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Systematic review and meta-analysis of the prevalence of depressive symptoms, dysthymia and major depressive disorders among homeless people

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ABSTRACT

Objectives To assess the global prevalence estimates of depressive symptoms, dysthymia and major depressive disorders (MDDs) among homeless people.

Design Systematic review and meta-analysis.

Data sources Databases including PubMed, Scopus and Web of Science were systematically searched up to February 2020 to identify relevant studies that have reported data on the prevalence of depressive symptoms, dysthymia and MDDs among homeless people.

Eligibility criteria Original epidemiological studies written in English that addressed the prevalence of depressive problems among homeless people.

Data extraction and synthesis A random-effect meta-analysis was performed to pool the prevalence estimated from individual studies. Subgroup and sensitivity analyses were employed to compare the prevalence across the groups as well as to identify the source of heterogeneities. The Joanna Briggs Institute's quality assessment checklist was used to measure the study quality. Cochran's Q and the I^2 test were used to assess heterogeneity between the studies.

Results Forty publications, including 17215 participants, were included in the final analysis. This meta-analysis demonstrated considerably higher prevalence rates of depressive symptoms 46.72% (95% CI 37.77% to 55.90%), dysthymia 8.25% (95% CI 4.79% to 11.86%), as well as MDDs 26.24% (95% CI 21.02% to 32.22%) among homeless people. Our subgroup analysis showed that the prevalence of depressive symptoms was high among younger homeless people (<25 years of age), whereas the prevalence of MDD was high among older homeless people (>50 years of age) when compared with adults (25–50 years).

Conclusion This review showed that nearly half, one-fourth and one-tenth of homeless people are suffering from depressive symptoms, dysthymia and MDDs, respectively, which are notably higher than the reported prevalence rates in the general population. The findings suggest the need for appropriate mental health prevention and treatment strategies for this population group.

BACKGROUND

Global epidemiological evidence shows that a substantial proportion of homeless people

Strengths and limitations of this study

► Estimating the prevalence of the different categories of depressive problems separately (depressive symptoms, dysthymia and major depressive disorders) and assessing the prevalence across the lifespan are the main strengths of the present systematic review and meta-analysis.

► The vast majority of the included studies were performed in high-income countries, and only three studies were conducted in low-income and middle-income countries, which significantly affects the global representativeness of the estimates.

► We included only peer-reviewed published articles.

► Only studies published in the English language were included in this meta-analysis, therefore, relevant studies published in another language might have been missed.

living in both high-income and low-income countries are suffering from mental, neurological and substance-use disorders.[1–3] The reported prevalence estimates of mental, neurological and substance-use disorders among homeless people ranged from 25% to 92%.[4–7] Research evidence indicates that the presence of mental and substance disorders among homeless people is frequently and consistently associated with a higher risk of negative outcomes including disability and mortality from alcohol and drug use, suicide and general medical conditions.[8–12]

Regarding depressive problems, in particular, scientific evidence from numerous studies has shown that depressive problems are the most common mental health problems among homeless people.[13–17] The reported prevalence estimates of depressive problems among the homeless people ranged from 9.5% to 76.9% across the studies.[13–17] These prevalence rates are higher than the estimates in the general population

(5%–7.2%).[18 19] Moreover, the vast majority of homeless people with depressive problems have comorbid physical disease, mental and substance-use disorders.[1 3 20] Epidemiological evidence suggests that comorbid conditions in patients with depressive disorders are associated with more severe disability, suffering, suicide, as well as higher mortality rates from different causes when compared with non-comorbid depressive disorders.[8–11 21–25]

However, to the best of our knowledge, there is no previous systematic review and meta-analysis that measured the global prevalence estimates of depressive symptoms, dysthymia and major depressive disorders (MDDs) among homeless people. This study fills this gap in the literature by analysing the global prevalence estimates of those depressive problems among homeless people. The finding from such analysis will provide robust data on depressive problems among homeless individuals, which in turn helps policy-makers and programme managers in developing policy solutions and designing appropriate and effective intervention strategies for those population groups.

METHODS
Data sources and search strategies
This systematic review and meta-analysis was performed in accordance with the guidelines of Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA).[26] We used a predesigned protocol (unpublished) for searching, extracting data, inclusion or exclusion of studies, assessing quality and data analysis. A systematic search of relevant studies was carried out in three reputable databases—PubMed, Scopus and Web of Science using keywords and combinations tailored to each database. The details about the searching technique are in online supplemental material 1. In addition, the reference lists of included studies were hand-searched to identify additional articles.

Eligibility criteria and study selection
In this systematic review and meta-analysis, studies were included if they: (1) were conducted among homeless people; (2) assessed the prevalence of depressive symptoms, dysthymia or MDDs or reported data to estimate the prevalence and (3) were written in English language. Studies were excluded if they satisfy the following criteria: (1) they were commentaries, reviews, case reports and animal studies; (2) they were letters, editorials, conference papers, books and notes.

Selection of studies for the inclusion in the systematic review and meta-analysis
In this systematic review and meta-analysis, the corresponding author (GA) identified articles and consequently evaluated them by their titles and abstract based on the eligibility criteria. Full-text articles were selected for further assessment by the author. This author further appraised the full text of each study and subsequently retained those full-text articles to be included in the final analysis.

Definition of key terms and concepts
Depressive disorders and dysthymia
This systematic review and meta-analysis combined studies from a wide range of settings and countries across the globe that reported the lifetime prevalence estimate of MDDs as well as dysthymia according to standard diagnostic criteria's, which were assessed by using standard diagnostic instruments such as the Diagnostic Statistical Manual of Mental disorders (DSM), Schedule for Clinical Assessment of Neuropsychiatry (SCAN), International Classification of Disease (ICD) and Composite International Neuropsychiatric Interview (CIDI) and Mini-International Neuropsychiatric Interview (MINI).

