31 Murdie R, Teixeira C. The impact of gentrification on ethnic neighbourhoods in Toronto: a case study of Little Portugal. *Urban Stud* 2011;48:61–83.

32 Navarro Yáñez CJ. Do 'creative cities' have a dark side? Cultural scenes and socioeconomic status in Barcelona and Madrid (1991–2001). *Cities* 2013;35:213–20.

33 Phillips D, Harrison M. Constructing an integrated society: historical lessons for tackling black and minority ethnic housing segregation in Britain. *Hous Stud* 2010;25:221–35.

34 Rankin KN, McLean H. Governing the commercial streets of the city: new terrains of disinvestment and gentrification in Toronto's inner suburbs. *Antipode* 2015;47:216–39.

35 Shaw K. Independent creative subcultures and why they matter. *Int J Cult Policy* 2013;19:333–52.

36 Slater T. Gentrification of the city. In: Bridge G, Watson S, editors. *The New Blackwell Companion to the City*. Oxford, UK: Wiley-Blackwell, 2012: 571–85.

37 Arbacia S, Tapada-Berteli T. Social inequality and urban regeneration in Barcelona city centre: reconsidering success. *Eur Urban Reg Stud* 2012;19:287–311.

38 Mallach A. Managing Neighborhood Change: A Framework for Sustainable and Equitable Revitalization [Internet]. National Housing Institute; 2008, p. 28. Available at: http://www.nhi.org/pdf/ManagingNeighborhoodChange.pdf

39 Camprubí L, Malmusi D, Mehdipanah R, et al. Façade insulation retrofitting policy implementation process and its effects on health equity determinants: A realist review. *Energy Policy* 2016;91:304–14.

The European Journal of Public Health, Vol. 28, No. 2, 248–252

doi:10.1093/eurpub/cky002 Advance Access published on 4 February 2018

Unnatural death: a major but largely preventable cause-of-death among homeless people?

Marcel T. Slockers, Wilma J. Nusselder, Judith Rietjens, Ed F. van Beeck

Department of Public Health, Erasmus MC, University Medical Center Rotterdam, Rotterdam, The Netherlands

Correspondence: Marcel T. Slockers, Rijnwaterstraat 10, 3063HC Rotterdam, The Netherlands, Tel: +31104526363, Fax +31 104525413, e-mail: slockers@knmg.nl

Background: We aimed to assess the contribution of specific causes-of-death to excess mortality of homeless persons and to identify differences in cause-specific mortality rates after vs. before implementing social policy measures. **Methods:** We conducted a register based 10-year follow-up study of homeless adults in Rotterdam and calculated the proportion of deaths by cause-of-death in this cohort in the period 2001–2010. We estimated cause-specific mortality among the homeless compared to the general population with Standardized Mortality Ratios. We calculated Hazard Ratios adjusted for age and sex to compare mortality rates by cause-of-death among the homeless in the period after (2006–2010) vs. before (2001–2005) implementing social policy measures. **Results:** Our cohort consisted of 2130 homeless persons with a mean age of 40, 3 years. Unnatural death, cardiovascular disease and cancer were the main causes of death. Compared to the general population of Rotterdam, the homeless had an excess risk of death for all causes. The largest mortality differences with Rotterdam citizens were observed for unnatural death (SMR 14.8, CI 11.5–18.7), infectious diseases (SMR 10.0, CI 5.2–17.5) and psychiatric disorders (SMR 7.7, CI 4.0–13.5). Mortality due to intentional injuries (suicide and homicide) differed significantly between the two study periods (HR 0.45, CI 0.20–0.97). **Conclusions:** Reducing unnatural death should be a target in social policies aimed at improving the health of the homeless. We generated the hypothesis that social policies aimed at housing, work and improved contact with health care could be accompanied by less suicides and homicides within this vulnerable group.

