TITLE:

How complete is the reporting of the assumptions required for causal inference in population-based prevalence studies investigating health outcomes among people living near animal feeding operations? A scoping review protocol

REGISTRATION:

This protocol will be made available online at Systematic Reviews for Animals and Food (SYREAF) (www.syreaf.org).

AUTHORS AND CONTRIBUTIONS:

B. Alexander Fonseca Martinez conceived the idea and developed the protocol.

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AMENDMENTS:

None to report

SUPPORT: SOURCE, SPONSOR, AND ROLE OF FUNDER:

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REPORTING GUIDELINES:

No reporting guidelines specific to scoping review protocols are available, therefore, we used a combination of the PRISMA-P [1] and PRISMA-ScR [2] to report this protocol.

1. INTRODUCTION

1.1. RATIONALE

The association between Animal Feeding Operations (AFOs) and community member health continues to be a contentious topic in public health. Numerous studies have been conducted with the general question "Does exposure to animal feeding operations cause diseases such as upper- and lower-respiratory disease in community members?" Establishing a causal link would inform public policy and regulations about the locations of and emissions from AFOs. However, as with many environmental topics, establishing a causal link is difficult. The research studies used to investigate this topic are, of necessity, observational, because it would not be feasible or ethical to randomize people to potentially harmful exposures. Further, the health conditions investigated tend to be varied and often include chronic upper- and lower- respiratory diseases such as asthma. Because of the chronic nature of the diseases of interest, this body of work consists of many population-based prevalence studies that report a confounder-adjusted prevalence ratio as an effect measure. As prevalence may differ between two groups in a population because of differences in disease duration, disease incidence, or both, additional conditions are required for estimating a causal effect in prevalence studies [3]. The prevalence odds ratio (POR) is an estimate of the incidence rate ratio if:

1) the source population is in a steady state over the "study period";
2) the mean duration of the outcome is the same regardless of the exposure group, i.e., independent of exposure status;
3) the outcome cannot cause the exposure status in any way, i.e., no reverse causality;
4) the temporal directionality from the exposure to the outcome is sustainable, i.e., the exposure is antecedent to the outcome.

All these conditions are applied without the need to assume that the outcome or event of interest is rare (i.e., the prevalence of the disease is < 10%, regardless of exposure status).

Our group has already conducted several systematic reviews of the topic of the association between CAFOs and community. [4-6]The 2022 updated systematic review protocol for this review can be found at (https://syreaf.org/wp-content/uploads/2022/05/Draft_Protocol_CAFO-3.pdf). Those reviews aimed to summarize the effect of AFOs on community health by calculating a summary effect size. However, a consistent finding of those reviews was that it was not possible to calculate a summary effect size due to the heterogeneity of the study outcomes including the use of prevalence outcomes.

From the findings of those reviews arose a need for the current scoping review to assess how frequently population structural assumptions are reported (which would allow readers to know whether the prevalence rate could reasonably be interpreted as a measure of comparative incidence). Given the importance of this topic for public health, the frequent use of prevalence estimates in the body of research conducted, our aim for this scoping review was to determine how commonly the investigators using prevalence measures of health status discussed the population assumptions required for causal estimation.

1.2. OBJECTIVES

The objective of this scoping review is to examine the reporting of the relevant population structural assumptions necessary to make causal inference in prevalence studies investigating health in communities proximal to AFOs. The specific review question is: Which population assumptions are discussed in population-based prevalence studies investigating the effect of AFOs on the health of people living close to those facilities?

2. METHODS

2.1. ELIGIBILITY CRITERIA

Table 1 presents the explicit inclusion and exclusion criteria to be utilized in this scoping review. The literature considered in this study will be confined to prevalence studies. The classification of studies as prevalence studies will be based on the investigators' description of the design, or if none is provided, we will use the description provided in the Materials and Methods sections of the included articles to infer if the outcome measured was incident or prevalent. Investigators might also use the term cross-sectional study to describe prevalence studies.

Table 1: *Scoping review inclusion and exclusion criteria.*

	Inclusion criteria	**Exclusion criteria**
Population	• Humans living in communities near AFOs that might be described as industrial, large, concentrated, or other synonyms.	• Production systems that appear to be grass-based, nomadic, or confined smallholder operations based on the authors' description.

