Article

Mortality and Suicide Among Persons Experiencing Homelessness: A Seven-Year Follow-up Study

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ARTICLE INFO

ABSTRACT

Background: There is a significant gap in scientific understanding about suicide among people experiencing homelessness (PEHs). **Method:** This seven-year longitudinal study examined a cohort of 154 PEHs. In 2015, clinical assessments were conducted, including an evaluation of suicide risk, with data on causes of death collected from public health service records in 2022. **Results:** Over the course of seven years, 14.3% of the sample passed away at an average age of 52.6 years. The leading causes of death were cancer, suicide, and accidental overdose. Participants who experienced violence had a higher number of suicide attempts and scored higher on the suicidal ideation scale. The most significant factors associated with mortality were prior suicide attempts and suicidal ideation. **Conclusions:** This study underscores the importance of suicide risk scale scores as the primary predictor of mortality. It emphasizes the need for further longitudinal research on suicide among PEHs and the development of specific programs to prevent suicide within this population. An approach combining structural and individual perspectives is suggested, considering appropriate housing policies and mental health care.

Mortalidad y Suicidio Entre Personas en Situación de Sinhogarismo: un Estudio de Seguimiento de Siete Años

RESUMEN

Antecedentes: Existe un vacío en el conocimiento científico sobre el suicidio entre las personas en situación de sinhogarismo (PSH). **Método:** Este estudio longitudinal de siete años, examinó una cohorte de 154 PSH. En 2015 se evaluaron el riesgo de suicidio y las causas de muerte recopiladas en los registros del servicio de salud en 2022. **Resultados:** En estos siete años, el 14.3% de la muestra falleció a una edad promedio de 52.6 años. Las principales causas de muerte fueron cáncer, suicidio y sobredosis accidental. Se encontró que aquellos participantes que experimentaron violencia presentaron un mayor número de intentos de suicidio, así como una puntuación más elevada en la escala de ideación suicida. Los factores más significativos relacionados con la mortalidad fueron los intentos de suicidio previos y la ideación suicida. **Conclusiones:** Este estudio resalta la importancia de la puntuación en la escala de riesgo de suicidio como el predictor principal de mortalidad. Así mismo, destaca la necesidad de realizar investigaciones longitudinales sobre suicidio entre PSH y de desarrollar programas específicos para prevenir el suicidio en esta población. Se sugiere un enfoque que combine perspectivas estructurales e individuales, considerando políticas de vivienda adecuadas y atención de salud mental.

Suicide—defined as intentionally ending one's own life—is a serious and complex public health problem (Turecki & Brent, 2016). Approximately 804,000 deaths occur by suicide each year worldwide, equivalent to 11.4 suicides per 100,000 people (World Health Organization, 2023). The prevalence of self-reported suicide attempts is estimated at 0.3% of the world's population (Zalsman et al., 2016). In Spain, the rate stands at 8.3 suicides per 100,000 inhabitants (National Institute of Statistics, 2023) and the number of suicide attempts in the general Spanish population is 73,000 per year (Al-Halabí & Fonseca-Pedrero, 2021).

Existing research indicates that people who have attempted suicide are up to twenty times more likely to die by suicide than the general population (Zortea et al., 2020). Suicidal ideation—defined as thoughts about intentionally ending one's life—has a prevalence throughout the life cycle and in the general population of between 2% and 16% (Geulayov et al., 2019; O'Connor & Nock, 2014). Non-lethal suicide attempts and suicidal ideation are some of the most robust predictors of suicide mortality (Turecki et al., 2019), especially in specific clinical subsamples, such as in people with personality, affective, anxiety, or substance use disorders (Goñi-Sarriés et al., 2018).

The etiology of suicide is multifactorial and includes biological, genetic, psychological, social, economic, and cultural factors (Zalsman, 2019). Among the main risk factors are social and educational disadvantages; adversity in childhood and family of origin; exposure to stressful life events and circumstances; social, cultural, and contextual factors; and, especially, psychopathology (Beautrais, 2016). Rates of suicidal behavior vary both between and within countries, and some scholars have identified a potential correlation with socioeconomic status (Guzmán et al., 2019). Thus, the accumulation of these risk factors in a person and their individual and social vulnerability will strongly influence suicidal behavior (Shoib et al., 2022). Suicidal behavior occurs when a person is in an intolerable situation for which they feel unable to find another solution. The consequences of suicidal behavior and suicide go beyond the person themselves to have severe emotional consequences for their family, friends and other close associates (García et al., 2023).

One of the populations with the highest prevalence of both suicidal behaviors and mortality from completed suicide are persons experiencing homelessness (PEHs) (Sinyor et al., 2017). The number of deaths by suicide among PEHs varies across studies around the world, between 111.4 (Nilsson et al., 2014) and 2,683.6 (Babidge et al., 2001) deaths per 100,000 inhabitants. The prevalence among PEHs of suicide attempts ranges from 9.2% to 51.3% and of suicidal ideation from 17.8% to 66.2% (Desai et al., 2003; Nilsson et al., 2014). According to these data, suicide mortality in PEHs can be up to 230 times that of the general population.