Depressive symptoms
The prevalence of depressive symptoms in this review indicates the current prevalence as measured by the screening instruments such as the Centre for Epidemiologic Surveys for Depression (CES-D), Depression, Anxiety and Stress Scale (DASS), Patient Health Questionnaire (PHQ-9) and Zung Self-rating Depression Scale.

Homelessness
There is no internationally consistent definition of homelessness. Some scholars (countries) define homelessness narrowly as the absence of access to safe shelter while others define broadly comprising those people living in marginal housing (marginal accommodations), people who are sleeping in public places or designed shelter and rooflessness.[27 28] In this study, we have included studies that defined homelessness in various ways. Thus, homelessness represents the comprehensive definition mentioned above (which is beyond rooflessness).

Methods for data extraction and quality assessment
Two independent authors (AB and GA) performed data extraction from the included studies. We extracted the following data from each study: first author(s) name, country of the study, sample size, year of publication, tools used and a number of positive cases, and the reported prevalence of depressive symptoms, dysthymia and MDDs. The Joanna Briggs institute quality assessment tool was used to assess the quality of studies included in this meta-analysis.[29] According to this scale, the scoring of each study was conducted based on the frequency scales that are answered as yes, no, not clear (when some information is missing in the study) and not applicable (the question does not apply to that study depending on the design). The total quality score for each study was calculated based on the total number of positive scores.

Data synthesis and analysis
All statistical analysis was conducted by using comprehensive meta-analysis software version 3. The prevalence and 95% CI were calculated using a random-effect model.[30] The I^2 statistics was used to measure between-study heterogeneity.[30] The values of I^2 statistics such as 25, 50 and 75% represented low, medium and high heterogeneity, respectively.[31] The ages of the participants and the
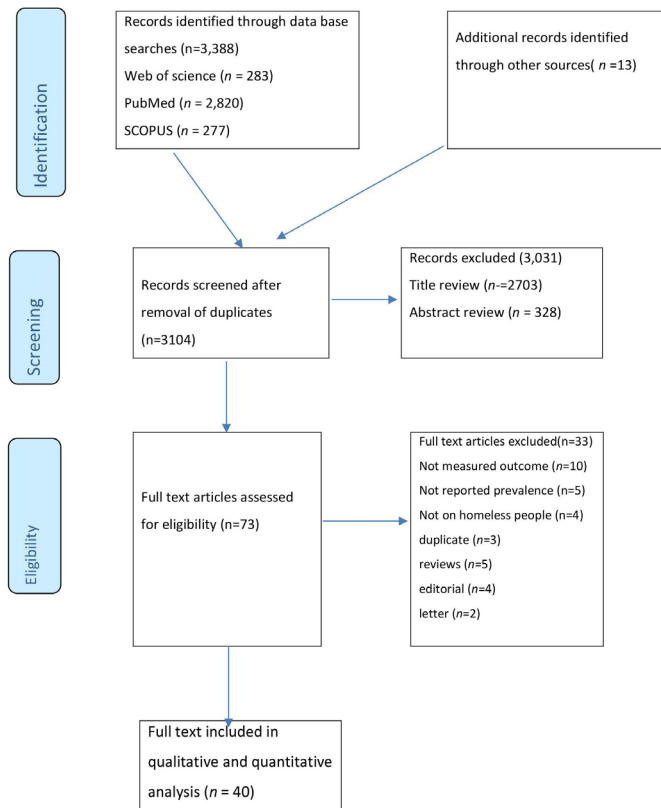
Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses flowchart of review search. This figure illustrates the process of searching for relevant studies from the three reputable databases including identification, selection, eligibility and inclusion of the studies depending on the predefined criteria.

quality of the studies were used to determine the possible source of heterogeneity between the studies. Publication bias was assessed by using the funnel plot and Egger's regression tests. For all analyses, the p value for statistical significance was set at 0.05.

Patient and public involvement
Patient and the public were not involved in this study.

RESULTS
Identification of relevant studies
After database searches performed strictly according to a predesigned protocol, 3388 studies were identified through an electronic database search. Further 13 studies have been added using manual searches making the total studies 3401. Of these, we excluded 2703 articles during the assessment of duplicate and titles, as they did not satisfy the selection criteria. Subsequently, 328 articles were excluded after the assessment of the abstract as they did not meet the inclusion criteria. Hence, a full text of 73 articles were retained for further evaluation and 40 of these were found to be eligible for meta-analysis (figure 1).

Characteristics of included studies
Overviews of the key characteristics of the studies included in this systematic review and meta-analysis are shown in table 1. A total of 40 studies,[1 3 13–17 20 21 32–62] with 17 215 participants, were included in the analysis. Majority of these studies (n=21) were conducted in the USA,[13–17 21 32–34 39 41 43 44 46 47 51 54 57 58] and six were conducted in Canada,[3 20 35 48 50 62] two in Australia,[52 61] two in Germany,[53 55] two in the UK,[38 40] two in France,[36 56] one in Spain,[42] one in Japan,[45] one in Iran,[49] one in Serbia,[37] one in Netherlands[59] and one in Ethiopia.[1] The eligible articles were published between 1989 and 2017. The sample size for the included studies ranged from 36 participants in Germany to 2838 participants in the USA.