		• People who actively participate in livestock production and who are therefore occupationally exposed.
Exposure	• Any strategy used to measure exposure to AFOs such as odor intensity, levels of contaminants in the air, soil, or water, proximity measured by distance, or AFO animal density units.	• Models of AFOs exposure. The relevance of such models of exposure in real life is often unclear.
Outcome	• Outcomes of interest will be prevalant health state measured on humans. The outcome does not need to be a disease; for example, colonization or culture of bacteria from a human is an eligible outcome. •	• Self-reported health states, are not eligible unless the primary research authors provide evidence of appropriate psychometric properties (validity, reliability, responsiveness) and clinical interpretability (validated). • Outcomes that do not represent direct health measures in humans (e.g., antimicrobial resistance patterns in soil or water resources).
Geographical location/country of population:	• All geographic locations are eligible.	N/A
Publication type	• Prevalence studies (e.g., cross-sectional studies such as surveys).	• Ecological study designs, descriptive studies (e.g., case reports and series), or other analytic observational studies (e.g., cohort, incidence case control, or prevalence case-control studies). Prevalence case control studies are excluded as

		additional assumptions are required required.
Timeframe	• 1st October 2014 – 1st October 2023	N/A
Language	• Any language	N/A

2.2. INFORMATION SOURCES

Electronic searches of MEDLINE®(via Web of Science) (2014 – 2023), CABI Global Health (via Web of Science) (2014 –2023), Centre for Agricultural Biosciences (CAB) Abstracts (via Web of Science) (2014 – 2023), and Science Citation Index (via Web of Science) (2014 – 2023) will be conducted.

2.3. SEARCH STRATEGY

Table 2: Search strategy in MEDLINE®.

Search line	Search string
1	MH=animal husbandry
2	MH=housing, animal
3	MH=animal feed
4	TS=((animal$ OR bovine OR cow OR cows OR cattle OR beef OR pig OR pigs OR piglet* OR pork OR swine OR porcine OR hog OR hogs OR finisher* OR sheep OR murine OR lamb OR lambs OR poultry OR chicken* OR hen OR hens OR broiler* OR turkey* OR livestock OR "live stock" OR intensiv* OR industrial* OR confined OR confinement OR concentrated OR large-scale) NEAR/3 ("feed* facilit*" OR "feed* operation*")))
5	TS=(cafo OR cafos OR afo OR afos)
6	TS=("feed lot$" OR feedlot* OR feedyard* OR "feed yard*")
7	TS=((animal$ OR bovine OR cow OR cows OR cattle OR beef OR pig OR pigs OR piglet* OR pork OR swine OR porcine OR hog OR hogs OR finisher* OR sheep OR murine OR lamb OR lambs OR poultry OR chicken* OR hen OR hens OR broiler* OR turkey* OR livestock OR "live stock") NEAR/0 (operation* OR facility OR facilities OR confined OR confinement))
8	TS=((confined OR confinement) NEAR/2 (feed or feeding))
9	TS =((intensive or intensively or large-scale or industrial) NEAR/2 (farm or farms or farming or livestock or "live stock"))

10	TS=(("animal production" or "livestock production" or "live stock production") NEAR/0 (operation* OR facility OR facilities))
11	#10 OR #9 OR #8 OR #7 OR #6 OR #5 OR #4 OR #3 OR #2 OR #1
12	MH= (Environmental Health)
13	MH= (Environmental Exposure OR Inhalation Exposure)
14	MeSH HEADING: (environmental pollutants)
15	MeSH HEADING:exp: (air pollutants)
16	MH=(water pollutants)
17	MH=(Environmental Illness)
18	TS= ("public health*" OR "environmental health*" OR "environmental medicine" OR "community health*")
19	SO= ("public health*" OR "environmental health*" OR "environmental medicine" OR "community health*")
20	TS= ((community or communities or resident* or residence$ or neighbor* or neighbour* or family or families or local$ or populace$ or school$ or preschool* or highschool* or nursery or nurseries or playgroup* or "play group*" or kindergarten*) NEAR/4 (health or disease$ or impact* or effect$ or exposure$ or expose$ or outcome$ or symptom$ or risk$))
21	TS= ((public or community or communities or resident* or residence$ or living or neighbor* or neighbour* or family or families or local$ or population$ or populace or school$ or preschool* or highschool* or nursery or nurseries or playgroup* or "play group*" or kindergarten*) NEAR/4 (proximity or vicinity or location$ or located or nearby or "near" or close or closely))
22	#21 OR #20 OR #19 OR #18 OR #17 OR #16 OR #15 OR #14 OR #13 OR #12
23	#22 AND #11
24	MeSH HEADING:exp: (animals)
25	MeSH HEADING: (humans)
26	#24 NOT #25
27	#23 NOT #26

