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REVIEW ARTICLE

Correlates of Physical Activity Among Disadvantaged Groups: A Systematic Review

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Context: Socioeconomically disadvantaged adults have lower engagement in leisure-time physical activity than those who are more affluent. Identification of correlates of physical activity can inform the design of effective interventions. The aim of this systematic review was to identify consistent correlates of unspecified physical activity and leisure-time physical activity among socioeconomically disadvantaged adults.

Evidence acquisition: PubMed and Scopus were searched up to May 2018, and titles/abstracts and full texts were screened against eligibility criteria. Methodologic quality was assessed, and correlates were synthesized from July to September 2018.

Evidence synthesis: Seventy-three studies were selected for synthesis; 48 examined unspecified physical activity and 31 examined leisure-time physical activity (6 examined both). Self-rated health, functional capacity, and physical activity self-efficacy were consistently, positively associated with unspecified physical activity. Mental health status and perceived benefits and enjoyment of physical activity were consistently, positively associated with leisure-time physical activity. Most studies were cross-sectional and used validated self-report measures of physical activity; few reported response rates >50%.

Conclusions: Few factors were consistently associated with either unspecified physical activity or leisure-time physical activity. Based on available evidence, strategies to increase physical activity should consider the needs of, and focus on, those with poor self-rated health and functional capacity and should use strategies to improve physical activity self-efficacy. Strategies to increase leisure-time physical activity should focus on simultaneously addressing leisure-time physical activity and mental health concerns and improving perceptions of physical activity benefits and enjoyment. It is recommended that future studies focus on leisure-time physical activity, focus on men, use longitudinal design, examine variables related to behavioral attributes and skills, and carefully consider and plan recruitment strategies.

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CONTEXT

Regular physical activity (PA) has a range of health benefits.[1] It is a protective factor for the prevention and treatment of leading chronic diseases, including heart disease, stroke, diabetes, and breast and colon cancer. PA is also associated with delay in the onset of dementia and improved mental health, quality of life, sleep, and well-being.[2–7] However, more than 40% of adults from developed countries do not

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meet recommended levels of PA.[8] Consequently, physical inactivity has been described as one of the leading public health problems of the 21st century in developed countries.[9,10]

Adults from socioeconomically disadvantaged groups report less participation in leisure-time PA (LTPA)[11–13] and experience higher rates of chronic disease[14,15] than those who are more affluent. These associations are consistent across area-level and individual (e.g., income and education) indicators of socioeconomic disadvantage.[13] Improving LTPA among socioeconomically disadvantaged groups will improve health outcomes and reduce health inequities and therefore has been identified as a public health priority.[14,16]

Compared with LTPA, evidence about differences across social strata is less consistent for PA in other domains, such as transportation, and unspecified PA (where PA across a range of domains is assessed). People from socioeconomically disadvantaged groups tend to engage in higher levels of occupational PA, thus adding to their overall PA, but evidence is mixed with respect to differences in transportation-related PA.[13] It is likely that, in the future, differences in engagement in unspecified PA across social strata will mirror those of LTPA owing to decreasing levels of occupational PA and increased access to motorized transport.[17]

Evidence of the effectiveness of interventions to improve PA among socioeconomically disadvantaged adults is inconclusive, and intervention studies are characterized by low participation and high attrition rates.[18] This suggests that current approaches to improving PA may not be appropriate for socioeconomically disadvantaged adults.[18] According to the behavioral epidemiology framework, to develop effective interventions, researchers must first identify factors that are associated with the target behavior.[19] Identification of consistent correlates of PA in socioeconomically disadvantaged groups will inform the targeting and design of interventions.[20]

Several systematic reviews have examined differences in PA participation according to socioeconomic position[11–13] and correlates of PA among adults.[21,22] However, to the authors' knowledge, no reviews have examined the correlates of either unspecified PA or LTPA in socioeconomically disadvantaged groups. It is important to review the correlates of different domains of PA (e.g., LTPA) in specific target population groups because the factors influencing PA vary according to the studied PA domain[20,21,23] and by population group.[21] Examination of the correlates of LTPA is important because LTPA is modifiable and amenable to change with intervention[20] and is associated with mental health benefits.[24] Examination of the correlates of PA across several domains, or unspecified PA, is also important because PA can provide health benefits if undertaken regularly and of sufficient duration and intensity.[25]

The aims of this systematic review are to examine the correlates of (1) unspecified PA (for ease of reading, this is referred to as PA in this review) and (2) LTPA among adults from socioeconomically disadvantaged groups. The findings of this review will be used to (1) assist in the identification of priority groups for intervention, (2) develop recommendations for the targeting of constructs within interventions, and (3) provide recommendations for future research.

EVIDENCE ACQUISITION

PubMed and Scopus were searched up to May 2018 with no date limitation (Appendix Text 1, available online). Groups of thesaurus terms and free terms were searched for PA (*physical* activ*, walk*, exercise, lifestyle, life style, health behavio**), correlates (*correlate, determinant, mediator, moderator, predictor, relationships, associations, barriers, facilitators*), and socioeconomic disadvantage (*low SES, low* socio*, low* income, disadvantaged, deprived, underserved, low* educat**). Reference lists of all included papers were manually checked to identify additional relevant articles.

