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Understanding drug use patterns among the homeless population: A systematic review of quantitative studies

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ABSTRACT

Substance use problems among the homeless population represents a major issue leading to increased morbidity and mortality. The aim of this review was to investigate the prevalence, trends and effects of substance use among the homeless population. Studies were identified through electronic searches of Google Scholar, Science Direct, Medline, Embase and Scopus between January 2007 and December 2020. Studies included were those reporting substance use and homelessness within the age range of 18–64 years old, whereas interventional and rehabilitation studies were excluded. Subsequently the extraction yielded twenty-five studies. The results showed that substance use was more prevalent in males than females and alcohol the most popular substance used among the homeless population. After 2017, however, both alcohol and new psychoactive substances (NPS) were equally a problem. This urges the need to develop research in homelessness and NPS consumption to increase awareness among health care providers, governmental agencies and academics.

Introduction

Homelessness is a major problem that affects both the developed and developing world Tyler, 2013). The response from governments towards homelessness has been targeted towards families threatened with homelessness rather than single homeless individuals (Paudyal et al., 2017). The favouritism of supporting families threatened with homelessness alongside the decline of housing in the rented sector contributed to the increase in homelessness in developing countries (Busch-Geertsema et al., 2016; Kidd et al., 2021). The number of articles published on the topic has increased dramatically since the 1980s with a primary focus on the specific issues associated with homelessness such as substance use, mental health, morbidity and mortality (Doran et al., 2018). Whilst the prevalence of homelessness is difficult to measure, the United Nations estimates that roughly 150 million individuals globally are homeless at any given time (United Nations, 2020). Not only does homelessness deprive individuals and families of basic human needs; but also, it is strongly associated with a number of serious social issues. Levels of substance use for example, are much higher among the homeless than general population (Krupski et al., 2015). The estimates of substance use among the homeless have varied depending on the population studied, location and definitions used but are consistently high (Aldridge, 2020).

Homelessness and substance use are often described as intricately related (Taylor et al., 2018). There is a widely accepted view that substance use has been regarded as both a cause and consequence of homelessness. In numerous studies, more than two-thirds of homeless individuals have reported that substance use had been a major cause of their homelessness (Khezri et al., 2020; Rew et al., 2001; Rosario et al., 2012; Santa Maria et al., 2018). Other studies have also stated that substance use had been a consequence of homelessness rather than a cause. Indeed, while these studies did have supporting evidence there is still a lack of suitable data that analyse substance use in the homeless population considering the different settings, locations and levels of homelessness (Prangnell et al., 2017; Tyler, 2013). Individuals experiencing homelessness are a difficult population to reach and for that reason many of the studies tend to be small-scall cross-sectional surveys with specific intentions (Aldridge, 2020).

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A US based study found that alcohol prevalence ranged from 8.7 % to 84.8 % and substance use prevalence ranged from 4.5 % to 63.3 % among homeless population (Santa Maria et al., 2018). With drug overdose being the leading cause of death among the homeless, knowing the prevalence rate of substance use would better enable the understanding of the interactions between the overlapping issues (Laporte et al., 2018). Prior reviews on homelessness and substance use have not focused on the overlapping problem, but rather on mental health issues and effectiveness of interventions. The consistent association has been found between substance use and homelessness, which has underpinned a broad range of social policies and public health initiatives (Rosario et al., 2012). However, such analyses had not adequately assessed the current drug trends among individuals who face considerable social exclusion. Although, new drugs have been reported to have entered the black market, such as SCRA and fentanyl derivatives, no review to date has documented the emergence of such compounds in the homeless population.

More reliable estimates of the prevalence of substance misuse in the homeless population should help inform public policy and the development of drug support services that are tailored to current drug trends. The most recent review did not consider the drug trends among the homeless population and made no attempt to explore the differences in drug consumption (Aldridge, 2020). In this review we aim to examine substance use prevalence and patterns in substance misuse among the homeless population.

Method

Search strategy

For this systematic review, the following 13 databases were searched: British Nursing index, Cochrane library, Embase, Google, Google Scholar, Medline, National Electronic Library of Medicine, PsychExtra, PsychInfo, PubMed, ScienceDirect, Scopus, and Web of Science for articles published between Jan 1, 2007 and Dec 31, 2020. The timeframe was selected due to the emergence of new psychoactive substances during 2007 and aimed to capture the homeless populations usage between the chosen timeframe. The search terms were derived from previous reviews and are provided in Appendix A. We searched for articles about the homeless population consuming substances of abuse from interviews, case reports, cross-sectional and longitudinal surveys. The systematic review was registered with PROSPERO (ID: 447222) and the 27-item checklist is in Appendix B.

Inclusion and exclusion criteria

We included studies if they investigated substance use among the homeless population and had explicit data on adult homeless population (ages ranged between 18 and 64 years old). Additionally, studies were eligible if published during or after 2007 and the abstract written in English. We excluded studies that had other marginalised population in them in addition to the homeless. We also excluded studies that focused on intervention and rehabilitation programs for homeless substance users.

For the purposes of this review, homelessness was defined as being without suitable or permanent accommodation (United Nations, 2020). This 'umbrella term' includes street dwelling homeless, also known as rough sleepers, those in sheltered in accommodation and staying with friends or family. Case report and case series studies were included as they reveal relevant knowledge that should be considered in recommendations when data from observational studies is limited, especially when a small number of studies report important or possibly causal association in an epidemic or side effect of new substances, and in this research that would be NPS (Nambiema et al., 2021).

Data extraction

The data extracted was carried out by TC and included the following information: study type (retrospective and prospective), country, study settings, population, sample size, study duration, homeless definition, mean age, male to female ratio, ethnicity, substance use prevalence, dependency, and risk factors. The references were screened independently from two authors (SA and TG) and the data extracted was reviewed by all authors.

Data analysis

We analysed the data using SPSS version 26. The summary of statistics included the reported prevalence rate, dependency, mental and physical health problems, resulting from substance use among the homeless population. The reported prevalence rate was calculated as the number of participants who consumed at least one substance *numerator) divided by the total number of participants in each study (denominator). We also identified the main adverse events associated with substance use and to simplify the comparison, the adverse effects were classed into six main categories based on the systems within the body. The six categories are as followed: cardiovascular, neurological, respiratory, hepatic, renal and gastro-intestinal systems As this research is trying to understand drug use patterns with a focus on prevalence, there was no hypothesis, hence no need for a statistical test (Parab and Bhalerao, 2010).

Data validation

The evaluated publications were subject to bias evaluation also known as data validation. The CASP and Cochran quality assessment tool was used to evaluate publication bias for the included studies. To ensure the reliability of the data used, Higgins's test of homogeneity was chosen Higgins et al., 2003; (Long et al., 2020). The evaluated publications were also subject to validation from the four authors (AA, SA, PVC and TG) using Cohens Kappa coefficient (Cohen, 1960). The result after data validation achieved a study interrater reliability statistic of 0.95.

