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Complete List of Authors:	Mohammed, Shimels Hussien; University of Gondar, Nutrition; Tehran University of Medical Sciences, Community Nutrition Birhanu, Mulugeta ; Universiteit Groningen Faculteit voor Geneeskunde, Epidemiology Sissay, Tesfamichael Awoke ; Universiteit Groningen Faculteit voor Geneeskunde, Epidemiology Habtewold, Tesfa; Debre Berhan University, Nursing; Universiteit Groningen Faculteit voor Geneeskunde, Epidemiology Tegegne, Balewgizie; Universiteit Groningen Faculteit voor Geneeskunde, Epidemiology Esmaillzadeh, Ahmad; Tehran University of Medical Sciences, Community Nutrition
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What does my neighborhood have to do with my weight? A protocol for systematic review and meta-analysis of the association between neighborhood socio-economic status and body weight.

Shimels Hussien Mohammed[1, 2], Mulugeta Molla Birhanu[3], Tesfamichael Awoke Sissay[4], Tesfa Dejenie Habtewold[3],[4], Balewgizie Silesh Tegegn[4], Ahmad Esmaillzadeh[2]*

[1]Department of Nutrition, Institute of Public Health, University of Gondar, Gondar, Ethiopia.

[2]Department of Community Nutrition, School of Nutrition and Dietetics, Tehran University of Medical Sciences, Tehran, Iran.

[3]Department of Nursing, Debre Berhan University, Debre Berhan, Ethiopia.

[4]Department of Epidemiology, University Medical Center Groningen, Groningen University, Groningen, The Netherlands.

Correspondence to:

Prof. Ahmad Esmaillzadeh (PhD): a.esmaillzadeh@gmail.com

Abstract

Introduction: The 21th century epidemic, obesity, is among the top global disease burdens and still on rise. Neighborhood's socio-economic status (NSES) has a strong contribution to the genesis of overweight/obesity risks. The aim of this systematic review and meta-analysis is to synthesize the existing evidence on the influences of NSES on body weight and provide pooled estimate of associated risks.

Methods and analysis: All cross-sectional and longitudinal studies published in English, from inception to May 15, 2017, will be systematically searched through PubMed, EMBASE, Web of Sciences and Google Scholar databases. Selection, screening, reviewing and data extraction of studies will be done by two reviewers, independently and in duplicate. Newcastle-Ottawa Scale (NOS) and Agency for Healthcare Research and Quality (ARHQ) tools will be used to assess the quality of evidence. Publication bias will be checked by visual inspection of funnel plots and Egger's regression test. Heterogeneity will be checked by Higgins's method (I^2 statistics). Meta-analysis and meta-regression will be carried out to calculate pooled risks.

Ethics and dissemination: Ethical clearance is not required for primary data is not to be collected. All scientific integrity measures will be ensured in all process of this study. Findings will be communicated through a publication in a peer-reviewed journal and presentations at research conferences.

Review registration: This protocol has been registered with the International Prospective Register of Systematic Reviews (PROSPERO); ID: CRD42017063889.

Keywords: Neighborhood socio-economic status, Obesogenic environment, Overweight, Obesity, BMI, Body mass index

Strengths and limitations of this study

- This will be the first systematic review and meta-analysis on obesogenic effects of NSES.
- This study will have wider representativeness, by including all age group and continents.
- Pooled risk estimates will be determined by meta-analysis.
- The protocol is developed following the recent PRISMA-P guidelines.
- Included cross-sectional studies may limit making causal inference.

Introduction

Obesity is a global public health threat, still on rise and with negative consequences at both individual and society levels. Over the past three decades, there has been an enormous increase in the prevalence of overweight or obesity. The problem is spreading further across the world, affecting more individuals of all age groups and socio-economic status. Worldwide, 39% of adults aged 18 years and above were overweight in 2014. In the same year, 13% of adults were obese; more than double of the figure in 1980.[1, 2] The problem has already reached to an alarming level among children, too. It was estimated that 41 million children under 5 years of age were overweight or obese in 2014. Asia has the highest burden childhood overweight or obesity bearing almost half of the global cases. Nearly 11 million African children were obese or overweight in 2014, doubling from what it was in 1990 (5.4 million).[1, 2] Obesity has posed tremendous challenges not only to the health system but also to nation's economy. Consecutive generations are at a higher risk; developing obesity at early age and at higher rate.[3, 4] The WHO has adopted the prevention and control of obesity as a central priority agenda and recommends nations to make substantial improvement with regard to the current trend of obesity.[5]

Obesity is a multi-causal phenomenon with a web of multiple and interacting risk factors originating from various dimensions. According to the ecological model on obesity causations (refer additional file 1: Ecological model of weight influences), obesity influences could be viewed as direct and indirect causes.[6, 7] The main direct causes being the behavioral factors - unhealthy eating and physical inactivity- resulting in a positive energy balance.[6-9] Smoking,[10] depression,[11] stress and sleep disturbance[12] might also influence weight, but mainly through tipping the energy balance which is at the center of the causal pathways to obesity. [13] Unhealthy eating and physical inactivity are, however, themselves consequences of the underlying obesity promoting structural factors; socio-economic, policy and environmental conditions.[7,13] For example, aspects of the environment -access to exercise facilities and healthy food stores- have been associated with increased physical activity, healthy eating and reduced obesity risk. On the contrary, neighborhood deprivation has been associated with unhealthy eating, physical inactivity and an increased risk of obesity and chronic illnesses.[14, 15]

Neighborhood influence on obesity risks, has gained a significant importance. Poor neighborhoods are hot spots in the current and global obesity epidemics. Studies have shown that the neighborhood in which people live has a strong influence on one's choice and adoption of health-enhancing behaviors. Irrespective of individuals own socio-economic status, people living in low socio-economic neighborhoods are more likely to have an increased risk of obesity,

compared to those living in better off neighborhoods.[16-17] A number of factors could explain why poor neighborhoods have become obesogenic. Health enhancing -facilities and –options are often limited in the poor neighborhoods while junk food items, alcohol and drug are readily available. Streets walkability and safety are often compromised, thus, limiting resident's movement. Stress, depression and poor mental health are more prevalent in poor neighborhoods.[18-19] The effects of neighborhood socio-economic conditions are not just limited to overweight/ obesity. They have also been linked to a variety of health and behavioral outcomes, including smoking, depression and chronic illness. Thus, improving NSES is one of the strategies for prevention and control of the current obesity epidemics and other chronic illnesses. Thus, an integrated approach has been recommended to improve NSES, and make healthy choices easier for everyone and at all places.[20]

Researching environmental correlates of obesity, and NSES in particular, has been emphasized over the last decade. A number of studies have evaluated the influence of NSES on the genesis of obesity risks. Indeed, they produced important results, including showing how poor neighborhoods promote an obesogenic lifestyle and people living in these neighborhoods become more vulnerable to obesity and its associated consequences.[15-16] Despite that, there is no systematic review and meta-analysis of studies that investigated the influence of NSES on obesity risks. We believe synthesizing the existing body of evidence could provide a strong evidence on the relation between NSES and obesity, and facilitate evidence based decision making as there is an increasing recognition of systematic review and meta-analysis findings in policy making process. Thus, in this study, we will systematically review and meta-analyze studies that investigated the effect of NSES on obesity risks. Our aim is to synthesize the existing evidence on NSES correlates of obesity, calculate pooled risks, and evaluate how the relation behaves at different settings (developed and developing countries) and across different population groups (children, adolescent, adult and elderly). Thus, the review will be comprehensive in terms of both geographic coverage and population groups addressed; such that studies across all regions of the world and individuals of different age group will be included. The results of the study will have significant impact in the effort to address the structural genesis of obesity risks.

Methods and analysis

We will undertake systematic review and meta-analysis answering three linked research questions: -

1. What is the existing evidence on obesity risks associated with the different NSES profiles?
2. How do neighborhood socio-economic conditions influence BMI (mediating factors)?
3. What population groups are more vulnerable to the obesogenic effect of poor NSES (moderating factors)?

