



SYSTEMATIC REVIEW

REVISED

Physical functioning limitations and physical activity of people experiencing homelessness: A scoping review [version 2; peer review: 2 approved]

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Abstract

Background: Adults who are experiencing homelessness suffer higher levels of premature mortality and age-related medical conditions compared to the general population, but little is known about physical factors that influence their health experience. The aim of this scoping review was to evaluate what is known about physical functional limitations and physical activity levels and how they are measured in adults experiencing homelessness.

Methods: This review was conducted in accordance with the Joanna Briggs Institute's methodology for scoping reviews. Suitable quantitative and qualitative articles were searched using PubMed, CINAHL, EMBASE, PsychInfo, Web of Science and SCOPUS databases using a combination of keywords and a gray literature search was performed. Two reviewers independently screened articles for inclusion. Inclusion criteria were studies that examined physical functional limitations and/or physical activity among homeless adults (with/without co-occurring mental illness, infectious disease, substance use disorder), as a primary or secondary outcome measure.

Results: We identified 15 studies for inclusion including 2,018 participants. Studies were primarily quantitative (n=13) and there were 2 qualitative studies. The following outcomes related to physical functioning were reported; mobility levels (n=3), frailty (n=1), flexibility (n=2), strength (n=1), physical symptom burden (n=3), and exercise capacity (n=3). Eight studies reported outcomes related to physical activity. The majority of studies reported high levels of functional limitations among participants and low physical activity levels although a spectrum of abilities was noted.

Conclusion: This review showed that many adults who are homeless appear to show a high burden of physical functional limitations and

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low physical activity levels but more objective and consistent measures should be applied to examine these factors in future studies. This will help address and plan future care, physical rehabilitation and housing needs for this vulnerable cohort. This scoping review will help direct research and future systematic reviews in this emerging area.

Keywords

Functional status, physical activity, homeless adults, homelessness

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REVISED Amendments from Version 1

The authors revised this work in response to valuable comments from reviewers. The main aspects addressed were as follows; In the introduction section, specific detail in relation to study objectives was added. In the methods section, more detail was added in relation to the subject expert, data extraction instrument and date of the search. A greater distinction was made between physical focused outcomes and physical activity focused outcomes in [Table 1](#). In the Results section, the number of quantitative and qualitative studies was clarified, details about participant co-morbidities was included, Biological sex replaced the word gender as a column heading. In the discussion section, more interpretation in relation to biological sex, ethnicity of participants, and application of results community services was added.

Any further responses from the reviewers can be found at the end of the article

Introduction

The number of people experiencing homelessness is significant and increasing, with estimates of 307,000 people in the UK¹, 550,000 in the USA² and 235,000 in Canada³ at any one point, based on data from 2017, 2016 and 2017 respectively. A 'person experiencing homelessness' is someone without stable housing who may live on the streets, in a shelter, in temporary accommodation, or in some other unstable or non-permanent situation⁴.

Life expectancy is greatly reduced among people who are homeless. Recent data from the UK reports a mean age of death among people who died homeless of 45 years among men and 43 years among women, which compares with 76 and 81 years respectively, in the general population⁵. In Ireland the median age at death for people experiencing homelessness in Dublin is devastatingly low at 44 years for males and 36 years for females⁶. Contributing factors to lowered mortality levels are complex. People who are homeless people experience a 'tri-morbidity' of mental ill health, physical ill health, and addiction as well as complex interwoven factors related to social exclusion, higher rates of accidental, violent death and poor access to healthcare⁷.

Common chronic diseases such as chronic obstructive pulmonary disease, asthma, epilepsy, heart disease and stroke are substantially more prevalent among people experiencing homelessness compared to stably housed individuals⁸. External factors as well as chronic diseases have a multi-system effect with reported accelerated ageing⁹ and early onset of geriatric conditions¹⁰. Reflective of disease prevalence and other factors related to extreme socioeconomic deprivation, people who are homeless present for acute hospital care disproportionately compared to housed individuals¹¹.

The benefits of physical activity are well known and recent guidelines¹² have highlighted additional benefits of physical activity in terms of cognitive health health-related quality of life, mental health and sleep which has largely been explored in

healthy populations. Information on physical activity levels among individuals who are homeless is not well known¹³.

Physical performance and functional limitation measures may provide an insight into early signs of disability, poor health, hospitalization and increased death risk^{9,12}. These measures give an indication of a person's ability to perform everyday tasks making them good indicators of overall ability to live independently as ageing occurs⁹. To date there has been no prior effort to characterize the overall physical status of people experiencing homelessness. Improved understanding of physical functioning and physical activity is important, as this may guide the development of screening tools to identify, and interventions to attenuate declines in people experiencing homeless. This will also help direct research as well as future systematic reviews in this topic area.

The protocol was developed and peer-reviewed locally and then registered in the PROSPERO database ([CRD42019124306](#)). In order to address the breadth of this area however, a scoping review rather than a 'pure' systematic review¹⁴ was conducted. Although some consider a scoping review a form of systematic review¹⁵, subtle differences are, for example, the breadth of the research question and the lack of risk of bias assessment^{14,15}.

Based upon the PCC (Population, Concept and Context) elements¹⁶, the overall aim of this scoping review was to evaluate the magnitude and scope of literature pertaining to the overall physical status of adults experiencing homelessness. Specific objectives were to evaluate the quantitative and qualitative literature on the following topics (i) physical functioning in adults experiencing homelessness, (ii) physical activity in adults experiencing homelessness, (iii) related secondary outcome measures such as frailty and cardiovascular fitness. In addition a further objective was (iv) to evaluate measurement methods of physical outcomes in included studies.

Methods

This review was informed by the Joanna Briggs Institute's (JBI) methodology for scoping reviews¹⁴ and guided by the original framework of Arksey and O' Malley¹⁶, and enhancements proposed by Levac *et al.*¹⁷. This review was checked against the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist¹⁸ (see reporting guidelines¹⁹).

Data sources and searches

A comprehensive search strategy was developed collaboratively with a skilled research librarian (D.M.) and a subject expert (C.N.C.) was consulted. The subject expert was a medical consultant who developed an inclusion health service for adults experiencing homelessness and is the clinical lead for service provision for people experiencing homelessness admitted to a large acute inner-city hospital in Dublin, Ireland. The following electronic databases were searched without date restrictions; [MEDLINE/PubMed](#), [EMBASE](#), [PEDro](#), [AMED](#), [CINAHL](#), [PsycINFO](#), [SCOPUS](#) (see extended data¹⁹). A grey literature

search using [Google Scholar](#) and [WorldCat](#) search engines was performed; government reports were searched using the Google search engine and a combination of key word text from inception to 16.01.19.

Physical focused definitions employed in this review

We employed Nagi's²⁰ definition of functional limitations as restrictions in the basic performance of the person such as limitations in the performance of locomotor tasks, such as the person's gait, and basic mobility. Although not the specific focus of this review, factors that relate to physical functioning limitations such as, but not limited to, frailty, physical symptom burden and cardiovascular fitness were included if reported in studies sourced. Physical activity was defined as any bodily movement produced by skeletal muscles that results in energy expenditure²¹ and was considered any type of physical training or movement, including any form of exercise, physical fitness or therapeutic movement. The full search strategy is available in Supplementary File 2.

Inclusion/exclusion criteria

This review included English language studies only. To meet the objective of the scoping review questions in this study, both qualitative and quantitative study designs were included. Studies that examined physical functioning or physical activity (separate searches for each were conducted and later combined) among homeless adults (>18 years) as a primary or secondary outcome measure were included. The following criteria for homeless from the European Typology for Homelessness and Housing Exclusion (ETHOS) criteria²²: roofless, houseless, living in insecure housing, living in inadequate housing was employed in this review.

Selection of studies

Duplications were removed and relevant studies were imported into [Covidence](#) for title and abstract screening which took place independently by two reviewers (J.B. and S.K.). Both authors then conducted a full-text evaluation of selected studies. If necessary, any discrepancies were resolved by consensus by including a third author (C.N.C.).

