Identifying obesity and COVID-19 overlapping risk-factors: Protocol for a systematic review and meta-analysis

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Abstract

This systematic review main goal is to identify the common risk factors of obesity and COVID-19 overall, and highlight the ones related to urban settings specifically, using a syndemic framework. COVID-19 highlighted the interaction between infectious diseases and non-communicable diseases. We hypothesise that obesity and COVID-19 share determinants, thus our main goal is to identify the overlapping risk factors and their magnitude of association with both health outcomes. Literature search was conducted in Medline and Embase, Cochrane Library and Epistemonikos, Web of Science and Scopus, ASSIA and SocINDEX and, Google Scholar, in June 2021. Covidence will be used to conduct the title and abstract, and full-text screening, considering the following inclusion criteria: (a) study addresses both health outcomes, (b) full-length articles, (c) study focuses on humans and (d) studies in English. The exclusion criteria will be: (a) study addresses one of the outcomes in combination with other pathologies, (b) not full-length article, (c) study focuses on animals, (d) study not written in English, (e) study focuses on treatment (pharmacological or other), testing (prognostic) or specific patients with other pathologies and (f) study focussed in clinical and/or physiological mechanisms associated with obesity and/or COVID-19. The included studies will be assessed for quality using the Effective Public Health Practice Project for quantitative studies and the tool described by Hawker for qualitative studies. Qualitative results will be assessed using thematic analysis methods to synthesise findings and presented in summary tables. Quantitative results – meta-analysis – will be analysed and presented using Q test and Funnel Plot.

Introduction

COVID-19 was declared a pandemic by the World Health Organization (WHO) in March 2020[1] and, among other aspects, it has brought attention to the interaction between infectious diseases and the highly prevalent non-communicable diseases (NCDs) worldwide, namely diabetes, hypertension and obesity.[2,3]

On one hand, obesity has been identified as a risk factor for more severe cases of COVID-19, and higher rates of mortality are observed precisely among individuals with overweight and obesity.[4–7] On the other hand, being infected by the virus that causes COVID-19, severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), and needing intensive care for a long period of time, also might contribute to higher adiposity through sarcopenia, high levels of stress and anxiety, sleep disturbances and more sedentary time, among other effects increasing the risk of obesity.[8] Also, mobility restriction measures, such as lockdowns, implemented in several countries to prevent the dissemination of COVID-19, have contributed to weight gain in the overall population.[9]

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Contrary to what was initially suggested, COVID-19 does not affect all individuals, or territories, equally.[10–13] In fact, both obesity and COVID-19, tend to hit more the most vulnerable groups, such as minorities and socially disadvantaged populations and places.[14,15] Furthermore, there seems to be a higher prevalence of both obesity and COVID-19 in urban areas.[16,17]

This multifaceted interaction, between obesity and COVID-19, mediated by socioenvironmental factors, fulfils the criteria for a syndemic, which, in short, means that both diseases potentiate each other and tend to co-occur more in specific groups of the population and in specific geographic contexts.[18,19] Therefore, it is plausible that risk factors of obesity and COVID-19 overlap.

The majority of the systematic reviews that address both obesity and COVID-19 view obesity as a risk factor for more severe cases of COVID-19, and intend to demonstrate the degree to which having overweight or obesity increases the chances of needing more medical care during the acute phase of the disease and/or having longer-lasting cases of illness.[7,20,21] In contrast, this systematic review is based in a syndemic theoretical framework, so it addresses both health outcomes as being equally major public health problems, at the global level, that appear to fuel each other. Nevertheless, while the risk factors for obesity are relatively well described in the literature, there is still very little evidence regarding COVID-19 risk factors, beyond the biomedical scope.

Thus, the main goal of this systematic review is to identify the common risk factors of obesity and COVID-19 overall, and highlight the ones related to urban settings specifically, using a syndemic framework. Following the Socioecological Model (SEM) of health determinants, it is also a specific goal to analyse which determinants are addressed in the literature and to what degree. Further, if the necessary data are available, the magnitude of association between the identified risk factors and each health outcome, that is obesity and COVID-19, will be assessed.