Protocol registration and review reporting

This systematic review and meta-analysis has been registered with the International Prospective Register of Systematic Reviews (PROSPERO), registration number CRD42017063889, available on this site https://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42017063889. This protocol has been developed in accordance with the recommendations of the Meta-analysis of Observational Studies in Epidemiology (MOOSE) guideline[21] and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocol (PRISMA-P) statement.[22] A completed PRISMA-P checklist is included with this publication (refer to additional file 2: Completed PRISMA-P checklist). The review process will follow the conditions as specified in this protocol and the results will be reported based on the PRISMA statement and MOOSE guidelines.

Eligibility

All observational studies (cross-sectional, case-control and prospective) will be included provided they reported on the association of NSES with weight status; weight change, overweight, obesity or body mass index (BMI). Report of the studies (at least the abstract) should be in English language. We will include all studies published from inception till May 15, 2017.

Data source and search strategy

A literature search will be done using 4 data bases: PubMed, EMBASE, Web of Sciences and Google Scholar. The search will be done systematically by using combination of free texts and MeSH terms. In consultation with an experienced librarian, search strings and models have been developed for PubMed (refer to additional file 3: PubMed search strategy) and will be adopted to the other data bases. The data base searches will be supplemented by hand-searching reference lists of identified literatures.

Inclusion and exclusion criteria

We will include studies in which the effect of NSES on weight status was reported, irrespective of sex, age, geographic location and time of study. Articles will be excluded on any one of the following conditions: (1) focused primarily on physical, policy or social environment, (2) language other than English (at least the abstract is not English), (3) citations without full text or at least no abstract, and (4) qualitative studies, book chapters, symposium and conference proceedings, essays, commentaries, editorials and case reports.

Study selection

The results of data base searches will be exported to RefWorks version 2.0 software (http://www.refworks.com) and de-duplicated. Titles and/or abstracts of studies retrieved using the search strategy and from additional sources will be screened by two reviewers (SH, MM), independently and in duplicate, to determine eligibility for full text screening. Disagreement on eligibility will be resolved through consensus. After consensus reached, full text of eligible articles will be retrieved for extended review and screened by SH and MM, independently and in duplicate. Any disagreement between the reviewers over the eligibility of particular studies will be resolved through discussion. The screening and selection process of reviewed articles will be illustrated using PRISMA flow diagram (refer additional file 4: PRISMA flow diagram).

Data abstraction

Two review authors (SH, TD) will extract data, independently and in duplicate. Discrepancies will be identified and resolved by consensus or through a third reviewer (MM) as appropriate. A standardized format will be used for data abstraction and the following information will be abstracted from each eligible article: -

1. Study identification (title, first author, year of publication)
2. Study characteristics (country/region, study design, sample size, follow-up period for longitudinal studies)
3. Participants demographic factors (mean age, proportion of men)
4. NSES measurement method and value (category)
5. Weight status (index and mean value)
6. Measures of association between NSES and weight status (RR/OR with 95% confidence interval)

7. Information concerning adjustments (univariate versus multivariate analyses and confounding variables)

Assessment of study quality

All included studies will be assessed by two reviewers (SH, TD), independently and in duplicate. We will be guided by the Newcastle-Ottawa Scale (NOS)[23] for cohort and case-control studies and the Agency for Healthcare Research and Quality (ARHQ)[24] tool for cross-sectional studies. Ratings for each study will be compared between the two evaluators, with discrepancy resolved by consensus or a third mediating reviewer (MM) as necessary. Consensus will be reached on the final ratings of included articles.

Statistical analysis

We will check funnel plots to investigate publication bias. If funnel plots show asymmetry, Egger's regression test will be performed.[25] Publication bias will be assumed at P value <0.1. Should publication bias found, we will apply the Duval and Tweedie trim-and-fill method.[26] This method is based on the assumption that the effect sizes of all the studies are normally distributed around the center of the funnel plot; i.e. in the event of asymmetries, it adjusts for the potential effect of unpublished studies. Heterogeneity between studies will be assessed by using the $\chi 2$ test for the Cochran's Q statistic and calculated I^2, an estimate of the proportion of variance explained by between-study heterogeneity. According to Higgins et al.,[27] I^2 values less than 75% represent a none-critical level of heterogeneity. Furthermore, we will subgroup the data by countries SES, age group, gender and BMI level, in case heterogeneity is found high. Studies will be presented by summary table and forest plot(s). Meta-analysis and -regression will be carried out to calculate the pooled estimates; prevalence and effects sizes with 95% CI. Descriptive summary report of each study will be provided if pooling of data is not feasible due to a substantial heterogeneity among studies. Assuming NSES effect on weight varies for a number of individual level factors, we will use random effect model and weighting method in determining pooled estimates (prevalence, OR/RR with 95% CI). Review Manager (RevMan) version 5.3.5 (Cochrane Informatics and Knowledge Management Department) for Windows [28] will be used for analysis.

Discussions

Obesity is among the major burdens to the health system and the society at large. To date, progress in curbing the obesity threat has been slow and frustrating. It is still increasing with more people becoming at risk from year to year.[1-4] The main and immediate influences to obesity are unhealthy eating and physical inactivity. People are becoming more physically inactive and use more energy dense food stuffs than before.[6,7] However, these lifestyle changes are not out of nowhere. They are rather products of an increasingly obesogenic becoming environment. The response to obesity should comprehensively address all risks sets-behavioral, policy, socio-economic and environmental ones. Economic features of the neighborhood have been linked with unhealthy life styles, and increased risk of obesity and poor health outcomes. Poor neighborhoods bear a number of obesogenic risks, including low sport facilities, low fruit and vegetable outlets, but a plethora of fast food outlets, and poorly walkable streets.[15, 19, 29]

Recently, there has been an increased concern to address neighborhood NSES and bring healthy choices closer and affordable.[30] Neighborhoods are one of the preferred obesity intervention delivery platforms and a lot of intervention packages are being prepared and discussed by public health policy makers. Cognizant of the importance of systematic review and meta-analysis evidence for policy making and relevance of the issue, we will systematical review and meta-analyze the existing evidence on the effect of NSES on obesity risks.

This systematic review will provide: -

1. Evidence on the effect of NSES on obesity risks across the world and throughout the various stages of life (childhood, adolescent, adult and elderly).
2. Pragmatic reasons on why public health policy should address NSES disparity through an integrated and comprehensive strategy, including availing health enhancing choices closer to communities.
3. Evidence on most at risk populations for obesogenic effects of poor NSES.
4. Evidence on the mechanisms through which NSES influences weight and result in overweight/obesity.
5. An overview of knowledge gaps and future research needs.

Ethics and dissemination

We are not seeking ethical clearance for this study because we will be using publicly available secondary data from published studies. However, we will assure due precaution will be maintained in all processes of this work, including an unbiased presentation of results. The final findings will be published in a peer-reviewed international journal. Efforts will be made to present findings at relevant public health or nutrition conferences.

Authors' contributions

Shimels Hussien conceived and designed the study. Shimels Hussien, Mulugeta Molla, Tesfa Dejenie, Balewgizie Sileshi, Tesfamichael Awoke and Ahmad Esmaillzadeh developed search strategy and wrote the protocol. Ahmad Esmaillzadeh supervised the work process. All the authors read and approved the manuscript.

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Competing interests statement

The authors declared that they have no competing interests.