There are several reasons why PEHs may be particularly susceptible to the risk of suicide. The literature consistently demonstrates that PEHs exhibit high rates of mental illness (Fazel et al., 2014), including substance use disorders and dual pathology, both of which are associated with an elevated risk of suicide (Lee et al., 2017). Another reason is the presence and severity of physical and sexual abuse, especially during childhood (Heerde et al., 2015; Heerde & Hemphill, 2016). Desai et al. (2003) and Peltier et al. (2021) identify multiple factors contributing to homelessness that also increase the risk of suicide, including family instability, placement in foster care, family history of psychiatric illnesses, and involvement in the criminal justice system. Additionally, PEHs may encounter restricted access to healthcare services, potentially resulting in an inability to recognize and address suicidal symptoms. Lastly, the demoralizing consequences of becoming homeless can act as a precipitating stressor for a suicide attempt (Desai et al., 2003; Peltier et al., 2021).

In Spain, there are no national studies of suicide prevalence among PEHs, although data published in samples from different regions indicate that mortality from this cause is very high. A study carried out via analysis of public health service clinical records, recorded a suicide rate of 2.4% (21.4% of all deaths) (Calvo et al., 2023a). A self-report study indicated that 30% of PEHs had attempted suicide, and 57.9% of them had done so for the first time when they were homeless. The combination of having experienced family violence in childhood and/or adolescence, physical violence in adulthood, excessive drug use at some point in life, severe mental health problems, death of spouse or partner, the loss of one's home and not being an immigrant best predicted that PEHs had attempted suicide (Panadero et al., 2018). The two studies recruited people in literally homeless situations: people living on the street, outdoors, or borrowing from short- or medium-term shelters.

Most studies on suicide mortality are conducted using death registries, and those that analyze suicide attempts or the prevalence of suicidal ideation do so through self-reported prevalence (Ayano et al., 2019). Because establishing and maintaining contact with PEHs is challenging, it is difficult to conduct longitudinal follow-up with this population and therefore to establish a relationship between suicidal ideation and death by suicide of PEHs (Murray et al., 2021). Additionally, while suicide is a widely studied phenomenon in the general population, compared to other populations at risk of suicide, PEHs have generated little scientific interest (López et al., 2023).

Calvo-García et al. (2016) analyzed suicidal ideation in a sample of PEHs, whilst also recording details regarding drug use, presence of a substance use disorder, and severity of drug dependence. The results indicated that 24.7% of the sample had attempted suicide one or more times in the past and that 45.2% presented a risk of suicide. The main predictors of suicide risk were daily alcohol consumption and being female. Given the lack of research, the objective was to analyze mortality in general and suicidal behavior in particular (as recorded in hospital emergency services) in relation to other predictors of suicide among a cohort of PEHs, after seven years of prospective follow-up.

Method

Participants

The study was carried out in the province of Girona, Catalonia, which has a population of 101,932 (Idescat, 2017). In 2015, the population of people experiencing homelessness was 270, a number obtained from records from specialized social services for PEHs and public primary and mental health services. All of them were experiencing what is referred to as literal homelessness in the Spanish context, that is, they were living in public spaces, or their overnight housing situation forced them to spend the day on the streets or in extremely substandard housing. For clarity, this definition encompasses *The European Observatory on Homelessness* categories of homelessness and housing exclusion 1, 2, 3d, 3e, 3f and 3h (Busch-Geertsema et al., 2016), which include: i) people without accommodation, who sleep on the streets, in public spaces, in vehicles or under some type of improvised cover;

ii) people living in any type of temporary or crisis accommodation, iii) people illegally occupying conventional dwellings; iv) people living in conventional dwellings unsuitable for human habitation; v) people living in trailers, tents or caravans; and vi) people living in unconventional buildings and temporary structures or settlements.

Sample

Based on a population of 270 PEHs, a representative sample size was determined, considering the principle of maximum indeterminacy, p = q = 50, with a minimum requirement of 150 participants, to obtain an estimate of suicide risk with an accuracy of .08. The final sample consisted of 154 individuals. Non-probabilistic convenience sampling was employed, encompassing both PEHs who used specialized homelessness services in 2015 and those identified by outreach teams working with individuals on the streets who do not use these services. All were invited to participate in the study and did so voluntarily. The researchers were also professionals from mental health or social service sectors who provided care to these PEHs, thereby establishing a rapport that facilitated recruitment.

Instruments

Initial Measures (year 2015)

For general sociodemographic data, we used an ad hoc self-report questionnaire for age and sex. To measure the risk of suicide, the Plutchik Suicide Risk Scale (Plutchik et al., 1989) was used with a cut-off score of 6 for the Spanish population (Rubio et al., 1998). To select the level of drug dependence and its severity, the Severity of Dependence Scale was used (Gossop et al., 2006), with cut-off scores of 3 for alcohol and cocaine, 4 for cannabis and 5 for heroin (Castillo et al., 2010).