Data extraction

Two reviewers (S.K. and J.B.) independently extracted data using a specifically designed data extraction sheet. The data extraction instrument collected the following data relating to included studies (author, year of publication, country of study origin, inclusion criteria, living arrangements, physical focused outcomes measured, participant characteristics (number of participants, age, biological sex, race/ethnicity, percentage with less than high school education, co-morbid conditions), physical focused variables (physical variable measured, type of measure, total number of studies, authors, results), physical activity/sedentary behavior focused measures (author, type of measure, measure subscale, main results). Any differences were resolved by consensus discussion. A third author (C.N.C) was available if disparities emerged between reviewers.

Data analysis

Descriptive analysis was performed for all demographic data and data was grouped according to outcome evaluated. Due

to the heterogeneity of study design, interventions and outcomes, a narrative synthesis was conducted.

Results

Studies identified

After the removal of duplicates, 2832 studies were identified. After excluding studies which did not containing data relevant to physical functioning limitations or physical activity specific to adults who were homeless, a total of 15 studies were deemed eligible for inclusion in this review. After excluding studies which did not containing data relevant to physical functioning limitations or physical activity specific to adults who were homeless, a total of 15 studies were deemed eligible for inclusion in this review. The PRISMA flow chart²³ summarizes the search strategy ([Figure 1](#)). Quantitative (n=13) studies predominated and the remaining were qualitative in design (n=2). Over 2000 participants were included in this review (n=2,018). Over 70% of participants were male. A formal operational definition of homeless was included in one study only²⁴. The living arrangement of participants was outlined in the recruitment strategy and/or eligibility criteria of remaining studies. The majority of studies included participants in shelter accommodation. Four studies were limited to male only participants²⁴⁻²⁷, while only two were female only^{28,29}. Characteristics of the included studies are shown in [Table 1](#). The majority of studies took place in North America (12/15) with the remainder in Australia (n=1) and Denmark (n=2).

Participant characteristics are shown in [Table 2](#). Despite the relatively low mean/median age of participants [2nd decade (n=2 studies), 3rd decade (n=2 studies), 4th decade (n=5 studies), 50th decade (n=5 studies), 60th decade, (n=2 studies), participants experienced a high burden of physical and mental conditions. From data presented in included studies, rates of hypertension ranged from 20.4% to 59%, arthritis from 16.8% to 46.8%, diabetes from 14% to 18.3% and depression from 34% to 59.6%.

The following physical variables were evaluated in studies included in this review; mobility status, frailty, flexibility, physical symptom burden, physical activity levels and exercise intensity achieved and fitness. [Table 3](#) summarizes physical focused variables and [Table 4](#) summarizes physical activity/sedentary behavior variables.

Mobility status

Mobility status was evaluated in two studies. Overall results indicated that many people homeless experiencing homelessness have difficulty mobilizing. In two studies^{10,30} mobility was measured by self-reported difficulty walking. Brown *et al.* 2012³⁰ sampled 247 homeless adults, and found that 102 (41.3%) self-reported difficulty walking³⁰. Brown *et al.* 2017 included 350 participants aged 50 or older and reported mobility impairments in over one quarter of participants (26.9%) and 33.7% reported one or more falls in the previous 6 months. Results of this study indicated that greater mobility impairments (defined as difficulty across a room) were found in participants < 50 years, compared to those ≥ 50 years.

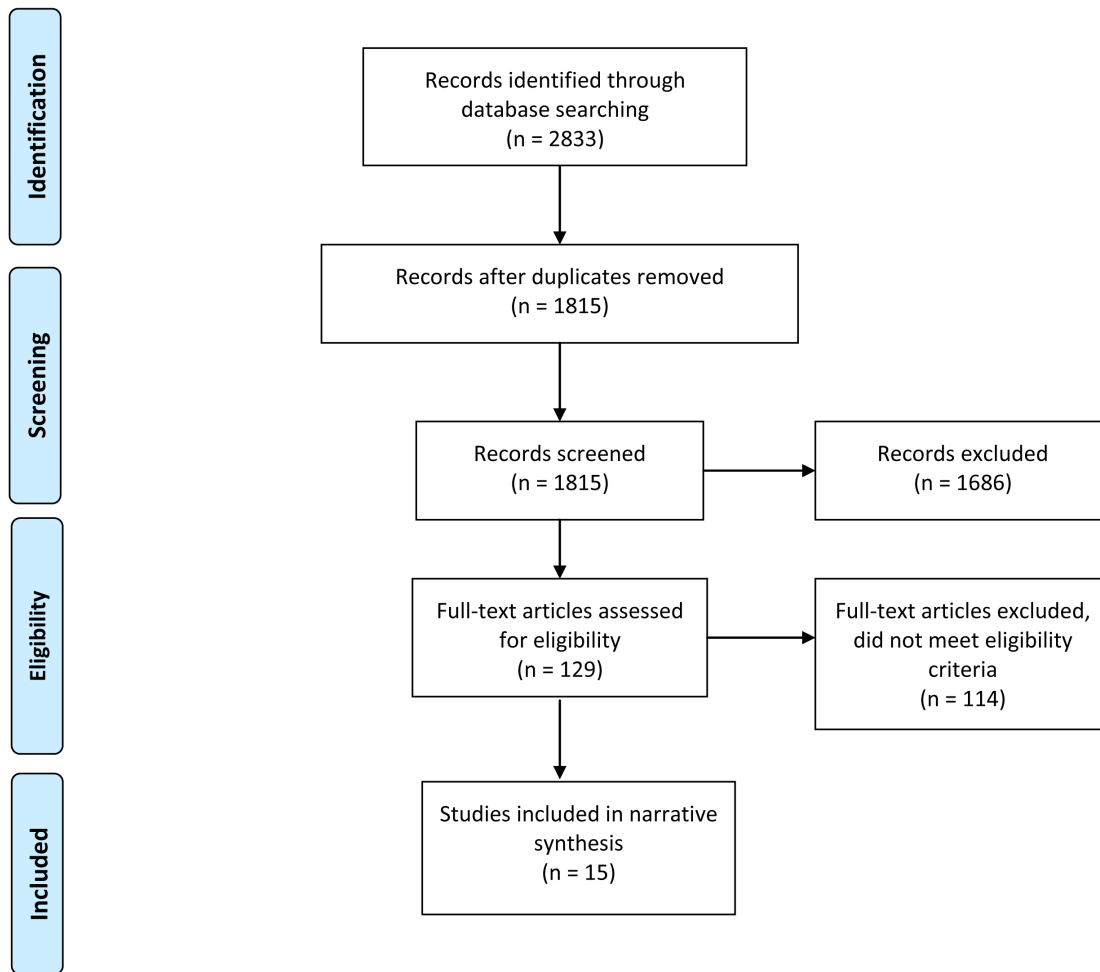


Figure 1. PRISMA flow diagram of selection for review.

Functional limitations

Raven *et al.* 2017 reported that over half (58.4%, n=204) of participants had limitations in lower extremity function measured by the Short Physical Performance Battery³¹. This study included participants with a median (IRQ) age of 58 (54–61) years.

Frailty

Frailty was evaluated in one study³⁰. Frailty was measured using the Fried criteria³² in which more than 3 of 5 characteristics were present: unintentional weight loss, low physical activity, exhaustion, slow walking speed and weak handgrip. In total, 40 participants (16%) met frailty criteria, bearing in mind that participants were aged between 50 and 69.

Flexibility

Flexibility was assessed in two studies^{24,33} and compared to control groups. The Sit and Reach test³⁴ was used which targets hamstring and lower back flexion. Other flexibility tests employed

were the butterfly test (targets adductor muscles), the trunk flexibility test and shoulder stretch³⁴. Mean (SD) results for the sit and reach test, butterfly test, left shoulder, right shoulder, left trunk twist and right trunk twist were 26.2 (9.01), 17.83 (7.29), 0.59 (9.55), 2.42 (7.54), 8.89 (7.96), 12.22 (8.23) respectively³³. It was noted that participants who were homeless were less flexible (p<0.05) in four stretch tests compared to a control group of university students. Similar low values were reported for the Sit and Reach test in the Gregg and Bedard (2016)²⁴ study of 24.32 ± 8.07cm.