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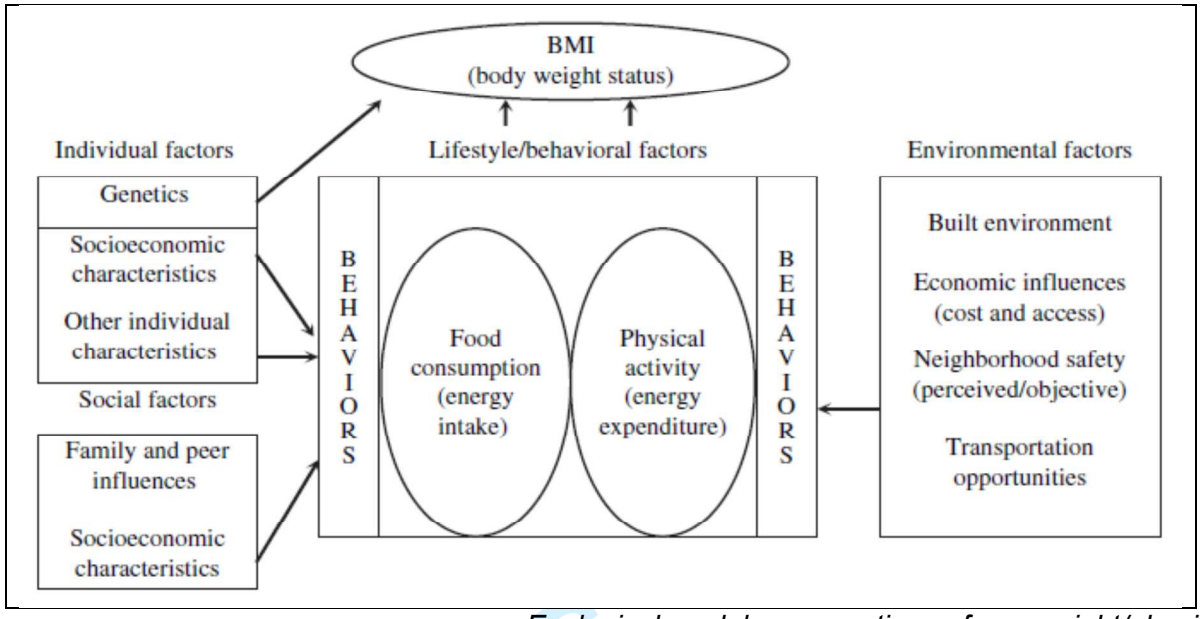

Ecological model on causations of overweight/obesity

Source: Papas et al. The built environment and obesity. Epidemiol Rev 2007

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PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item	Self-Evaluation
ADMINISTRATIVE INFORMATION			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	Yes
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	Not applicable
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	PROSPERO CRD42017063889
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	Yes
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	yes
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	Not applicable
Support:			
Sources	5a	Indicate sources of financial or other support for the review	Not applicable
Sponsor	5b	Provide name for the review funder and/or sponsor	Not applicable
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	Not applicable
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	Yes
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	Yes
METHODS			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	Yes
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial	Yes

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		registers or other grey literature sources) with planned dates of coverage	
Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	Yes (Additional file 3)
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	Yes
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	Yes
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	Yes
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	Yes
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	Yes
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	Yes
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	Yes
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I^2, Kendall's τ)	Yes
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	Yes
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	Yes
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	Yes (NOS and AHRQ tool)

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

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PubMed Search strategy

Search	Query	Hits*
#1	(((((((Body Weight[MeSH Terms]) OR Body Mass Index[MeSH Terms]) OR Body weight[Title/Abstract]) OR Weight[Title/Abstract]) OR Obesity[Title/Abstract]) OR Overweight[Title/Abstract]) OR Over-weight[Title/Abstract]) OR BMI[Title/Abstract]	1049827
#2	((((((((((((Residence Characteristics/statistics and numerical data[MeSH Terms])))) OR Residence Characteristics/standards[MeSH Terms]) OR Residence Characteristics/economics[MeSH Terms]) OR Poverty Areas[MeSH Terms]) OR neighborhood socioeconomic*[Title/Abstract]) OR neighbourhood socioeconomic *[Title/Abstract]) OR neighborhood-level socioeconomic*[Title/Abstract]) OR neighbourhood-level socioeconomic*[Title/Abstract]) OR neighborhood socio-economic*[Title/Abstract]) OR neighbourhood socio-economic *[Title/Abstract]) OR neighborhood-level socio-economic*[Title/Abstract]) OR neighbourhood-level socio-economic*[Title/Abstract]	15170
#3	#1 AND #2	1271

*= *Date of search: April 29, 2017*

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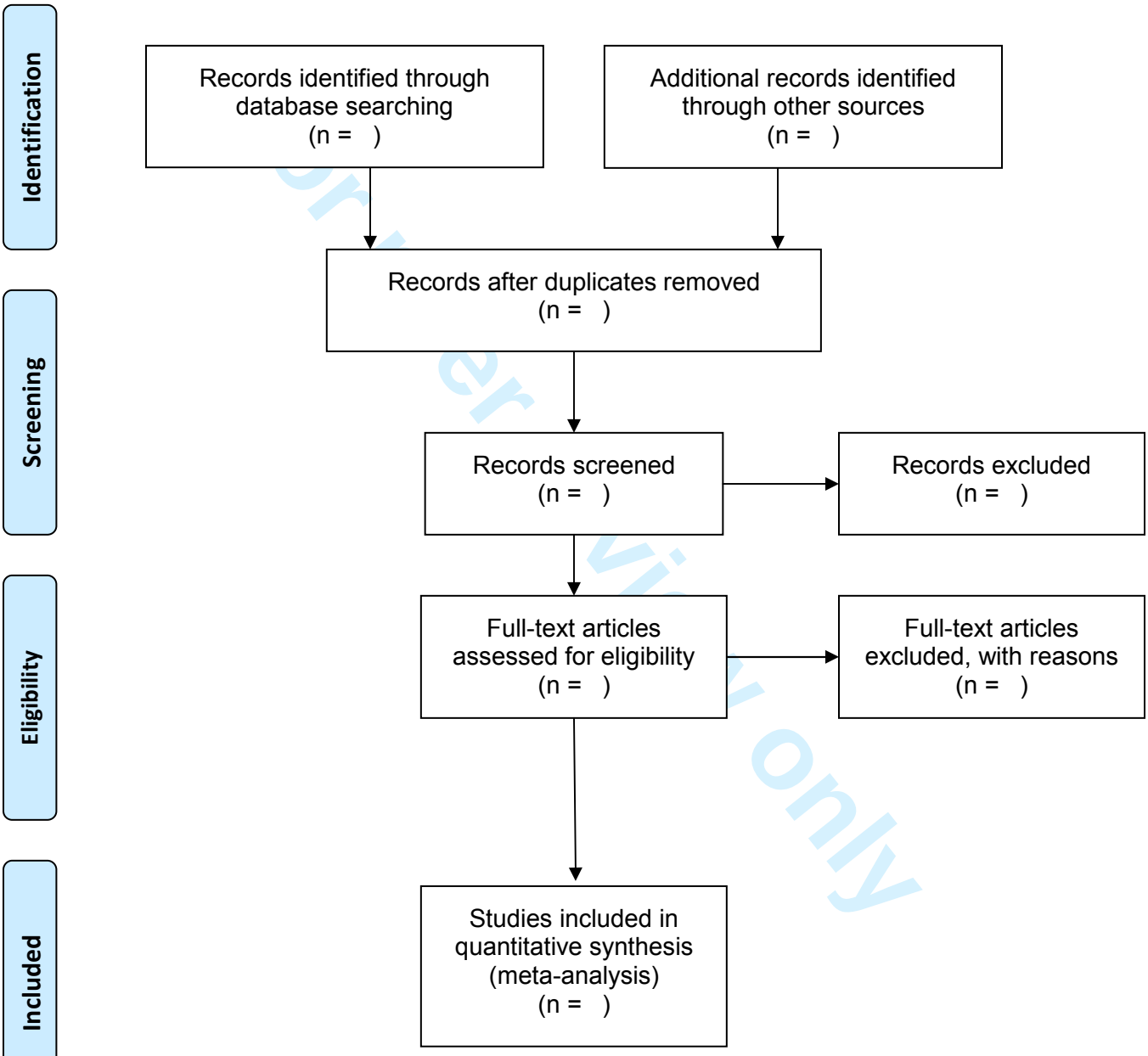
PRISMA Flow Diagram



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Complete List of Authors:	Mohammed, Shimels Hussien; University of Gondar, Nutrition; Tehran University of Medical Sciences, Community Nutrition Birhanu, Mulugeta ; Universiteit Groningen Faculteit voor Geneeskunde, Epidemiology Sissay, Tesfamichael Awoke ; Universiteit Groningen Faculteit voor Geneeskunde, Epidemiology Habtewold, Tesfa; Debre Berhan University, Nursing; Universiteit Groningen Faculteit voor Geneeskunde, Epidemiology Tegegne, Balewgizie; Universiteit Groningen Faculteit voor Geneeskunde, Epidemiology Esmaillzadeh, Ahmad; Tehran University of Medical Sciences, Community Nutrition
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[1]Department of Nutrition, Institute of Public Health, University of Gondar, Gondar, Ethiopia.