Follow-up Measures (year 2022)

We collected diagnostic data of mental disorders (and dual disorders) and suicidal behavior, including all types of self-harm (suicide attempts, method); non-fatal and fatal drug overdose precedents (and type of drug); experience of violence (episodes of medical care for assault; hospital or outpatient medical care as a result of serious assaults); mortality; age at death; and cause of death.

Procedure

The Plutchik Suicide Risk Scale, Severity of Dependence Scale and sociodemographic data questionnaire were conducted in public homeless shelters and in public spaces for people who regularly attended the mentioned services between January and May 2015. When linguistic and cultural differences were present, multilingual and multicultural interpreters were used to facilitate interviews and provide guidance on potential linguistic and cultural nuances that could affect communication between researchers and participants. Data about mortality and causes of mortality, suicide attempts, non-fatal overdose, and experienced violence (as evidenced by having received hospital or outpatient medical care because of serious assaults) were collected seven years later, between March and June 2022. This information was obtained from the clinical records of the following public health services: emergency and in-patient psychiatry, emergency and urgent care, and outpatient mental health and addiction. This information had been collected by the center when the participants sought help. The data were pseudo-anonymized by the health services and the investigators. Thus, to preserve the confidentiality of the participants, a random code was assigned to allow longitudinal analysis.

All participants were given a printout informing them about the study, and they signed an informed consent form in which they authorized the confidential use of their data for the research. Additionally, they were informed about the test results and were referred to specialized services if necessary. The research protocol was approved by the Comité de Ética de Investigación Clínica de l'Institut d'Assistència Sanitària (CIEC-IAS) in December 2014.

Data Analysis

This was a longitudinal, observational, analytical study. The description of prevalence was carried out using absolute and relative frequencies. Measures of location and dispersion were used for the description of quantities, and comparisons were made between the score on the suicide risk test and the variables for risk factor and clinical and sociodemographic background. For qualitative variables, we used contingency tables, and for quantitative variables, we used averages with parametric (t-Student) or non-parametric (U Mann-Whitney) techniques, according to the type of variable. To identify the predictor variables for suicide mortality, a hierarchical binary logistic regression model was employed, adjusting for variables related to the SDS scale outcomes and diagnoses in substance use disorders and non-drug-related mental disorders. The statistical analysis was carried out with the Statistical Package for Social Sciences (SPSS® Inc.; Chicago) v. 21 for Mac, with significance set at $p = \leq 0.05$ and 95% confidence intervals.

Results

Mortality and Suicide

Of the 154 PEHs, a total of 133 were male and 21 were female. After the initial data collection, between 2015 and 2022, 23 people died, representing 14.3% of the sample. The average age at death was 52.6 years. The leading causes of death were cancer ($n = 10$), suicide (not including overdose) ($n = 9$) and overdose ($n = 4$). The methods used in suicide were drug overdose ($n = 5$), jumping from a height ($n = 3$) and deep vein injury ($n = 1$).

In the initial interview, the mean score for the suicidal ideation scale was 5.64 and was significantly higher in people who later died (8.55 vs. 5.13). No statistically significant differences were found between deceased and living participants with respect to family history of suicide, suicidal ideation, or telling others about their intention to commit suicide, but there were differences in prior suicide attempts (52.4% of the deceased had attempted suicide previously vs. 23.3% of the living). Of the sample, 48.3% scored above the cut-off score of the suicide risk scale. We found that deceased people had scored above this cut-off point to a greater extent than those who were alive at the time of follow-up (72.7% vs. 44.0%) (Table 1).

Table 1
Mortality and Suicide Characteristics

Variables	Total n = 154 [a]	Survival status [b]		Values				
		Deceased n = 23	Living n = 131	X^2 / t / U	df	p	Fisher	Cramér's V
Sex [n (%)]								
Male	133 (86.4)	20 (15.0)	113 (85.0)	0.008	1	0.928	0.615	0.007
Female	21 (13.6)	3 (14.3)	18 (85.7)					
Mortality								
Death [n (%)]	-	23 (14.9)	-	-	-	-	-	-
Age at death [M (ED)]	-	52.58 (11.20)	48.03 (11,55)	-	-	-	-	-
Other causes (cancer) [n (%)]	-	10 (6.5)	-	-	-	-	-	-
Fatal overdose [n (%)]	-	4 (2.6)	-	-	-	-	-	-
Suicide [n (%)]	-	9 (5.8)	-	-	-	-	-	-
Method of suicide [n (%)]								
Medication overdose	-	5 (3.2)	-	-	-	-	-	-
Jumping from a height	-	3 (1.9)	-	-	-	-	-	-
Deep vein wound	-	1 (0.6)	-	-	-	-	-	-
Score on Plutchik scale (2016) [M (ED)]	5.64 (3.48; 0-13)	8,55 (4.03)	5.13 (3.12)	685.5	-	<0.001	-	-
Family history of suicide [n (%)]	32 (20.8)	6 (28.6)	26 (21.5)	0.514	1	0.473	0.322	0.60
Thoughts of suicide [n (%)]	60 (39.0)	14 (66.7)	46 (38.0)	6.020	1	0.014	0.014	0.206
Tell others about suicide plans [n (%)]	32 (20.8)	8 (38.1)	24 (19.8)	3.4118	1	0.064	0.063	0.155
Previous suicide attempts [n (%)]	39 (25.3)	11 (52.4)	28 (23.3)	7.537	1	0.006	0.008	0.231
Score on Plutchik scale (above the cut-off) [n (%)]	71 (48.3)	16 (72.7)	55 (44.0)	6.183	1	0.013	0.011	0.205