To be included in this review, studies had to meet the following criteria:

1. Studies included populations in developed countries (the authors excluded studies from countries on the *List of Developing Countries* as declared by the Australian Government Department of Foreign Affairs and Trade[26]);
2. included adults (aged ≥18 years), or average age ≥18 years;
3. had a study population or subsample defined as "socioeconomically disadvantaged";
4. had a nonclinical population (populations were excluded that were characterized by chronic disease, pregnant women, or other special conditions);
5. were observational studies (cross-sectional or longitudinal);
6. were quantitative studies that included a *p*-value to indicate a significant association;
7. were written in English; and
8. examined PA or LTPA.

In this review, LTPA was defined as recreational PA, including a range of activities conducted specifically for enjoyment, social, competitive, or fitness purposes, performed in leisure or discretionary time.[27] An outcome was defined as LTPA if (1) it was identified as LTPA in the methods with words such as "in free time"

or "during leisure time" or (2) the measure that was used assessed PA during free time or spare time. Studies were excluded when specific types of LTPA, such as recreational walking, were assessed. In terms of PA, studies were included if they measured overall participation in PA or participation in PA across several domains.

There is no universally accepted definition of "socioeconomic disadvantage," and the cut points that define socioeconomic disadvantage differ between studies.[28] Given these differences, the study authors' definition of socioeconomic disadvantage was accepted. That is, if a study described a population group as socioeconomically disadvantaged or used words such as "underserved" or "low education," it was included in this review.

Titles and abstracts of the identified articles were reviewed by 3 authors (GW, TAH, MC). Three authors (GW, TAH, MB) independently reviewed the full text of all potentially relevant articles. Disagreements between reviewers were resolved by consensus approach with a fourth reviewer (AP).

Data extraction was conducted by 2 researchers (GW, MB), with all data checked by other researchers (MC, TAH, MP, AP). Where studies reported multiple population groups or types of PA, extracted data were based on, and limited to, the aforementioned key inclusion criteria.

The correlate coding frameworks of previous correlates reviews were adopted in this review and, as such, variables are not included in the summary tables unless 3 or more comparisons were available.[29] Following the methods of Sallis et al.,[29] even if multivariate tests were conducted, univariate tests were reported for consistency across studies. Variables that were similar conceptually were combined when there were not enough studies to examine the variables individually. For example, a "perceived benefits and enjoyment of PA" variable was created that included variables such as having fun and feeling healthy. For studies that examined multiple benefits separately, multiple associations were recorded and summarized under the general "perceived benefits and enjoyment of PA" category. Consistent with previous reviews of correlates of PA in adults and a socioecological approach,[23] correlates were classified into 5 categories: demographic and biological, psychological/cognitive/emotional, behavioral attributes and skills, social and cultural factors, and physical environment.[30,31] For both PA and LTPA, fewer than 3 studies examined variables categorized as behavioral attributes and skills; therefore, this heading was not included in the summary table.

If more than 1 type of PA was reported (i.e., meeting guidelines and PA in minutes), the correlations of the continuous measure of PA were reported. If correlates were reported separately by gender, they were reported separately with (W) or (M) in parentheses. If correlates were reported cross-sectionally and longitudinally in either the same paper[32,33] or separate papers based on the same data set,[34,35] both were reported, with longitudinal results reported with (L) in parentheses to differentiate them from cross-sectional results. When studies based on the same sample examined the same correlates, only the most recent data were reported. If studies reported a subset of the same data set,[32,36] results were reported separately. Studies that used device-based measures of PA were denoted using an asterisk. Data extraction and synthesis occurred from July to September 2018.

As only observational studies were included in this study, methods for quality assessment were limited. Similar to other correlates reviews, 3 markers of quality were assessed[37]: (1) response rate (not reported, response rate <50%, or response rate ≥50% reported);[13] (2) whether the study was cross-sectional or longitudinal; and (3) the measure of PA as either self-report with reliability and validity not reported, a modified version of a validated scale but modification was not validated, self-report with demonstrated validity and reliability (including validated subscales), or acceptable device-based measure. The same assessment of LTPA measurement was used; however, device-based PA measures were not included because LTPA is a subset of PA, and device-based assessment is not appropriate.

EVIDENCE SYNTHESIS

In total, 1,558 titles and abstracts were screened; 1,435 were removed by title or abstract, and 123 full texts were reviewed, 73 of which were selected for synthesis (Figure 1).

Most eligible studies included analyses of PA (n=48), and 31 included analyses of LTPA. Six articles included analyses of both PA and LTPA. Study characteristics, quality assessment, and findings of these analyses are presented separately (noting that some articles appear in both).