[2]Department of Community Nutrition, School of Nutrition and Dietetics, Tehran University of Medical Sciences, Tehran, Iran.

[3]Department of Nursing, Debre Berhan University, Debre Berhan, Ethiopia.

[4]Department of Epidemiology, University Medical Center Groningen, Groningen University, Groningen, The Netherlands.

Correspondence to:

Prof. Ahmad Esmaillzadeh (PhD): a.esmaillzadeh@gmail.com

Abstract

Introduction: Obesity is among the major public health threats across all regions of the World and still on the rise. Previous studies have shown an increased risk of overweight/obesity, related with poor neighborhoods' socio-economic status (NSES). To date, there is no systematic review and meta-analysis of studies that reported on NSES-overweight/obesity association. The aim of this study is to systematically review and meta-analyze the existing evidence on the association of NSES with overweight/obesity.

Methods and analysis: Cross-sectional and longitudinal studies published in English, from inception to May 15, 2017, will be systematically searched in the PubMed, EMBASE, Web of Sciences and Google Scholar databases. Selection, screening, reviewing and data extraction will be done by two reviewers, working independently and in duplicate. The Newcastle-Ottawa Scale (NOS) will be used to assess the quality of evidence. Publication bias will be checked by visual inspection of funnel plots and Egger's regression test. Heterogeneity will be checked by Higgins's method (I^2 statistics). Meta-analysis will be done if the studies are sufficiently homogeneous.

Ethics and dissemination: Ethical clearance is not required, as we will be using data from published articles. Scientific integrity measures will be ensured in all stages of this study. Findings will be communicated through publication in a peer-reviewed journal and presentations at research conferences.

Review registration: This protocol has been registered with the International Prospective Register of Systematic Reviews (PROSPERO); ID: CRD42017063889.

Keywords: Neighborhood socio-economic status, Obesogenic environment, Overweight, Obesity, BMI, Body mass index

Strengths and limitations of this study

- First systematic review and meta-analysis on NSES-overweight/obesity association.
- Wider representativeness, by including individuals of all age groups and from all regions.
- Observational studies will limit making causal inference.
- Lack of uniformity in measures of NSES may undermine comparability of studies.

Introduction

Obesity is a global public health threat, still on the rise and with negative consequences at both individual and societal levels.[1] Over the past three decades, there has been an enormous increase in the prevalence of overweight or obesity.[1, 2] Worldwide, 39% of adults aged 18 years and above were overweight in 2014. In the same year, 13% of adults were obese; more than double of the figure in 1980. [3] Consecutive generations are at a higher risk; developing obesity at an early age and at a higher rate.[4] The World Health Organization (WHO) has adopted the prevention and control of obesity as a central priority agenda and recommends nations to make a substantial improvement with regard to the current trend of obesity.[5]

Obesity is a multi-causal phenomenon with a web of multiple and interacting risk factors, originating from various levels.[6, 7] The neighborhood in which individuals live has a strong influence on one's choice and adoption of health-enhancing behaviors, and consequently, the development of overweight/obesity.[8, 9] Studies have shown that irrespective of individual-level socio-economic status, people living in poor neighborhoods are more likely to have an increased risk of overweight/obesity, compared to those living in better-off neighborhoods.[10-12] Availability, access, and utilization of health enhancing options are often limited in poor neighborhoods; while junk food items, alcohol, and drug are readily available.[13] Streets' walkability and safety are often compromised; thus, limiting resident's movement.[13, 14] Poor neighborhood socio-economic conditions have also been linked to stress and depression, which were reported to be associated with obesity.[15]

Recently, investigating environmental drivers of obesity has been identified as a priority agenda and attracted researchers' attention.[16] A number of studies were conducted and showed important results; including showing how poor neighborhoods promote obesogenic lifestyles and bear a higher burden of obesity and its associated consequences.[10-14] However, there is variation in the studies; including population groups studied, geographical coverage, measures of NSES and attributable risks. To date, there is no systematic review and meta-analysis of studies that reported on NSES-overweight/obesity relationship. We believe synthesizing these studies could fill the gap in the literature, and also provide a stronger evidence for policy-making processes, as there is an increasing recognition of systematic review and meta-analysis findings in these processes. Thus, we will systematically review and meta-analyze studies on the association of NSES with overweight/obesity. The study will be comprehensive in terms of both

geographic coverage and population groups addressed; such that studies across all regions of the world and individuals of different age groups will be included.

Methods and analysis

We will undertake systematic review and meta-analysis answering three linked research questions: -

1. What is the existing evidence on the risks of overweight/obesity associated with the different NSES profiles?
2. How do neighborhood socioeconomic conditions influence overweight/obesity (mediating factors)?
3. What are the population groups who are more vulnerable to the obesogenic influence of poor NSES (moderating factors)?

Protocol registration and review reporting

This systematic review and meta-analysis has been registered with the International Prospective Register of Systematic Reviews (PROSPERO), registration number CRD42017063889, available on this site https://www.crd.york.ac.uk/PROSPERO/display_record.asp?ID=CRD42017063889. This protocol has been developed in accordance with the recommendations of the Meta-analysis of Observational Studies in Epidemiology (MOOSE) guideline[17] and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocol (PRISMA-P) statement.[18] The review process will follow the conditions specified in this protocol and the results will be reported based on the PRISMA statement and MOOSE guidelines.

Eligibility

All observational studies (cross-sectional, case-control and cohort) will be included, provided report was done on the association of NSES with weight status; weight change, overweight, obesity or body mass index (BMI). Report of the studies (at least the abstract) should be in English language. We will include all studies published from inception to May 15, 2017.

Data source and search strategy

A literature search will be done using 4 databases: PubMed, EMBASE, Web of Sciences and Google Scholar. The search will be done systematically by using a combination of free texts and MeSH terms. In consultation with an experienced librarian, search strings and models have

been developed for PubMed (refer to Supplementary file 1: PubMed search strategy) and will be adopted to the other databases. The database searches will be supplemented by hand-searching reference lists of identified articles.

Inclusion and exclusion criteria

We will include studies in which the association of NSES with overweight/obesity was reported, irrespective of sex, age, geographic location and time of the study. The main outcome of interest is overweight/obesity, reported by BMI or related indices. The main exposure of interest is NSES, measured by composite indexes like NSES, neighborhood deprivation, and neighborhood economic hardship. Articles will be excluded on any one of the following conditions: (1) focused primarily on physical, policy or social environment, (2) language other than English (at least the abstract is not in English), (3) citations without full text, and (4) qualitative studies, book chapters, symposium and conference proceedings, essays, commentaries, editorials, and case reports.

Study selection

The results of database searches will be exported to RefWorks version 2.0 program (http://www.refworks.com) and de-duplicated. Titles and/or abstracts of studies retrieved using the search strategy and from additional sources will be screened by two reviewers (SHM, MMB), independently and in duplicate, to determine eligibility for full-text screening. Disagreement on eligibility will be resolved by consensus. After consensus reached, the full text of eligible articles will be retrieved for extended review and screened by SHM and MMB, independently and in duplicate. Any disagreement between the reviewers over the eligibility of particular studies will be resolved by discussion. The screening and selection process of reviewed articles will be illustrated using PRISMA flow diagram (refer to Supplementary file 2: PRISMA flow diagram).

Data abstraction

Two review authors (SHM, TDH) will extract data, independently and in duplicate. Discrepancies will be identified and resolved by consensus or a third reviewer (MMB) as appropriate. A standardized format (refer to Supplementary file 3: Data abstraction form) will be used for data abstraction and the following information will be abstracted from each eligible article: -

1. Study identification (title, first author, year of publication)

2. Study characteristics (country/region, study design, sample size, follow-up period for longitudinal studies)
3. Participants demographic factors (mean age, proportion of men)
4. NSES measurement method and value (category)
5. Weight status (index and mean value)
6. Measures of association between NSES and weight status (RR/OR with 95% confidence interval)
7. Information concerning adjustments (univariate versus multivariate analyses and confounding variables)

Assessment of study quality

All included studies will be assessed by two reviewers (SHM, TDH), independently and in duplicate. In grading quality of studies, we will be guided by the Newcastle-Ottawa Scale (NOS)[19]. Ratings for each study will be compared between the two evaluators, with discrepancy resolved by consensus or a third mediating reviewer (MMB), as necessary. Consensus will be reached on the final rating of included articles.