Regarding the specific outcomes, 21 studies assessed depressive symptoms, 20 assessed MDDs and 5 assessed dysthymia (chronic minor depressive disorders).

Depressive symptoms among homeless people were predominantly measured using the Centre for Epidemiological Studies Depression Scale-Revised (CES-D). The CES-D was used in 11 studies, Beck's Depression Inventory (BDI) in 2 studies, PHQ in 2 studies, DASS, Rost-Burnam Screener for Depression (RBSD) in 1 study and 1 study used a self-reported history of depressive symptoms.

Regarding MDDs, the majority (n=11) of the studies used the DSM to measure MDD. While five studies used Composite International Neuropsychiatric Interview (CIDI), five studies used MINI and ICD applied in one study. All studies used DSM to measure dysthymia.

Quality of included studies
Table 2 demonstrates the risk of bias and the quality of the included articles. Twenty-eight studies used an adequate sample size (71.79%) to measure the prevalence of depressive problems. About one-third of the studies scored positive on the item regarding response rate (35.89%), and the remaining studies scored negative (64.11%). To measure depressive problems, the vast majority of the studies used a standard instrument or valid diagnostic criteria (97.43%), and almost all studies used a study-specific questionnaire or instrument specifically designed to assess depressive problems (97.43%). All studies (100%) used appropriate statistical analysis to assess the prevalence of depressive problems. According to the Joanna Briggs institute quality assessment checklist, the included articles had a mean quality score of 7.71 ranging from 5 to 9. Twenty-five studies (64.10%) were high-quality studies (scored 7.71 and above) and the remaining were fair-quality studies (scored between 5 and 7.71) (table 2).

The prevalence of depressive symptoms in homeless people (meta-analysis)
The pooled prevalence estimates of depressive symptoms in the homeless people was found to be 46.72% (95% CI 37.77% to 55.90%). The heterogeneity across the studies was significant for this analysis (I^2=97.57%; p<0.001) (figure 2).

Table 1 Distribution of studies on depression in homeless people included in the qualitative and quantitative analysis based on year, study design, sample size, instrument, country, response rate, study population and prevalence

Author (year) (reference number)	Sample size	Tools used	Country	Study population	Outcome (magnitude of depressive problems)
Landefeld et al (2017)[21]	348	Centre for Epidemiologic Surveys for Depression (CES-D)	USA	Old adults age ≥50	Depressive symptoms 53.5% (n=185)
Bacciardi et al (2018)[32]	489	Mini-International Neuropsychiatric Interview (MINI)	USA	Adult with TBI	Depressive symptoms 35.78% (n=175)
Rogers et al (2017)[33]	124	Rost-Burnam Screener for Depression (RBSD)	USA	Adults ≥50	Depressive symptoms 52 (n=64)
Lee et al (2017)[13]	156	CES-D	USA	Adults	Depressive symptoms 120 (77.5%)
Palar et al (2015)[34]	346	Beck Depression Interview (BDI)	USA	Adults with HIV	Depressive symptoms 139 (35.8%)
Noël et al (2016)[35]	497	MINI	Canada	Adults with mental health problems	Depressive symptoms 40% (n=199)
Roze et al (2018)[36]	733	Composite International Neuropsychiatric Interview (CIDI)	France	Women (adults)	MDD 28.8%
Sarajlija et al (2014)[37]	104	BDI	Serbia	Adults	MDD 15.4% (n=16)
					Depressive symptoms 62.5% (n=65/104)
Berg et al (2005)[14]	415	CES-D	USA	Adults (18–55) with latent TB	Depressive symptoms 50% (n=209)
Topolovec-Vranic et al (2017)[20]	990	MINI	Canada	Adults with mental helath problems/TBI	MDD 42.1% (n=417/990)
Coohey et al (2015)[16]	457	Diagnostic Statistical Manual of Mental disorders (DSM)	USA	Adults	26.25% (n=)
Pluck (2008)[38]	50	Zung Self-rating Depression Scale	UK	Adults	Depressive symptoms 62.14% (n=31)
Fletcher et al (2017)[39]	131	Structured Clinical Interview for DSM-IV Axis I Disorders (SCID)	USA	Adults who were have sex with men (MSM)	MDD 39% (n=51)
Gory et al (1990)[40]	150	CES-D	UK	Adult	Depressive symptoms 75% (n=150)
Susser et al (1989)[41]	223	CES-D	USA	Adults (men)	Depressive symptoms 33% (n=74)
Munoz et al (1998)[42]	262 Madrid 1563 Los Angeles	CIDI Diagnostic Interview Schedule (DIS)	Spain	Adult	MDD Madrid 21% (n=55/262); MDD Los Angeles 21.2% (n=332/1563) Dysthymia Madrid 17.7% (n=47/262) Los Angeles 14.8% (n=231)
Nyamathi et al (2012)[43]	267	CES-D	USA	Adult (18–46) with G/B	Depressive symptoms 62.2% (n=166)
Ghose et al (2013)[44]	2838	International Classification of Disease (ICD)	USA	Adults (veterans)	MDD 9.5% (n=269)
Okamura et al (2014)[45]	423	Patient Health Questionnaire (PHQ2 (two question Instrument))	Japan	Adults	Depressive symptoms 28.9% (n=119/412)
Brown et al (2013)[15]	472	PHQ-9	USA	Adults aged 50 years and older	Depressive symptoms 39.8% (n=99)
Logan et al (2013)[46]	208	Not mentioned	USA	Young adults aged 18–25 years	Depressive symptoms 64.4% (n=134)