Design and methods protocol and registration

The review will follow the Preferred Reporting Items for Systematic Review and Meta-Analysis Protocols (PRISMA-P) guidelines for reporting systematic reviews[22] which will increase the transparency and accuracy of the evidence systematisation. The protocol for the systematic review was registered in International Prospective Register of Systematic Reviews (PROSPERO) and it will be updated while conducting the review, if necessary. The review is expected to be concluded and submitted for peer-reviewed publication by December 2022.

Search strategy and eligibility criteria

The literature search was conducted in the following international online bibliographic databases: Medline and Embase via Ovid as key health science databases, Cochrane Library via Wiley and Epistemonikos for identifying reviews and clinical trials, Web of Science via Clarivate and Scopus via Elsevier for a more interdisciplinary coverage, ASSIA via ProQuest and SocINDEX via EBSCOhost for coverage of the social sciences and lastly, Google Scholar via Publish or Perish to increase the likelihood of identifying studies not indexed in these databases. The searches were primarily conducted in June 2021. Only literature published in 2020 or later were included. The literature search was developed in cooperation with and conducted by information specialists. The search terms will consist of both subject headings (where available) and text words on COVID-19 and obesity, and will be adapted for each database to optimise identification of potentially relevant studies (Table 1). Considering PICOS criteria, in this review the population (P) are all individuals diagnosed with obesity, COVID-19 or both, the intervention (I) or exposure are the risk factors (age, sex, profession, education, income among others), the comparison (C) is not applicable to this review, the outcomes (O) are morbidity, disease severity, hospitalisation and death, and finally all type of studies (S) will be included.

Review process

After identifying the potential papers through the systematic searches in online bibliographic platforms, references will be imported to EndNote where duplicates will be removed, and missing abstract added manually, then imported to Covidence. Then, all papers will be screened based on title and abstract to include only the relevant papers, after which the included papers will be fully read to ensure their relevance and to retrieve information. Screening of papers will be independently performed by two reviewers and discrepancies in the classification to include/exclude papers according to the criteria will be discussed until a consensus is achieved. If necessary, a third reviewer will participate in the discussions to achieve the consensual decision.

For the title and abstract screening, the inclusion criteria will be: (a) study addresses both health outcomes (obesity and COVID-19 cases, deaths, hospitalisation), (b) full-length articles (not editorials, comments, letters to the editor etc. . .), (c) study focuses on humans, (d) study written in English, (e) study identifies risk factors (predictors, determinants) for obesity and/or COVID-19, its cause, severity or death by such diseases. At this stage the exclusion criteria will be: (a) study addresses one of the outcomes in combination with other pathologies, (b) not full-length article, (c) study focuses on animals, (d) study not written in English, (e) study focuses on treatment (pharmacological or other), testing (prognostic) or specific patients with other pathologies, (f) study focussed in clinical and/or physiological mechanisms associated with obesity and/or COVID-19.

Table 1. Search inOvid MEDLINE(R) and Epub Ahead of Print, In-Process, In-Data-Review & Other Non-Indexed Citations and Daily <1946 to June 16, 2021> conducted in 17/06/2021 and limited to 2020–2021.

#	Searches	Results
1	COVID-19/	84,854
2	Coronavirus Infections/	44,893
3	SARS-CoV-2/	65,703
4	Betacoronavirus/ or Coronavirus/	35,807
5	(covid-19 or covid19* or covid or coronavirus* or corona virus* or betacoronavirus* or nCoV* or 2019nCoV* or 19nCoV* or SARS-COV-2 or SARSCOV-2 or SARSCOV2 or cov 2 or cov2 or cov-19 or ((new or novel or '19' or '2019' or Wuhan or Hubei or China or Chinese) adj3 (CoV or HCoV)) or (wuhan adj2 (virus* or pneumonia*))).tw,kw,kf.	154,674
6	1 or 2 or 3 or 4 or 5	159,938
7	Obesity, Metabolically Benign/ or Pediatric Obesity/ or Obesity/ or Obesity, Morbid/ or Obesity, Abdominal/ or Obesity, Maternal/	223,525
8	Body Weight/	192,952
9	Overweight/	26,916
10	body weight changes/ or weight gain/	32,562
11	body constitution/ or 'body weights and measures'/ or body fat distribution/ or body mass index/ or body size/ or adiposity/	175,096
12	(Obese or obesit* or adipose or adiposit* or overweight* or over weight* or body weight* or bodyweight* or BMI or body mass or body size* or waist circumference* or body fat or fatness or weight change* or weight gain* or (waist* adj2 ratio*)).tw,kw,kf.	849,930
13	7 or 8 or 9 or 10 or 11 or 12	1,024,348
14	6 and 13	3421
15	limit 14 to yr ='2020 - 2021'	3288