Results

In total 38,383 articles were retrieved of which 3289 abstracts were screened before applying the limitations of time, age range and language limits. Consequently, 264 studies remained, and their title and abstracts were investigated. Out of these 264 studies, 220 were excluded because they did not consider substance use among the homeless population. From the remaining 42 studies, 17 were further excluded as they did contain information on substance use prevalence. The remaining 25 studies were then investigated for substance use prevalence, trends in substances, psychological and physical adverse events. Table 1 shows the study characteristics of the homeless populations analysed.

Study characteristics

The majority of publications examined homelessness in the United Sates ($n = 17$) followed by Canada ($n = 4$), United Kingdom ($n = 2$), Italy ($n = 1$) and Spain ($n = 1$). Most of the studies used cross-sectional research design, a few were longitudinal, cohort, case report and retrospective. Prospective studies included case report (Torres and Espiridion 2020; Shahbaz et al., 2018, cross-sectional (North et al., 2010; Tsai et al., 2014 Reitzel et al., 2020; Neisler et al., 2019; Gomez et al., 2010; O'Brien et al., 2015; Johnson and Fendrich, 2007; Tyler et al., 2007; Torchalla et al., 2014; Torchalla et al., 2011; Palepu et al., 2013; Wenzel et al., 2009; Rhoades et al., 2011; Barnett and Owusu, 2016; Palepu et al., 2012; Guillen et al., 2020) and cohort (Riley et al., 2015; Doran et al., 2018). Retrospective studies included cross-sectional

Table 1
Study characteristics of the homeless populations analysed.

Study number	Study type	Study design	Method	Setting	Population	Study duration (weeks)	Sample size (number)	Country	Criteria for homelessness	Reference
1	Prospective		Structured questionnaire	Six homeless serving shelters in Oklahoma City	Homeless individuals from homeless shelters	6	581	USA	No fixed abode and requiring services from the shelters	Neisler et al., 2019
2		Cross sectional	Semi-structured questionnaire	Six homeless serving shelters in Oklahoma City	Homeless individuals from homeless shelters	2	528	USA	Individuals requiring services from the homeless shelters and without a fixed abode	Reitzel et al., 2020
3				Four safety net health clinics in Dublin	Data from health clinics	2	105	Northern Ireland (UK)	individuals who are rough sleepers, residents of emergency accommodation, and those living in insecure and inadequate housing	O'Brien et al., 2015
4			In-depth interviews	Community centre drop-in, Central Texas.	Young homeless (aged 18 to 23 years old)	9	185	USA	Individuals without stable housing and who identify with the culture and economy of being homeless	Gomez et al., 2010
5				Temporary shelter settings in central region Los Angeles County	Women's alcohol and drug problems	10	445	USA	they currently did not have a regular place to stay (e.g., own house, apartment, or room, or the home of a family member or friend)	Wenzel et al., 2009
6				13 shelters in Skid \row Los Angeles County	Men's substance use	6	305	USA	stayed at least one night in a place like a shelter, abandoned building, voucher hotel, vehicle, or outdoors because they didn't have a home to stay in	Rhoades et al., 2011
7				Homeless shelters, streets or abandoned buildings in Madrid, Spain	Substance use and mental health among homeless women	24	138	Spain	shelter or other facility for homeless people, on the street or in other places not initially designed for sleeping (abandoned buildings, underground railway stations, etc.).	Guillen et al., 2020
8		Cohort		Homeless community based venues San Francisco	Risk factors among homeless women	22	260	USA	No fixed abode and requiring services from the shelters	Riley et al., 2015
9				Urban hospital setting, New York	Substance use and homelessness among ED patients	10	316	USA	We defined current homelessness as self-report of spending the past night in a homeless shelter or outdoors, on the street, in an abandoned or public building, an automobile, or another place not meant for human habitation.	Doran et al., 2018

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Table 1 (*continued*)

Study number	Study type	Study design	Method	Setting	Population	Study duration (weeks)	Sample size (number)	Country	Criteria for homelessness	Reference
10		Cross-sectional	Structured interviews	University of Minnesota Metropolitan Chicago Survey Research Laboratory	SCRA homeless assessment	6	527	USA	No fixed abode and requiring services from the shelters who were leading a street-based	Johnstad, 2021 Gabrielsen and Ulrich 2007
12				University of Nebraska, Lincoln	Homeless individuals aged between 19 and 21		40	USA		Tyler et al., 2007
13				BC Health of the Homeless Survey, Vancouver British Columbia	PTSD and substance use among homeless	5	489	Canada	Homelessness was defined as living in a shelter or on the streets (e.g., the outdoors, abandoned and public buildings, subways, vehicles).	Torchalla et al., 2014
14				centre for health evaluation and outcome services, vancouver, british columbia	Homeless women	5	193	Canada	Homelessness was defined as living in a shelter or on the streets (e.g., the outdoors, abandoned and public buildings, subways, vehicles).	Torchalla et al., 2011
15				University School of Medicine in St. Louis	Homeless individuals from homeless shelters	24	254	USA	Having no fixed abode and having spent the previous 14 days in an unsheltered location	North et al., 2010
16			Semi-structured interviews	Massachusetts General Hospital	SCRA among the homeless	1	8	USA	No fixed abode and requiring services from the shelters	Barnett and Owusu, 2016
17			interviewer administered questionnaire	centre for health evaluation and outcome services, vancouver, british columbia	Access to treatment among the homeless	12	1191	Canada	A homeless participant was defined as living in a shelter, public space, motor vehicle, abandoned building, or not having their own place for which they paid rent.	Palepu et al., 2013
18				Homeless shelters in Vancouver British Columbia	Vancouver at home study	9	497	Canada	A homeless participant was defined as living in a shelter, public space, motor vehicle, abandoned building, or not having their own place for which they paid rent.	Palepu et al., 2012
19		Case report	Case report	Queens Hospital New York	SCRA hospitalisation	0.25	1	USA	No fixed abode and requiring services from the shelters	Shahbaz et al., 2018
20				Reading hospital, USA	Use of Spice for appetite stimulation	0.25	1	USA	Self-described homelessness	Torres and Espiridion 2020
21		Cross sectional	Homeless veterans compared on a housing initiative	New England Mental Illness Research, Education and Clinical centre	Homeless war veterans	6	29,143	USA	Residing in a place not meant for human habitation, in an emergency shelter, in transient housing or exiting an institution.	Tsai et al., 2014

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Table 1 (*continued*)

Study number	Study type	Study design	Method	Setting	Population	Study duration (weeks)	Sample size (number)	Country	Criteria for homelessness	Reference
22	Retrospective	Cohort	ED hospital data	New York supportive housing program	Individuals eligible for housing first scheme	60	1558	USA	No fixed abode and requiring services from the shelters	Miller-Archie et al., 2019
23		Cross-sectional		Emergency Department admissions in Florida, Maryland, Massachusetts and New York.	Homeless with at least one ED visit	12	96,099	USA	Self-described homelessness	Yamamoto et al., 2019
24				Health Centre's Comprehensive Psychiatric Emergency Program	Medical records	1	321	USA	No fixed abode and requiring services from the shelters	Joseph et al., 2019
25			structured clinical Interviews	Homeless individuals from the Vancouver at Home/Chez Soi study	Mood patterns and substance use	48	319	Italy	Having no fixed abode and having spent the previous 30 days in an unsheltered location	Maremmani et al., 2015

USA: United States of America. UK: United Kingdom. ED: emergency department. PTSD: post-traumatic stress disorder. BC: British Columbia. NR: not reported. SCRA: synthetic cannabinoid receptor agonists.