Introduction

Both in the European Union and the USA around half a million persons are homeless on any given day.[1–2] Homeless people have higher rates of premature mortality than the rest of the population, which is most evident among younger people.[2–6] This result in a largely reduced life expectancy, e.g homeless persons losing 14–16 life years in the Netherlands[7] and losing 17–22 life years in Denmark.[8]

The contribution of specific causes-of-death to this excess mortality has not been studied extensively yet due to difficulties to reach out this vulnerable population. A limited number of studies in a few countries have shown an increased proportion of deaths resulting from substance misuse,[9] accidents, suicide and homicide[1,2,10,11] and mental disorders, infectious diseases and ischaemic heart disease.[1]

According to several review studies social policy interventions may improve the health status of the homeless.[1,12–14] Many different types of interventions, including case management, are effective in the reduction of substance misuse.[12,13] For homeless people with substance abuse provision of housing is associated with decreased substance use, and health promotion programs can decrease risk behaviours among homeless populations.[14] Programmes focused on high risk groups, such as individuals leaving prisons and psychiatric hospitals and the introduction of national and state wide plans that target homeless people are likely to improve the mental health status of the homeless[1]

In the Netherlands, in 2006 social policy measures were introduced in the four largest cities aimed at housing and access to community services and medical care of the homeless. The Dutch Government, together with the four major Dutch cities (Amsterdam, Rotterdam, The Hague and Utrecht) started an

ambitious programme to guide all homeless persons into temporary care and social rehabilitation and subsequently into clustered or individual supported housing projects. Since 2006, substantial local policy efforts have been made in Rotterdam, which have led to large improvements of the living conditions of the homeless in this city. Homeless people were supported with housing projects with guidance into jobs, daytime activities and social education. They received psychiatric support and help with controlling their drug and alcohol addiction. In 2010, a policy evaluation showed that 3634 homeless persons had started an individual help trajectory and 2108 homeless people had been provided with housing for at least 3 months, were acquiring a legal income and had stable contacts with community services.[15] These measures showed a positive effect on feelings of safety and other social outcome measures, but not on total mortality rates of homeless in the city of Rotterdam.[16]

The latter was established in a cohort of homeless persons visiting a facility for this group in 2001. Within this cohort we further analyzed the contribution of specific causes-of-death to the excess mortality of homeless persons and we compared mortality rates among the homeless before and after the implementation of the Dutch social policy measures. This explorative study addressed the following research questions:

(1) What is the contribution of specific causes-of-death to the excess mortality of homeless persons in Rotterdam?
(2) Can we identify differences in cause-specific mortality rates before vs. after implementing social policy measures in Rotterdam?

Methods

Study design and population

We conducted a register-based 10-year follow-up study of homeless adults (20+), who visited one or more institutions providing care to homeless people in Rotterdam in 2001. Institutions providing services to homeless people ranging from the provision of meals to night care facilities and convalescence care were approached to provide full name, date of birth and sex of persons who visited their facility in 2001. This information was largely available because in 2001 homeless people were counted for research purposes.[17] Both institutions subsidized by the local government and services provided by the church were included, covering services at different locations in Rotterdam. To construct a database for this project on mortality among the homeless we pooled the lists from the different facilities, which yielded 5810 records; removal of duplicates with same name, initials/surname, date of birth and sex yielded 3398 persons. We used a restrictive matching procedure to ensure that for all matched persons we could determine in the municipal population registers whether (and if so when) that person had died. Of the 3398 persons in our cohort, 2159 provided a match with the municipal population registers (which include information on vital status and date of death). A total of 7 persons had died before the start of the follow-up (leaving 2152). Persons below age 18 were excluded (leaving 2130).

Mortality data

Data on mortality within this cohort were extracted from the municipal population registers with national coverage, extended with other registries (i.e. from general practice, health insurance and municipal public mental health care). In total 265 homeless persons died between 2001 and 2010. To identify their causes of death, our cohort data were linked to non-public microdata from Statistics Netherlands. We were unable to link 4 deaths to the cause-of-death database of Statistics Netherland We used the International Classification of Diseases (ICD 10) to classify all fatalities in 8 main categories: unnatural death (V010-Y899), infectious diseases (A000-B999), cardiovascular diseases (I000-I999), cancer (C000-D489), psychiatric disorders (F000-F999), respiratory diseases (J000-J999), gastrointestinal diseases (K000-K939) and,- other diseases (all other ICD 10 codes). Unnatural deaths could be further subdivided into: intentional injury (suicide and homicide combined),- accidental poisoning, -other accidents (all accidents other than poisoning combined, e.g. traffic accidents, accidental falls, accidental drowning, burns). To prevent personal identifications within our small dataset ($n = 261$), further distinctions were not allowed. We could therefore not separately study homicide deaths, but in addition to the combined category 'intentional injury' separate results for suicide could be produced.