Studies might also be excluded in the phase of full-text reading because: (a) full text was not available or (b) other reasons to be identified while conducting this phase. This review will not limit the inclusion of papers based on a specific population. Instead, it will include all studies focussed on individuals with overweight or obesity and/or infected by the SARS-CoV-2 virus. The PRISMA flow-chart diagram will be used to summarise the studies' selection processes, as seen in Figure 1.

## Data extraction and quality assessment

The following information will be retrieved from the papers: (A) Article information: date of publication, country of the first author; (B) Methods and data: type of study (cross-sectional, longitudinal, review or other), date of data collection, nature of data (quantitative or qualitative), instrument of data collection (questionnaire, interviews, other), sources of data (primary or secondary), relevant variables analysed (individuals infected/hospitalised/deceased with COVID-19 and with overweight or obesity), type of analysis, study setting, analytical unit; (C) Sample characteristics: sample size, gender of participants, age of participants, other socio-demographic and economic characteristics of the sample; and (D) Results: significant association variables identified, causality effect description, mechanisms of association description. Extracted data will be presented using the most suitable

means, depending on its nature (quantitative/qualitative) and the volume of information retrieved and analysed.

For quantitative studies a quality assessment tool will be used to attest the studies' overall quality regarding the study design, participation rate, sample representativeness and results such as the Effective Public Health Practice Project.[23] Qualitative studies' quality will be assessed using the tool described by Hawker et al.[24] Such tool uses a system that attribute a score from 10 (very poor) to 40 (good) to each paper according to its methodological rigour.[24] As with the screening process, quality assessment will be conducted by the two reviewers and any discrepancies will be resolved through discussion, with a third reviewer if necessary.

Evidence synthesis/analysis

Studies will be grouped according to their main outcome into four categories: I-obesity, II-COVID- 19, III-both or IV-other. The latter category (IV-other) refers to studies that might include obesity, COVID-19 together with other comorbidity, such as diabetes, hypertension or Chronic Obstructive Pulmonary Disease (COPD) and others. Afterwards quantitative studies will be compared using descriptive statistical analysis. For example, Chi-square tests will be used to compare sample sizes, gender of participants or other socioeconomic features between the groups of studies. If feasible, qualitative studies will be analysed using thematic analysis methods to synthesise
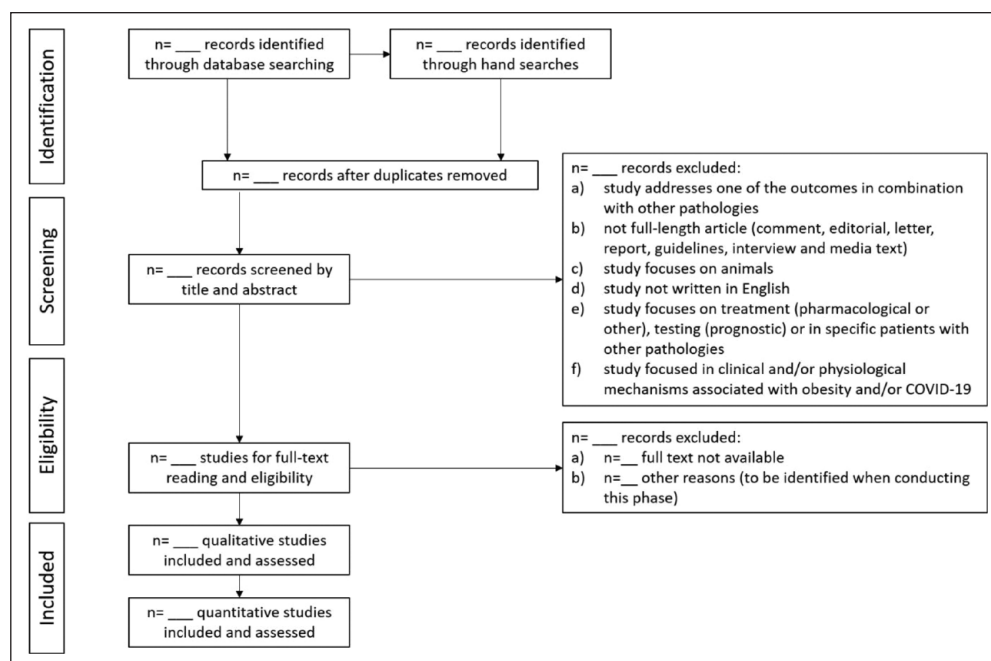
Figure 1. Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flowchart diagram of the protocol.