[a] Percentage of total
[b] Percentage of survival status

All the people who died by suicide scored above the cut-off of the Plutchik Suicide Risk Scale at the initial interview (Fischer = 0.023) and 66.7% of these individuals had reported a previous suicide attempt at the initial interview (Fisher = 0.245). All the people who died by suicide had made an unsuccessful attempt after the initial interview (Fisher < 0.001).

Suicide Attempts and Violence

Of the people who had died by the time of follow-up, 60.8% had reported a previous suicide attempt at the initial interview, compared to 19.1% of those who were still living. A higher average number of suicide attempt episodes was also recorded for deceased participants in comparison with those still living at follow-up (0.70 vs. 0.24).

The methods used to attempt suicide were drug overdose (n = 20), deep wrist injury (n = 11), jumping from a height (n = 8), self-stabbing (n = 3) and self-poisoning, self-drowning, jumping in front of a vehicle, and self-immolation (n = 1). Care for people treated for suicide attempts was carried out in psychiatric emergency services (n = 23), general emergency services (n = 14), and primary health care centers (n = 8) (Table 2). PEHs that reported a previous suicide attempt in 2015 had more suicide attempts between 2015 and 2022 (33.3%; n = 13 vs. 17,6%; n = 18; X^2 = 4.047; df = 1, p = .044).

At some point during the follow-up period, 37.0% of the sample received emergency medical attention because of having suffered an aggression (i.e., violence of any sort) (M = 1.56 times). There was a correlation between the number of suicide attempts and the number of episodes of violence experienced (as indicated by the number of episodes of medical care for assault recorded) (Spearman = 0.245; p = .05). PEHs that received care for assault during the follow-up period had higher scores for the Plutchik Suicide Risk Scale (M = 6.51; SD = 3.60 vs. 5.12; SD = 3.32; t = 2.379; df = 145; p = 0.019)

and more suicide attempts (M = 0.47; SD = 0.93 vs. M = 0.22; SD = 0.56; U = 2 362.5; p = .033).

Non-Fatal Overdoses

A total of 33 people experienced an average of 1.67 non-fatal overdoses. There were no statistically significant differences in mean overdose episodes after 2015 between people who died and those who survived. Of the total sample, 20.1% suffered a non-lethal overdose from alcohol, 2.6% from benzodiazepines or other sedatives and cannabis, 2.0% from heroin and methadone, and 0.7% from cocaine. Significant differences were found between the PEHs who died and those that survived in the number of non-lethal overdoses from benzodiazepines and other sedatives (13.6% vs. 0.8%), heroin (9.1% vs. 0.8%), cannabis (9.1% vs. 1.5%) and central nervous system depressants (including alcohol) (43.5% vs. 17.6% respectively).

The episodes of non-lethal overdose according to the drug consumed were: 40 for alcohol use, 8 for benzodiazepines or other sedatives, 7 for heroin, 4 for cannabis (wherein overdose is classified as a severe induced psychotic break), 3 for methadone and 1 for cocaine. (Table 3). PEHs that experienced violence over the period recorded were more likely to have experienced non-fatal overdoses from depressants (including alcohol) (40.4%; n = 23 vs. 13.5%; n = 13; X^2 = 14.286; df = 1, p <.001), and more alcohol-based non-fatal overdoses (36.8%; n = 21 vs. 10.3%; n = 10; X^2 = 15.721; df = 1, p <.001).

Mental Health and Addiction

Table 4 shows the average scores of the Severity of Dependence Scale for each drug, as well as the number of people who exceeded

the determined cut-off to establish dependence, and the number of people diagnosed for dependence on that drug in mental health and addiction services. People who died had a significantly higher mean cocaine dependence severity score than people who did not die ($M = 14.0$ vs. $M = 5.6$) (Table 4).

Variables Linked to Mortality

The hierarchical binary logistic regression performed with the dichotomous dependent variable dead/not-dead reported as predictor variables of mortality the results of the Plutchik Suicide Risk Scale and having experienced a suicide attempt (Table 5).

