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Mortality among homeless people in France, 2008-2010

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Abstract

Background

Studies in various countries have shown that homeless people have high mortality levels. The aims of this study concerning the French population were to investigate mortality among the homeless and to study their causes of death in comparison to those of the general population.

Methods

A representative sample of 1145 homeless deaths registered by an association was matched to the national database of medical causes of death using common descriptive variables. Log-binomial regression was used to compare mortality among the homeless to that of the general population. Multiple imputation was used to manage missing causes of deaths.

Results

Out of the 1145 registered homeless deaths, 693 were matched to the causes of death database. Homeless deaths were young (average age: 49). Overall, homeless deaths were slightly more frequent during winter. Among all deaths, the probability of being homeless was higher when dying from hypothermia (RR=6.4), alcohol-related deaths (RR=1.7), mental disorders, diseases of the digestive and circulatory systems, and undetermined causes (RR from 1.5 to 3.7).

Conclusion

The homeless died at 49 years old on average compared to 77 in the general population in 2008-2010. The health of homeless people should be considered not only in winter periods or in terms of alcohol- or cold-related conditions. This study also highlights the need for more precise data to estimate the mortality risks of the homeless in France.

Keywords: homeless; mortality; causes of death; matching databases.

INTRODUCTION

Homeless people have higher rates of premature mortality than the rest of the population. Studies in the United States¹⁻⁶, Canada⁷⁻¹⁰ and Europe¹¹⁻¹⁹ conducted since the 80s have found that mortality rates among the homeless are 3 to 13 times higher than those in the general population. The data used in these studies to examine mortality among homeless people was scarce and of uneven quality. While the by-cause distribution of mortality in these countries among the homeless varied from one study to another, the leading causes were generally cardiovascular diseases, accidents, intoxication and suicide. Homicides within the homeless are more frequent in United States cities, while suicides are more frequent in Europe and in Canada. Noticeably, the proportion of undetermined causes was very large in some studies, with 4 studies including more than 20% of deaths notified as due to unknown cause.^{3,4,10,15}

In the second half of 2012, approximately 144 000 people in France were homeless.²⁰ Between 2008 and 2010, approximately 6500 homeless people died as estimated by a capture-recapture method, highlighting the public health importance of mortality among this population.²¹

According to the media and to public policies on homelessness, alcohol and cold are responsible for a majority of deaths.²² However, no epidemiological studies have focused on the causes of mortality among homeless people in France.²³ Only a few local studies have provided a limited number of observations²⁴⁻²⁷.

The aim of this study was to investigate mortality among the homeless in France. The objectives were to describe the main demographic characteristics of homeless deaths and the leading causes of deaths and to compare the mortality distribution of the homeless with that of the general population from January 2008 to December 2010.

METHODS

CMDR database

“Le Collectif les Morts de la rue” (the “deaths from the street” association, hereafter called the CMDR) is an association considered to be the most exhaustive source of homeless death records in

France.²⁸ It seeks to alert political decision makers about the health conditions of the homeless and to help the relatives of the homeless in the grieving process.

The CMDR recorded 1145 homeless deaths from January 2008 to December 2010, mainly thanks to informal declarations (associations, media, institutions and relatives)

CépiDc database

The death certificate comprises an administrative and a medical part. The INSEE (National Institute of Statistics and Economic Studies) manages the administrative part, which contains the name of the deceased and information related to civil status. The CépiDc (Epidemiology Centre on Medical Causes of Death) manages the non-nominative medical part, which contains the medical causes of death, dates of birth and death, and cities of residence and death. Causes are then coded according to the International Classification of Disease, 10th revision (ICD-10). The CépiDc registered over 1.6 million deaths occurring in France between 2008 and 2010.