Data on mortality by cause of death for the population in Rotterdam were obtained from Statistics Netherlands (http://statline.cbs.nl).

Statistical analysis

For the total period 2001–2010 we calculated the proportion of death by cause-of-death. We also calculated Standardized Mortality Ratios (SMRs) for this period to estimate excess mortality by cause-of-death among the homeless compared to the general population of Rotterdam. In the Netherlands, social policy measures to improve the living conditions of the homeless in the four largest cities were introduced in 2006. We calculated Hazard Ratios adjusted for age and sex to compare mortality rates by cause-of-death among the homeless in the period after (2006–2010) vs. before (2001–2005) implementing these measures. We started with a model without period, including only age classes and gender as independent variables, and compared this with a model with in addition period (dichotomous). A significant HR for period indicates that the mortality hazard differs significantly between the two periods.

Results

The presented cohort consisted of 1870 men and 260 women. The mean age was 40.3 years. The mean follow up was 8.4 years and a total of 17909 persons years were observed. In total 265 homeless persons died during follow up (232 men-and 33 women). For 261 deaths the cause of death information was available.

In this cohort, unnatural death (26%, CI 21–32%), cardiovascular disease (22%, CI 17–22%) and cancer (17%, CI 13–22%) were the main causes-of-death (table 1). Intentional injuries (suicide and homicide) caused 50% of all unnatural deaths in the homeless. In total there were 34 deaths for intentional injury, of which 25 for suicide.

With a share of 26% unnatural death was a much larger cause-of-death in the homeless than in the general population of Rotterdam (4%).

Compared to the general population the homeless had an excess risk of death for all causes. The largest mortality differences with Rotterdam citizens were observed for unnatural death (14.8, CI 11.5–18.7), infectious diseases (10.0, CI 5.2–17.5) and psychiatric disorders (7.7 CI 4.0–13.5) (table 2).

We found an excess risk of death for intentional injury (SMR 14.4, CI 10. 0–20.1), suicide (SMR 14.2, CI 9.2–20.9) accidental poisoning (SMR 40.2, CI 23.8–63.6) and other accidents (SMR 9.2, CI 5.4–14.7).

After the implementation of social policy measures in 2006 the mortality rates of most specific causes-of-death did not differ significantly as compared to the period before 2006 with the exception of intentional injury mortality (Hazard Ratio 0.45, CI 0.20–0.97) and mortality due to other diseases (Hazard ratio 0.48, CI 0.24–0.99) (table 3). When looking separately at suicide a non-significant change in mortality before and after 2006 could be established [Hazard Ratio 0.53 (0.23–1.22), p 0.12].

Table 1 Proportion (%, CI) of deaths by cause-of death in a Dutch homeless cohort and Rotterdam population, 2001–2010

	Homeless, % (95% CI)	Rotterdam population, % (95% CI)
Infectious diseases	*0.05 (0.03–0.08)*	*0.02 (0.01–0.02)*
Cancer	*0.17 (0.13–0.22)*	*0.27 (0.27–0.27)*
Psychiatric disorders	*0.05(0.03–0.08)*	*0.05 (0.05–0.06))*
Cardiovascular diseases	*0.22 (0.17–0.27)*	*0.31 (0.31–0.32)*
Respiratory diseases	*0.06 (0.03–0.10)*	*0.10 (0.10–0.10)*
Gastrointestinal diseases	*0.07 (0.05–0.11)*	*0.05 (0.04–0.06)*
Other diseases[a]	*0.13 (0.09–0.17)*	*0.16 (0.16–0.16)*
Unnatural death[b]	0.26 (0.21–0.32)	0.04 (0.04–0.04)
Accidental poisoning	0.07 (0.04–0.11)	0.00 (0.00–0.01)
Other accidents[c]	0.06(0.04–0.10)	0.02 (0.02–0.03)
Intentional injury	0.13 (0.09–0.18)	0.01 (0.01–0.01)
-Suicide	0.11 (0.07–0.15)_	0.01 (0.01–0.01)