Strength

Strength was measured in one study²⁴ using a grip strength test³⁵ which was reported to be mean (SD) 43.24 (6.79). Values from the homeless cohort age 41.05 ± 11.32 years were reported to be comparable to a reference population.

Physical health/symptom burden

Physical symptom burden was evaluated in three studies, assessed in 3 different ways. Patanwala *et al.* (2017) evaluated physical

Table 1. Study characteristics.

Author and year	Study Location	Listed study type	Inclusion criteria	Definition of homelessness/living arrangement/access to services	Physical-functioning measure or Physical activity measure	Outcomes (measure)
Quantitative Studies						
Ballard, 2009	North Carolina, U.S.	Cross sectional	Age >18 years Understood and spoke English	Staying overnight in a shelter got homeless women	Physical activity	-Physical activity subscale of the Health Promoting Lifestyle Profile II questionnaire
Brown <i>et al.</i> 2012	Boston, U.S.	Cross sectional	Age >50 years Able to communicate in English Able to give consent	Accessing emergency, transitional and day centers	Physical functioning	-Frailty (Fried frailty criteria, -Functional status (self-reported mobility impairments)
Brown <i>et al.</i> 2017	California, U.S.	Prospective cohort study	Age >50 years Able to give consent English speaking Homeless	Accessing low-cost meal programs serving (for homeless people), overnight shelters, also 'recycling centers and places where unsheltered people stayed'	Physical functioning Physical activity	-Physical activity (self-reported frequency) -Functional status (self-reported mobility impairments)
Chau <i>et al.</i> 2002	Los Angeles, U.S.	Survey	Homeless English-speaking >18 years New to study	No regular home or apartment to stay in for at least one night of the previous 30 nights but had to stay in: (a) a shelter; (b) a hotel paid for with a voucher; (c) the street or other outdoor public place; (d) a church; (e) an indoor public place; (f) an abandoned building; or (g) a car or other vehicle	Physical activity	-Daily exercise habit (self-report)
Gaderman <i>et al.</i> 2014	Vancouver, Toronto, Ottawa, Canada	Cross sectional	Age >18 years	Accessing homeless shelters, meal programs, rooming houses, and a supervised injection site	Physical functioning	-Physical health impact (Short form-12 questionnaire)
Gregg and Bedard 2016	Winnipeg, Canada	Cross sectional	Not specified	Patrons of a homeless shelter	Physical activity Physical functioning	Reporting of frequency of exercise -Fitness (1 mile treadmill walk test) -Strength (grip strength) -Flexibility (sit and reach test)

Author and year	Study Location	Listed study type	Inclusion criteria	Definition of homelessness/living arrangement/access to services	Physical-functioning measure or Physical activity measure	Outcomes (measure)
Kendzor <i>et al.</i> 2015	Dallas, U.S.	Pilot study	>6th grade English literacy, Willingness to quit smoking Age >18 years Willingness to attend weekly smoking cessation treatment sessions	Patrons of a homeless shelter	Physical activity	-Physical activity (7 items from the Behavioral Risk Factor Surveillance System Questionnaire)
Marmolejo <i>et al.</i> 2018	Los Angeles, U.S.	2 group cross-sectional comparative study	Ability to give consent	Accessing a homeless youth drop-in centre	Physical activity Physical functioning	-Self-report physical activity questionnaire -Flexibility (sit and reach test)
Patanwala <i>et al.</i> 2017	California, U.S.	Cross-sectional analysis within longitudinal cohort study	Age > 50 years English-speaking Defined in the federal Homeless Emergency Assistance and Rapid Transition to Housing Act Able to give informed consent	Accessing low-cost meal programs serving (for homeless people), overnight shelters, also 'recycling centers and places where unsheltered homeless adults stayed'	Physical functioning	-Physical symptoms (Patient Health Questionnaire 15)
Randers <i>et al.</i> 2010	Copenhagen, Denmark	Cross sectional	NS Able to give informed consent	Recruited from shelters and unemployment offices	Physical functioning	-Fitness (VO ₂ max test)
Randers <i>et al.</i> 2012	Copenhagen, Denmark	Controlled study	NS	Recruited from shelters and unemployment offices	Physical functioning	-Fitness (VO ₂ max test)
Raven <i>et al.</i> 2017	California, U.S.	Cross sectional	English speaking Age > 50 years	Recruited from people in homeless encampments, one recycling centre, all overnight homeless shelters and free and low cost meal programmes	Physical functioning	-Functional limitations (Short physical performance battery)
Wilson, 2004	Midwest, U.S.	Cross-sectional study	Homeless women Registered residents of the shelters Could read and understand the English language	Recruited from urban shelters	Physical activity	-Physical activity levels (Health-Promoting Lifestyle Profile II questionnaire)
Qualitative studies						
Bazari <i>et al.</i> 2018	California, U.S.	Qualitative study including semi-structured interviews	Age >50 years Able to give consent English speaking Homeless	Recruited from low-cost meal programs, recycling centers, overnight homeless shelters and locations where unsheltered adults stay	Physical functioning	-Physical symptom burden (semi-structured interviews)
Quine <i>et al.</i> 2004	Sydney, Australia	Qualitative study	Older men ≥ 50 years, In receipt of a pension or benefit Effectively single Non-home owners Living alone	Non home-owning men living alone in insecure housing in inner city area	Physical activity	-Physical activity levels (semi structured interviews)

Table 2. Details of participant characteristics.

Citation	Number of participants	Age mean (SD)	Biological Sex	Race/ Ethnicity	<High school education	Comorbid conditions
Ballard, 2009	126	41.99 ± 9.42 years	Female only M:0 F:126	African American (54%) White (32.5%) American Indian (4.8%) Mixed race (4.8%) Asian (1.6%) Other/unsure (4.4%)	31.8%	High blood pressure: 41.1% Asthma: 26.8% Arthritis: 25% STDs: 22.4%
Bazari <i>et al.</i> 2018	20	62 years	Male= 65% M:13 F:7	African American (85%)	NS	NS
Brown <i>et al.</i> 2012	247	56 years	Male= 92% M:187 F:60	White (39.7%)	26.1%	Hypertension (59%), arthritis (44.9%), depression (59.6%)
Brown <i>et al.</i> 2017	350	58 (54–61 years) ^a	Male= 77.1%	African American (79.7%), White (10.9%) Latino (4.6%), Other (4.9%)	25.7%	Hypertension (56%) Coronary artery disease or myocardial infarction (9.1%) Congestive heart failure (7.1%) Diabetes (14%) Stroke (11.2%) Respiratory disease (26.3%) Arthritis (44.6%) HIV/AIDS (5.5%)
Chau <i>et al.</i> 2002	221	46.7 years	Male=54% M:120 F:101	African-American (57%) Caucasian (26%) Other (17%)	60%	NS
Gadermann <i>et al.</i> 2014	100	43.3 +/- 11.9 years	Male= 69% M:69 F:31	White (55%), Aboriginal (30%) Other (15%)	27.2%	Arthritis/rheumatism, joint problems (43.9%), Hepatitis C (31.6%), Migraines (28.6%), Mental health conditions (52.5%), Substance abuse (40.2%), Depression (34%), Substance dependence (26.6%), GAD (15.6%), PTSD (12.5%)
Gregg and Bedard 2016	18	41.05 ± 11.32 years	Male = 100% M:18 F:0	NS	NS	NS
Kendzor <i>et al.</i> 2015	57	49.4 +/- 7.7 years	Male = 66.6%	African-American (54.4%) Latino (3.5%) Mixed race(5.3%)	NS	NS