Statistical analysis

We will check funnel plots to investigate publication bias. If funnel plots show asymmetry, Egger's regression test will be performed.[20] Publication bias will be assumed at P value <0.1. Should publication bias found, we will apply the Duval and Tweedie trim-and-fill method.[21] This method is based on the assumption that the effect sizes of all the studies are normally distributed around the center of the funnel plot; i.e. in the event of asymmetries, it adjusts for the potential effect of unpublished studies. Heterogeneity between studies will be assessed by using the $\chi 2$ test for the Cochran's Q statistic and calculated I^2, an estimate of the proportion of variance explained by between-study heterogeneity. According to Higgins et al.,[22] I^2 value less than 50% represents a none-substantial level of heterogeneity. The data will guide us whether to do subgroup analysis. However, given that there are variations in methods of measuring NSES and NSES-overweight/obesity association varies from country to country, we will do subgroup analyses by NSES measures and countries' economic level (high vs. low). We will also consider subgroup analysis by age, gender, and BMI levels, in case we find high heterogeneity.

Studies will be presented a summary table and forest plot(s). Meta-analysis will be done to pool estimates (OR/RR, 95% CI). Descriptive summary report of each study will be provided if

pooling of data is not feasible due to a substantial heterogeneity among studies. Assuming there might be variation in the studies and their reports, we will use random effect and weighting method in determining pooled estimates. Review Manager (RevMan) version 5.3.5 (Cochrane Informatics and Knowledge Management Department) for Windows[23] will be used for the analysis.

Discussion

The findings of this study will have important policy implications. By pooling the existing evidence on the link of NSES with overweight/obesity, we will provide a strong evidential basis for decision making. We will also synthesize and report the potential moderating and mediating factors in the association; thereby, showing what particular population groups are more vulnerable to the obesogenic influences of neighborhood deprivation. In these ways, it will highlight the need of a comprehensive obesity prevention and control strategies unlike the current approach, which is mainly focused on addressing individual-level behavioral factors. More specifically, it will help to make recommendations that it is worth considering to address NSES disparity, and the groups more vulnerable to its obesogenic influence. We believe that addressing neighborhood deprivation by bringing healthy choices closer and affordable to everyone could facilitate the adoption of health-enhancing behaviors; thereby contributing to the effort to the goal of curbing obesity.

We anticipate some potential limitations and strengths in our study. The inclusion of observational studies will preclude making a causal inference as reverse causality cannot be ruled out. The lack of uniformity in the approaches of measuring NSES may undermine the comparability of studies. Cautious sub-grouping and analysis will be done to address that. To our knowledge, this will be the first systematic review and meta-analysis on the topic. Furthermore, the study will have Wider representativeness, by including individuals of all age groups and from all regions.

Ethics and dissemination

We are not seeking ethical clearance for this study because we will be using publicly available secondary data from published studies. However, we will ensure scientific integrity in the processes of the work, including an unbiased presentation of results. The final findings will be

published in a peer-reviewed international journal. Efforts will be made to present findings at relevant public health or nutrition conferences.

Authors' contributions

Shimels Hussien conceived and designed the study. Shimels Hussien, Mulugeta Molla, Tesfa Dejenie, Balewgizie Sileshi, Tesfamichael Awoke and Ahmad Esmaillzadeh developed search strategy and wrote the protocol. Ahmad Esmaillzadeh supervised the work process. All the authors read, commented and approved the final manuscript.

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Competing interests statement

The authors declared that they have no competing interests.

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What does my neighborhood have to do with my weight? A protocol for systematic review and meta-analysis of the association between neighborhood socio-economic status and body weight.

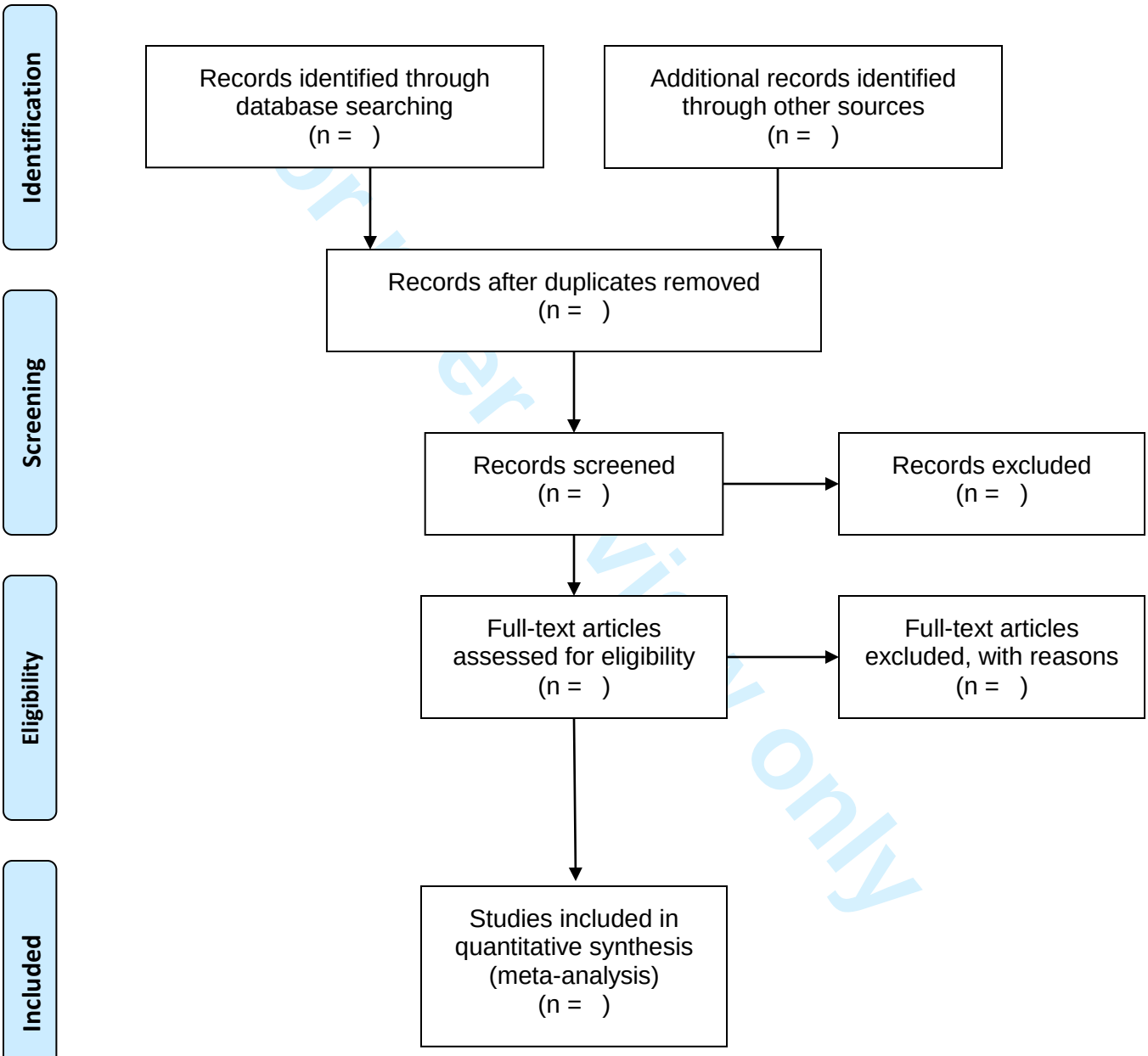
PubMed Search strategy

Search	Query	Hits*
#1	(((((((Body Weight[MeSH Terms]) OR Body Mass Index[MeSH Terms]) OR Body weight[Title/Abstract]) OR Weight[Title/Abstract]) OR Obesity[Title/Abstract]) OR Overweight[Title/Abstract]) OR Over-weight[Title/Abstract]) OR BMI[Title/Abstract]	1049827
#2	((((((((((((Residence Characteristics/statistics and numerical data[MeSH Terms])))) OR Residence Characteristics/standards[MeSH Terms]) OR Residence Characteristics/economics[MeSH Terms]) OR Poverty Areas[MeSH Terms]) OR neighborhood socioeconomic*[Title/Abstract]) OR neighbourhood socioeconomic *[Title/Abstract]) OR neighborhood-level socioeconomic*[Title/Abstract]) OR neighbourhood-level socioeconomic*[Title/Abstract]) OR neighborhood socio-economic*[Title/Abstract]) OR neighbourhood socio-economic *[Title/Abstract]) OR neighborhood-level socio-economic*[Title/Abstract]) OR neighbourhood-level socio-economic*[Title/Abstract]	15170
#3	#1 AND #2	1271

*= *Date of search: April 29, 2017*

What does my neighborhood have to do with my weight? A protocol for systematic review and meta-analysis of the association between neighborhood socio-economic status and body weight.