a: Mainly unpecified or ill-defined disorders (50%), endocrine diseases (20%) and neurologic diseases (20%).
b: Unnatural death includes unintentional injuries (accidental poisoning and other accidents) and intentional injuries (suicide and homicide).
c: Other accidents: all accidents other than poisoning combined, e.g. traffic accidents, accidental falls, accidental drowning, burns.

Table 2 Standardized Mortality Ratios (SMR) of deaths of homeless persons (Rotterdam, 2001–2010) compared to the general Rotterdam population by cause-of-death

	SMR (95% CI)
Infectious diseases	10.0 (5.2–17.5)
Cancer	2.0 (1.5–2.7)
Psychiatric disorders	7.7 (4.0–13.5)
Cardiovascular diseases	3.7 (2.8–4.7)
Respiratory diseases	3.7-(2.0–6.0)
Gastrointestinal diseases	6.6 (4.0–10.4)
Other diseases[a]	3.0 (2.1–4.2)
Unnatural death[b]	14.8 (11.5–18.7)
Accidental poisoning	40.2 (23.8–63.6)
Other accidents[c]	9.2 (5.3–14.7)
Intentional injury	14.4 (10.2–20.1)
-Suicide	14.2 (9.2–20.9)

a: Mainly unpecified or ill-defined disorders (50%), endocrine diseases (20%) and neurologic diseases (20%).
b: Unnatural death includes unintentional injuries (accidental poisoning and other accidents) and intentional injuries (suicide and homicide).
c: Other accidents: all accidents other than poisoning combined, e.g. traffic accidents, accidental falls, accidental drowning, burns.

Table 3 Mortality in a Dutch homeless cohort after (2006–2010) vs. before (2001–2005) implementing social policy measures

	Hazard Ratio 2006–2010 vs. 2001–2005 (95% CI)	*P* value
Infectious diseases	*0.51 (0.15–1.76)*	*0.28*
Cancer	*0.51 (0.15–1.76)*	*0.51*
Psychiatric disorders	*2.44 (0.66–9.09)*	*0.16*
Cardiovascular diseases	*1.39 (0.81–2.39)*	*0.23*
Respiratory diseases	*0.84 (0.30–2.32)*	*0.73*
Gastrointestinal diseases	*2.17 (0.78–6.07)*	*0.12*
Other diseases[a]	0.48 (0.24–0.99)	0.04*
Unnatural death[b]	0.68 (0.41–1.12)	0.12
Accidental poisoning	*0.84 (0.32–2.19)*	*0.83*
Other accidents[c]	*1.10 (0.42–2.90)*	*0.84*
Intentional injury	*0.45 (0.20–0.98)*	*0.03**
-Suicide	*0.53 (0.23–1.22)*	*0.12*

a: Mainly unpecified or ill-defined disorders (50%), endocrine diseases (20%) and neurologic diseases (20%).
b: Unnatural death includes unintentional injuries (accidental poisoning and other accidents) and intentional injuries (suicide and homicide).
c: Other accidents: all accidents other than poisoning combined, e.g. traffic accidents, accidental falls, accidental drowning, burns.
*: *P* values < *0.05.*

Discussion

In a Dutch homeless cohort, the three main causes of death were unnatural death, cardiovascular diseases and cancer. Compared to the general population of Rotterdam the homeless had an excess risk of death for all causes. The largest mortality differences with non-homeless citizens were observed for unnatural death, infectious diseases and psychiatric disorders. Unnatural causes were responsible for one quarter of all deaths among the homeless, i.e. a much larger share than in the general population of Rotterdam. The mortality due to intentional injuries, which caused one half of all unnatural deaths, differed significantly between the two study periods: after vs. before the implementation of social policy measures.