Citation	Number of participants	Age mean (SD)	Biological Sex	Race/ Ethnicity	<High school education	Comorbid conditions
Marmolejo <i>et al.</i> 2018	40	21.4 ± 2.3 years	Male = 67.5% M:27 F:13	White (30%) Hispanic (27.5%) African American (20%) American Indian/ Alaska Native 3(7.5%) Native Hawaiian/ Pacific Islander 1(2.5%) Missing (12.5%)	15%	NS
Pantalawa <i>et al.</i> 2017	283	59 (51–82) ^a	Male=75.6% M:214 F:69	African American (82.4%) White (9.6%) Other (21.9%)	21.9%	Heart related (17.2%) Respiratory related (23.7%) Diabetes (18.3%) Arthritis (46.8%) Cirrhosis/liver disease (21.0%) Kidney disease (5.4%) Cancer (5.9%) HIV/AIDS (6.2%)
Quine <i>et al.</i> 2004	32	66 years	Male = 100% M:32, F:0	Australian born (66%) Born overseas (33%)	NS	'Significant' health difficulties (66%)
Randers <i>et al.</i> 2010	15	29 ± 2 years	Male = 100% M:15,F:0	NS	NS	NS
Randers <i>et al.</i> 2012	22	37 ± 10 years	Male = 100% M:22, F:0	NS	NS	NS
Raven <i>et al.</i> 2017	350	58 (54–61) ^a	Male = 77.1% M:270 F:80	African American (79.7%) Non-African American (20.3%)	74.3%	Chronic illness (23.9%), Acute illness (21.6%), Pain (19.2%) PTSD (32.6%) Depression (53.3%)
Wilson, 2004	137	36 years (range 18–60)	Female only M:0 F:137	White (53%) African American (43.8%)	22%	Physical diseases: Asthma: 27% Chronic bronchitis: 25.5% Hypertension: 20.4% Arthritis: 16.8% STD: 16.8% Ulcer: 15.3%

NS: not stated, ^aMedian(IQR), Abbreviations: AIDS; acquired immunodeficiency syndrome, GAD; generalised anxiety disorder, HIV; human immunodeficiency virus, F: female, M; male, NS; not stated, PTSD; post-traumatic stress disorder, STD; sexually transmitted disease,

symptoms in homeless aged ≥ 50 years³⁶ using the Patient Health Questionnaire-15 (PHQ-15)³⁷. They reported that over one-third (34%, n= 96) had a moderate-high physical symptom burden. The most common physical symptoms were joint pain, fatigue, back pain and sleep difficulties.

Similarly, Gaderman *et al.* (2014) using the SF-12³⁸, reported that the physical component summary scale was 43.6 (SD=11.0), which was 'substantially lower' than US population normative

values³⁹. In this study it was found that 87.9% (n=53) of participants suffered at least one physical health condition.

These findings concur with a qualitative study included in this review. Bazari *et al.* (2018) reported that physical symptoms experienced by homeless adults interfere with daily functioning⁴⁰. They included 20 participants aged between 52 and 78 years (median age 62). It was found that daily challenges

Table 3. Physical focused variables measured in systematic review studies.

Physical Variable	Type of Measure	Total number of studies	Authors
Mobility	Self-reported difficulty walking	2	Brown <i>et al.</i> (2012) Brown <i>et al.</i> (2016)
Lower extremity functioning	Short Physical Performance Battery	3	Raven <i>et al.</i> (2017)
Frailty	Fried criteria	1	Brown <i>et al.</i> (2012)
Flexibility	Sit and Reach Test	1	Marmolejo <i>et al.</i> 2018 Gregg and Bedard (2016)
Strength	Grip Strength	1	Greg and Bedard (2016)
Physical health/ symptom burden	Physical symptom burden (self-report)	1	Bazari <i>et al.</i> (2018)
	SF-12 (Physical component)	1	Gaderman <i>et al.</i> (2014)
	Patient Health Questionnaire-15	1	Pantanwala <i>et al.</i> (2017)
Exercise capacity	1 mile walk test	1	Greg and Bedard (2016)
	VO ₂ max	2	Randers <i>et al.</i> (2010) Randers <i>et al.</i> (2012)

and physical conditions of homelessness caused and exacerbated symptoms.

“I can’t be active anymore like playing sports because I used to like to go play basketball or lift weights... but I can’t do nothing anymore...” (M, 63)

Some participants cited premature aging as the reason for their physical symptoms and decreased functional ability.

“It’s the arthritis.... Sometimes I feel I am carrying all my weight on my legs....I just feel like I’ve aged so quickly in my life” (F, 58)

Fatigue was also a factor.

“I guess every day that I have to walk I’m tired. I guess that’s the main thing: that I go from bench to bench and feel tired” (M, 58)

Physical activity levels

Physical activity levels were measured in six studies. Diverse methods were employed to assess this construct in each study. Insufficient physical activity levels among homeless adults were generally reported across studies (Table 4). Kendzor *et al.* (2015) examined modifiable health risk factors among homeless smokers (n= 57)⁴¹. The results showed that 26.3% did not meet recommended physical activity levels in the previous week.

Chau *et al.* 2002 asked about exercise habits during an interview which mainly focused on cancer risk behaviours and screening. It was reported that 56% (n=125) performed daily exercise, but no details of the definition of exercise was supplied. Gregg and Bedard (2016) evaluated ‘regular exercise’ as per Courneya and Bobick, 2000⁴² and reported that 44% (n=8) exercised “at least three times per week, for at least 20–30 min in duration, and at least moderate-to-vigorous intensity”. Wilson (2005) explored health-promoting behaviours of women who were living in shelter accommodation (n= 137)²⁹. The study employed the Health-Promoting Lifestyle Profile II (HPLPII)⁴³ and found that participants scored lowest in the physical activity subscale which is shown in Table 5 although overall it was reported that total levels of health-promoting behaviours were similar to another study of low income and homeless women⁴⁴.

Quine *et al.* (2004)²⁷ employed semi structured interviews and a number of facets of physical activity emerged. It found that some participants were until recently physically active. However, deterioration in their health had reduced their activity levels.

“I used to walk about a quarter of a mile up and around the block” (M, 86)

Physical activity was also undertaken as a necessity.

Table 4. Physical activity/sedentary behaviour focussed measures.

Author	Type of measure	Detail of measure	Subscale (if relevant)	Main Result
Ballard, 2009	Questionnaire	Health Promotion Model Measures	Physical activity subscale [Health-promoting Lifestyle Profile II (HPLP II)]	2.08 (0.66) Range: 1.00–3.88
Chau <i>et al.</i> 2002	Interview	Asked in interview if exercise was 'daily', 'sometimes' or 'never'	N/A	125 (56%) exercised daily, 86 (39%) exercised sometimes, 10 (5%) never exercised
Gregg & Bedard, 2016	Reporting of frequency of exercise	Exercise defined as "at least three times per week, for at least 20–30 min in duration, and at least moderate-to-vigorous intensity"	N/A	8 (44%) participants reported exercising regularly
Kendzor <i>et al.</i> , 2015	Questionnaire	Behavioural Risk factor Surveillance System Questionnaire	Insufficient physical activity defined as <150 minutes of moderate physical activity or <75 minutes of vigorous physical activity (or less than an equivalent combination of the two)	During the previous week, 26.3% did not meet recommended physical activity guidelines
Marmolejo <i>et al.</i> 2018		Self-report paper questionnaire but unclear exactly how physical activity measured	'Low frequency' physical activity 0–2 times per week	N=14, 36.8%
			'High frequency' Physical activity 3+ times/week	N=24, 63.2%
Quine <i>et al.</i> (2004)	Self-report	Semi-structured interview	N/A	Physical activity (walking) emerged as a theme
Wilson	Questionnaire	Health Promotion Model Measures	Physical activity subscale [Health-promoting Lifestyle Profile II (HPLP II)]	2.05 (+/-0.98)

N/A: not applicable

"It's a good walk [to a meals centre] and they put on a hot breakfast" (M, 68)

Physical activity was also used as a time filler

"if there's something on like a movie worthwhile I'll watch that and if there's not I'll for out for a walk for an hour and come back" (M, 75).

Exercise capacity

Randers *et al.* (2010) reported VO₂ max levels for 15 people experiencing homelessness who were engaging in a football training program. Reported VO₂ max levels were 33.5 +/-2.0 ml.kg.min⁻¹²⁵. Similarly, Randers *et al.* 2012 reported VO₂ max levels for 22 men experiencing homelessness before and after a 12 week soccer training program. Reported VO₂ max levels were 36.7 +/- 7.6 ml.kg.min⁻¹ which appeared

higher than a control group (33.7 +/- 4.5)⁴⁵. One further study evaluated fitness using the 1 mile walk test²⁴ with a result of 16.48 +/- 2.42 minutes which was reported to be similar to reference values for age and gender.