(Yamamoto et al., 2019; Maremmani et al., 2015; Joseph et al., 2019) and cohort studies (Miller-Archie et al., 2019). Full psychiatric interviews using The Diagnostic and Statistical Manual of Mental Disorders (DSM), International Classification of Diseases (ICD) and Mini International Neuropsychiatric Interview (MINI) were used in interview studies (American Psychiatric Association, 2013; Sheehan et al., 1998). The AUDIT and Clinical Alcohol and Drug Use Scale were used to measure alcohol use and abuse in interview studies and the Alcohol Frequency Questionnaire for questionnaire studies (World Health Organization 2004).

Participant characteristics

Eighteen studies in this review reported the ethnicity of their participants, where Caucasian and African American ethnic groups dominated the homeless population. Caucasian and African American ethnic groups ranged between 14.9–67.6 % and 1.6–76.9 %, respectively (Table 2). The ethnic majorities and minorities reported in the review were often in their home countries but were mainly in the US and Canada. For the US, 11 studies (Doran et al., 2018; Gomez et al., 2010; Johnson and Fendrich, 2007; Miller-Archie et al., 2019; Neisler et al., 2019; North et al., 2010; Rhoades et al., 2011; Riley et al., 2015; Tsai and Rosenheck, 2015; Tyler et al., 2007; Yamamoto et al., 2019) reported the ethnic background of the participants to which African American and Caucasian were reported in all. Both of the aforementioned ethnicities were highly prevalent where African American individuals ranged between 1.6 and 76.9 % and Caucasian between 11.52 and 67.6 %. Other US ethnic backgrounds that were highly reported but less prevalent were Hispanic and Latino and ranged between 2.5–36.2 % and 4.3–25.35 %, respectively. All four Canadian studies in this review reported the ethnic background of their participants. Most Canadian homeless individuals were either Caucasian (56–60.62 %) or Aboriginal (16–54.4 %). African Canadian homelessness was significantly less prevalent (2–8.9 %) than Caucasian and Aboriginal. The studies from the UK did not consider the ethnic background of their participants.

Of the 25 studies, 17 reported both male and female participants and eight reported either male or female participants but not both. From the 17 studies that included both male and female homeless individuals, all but one had a male majority ranging between 51.99 and 95.34 %. For each geographical location males were more prevalent. For the US the prevalence of male homeless was between 40 and 95.34 %, Canada in the range of 60.53–65.5 % and the UK 75.23–88.67 %. Most studies (n = 16, 64 %) reported education with both the mean duration (years) or the level of education achieved (e.g., high school, university). The studies that reported the mean duration of education (n = 3, 12 %) of the participants ranged between 11.90 and 11.98 years. However, in the remaining studies (n = 13, 52 %) a significantly large portion of the homeless participants reported they had not completed high school education (ranging between 17.6 and 64.8 %). Unemployment was very high among the homeless population (60–95 %) and participants primary sources of income were panhandling, governmental financial support and selling blood/plasma (Fig. 1).

Substance use prevalence

The substances used by the homeless population varied between country, timeframe and the individual and in this review 21 substances from five pharmacological classes were reported. Alcohol was the most frequent substance reported (n = 20, 80 %). This was followed by heroin (n = 11, 44 %), cocaine (n = 10, 40 %), cannabis (n = 9, 36 %), crack cocaine (n = 6, 24 %) and SCRA (n = 6, 24 %). Studies reporting alcohol consumption used a variety of instruments to measure the prevalence. Interviews using AUDIT reported alcohol prevalence ranging between 18 and 58 %, whereas the Alcohol Frequency Questionnaire ranged between 28.41 and 44.4 %. The remaining studies measured prevalence through the participants self-reported use which was considerably higher and ranged between 7.5 and 100 %. Drug abuse prevalence was either measured using DAST or self-reported use. The two studies that used DAST to measure substance use only captured cannabis and heroin prevalence and cannabis was significantly more prevalent than heroin. The percentage of each substance used is shown in Table 3 below.

Mean prevalence of specific substances used in the evaluated studies

Fig. 2 shows that SCRA are the most prevalent substance used with an average of two-thirds (66.87 %) of the population using these substances in publications that report their use. The prevalence of alcohol and cannabis were similar, and both reportedly consumed by 50 % of population. The prevalence of crack cocaine was reported from one-third of the population (33.82 %) but was less frequently reported in

Table 2
Participant characteristics of the homeless population.