Our finding that the homeless had an excess risk of death for all causes is in line with findings reported in a review about descriptive epidemiology of the health of homeless people.[1] This review further showed causes of excessive mortality to be infections (HIV, tuberculosis), ischaemic heart disease, substance misuse, and external causes including unintentional injuries, suicides, homicides and accidental poisoning (from medication and illicit substances). Our study confirmed highest excess mortality from infectious diseases, psychiatric disorders and unnatural death, with high excess mortality for accidental poisoning (including drug overdoses) and intentional injury (suicide and homicide). The proportion of unnatural deaths, i.e. 26%, in our homeless cohort almost equals the results of a large Danish study that found 28% unnatural deaths (as a proportion of almost 5000 fatal cases).[8]

We obtained our results in a comprehensive sample of homeless men and women using a wide range of services provided by both local communities and the church. Another strength of our study is the availability of reliable and valid data on unnatural causes of death. In the Netherlands, all deaths due to accidents, suicide and violence are assessed and confirmed by forensic specialists of the municipality. Statistics Netherlands uses a standard procedure for this aim, which has remained unchanged between 2001 and 2010 and justifies the absence of registration bias in our comparison of two time periods.

But our study has some limitations as well. Homeless people who did not use any local service in 2001 were not included, not all institutes could provide data for the year 2001, persons without a legal status could not be matched, and homeless persons dying in other countries after migration were missed. Moreover, we had a small study sample for an analysis of mortality by specific causes-of-death. For several causes-of-death we observed rather wide confidence intervals in the Standardized Mortality Ratios and Hazard Ratios, and due to low numbers we were not allowed to conduct separate analyses for men and women or in-depth analyses for small causes-of-death (e.g. homicide). It should also be considered that our study design, i.e. an uncontrolled before-after study, has shown ecological associations between social policy measures and mortality reductions, which may generate hypotheses but does not allow conclusions on causal relationships. Another limitation is that we compared the hazard of mortality in the period 2001–2005 with the hazard of mortality in the period 2006–2010 for a cohort of homeless persons that were identified as such in 2001, without knowing whether they were still homeless in 2006 and without knowing the level of enrolment in the social

programmes that were provided. Because of these limitations it is not possible to attribute the difference in hazard rates between periods to the social policies.

It should also be considered that we did tests for all presented cause-of-death categories and spurious results due to multiple testing can therefore not be excluded.

The findings from our explorative study are in line with previous research, suggesting shifts in cause-of-death patterns after introducing social policy measures. We observed that after the implementation of social policy measures in the city of Rotterdam in 2006 mortality rates due to intentional injuries (suicide and homicide) were reduced, whereas total mortality rates remained unchanged.[16] These results suggest a shift in the cause of death pattern within our homeless cohort with a reduced contribution of unnatural death. The policy efforts after 2006 included temporary care and social rehabilitation. People were supported with housing projects with guidance into jobs and social education. They received psychiatric support and help with their addiction. Comparable social programs in large cities in the USA were also accompanied by shifts in the main causes of death among the (formerly) homeless. Baggett at al showed that despite expansion of services (mainly expansion of federally funded Health Care for the Homeless clinical services), the excess mortality of homeless people in Boston remained similar during the past two decades, but shifts in the causes of death occurred with fewer deaths from HIV infection and more from drug overdose and substance misuse disorders[9]. Henwood et al showed that of the participants of a Housing First program in Philadelphia (i.e. a program offering access to housing combined with ongoing community support services) only 15% died from unnatural death (accidents, suicide and homicide) compared to 49% of those staying homeless. Simultaneously the proportion of deaths due to the main natural causes (i.e. cardiovascular disease and cancer) rose to 51% in the Housing First participants compared to 30% in the homeless[10].