Discussion

This review provided a snapshot of existing literature in the area of physical functioning limitations and physical activity levels in people experiencing homelessness. The scoping review methodology enabled a broad range of inter-related physical related variables (mobility status, functional levels, frailty, flexibility, physical symptom burden, physical activity levels and exercise capacity) to be usefully subsumed into one review which gives a broad overview of this topic area. It is clear from this review that the experience of homelessness negatively influences physical –focused parameters but the diversity of measures limited our ability to synthesize data for the purposes of this review.

Table 5. Health-Promoting Lifestyle Profile - Physical activity subscale.

Health-Promoting Lifestyle Profile - Physical activity subscale (From Wilson, 2004)	Mean (SD)
Follow a planned exercise program	1.78 (0.77)
Exercise vigorously for 20 or more minutes at least three times a week (such as brisk walking, bicycling, aerobic dancing, using a stair climber)	2.05 (0.98)
Take part in light to moderate physical activity (such as sustained walking 30–40 minutes 5 or more times a week)	2.28 (0.93)
Take part in leisure-time (recreational) physical activities (such as swimming, dancing, bicycling)	2.02 (0.76)
Do stretching exercises at least 3 times per week	1.90 (0.89)
Get exercise during usual daily activities (such as walking during lunch, using stairs instead of elevators, parking away from destination and walking)	2.59 (0.94)
Check my pulse when exercising	1.53 (0.80)
Teach my target heart rate when exercising	1.61 (0.76)

This review included 2,018 participants, of which females were underrepresented as over 70% of review participants were male. This reflects that 4 studies exclusively included males, whereas only 2 studies only included females, and relatively there was a higher proportion of males than females in the remaining studies. Less therefore appears to be known about the physical profile of females experiencing homelessness compared to males. Sex as a biological characteristic was reported in studies was reported rather than gender which is more a social and identity construct⁴⁶. It is known that transgender people are disproportionately represented among homeless populations⁴⁷ but this group were not represented in studies included in this review.

The majority of studies included in this review were quantitative in design (n=11), while 3 were qualitative. Almost 80% of studies were based in North America, with the rest of studies from other high income countries of Denmark and Australia. There appears to be a large evidence gap in the evaluation of physical variables among people in low and middle income countries.

In the US based studies 59.6% of participants were African American, while a lower proportion were white (29.8%). This reflects the high proportion of African Americans among homeless populations in the US⁴⁸. Indigenous people are also over-represented among homeless populations⁴⁹ which likely mirrors the proportion of Aboriginal people in a Canadian study⁴² included in this review. It is possible that in other studies this group

may have been under-represented or not specifically reported. Out of 10 US based studies, one reported the proportion of American Indian participants was 4.8%, and another quoted that 10% of participants were American Indian/Alaska Natives/ Native Hawaiian/Pacific Islanders. Most of the rest of the studies included categories of ‘other’ in which it was likely native populations were subsumed. Similarly, there may have been an under-representation of Latino people and people of mixed race heritage but absolute proportions of different ethnic groups among homeless populations are likely to be context specific.

Studies predominately appeared to include people in shelter accommodation. The proportion of people sleeping rough who were included in studies within this review was low and it is probable that their physical health variables may be worse than individuals living in sheltered accommodation. Despite the frequency of hospital visits and stays in this population^{11,50}, no study profiled hospitalized homeless individuals. It is likely that this cohort may be especially vulnerable and debilitated and requires further evaluation with regard to physical focused variables.

Despite the disparity in measures, there generally appears to be a pattern of low physical functioning levels and poor physical activity levels among people experiencing homelessness compared to expected levels. A high physical symptom burden was also noted particularly in relation to joint pain, fatigue, back pain and sleep problems³⁶. Flexibility levels were also significantly lower than control group findings³³. This finding suggests a global decline or substandard level of physical fitness and function among homeless adults and an earlier onset of geriatric conditions which has been shown previously⁵¹, the reasons for which need to be further elucidated. In the study by Brown *et al.*, 2017, it was noted that despite a median age of 58 years, participants had rates of geriatric conditions similar or equivalent to adults in the general population with a median age of nearly 80 years^{52,53}. Similarly, the study by Raven *et al.* included participants with a median age of 58 years and reported that almost 60% had limitations in lower extremity function. This was also shown in the earlier study by Brown³⁰ and provides more evidence for the need for geriatric style rehabilitation services needed for people experiencing homelessness¹⁰.

At odds with the majority of studies, two Danish studies^{25,26} which evaluated fitness in a population of people experiencing homelessness who were participating in street soccer showed comparable fitness levels to control group values but mean ages were in the 3rd decade in these studies. Gregg and Bedard also showed that fitness and strength were comparable to reference ranges among healthy populations⁵⁴ in also a relatively young cohort with an average age of 41.05 +/- 11.32 years. It is possible that these groups are not representative of the population as a whole, nonetheless the diversity of people experiencing homelessness and spectrum of ability is important to consider. It is also possible that physical functioning limitations may develop after the 3rd and 4th decades for some people experiencing homelessness.

While reported physical activity levels varied between studies, a large proportion of participants experiencing homelessness appeared to have low physical activity levels³³. Promoting physical activity may mitigate against some of the burden of physical and mental health issues suffered by people experiencing homelessness⁴⁶. One study²⁷ highlighted a nuanced view indicating that physical activity was undertaken not necessarily for health gain but by participants out of necessity to access meals and to fill in time.

The number of outcomes and measures suggests a lack of empirical data in the area to aid clinical decision makers and researchers about the overall physical health status of people experiencing homelessness. Physical focused measures included in this review were for the most part cursory in nature and were subsidiary to other study outcomes. While a diversity of outcomes were included in studies included in this review, self-report measures were predominantly used rather than more robust objective methods with the exception of two studies which employed a gold standard measure to evaluate $\text{VO}_2 \text{ max}$ ^{32,33}. Studies by Brown *et al.* (2011), Brown *et al.* (2017) and Raven *et al.* (2017) were the only studies to examine mobility impairment. Only one study used the Short Physical Performance Battery, a useful battery of physical performance tests to assess functional status⁴⁷. Only one study evaluated frailty and falls (Brown *et al.* 2011). All studies which evaluated physical activity used self-report measures which lack reliability and are prone to inaccuracies⁴⁸.

The general lack of robust data which extensively evaluates physical functioning and physical activity among people experiencing homelessness may be also partly due to concerns regarding vulnerability and potential or perceived ability to participate in research can result in exclusion from research. This can lead to a lack of evidence on which to base policies and design suitable housing services.

Strengths and limitations

This review appears to be the first attempt to systematically present literature pertaining to physical functioning limitations and physical activity levels in adults experiencing homelessness. The scoping review methodology employed in this review was suitably broad to bring together evidence from heterogeneous methodology sources including observational, mixed method and qualitative designs of the experience of physical limitations in people experiencing homelessness as well as the diverse reporting of outcomes⁵⁵. This scoping review allowed various inter-related physical aspects such as frailty, cardiovascular fitness, and flexibility among others. This methodology was also useful to examine emerging evidence in this relatively new field of research. In a topic as broad as physical functioning limitations it has helped focus on where future research and eventual systematic reviews should be targeted.

A number of limitations pertained to this review, however. Firstly, studies lacked a consistent definition of homelessness. As diverse study designs were included in this review, this resulted in strong heterogeneity which precluded the ability to

quantitatively analyse results. A formal assessment of methodological quality of the included studies was not performed as scoping reviews aim to include a broad overview of available evidence, irrespective of quality⁵⁵. Finally, potentially relevant evidence from other languages may have been missed as this review only included English language papers.

As all studies included in this review were community based, the generally low level of physical functioning and physical activity of this population is relevant to a broad spectrum of community based services including housing, social health services. Housing services should bear accessibility in mind and social activities should incorporate a physical/exercise component where possible.