Study number	Age range (years) min - max)	Meane age (years)	Male to female ratio	Ethnicity (%)	Education	Previous employment	Ref
1	NR	43.64	370(63.68 %): 211(36.32 %)	Caucasian (56.4) African American (19.97) American Indian/ Alaska native (11.6) multi-racial (9.2) Hawaiian (0.7) Asian (0.4) other (1.6)	Participants were in education for an average of 11.9 years	NR	Neisler et al., 2019
2	NR	43.59	331(62.65 %): 197(37.35 %)	NR	Participants were in education for an average of 11.98 years	NR	Reitzel et al., 2020
3	NR	32.4	79(75.23 %): 26(24.77 %)	NR	NR	NR	O'Brien et al., 2015
4	18–23	20.8	125(67.56 %): 60(32.44 %)	Caucasian (67.6) African American (1.6) Latino (4.3) American Indian (2.16) Other/mixed (23.8)	54.1 % graduated school 45.9 % dropped out	71.89 % primary income panhandling	Gomez et al., 2010
5	NR	36.56	0(0 %): 445 (100 %)	African American (40.17) Hispanic (22.77) Caucasian (25.86) Native-American (2.17) Asian (1.38) Other or multi racial (7.65)	At least high school - GED (66.85)	NR	Wenzel et al., 2009
6	NR	45.56	305 (100 %): 0 (0 %)	African American (71.69) Caucasian (11.52) Hispanic (10.43) Other/multi racial (6.35)	Completed high school (73.31) Not graduated high school (26.69)	NR	Rhoades et al., 2011
7	NR	45.52	0 (0 %): 138 (100 %)	Spanish (65.2) Foreign (30.4) Both (4.3)	No education (9.4) Incomplete primary education (13) Primary education - up to 14 (32.6) Secondary education - up to 18 (18.8) Non-university higher education (8.7) University higher education (17.4)	NR	Guillen et al., 2020
8	18–69	47	0 (0 %): 260 (100 %)	Caucasian (30.4) African American (43.5) Latina (4.6) Asian (2.7) Other (18.8)	NR	Employed (18.5)	Riley et al., 2015
9		49.3	257(81.32 %): 59(18.68 %)	Caucasian (14.9) African American (41.0) Hispanic (36.2) other (7.9)	Less than high school diploma (38.6) Graduated high school (33.2) Some college or higher (28.2)	Employed (17.7) Unemployed (39.2) Unable to work (36.1) Retired (7.0)	Doran et al., 2018
10	16–52	NR	47(88.67 %): 6(11.33 %)	NR	NR	NR	Gray et al., 2021
11	18–40	27.3	326(51.99 %): 301(48.01 %)	African American (35.6) Caucasian (33.1) Latino (22.1) other races (9.2)	Completed college (32.2) Dropped out of college (27.8) Completed high-school (22.6) Did not completed high School (17.6)	NR	Johnson and Fendrich, 2007
12	19–21	20.17	16(40 %): 24(60 %)	Caucasian (67.5) African American (20.0) Hispanic (2.5) multi-racial (10.0)	Completed high school (37.5) Currently in high school (7.5) Working on GED (12.5) Dropped out (30.0) Not reported (12.5)	Currently working (40.0) Unemployed (60.0)	Tyler et al., 2007
13	19–66	38	296(60.53 %): 193(39.47 %)	Caucasian (56.0) Aboriginal (40.0) African Canadian	Not graduated high school (63.0) Graduated high school (27.9)	NR	Torchalla et al., 2014

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Table 2 (*continued*)

Study number	Age range (years) min - max)	Meane age (years)	Male to female ratio	Ethnicity (%)	Education	Previous employment	Ref
				(2.0) Hispanic (0.8) Asian (0.6) Other (0.6)	University degree (7.0) Professional studies (0.2) Other education (1.9)		
14	19–57	35.3	0(0 %): 193(100 %)	Aboriginal (54.4) Others (46.6)	Not graduated high school (64.8) Graduated high school (35.2)	Unemployed (94.9) Government financial support (82.6)	Torchalla et al., 2011
15	NR	41.5	186(73.33 %): 68(26.67 %)	African American (76.9 %) Caucasian (20.0 %) other races (3.1 %)	Participants were in education for an average of 11.9 years	69.9 % unemployed	North et al., 2010
16	22–61	38	5(65.5 %): 3(34.5 %)	NR	NR	NR	(Barnett and Owusu, 2016)
17	NR	42.2	776(65.15 %): 415(34.85 %)	Caucasian (60.62) African Canadian (8.90) Aboriginal (17.13) Mixed (5.37) Other (4.95)	Graduated high school (23.17) Did not graduate high school (44.41) post-secondary school (31.65)	Employed in the previous 12 months (39.71)	Palepu et al., 2013
18	NR	40.8	363(72.74 %): 136(27.26 %)	Aboriginals (16) Caucasians (56) Mixed/other (28)	Did not graduated high school (57) Graduated high school (43)	92 % unemployed 4 % employed 4 % student/housewife	Palepu et al., 2012
19	NA	22	1(100 %): 0(0 %)	NR	NR	NR	Shahbaz et al., 2018
20	NA	40	0(0 %): 1(100 %)	NR	NR	NR	Torres and Espiridion 2020
21	NR	50.05	27,784(95.34 %): 1359(4.66 %)	Caucasian (40.03) Black (47.21) Hispanic (7.96) Other (3.55)	NR	100 % Veterans	Tsai et al., 2014
22	NR	48.1	1344(86.26 %): 214(13.74 %)	Caucasian (16.08) African American (56.48) Latino (25.35) Asian/other (2.11)	Graduated high school (51.92) Did not graduate high school (44.61) other (3.46)	NR	Miller-Archie et al., 2019
23	NR	47.7	53,394(55.56 %): 42,705(44.44 %)	Caucasian (31.3) Black (30.2) Hispanic (24.2) Other (14.4)	NR	NR	Yamamoto et al., 2019
24	NR	NR	NR	NR	NR	NR	Joseph et al., 2019
25	19–66	39	223(69.91 %): 96(30.09 %)	Aboriginal (16.3)	56.4 % in education for less than 9 years	95 % unemployed	Maremmani et al., 2015

evaluated publications in this review than heroin and cocaine. Cocaine (23.32 %) and heroin (16.15 %) were less prevalent.

Substance use trends

Time frame between 2007 and 2011

Between 2007 to 2011 alcohol and cannabis were reported in 85.71 % of the evaluated studies. Alcohol prevalence, however, was higher than cannabis in all but two studies and ranged between 27.6 to 100 % whereas cannabis ranged between 29.7 to 85 %. Cocaine and heroin both were reported from more than half of the evaluated studies (57.1 %) and cocaine (11.9–44.7 %) more prevalent than heroin (7.48–29.5 %). Amphetamine, crack cocaine and methamphetamine were all reported in three studies each, but the prevalence of crack cocaine significantly dominated over both amphetamine and methamphetamine.

Time frame between 2012 and 2016

Again, alcohol consumption was the most prominent substance abused in the homeless population. Heroin consumption however increased between 2012 and 2016 and surpassed cannabis and cocaine. Heroin prevalence remained relatively low (15–19.04 %) similar to 2007–2011. Although cannabis, cocaine and crack cocaine were reported less frequently between 2012 and 2016 the prevalence of all three remained similar to the prevalence that was reported between 2007 and 2011.

Time frame between 2017 and 2020

Alcohol consumption was prominent in the homeless population between 2017 and 2020. However, what is captivating is the emergence of SCRA being consumed among individuals in the homeless population. A total of six studies (54.5 %) reported the use of SCRA among the homeless population between 2017 and 2020 but had not been reported prior to 2017 (Barnett and Owusu, 2016; Doran et al., 2018 Joseph et al., 2019;Shahbaz et al., 2018; Torres and Espiridion, 2020). The recent emergence of SCRA was seen in parallel with increase cocaine consumption and decrease in crack cocaine during this time frame.