2.4. SELECTION OF SOURCES OF EVIDENCE

Study selection has three levels: a first level based on assessing information in titles and abstracts, and a second level based on assessing information from the full text of studies. Screening will be conducted using DistillerSR® (Evidence Partners, Ottawa, ON, Canada). Two independent reviewers will conduct the selection process (ST, BAFM) and disagreements will be resolved by consulting a third expert reviewer (AMOC).

In the first round of study selection screening, the abstracts and titles will be screened for eligibility using the following question:

- Does the title and/or abstract describe an observational study reporting the association between relevant AFOs and measures of health in surrounding-community members?

Each citation that passes level 1 screening will progress to level 2. During this full-text screening, any disagreements will be resolved by consensus between the two reviewers. A third reviewer will arbitrate when consensus cannot achieved (AO). For full-text screening the following questions will be used:

- Is the full text available in English?
- Does the study report a comparative association between a relevant animal feeding operation and measures of health in surrounding-community members?
- Does the study assess the relationship between outcome and exposure at the individual human level?
- Does the study report animal feeding operations that would be reasonably considered either large, concentrated or intensive by modern standards (not nomadic, smallholder or pastoral)?
- Does the study include more than one unit of measurement of exposure?
- Does the study include at least one human health outcome measured using either an eligible survey instrument, test, assay or diseases measure obtained from medical records?

Level 3

- Is the study a prevalence study i.e. measures a prevalence outcome.

2.5. DATA CHARTING PROCESS

A data collection form was developed within DistillerSR® to gather relevant data. The form underwent a pretest by two reviewers (BAFM and ST) across the 15 references included until 2014. Subsequently, two reviewers (BAFM and ST) will independently extract the data from all relevant articles utilizing this form. Any discrepancies will be resolved through discussion, and if consensus cannot be reached, a third reviewer will be consulted (AMOC). Information will solely be gathered from the articles themselves; no attempts will be made to contact study investigators for additional or confirmed data. Any missing data will be recorded as 'Not reported', and no assumptions will be made about the unreported information.

2.6. DATA ITEMS

For each relevant prevalence study identified, two reviewers (BAFM, ST) will extract the year(s) the study was conducted, the study population's location, the animal species at the AFOs, and a description of the human community (e.g., "neighboring residents of animal farms in the Dutch provinces of Noord-Brabant and Limburg").

The reviewers will determine if the manuscript used an adjustment method to obtain an estimate of the association between exposure and the prevalence outcome. Adjustment for confounders will be used as a metric that the authors are seeking to obtain a causal estimate which would reply to the population's assumptions.

We will also determine if the authors reported an effect measure that was not based on prevalence. For example, if any authors call the prevalence ratio an incidence density ratio (IDR) and discuss the structural assumptions necessary for such inference.

Further, we will assess if the authors reported or discussed any information regarding the four assumptions necessary for estimating IDR from a prevalence study.

1. Is the study population dynamic and in a steady state?
2. Is the mean duration of the outcome the same regardless of exposure group?
3. Is the study free of concerns due to reverse causality?
4. Is the temporal directionality from the exposure to the outcome continuous (exposure precedes the outcome)?

2.7. CRITICAL APPRAISAL OF INDIVIDUAL SOURCES OF EVIDENCE

As this is a scoping review, critical appraisal of the included studies will not be performed.

2.8. SYNTHESIS OF RESULTS

We will use descriptive statistics to summarize frequencies, of prevalence studies providing adjusted estimates and reporting of populations assumptions.

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