Table 2

Suicide Attempt Characteristics and Violence Experienced

Variables	Total n = 154 [b]	Survival status [c]		Values				
		Deceased n = 23	Living n = 131	X² / t / U	df	p	Fisher	Cramér's V
Previous attempted suicide [a] [n (%)]	39 (25.3)	14 (60.8)	25 (19.1)	16.19	1	<0.001	<0.001	0.324
Episodes of attempted suicide [M (ED)]	0.31 (0.73; 0-5)	0.70 (0.76)	0.24 (0.70)	958.5	-	<0.001	-	-
Method of attempt [n (%)]								
Medication overdose	20 (13.0)	10 (43.5)	10 (7.6)	7.416	7	0.387	0.267	0.481
Deep vein injury	11 (7.1)	4 (17.4)	7 (5.3)					
Jumping from a height	8 (5.2)	5 (21.7)	3 (2.3)					
Stabbing	3 (1.8)	0 (0)	3 (2.3)					
Poisoning	1 (0.6)	0 (0)	1 (0.8)					
Drowning	1(0.6)	0 (0)	1 (0.8)					
Jumping in front of a vehicle	1(0.6)	0 (0)	1 (0.8)					
Self-immolation	1(0.6)	0 (0)	1 (0.8)					
Emergency department [n (%)]								
Emergency (psychiatry)	23 (14.8)	10 (43.5)	13 (9.9)	1.517	2	0.678	-	0.218
Emergency (general hospital)	14 (9.1)	5 (21.7)	9 (6.9)					
Primary care center	8 (5.2)	3 (13.0)	5 (3.8)					
Violence experienced (medical care for assault) [n (%)]	57 (37.0)	11 (47.8)	46 (35.1)	1.356	1	0.244	0.176	0.094
Episodes of medical care for assault [M (ED)]	1.56 (1.09;1-5)	1.73 (1.10)	1.52 (1.09)	0.560	55	0.577	-	-

[a] Includes fatal attempts
[b] Percentage of total
[c] Percentage of survival status

Table 3

Non-fatal Overdose Characteristics

Variables	Total n = 154 [a]	Survival status [b]		Values				
		Deceased n = 23	Living n = 131	X² / t / U	df	p	Fisher	Cramér's V
Non-fatal overdoses (n = 33 individuals) [M (ED)]	1.67 (1.08; 1-5)	2.18 (1.54)	1.41 (0.67)	87.00	-	0.137	-	-
Number of total episodes per drug [n (%)]								
Alcohol	40 (26.0)	10 (43.5)	30 (22.9)	8.976	5	0.050	0.034	0.319
Benzodiazepines or other sedatives	8 (5.2)	7 (30.4)	1 (0.8)					
Heroin	7 (4.5)	6 (26.1)	1 (0.8)					
Cannabis (severe induced psychosis)	4 (2.6)	2 (8.6)	2 (1.6)					
Methadone	3 (1.9)	1 (4.3)	2 (1.6)					
Cocaine	1 (0.6)	0	1 (0.8)					
Individuals suffered overdose per drug [n (%)]								
Alcohol	31 (20.1)	7 (30.4)	24 (18.3)	1.786	1	0.181	0.256	0.108
Benzodiazepines or other sedatives	4 (2.6)	3 (13.6)	1 (0.8)	12.26	1	<0.001	0.010	0.283
Heroin	3 (2.0)	2 (9.1)	1 (0.8)	6.795	1	0.009	0.054	0.211
Cannabis (severe induced psychosis)	4 (2.6)	2 (9.1)	2 (1.5)	4.233	1	0.040	0.099	0.166
Methadone	3 (2.0)	1 (4.3)	2 (1.5)	0.893	1	0.345	0.374	0.076
Cocaine	1 (0.7)	0 (0)	1 (1.8)	0.169	1	0.681	1.000	0.033
Overdose for any CNS depressant [c] [n (%)]	33 (21.4)	10 (43.5)	23 (17.6)	10.06	1	0.002	0.003	0.256
Emergency department [n (%)]								
Emergency (general hospital)	41 (26.6)	15 (65.2)	26 (19.8)	0.005	2	0.997	-	0.011
Emergency (psychiatry)	17 (11.0)	5 (21.7)	12 (9.2)					
Primary care center	5 (3.2)	1 (4.3)	4 (3.1)					

[a] Percentage of total
[b] Percentage of survival status
[c] Individuals for one or more central nervous system depressant