Continued

Table 1 Continued

Author (year) (reference number)	Sample size	Tools used	Country	Study population	Outcome (magnitude of depressive problems)
Rhoades et al (2013)[47]	305	CES-D	USA	Adult men heterosexual (age >18)	Depressive symptoms 46.36% (n=141)
Strehlua et al (2012)[48]	196	MINI	Canada	Women with age 19–25	MDD 29% (n=56)
Prinsloo et al (2012)[49]	38	SCID	Iran	Adult with age ≥26	MDD 42.1% (n=16)
Whitbeck et al (2012)[50]	112	CIDI	Canada	Adult	MDD 29.7% (n=33)
Hadland et al (2011)[3]	559	CES-D	Canada	Young with age 14–26	Depressive symptoms 43.4% (n=194)
Crawford et al (2011)[17]	241	CIDI	USA	Young women with age b/n 16 and 19	MDD 32.50% (n=73)
Nyamathi et al (2012)[51]	156	CES-D	USA	Young adults	Depressive symptoms 52.60% (n=82)
Larney et al (2009)[52]	105	Depression, Anxiety and Stress Scale (DASS)	Australia	Adult	Depressive symptoms 44.76% (n=47)
Greifenhage et al (1997)[53]	36	DSM	Germany	Adult women	MDD 50% (n=16) Dysthymia 6 % (n=2)
Koegel et al (1998)[54]	445	DSM	USA	Adult	MDD 18.3% (n=60) Dysthymia 9.3% (n=41)
Fichter et al (2001)[55]	265	SCID	Germany	Adult men	MDD 21.1% (n=59)
Kovess et al (1999)[56]	838	CIDI	France	Adult	MDD 33.7% (n=241)
Rohde et al (2001)[57]	523	SCID	USA	Adolescent age less than 21	Depressive symptoms 17.6% (n=92), MDD 12.2% (n=61) and dysthymia 6.5% (n=34)
Spinelli et al (2017)[58]	350	CES-D	USA	Adult with age 50 and above	Depressive symptoms 38.3% (n=134)
Van Straaten et al (2014)[59]	385	DASS	Netherlands	All homeless	Depressive symptoms 41.55% (n=160)
Bassuk et al (1986)[60]	80	DSM	USA	Adult	MDD 12.5% (n=10)
Herman et al (1989)[61]	382	DSM	Australia	Adult	MDD 20% (n=78)
Ayano et al (2017)[1]	456	DSM	Ethiopia	Adult	MDD 9.6% (n=44)
Krausz et al (2013)[62]	489	MINI	Canada	—	MDD 45.429% (n=222) Dysthymia 4.7 (n=23)

MDD, major depressive disorders; TBI, Traumatic Brain Injury.

The prevalence of MDDs in homeless people (meta-analysis)

The pooled prevalence of MDDs was 26.24% (95% CI 21.02% to 32.22%). Significant heterogeneity has been found for this analysis (I^2=97.57; p<0.001) (figure 3).

The prevalence of persistent depressive disorders (dysthymia) disorder in homeless people

Our random-effects meta-analysis resulted in pooled prevalence estimates of dysthymia in the homeless people 8.25% (95% CI 4.79% to 11.86%). This analysis also resulted in a significant heterogeneity between the studies (I^2=89.80%; p<0.001) (figure 4).

Sensitivity analysis

Table 3 illustrates the results of the subgroup and sensitivity analysis. We conducted a sensitivity analysis by the age of the participants, the sample size, the instrument used to measure depressive problems and the quality of the included studies in order to explore the possible source of heterogeneity in the analysis of the prevalence

Table 2 The quality of studies included in the systematic review and meta-analysis

Study name	Response									
	Q1	Q2	Q3	Q4	Q5	Q6	Q7	Q8	Q9	Total
Landefeld et al[21]	Y	N	Y	Y	Y	Y	Y	Y	U	7
Bacciardi et al[32]	Y	N	Y	Y	Y	Y	Y	Y	U	7
Rogers et al[33]	Y	N	N	Y	Y	N	Y	Y	U	6
Lee et al[13]	Y	N	N	Y	Y	N	Y	Y	U	6
Palar et al[34]	Y	Y	Y	Y	Y	Y	Y	Y	U	8
Noel et al[35]	Y	Y	Y	Y	Y	Y	Y	Y	U	8
Roze et al[36]	Y	Y	Y	Y	Y	Y	Y	Y	Y	9
Sarajlija et al[37]	Y	N	Y	Y	Y	Y	Y	Y	Y	8
Berg et al[14]	Y	Y	Y	Y	Y	Y	Y	Y	U	8
Topolovec-Vranic et al[20]	N	Y	Y	Y	Y	Y	Y	Y	U	7
Coohey et al[16]	Y	Y	Y	Y	Y	Y	Y	Y	U	8
Pluck et al[38]	N	N	N	Y	Y	Y	Y	Y	U	5
Fletcher et al[39]	N	N	N	Y	Y	Y	Y	Y	U	5
La Gory et al[40]	Y	Y	N	Y	Y	Y	Y	Y	U	7
Susser et al[41]	Y	Y	N	Y	Y	Y	Y	Y	U	7
Munoz et al[42]	Y	Y	Y	Y	Y	Y	Y	Y	Y	9
Nyamathi et al[43]	Y	Y	Y	Y	Y	Y	Y	Y	U	8
Ghose et al[44]	Y	Y	Y	Y	Y	Y	Y	Y	U	8
Okamura et al[45]	Y	Y	Y	Y	Y	Y	Y	Y	U	8
Brown et al[15]	Y	Y	Y	Y	Y	Y	Y	Y	Y	9
Logan et al[46]	Y	Y	Y	Y	Y	Y	Y	Y	U	8
Rhoades et al[47]	Y	Y	Y	Y	Y	Y	Y	Y	U	8
Strehlua et al[48]	N	Y	Y	Y	Y	Y	Y	Y	U	8
Prinsloo et al[49]	N	Y	N	Y	Y	Y	Y	Y	Y	7
Whitbeck et al[50]	N	Y	N	Y	Y	Y	Y	Y	U	6
Hadland et al[3]	Y	Y	Y	Y	Y	Y	Y	Y	Y	9
Crawford et al[17]	Y	Y	Y	Y	Y	Y	Y	Y	Y	9
Nyamathi et al[51]	Y	Y	Y	Y	Y	Y	Y	Y	Y	9
Larney et al[52]	N	Y	N	Y	Y	Y	Y	Y	Y	7
Greifenhage et al[53]	N	Y	N	Y	Y	Y	Y	Y	Y	7
Koegel et al[54]	Y	Y	Y	Y	Y	Y	Y	Y	Y	9
Fichter et al[55]	Y	Y	Y	Y	Y	Y	Y	Y	U	8
Kovess et al[56]	Y	Y	Y	Y	Y	Y	Y	Y	Y	9
Rohde et al[57]	Y	Y	Y	Y	Y	Y	Y	Y	Y	9
Spinelli et al[58]	Y	Y	Y	Y	Y	Y	Y	Y	U	8
Van Straaten et al[59]	Y	Y	Y	Y	Y	Y	Y	Y	Y	9
Bassuk et al[60]	N	Y	N	Y	Y	Y	Y	Y	U	6
Herman et al[61]	Y	Y	Y	Y	Y	Y	Y	Y	U	8
Ayano et al[1]	Y	Y	Y	Y	Y	Y	Y	Y	Y	9