findings, and presented in summary tables, according to the studies' categories.

Meta-analysis will be performed using the most suitable methods. First the Funnel Plot and the respective Egger et al.'s[25] and Begg and Mazumdar's[26] test will be used to detect publication bias. Funnel Plots are pyramid-shaped graphs that use the standard error (or sample size) against mean effect of each study to identify if the published studies suffer from a positive bias. Second, the heterogeneity between the studies' results will be assessed by the Q test (χ^2 of Cochran) and I2 test (percentage of unexplained heterogeneity). This will determine if the heterogeneity was due to chance or the product of systematic differences. If the heterogeneity is high, the method of Random Effect Model (REM) will be used, and a sensitivity analysis will be computed to identify whether the source of heterogeneity is the design or study population. If results show a low heterogeneity, then a Fixed Effect Model (FEM) will be used. Either way, forest plots will be used to represent estimated results.

Discussion

To our knowledge, no other systematic review aims to identify the overlapping risk factors of obesity and COVID-19 from a syndemic perspective. The broad literature search strategy, conducted by experienced librarians in collaboration with the authors, enhances the chances of including the most relevant and up-to-date literature about this subject, while also assuring high quality.

We anticipate that it might be challenging to unequivocally establish the common risk factors, that is, to have evidence to support the link of a certain indicator with both obesity and COVID-19. This might lead to changes in the original protocol, but the methodological process and any potential changes will be documented in PROSPERO for transparency (registration number CRD4202125743319).

Knowing which common factors affect both obesity and COVID-19 improves understanding of the dynamic interactions between them. This improved understanding will enable better protection for the most vulnerable individuals and regions affected by the syndemic configurations of these diseases. For example, by aiding the development of more tailored public health policies and holistic interventions for tackling both diseases.

Author contributions

MP is the guarantor of the review, planned the systematic review, registered the protocol in PROSPERO and wrote the manuscript draft and final versions. SEM, JD and NZB critically reviewed the manuscript and provided input to the study. All authors have contributed significantly to the study and have read and approved the final version of the manuscript.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Ethics approval and consent to participate

This review does not require ethical approval once it uses secondary data.

Informed consent

The manuscript does not contain any individual person's data in any form.

Significance for public health

Neither COVID-19, nor obesity, affect all individuals, or territories, equally. Both health outcomes tend to hit more the most vulnerable and socially disadvantaged populations. Furthermore, there seems to be a higher prevalence of both obesity and COVID-19 in urban areas. The identification of risk factors common to obesity and COVID-19 will contribute to creating more efficient responses to future pandemics, more specifically in reducing deaths and serious illness among individuals with excess weight and obesity. Knowing which common factors affect both obesity and COVID-19 improves understanding of the dynamic interactions between them and enables a better protection of the most vulnerable individuals and regions affected by the syndemic configurations of these diseases. For example, by aiding the development of more tailored public health policies and holistic interventions for tackling both diseases. To our knowledge this is the first review based in a syndemic perspective of obesity and COVID-19.

Availability of data and materials

The datasets used and/or analysed during the current study are available from the corresponding author on reasonable request.

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