Table 4
Mental Health and Drug Addiction

Variables	Total n = 154 [a]	Survival status [b]		Values					
		Deceased n = 23	Living n = 131	X² / t / U	df	p	Fisher	Cramér's V
Drug dependence								
Alcohol (SDS result) (n = 75 individuals) [M (ED)]	5.59 (4.21; 0-14)	6.25 (4.18)	5.46 (4.23)	0.593	73	0.555	-	-
Alcohol (score above the cut-off score for dependence) [n (%)]	53 (34.4)	10 (83.3)	43 (68.3)	1.106	1	0.293	0.247	0.121
Alcohol (diagnosed in outpatient services) [n (%)]	41(26.6)	12 (85.7)	29 (60.4)	3.097	1	0.078	0.071	0.223
Cocaine (SDS result) (n = 11 individuals) [M (ED)]	6.36 (4.15; 0-14)	14.0 (0)	5.60 (3.47)	2.308	9	0.046	-	-
Cocaine (score above the cut-off score for dependence) [n (%)]	9 (5.8)	1 (100)	8 (80.0)	0.244	1	0.621	0.818	0.149
Cocaine (diagnosed in outpatient services) [n (%)]	5 (3.2)	1 (7.1)	4 (8.3)	0.021	1	0.886	0.686	0.018
Cannabis (SDS result) (n = 32 individuals) [M (ED)]	4.03 (4.13; 0-14)	2.63 (3.46)	4.50 (4.29)	69.00	-	0.234	-	-
Cannabis (score above the cut-off score for dependence) [n (%)]	11 (7.1)	2 (25)	9 (37.5)	0.416	1	0.519	0.425	0.114
Cannabis (diagnosed in outpatient services) [n (%)]	4 (2.6)	0 (0)	4 (8.3)	1.247	1	0.264	0.349	0.142
Heroine (SDS result) (n = 7 individuals) [M (ED)]	8.14 (3.34; 4-12)	4.00 (0)	8.83 (3.06)	-1.462	5	0.204	-	-
Heroine (score above the cut-off score for dependence) [n (%)]	6 (3.9)	0 (0)	6 (100)	7.000	1	0.008	0.143	1.000
Heroine (diagnosed in outpatient services) [n (%)]	15 (9.7)	2 (14.3)	13 (27.1)	0.968	1	0.325	0.273	0.125
Benzodiazepines (SDS result) (n = 1 individual)	14.0	-	-	-	-	-	-	-
Benzodiazepines (score above the cut-off score for dependence) [n (%)]	1 (0.6)	-	-	-	-	-	-	-
Benzodiazepines (diagnosed in outpatient services) [n (%)]	4 (2.5)	2 (4.2)	2 (14.3)	1.839	1	0.175	0.217	0.172
Drug dependence, any drug (SDS) [n (%)]	61 (39.6)	11 (78.6)	50 (70.4)	0.383	1	0.536	0.397	0.067
Drug dependence, multiple drugs (SDS) [n (%)]	13 (8.4)	4 (28.6)	9 (12.7)	2.281	1	0.131	0.136	0.164
Drug dependence, multiple drugs (outpatient services) [n (%)]	13 (8.4)	3 (21.4)	10 (20.8)	0.002	1	0.962	0.612	0.006
Other mental health problems [n (%)]								
Psychotic disorders	20 (13.0)	5 (21.7)	15 (11.7)	1.833	1	0.176	0.154	0.109
Mood disorders	5 (3.2)	2 (8.7)	3 (2.3)	2.556	1	0.110	0.161	0.129
Anxiety disorders	3 (1.9)	0 (0)	3 (2.3)	0.537	1	0.464	0.613	0.059
Others	2 (1.3)	0 (0)	2 (1.5)	0.356	1	0.551	0.723	0.048
Dual pathology [n (%)]	13 (8.4)	5 (23.8)	8 (6.1)	7.252	1	0.007	0.019	0.218
Severe mental illness [n (%)]	13 (8.4)	5 (23.8)	8 (6.1)	7.252	1	0.007	0.019	0.218

[a] Percentage of total
[b] Percentage of survival status

Table 5
Hierarchical Binary Logistic Regression Model. Cox and Snell r square = 0.147; Nagelkerke r square = 0.257

Variables included in the model	B	Standard error	Wald	df	Sig.	Exp(B)
Plutchik results (year 2015)	1.223	0.541	5.107	1	0.024	3.398
Suicide attempts vs. no suicide attempts	0.239	0.082	8.593	1	0.003	1.270
Constant	-3.775	0.660	32.737	1	<0.000	0.023

Discussion

The objective of this study was to analyze mortality and suicidal behavior and their relationship to the variables linked to mortality in a cohort of PEHs followed from 2015 to 2022. During the seven years of follow-up, one in seven people died, at an average age of 52 years. The main results indicated that suicide and accidental overdose were among the leading causes of death (outnumbered only by cancer). Participants who had experienced more episodes of violence during the seven-year data collection period had more suicide attempts and a higher mean score on the suicidal ideation scale. Previous suicide attempts and suicidal ideation were the main variables associated with mortality.

The suicide mortality rate among PEHs in this study was 5,844.2 deaths per 100,000 inhabitants, which is more than 500 times the global mortality rate from suicide (World Health Organization, 2023) and more than 700 times the mortality rate from suicide among the general Spanish population (National Institute of Statistics, 2023). So,

individuals in the sample of PEHs in Catalonia were 84 times more likely to experience suicide attempt than the general international population (Zalsman, 2019), and between 3 and 16 times more likely to experience suicidal ideation than the general population of other countries (Geulayov et al., 2019; O'Connor & Nock, 2014).

Rates of suicide mortality among PEHs vary widely across existing research. The data obtained in this study indicate a mortality prevalence that exceeds between two and 52 times (Nicholas et al., 2021; Nilsson et al., 2014) the suicide mortality of other PEH samples reported to date. The prevalence of suicide attempts and suicidal ideation was consistent with international data (Ayano et al., 2019). The suicide attempts in our sample are likely undercounted, because we only have a record of attempts for which treatment was sought.