Because of the discussed limitations of our study design the observed reduction of deaths due to intentional injuries cannot be attributed to the social policy measures, but seems nevertheless relevant from a policy perspective. Our explorative study has generated the hypothesis that social policies providing housing, supporting the acquisition of a legal income and improving contacts with community and (mental) health care services could be accompanied by less suicides and homicides among the homeless. Mental health problems are highly prevalent among the homeless[18] and are associated with elevated suicide risks,[19] which can be further exacerbated by hopelessness, i.e. generalized negative expectations about the future.[20] We hypothesize that the Dutch social policy measures may have improved mental health and reduced hopelessness among the homeless thereby contributing to less self-harm and suicides within this vulnerable group. In addition, these measures have provided housing for many formerly homeless and may have reduced their exposure to several risks of living in the street. It has been shown that the safety index of Rotterdam improved after 2006 with a decreased street use of illegal drugs (including cocaine, which may lead to agitation, loss of impulse control and an elevated risk of intentional injury) and a reduction of violent crimes.[21]

The Dutch social policy measures were not accompanied by a mortality reduction in chronic diseases. We previously hypothesized that our cohort of homeless persons carries the burden of a long previous history of homelessness, unhealthy living circumstances and lifestyles (e.g. long-term use of alcohol and illicit drugs, heavy smoking) and related chronic health problems (e.g. atherosclerosis and chronic obstructive lung disease).[16] This may have induced permanent damage to several organ systems that cannot be reversed by any social policy and explains why a short-term effect on chronic disease mortality was not found. This is in line with previous research, suggesting that adverse health outcomes among long-term homeless persist after individuals obtain housing.[22]

But why did total mortality among the homeless remain unchanged in spite of large and significant mortality reductions related to intentional injury? After 2006 the homeless started to lead safer life's with community guidance in protected housing. Their lifestyles however, have not necessarily become healthier as well and novel habits and conditions (e.g. lack of movement, sugar addiction and obesity) could have further compromised their bad health status. This could have induced an increase in cardiovascular disease mortality. In our study, we observed this type of trend, which was however not significant. We therefore hypothesize that after the implementation of social policy measures a substantial number of suicides and homicides could be prevented among homeless persons already suffering from a severely compromised health status due to a variety of natural causes. Within this very vulnerable group unnatural deaths prevented are instantaneously replaced by competing natural death risks and total mortality remains unchanged. In our cohort similar mechanisms could be involved as in Housing First (HF) participants in the USA, who have a higher disease burden and are more vulnerable to death than those who remain on the street.[10] This mechanism is called 'vulnerability indexing': individuals with the most severe medical conditions and the highest risk of death receive priority for placement in housing or other support.[23] We hypothesize that vulnerability indexing may have prioritized social help for homeless with the highest care needs and may have induced suicide and homicide prevention in—mainly—the most severely ill persons in our cohort.

Our findings have implications for policymakers, public health professionals, and general practitioners and clinicians serving this population. Reducing unnatural death should be an important target in social policies aimed at improving the health of the homeless. We generated the hypothesis that social policies providing housing, supporting the acquisition of a legal income and improving contacts with community and (mental) health care services could be accompanied by less suicides and homicides within this vulnerable group.

Ethics statement

The Medical Ethical Review Committee of the Erasmus MC declared that this study was not subject to the Law on Medical research with human beings and had no objections to its performance.

Conflicts of interest: None declared.

Funding

This study was supported by a grant from the Municipal Health Service (GGD) Rotterdam-Rijnmond en The Netherlands Organization for Health Research and Development.

Data

This paper presents results based on calculations by Erasmus MC using non-public microdata from Statistics Netherlands. Under certain conditions, these microdata are accessible for statistical and scientific research. For further information: microdata@cbs.nl.

Key points

- Unnatural death is a leading cause of mortality in a cohort of homeless persons in Rotterdam.
- Compared to the general population of this city, the homeless in Rotterdam have a 15-fold higher risk to die from unnatural causes.
- Half of all unnatural deaths in this cohort are caused by intentional injuries: suicide and homicide.

- Mortality due to intentional injury differed significantly between two study periods: after vs. before implementation of social policy measures.

References

1 Fazel S, Geddes JR, Kushel M. The health of homeless people in high-income countries: descriptive epidemiology, health consequences, and clinical and policy recommendations. *Lancet* 2014; 384:1529–40.

2 Nordentoft M, Wandall-Holm N. 10 year follow up study of mortality among users of hostels for homeless people in Copenhagen. *BMJ* 2003;327:81.