Bearing in mind the prevalence of physical functioning limitations, we would advocate that all clinicians should screen this population for physical deficits so appropriate rehabilitation or other services can be initiated. We appreciate however, that the non-uniformity of outcomes and measurement tools applied presents a challenge to clinicians. Recommendations on appropriate physical functioning and physical activity measures are needed which are suitable to use in this population to prevent waste of valuable healthcare resources⁴⁹. Studies should focus on reliability, validity and responsiveness of physical functioning measures for people experiencing homelessness as a basis for more effective clinical assessment and management. Further research should determine a core outcomes set⁵⁶ applicable to this population. Ideally this would be a quick standardized physical test battery so reliable consistent data can be collated to highlight at risk groups, inform clinical decision making and practice and advocate for better services. Further consistent primary research needs to be conducted before a comprehensive systematic review can be conducted. Factors possibly contributing to physical functioning limitations such as age, co-morbidities as well as a host of other factors also need further exploration.

Conclusion

This review shows that adults experiencing homelessness appear to suffer physical functioning limitations and low physical activity levels but the inconsistency in measurement methods limits our ability to extensively profile this population at this time. Given the low levels of physical functioning shown in people experiencing homelessness, greater prominence and robustness of measurement methods should be applied to fully interrogate this area. Further research is necessary so adequate rehabilitation regimes and support can be put in place for this vulnerable population. This scoping review will guide future research and systematic review development in this emerging area.

Data availability

Underlying data

All data underlying the results are available as part of the article and no additional source data are required.

Extended data

Open Science Framework: Physical functioning limitations and physical activity of people experiencing homelessness: A review. <https://doi.org/10.17605/OSF.IO/7VGZP>¹⁹

This project contains the following extended data:

- Supplementary File 2 Search Strategy - Copy.docx (Study search strategy)

Reporting guidelines

Open Science Framework: PRISMA-ScR checklist for 'Physical functioning limitations and physical activity of people experiencing homelessness: A scoping review'. <https://doi.org/10.17605/OSF.IO/7VGZP>¹⁹

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 **Cilia Mejia-Lancheros** 

MAP Centre for Urban Health Solutions, St Michael's Hospital, Li Ka Shing Knowledge Institute, Toronto, ON, Canada

I think the authors have done a great job in addressing the comments and suggestions; therefore, I do not have any further revisions to request. Congratulations to the authors.

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Social epidemiology and public health scientist with expertise on health inequalities, social determinants of health, homelessness, housing and health.

I confirm that I have read this submission and believe that I have an appropriate level of expertise to confirm that it is of an acceptable scientific standard.

Version 1

Reviewer Report 07 December 2020

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 **Cilia Mejia-Lancheros** 

MAP Centre for Urban Health Solutions, St Michael's Hospital, Li Ka Shing Knowledge Institute, Toronto, ON, Canada

Overview

The study assessed the existing evidence on physical functioning limitation and physical activity among homeless adults using the scoping review framework. The findings highlight that people who experience homelessness have a high level of physical functioning impairment and low physical activities, which provides evidence of this population's low health status. It also shows the need for effective community-based and clinical-based interventions to diminish their premature physical functioning decline and poor health and social well-being.

Overall, the paper is well-written and structured. However, I have some suggestions below that might strengthen the paper's quality, the interpretation of the findings and the derived knowledge translation process.

Abstract

1. In the statement, "This review aimed to evaluate what is known about physical functional limitations and physical activity levels and how these constructs are measured in adults experiencing homelessness", I think physical functional limitations and physical activity are more conditions and abilities than constructs.
2. In the abstract methods: I suggest including the period within which the reviewed literature was considered.
3. In the statement "The following physical focused measures ..." I suggest separating the specific outcomes related to physical functional limitations than those related to physical activity level by not putting all together in the same statement.

Introduction

1. The statistic of the figure of homelessness in the USA and Canada should be accompanied by the referring period. For example, for Canada, the figures refer to 2017 and for the USA to 2016.
2. By 'tri-morbidity, do you mean: mental illness, physical illness(included chronic diseases) and substance use disorders? Since chronic diseases are communally referred to as physical diseases.
3. By housed individuals, do you mean people with stably housed or non-homeless people? I think it is essential to be more specific.
4. In the statement, "An abundance of epidemiological highlights physical inactivity as a significant predictor of cardiovascular disease, type 2 diabetes mellitus, obesity, some cancers, poor skeletal health, some aspects of mental health, and overall mortality, as well as poor quality of life" please specify the population.
5. The statement "Improved understanding of physical variables is important..." please specify what physical variable you are referring to. Perhaps, physical functioning and activity?
6. In the scoping review, it is important to specify that the study population is adults experiencing homelessness. As there are also youth and children who experience homelessness.

Methods

Data sources and searches

1. Who was that subject expert? An academic expert in homelessness? A person with lived experience of homelessness? Please, elaborate on it.
2. Please, report the period in which the research for studies was conducted. It will allow the replicability or update of the searching strategy.

Physically focused definitions employed in this review

1. "We employed the definition of functional limitation" do you mean the definition of physical functioning? Please specify.

Selection of studies

1. I wondered if you used any strategy or tool to perform the appraisal of the included studies' quality. Please elaborate on this matter.

Data analysis

1. As you well-know, the scope of a scoping review is not to pool empirical findings using statistical methods as it happens in a systematic and meta-analysis review. Instead, it is more synthesized or summarized the findings. Thus, the statement "Due to the heterogeneity of study design, interventions and outcomes, a narrative synthesis was conducted" is no application for the scoping review.

Results

1. In the result, you describe female and male as one of the demographic characteristics of the revised studies' participants. In Table 2, you report this characteristic as gender. Gender (e.g. men/women) is more a social and identity construct, while sex (female/male) more a biological characteristic. Considering these differences, please clarify whether all studies measure gender or biological sex or both. If both, please include them as two distinct characteristics. This health to inform any potential gender-based or biological sex-based differences and similitudes, and gaps in the review' findings.
2. Perhaps briefly summarize the definition of homelessness employed in the included studies could give a more comprehensive view of what groups of homeless people were more likely to be studied.
3. Please state clearly in the results (text and Table 1) which of the findings you are presented as "Physical Focused Outcomes (measure)" are those referring to physical functioning measures only and which to the physical activity only. This is important as they are the two primary distinct outcomes assessed in your review. You may consider two add one column for the physical functioning outcome and the other for the physical activity outcomes. In Table 3, If the measures you are presented there are those regarding physical functioning, please state that clearly in the table's title and the variable level within the table.
4. As you included both qualitative and quantitative studies, it would better to present the characteristics and findings of those two groups of designed papers separately in the tables. Moreover, the number of studies with qualitative design reported in the results text do not concord with the number of qualitative studies present in Table 1.
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2. There are discrepancies between the numbers of records found reported in Figure 1 and those reported in the result text. Please correct it accordingly.

Are the rationale for, and objectives of, the Systematic Review clearly stated?

Yes

Are sufficient details of the methods and analysis provided to allow replication by others?

Partly

Is the statistical analysis and its interpretation appropriate?

Not applicable

Are the conclusions drawn adequately supported by the results presented in the review?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: Social epidemiology and public health scientist with expertise on health inequalities, social determinants of health, homelessness, housing and health.

I confirm that I have read this submission and believe that I have an appropriate level of

expertise to confirm that it is of an acceptable scientific standard, however I have significant reservations, as outlined above.

Author Response 26 Jan 2021

Julie Broderick, Trinity College Dublin, the University of Dublin, Dublin, Ireland

The authors would like to sincerely thank the reviewer for their extremely insightful comments. We have numbered each comment and responded to each in turn as per below.

Overview

The study assessed the existing evidence on physical functioning limitation and physical activity among homeless adults using the scoping review framework. The findings highlight that people who experience homelessness have a high level of physical functioning impairment and low physical activities, which provides evidence of this population's low health status. It also shows the need for effective community-based and clinical-based interventions to diminish their premature physical functioning decline and poor health and social well-being.

Overall, the paper is well-written and structured. However, I have some suggestions below that might strengthen the paper's quality, the interpretation of the findings and the derived knowledge translation process.