Merging the two databases

The CépiDc database does not contain any nominative data or direct identifier. To combine the homeless deaths of the CMDR database with their medical information from the CépiDc database, record matching was performed by using common descriptive variables (age, sex, birth and death dates, place of birth and death, birth and death locations, and causes of death). Permission was obtained from the French Commission for Data Protection and Liberties to merge both files. The matching process is extensively detailed elsewhere.²¹

Out of the 1145 deaths in the CMDR database, 693 were matched with the CépiDc database (60%).

Causes of death

On the death certificate, the medical officer has to indicate the underlying cause of death that initiated the morbid process leading to death. There may also have been causes associated with the death but not directly causing it. To analyse mortality by-cause, the underlying cause reported in the CépiDc database was primarily considered. In addition, cold- or alcohol-related deaths were defined by using a multiple cause approach (cold- or alcohol-related mentioned as one of the causes of death and not only as the underlying cause).

The causes of death were grouped according to seven chapters of the ICD: diseases of the circulatory system (I00-I99), mental and behaviour disorders (F00-F99), neoplasms (C00-D48), digestive system diseases (K00-K93), external causes (V01-Y98), ill-defined and unknown causes (R95-R99) and other causes. Cold-related diseases were defined as exposure to excessive natural cold (X31) and hypothermia (T68, R680). Alcohol-related diseases²⁹ were malignant neoplasm of the lip, oral cavity and pharynx (C00-C14), of the oesophagus (C15), larynx (C32), alcoholic liver disease (K70), alcohol-induced chronic pancreatitis (K860), and mental and behavioural disorders due to alcohol use (F10).

Ill-defined and unknown causes

During the study period, some forensic institutes, such as the one in charge of investigating suspicious deaths in the Paris area, did not send the medical part of the death certificates of investigated deaths to the CépiDc.²³ In this case the cause of death was coded R99. This could have specifically affected the by-cause mortality distribution in the Paris area due to the large proportion of unknown causes of deaths, mostly those occurring in the street. These unknown causes are not distributed at random as they are more likely to hide external causes. Hence, the by-cause distribution of homeless deaths was studied twice: using the entire sample and stratifying by the region of death (Paris region/others regions).

We considered deaths with an underlying cause coded R96 to R99 (“other sudden death, cause unknown”, “unattended death”) as having a missing cause and deaths coded R00 to R95 as having “ill-defined and unknown causes”. To handle the missing causes of death, we performed analyses using multiple imputation as recommended in the literature.³⁰ This approach relies on the assumption that the causes are missing at random (MAR), that is, that the missingness probability does not depend on the actual cause of death conditionally on other observed variables. Estimates of parameters of interest were averaged across five imputed datasets to obtain the final estimates. Standard errors were computed according to Rubin’s rules.³¹

Statistical analysis

We compared the proportion of homeless deaths to those in the general population by applying different categories of interest, to see whether the homeless were relatively overrepresented in certain

groups. For this purpose, we used a log-binomial model ^{32,33} which included the following variables: age, gender, season, location, region, year and causes of death (leading). The factor “location of death” was divided into 4 classes: housing (staying with friend, relatives, or foster family), hospital, public area and others (emergency shelter, caravan, squatting, prison...).

In a second step, we compared the mortality distributions of the homeless and general populations for cold- or alcohol-related deaths (multiple cause approach). The factors used in this second model were the same as those in the first model but without the leading causes.

All factors associated with mortality at $p < 0.05$ level were included in multivariate models (the first with the leading cause and the second with cold- and alcohol- related causes as explanatory variables). We explored seasonal distribution according to the location of death because of a significant interaction between season and location of death ($p < 0.001$). All analyses were carried out using the R package ‘mice’ (package implementing multiple imputation of incomplete multivariate data according to the principle of Fully Conditional Specification).³⁴

RESULTS

Characteristics of homeless mortality

Out of 1145 deaths registered by the CMDR in this period, 693 were matched with the CépiDc database. Homeless men accounted for more than 90% of homeless deaths (Table 1). Among the homeless, the mean age at death was 49 years. More than 80% of homeless deaths occurred between the ages of 30 and 65. In comparison, deaths in the general population had a mean age at death of 77 with 80% of deaths occurring after 65 years of age. Among the homeless, the frequency of death was higher in winter and in fall ($p = 0.002$). Homeless deaths were more frequent in hospitals (39%) and in public places (27%) ($p < 0.001$). Deaths in the general population were also more frequent in winter (28%) and in hospitals (57%) ($p < 0.001$).