Characteristics of PA studies are in Appendix Table 1, available online. Most studies were based in the U.S. (32/48, 66.7%) and used self-report measures to assess PA (38/48, 79.2%). Most studies used an area-level measure of disadvantage (37/48, 77.1%); of these, most (n=28) included participants from socioeconomically disadvantaged, low-income, or deprived neighborhoods. Few studies used individual-level measures of disadvantage (11/48, 22.9%); of these, most (n=6) used individual or household income as a measure of individual disadvantage. Five

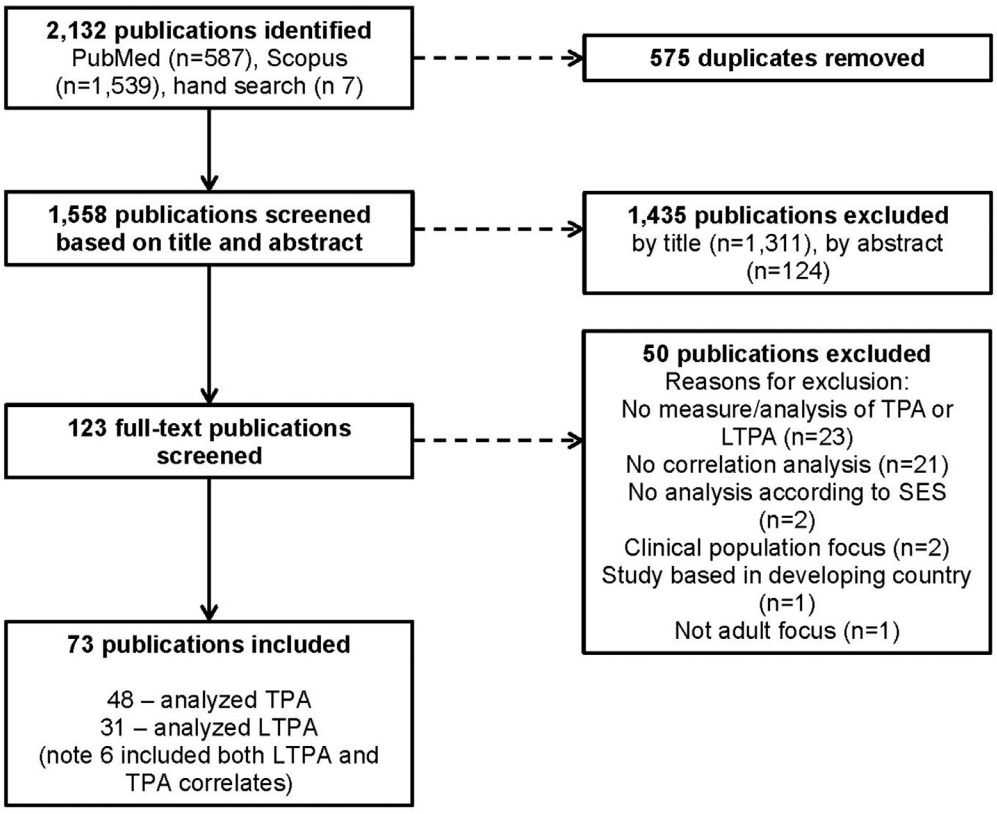

Figure 1. PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-Analyses) flowchart.

studies focused on older adults,[38–42] and 9 focused on women only.[35,43–49]

Table 1 shows quality assessment for PA; 27.1% (13/48) reported a response rate >50%, 2.1% (1/48) had a longitudinal design, 64.6% (31/48) used self-report measures of PA with demonstrated validity and reliability, and 21% (10/48) used an acceptable device-based measure. Table 2 shows the correlates summary for PA.

Of the 13 examined demographic and biological variables, evidence for consistent positive associations was found only for functional capacity, with some evidence supporting associations with employment status (those who were employed had higher levels of PA). Inconsistent associations were found with gender (women), age, tenancy (e.g., renting or home ownership), BMI, and comorbidities. Worth noting is that all 3 studies that examined age using device-based measures showed significant negative associations, and 2 of 3 studies that examined gender using a device-based measure showed a significant negative association (that is, women had lower levels of participation). There were mostly nonsignificant associations with ethnicity, education, income, marital status, living status, and vehicle/car access/ownership.

Of the 6 examined psychological, cognitive, and emotional factors, evidence for consistent positive associations were found with self-efficacy and self-rated health. There was also some evidence of a positive association with perceived benefits and enjoyment of PA. There were inconsistent associations with perceived intrapersonal barriers and mostly nonsignificant associations with mental health and perceived barriers (general).

Of the 7 examined social and cultural factors, none were found to have a consistent association with PA. There were inconsistent associations with density or number of social ties and social support for PA from friends, and mostly nonsignificant associations with social support in general, social support for PA (unspecified), social norms for PA, perceived interpersonal barriers, and perceived community harmony/cohesion.

Nineteen physical environmental factors were examined, and none had consistent associations with PA. Some evidence, however, supported positive associations with neighborhood aesthetics.

Inconsistent associations were found with objective number of resources and facilities. Mostly nonsignificant associations were found with perceived access to PA opportunities, objective assessment of quality of PA opportunities, and perceived environmental barriers.