PRISMA Flow Diagram



What does my neighborhood have to do with my weight? A systematic review of the association between neighborhood socioeconomic status and body mass index.

Data abstraction form

S.No	First author, year published	Country or Region	Study design	Sample size	Follow-up time	Study population	Mean age	Proportion of men	NSES measunment method, value	Measure of obesity risk, value	OR/RR (95% CI)	Adjusted covariates	Moderators	Mediators

What does my neighborhood have to do with my weight? A protocol for systematic review and meta-analysis of the association between neighborhood socio-economic status and body weight.

PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item	Self-Evaluation
ADMINISTRATIVE INFORMATION			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	Page 4
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	Not applicable
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	Page 4
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	Page 1
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	Page 7
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	Not applicable
Support:			
Sources	5a	Indicate sources of financial or other support for the review	No financial support, page 8
Sponsor	5b	Provide name for the review funder and/or sponsor	Not applicable
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	Not applicable
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	Page 3
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	Page 4
METHODS			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	Page 4
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	Page 4

What does my neighborhood have to do with my weight? A protocol for systematic review and meta-analysis of the association between neighborhood socio-economic status and body weight.

Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	Additional file 2
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	Page 5
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	Page 5
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	Page 5
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	Page 5
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	Page 5
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	Page 6
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	Page 6
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I^2, Kendall's τ)	Page 6
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	Page 6
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	Page 6
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	Page 6
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	Page 6

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**

BMJ Open

What does my neighbourhood have to do with my weight? A protocol for systematic review and meta-analysis of the association between neighbourhood socioeconomic status and body weight.

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Manuscript ID	bmjopen-2017-017567.R2
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Primary Subject Heading:	Public health
Secondary Subject Heading:	Nutrition and metabolism, Epidemiology
Keywords:	Neighborhood socioeconomic status, Obesogenic environment, Overweight, Obesity, BMI

What does my neighbourhood have to do with my weight? A protocol for systematic review and meta-analysis of the association between neighbourhood socioeconomic status and body weight.

Shimels Hussien Mohammed[1], Mulugeta Molla Birhanu[2], Tesfamichael Awoke Sissay[2], Tesfa Dejenie Habtewold[2, 3], Balewgizie Silesh Tegegn[3], Ahmad Esmaillzadeh[4, 5, 6]*

[1]Department of Community Nutrition, School of Nutritional Sciences and Dietetics, Tehran University of Medical Sciences-International Campus (TUMS-IC), Tehran, Iran.

[2]Department of Epidemiology, University Medical Center Groningen, Groningen University, Groningen, The Netherlands.

[3]Department of Nursing, Debre Berhan University, Debre Berhan, Ethiopia.

[4]Obesity and Eating Habits Research Center, Endocrinology and Metabolism Molecular Cellular Sciences Institute, Tehran University of Medical Sciences, Tehran, Iran.

[5]Department of Community Nutrition, School of Nutritional Sciences and Dietetics, Tehran University of Medical Sciences, PO Box 14155-6117, Tehran, Iran.

[6]Food Security Research Center, Department of Community Nutrition, Isfahan University of Medical Sciences, Isfahan, Iran.

*Correspondence to: Prof. Ahmad Esmaillzadeh (PhD), Email: a-esmaillzadeh@tums.ac.ir, a.esmaillzadeh@gmail.com

Abstract

Introduction: Individuals living in poor neighbourhoods are at a higher risk of overweight/obesity. There is no systematic review and meta-analysis study on the association of NSES with overweight/obesity. We aimed to systematically review and meta-analyse the existing evidence on the association of NSES with overweight/obesity.

Methods and analysis: Cross-sectional, case-control, and cohort studies published in English, from inception to May 15, 2017, will be systematically searched using databases: PubMed, EMBASE, Web of Sciences and Google Scholar. Selection, screening, reviewing, and data extraction will be done by two reviewers, independently and in duplicate. The Newcastle-Ottawa Scale (NOS) will be used to assess the quality of evidence. Publication bias will be checked by visual inspection of funnel plots, and Egger's regression test. Heterogeneity will be checked by Higgins's method (I^2 statistics). Meta-analysis will be done to estimate the pooled odd ratio (OR). Narrative synthesis will be performed if meta-analysis is not feasible due to high heterogeneity of studies.

Ethics and dissemination: Ethical clearance is not required as we will be using data from published articles. Findings will be communicated through a publication in a peer-reviewed journal and presentations at professional conferences.

Review registration: This protocol is registered in the International Prospective Register of Systematic Reviews (PROSPERO), ID: CRD42017063889.

Keywords: Neighborhood socioeconomic status, Obesogenic environment, Overweight, Obesity, BMI

Strengths and limitations of this study

- To the best of our knowledge, this is the first systematic review and meta-analysis to examine NSES-overweight/obesity association.
- The study will have wider representativeness, including individuals of all age groups and from all continents.
- The lack of uniformity in measures of NSES may yield significant heterogeneity and undermine comparability of studies.

Introduction

Obesity is a global public health threat, with negative consequences at both individual and societal levels.[1] Over the past three decades, there has been an enormous increase in the prevalence of overweight or obesity.[1, 2] Worldwide, 39% of adults aged 18 years and above were either overweight in 2014. In the same year, 13% of adults were obese; more than double of the figure in 1980. [3] Consecutive generations are at a higher risk; developing obesity at an early age and at a higher rate.[4] The World Health Organization (WHO) has adopted the prevention and control of obesity as a priority agenda and recommends nations to make a substantial improvement with regard to the current trend.[5]

Obesity has multiple risk factors, including those related with the environment.[6, 7] The neighbourhood in which individuals live has a strong influence on one's choice and adoption of health enhancing behaviors and consequently, the development of overweight/obesity.[8, 9] Studies have shown that irrespective of individual-level socioeconomic status, people living in poor neighborhoods are more likely to be overweight/obesity, compared with those living in better-off neighbourhood.[10-12] Availability, access, and utilization of health enhancing options are often limited in poor neighbourhoods, while fast food, alcohol, and drug are readily available.[13] Streets' walkability and safety are often compromised, thus limiting resident's movement.[13, 14] Poor neighbourhood socioeconomic conditions have also been linked to stress and depression which are also risks for obesity.[15]

Investigating environmental drivers of obesity has increased recently.[16] A number of studies were conducted and showed important results, including showing how poor neighbourhoods promote obesogenic lifestyles and result in a higher proportion of overweight/obese individuals.[10-14] However, there is variation in the studies, including population groups studied, geographical coverage and measures of NSES. To the best of our knowledge, there is no systematic review and meta-analysis of studies that reported on NSES-overweight/obesity relationship. We believe synthesizing these studies may fill the gap in the literature and provide a stronger evidence for policy making as there is an increasing recognition of systematic review and meta-analysis findings in the policy making processes. Thus, we will systematically review and meta-analyze studies that reported on the association of NSES with overweight/obesity. The study will be comprehensive in terms of both geographic coverage and population groups addressed, such that studies across all continents and individuals of different age groups will be included.