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8. The statement "Improved understanding of physical variables is important..." please specify what physical variable you are referring to. Perhaps, physical functioning and activity?

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11. Please, report the period in which the research for studies was conducted. It will allow the replicability or update of the searching strategy.

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12. Physically focused definitions employed in this review "We employed the definition of functional limitation" do you mean the definition of physical functioning? Please specify.

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Selection of studies

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13. I wondered if you used any strategy or tool to perform the appraisal of the included studies' quality. Please elaborate on this matter.

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14. As you well-know, the scope of a scoping review is not to pool empirical findings using statistical methods as it happens in a systematic and meta-analysis review. Instead, it is more synthesized or summarized the findings. Thus, the statement "Due to the heterogeneity of study design, interventions and outcomes, a narrative synthesis was conducted" is no application for the scoping review.

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15. In the result, you describe female and male as one of the demographic characteristics of the revised studies' participants. In Table 2, you report this characteristic as gender. Gender (e.g. men/women) is more a social and identity construct, while sex (female/male) more a biological characteristic. Considering these differences, please clarify whether all studies measure gender or biological sex or both. If both, please include them as two distinct characteristics. This health to inform any potential gender-based or biological sex-based

differences and similitudes, and gaps in the review' findings.

Response to R2 Comment 15: This refers to biological sex rather than gender and has been changed in the table and text.

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16. Perhaps briefly summarize the definition of homelessness employed in the included studies could give a more comprehensive view of what groups of homeless people were more likely to be studied.

Response to R2 Comment 16: To clarify this information the column 'Living arrangement' in table 1 was changed to 'Definition of homelessness/living arrangement/access to services' changed to 'definition of homelessness'. The following was added to the results section 'A formal operational definition of homeless was included in one study only (4). The living arrangement of participants was outlined in the recruitment strategy and/or eligibility criteria of remaining studies. The majority of studies included participants in shelter accommodation.'

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19. Perhaps the synthesis of the studies' results could be organized under two main headings: Physical functioning and physical activity, as they are the two primary outcomes, you were assessed. Under these two main subheadings, you can summarise the related physical functional sub-outcomes and physical activity sub-outcomes as sub-headings.

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In the results, perhaps before summarising the physical functioning and physical activity related findings, presenting a brief description of the participants' comorbid profile could contribute to having a more comprehensive view of the health status of the study population. As many of those comorbid conditions are directly related to their physical functioning and physical activity status/levels.

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23. Discuss the potential ethno-racial gaps in the studied topic.

Response to R2 Comment 23: 'In the US based studies 59.6% of participants were African American, while a lower proportion were white (29.8%). This reflects the high proportion of African Americans among homeless populations in the US (7). Indigenous people are also over-represented among homeless populations (8) which likely mirrors the proportion of Aboriginal people in a Canadian study (9) included in this review. It is possible that in other studies this group may have been under-represented or not specifically reported. Out of 10 US based studies, one reported the proportion of American Indian participants was 4.8%, and another quoted that 10% of participants were American Indian/Alaska Natives/Native Hawaiian/Pacific Islanders. Most of the rest of the studies included categories of 'other' in

which it was likely native populations were subsumed. Similarly, there may have been an under-representation of Latino people and people of mixed race heritage but absolute proportions of different ethnic groups among homeless populations are likely to be context specific.'

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25. Please state the reason for excluding records. You only included those included in the database searching. Are those figures also include the studies identified by searching grey literature?

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26. There are discrepancies between the numbers of records found reported in Figure 1 and those reported in the result text. Please correct it accordingly.

Response to R2 Comment 26: The discrepancies have been amended.

Competing Interests: Nil

Author Response 19 Feb 2021

Julie Broderick, Trinity College Dublin, the University of Dublin, Dublin, Ireland

Dear Reviewer 2,

Thank you for your very insightful comments, in response to your comments; we have made the following changes to the review.

Each comment is listed, numbered, and responded to in turn.

Kind Regards, Julie Broderick and co-authors

From R2 Overview

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4. Chau S, Chin M, Chang J, Luecha A, Cheng E, Schlesinger J, et al. Cancer risk behaviors and screening rates among homeless adults in Los Angeles County. *Cancer epidemiology, biomarkers & prevention : a publication of the American Association for Cancer Research, cosponsored by the American Society of Preventive Oncology*. 2002;11(5):431-8.
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Competing Interests: Nil

Reviewer Report 01 May 2020

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✓ **Jo Dawes** 

¹ Faculty of Health, Social Care and Education, a joint faculty between Kingston University and St George's, University of London, London, UK

² Collaborative Centre for Inclusion Health, Department of Epidemiology and Public Health, University College London, London, UK

Introduction

The background and rationale for this scoping review was clearly described and explains the importance of it being undertaken. The authors do address the aims of the paper, but are not explicit about the objectives (although objectives are mentioned later under "inclusion/ exclusion criteria", so it would be useful to state these in introduction). The authors have rightly based their review on PCC (Populations, Concept, Context) rather than PICO (Participants, Interventions, Comparators, and Outcomes) as this is not a review of interventions. Their reasoning for this is adequately described.

Methods

Much of the methods are well described. The authors are clear that this is a scoping review and have described using appropriate frameworks and guidance to inform their procedures. The authors are clear about information sources, for example language, databases searched and inclusion of grey literature. They noted that a subject expert was consulted, but did the authors also contact study authors to identify further literature? Although no date restriction was applied in the search, it would be useful to for authors to state the date of the last search. The current information given, it is not sufficiently detailed to be repeatable, for example, the authors could provide more detail of their search strategy, including limits used. Under "Physical focused definitions employed in the review" the authors provide definitions for functional limitation and physical activity. However, they also provide examples of functional limitations, but not physical activity, as physical activity is so broad, to add examples of search words used would add clarity.

The PRISMA diagram is helpful, though it would be more accurate to describe Figure 1 as "PRISMA flow diagram of *selection for review*", as it covers the selection/ inclusion process, not the whole review process. It might be more appropriate to make reference to Fig 1 earlier in "selection of studies" section. There was limited description of "data extraction" (it would be useful to hear more about what the specifically designed data extraction sheet contained). Again, limited information provided about data analysis - more detail on what was involved in the narrative synthesis would give greater transparency for the reader.

Results

It is shown (in Fig 1) and described (in text) how many studies were excluded at each stage, but apart from the removal of duplicates, reasons for exclusions are not described. Also, the number

of studies identified after duplicates removed does not match what is stated in text/Figure 1. (n=2832 in text/ n=2833 in Fig 1). For clarity, it might help to add *title and abstracts of* to the box "Records screened (n=1815)" in Figure 1.

Authors have clearly expressed study characteristics in Table 1. However, it is stated in text they identified 11 quantitative studies and 4 qualitative studies, whereas only 3 studies are explicitly described as qualitative in Table 1. Was it the pilot study by Kendzor *et al.* (2015) which was also qualitative? If so, it would be useful if the authors made this clear. In Table 1, it would also be useful to be clearer about which studies addressed physical function, which addressed physical activity and which addressed both. For example, where Table 4 describes studies using physical activity measures, Gregg and Bedard (2016) and Marmolejo *et al.* (2018) feature, but in Table 1 the physical focused outcomes column does not clearly describe physical activity measures (for Gregg and Bedard (2016) exercise and intention to exercise are stated, but is not a measure of actual physical activity levels and Marmolejo *et al.* (2018) only a flexibility measure is described).

Only minor, but in Table 2, there is slight inconsistency in presentation of data in "gender" column. Sometimes % and numbers, but sometimes only %, is this because numbers were not always provided in studies? If so, you could use "NS", like you have in other parts of that table. Also, there are typos on p 8, para 1, lines 2-3: "many people homeless experiencing homelessness" and p 10, para 2, line 4: in this study is was"- replace "is" with "it".

Due to the authors not formally assessing methodological quality of the studies, they were limited in how well they could acknowledge biases across studies.

Discussion and Conclusion

A clear and succinct summary of the main findings and their implications for understanding the knowledge base, clinical practice and future research. Strengths and limitations of the paper appropriately identified and described.

