among 'PMHc+' clients (HR=0.71, 95%-CI: 0.54-0.92, P=0.011). This lower HR was due to smaller HRs of infectious, of circulatory, and of respiratory diseases. The HR of suicide was substantially higher among 'PMHc+' clients (HR=2.63, 95%-CI: 0.99-7.02, P=0.052). The HR of death due to mental and behavioural disorders was slightly and non-significantly increased (Figure 2).

Compared to controls, the HRs of suicide and of death due to mental and behavioural disorders among 'PMHc-' clients were both substantially and statistically significantly increased (HR=3.63, 95%-CI: 1.42-9.26, P=0.007 and HR=7.85, 95%-CI: 3.54-17.43, P<0.001, respectively) (Figure 1).

A registered episode of homelessness (i.e., living on the streets, N=2464) influenced neither all-cause nor cause-specific mortality and inclusion of this covariate did not modify the estimated HRs for 'PMHc+' compared to 'PMHc-' clients (data not shown).

Cause-specific mortality in relation to diagnostic category (Table 3)

HRs of cause-specific mortality were estimated for different diagnostic groups of 'PMHc+' clients compared to 'PMHc-' clients as reference category. Due to small numbers, natural causes of death were analysed as one category. Compared to 'PMHc-' clients, a substantially lower all-cause mortality was found among 'PMHc+' clients with a mood or a psychotic disorder without a registered SAD (HR=0.48, 95%-CI: 0.31-0.74). This decreased HR appeared to be explained by a significantly decreased HR of natural death causes (HR=0.38, 95%-CI: 0.22-0.63). On the other hand, a substantially and significantly increased HR of suicide was found among 'PMHc+' clients with a mood or a psychotic disorder and a comorbid SAD (HR=8.56, 95%-CI: 3.04-24.08). Because of the small numbers per stratum, these results should be interpreted with caution.

Discussion

An increased mortality was established among clients of the PMHc in Utrecht. This appeared to be associated with a broad range of natural and external causes of death. PMHc

clients with a registered diagnostic assessment at a local mental health care facility ('PMHc+') experienced a lower risk of natural death causes, but an increased risk of suicide compared to those without ('PMHc-' clients). When comparing 'PMHc-' clients with the general population, significantly increased risks of suicide and death due to mental and behavioural disorders were found.

Interpretation and comparison with other studies

The rate ratio of all-cause death among PMHc clients compared to controls of 2.9 was in the range of estimates previously reported (Barrow et al., 1999; Babidge et al., 2001; Nordentoft & Wandall-Holm, 2003; van Laere et al., 2009; Nielsen et al., 2011; Hwang et al., 2009). The trend towards a lower rate ratio with increasing age was also found in the study of Nielsen et al. among the homeless (Nielsen et al., 2011) and in the study of Hwang et al. among marginally housed persons (Hwang et al., 2009). Especially PMHc clients at young age appear to be at comparatively high risk of the adverse health effects and the risk of premature death associated with marginalized living conditions. The lower death rate ratio at a higher age may be due to the selective survival of those who possess better resilience. On the other hand, when comparing PMHc clients with the general population in terms of a rate difference (instead of a ratio), an excess mortality at high ages was present. Thus, for prevention of premature death, targeting those at higher ages is as important as well.

Our finding of slightly lower all-cause mortality among 'PMHc+' clients is in accordance with earlier studies among the homeless that, counter-intuitively, found similar or reduced mortality among those with a mental illness compared to the marginalized without (registered) mental illness (Beijer et al., 2011; Barrow et al., 1999; Babidge et al., 2001; Nordentoft & Wandall-Holm, 2003b; Hwang et al., 1998; Beijer et al., 2007). In the present study, this lower mortality appeared to be the result of a differential influence on the risk of natural causes of death, which was significantly decreased, as opposed to the risk of suicide, which was clearly increased among 'PMHc+' compared to 'PMHc-' clients. The high risk of suicide among 'PMHc+' clients indicates that this subgroup indeed is characterized by a high prevalence of severe psychopathology. Notwithstanding the presence of these severe psychiatric problems, which are known to have a strong and unfavourable impact on physical health as well (Carney et al., 2002; Carney et al., 2006; Carney & Jones, 2006), the rate of natural death was significantly lower among these 'PMHc+' clients. This finding suggests that mental health care facilities are an important point for intervention for physical disorders, e.g. by providing physical health care themselves or by guiding their patients to facilities for appropriate medical care. In addition, the reduced rate of natural death