Methods

We will undertake systematic review and meta-analysis answering three linked research questions: -

1. What is the existing evidence on the risk of overweight/obesity associated with NSES?
2. How do neighbourhood socioeconomic conditions influence overweight/obesity (mediating factors)?
3. What are the population groups who are more vulnerable to the obesogenic influences of poor NSES (moderating factors)?

Protocol registration and reporting

This protocol is registered in PROSPERO, registration number CRD42017063889. This protocol reporting follows the recommendations of the Meta-analysis of Observational Studies in Epidemiology (MOOSE) guideline[17] and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses Protocol (PRISMA-P) statement.[18] The review process will follow the approach specified in this protocol. The results will be reported based on the PRISMA statement and MOOSE guidelines.

Eligibility

All observational studies (cross-sectional, case-control and cohort) will be included, provided they reported the association of NSES with weight status, which includes weight change, overweight, obesity, or body mass index (BMI). Report of the studies (at least the abstract) should be in the English language. We will include all studies published from inception to May 15, 2017.

Data source and search strategy

A systematic literature search will be done using 4 databases: PubMed, EMBASE, Web of Sciences and Google Scholar. The search will be done using a combination of free texts and MeSH terms. In consultation with an experienced librarian, search model was developed for PubMed (refer to Supplementary file 1 PubMed search strategy). The model will be adopted to the other databases. The database search will be supplemented by hand-searching reference lists of identified articles.

Inclusion and exclusion criteria

We will include studies in which the association of NSES with overweight/obesity was reported irrespective of sex, age, geographic location, and study year. The main outcome of interest is overweight/obesity, reported by BMI or related indices. The main exposure of interest is NSES, measured by composite indices like NSES-, neighbourhood deprivation-, or neighbourhood economic hardship- indices. Articles will be excluded on any one of the following conditions: (1) focused primarily on physical, policy or social environment, (2) language other than English, (3) no full text, or (4) qualitative studies, book chapters, symposium and conference proceedings, essays, commentaries, editorials, and case reports.

Study selection

Articles from the database searches will be imported into RefWorks version 2.0 program (http://www.refworks.com) and de-duplicated. To determine eligibility for full-text screening, title and abstract of the studies will be screened by two reviewers independently. Disagreement on eligibility will be resolved by consensus. After consensus reached, the full text of eligible articles will be retrieved for an extended review and screened by SHM and MMB, independently and in duplicate. The screening and selection process of reviewed articles will be illustrated using PRISMA flow diagram (refer to Supplementary file 2 PRISMA flow diagram).

Data abstraction

Two review authors (SHM, TDH) will extract data, independently and in duplicate. Discrepancies will be resolved by consensus. We will use a standardized format (refer to Supplementary file 3 Data abstraction form) to extract the following information from each eligible article: -

1. Study identification (title, first author, year of publication)
2. Study characteristics (country/region, study design, sample size, follow-up period for longitudinal studies)
3. Participants demographic factors (mean age, proportion of men)
4. NSES measurement method and category of NSES
5. Weight status (indices and mean value)
6. Measures of association between NSES and weight status (RR/OR with 95% confidence interval)
7. Information on adjustments (multivariate analyses, confounding variables)

Assessment of study quality

All included studies will be assessed by two reviewers (SHM, TDH), independently and in duplicate. In grading the quality of studies, we will be guided by the Newcastle-Ottawa Scale (NOS)[19]. Ratings for each study will be compared between the two evaluators and discrepancy, if any, will be resolved by consensus.

Statistical analysis

We will check funnel plots to investigate publication bias. If funnel plots show asymmetry, Egger's regression test will be performed.[20] Publication bias will be assumed at P-value <0.1. If we find publication bias, we will apply the Duval and Tweedie trim-and-fill method.[21] This method is based on the assumption that the effect sizes of the studies are normally distributed around the centre of the funnel plot; i.e. in the event of asymmetries, it adjusts for the potential effect of unpublished studies. Heterogeneity among studies will be assessed by the χ2 test for the Cochran's Q and I^2 statistics, an estimate of the proportion of variance explained by between-study heterogeneity. I^2 value less than 50% represents a none-substantial level of heterogeneity.[22] We will do separate analyses for low-, middle- and high-income countries. Subgroup analyses will also be done by age, gender, BMI levels, or the types of NSES measurement methods used in the studies which may include NSES-, neighbourhood deprivation-, or neighbourhood economic hardship- indices. Studies will be presented a summary table and forest plot(s). Meta-analysis will be done to pool estimates (OR/RR, 95% CI). Narrative synthesis will be performed if meta-analysis is not feasible due to high heterogeneity of studies. Assuming there will be variation in the studies, we will use random effect and weighting method in determining pooled estimates. Review Manager (RevMan) version 5.3.5 (Cochrane Informatics and Knowledge Management Department) for Windows[23] will be used for all analyses.

Discussion

The findings of this study will have important policy implications. By pooling the existing evidence on the link of NSES with overweight/obesity, we will provide a strong evidence base for decision making. We will also synthesize and report the potential moderating and mediating factors in the association, thereby showing the population segments who are more vulnerable to the obesogenic influences of neighbourhood deprivation. In these ways, it will highlight the need for comprehensive obesity prevention and control strategies, including addressing NSES disparities. The current approaches are mainly focused on addressing individual-level

behavioural risks. We believe that addressing NSES disparities by bringing healthy choices closer to everyone may facilitate the adoption of health-enhancing behaviours.

We anticipate some potential limitations and strengths in our study. The inclusion of observational studies will preclude making a causal inference as reverse causality could not be ruled out. The lack of uniformity in NSES measurement methods may result in high heterogeneity and undermine the comparability of studies. To our knowledge, this is the first systematic review and meta-analysis on the topic. The study will have wider representativeness by including individuals of all age groups and from all continents.

Ethics and dissemination

We will not seek ethical clearance for this study because we will use publicly available data from published studies. The findings of the study will be published in a peer reviewed journal. Efforts will be made to present findings at relevant public health or nutrition conferences.

Authors' contributions

SHM conceived and led the study. SHM, MMB, TDH, BST, TAS and AE developed search strategies and wrote the protocol. AE critically reviewed the final manuscript. All the authors read, commented, and approved the final manuscript.

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Competing interests statement

The authors declared that they have no competing interests.

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What does my neighbourhood have to do with my weight? A protocol for systematic review and meta-analysis of the association between neighbourhood socioeconomic status and body weight.