Table 1. Quality Assessment of PA and LTPA Studies

Author (year)	Response rate[a]	Study design[b]	Measure of PA
Unspecified PA[c]			
Alakaam et al. (2015)[89]	0	0	0
Allen et al. (2014)[90]	0.5	0	1
Brown et al. (2014)[91]	0.5	0	2
Brownson et al. (2001)[92]	0	0	1
Child et al. (2017)[93]	0	0	1
Chudyk et al. (2017)[41]	0.5	0	2
Clark et al. (1999)[38]	1	0	0
Cochrane et al. (2009)[94]	0.5	0	1
Coulon et al. (2013)[95]	0	0	2
Dlugonski et al. (2017)[43]	0	0	1
Dogra et al. (2015)[39]	0	0	1
Fahrenwald et al. (2006)[44]	0	0	1
Florez et al. (2018)[96]	0	0	2
Geboers et al. (2014)[42]	0.5	0	1
Ghaddar et al. (2010)[97]	0	0	1
Jilcott et al. (2007)[45]	0	0	2
Jones et al. (2009)[98]	0.5	0	0
Kaiser et al. (2010)[99]	0	0	1
Lee et al. (2007)[47]	1	0	0
Lee et al. (2011)[100]	0	0	1
Lewis et al. (1993)[101]	1	0	1
Maglione et al. (2009)[102]	0.5	0	1
Mansfield et al. (2012)[48]	0	0	1
Marlier et al. (2015)[103]	1	0	1
Ogilvie et al. (2008)[104]	0.5	0	1
Osuji et al. (2006)[49]	1	0	1
Pan et al. (2009)[105]	1	0	1
Park et al. (2013)[106]	1	0	1
Parker et al. (2016)[107]	0	0	1
Parks et al. (2003)[108]	0	0	1
Richardson et al. (2017)[109]	1	0	2
Roman et al. (2009)[110]	1	0	0
Sallis et al. (2009)[84]	0.5	0	2
Sawyer et al. (2017)[111]	1	0	0
Shaw et al. (2008)[112]	0	1	0
Shuval et al. (2015)[83]	0	0	1
Siceloff et al. (2014)[113]	0	0	2
Tamers et al. (2013)[114]	0.5	0	1
Tamers et al. (2014)[115]	0.5	0	1
Teychenne et al. (2010)[35]	0.5	0	1
Van Dyck et al. (2010)[116]	1	0	2
Van Holle et al. (2014)[40]	0.5	0	2
Watts et al. (2013)[117]	1	0	1
Wilbur et al. (2003a)[46]	0	0	1
Wibur et al. (2003b)[118]	0	0	1
Wilson et al. (2004)[119]	1	0	1
Yu et al. (2011)[120]	0.5	0	1
Zoellner et al. (2012)[82]	0	0	1

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Table 1. Quality Assessment of PA and LTPA Studies (*continued*)

Author (year)	Response rate[a]	Study design[b]	Measure of PA
LTPA[d]			
Alverson et al. (2012)[121]	1	0	0
Andersen et al. (2015)[122]	1	0	0
Ball et al. (2010)[50]	0.5	0	1
Blank et al. (2007)[123]	0	1	0.5
Bylina et al. (2006)[124]	1	0	0.5
Casper et al. (2013)[125]	1	0	1
Cleland et al. (2008)[56]	0.5	0	1
Cleland et al. (2010)[20]	0.5	0	1
Cleland et al. (2013)[51]	0.5	0	1
Diez Roux et al. (2007)[126]	0	0	0.5
Ellis et al. (2007)[127]	0	0	0.5
Fox et al. (2012)[128]	0	0	0.5
Heinrich et al. (2007)[129]	0.5	0	1
MacFarlane et al. (2009)[36]	0.5	0	1
Mäkinen et al. (2010)[130]	1	0	1
Mansfield et al. (2012)[48]	0	0	1
Marlier et al. (2015)[103]	1	0	1
Middelweerd et al. (2017)[32]	0.5	1	1
Perez et al. (2017)[55]	0	0	1
Plow et al. (2011)[53]	0.5	0	1
Santos et al. (2016)[33]	0.5	1	1
Shuval et al. (2015)[83]	0	0	1
Siceloff et al. (2014)[113]	0	0	1
Teychenne et al. (2010)[35]	0.5	0	1
Teychenne et al. (2017)[34]	0.5	1	1
Timperio et al. (2015)[52]	0.5	0	1
Tucker-Seeley et al. (2009)[54]	1	0	0
Van Holle et al. (2014)[40]	0.5	0	1
Weiss et al. (2007)[131]	0.5	1	1
Wolin et al. (2006)[132]	0.5	0	1
Yu et al. (2011)[133]	1	0	1

[a]0=not reported, 0.5=<50%, 1= ≥ 50%.
[b]0=cross-sectional, 1=longitudinal.
[c]For measure of physical activity, 0=self-report, reliability and validity not reported, 0.5=modified version of validated scale, modification not validated, 1=self-report, with demonstrated validity and reliability; 2=acceptable device-based measure.
[d]For measure of physical activity, 0=self-report with reliability and validity not reported, 0.5=modified version of validated scale but modification not validated, 1=self-report, with demonstrated validity and reliability reported.
LTPA, leisure-time physical activity; PA, physical activity.

Nonsignificant associations were found with perceived access to parks and greenspaces, objective number of parks/greenspaces, and objective distance to parks/greenspaces as well.