among 'PMHc+' clients may also indicate that these clients are more amenable for health care in general compared to 'PMHc-' clients. In the study of Hwang et al. among clients of the Boston Health Care for the homeless Program, a diagnosed mental illness appeared to be statistically associated with a higher percentage of health care contacts in the year prior to death (Hwang et al., 2001).On the other hand, among 'PMHc-' clients a high proportion of care avoiders is likely. This notion of care avoidance is supported by the finding of increased risks of suicide and death due to mental and behavioural disorders among 'PMHc-' clients compared to controls. This finding points to a high prevalence of mental health problems also among 'PMHc-' clients which are probably not diagnosed and appropriately treated.

The lower natural death among 'PMHc+' compared to 'PMHc-' clients appeared to be associated especially with the presence of a mood or psychotic disorder without a comorbid diagnosis of a SAD. This finding supports the supposition that the presence of a severe mental illness requiring chronic mental health care is favourably associated with lower rates of natural death causes. The increased suicide risk among 'PMHc+' clients appeared to be associated especially with the presence of a mood or psychotic disorder with a comorbid diagnosis of SAD. The differential effects of mental illness vs. SAD on mortality have been reported before (Beijer et al., 2011; Hwang et al., 1998; Nielsen et al., 2011; Nordentoft & Wandall-Holm, 2003). In a recent study in Stockholm, the excess mortality among homeless men and women was fully explained by the prevalence of SAD (Beijer et al., 2011). The presence of a comorbid SAD in addition to a chronic psychiatric disorder, the so-called dual diagnosis, is often associated with lower treatment adherence and hazardous health consequences (Drake et al., 1998; Wilk et al., 2006). This may explain our finding among 'PMHc+' clients with a mood or a psychotic disorder that presence of a comorbid SAD seemed to outweigh the favourable effects of receiving chronic psychiatric care on premature death.

Strengths and limitations

In the present study, we used the linkage between three data-sources to explore mortality, specific causes of death and its correlates among a large group of clients of the PMHc with more than 20,000 person years of observation. The proportion of 26.3% of client's records without valid linkage to the CBS was similar to earlier findings for the PCR-MN as a whole (21%) (Laan et al., 2011). Although it is a hard task to get and keep PMHc clients in follow-up studies, by using the population registry the vast majority could be followed from date of earliest registration until death or 31/10/2010. These dates were the pivotal variables in the analysis and may be regarded as highly reliable. Furthermore, the PCR-MN registers individual patient data of all psychiatric services in Utrecht and surroundings and,

thus, may be regarded as fairly complete. Although other external death causes may be spuriously registered as suicide, misclassification between natural death causes and suicide is less obvious. Thus, our rates of suicide may be overestimated but this does not explain the lower rates of natural death among 'PMHc+' clients.

The increased IRR of death among PMHc clients compared to the general population was adjusted for gender, age, and ethnic origin, as these factors were taken into account in the matching procedure. However, residual confounding may still be present due to other important factors that might explain the increased IRR, such as lower education and income, and lack of social capital. Thus, this study do not give insight into the precise mechanisms underlying the higher risk of death among the socially marginalized.