A. Q1–Q9 represents questions used to assess the quality of included studies, which are listed below.
Q1. Was the sample frame appropriate to address the target populations?
Q2. Were the study participants sampled in appropriate way?
Q3. Was the sample size adequate?
Q4. Were the study subjects and setting described in details?
Q5. Was the data analysis conducted with sufficient coverage of the identified sample?
Q6. Was a valid method used in the identification of conditions?
Q7. Was the condition measured in a standard, reliable way for all participants?
Q8. Was there an appropriate statistical analysis?
Q9. Was the response rate adequate, and if not, was the low response rate managed appropriately?
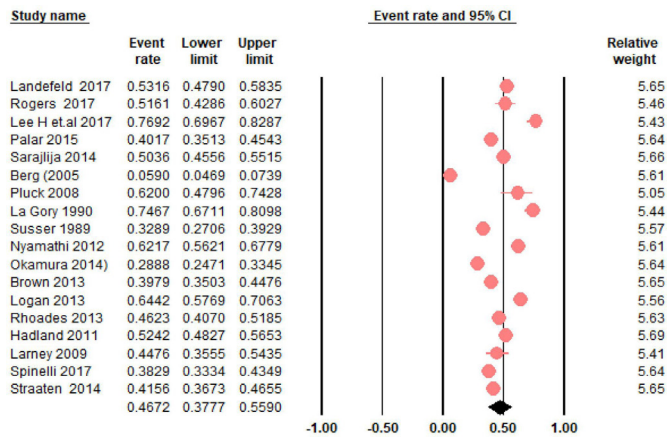N, no; NA, not applicable; U, unclear; Y, yes.

Study name

	Event rate	Lower limit	Upper limit	Event rate and 95% CI	Relative weight
Landefeld 2017	0.5316	0.4790	0.5835		5.65
Rogers 2017	0.5161	0.4286	0.6027		5.46
Lee H et.al 2017	0.7692	0.6967	0.8287		5.43
Palar 2015	0.4017	0.3513	0.4543		5.64
Sarajlija 2014	0.5036	0.4556	0.5515		5.66
Berg (2005	0.0590	0.0469	0.0739		5.61
Pluck 2008	0.6200	0.4796	0.7428		5.05
La Gory 1990	0.7467	0.6711	0.8098		5.44
Susser 1989	0.3289	0.2706	0.3929		5.57
Nyamathi 2012	0.6217	0.5621	0.6779		5.61
Okamura 2014)	0.2888	0.2471	0.3345		5.64
Brown 2013	0.3979	0.3503	0.4476		5.65
Logan 2013	0.6442	0.5769	0.7063		5.56
Rhoades 2013	0.4623	0.4070	0.5185		5.63
Hadland 2011	0.5242	0.4827	0.5653		5.69
Larney 2009	0.4476	0.3555	0.5435		5.41
Spinelli 2017	0.3829	0.3334	0.4349		5.64
Straaten 2014	0.4156	0.3673	0.4655		5.65
	0.4672	0.3777	0.5590		

Figure 2 The prevalence of depressive symptoms among homeless people: a meta-analysis. The figure shows the results of the meta-analysis of the studies on depressive symptoms among homeless people using random-effect model.