3 Beijer U, Andreasson S, Ågren G, Fugelstad A. Mortality and causes of death among homeless women and men in Stockholm. *Scand J Public Health* 2011;39:121–7.

4 Hwang SW. Mortality among men using homeless shelters in Toronto, Ontario. *JAMA* 2000; 283:2152–7.

5 Morrison DS. Homelessness as an independent risk factor for mortality: results from a retrospective cohort study. *Int J Epidemiol* 2009;38:877–83.

6 Hwang SW, Wilkins R, Tjepkema M, et al. Mortality among residents of shelters, rooming houses, and hotels in Canada: 11 year follow-up study. *BMJ* 2009;339:b4036.

7 Nusselder WJ, Slockers MT, Krol L, et al. Mortality and life expectancy in homeless men and women in Rotterdam: 2001–2010. *PLoS One* 2013;8:e73979.

8 Nielsen SF, Hjorthoj CR, Erlangsen A, Nordentoft M. Psychiatric disorders and mortality among people in homeless shelters in Denmark: a nationwide register-based cohort study. *Lancet* 2011;377:2205–14.

9 Baggett TP, Hwang SW, O'Connell JJ, et al. Mortality among homeless adults in Boston: shifts in causes of death over a 15-year period. *JAMA Intern Med* 2013; 173:189–95.

10 Henwood BF, Byrne T, Scriber B. Examining mortality among formerly homeless adults enrolled in Housing First: an observational study. *BMC Public Health* 2015; 15:1209.

11 Feodor Nilsson S, Hjorthøj CR, Erlangsen A, Nordentoft M. Suicide and unintentional injury mortality among homeless people: a Danish nationwide register-based cohort study. *Eur J Public Health* 2014; 24:50–6.

12 Hwang SW, Burns T. Health interventions for people who are homeless. *Lancet* 2014; 384:1541–7.

13 Fitzpatrick-Lewis D, Ganann R, Krishnaratne S, et al. Interventions to improve the health of the homeless: a systematic review. *Am J Prev Med* 2005; 29:311–9.

14 Fitzpatrick-Lewis D, Ganann R, Krishnaratne S, et al. Effectiveness of interventions to improve the health and housing status of homeless people: a rapid systematic review. *BMC Public Health* 2011; 11:638.

15 Tuynman M, Planije M, Place C. Monitor Plan van Aanpak Maatschappelijke Opvang: rapportage 2010 Amsterdam, Den Haag, Rotterdam en Utrecht. Utrecht, Trimbos Instituut, 2011 (in Dutch).

16 Slockers MT, Nusselder WJ, Looman CW, et al. The effect of local policy actions on mortality among homeless people: a before-after study. *Eur J Public Health* 2015;25:290–2.

17 Jansen H, Kolk R, Maaskant J, Stoele M. Dak- en thuislozen monitor 2001–2002. Instituut voor Onderzoek naar leefwijzen en verslaving. Rotterdam, Sociale Zaken en Werkgelegenheid, 2002 (in Dutch).

18 Fazel S, Khosla V, Doll H, et al. The prevalence of mental disorders among the homeless in Western countries: systematic review and meta-regression analysis. *PLoS Med* 2008; 5:e225.

19 Termorshuizen F, van Bergen AP, Smit RB, Smeets HM, van Ameijden EJ. Mortality and psychiatric disorders among public mental health care clients in Utrecht: A register-based cohort study. *Int J Soc Psychiatry* 2014;60:426–35.

20 Steeg S, Haigh M, Webb RT, et al. The exacerbating influence of hopelessness on other known risk factors for repeat self-harm and suicide. *J Aff Dis* 2016;190: 522–8.

21 *Veiligheidsindex 2012. Meting Van Veiligheid in Rotterdam*. Rotterdam: Gemeente Rotterdam, 2012.

22 O'Connell JJ. *Premature Mortality in Homeless Populations: A Review of the Literature*. Nashville: National Health Care for the Homeless Council, 2005.

23 Kanis R, McCannon J, Craig C, Mergl KA. An end to chronic homelessness: an introduction to the 100,000 homes campaign. *J Health Care Poor Underserved* 2012; 23:321–6.