We found a high occurrence of psychiatric disorders and comorbid SAD, which is in accordance with earlier reports (Reinking et al., 2001; Fazel et al., 2008; Beijer & Andreasson, 2010; Folsom et al., 2005). However, our data were not suitable for valid prevalence estimates, as an important proportion of mental health problems remained probably undiagnosed. In addition, those PMHc clients with a PCR-MN record linkage were overrepresented in the final selection, as data from the PCR-MN were used to establish a link with the GBA. As a trend towards a lower mortality was found among those with a PCR-MN record linkage, the observed mortality gap between PMHc clients and the general population was probably even an underestimate. For this reason, our findings are not fully generalizable to the total population of marginalized persons. On the other hand, the comparison between the 'PMHc+' and 'PMHc-' clients was not influenced by this overrepresentation of 'PMHc+' clients.

We may question whether the group of PMHc clients is similar to the study populations in other studies. Among the PMHc clients included in the present analysis, a higher percentage of registered homelessness was found compared to the clients who were excluded because of insufficient data, which also restricts generalizability to all PMHc clients. But probably more important, the starting point of follow-up in earlier studies was often registration at a shelter for the homeless, whereas the PMHc also encompasses clients who are at high risk of homelessness. However, homelessness is not a trait, but often a temporary state. Thus, the follow-up in the studies among the homeless inevitably includes episodes of more stable housing or residence at psychiatric institutions. We found no difference in mortality between PMHc clients with and those without a registered episode of homelessness. However, this crude comparison is probably insufficient to capture the capricious course of living conditions and treatment trajectories and associated health risks among the socially marginalised.

In the present analysis, details on actually received psychiatric and physical health care were not taken into account. Thus, whether our finding of lower risk of natural

death among 'PMHc+' clients indicates a causal relationship with intensity and quality of delivered care is an issue that remains to be settled.

Albeit large numbers of person years were included in the analysis, the number of death events was limited, especially after splitting up this number in both categories of death causes and in categories of psychiatric diagnoses. Databases updated with more calendar years and/ or extended with data from other PMHc services are needed to further explore the relationship between specific psychiatric diagnoses and cause-specific mortality.

Conclusion

Services for mental health care may deliver an important contribution to the prevention of premature death among PMHc clients. The presence of a group of PMHc clients with high rates of suicide and death due to mental and behavioural disorders, but without a registered mental illness highlight the challenge for mental health services to get and keep PMHc clients into psychiatric care. Dual diagnosis patients form another important challenge in the prevention of premature death among the homeless and the socially marginalized.

References

Babidge, N. C., Buhrich, N., & Butler, T. (2001). Mortality among homeless people with schizophrenia in Sydney, Australia: A 10-year follow-up. *Acta Psychiatrica Scandinavica*, *103*, 105–110.

Barrow, S. M., Herman, D. B., Cordova, P., & Struening, E. L. (1999). Mortality among homeless shelter residents in New York City. *American Journal of Public Health*, *89*, 529–534.

Beijer, U., Andreasson, A., Agren, G., & Fugelstad, A. (2007). Mortality, mental disorders and addiction: A 5-year follow-up of 82 homeless men in Stockholm. *Nordic Journal of Psychiatry*, *61*, 363–368.

Beijer, U., & Andreasson, S. (2010). Gender, hospitalization and mental disorders among homeless people compared with the general population in Stockholm. *European Journal of Public Health*, *20*, 511–516.

Beijer, U., Andreasson, S., Agren, G., & Fugelstad, A. (2011). Mortality and causes of death among homeless women and men in Stockholm. *Scandinavian Journal of Public Health*, *39*, 121–127.

Carney, C. P., Jones, L., & Woolson, R. F. (2006). Medical comorbidity in women and men with schizophrenia: A population-based controlled study. *Journal of General Internal Medicine*, *21*, 1133–1137.

Carney, C. P., & Jones, L. E. (2006). Medical comorbidity in women and men with bipolar disorders: A population-based controlled study. *Psychosomatic Medicine*, *68*, 684–691.

Carney, R. M., Freedland, K. E., Miller, G. E., & Jaffe, A. S. (2002). Depression as a risk factor for cardiac mortality and morbidity: A review of potential mechanisms. *Journal of Psychosomatic Research*, *53*, 897–902.