Causes and risk factors for substance use

Fourteen studies explored the relationship between homelessness and drug dependency (Table 4). Alcohol was the most frequently reported substance the homeless population depended on. Across all studies males had higher profile of drug dependence than females. Niesler (2019) elaborated this further and reported that women were significantly less likely to have at-risk drinking problems than males. Drug dependence for males ranged between 24.7 and 82.8 % and females between 8.57 and 82.4 % and was classified according to the

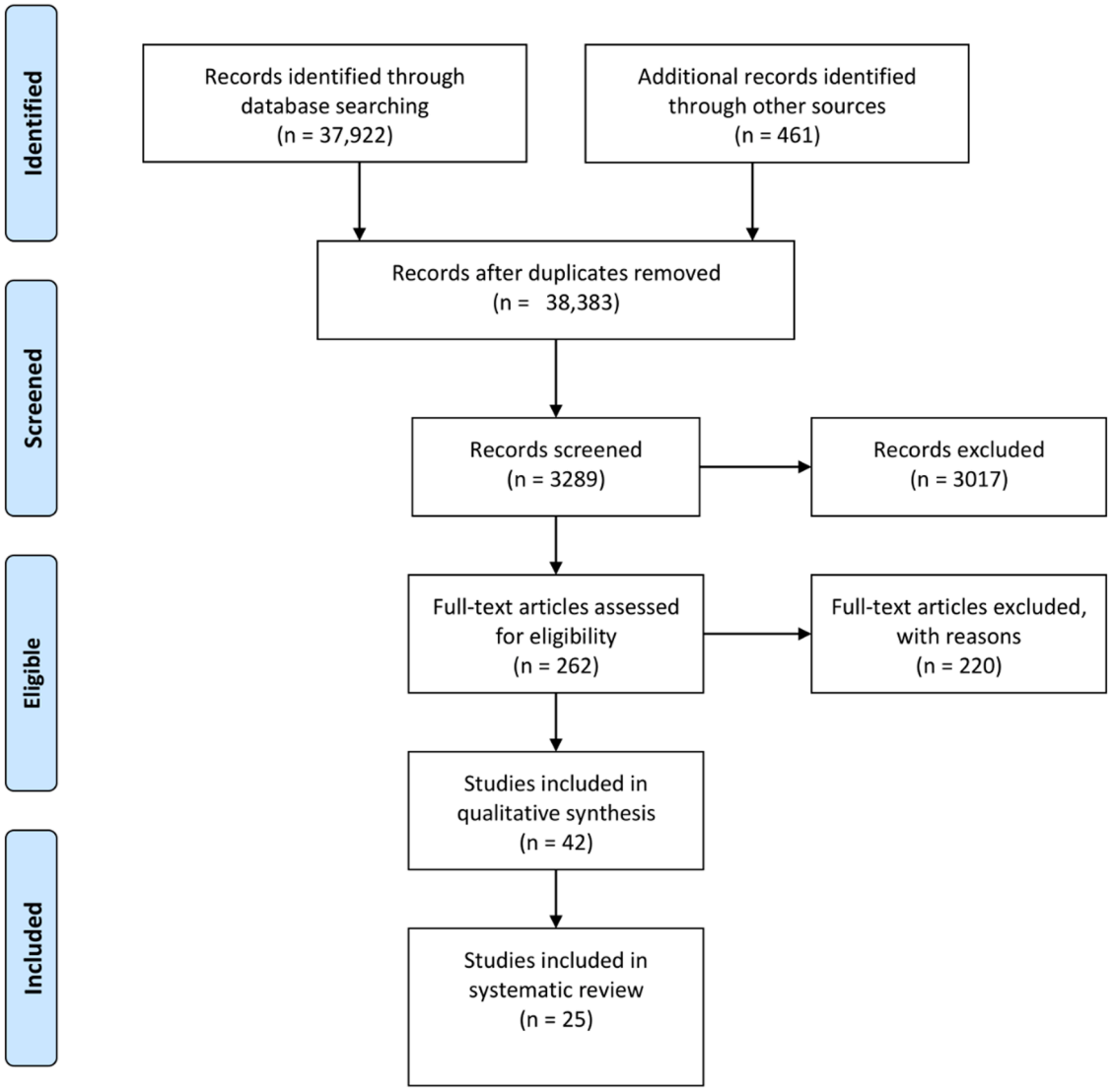

Fig. 1. PRISMA flow chart.

diagnostic tool that the researcher had chosen (e.g., ICD or DSM).

Furthermore, drug dependence was not the only risk factor to substance use and other researchers in this review reported a variety of associated risk factors including: sexual and physical abuse, older age and mental health issues. Tyler and Johnson (2007) found that 90 % had experienced physical violence/abuse prior to homeless and one-third experienced sexual abuse during homelessness, namely but not exclusively, females. Riley (2015) reported that women who consume stimulants were more likely to have suffered sexual abuse prior or during homelessness, elaborating the dangers homeless individuals can experience. Wenzel et al. (2009) reported that older homeless women were more likely to binge drink and consume cocaine than younger homeless women. Similarly, drug users were more likely to present mental health systems. Experience of rough sleeping was linked with persistent disorder. North et al. (2007) found in a sample of homeless individuals residing in a shelter who consumed cocaine could not obtain housing. The dangers associated with homelessness and substance use were profound, and more than 70 % of women who were addicted to drugs had attempted suicide. Doran (2018) reported than almost half of opioid users had experienced an overdose and the use of heroin and cocaine increased periods of homelessness.

SCRA consumption was associated with a number of risk factors, namely due to the high prevalence and unknown chemical composition. Gray et al. (2020) found that 95 % of street dwelling homeless in Manchester were users of the SCRA, Spice. The high prevalence of Spice among the homeless population is suggested to only occur in vulnerable populations and most users stated they had not known of their existence prior to homelessness (Barnett and Owusu, 2016). The consumption of Spice resulted in serious health consequences and increased the likelihood and duration of hospitalisation. Joseph et al. (2019) reported that 84.54 % SCRA emergency department (ED) visits were from homeless individuals. Repeated consumption even led to acute kidney damage lasting a total of eight days (Shahbaz et al., 2018).

Adverse events associated with substance use

Among the homeless population a variety of physical and psychological issues were reported from the studies evaluated. In total sixteen studies explored the relationship between homelessness and substances use and the underlying physical and psychological issues. Physical adverse events were reported less frequently than psychological issues but were more longer lasting and life-threatening. Two studies examined the physical effects associated with injection drug-use and reported that 28.9 % of participants were infected with Hepatitis C (O'Brien et al., 2015) and 49.5 % HIV positive (Riley et al., 2015). Among SCRA users, nausea and vomiting were common side effects and had been

Table 3
Substance use among the homeless population.