There was some evidence of a positive association with neighborhood aesthetics. Inconsistent associations were found with objective walkability, and mostly nonsignificant associations were found with objective land use mix, perceived walkability, perceived and objective distance to destinations, and road attributes and conditions.

Inconsistent associations were found with perceived safety, and mostly nonsignificant associations were found with perceived road safety, fear of crime, objective crime rate, and perceived social and physical disorder.

Characteristics of included studies for LTPA are shown in Appendix Table 2, available online. Most studies were based in the U.S. (13/31, 42%). Nine of the 10 studies from Australia[20,32–36,50–52] were derived from the Resilience for Eating and Activity Despite Inequality study. Most studies used an area-level measure of disadvantage (25/31, 80.6%); of these, most (*n*=21) recruited participants from socioeconomically disadvantaged, low-income, or deprived communities. Of the studies that used individual-level measures (6/31, 19%), most (*n*=3) used

Table 2. Summary of Correlates of Unspecified PA Among Socioeconomically Disadvantaged Populations

Variable	Negative/inverse	Positive	Not significant	Association
Demographic/biological				
Age (older)	38, 41*, 48(W), 90, 101, 107(M,W), 109*, 111, 112(L), 113, 117	94	39, 43(W), 97, 99, 102, 118(W), 119, 120	??
Gender (women)	38, 89, 97, 101, 109*, 113*, 117	94, 111	39, 41*, 90, 99, 103, 120	??
Ethnicity (white)	—	117	38, 89, 90, 99, 103, 120	00
Education (higher)	103, 109*	39, 90, 114, 120	38, 46(W), 89, 97, 118 (W), 119	00
Income (higher)	—	39, 89	38, 46(W), 97, 109*, 118(W)	00
Employment status (employed)	—	48(W), 111, 112(L)	46(W), 118(W)	+
Marital status (married)	—	46(W), 120	39, 41*, 89, 90, 103, 118(W)	00
Tenancy (owner)	104	111	103	?
Living status (alone)	—	38	41*, 109*	0
Vehicle/car access, ownership	—	111	41*, 109*	0
BMI or weight (higher)	41*, 104, 113*	—	39, 43(W), 97, 110, 119	??
Comorbidities	41*, 112(L)	—	38, 39, 95*	?
Functional exercise capacity	—	39, 41*, 104, 109*, 112(L)	38	++
Psychological, cognitive, and emotional				
Self-efficacy	—	38, 41*, 46(W), 94, 102, 105	118(W)	++
Mental health[a]	—	112(L), 117	35(W), 43(W), 90, 103	00
Perceived benefits and enjoyment of PA	—	41*, 105	38	+
Perceived barriers (general)	108	—	43(W), 105	0
Perceived intrapersonal barriers	38, 49(W)	—	92, 108	?
Self-rated health status	—	38, 92, 97, 105, 110	43(W), 46(W), 118(W)	++
Social and cultural				
Density or number of social ties[b]	96(W)*	90, 111, 117, 120	93,96(M)*	??
Social support (general)	111	—	90, 120	0
Social support for PA	—	102	96(M,W)*, 105	0
Social support for PA — friends	—	95*, 108	92, 113*	?
Social norms for PA	—	46(W)	92, 118(W)	0
Perceived interpersonal barriers	49(W)	—	46(W), 108, 118(W)	0
Perceived community harmony/ cohesion[c]	—	103	41*, 46(W), 110, 111, 118(W)	00
Physical environment				
PA facilities and opportunities (home, neighborhood)				
Perceived access to PA opportunities[d]	—	108	45(W)*, 46(W), 92, 105, 118(W). 119	00
Objective quality of PA resources[e]	—	107(M)	107(W), 111	0
Perceived environmental/structural barriers	38	—	49(W) , 92, 108	0
Objective number of PA resources[f]	—	47(W), 107(M)	45(W)*, 107(W) 117	?
Parks, open space, green space				
Perception of park/open space accessibility/distance	—	98	45(W)*, 92	0
Objective distance to parks/open space	117	—	45(W), 98	0
Objective number of parks or amount of open space	—	106	109*, 117	0

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Table 2. Summary of Correlates of Unspecified PA Among Socioeconomically Disadvantaged Populations (*continued*)

Variable	Negative/inverse	Positive	Not significant	Association
Scenery, aesthetics, neighborhood features (including indicators of walkability/pedestrian)				
Objective "land use mix," land use diversity	107(M)	—	07(W), 117	0
Neighborhood aesthetics[g]	—	41*, 92	111	+
Objective walkability[h]	—	40, 84-, 107(M), 116*	41*, 100, 107(W), 109*, 117	??
Perceived walkability[i]	—	113*, 119	46(W), 82, 92, 118(W)	00
Perceived distance and access to destinations	—	94	45(W)*, 46(W), 92, 113, 118(W), 119	00
Objective distance to destinations	94	—	45(W)*, 117	0
Road attributes and conditions	107(M)	—	100, 107(W), 117	0
Crime and safety				
Perceived road/pedestrian safety	—	104	41*, 46(W), 82, 92, 118(W)	00
Perceived personal safety	—	91*, 111, 117	46(W), 82, 118(W)	?
Fear of crime,[j] perceived crime, violence	—	—	41*, 92, 110, 113*	00
Perceived or objective social or physical disorder	111	—	41*, 110, 113*	0
Objective crime rate	—	—	107(M,W), 109*, 117	00