Leading causes of homeless death

The leading causes of death among the homeless were external causes (20%), neoplasms (18%), diseases of the circulatory system (11%), digestive system (7%), mental and behaviour disorders (7%), and other causes (9%) (Table 2). Ill-defined or unknown causes were numerous in the homeless

(28%). Half of the causes of death were natural (neoplasm, mental disorders, diseases of the circulatory, digestive, respiratory and nervous systems). Unintentional accidental causes (transport accident, drowning, falls, poisoning, and cold) accounted for 14% of homeless deaths. Homicides and suicides accounted for 1% and 5% of deaths, respectively.

The cause-specific mortality distributions within and outside Paris were significantly different ($p < 0.001$). External causes and mental disorders were 4 times more frequent in deaths occurring outside Paris. The proportion of ill-defined or unknown causes was higher and the proportion of external causes lower within Paris than outside. The proportions of alcohol-related and cold-related homeless deaths were 21% and 4%, respectively.

After multiple imputation, the leading causes of death were still external causes (29%), neoplasms (21%) and diseases of the circulatory system (14%). Mental and behavioural disorders, diseases of the digestive system, ill-defined causes and other causes represented 10%, 8%, 5% and 13% respectively of causes of death (Table 2).

Comparison of homeless and general populations

The by-cause mortality distribution in the homeless was significantly different from that of the general population ($p < 0.001$) (Table 3). In the multivariate analysis, the probability of being homeless was higher when dying of mental and behavioural disorders ($RR = 4.3[3.2-5.8]$), external causes ($RR = 1.2[0.9-1.5]$), diseases of the digestive system ($RR = 2.5[1.9-3.5]$) and undetermined causes ($RR = 2.2[1.5-3.2]$) than for neoplasms.

The interaction between season and location of death was statistically significant ($p = 0.02$) (data not shown). For deaths in hospital, the proportion of homeless deaths among the general population was the same in winter as in the other seasons ($p = 0.53$). Regarding deaths in housing and in public areas, the proportion of homeless deaths was higher during winter.

The proportions of homeless deaths were significantly higher in alcohol-related deaths ($RR = 1.7[1.4-2.0]$) and cold-related deaths ($RR = 6.4[4.7-8.8]$) than in other deaths (Table 4).

DISCUSSION

Characteristics of deaths

The younger age at death among the homeless in France cannot be interpreted as a difference in life expectancy because the age distribution of the two living populations is probably not the same. Although the mean age of death is not similar to the life expectancy, and the homeless are an open population, this tends to indicate that people suffering from homelessness are at risk of premature death.

The proportion of homeless deaths in the general population was much higher among men than among women, which is consistent with findings in other countries.^{15,35,36} In our study, the differences in mortality according to the season depended on the location of death. There was no difference between seasons in hospital, while deaths in a public area or in housing occurred more frequently during winter or fall. Indeed, there was a possible bias related to the information feedback which is likely to be more intensive during winter because some associations are open only during that season. Furthermore, the media and the public at large are more mobilised by homelessness in winter while hospitals have stable reporting activity during the whole year.²²

Leading causes of death

The leading causes of death in the French homeless included in this study were different to those found in other studies. Violent deaths and neoplasm were the leading causes in our study. In previous studies, deaths by neoplasms were less frequent^{3-6,10,14,15,35,37} while external causes were more frequent^{3,5,6,9,10,14,17,37-39}. In this study, homicides represented 1% of deaths while the proportion of homicides in United States cities ranged from 4% to 12% of deaths in the homeless.^{5,6,17,37,39} In our study, 5% of deaths were suicides compared to 22% in London^{17,18}, 23% in Sydney³⁵, 50% in the population aged 18 to 25 in Montreal⁹, 18% in Los Angeles⁴ and 2% to 8% in other areas^{5,6,14,15,37,39,38}. The social context of these countries should be taken into account when comparing the proportions of cause-specific deaths in homeless populations. Violence and the use of firearms are more prevalent in some cities in the United States compared to those in France and this could partly explain the high prevalence (10% to 12%) of homicide in the homeless in San Francisco and Atlanta.^{37,38}