Study number	Number of drugs reported	Substance (%)	Substance class	Drug use (occasional/ frequent)	Modality of intake	Reference
1	1	Alcohol	Sedative	Frequent	Oral	Neisler et al., 2019
2	1	Alcohol (28.41)	Sedative	Frequent	Oral	Reitzel et al., 2020
3	3	Alcohol (58.0) Heroin (19.04) Cocaine (20.95)	Sedative opioid Stimulant	Frequent	Oral Intravenous Snorting	O'Brien et al., 2015
4	5	Alcohol (100) Heroin (13.5) Cannabis (92.97) Methamphetamine (3.24) LSD (3.8)	Sedative Opioid Cannabinoid Stimulant Hallucinogen	Frequent	Oral Intravenous Smoking Snorting	Gomez et al., 2010
5	7	Alcohol (27.6) Cannabis (29.7) Crack cocaine (20.5) Cocaine (16.8) Amphetamine (23.2)	Sedative Cannabinoid Stimulant	Frequent	Oral Smoking Snorting	Wenzel et al., 2009
6	5	Alcohol (38.09) Heroin (7.48) Prescription pills (16.79) Cannabis (55.52) Crack cocaine (39.56) Cocaine (11.89) Methamphetamine (10.74) Other (4.77)	Sedative Opioid Cannabinoid Stimulant	Frequent	Oral Smoking Snorting	Rhoades et al., 2011
7	6	Alcohol (36.2) Sedatives (48.6) Heroin (26.1) Methadone (13.7) Cannabis (39.9) Cocaine (41.3)	Sedative Opioid Cannabinoid Stimulant	Frequent	Oral Intravenous Smoking Snorting	Guillen et al., 2020
8	7	Alcohol (44.2) Heroin (15.4) Prescription opioid (25.8) Crack cocaine (46.9) Cocaine (11.5) Methamphetamine (20.8)	Sedative Opioid Stimulant	Frequent	Oral Intravenous Snorting	Riley et al., 2015
9	6	Alcohol (44.4) Sedatives (11.2) Prescription opioids (12.5) Heroin (16.7) Cannabis (34.6) Un-specified SCRA (5.4) Cocaine (24.7) Prescription stimulants (3.8) Methamphetamine (4.8) Inhalants (1.6) Un-specified Hallucinogens (4.5)	Sedative Opioid Cannabinoid Stimulant Hallucinogen	Frequent	Oral Intravenous Smoking Snorting Inhaling	Doran et al., 2018
10	3	SCRA	Cannabinoid	Frequent	Smoking	Gray et al., 2021
11		NR	NR	Occasional	NR	Johnson and Fendrich 2007
12	2	Alcohol (92.5) Cannabis (85.0)	Sedative Cannabinoid	Occasional	Oral Smoking	Tyler et al., 2007
13	1	Alcohol (41.7)	Sedative	Frequent	Oral	Torchalla et al., 2014
14	10	Alcohol (52.9) Benzo's (6.2) Heroin (29.5) Methadone (6.2) Prescription Opioids (16.6) Cannabis (41.5) Amphetamine (4.7) Crack cocaine (57.5) Cocaine (20.2) Methamphetamine (9.8)	Sedative Opioid Cannabinoid Stimulant	Frequent	Oral Intravenous Smoking Snorting	Torchalla et al., 2011
15	9	Alcohol (59.5) Unknown sedatives (3.6) Heroin (9.1) Cannabis (34.1) Amphetamines (8.2) Cocaine (44.7) LSD (4.8) PCP (6.4)	Sedative Opioid Cannabinoid Stimulant Hallucinogen	Frequent	Oral Intravenous Smoking Snorting	North et al., 2010
16	11	Un-specified synthetic cannabinoid (100)	Cannabinoid	Frequent	Smoking	Barnett and Owusu, 2016
17						Palepu et al., 2013

(*continued on next page*)

Table 3 (*continued*)

Study number	Number of drugs reported	Substance (%)	Substance class	Drug use (occasional/ frequent)	Modality of intake	Reference
18	7	Alcohol (18) Heroin (15) Cannabis (49) Crack cocaine (27) Amphetamines (8)	Sedative Opioid Cannabinoid Stimulant	Frequent	Oral Intravenous Smoking Snorting	Palepu et al., 2012
19	1	Alcohol (100) SCRA - Spice/K2 (100)	Sedative Cannabinoid	Frequent	Oral Smoking	Shahbaz et al., 2018
20	2	Alcohol SCRA - Spice/K2 Cocaine	Sedative Cannabinoid Stimulant	Frequent	Oral Smoking Snorting	Torres and Espiridion 2020
21	1	Alcohol (16.63)	Sedative	Frequent	Oral	Tsai et al., 2014
22	5	Alcohol (60.91) Sedatives (1.73) Heroin (9.69) Cannabis (27.40) Crack cocaine (11.48) Cocaine (17.91) Amphetamines (4.5)	Sedative Opioid Cannabinoid Stimulant	Frequent	Oral Intravenous Smoking Snorting	Miller-Archie et al., 2019
23	2	Alcohol (7.5)	Sedative Opioid	Frequent	Oral	Yamamoto et al., 2019
24	1	Un-specified synthetic cannabinoid (28.97)	Cannabinoid	Frequent	Smoking	Joseph et al., 2019
25	5	Alcohol Tranquillisers Heroin Cannabis CNS stimulants Inhalants LSD	Sedative Opioid Cannabinoid Stimulant Hallucinogen	Frequent	Oral Intravenous Smoking Snorting Inhaling	Maremmani et al., 2015

NR: Not reported. CNS: Central nervous system. LSD: Lysergic acid diethylamide. PCP: Phencyclidine.

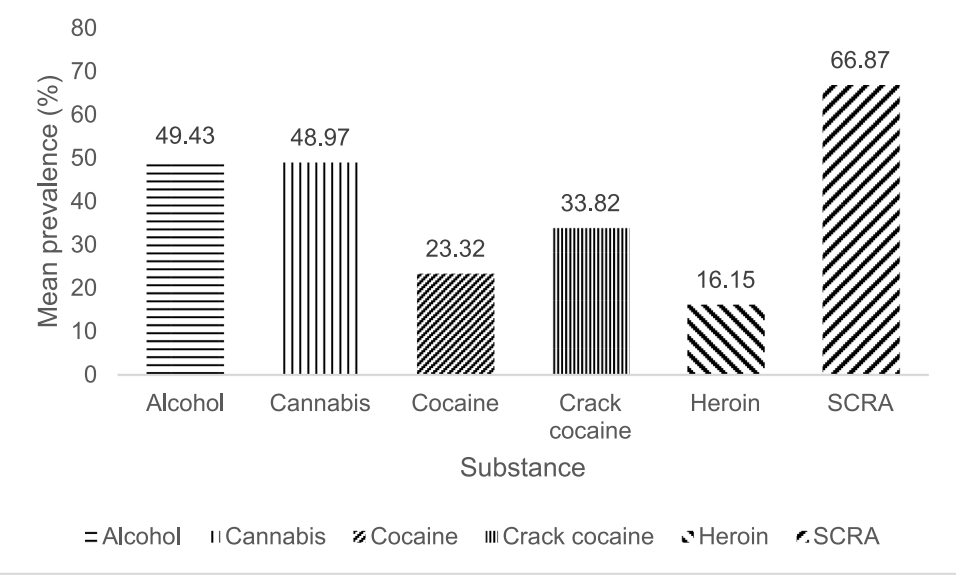

Fig. 2. The mean prevalence of substances used in the homeless population in the evaluated studies.