Note: The asterisk symbol denotes association with objectively measured physical activity, (W) denotes association in women, (M) denotes association in men, and (L) denotes longitudinal correlates. In the Association column, the overall finding was reported as follows: 0 (no association), 0% to 33% reported significant findings in a consistent direction; ? (inconsistent association), 34% to 59% reported significant findings in a consistent direction; + (positive association) or − (negative association): 60% to 100% of studies reported significant positive or negative associations. When 4 or more studies supported a consistent association or no association, it was coded as ++, −, or 00. If a variable was studied frequently with a lack of consistency in findings, it was coded as ??.

[a]Includes depressive symptoms, mental well-being, perceived stress.

[b]Includes social networks, social interactions, frequency of meeting friends, frequency of talking to neighbors, social isolation (reversed).

[c]Includes perceived social cohesion and trust, perceived community cohesion and informal social control, sense of community, social capital.

[d]Includes PA facilities, facility availability, places to be physically active, perceived distance to PA facilities, perceived number of gyms in neighborhood.

[e]Includes objective aesthetics/maintenance of open space.

[f]Includes density of gyms, number of gyms in neighborhood, distance to closest PA facility, distance to closest gym.

[g]With little consistency or consensus in definitions and measurement, the definitions and measurement of neighborhood aesthetics provided by the primary studies were followed.

[h]Includes pedestrian environment, pedestrian infrastructure, objective street connectivity.

[i]Includes perceived infrastructure for walking, perceived access/distance to walking trails.

[j]Includes perceived crime, violence.

PA, physical activity.

education as an indicator of individual disadvantage. Three studies focused on older adults,[40,53,54] and 11 focused on women only.[20,32–36,50–52,55,56]

Table 1 shows quality assessment for LTPA; 25.8% (8/31) reported a response rate >50%, 16.1% (5/31) had a longitudinal design, and 74.2% (23/31) used a self-report measure with demonstrated validity and reliability. Table 3 shows the correlates summary for LTPA.

Of the 11 examined demographic/biological factors, no consistent associations with LTPA were identified. There was some evidence of negative associations with number of children and comorbidities. There were inconsistent associations for age, gender, education, employment status, and BMI, and mostly nonsignificant associations for marital status, ethnicity, income, and being foreign born.

Of the 5 examined psychological, cognitive, and emotional factors, consistent evidence of positive associations was found for perceived benefits and enjoyment of PA and mental health. There was some evidence of positive association with PA self-efficacy. Perceived intrapersonal barriers and self-rated health showed inconsistent associations.

Of the 5 examined social and cultural factors, no consistent associations with LTPA were identified. There was some evidence of a positive association with social support for PA from friends and a negative association with interpersonal barriers. Mostly nonsignificant associations were found for social

Table 3. Summary of Correlates of LTPA Among Socioeconomically Disadvantaged Populations

Variable	Negative/inverse	Positive	Not significant	Association
Demographic and biological				
Age (older)	103, 122, 127, 131(L), 133	—	33(W,L-W), 53, 121, 126, 128	??
Gender (women)	103, 122, 128, 131(L), 133	127	53, 126, 129	??
Ethnicity (white)	127	—	53, 103, 126, 128	00
Education (higher)	—	33(W), 127, 131(L), 133	33(L-W), 53, 103, 122, 128	??
Income (higher)	—	33(W), 133	33(L-W), 121, 126, 131(L)	0
Employment status (employed)	122, 133	33(W,L-W), 127	48(W)	?
Marital status (married)	133	122	33(W,L-W),103	0
Number of children	33(W-L-W), 127	—	—	
Foreign born	132	—	33(W,L-W), 128	0
BMI or weight (higher)	51(W), 122, 131(L)	121	53, 113, 128	?
Comorbidities	51(W), 127	121	—	—
Psychological, cognitive, and emotional				
Self-efficacy	—	32(W), 56(W), 131(L)	32(L-W)	+
Mental health[a]	—	34(L-W), 35, 103, 123(L),127	53, 121	++
Perceived benefits and enjoyment of PA[b]	—	32(W), 33(W,L-W), 56(W), 124	32(L-W), 122	++
Perceived barriers (general)[c]	56(W), 128	124	53	?
Self-rated health status	—	127, 131(L)	53, 121, 123(L)	?
Social and cultural				
Social support for PA — unspecified	—	122	113 , 131(L)	0
Social support for PA — friends	—	32(W), 56(W)	32(L-W)	+
Social support for PA — family	—	32(W)	32(L-W), 56(W)	0
Perceived interpersonal barriers	33(W), 125	—	33(L–W)	–
Perceived community harmony/cohesion[d]	—	52(W)	103, 122	0
Physical environment				
Scenery, aesthetics, neighborhood features (including indicators of walkability/ pedestrian)				
Neighborhood aesthetics[e]	—	20(W), 55(W)	56(W)	+
Perceived walkability[f]	—	33(W)	33(L-W), 55(W), 113	0
Crime and safety				
Perceived safety	—	54, 122, 133	33(W, L-W), 55(W)	?
Perceived crime[g]	52(W)	126	113	?