The proportion of homeless deaths with mental disorders was higher than in deaths among the general population. This finding is consistent with those of the SAMENTA study focusing on addictions and mental health among the homeless in the Paris area, which showed that one third of the homeless

suffered from psychiatric disorders.⁴⁰ Previous studies have demonstrated poorer mental health to be strongly associated with lower socioeconomic status and homelessness.^{2,3,11,41} The proportion of cardiovascular diseases (14% after imputation) was lower than in most studies (25% to 30%).^{3,4,18,35,38} This is not specific to mortality in the homeless since the French population has lower rates of cardiovascular disease than in most other countries.⁴²

The proportion of undetermined causes was higher in the French homeless population compared with other studies, except in Los Angeles⁴, Philadelphia³, Toronto¹⁰ and Copenhagen¹¹. In some American cities such as New York², the reporting of death among the homeless is mandatory such that the collection of information on such deaths is likely to be more exhaustive and of better quality.

In addition, the high proportion of unknown causes and the low proportion of homicides and suicides in the homeless population could partly be due to the absence of transmission of death certificates from some forensic institutes to the CépiDc. This is a particularly acute problem in France as many deaths among the homeless that occurred in the street or in unknown conditions are investigated at a forensic institute. Therefore, some death certificates of homeless persons in the Paris area are not included in the CépiDc database. In these cases, the CépiDc receives only socio-demographic information and not the causes of deaths.

Comparison to the general population

Causes of death among the homeless were different from those in the general population. Deaths due to diseases of the circulatory and digestive systems, mental and behavioural disorders, and ill-defined and unknown causes were significantly more frequent among the homeless than in the general population. Studies have shown that the prevalence of cardiovascular and digestive diseases and mental health problems are higher in the homeless compared to the general population.⁴³ In addition, the homeless often cannot adhere to treatment and medical care needs because they encounter many barriers to healthcare.⁴⁴

Alcohol and hypothermia

Even if the proportion of homeless deaths among the general population was more frequent when deaths were cold-related or alcohol-related, these factors accounted for only a fraction of mortality in the homeless.

Concerning alcohol-related deaths, even though the proportion of heavy drinkers is high in the homeless, the proportion of abstinence is also larger in the homeless than in the general population according to the SAMENTA study, thus potentially explaining our results.⁴⁰

The proportion of cold-related deaths in the homeless was not as high as expected. However, only hypothermia was considered in this study. However, many other less specific causes (e.g. pneumonia) are possibly associated with cold.⁴⁵ Thus, the number of cold-related deaths is likely to be underestimated in our study.

Another way to consider cold-related deaths is to compare mortality by season. The latter was higher in the homeless than in the general population with a higher mortality during winter. This may be attributed either to the effect of cold on homeless health or to a selection bias due to the intensification of information collection in winter, as previously explained. Nevertheless, a large proportion of deaths in the homeless occurred outside the winter period, which illustrates that cold is probably not the main reason for excess mortality among homeless people.

Limitations

This study has several limitations. The matching of two sources could introduce a serious selection bias. The high proportion of missing data implies that the deaths with the most detailed information in the CMDR database are more likely to be matched. In view of the missing data in the CMDR database, the CMDR has planned to develop its network to increase the completeness of, and to standardise its data collection methods.

Information bias should be considered as potentially influencing all the results. However, as previously described, we specifically identified its possible impact on seasonal distribution. Indeed, the information feedback is likely to be more intensive in winter because of the larger mobilisation by homelessness in this period.