experienced by the majority of users (50- 100 %). Torres and Espiridion (2020) stated that one-third of SCRA users that visited the ED had symptoms of hypokalaemia and when untreated usually results in vomiting and diarrhoea. Therefore, a strong relationship between SCRA and gastrointestinal side effects was identified. However, adverse effect affecting the cardiovascular, nervous, renal and respiratory systems were also recognised. Moreover, Torres and Espiridion (2020) additionally discovered that a third of SCRA users used them to stimulate appetite but found a relationship between increased Spice use and moderate persistent asthma. However, similar to traditional drugs, psychological problems such as depression, psychosis, paranoia and anxiety were linked with SCRA consumption.

Seven of the studies used a full psychiatric interview to diagnose individuals according to DSM, ICD-10/11 or MINI criteria. The remaining studies relied on participants to self-report their psychological conditions. Participants from fourteen studies (56 %) reported mental health issues compared to only seven reporting physical health issues. Depression (n = 8, 57 %), PTSD (n = 4, 28 %) and psychotic disorder (n = 4, 28 %) were the most common mental health symptoms reported among the homeless population in this review. Other

Table 4
Risk factors associated with substance use in the homeless population.

Study number	Drug dependency (Y/N)	Drug dependency (%) Male	Female	Risk factors	Reference
1	Y - 27.34	32.07	19.05	Women were significantly less likely to have at risk drinking (27.6 % vs. 44.7 %) report having a history of problems with alcohol (26.6 % vs. 46.1 %) and past 6-month alcohol abuse/dependence (19.1 % vs. 32.1 %) relative to men.	Neisler et al., 2019
2	Y - 28.41	33.23	20.3	Alcohol dependant individuals were more likely to suffer from food insecurity	Reitzel et al., 2020
vvv3	Y - 13.33	24.76	8.57	Homeless drugs users had a 94 % chance of having depression than non-drug using homeless	O'Brien et al., 2015
4	Y - 61.1	62.4	58.33	Homeless individuals who sold their blood/plasma for money were 13 times more likely to abuse alcohol	Gomez et al., 2010
5	4.3	N/A	4.3	Older women had increased odds of binge drinking, using crack cocaine and cocaine but decreased odds of consuming amphetamine.	Wenzel et al., 2009
6	NR	NR	NR	Hispanic males were nearly 8 times more likely to use crack cocaine than Caucasian males	Rhoades et al., 2011
7	19.6	NR	19.6	More than 70 % of women who were addicted to drugs attempted suicide	Guillen et al., 2020
8	N	NR	NR	Women who had experienced sexual violence were more likely to consume stimulants	Riley et al., 2015
9	51.4	NR	NR	Almost half (44.6 %) of current opioid users had experienced an overdose.	Doran et al., 2018
10	NR	NR	NR	Street homeless in Manchester are reported to have a high prevalence of synthetic cannabinoid consumption, Spice (95 %)	Gray et al., 2021
11	Y - 15.1	NR	NR	Homelessness experiences before 19 years old were 66 % more likely to consume drugs	Johnson and Fendrich 2007
12	Y - 75.0	NR	NR	The majority of homeless drugs users had experienced physical abuse (90.0 %) and 32.5 % experienced sexual abuse.	(Tyler et al., 2007)
13	Y - 82.6	82.8	82.4	Females had a significantly higher prevalence of PTSD (28.0 % vs. 15.5 %) than males. Females also had a high prevalence of SUD-PTSD comorbidity (24.9 % vs. 14.9 %)	Torchalla et al., 2014
14	82.4	NR	82.4	Women under the age of 35 years old were more likely to abuse drugs than women older than 35 years old	Torchalla et al., 2011
15	Y - 76.6	NR	NR	Lack of housing was associated with cocaine use	North et al., 2010
16	Y - 50.0	NR	NR	Most users starting using synthetic cannabinoids when they moved into the shelter and did not know of their existence prior	Barnett and Owusu, 2016
17	N	NR	NR		Palepu et al., 2013
18	29 %	NR	NR	Daily substance users had a higher chance of mental health problems (3.67)	Palepu et al., 2012
19	Y - 100	100	NR	Acute liver injury induced from synthetic cannabinoids Spice/K2. Eight day recovery for alanine transferase, aspartate aminotransferases and bilirubin.	Shahbaz et al., 2018
20	Y - 100	NR	100	The self reported use of cannabis and Spice/K2 to stimulate appetite induced persistent asthma.	Torres and Espiridion 2020
21	NR	NR	NR	Caucasian veterans were more likely to consume only alcohol than use substances	Tsai et al., 2014
22	NR	NR	NR	Homeless individuals placed into supportive housing were less likely to visit the ED for SUD than individuals who were not selected for the program (26 % vs. 32 %)	Miller-Archie et al., 2019
23	Y - 16.6	NR	NR	Caucasian homeless females experienced the highest rate of opioid overdose	Yamamoto et al., 2019
24	NR	NR	NR	84.5 % of synthetic cannabinoid ED cases were from homeless individuals, highlighting the high consumption among homeless individuals	Joseph et al., 2019
25	NR	NR	NR	two-thirds of male substance users had bipolar depression (66.7 %)	Maremmani et al., 2015

SUD: substance use disorder.

psychological disorders reported included eating disorders (n = 2, 14 %), mood disorder (n = 2, 14 %), schizophrenia (n = 2, 14 %), childhood trauma (n = 2, 14 %), manic disorder (n = 2, 14 %), anxiety (n = 1, 7 %), attempted suicide (n = 1, 7 %) and panic disorder (n = 1, 7 %).

Discussion

This systematic review investigated the prevalence, risk factors and effects of substance use among individuals from the homeless population. Two other reviews were reported in literature in relation to substance use prevalence among the homeless population. The first review was conducted by Aldridge et al. (2018) and explored substance use disorders and associated mortality among the homeless population but did not look into prevalence of NPS use. The second review conducted by Heerde and Hemphill (2014) investigated substance use and sexual victimisation among vulnerable populations. This systematic review contributed to the findings of the previous two reviews by going beyond substance use and its associated harm among the homeless in two ways. First, this review is more specific to the homeless population experience rather than looking in general at marginalised populations and thus it gives more in-depth information about their experience with substance use. Second, this review determined the prevalence and pharmacological classes of substances' used and their corresponding trends. More specifically the overall findings of this systematic review captured the substance use trends and emphasised the emergence of NPS, namely SCRA being consumed in the homeless populations.