Note: (W) denotes association in women, (L) denotes longitudinal correlates. In the Association column, the overall finding was reported as follows: 0 (no association), 0% to 33% of studies reported significant findings in a consistent direction; ? (inconsistent association), 34% to 59% of studies reported significant findings in a consistent direction; + (positive association) or — (negative association), 60% to 100% of studies reported significant positive or negative associations. When 4 or more studies supported a consistent association or no association, it was coded as ++, — or 00. If a variable was studied frequently with a lack of consistency in findings it was coded as ??.

[a]Includes depressive symptoms, mental well-being, perceived stress.

[b]Includes health benefits, outcome expectations; enjoying PA, intrinsic motivation.

[c]Includes pain, difficulty hearing, difficulty seeing.

[d]Includes perceived social cohesion and trust, perceived community cohesion and informal social control, sense of community, social capital.

[e]With little consistency or consensus in definitions and measurement, the definitions and measurement of neighborhood aesthetics provided by the primary studies were followed.

[f]Includes perceived infrastructure for walking; perceived access to walking trails.

[g]Includes fear from crime, perceived violence.

LTPA, leisure-time physical activity; PA, physical activity.

support for PA (unspecified), social support from family, and perceived community harmony and cohesion.

Of the 4 examined physical environmental factors, no consistent associations with LTPA were identified. There was some evidence of a consistent association with neighborhood aesthetics. There were inconsistent findings for associations with perceived safety and perceived crime and mostly nonsignificant associations for perceived walkability.

DISCUSSION

This review examined evidence relating to correlates of PA and LTPA among socioeconomically disadvantaged population groups. Overall, few factors were consistently associated with participation in either PA or LTPA. One explanation for the lack of consistent associations was that the included studies selected participants based on their low SES. Therefore, it was less likely that factors that are associated with engagement in PA when the general population is studied, such as level of education,[13] would be identified in this review.

Functional capacity was the only demographic/biological factor that showed consistent associations with PA, and none showed consistent associations with LTPA, although it is worth noting that comorbidities showed some evidence of a negative association with LTPA. Associations between functional capacity and PA have been found in other studies,[57] and findings of this review suggest that people with low functional capacity should be targeted, or provided with additional support, to engage in PA. In addition, PA promotion through healthcare settings could be an important intervention to facilitate engagement in PA in this group because evidence suggests that PA counseling in healthcare settings is effective in improving PA engagement in socioeconomically disadvantaged populations.[58]

There was some evidence to support an association between employment status and PA, that those who are in the workforce engage in more PA than those not in the workforce. For studies that included women only, this association was not significant in 2 of 3 studies. People from socioeconomically disadvantaged groups tend to engage in higher levels of occupational PA,[13] and occupational PA contributes to PA.[59] Therefore, those not in the workforce or transitioning out of the workforce need to be considered, as this group is more at risk of physical inactivity.

There was also some evidence that the number of children was negatively associated with LTPA, with this association reported in studies of women. Evidence shows that parents with dependent children are less physically active than nonparents[60,61] and have less time because of caring responsibilities.[62] Barriers to engagement in LTPA for socioeconomically disadvantaged parents, particularly women, need to be addressed through strategies such as provision of child care, family-based PA opportunities, and coordinating child and parent PA opportunities.

Self-efficacy consistently and positively associated with engagement in PA, and there was also some evidence of an association with LTPA. This is consistent with systematic review evidence showing that self-efficacy is associated with engagement in PA across a range of population groups.[22,63] According to Bandura's social cognitive theory,[64] to improve perceived efficacy, interventions should incorporate strategies such as goal setting and monitoring, role models or peer leadership, praise and encouragement, and cultivation of positive moods or emotions. A review that examined behavior change techniques used in PA interventions concluded that "action planning," "instruction," and "reinforcing effort toward behavior" were associated with significantly higher levels of both self-efficacy and PA.[65] These strategies should be incorporated into interventions and campaigns to engage people in PA. For example, a focus on communicating PA options and providing information on opportunities for engagement in PA in the local community might improve individuals' self-efficacy to engage in PA.

Similar to studies of the general adult population,[66] perceived benefits and enjoyment was consistently associated with LTPA, and there was some evidence to support an association with PA. In communicating the benefits of PA, it is important that interventions and public health campaigns focus on the benefits that are personally meaningful to socioeconomically disadvantaged populations, which may require research and testing of messaging during intervention and campaign development using a participatory action approach.[67] It is also imperative that researchers focus on devising and testing strategies to make PA more pleasant and enjoyable.[68] It is notable that the role of positive affect in PA engagement is gaining increasing research attention because of its importance on the uptake and maintenance of PA.[68]

There were consistent, positive associations between LTPA and mental health but mostly nonsignificant associations between PA and mental health. This suggests that engagement in PA through domains such as work, in which socioeconomically disadvantaged populations are more likely to engage,[13] may not provide the same mental health benefits as LTPA. Studies in nonclinical populations show an inverse relationship between LTPA and subsequent depressive symptoms.[69] Research considering other directions of influence has shown a bidirectional association between PA and depressive symptoms[70] and, similar to longitudinal studies in the current review, that depressive symptoms are associated with subsequent levels of LTPA.[71] Given that socioeconomically disadvantaged populations experience higher levels of mental health concerns,[72] it seems advantageous that interventions simultaneously address LTPA and mental health.