Drake, R. E., Mercer-McFadden, C., Mueser, K. T., McHugo, G. J., & Bond, G. R. (1998). Review of integrated mental health and substance abuse treatment for patients with dual disorders. *Schizophrenia Bulletin*, *24*, 589–608.

Fazel, S., Khosla, V., Doll, H., & Geddes, J. (2008). The prevalence of mental disorders among the homeless in western countries: Systematic review and meta-regression analysis. *PLoS Medicine*, *5*, e225.

Folsom, D. P., Hawthorne, W., Lindamer, L., Gilmer, T., Bailey, A., Golshan, S., … Jeste, D. V. (2005). Prevalence and risk factors for homelessness and utilization of mental health services among 10,340 patients with serious mental illness in a large public mental health system. *American Journal of Psychiatry*, *162*, 370–376.

Hwang, S. W., Lebow, J. M., Bierer, M. F., O'Connell, J. J., Orav, E. J., & Brennan, T. A. (1998). Risk factors for death in homeless adults in Boston. *Archives of Internal Medicine*, *158*, 1454–1460.

Hwang, S. W., O'Connell, J. J., Lebow, J. M., Bierer, M. F., Orav, E. J., & Brennan, T. A. (2001). Health care utilization among homeless adults prior to death. *Journal of Health Care for the Poor and Underserved*, *12*, 50–58.

Hwang, S. W., Wilkins, R., Tjepkema, M., O'Campo, P. J., & Dunn, J. R. (2009). Mortality among residents of shelters, rooming houses, and hotels in Canada: 11 year follow-up study. *British Medical Journal*, *339*, b4036.

Laan, W., Termorshuizen, F., Smeets, H. M., Boks, M. P., de Wit, N. J., & Geerlings, M. I. (2011). A comorbid anxiety disorder does not result in an excess risk of death among patients with a depressive disorder. *Journal of Affective Disorders*, *135*, 284–291.

Nielsen, S. F., Hjorthoj, C. R., Erlangsen, A., & Nordentoft, M. (2011). Psychiatric disorders and mortality among people in homeless shelters in Denmark: A nationwide register-based cohort study. *Lancet*, *377*, 2205–2214.

Nordentoft, M., & Wandall-Holm, N. (2003). 10 year follow up study of mortality among users of hostels for homeless people in Copenhagen. *British Medical Journal*, *327*, 81.

Reinking, D. P., Wolf, J. R., & Kroon, H. (2001). [High prevalence of mental disorders and addiction problems among the home-

less in Utrecht]. *Nederlands Tijdschrift voor Geneeskunde*, *145*, 1161–1166.

Saha, S., Chant, D., & McGrath, J. (2007). A systematic review of mortality in schizophrenia: Is the differential mortality gap worsening over time? *Archives of General Psychiatry*, *64*, 1123–1131.

Smeets, H. M., Laan, W., Engelhard, I. M., Boks, M. P., Geerlings, M. I., & de Wit, N. J. (2011). The psychiatric case register middle Netherlands. *BMC Psychiatry*, *11*, 106.

Smit, R. B., van Bergen, A. P., & van Ameijden, E. J. (2012). Changes in insurance status of a cohort public mental health clients in Utrecht after the introduction of a new health insurance system: The impact of intensified case management. In A. Fagerland & E. Abrahamsen (Ed.), *Health insurance* (pp. 37–55). New York: Nova Science Publishers.

van Laere, I., deWit, M., & Klazinga, N. (2009). Shelter-based convalescence for homeless adults in Amsterdam: A descriptive study. *BMC Health Services Research*, *9*, 208.

Wilk, J., Marcus, S. C., West, J., Countis, L., Hall, R., Regier, D. A., & Olfson, M. (2006). Substance abuse and the management of medication nonadherence in schizophrenia. *Journal of Nervous and Mental Disease*, *194*, 454–457.