The results from this review showed that the homeless population was of male majority and of Caucasian ethnic background. Moreover, substance use prevalence among the homeless population remains high where alcohol is the most popular substance used. What this review captured is the emergence of SCRA since 2017. Although SCRA have been documented in national and international studies this is the first review to capture a change in substance use individuals from the homeless population (Irving, 2017; MacLeod et al., 2016; Ralphs et al., 2021). The majority of publications examined in this systematic review were from the US, where the results could have affected the generalisability of substance use among the homeless population. A likely reason for this is the number scientific studies published from the US (624,554 in 2020) compared to the UK (198,500 in 2020), Italy (127, 502 in 2020), Canada (121,111 in 2020), and Spain (104,353 in 2020) (White et al., 2022).

The findings suggested that substance use among the homeless population had a high prevalence that had a rate of more than 50 % in most studies. Alcohol was the most popular substance used by individuals experiencing homelessness followed by heroin. This result confirmed the outcomes of other studies that showed alcohol was the

most reported substance used by the homeless population and is likely due to its legal status worldwide (Dyb, 2016; Grazioli et al., 2015; Khezri et al., 2020). Moreover, the trends in substance use showed that new drug compounds, namely SCRA have entered the drug market and are currently being abused by the homeless population. Although SCRA have been used and abused by the general population since 2007, the consumption of the compounds in the homeless population has only been reported in literature since 2017 (Irving, 2017).

The documented emergence of SCRA being used among the homeless population could be due to decrease in drug purity since 2014. It is noteworthy to mention that the period prior to 2014 witnessed an increase in drug purity (United Nations 2021). For example, 2009 −2014 period saw increase in heroin purity from 23 to 39 %. However, after 2014 heroin purity decreased by 5 % and price per gram nearly doubled (United Nations 2021). These changes are contrary to trends observed for other illicit drugs at retail, where increased supply by traffickers and demand by users normally leads to parallel decreases in price and increase in purity (Rosenblum et al., 2014). The change in heroin purity and price over the past five years led to homeless individuals seeking alternatives, and with SCRA being described as stronger than heroin, more addictive and substantially cheaper their use among the homeless population is now desirable (MacLeod et al., 2016).

This research involved identifying the prevalence, risk factors and effects of substances use among the homeless population. The results showed that alcohol is the most used and abused substance among the homeless population and documented the emergence of NPS since 2017. Moreover, the associated risk factors and adverse events for the different substances was investigated. Major information was missing regarding demography of participants, first time using substances, and the scene where the drugs were consumed, which influenced the understanding of the prevalence of substance use among the homeless population. The substance used from participants also could not be confirmed as the studies used in this review did not use any chemical testing to identify the substance.

Conclusion

Overall, this systematic review showed substance use trends among the homeless population between 2007 and 2020. Not only did this review document substance use trends but also highlighted the emergence of NPS among the homeless population. In summary, the majority of the homeless population were males of Caucasian or African American decent. Traditional drug compounds such as alcohol, cannabis, cocaine and heroin still remain popular among the homeless population. However, NPS have become popular among the homeless since 2017 and were associated with physical and psychological harm. Substance use was more reported in males than females and in both cases it attributed to mental and physical health problems. Mental health problems associated with substance use were depression anxiety and PTSD. Physical health problems were attributed to multiple organ damage including the nervous, cardiovascular, renal and respiratory systems. The emergence of NPS among users from the homeless population has seen a decrease in alcohol, heroin, and crack cocaine prevalence. However, several limitations were encountered during the research study with the first being that a large majority of publications evaluated were from the US and would affect generalisability on drug use prevalence among the homeless population.

Future work should develop research in the area of homelessness and new psychoactive substances in order to increase awareness among health care providers, social workers, governmental agencies and academics.

CRediT authorship contribution statement

Thomas Coombs: Conceptualization, Methodology, Software, Visualization, Investigation, Writing – review & editing. **Amor Abdelkader:** Supervision, Writing – review & editing. **Tilak Ginige:** Supervision, Investigation. **Patrick Van Calster:** Conceptualization, Supervision, Investigation. **Matthew Harper:** Writing – review & editing. **Dhiya Al-Jumeily:** Software, Validation. **Sulaf Assi:** Data curation, Writing – original draft, Supervision.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Appendix A

The following search terms were used: ‘substance use’, ‘homelessness’, ‘homeless’, ‘rough sleepers’, ‘substance abuse’, ‘drug use’ and ‘drug abuse’. The search strategy involved the use of the seven terms in each database as follows: ‘substance use and homelessness’ or ‘substance use and rough sleepers’ or ‘homeless and substance use’ or ‘substance use among the homeless population’ or ‘rough sleepers and new psychoactive substances’ or ‘homeless and new psychoactive substance use’ or ‘homelessness and drug use’ or ‘substance use prevalence in the homeless population’ or ‘homeless and Spice use’ or homelessness and injection drug use’ or ‘homeless drug abuse’.

Appendix B

Section and topic	Item #	Checklist item	Location where item is reported
TITLE			
Title	1	Identify the report as a literature review.	Page 1
ABSTRACT			
Abstract	2	Provide a structured summary including, as applicable: background; objectives; data sources; study eligibility criteria, participants, and interventions; study appraisal and synthesis methods; results; limitations; conclusions and implications of key findings. See the PRISMA 2020 for Abstracts checklist for the complete list.	Page 2
INTRODUCTION			
Rationale	3	Describe the rationale for the review in the context of existing knowledge, i.e., what is already known about your topic.	Page 4
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses with reference to participants, interventions, comparisons, outcomes, and study design (PICOS).	Page 4
METHODS			

(continued on next page)

(*continued*)

Section and topic	Item #	Checklist item	Location where item is reported
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses with study characteristics (e.g., PICOS, length of follow-up) and report characteristics (e.g., years considered, language, publication status) used as criteria for eligibility, giving rationale.	Page 5
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	Page 35
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Page 4
Selection process	8	State the process for selecting studies (i.e., screening, eligibility). Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	Page 5
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	Page 6
RESULTS			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	Page 6
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	Page 6
Study characteristics	17	Cite each included study and present its characteristics (e.g., study size, PICOS, follow-up period).	Page 7
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Page 6
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	Page 6–31
DISCUSSION			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	Page 7
	23b	Discuss any limitations of the evidence included in the review.	Page 32
	23c	Discuss any limitations of the review processes used.	Page 32–33
	23d	Discuss implications of the results for practice, policy, and future research.	Page 32–33
OTHER INFORMATION			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	Page 5
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	Page 5
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	Page 5
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	Page 34
Competing interests	26	Declare any competing interests of review authors.	Page 34
Availability of data, code, and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	Page 34

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