The large proportion of missing causes of deaths limits the interpretation of its distribution. To handle this problem we used multiple imputation for missing causes. However, even if results based on multiple imputation are preferable to those considering the code R99 as a cause of death in that they rely on relaxed assumptions, they are still based on the MAR assumption which cannot be formally

proven with existing data.³⁰ For this reason, the best solution would be to obtain a larger fraction of known causes of deaths.

The data considered are only mortality data and no comparable population data was available to be used as a denominator. Thus, mortality rates cannot be calculated. In view of previous studies, the all-cause mortality rate in the homeless is likely to be much higher than in the general population. A lower proportion of deaths due to a specific cause should not be interpreted as a lower mortality rate in the homeless compared to the general population. For instance, mortality rates concerning neoplasms or external causes could be higher in the homeless compared to the general population.

Recommendations

Furthermore, in order to develop strategies for prevention and care in the homeless, comparable information on the living population of homeless would be required to be able to estimate mortality rates and to better focus policies on their main health problems. In today's world of on-going economic, social and political change, the homeless are subject to rapid evolution. For this reason, a follow-up study of mortality in the homeless is needed. In this way, the matching of the two databases will be reproduced annually in order to monitor mortality trends in this specific population. Several methods could improve the collection of morbidity and mortality data in the homeless. For example, standardized information on accommodation and food distribution services dedicated to the homeless population should be collected. In addition, a specific flag for homeless situations could be included in medico-administrative databases. This would potentially be reproducible in several countries and hence enable the production of comparable data across Europe.

Conclusion

This study aimed to describe mortality among the homeless in France for the first time. While the age and gender distribution of the mortality experience among the homeless is different from that of the general population, some characteristics are not as different as might be expected in this population. Considering the slight difference between the frequency of alcohol- and cold-related deaths in the homeless and in the general population, campaigns to help the homeless should not focus solely on alcohol- or hypothermia-related deaths.

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Conflicts of Interest

None declared

Keypoints

- The homeless are at risk of premature death.
- The health of homeless people should be considered not only in winter periods or in terms of alcohol- or cold-related conditions.
- Since the homeless are subject to a rapidly changing socio-economic environment, a follow-up study of mortality in the homeless is needed: the matching of the two databases will be reproduced annually in order to monitor mortality trends in this specific population.

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Table 1 – Mortality distribution among the homeless population and the general population in France in 2008-2010.

Variables	Homeless population (N=693)	General population (N=1 642 766)
Sex		
Female	8%	49%
Male	92%	51%
Age mean (\pmsd)	49 (\pm 13)	77 (\pm 17)
Age range	4–94	0–114
Classes		
0–30	6%	2%
30–45	31%	3%
45–65	52%	16%
\geq 65	11%	80%
Year of death		
2008	33%	33%
2009	34%	33%
2010	33%	34%
Season of death^a		
Winter	30%	28%
Spring	22%	24%
Summer	20%	23%
Fall	28%	25%
Location of death		
Housing	17%	26%
Hospital	39%	57%
Public area	27%	2%
Other	17%	15%

^a Winter from 21 December to 20 March, Spring from 21 March to 20 June, Summer from 21 June to 20 September, and Fall from 21 September to 20 December

Table 2 – Distribution of causes of death in homeless population in Paris area and outside Paris in France in 2008-2010.