The second most frequent cause of death was accidental overdose. The drugs that caused the most episodes of overdose (lethal and non-lethal) were heroin and benzodiazepines or other sedatives, and all depressants including alcohol and methadone. Overdose due to opioid consumption has been a public health problem in Spain for four decades (Salazar et al., 2020), and mortality from this cause is still among the main causes of death in young people (Calvo et al., 2020). Among the main risk factors for death from opioid overdose in the general population are homelessness (Yamamoto et al., 2019) and the use of other central nervous system depressants that increase sedation (Jolley et al., 2015). With the rise of opioid painkillers worldwide (Krausz et al., 2021; Volkow et al., 2019) and in Spain (Pedrero-Pérez et al., 2020) and of benzodiazepines particularly in Spain (Carrasco-Garrido et al., 2018), the risk of overdose mortality

in socially vulnerable groups has increased worldwide (Martins et al., 2015), and PEHs are the people who suffer most from this crisis (Saloner et al., 2018).

In Spain, alcohol consumption is considered a risk factor for overdose in interaction with other substances, but death from alcohol overdose in itself—with or without suicidal intention—is not considered by practitioners, researchers and/or policymakers. Daily clinical practice in Spanish health systems shows that primary care forensic physicians who are called upon to certify the death of a PEH in an emergency service tend, in the absence of further information, to attribute the cause of death to direct reasons, such as cardiorespiratory arrest (Calvo-García et al., 2016). Even when there is no evidence that a death was caused by lethal overdose, people who die by suicide have usually consumed a drug, either as a suicide method or as a mediator/facilitator of the act that causes death (Darke et al., 2009). Considering that the main mental health diagnosis of PEHs is alcoholism, that in half of the deaths by suicide the person has consumed alcohol, and that the risk of lethal overdose increases because of the interaction between alcohol and other depressants, researchers should pay attention to alcohol consumption as a risk factor for mortality in general and as a risk factor for suicide and overdose.

Baseline data collected for this study in 2015 found that people with alcohol dependence were at increased risk of suicidal behavior (Calvo-García et al., 2016). The results obtained seven years later have established an even higher risk of death among people with cocaine dependence and dual pathology. The relationship between mental health and early death among PEHs is clear (Calvo et al., 2023b), and the intervention of mental health and social services is necessary to implement specific harm-reduction, treatment, and social programs that consider the particularities of PEHs.

At the same time, people who had experienced violence (as evidenced by having received hospital or outpatient medical care as a result of serious assaults) experienced more severe suicidal ideation, more suicide attempts, and more non-lethal overdoses. Existing research notes that victimization due to accumulation of structural and individual violence suffered by PEHs significantly increases suicidal behavior and suicide mortality (Tinland et al., 2018). Most PEHs, especially those experiencing literal homelessness—and women in particular—have suffered serious episodes of violence (Calvo et al., 2022). Both recurring experiences of violence and stressful life events cause or aggravate post-traumatic stress disorders, which are associated with greater risk of suicidal ideation or suicide attempts (Panadero et al., 2018; Vazquez & Panadero, 2019). And suicidal ideation and suicide attempts, in turn, increase the risk of dying by suicide.

Finally, we found that the variables that best predict mortality were previous suicide attempts and score on the Plutchik Suicide Risk Scale. There is vast scientific evidence that shows that previous suicide attempts are one of the main predictors of suicide mortality (Turecki et al., 2019; Zhong et al., 2021). Suicidal ideation scales, which usually include an item that evaluates previous suicide attempts (Paykel et al., 1974; Plutchik et al., 1989) are user-friendly tools that can provide valuable information for detecting suicide risk and, therefore, elicit application of prevention strategies. Although this type of scale is based on the probability of an outcome given certain risk factors, when it is complemented with a person-centered approach that includes the relationship between the professional and the PEH, it can improve preventive capacity (Navarrete Betancort et al., 2019). Because social work and social education professionals working in specific services for PEHs base their interventions on the therapeutic relationship and person-centered approaches, future research could assess the ability of these professionals to be trained to detect suicide risk and undertake preventative interventions.

In this study, one in ten people who exceeded the suicide risk cut-off point at baseline subsequently died because of suicide, usually after at least one failed attempt. All of those who died by suicide had passed this cut-off point, and all of them had a previous suicide attempt recorded in the emergency services of the public health system. Notably, about half of people who die by suicide consult a primary care physician one month before death, although there is scarce information about the reason for the visit or what the patient reveals in it (Turecki & Brent, 2016). Although some studies suggest that the classic risk factors for the detection of suicide risk have major limitations, especially in terms of previous suicide attempts (Sommers-Flanagan & Shaw, 2017), in our study, they were important predictors of completed suicide. Therefore, proper screening for these variables should take place in centers specialized in attending PEHs, and preventive interventions should take place within the same centers, to avoid attrition through the referral process. Our findings suggest that detecting and intervening in suicide risk within the same center offers substantial potential to save lives.