Study name

	Event rate	Lower limit	Upper limit	Event rate and 95% CI	Relative weight
Bacciardi 2018	0.3579	0.3166	0.4014		4.72
Noel F 2016	0.4004	0.3582	0.4441		4.72
Roze 2018	0.2879	0.2562	0.3217		4.74
Topolovec-Vranic 2017	0.4212	0.3908	0.4522		4.77
Ayano 2017	0.0965	0.0726	0.1272		4.56
Coohey 2015	0.2626	0.2243	0.3049		4.69
Fletcher 2017	0.3893	0.3097	0.4753		4.49
Munoz 1998	0.2099	0.1648	0.2635		4.58
Munoz 1998b	0.2124	0.1928	0.2334		4.77
Ghose 2013	0.0948	0.0845	0.1061		4.77
Strehla 2012	0.2857	0.2268	0.3529		4.56
Prinsloot 2012	0.4211	0.2764	0.5807		3.89
Whitbeck 2012	0.2946	0.2177	0.3854		4.40
Crawford 2011	0.3237	0.2676	0.3853		4.62
Greifenhage 1997	0.5000	0.3422	0.6578		3.87
Koegel 1998	0.1820	0.1489	0.2206		4.66
Fichter M 2001	0.2113	0.1663	0.2646		4.58
Kovess 1999	0.3365	0.3053	0.3692		4.76
Rohde 2001	0.1224	0.0969	0.1533		4.63
Bassuk 1986	0.1250	0.0686	0.2170		3.85
Herman 1989	0.2042	0.1667	0.2476		4.65
Krausz 2011	0.4540	0.4103	0.4984		4.73
	0.2624	0.2102	0.3222		

Figure 3 The prevalence of major depressive disorders (MDDs) among homeless people: a meta-analysis. The figure shows the results of the meta-analysis of the studies on MDDs among homeless people using random-effect model.

Study name

	Event rate	Lower limit	Upper limit	Event rate and 95% CI	Relative weight
Munoz 1998b	0.1794	0.1375	0.2306		22.90
Greifenhage 1997	0.0556	0.0139	0.1967		9.92
Koegel 1998	0.0921	0.0686	0.1228		22.84
Rohde 2001	0.0650	0.0468	0.0896		22.57
Krausz 2013	0.0470	0.0315	0.0698		21.78
	0.0825	0.0479	0.1386		

Figure 4 The prevalence of dysthymia among homeless people: a meta-analysis. The figure shows the results of the meta-analysis of the studies on dysthymia among homeless people using random-effect model.

by the age of the participants (p=0.839). The prevalence of depressive disorder was 22.98% for younger participants and it was 25.38% and 29.89% for adult and older participants, respectively.

In our sensitivity analysis based on the quality of included studies, the pooled estimated prevalence of depressive symptoms was 40.45% for high-quality studies and it was 57.03% for fair-quality studies, although the difference observed was not statistically significant (p=0.059). Likewise, the prevalence of depressive disorder was 21.75% as measured for high-quality studies and it was 32.45% for fair-quality studies, although the difference observed was statistically significant (p=0.002) (table 2).

We also found that the prevalence of depressive disorders was highest when measured by MINI (33.64%) followed by CIDI (27.42%), Structured Clinical Interview for DSM-IV Axis I Disorders (21.66%) and DSM (20.18%). However, the observed differences across the tools were not statistically significant (p>0.05).

Moreover, our sensitivity analysis based on the sample size revealed that the prevalence estimates of both depressive symptoms as well as depressive disorders were found to be considerably higher in studies that involved a lower small sample size when compared with studies that involved a higher sample size.

Finally, one of the studies included in the final analysis was conducted among female participants only. When we remove this study from the final analysis, the prevalence estimates remained virtually the same 26.13% (95% CI 20.76% to 32.33%).

Publication bias

In this review, the funnel plot was symmetrical and regression tests associated with the funnel plot (Egger's test) provided no evidence of potential publication bias for the prevalence of depressive symptoms (B=5.11, SE=35.78, p=0.390) as well as depressive disorders (B=0.289, SE=3.26, p=0.930) (figures 5 and 6).

DISCUSSION

To our knowledge, this is the first comprehensive systematic review and meta-analysis on the prevalence of depressive symptoms, dysthymia and MDDs among homeless people. We found 39 studies measuring the three types of depressive problems among homeless people: depressive

of depressive problems in the homeless people. All the sensitivity analyses were conducted by using a random-effect model.

Our analysis based on the age of the participants demonstrated that the prevalence of depressive symptom was high among younger homeless people (<25 years of age), whereas the prevalence of MDD was high among older homeless people (>50 years of age) when compared with adults (25–50 years). The prevalence of depressive symptoms was 58.21% for younger participants and it was 44.76% and 47.44% for adult and older participants, respectively. In these sensitivity analyses, the observed difference in the magnitude of depressive symptoms by the age of the participants was not statistically significant (p=0.261).

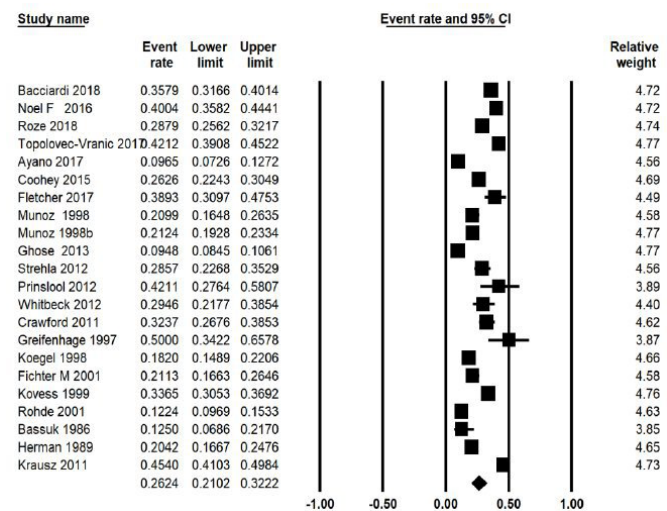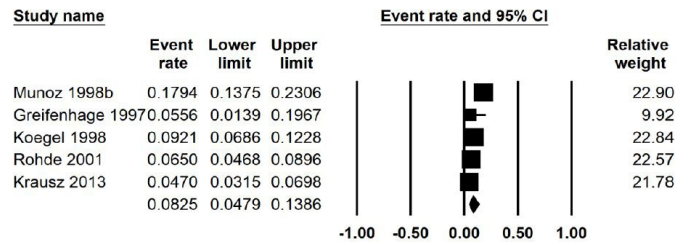Similarly to depressive symptoms, we found no significant difference in the prevalence of depressive disorders