Self-rated health was consistently associated with PA but inconsistently associated with LTPA. Studies of the general adult population have found significant

associations between self-rated health and both PA and LTPA.[73–75] It is well established that PA has positive effects on health outcomes[1]; however, it is also possible that poorer health has a negative influence on engagement in PA. Given that people who are socioeconomically disadvantaged are more likely to report lower self-rated health,[76] it is suggested that those with poor health status should be a priority focus of interventions and provided with intensive support to facilitate their engagement in PA.

None of the social/cultural factors showed consistent associations with either PA or LTPA. There was some evidence that social support for PA from friends was positively associated, and interpersonal barriers were negatively associated, with LTPA. Previous studies of the general population show the importance of social support in encouraging LTPA.[77] A recent umbrella review, which examined PA interventions in socioeconomically disadvantaged groups, found strong evidence for the effectiveness of group-based interventions.[18] It is therefore recommended that interventions incorporate friend support, peer leadership, and group components; address interpersonal barriers such as family commitments; and promote LTPA as an opportunity for social interaction.

Although 19 environmental factors were examined in 3 or more studies of PA, none showed consistent associations, and only neighborhood aesthetics showed some evidence of an association with PA. Similarly, for LTPA, none showed consistent associations, and only neighborhood aesthetics showed some evidence of an association. Findings provide support for strategies that improve perceptions of the attractiveness of neighborhoods such as enhancing natural and built environment features, ornate or decorative architecture, and public art.[22] Such microscale factors represent an attractive focus for intervention because they can be modified at lower cost and in a shorter time frame than reconfiguring the macroscale design.[78,79]

Given that many studies examined environmental factors but few found significant associations, the findings of this review support recommendations that changing the physical environment may not be enough to influence PA levels in disadvantaged communities.[80] Consequently, it is recommended that interventions include individual or socially focused strategies to support environmental regeneration, for example, combining changes to the built environment with informational outreach[81] and social marketing campaigns.[82]

The following recommendations are made for studies that examine correlates of PA in socioeconomically disadvantaged groups. First, focus on LTPA, which is modifiable and associated with mental health benefits. A greater number of studies examined correlates of PA (n=48) compared with LTPA (n=31), and 9 studies examining LTPA were from the same data set. Second, focus on men or seek a balance of men and women respondents. Women-only samples were included in 11 studies on LTPA and 9 studies on PA, and all but 3 studies including both men and women[39,83,84] had >50% women respondents. Third, more longitudinal studies are needed to better understand the directionality and stability of associations. In the absence of longitudinal data, effects of associations may be overstated.[85] Fourth, inclusion of variables related to behavioral attributes and skills is needed. Few studies included these variables, despite intervention studies showing the effectiveness of action planning, goal setting, and monitoring in increasing PA.[65,86] Finally, careful consideration and planning of recruitment strategies is needed to increase response rates. Increasing response rates in disadvantaged groups is likely to be time and resource intensive.[87] There is some evidence that community partner involvement, translated material, and media involvement may improve response rates.[87,88]

Limitations

Summarizing evidence from studies that focus on socioeconomically disadvantaged groups has limitations because of the different definitions and categorizations of disadvantage. Cut points that define socioeconomic disadvantage differed between studies, and some studies used individual indicators, whereas others use area-level measures (Appendix Tables 1 and 2, available online). Variations in the definitions and categorization of socioeconomic disadvantage might influence study findings and limit comparability across studies.

Most studies were cross-sectional; however, they nevertheless provide evidence about the potential mediators of PA that can be targeted in interventions and moderators to prioritize specific groups. The review included studies that focused on samples with varying characteristics; for example, some focused on older adults or women. Consequently, some of the inconsistent findings in this review might be related to the variation in study sample characteristics, particularly those related to age and stage of life. Finally, a challenge in the interpretation of findings of this review is that there were some inconsistent findings when the same correlates were examined cross-sectionally and longitudinally.

CONCLUSIONS

The aim of this review was to identify consistent correlates of participation in PA and LTPA among socioeconomic disadvantaged populations in developed countries. Overall, there were few consistent associations with either LTPA or PA. The available evidence suggests that future interventions and campaigns should focus on

simultaneously addressing LTPA and mental health concerns, improve perceptions of benefits and enjoyment of PA, consider the needs of and focus on those with poor self-rated health and functional capacity, and employ strategies to improve PA self-efficacy. In socioeconomically disadvantaged population groups, more studies of correlates are needed that focus on LTPA and men, use longitudinal designs, examine variables related to behavioral attributes and skills, and carefully consider recruitment strategies to ensure the evidence base is sufficiently developed to increase engagement in PA.

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SUPPLEMENTAL MATERIAL

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