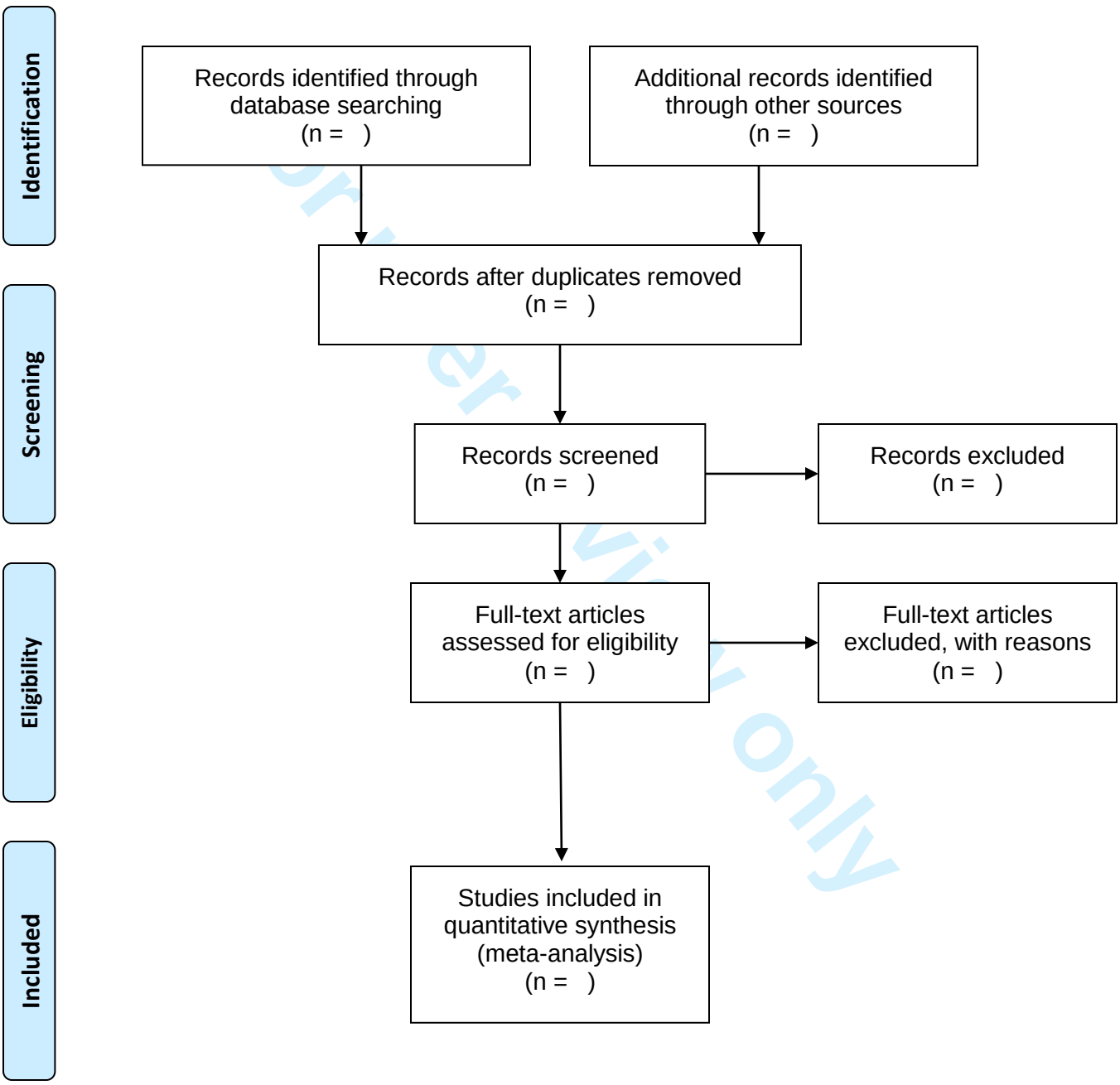
PubMed Search Strategy

Search	Query	Hits*
#1	(((((((Body Weight[MeSH Terms]) OR Body Mass Index[MeSH Terms]) OR Body weight[Title/Abstract]) OR Weight[Title/Abstract]) OR Obesity[Title/Abstract]) OR Overweight[Title/Abstract]) OR Over-weight[Title/Abstract]) OR BMI[Title/Abstract]	1049827
#2	((((((((((((Residence Characteristics/statistics and numerical data[MeSH Terms])))) OR Residence Characteristics/standards[MeSH Terms]) OR Residence Characteristics/economics[MeSH Terms]) OR Poverty Areas[MeSH Terms]) OR neighborhood socioeconomic*[Title/Abstract]) OR neighbourhood socioeconomic *[Title/Abstract]) OR neighborhood-level socioeconomic*[Title/Abstract]) OR neighbourhood-level socioeconomic*[Title/Abstract]) OR neighborhood socio-economic*[Title/Abstract]) OR neighbourhood socio-economic *[Title/Abstract]) OR neighborhood-level socio-economic*[Title/Abstract]) OR neighbourhood-level socio-economic*[Title/Abstract]	15170
#3	#1 AND #2	1271

*= *Date of search: April 29, 2017*

What does my neighbourhood have to do with my weight? A protocol for systematic review and meta-analysis of the association between neighbourhood socioeconomic status and body weight.

PRISMA Flow Diagram



What does my neighbourhood have to do with my weight? A protocol for systematic review and meta-analysis of the association between neighbourhood socioeconomic status and body weight.

Data abstraction form

S.No	First author, year published	Country or Region	Study design	Sample size	Follow-up time	Study population	Mean age	Proportion of men	NSES measunment method, value	Measure of obesity risk, value	OR/RR (95% CI)	Adjusted variables	Moderators	Mediators

What does my neighbourhood have to do with my weight? A protocol for systematic review and meta-analysis of the association between neighbourhood socioeconomic status and body weight.

PRISMA-P (Preferred Reporting Items for Systematic review and Meta-Analysis Protocols) 2015 checklist: recommended items to address in a systematic review protocol*

Section and topic	Item No	Checklist item	Self-Evaluation
ADMINISTRATIVE INFORMATION			
Title:			
Identification	1a	Identify the report as a protocol of a systematic review	Page 1
Update	1b	If the protocol is for an update of a previous systematic review, identify as such	Not applicable
Registration	2	If registered, provide the name of the registry (such as PROSPERO) and registration number	Page 2, 4
Authors:			
Contact	3a	Provide name, institutional affiliation, e-mail address of all protocol authors; provide physical mailing address of corresponding author	Page 1
Contributions	3b	Describe contributions of protocol authors and identify the guarantor of the review	Page 7
Amendments	4	If the protocol represents an amendment of a previously completed or published protocol, identify as such and list changes; otherwise, state plan for documenting important protocol amendments	Not applicable
Support:			
Sources	5a	Indicate sources of financial or other support for the review	No financial support, page 7
Sponsor	5b	Provide name for the review funder and/or sponsor	Not applicable
Role of sponsor or funder	5c	Describe roles of funder(s), sponsor(s), and/or institution(s), if any, in developing the protocol	Not applicable
INTRODUCTION			
Rationale	6	Describe the rationale for the review in the context of what is already known	Page 3
Objectives	7	Provide an explicit statement of the question(s) the review will address with reference to participants, interventions, comparators, and outcomes (PICO)	Page 4
METHODS			
Eligibility criteria	8	Specify the study characteristics (such as PICO, study design, setting, time frame) and report characteristics (such as years considered, language, publication status) to be used as criteria for eligibility for the review	Page 4
Information sources	9	Describe all intended information sources (such as electronic databases, contact with study authors, trial registers or other grey literature sources) with planned dates of coverage	Page 4

What does my neighbourhood have to do with my weight? A protocol for systematic review and meta-analysis of the association between neighbourhood socioeconomic status and body weight.

Search strategy	10	Present draft of search strategy to be used for at least one electronic database, including planned limits, such that it could be repeated	Additional file 2
Study records:			
Data management	11a	Describe the mechanism(s) that will be used to manage records and data throughout the review	Page 5
Selection process	11b	State the process that will be used for selecting studies (such as two independent reviewers) through each phase of the review (that is, screening, eligibility and inclusion in meta-analysis)	Page 5
Data collection process	11c	Describe planned method of extracting data from reports (such as piloting forms, done independently, in duplicate), any processes for obtaining and confirming data from investigators	Page 5
Data items	12	List and define all variables for which data will be sought (such as PICO items, funding sources), any pre-planned data assumptions and simplifications	Page 5
Outcomes and prioritization	13	List and define all outcomes for which data will be sought, including prioritization of main and additional outcomes, with rationale	Page 5
Risk of bias in individual studies	14	Describe anticipated methods for assessing risk of bias of individual studies, including whether this will be done at the outcome or study level, or both; state how this information will be used in data synthesis	Page 6
Data synthesis	15a	Describe criteria under which study data will be quantitatively synthesised	Page 6
	15b	If data are appropriate for quantitative synthesis, describe planned summary measures, methods of handling data and methods of combining data from studies, including any planned exploration of consistency (such as I^2, Kendall's τ)	Page 6
	15c	Describe any proposed additional analyses (such as sensitivity or subgroup analyses, meta-regression)	Page 6
	15d	If quantitative synthesis is not appropriate, describe the type of summary planned	Page 6
Meta-bias(es)	16	Specify any planned assessment of meta-bias(es) (such as publication bias across studies, selective reporting within studies)	Page 6
Confidence in cumulative evidence	17	Describe how the strength of the body of evidence will be assessed (such as GRADE)	Page 6

*** It is strongly recommended that this checklist be read in conjunction with the PRISMA-P Explanation and Elaboration (cite when available) for important clarification on the items. Amendments to a review protocol should be tracked and dated. The copyright for PRISMA-P (including checklist) is held by the PRISMA-P Group and is distributed under a Creative Commons Attribution Licence 4.0.**