Table 3 Subgroup and sensitivity analysis of prevalence of depressive problems among homeless participants by age and quality of the studies

Subgroup	Number of studies	Estimates Prevalence (%)	95% CI	Heterogeneity across the studies I² (%)	P value	Heterogeneity between groups (p value)
Age (depressive symptom)						
Adult	13	44.76	32.95 to 57.20	98.04	<0001	0.261
Older	3	47.44	37.22 to 57.88	88.14	<0001	
Younger	2	58.21	46.13 to 69.38	88.6	<0001	
Age (depressive disorders)						
Adult	16	25.38	19.44 to 32.40	97.72	<0001	0.839
Older	2	29.89	14.84 to 51.05	95.28	<0001	
Younger	3	22.98	11.96 to 39.58	95.79	<0001	
Quality of the study (depressive symptoms)						
High	11	40.45	29.68 to 52.23	93.3	<0.0001	0.059
Fair	7	57.03	44.39 to 68.81	98.17	<0.0001	
Quality of the study (depressive disorders)						
High	14	21.75	16.67 to 27.86	81.24	<0.0001	0.002
Fair	7	35.45	29.31 to 42.11	97.43	<0.0001	
Sample size (depressive symptoms)						
300 and above	14	37.3	27.05 to 48.82	98.09	<0.0001	0.008
300 and above	14	59.18	47.74 to 69.69	93.41	<0.0001	
Sample size (depressive disorders)						
300 and above	14	23.91	17.99 to 31.04	98.23	<0.0001	0.397
Below 300	8	27.81	22.12 to 34.32	79.69	<0.0001	

symptoms, MDDs and dysthymia. Our analysis resulted in a considerably higher prevalence of depressive symptoms, (46.72%), MDDs (26.24%), as well as dysthymia (8.25%) among homeless people. These prevalence rates are notably higher compared with that of the general population, suggesting depressive symptoms, MDDs and dysthymia are important and global public health issues among homeless people requiring urgent attention in terms of prevention and treatments.

The review showed that the existing literature on the prevalence of depressive symptoms, MDDs and dysthymia, among homeless people demonstrated a significant variation depending on the age of the participants and the reported quality of the studies. The vast majority of the included studies were performed in high-income countries (92.5%; n=37) and only a few studies were performed in low-income and middle-income countries (7.5%; n=3). Almost all studies used standard instruments to measure
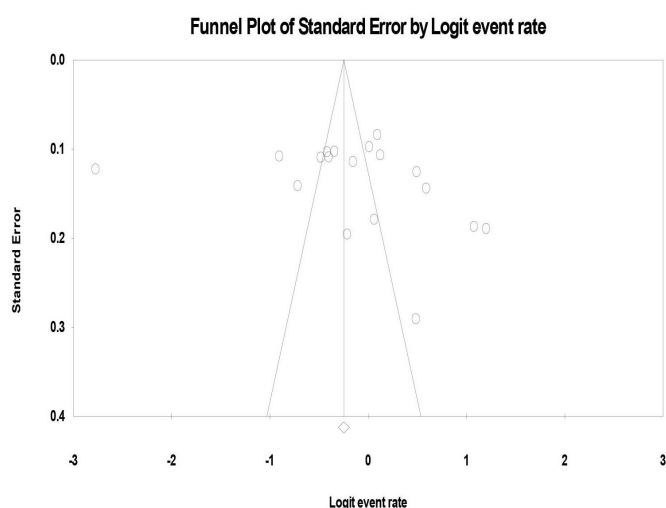
Figure 5 The risk of publication bias for the prevalence of depressive symptoms among homeless people.
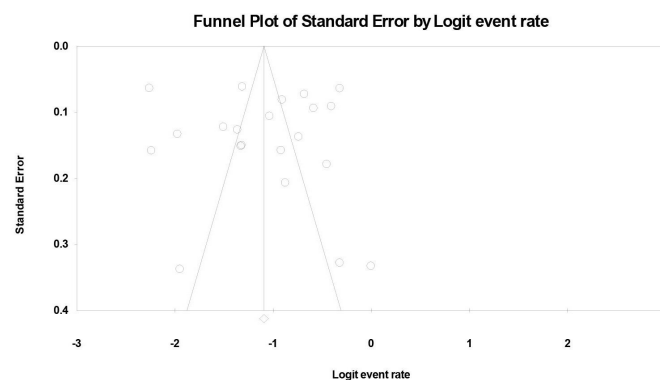
Figure 6 The risk of publication bias for the prevalence of major depressive disorders among homeless people.

the prevalence of depressive symptoms, MDDs and dysthymia among the homeless people.