Causes of death (ICD-10)	Paris N=212	Outside Paris N=481	Total N=693	Total after multiple imputation (N=693)
Neoplasm (C00-D48)	20%	18%	18%	21%
Trachea, bronchus and lung (C33-C34)	5%	6%	6%	
Upper aerodigestive tract (C00-C14, C15, C32)	3%	1%	2%	
Digestive organs (C16-C19, C22, C25)	2%	4%	3%	
Other	10%	6%	8%	
External causes (V01-Y98)	6%	26%	20%	29%
Assault (X85-Y09)	1%	4%	1%	
Intentional self-harm (X60-X84)	-	2%	5%	
Accidental drowning (W65-W74)	1%	6%	2%	
Transport accident (V01-V99)	<1%	2%	3%	
Falls (W00-W19)	1%	1%	1%	
Excessive natural cold (X31)	-	2%	2%	
Accidental poisoning (X40-X49)	<1%	3%	2%	
Other	2%	5%	4%	
Circulatory system (I00-I99)	11%	11%	11%	14%
Ischemic heart diseases (I20-I25)	3%	3%	3%	
Other forms of heart disease (I30-I52)	3%	4%	3%	
Cerebrovascular diseases (I60-I69)	4%	2%	3%	
Other	1%	2%	2%	
Mental and behavioral disorders (F00-F99)	2%	9%	7%	10%
Due to use of alcohol (F10)	1%	6%	5%	
Due to use of drugs (F11-16, F18-19)	-	2%	1%	
Other	1%	1%	1%	
Digestive system (K00-K93)	9%	6%	7%	8%
Diseases of liver and cirrhosis (K70, K73-K74)	7%	4%	5%	
Other	2%	2%	2%	
Ill-defined and unknown causes (R00-R99)	37%	24%	28%	5%
Other causes	15%	7%	9%	13%
Respiratory system (J00-J99)	6%	2%	3%	
Infectious and parasitic diseases (A00-B99)	4%	1%	2%	
Nervous system (G00-G99)	2%	3%	3%	
Other	3%	2%	2%	

Table 3 – Comparison of the mortality between homeless population (N=693) and general population in France in 2008-2010. (N=1 642 766)

Variables	Univariate		Multivariate ^a	
	RR	95% CI	RR	95% CI
Year of death	<i>p=0.970</i>			
2008	ref.			
2009	1.0	0.8–1.2		
2010	1.0	0.8–1.2		
Season of death^b	<i>p=0.029</i>		<i>p<0.001</i>	
Winter	ref.		ref.	
Spring	0.8	0.7–1.0	1.0	0.7-1.3
Summer	0.8	0.6–1.0	0.9	0.6-1.2
Fall	1.0	0.8–1.2	0.8	0.6-1.1
Place of death	<i>p<0.001</i>		<i>p<0.001</i>	
Hospital	ref.		ref.	
Housing	1.0	0.8–1.2	0.9	0.6-1.3
Public area	26.3	21.8–31.7	8.0	5.5-11.5
Other	1.7	1.3–2.1	3.1	2-4.6
Cause of deaths	<i>p<0.001</i>		<i>p<0.001</i>	
Neoplasm	ref.		ref.	
Ill-defined and unknown causes	1.7	1.2-2.5	2.2	1.5-3.2
External causes	5.6	4.5-6.9	1.2	0.9-1.5
Circulatory system	0.7	0.6-1.0	1.3	1.0-1.7
Mental and behavioral disorders	4.4	3.3-5.9	4.3	3.2-5.8
Digestive system	2.7	2.0-3.6	2.5	1.9-3.5
Other causes	0.9	0.7-1.1	1.6	1.2-2.1

^a Adjusted on age, sex and the geographic place of death

^b Winter from 21 December to 20 March, Spring from 21 March to 20 June, Summer from 21 June to 20 September, and Fall from 21 September to 20 December

Table 4 – Comparison of the mortality distribution according to alcohol and hypothermia related causes between homeless population (N=693) and general population in France in 2008-2010 (N=1 642 766)

Variables	Univariate		Multivariate ^a	
	RR	95% CI	RR	95% CI
Alcohol related deaths		<i>p<0.001</i>		<i>p<0.001</i>
Not related	ref.		ref.	
Related	4.1	3.4–5.0	1.7	1.4–2.0
Hypothermia related deaths		<i>p<0.001</i>		<i>p<0.001</i>
Not related	ref.		ref.	
Related	29.0	19.6–42.8	6.4	4.7–8.8

^a Adjusted on age, sex, season, place and the geographic place of death