Homelessness is a complex, dynamic process, and there are many forms of residential exclusion. In addition to literal homelessness, unsafe or inadequate housing also puts people at risk and can precede literal homelessness (Busch-Geertsema et al., 2016). Some studies have concluded that the onset of suicidal symptoms generally precede homelessness and that housing-first policies may not be effective in reducing suicide in PEHs (Aquin et al., 2017; Noël et al., 2016). However, suicidal ideation, suicide plans and suicide attempts are less frequent among people who are provided with stable housing after leaving life on the street (Peltier et al., 2021). Considering homelessness as a process, we should analyze the relationship of all forms of residential exclusion with suicidal behavior, rather than using a binary approach (in which people are classified simply as either "homeless" or "housed"). Stress related to the possibility of losing housing, foreclosure notices, owing back rent, and other socioeconomic stressors are also related to suicidal behavior without the person necessarily being literally homeless (Machado et al., 2015; Silva et al., 2016).

Based on the results outlined above, we offer some recommendations. First, it is important to expand the number of longitudinal studies on suicide among PEHs. These should ideally include psychological autopsies to help fill in the gap in scientific evidence on the etiology of suicide in people experiencing residential exclusion. Second, although PEHs constitute the subpopulation most at risk for suicidal behavior, only one review is known wherein the objective was to evaluate specific programs conducted with PEHs (Murray et al., 2021). This review included four articles that addressed, from a health perspective, suicidal ideation and behaviors in both adolescents and adults, covering youth aged 11 to 14 years, young adults aged 18 to 24 years, and adults over 18 years. Psychiatric illness, substance abuse, and psychosocial factors associated with homelessness may be direct contributors to suicidal symptoms and thus represent strategic intervention targets (Peltier et al., 2021). Therefore, we need to design and evaluate mental health and addiction programs that go beyond monitoring and urgent care and provide quality treatment for people in these situations. To meet

the needs of PEHs, these approaches should include specialized knowledge of the phenomenon of homelessness and the importance of social health in the risk of suicide, including the role of gender, trauma, victimization, and post-traumatic stress disorder.

Third, improving the health of PEHs requires adapting the available support to their situation of residential exclusion. Health and social systems must improve efforts to manage concomitant chronic diseases, to treat substance use disorders, to prevent homelessness among at-risk people, to ameliorate living conditions, to include PEHs' needs in health plans, and to provide access to health services (García et al., 2023). Stakeholders developing these services should be cognizant of burgeoning evidence regarding the value of personalized and psychologically informed approaches in supporting homeless and other socially excluded populations to access and maintain engagement with healthcare (Johnsen et al., 2021; Luchenski et al., 2018). In summary, given the complexity and multifactorial nature of suicidal behavior, selective prevention strategies targeting the PEH population are proposed. These strategies include early detection and support for high-risk groups through comprehensive mental health assessments, access to services in the shelters, staff training to identify suicide warning signs, short-term interventions and specific psychotherapy for suicidal behavior, promotion of social and community support networks, and short-term follow-up to ensure that at-risk individuals receive necessary care. The aim of these strategies is to address the various interconnected dimensions influencing suicidal behavior in the PEH population, recognizing that the approach must be holistic and tailored to their specific needs (Al-Halabí & Fonseca-Pedrero, 2021, 2023).

This study is not without limitations. Firstly, the limited sample size, despite its representativeness regarding the reference population, has posed certain constraints. Our relatively small sample hindered our ability to explore the impact of gender on suicide, given the low proportion of female participants, and impeded our capacity to conduct subgroup assessments, for instance, to control for variables related to mental health, including substance dependencies. Subsequent studies should consider expanding the sample size to enable more robust statistical analyses that take these factors into account. Secondly, the aforementioned limitation of information bias related to the diagnosis of death cause. Future research should include the complex and multifactorial nature of suicidal behavior and find out if there is more mortality due to external causes than has been discovered in this study. Finally, it is crucial to collect qualitative data from PEHs to understand suicidal ideation from a multidimensional perspective that includes the views of those at disproportionate risk of suicidal ideation.

In conclusion, the PEHs in our study had a very high mortality rate at an early age, especially as a result of suicide and accidental overdose. This risk is much higher than in the general population and amongst PEHs in other countries. The most important variables related to mortality were suicidal ideation, the number of previous non-lethal overdoses, and substance use disorders, especially those related to alcohol. Future studies should analyze whether suicidal intention is present in lethal overdoses and develop specific programs aimed at preventing suicide among PEHs who experience a high degree of suicidal ideation. The most effective approaches are likely to be ones that combine structural and individual perspectives, paying particular attention to adequate housing policies and mental health care.

Declaration of Interests

The authors declare that there is no conflict of interest.

Data Availability Statement

The data that support the findings of this study are available from the corresponding author, [Fran Calvo], upon reasonable request.

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