The results of our systematic review and meta-analysis suggest that nearly half of homeless people have experienced depressive symptoms. Thus, the prevalence of depressive symptoms among homeless people is 6.5 times higher than the estimates in the general population (7.2%).[18] One of the possible explanations for this difference could be the higher prevalence rates of acute and chronic medical conditions, including HIV/AIDS, tuberculosis and other medical problems among the homeless people that possibly increase the risks of psychiatric disorders including depressive symptoms as reported in many previous studies.[24 63–67] Another possible explanation is that homeless people are more likely to experience sexual assault and physical abuse that is frequently and consistently associated with a higher risk of depressive problems among the exposed individuals.[68–71] Finally, when compared with the general population the magnitude of substance-use disorders, as well as other psychiatric problems, are considerably high among homeless people, which are associated with greater risks of depressive symptoms among the homeless.[1 2 7 54 72]

Our study showed that more than one-fourth of the homeless people had MDDs, which was 2.30 times higher than the estimates from a previous systematic review conducted in Western countries among the homeless (11.4%).[2] The reason for variation in the prevalence could be due to: (1) the previous study was conducted only in Western countries, and this study included studies from developed as well as developing countries. Thus, the potential reason for the higher prevalence of depressive disorders in this study may be due to the inclusion of new studies including studies from low-income and middle-income countries. (2) The variation in characteristics of the participants across the countries in terms of experiencing the potential contributing factors that increase the risk of MDDs.

Surprisingly, the prevalence of MDDs in this study was 5.25 times higher than the global prevalence of MDD in the general population reported by a recent meta-analysis (5%).[19] Similarly, pooled prevalence estimates in this study was 1.5–3 times higher than the pooled prevalence estimates of dysthymia in the general population (3%–6%).[73] As discussed earlier, the possible factors for the higher prevalence in homeless people could be due to the presence of stressful life events, as well as comorbid medical, mental and substance-use disorders among the homeless people.[1 2 24 54 63–72]

This review also showed that the prevalence of depressive symptoms was high among younger homeless people (<25 years of age), whereas the prevalence of MDD was high among older homeless people (>50 years of age) when compared with adults (25–50 years). The findings support the views that depressive disorders are common in older people than younger adults and they are more likely to be severe in presentation, display cognitive changes and more complex presentations with high somatic symptoms.[74] The possible risk factors for these include age-related neurobiological changes, cognitive diathesis and increased rates of stressful life events.[75–77]

Strengths and limitations

Estimating the prevalence of the different categories of depressive problems separately (depressive symptoms, dysthymia and MDDs) and assessing the prevalence across the lifespan are the main strengths of the present systematic review and meta-analysis.

Nevertheless, our study has some limitations: first, the vast majority of the included studies were performed in high-income countries and only three studies were conducted in low-income and middle-income countries, which significantly affects the global representativeness of the estimates. Second, we included only peer-reviewed published articles so book reviews, grey literature, editorials and letters were excluded from the study during the selection process. Third, studies published in the English language are only included, which suggests that relevant studies published in another language might be missed. In fact, our evaluation of possible publication bias (small study effects due to possible missingness) revealed that the funnel plot was symmetrical and Egger's regression tests provided no evidence of substantial publication bias for the prevalence of depressive symptoms, dysthymia, as well as MDDs among the homeless people. Fourth, the observed heterogeneity across the studies used to measure depressive problems was the other limitation of the current meta-analysis. To further detect the potential source of heterogeneity, we conducted a sensitivity analysis by the age of the participants, the sample size, the instrument used to measure the outcome and the quality of the included studies. Our analysis revealed that the quality of the studies and the sample size explained some of the observed heterogeneity (p<0.05). Nevertheless, the results should be interpreted with caution. Fifth, we were unable to conduct sensitivity analysis stratified by the type of comorbid mental or substance-use disorders, trauma experiences, as well comorbid medical conditions including HIV/AIDS due to a limited number of studies in each subgroup.

The other limitation of the study is that only one reviewer (GA) conducted the selection of the studies. However, this is not a major concern in our systematic review and meta-analysis since our assessment of publication bias showed no evidence of significant publication bias or small study effects for the prevalence of depressive symptoms (B=5.11, SE=35.78, p=0.390) as well as depressive disorders (B=0.289, SE=3.26, p=0.930), suggesting the effects of missed studies (if any) were not statistically significant. In addition, we have involved two independent investigators for data extraction and quality assessment. The existing guidelines in systematic review and meta-analysis including Cochrane library and PRISMA suggest quality assessment and data extraction must be performed by two independent investigators.[26 78] However, involving the

second author in entire processes including selection and screening is not mandatory (optional).[26 78] In fact, a recent systematic review indicated that the involvement of more than one reviewer in the entire process could increase the probability of including more studies in the final review.[79] Another systematic review on the subject revealed no significant differences in the rates of effectiveness (avoiding the number of studies with inappropriate exclusions) in studies that involved a second author in the entire process and studies that did not.[80]

The implication of the findings

Our findings suggest the urgent need for robust studies to explore the possible reasons for the higher prevalence of depressive symptoms, depressive disorders and dysthymia among homeless people as compared with the reported magnitude in the general population. In addition, further studies to estimate the prevalence of depressive problems in low-income and middle-income countries are warranted. Finally, given the high prevalence rates of depressive problems and their potential negative consequences, early screening and interventions should be considered among those population groups. The intervention strategies might include the integration of homelessness, mental health, physical health, as well as alcohol and drug use and other human services, working in a coordinated and joined-up way to deliver tailored and holistic interventions for those population groups.

CONCLUSION

This systematic review and meta-analysis revealed that the prevalence of depressive symptoms, dysthymia and depressive disorders are notably high among homeless people, underlying the importance of early screening and prevention for depressive problems among homeless people. Further strong studies are needed to examine the possible reasons for the higher prevalence of depressive problems among homeless people. Also, future robust and informative studies need to investigate better mechanisms of prevention, screening and detection management of those problems among homeless people.

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