Are the rationale for, and objectives of, the Systematic Review clearly stated?

Yes

Are sufficient details of the methods and analysis provided to allow replication by others?

Partly

Is the statistical analysis and its interpretation appropriate?

Not applicable

Are the conclusions drawn adequately supported by the results presented in the review?

Yes

Competing Interests: No competing interests were disclosed.

Reviewer Expertise: My area of expertise is physiotherapy education and access to healthcare amongst homeless and excluded populations.

I confirm that I have read this submission and believe that I have an appropriate level of

expertise to confirm that it is of an acceptable scientific standard.

Author Response 26 Jan 2021

Julie Broderick, Trinity College Dublin, the University of Dublin, Dublin, Ireland

The authors would like to sincerely thank the reviewer for their extremely insightful comments. For clarity we numbered each comment and responded to it in turn.

Introduction

R1 Comment 1

The background and rationale for this scoping review was clearly described and explains the importance of it being undertaken. The authors do address the aims of the paper, but are not explicit about the objectives (although objectives are mentioned later under "inclusion/ exclusion criteria", so it would be useful to state these in introduction). The authors have rightly based their review on PCC (Populations, Concept, Context) rather than PICO (Participants, Interventions, Comparators, and Outcomes) as this is not a review of interventions. Their reasoning for this is adequately described.

Response to R1 Comment 1: The following has been added to the introduction section: ' Specific objectives were to evaluate the quantitative and qualitative literature on the following topics (i) physical functioning in adults experiencing homelessness, (ii) physical activity in adults experiencing homelessness, (iii) related secondary outcome measures such as frailty and cardiovascular fitness. In addition a further objective was added (iv) to evaluate measurement methods of physical outcomes in included studies.'

Methods

R1 Comment 2

2. Much of the methods are well described. The authors are clear that this is a scoping review and have described using appropriate frameworks and guidance to inform their procedures. The authors are clear about information sources, for example language, databases searched and inclusion of grey literature. They noted that a subject expert was consulted, but did the authors also contact study authors to identify further literature?

Response to R1 comment 2: Authors did not contact study authors to identify further information. From the Joanna Briggs institute guidance for scoping reviews which we followed, this is not considered a mandatory step and was therefore not conducted as part of this review.

R1 Comment 3

3. Although no date restriction was applied in the search, it would be useful to for authors to state the date of the last search.

Response to R1 Comment 3: The following has been included in the methods section: 'from inception to 16.01.19.'

R1 Comment 4

4. The current information given, it is not sufficiently detailed to be repeatable, for example, the authors could provide more detail of their search strategy, including limits used. Under "Physical focused definitions employed in the review" the authors provide definitions for functional limitation and physical activity. However, they also provide examples of

functional limitations, but not physical activity, as physical activity is so broad, to add examples of search words used would add clarity.

R1 Response to comment 4: Precise details of both searches are included in Supplementary File 2. In relation to this point, the following has been added in the methods section:

'Physical activity was considered any type of physical training or movement including any form of exercise, physical fitness or therapeutic movement. The full search strategy is available in Supplementary File 2.'

R1 Comment 5

5. The PRISMA diagram is helpful, though it would be more accurate to describe Figure 1 as "PRISMA flow diagram of selection for review", as it covers the selection/ inclusion process, not the whole review process.

R1 Response to comment 5: This has now been labelled as suggested.

R1 Comment 6

6. It might be more appropriate to make reference to Fig 1 earlier in "selection of studies" section.

R1 Response to comment 6: Following the scoping review methodology from the Joanna Briggs Institute, Fig. 1 was referenced at the start of the results section.

R1 Comment 7

7. There was limited description of "data extraction" (it would be useful to hear more about what the specifically designed data extraction sheet contained).

R1 Response to comment 7: The following has been added to the methods section: 'The data extraction instrument collected the following data relating to included studies (author, year of publication, country of study origin, inclusion criteria, living arrangements, physical focussed outcomes measured, participant characteristics (number of participants, age, gender, race/ethnicity, percentage with less than high school education, co-morbid conditions), physical focussed variables (physical variable measured, type of measure, total number of studies, authors, results), physical activity/sedentary behaviour focused measures (author, type of measure, measure subscale, main results).'

R1 Comment 8

Again, limited information provided about data analysis - more detail on what was involved in the narrative synthesis would give greater transparency for the reader.

Response to R1 Comment 8: As per point from R2 Comment 19, synthesis of the studies' results was organized under two main headings: Physical functioning and physical activity. As per R1 comment 7 above, details of the data extraction too have also been provided.

Results

R1 Comment 9

9. It is shown (in Fig 1) and described (in text) how many studies were excluded at each stage, but apart from the removal of duplicates, reasons for exclusions are not described.

R1 Response to comment 9: The reason for exclusion was not containing data relevant to physical functioning limitations or physical activity specific to adults who were homeless.

The following has been added to the results section 'After excluding studies which did not containing data relevant to physical functioning limitations or physical activity specific to adults who were homeless, a total of 15 studies were deemed eligible for inclusion in this review.'

R1 Comment 10

10. Also, the number of studies identified after duplicates removed does not match what is stated in text/Figure 1. (n=2832 in text/ n=2833 in Fig 1).

R1 Response to comment 10: The correct value of 2833 is now included in the text.

R1 Comment 11

11. For clarity, it might help to add title and abstracts of to the box "Records screened (n=1815)" in Figure 1.

Response to comment R1 11: This has now been inserted into Figure 1.

R1 Comment 12

12. Authors have clearly expressed study characteristics in Table 1. However, it is stated in text they identified 11 quantitative studies and 4 qualitative studies, whereas only 3 studies are explicitly described as qualitative in Table 1. Was it the pilot study by Kendzor et al. (2015) which was also qualitative? If so, it would be useful if the authors made this clear.

R1 Response to comment 12: Apologies for the lack of clarity around this. Two studies were qualitative (Bazari and Quine) and Table 1 has divided studies into quantitative and qualitative.

R1 Comment 13

13. In Table 1, it would also be useful to be clearer about which studies addressed physical function, which addressed physical activity and which addressed both. For example, where Table 4 describes studies using physical activity measures, Gregg and Bedard (2016) and Marmolejo et al. (2018) feature, but in Table 1 the physical focused outcomes column does not clearly describe physical activity measures (for Gregg and Bedard (2016) exercise and intention to exercise are stated, but is not a measure of actual physical activity levels and Marmolejo et al. (2018) only a flexibility measure is described).

Response to R1 comment 13: To improve clarity, a column 'Physical-functioning measure or Physical activity measure' construct measured has now been added to Table 1. Table 3 now includes Physical Functioning measures included in the review and Table 4 includes Physical Activity measures included in the review.

R1 Comment 14

14. Only minor, but in Table 2, there is slight inconsistency in presentation of data in "gender" column. Sometimes % and numbers, but sometimes only %, is this because numbers were not always provided in studies? If so, you could use "NS", like you have in other parts of that table.

Response to R1 comment 14: NS has been added as suggested.

R1 Comment 15

15. Also, there are typos on p 8, para 1, lines 2-3: "many people homeless experiencing

homelessness” and p 10, para 2, line 4: in this study is was”- replace “is” with “it”. Due to the authors not formally assessing methodological quality of the studies, they were limited in how well they could acknowledge biases across studies.

Response to R1 comment 15: Typos have been amended. This is correct regarding inability to acknowledge biases across studies. Biases were not formally assessed based on Joanna Briggs methodology for scoping studies which was followed in this review.

Discussion and Conclusion

R1 Comment 16

16. A clear and succinct summary of the main findings and their implications for understanding the knowledge base, clinical practice and future research. Strengths and limitations of the paper appropriately identified and described.

Response to comment R1 16: Thank you to Reviewer 1 for these comments.

Competing Interests: Nil

Author Response 19 Feb 2021

Julie Broderick, Trinity College Dublin, the University of Dublin, Dublin, Ireland

Dear Reviewer 1,

Thank you for your very insightful comments, in response to your comments; we have made the following changes to the review.

Each comment is listed, numbered, and responded to in turn.

Kind Regards, Julie Broderick and co-authors

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