BMJ Open

Use of qualitative systems mapping and causal loop diagrams to understand food environments, diet and obesity: a scoping review protocol

Ivana Stankov, Rosie Mae Henson, Irene Headen, Jonathan Purtle, Brent A Langellier


ABSTRACT

Introduction Food systems can shape dietary behaviour and obesity outcomes in complex ways. Qualitative systems mapping using causal loop diagrams (CLDs) can depict how people understand the complex dynamics, inter-relationships and feedback characteristic of food systems in ways that can support policy planning and action. To date, there has been no attempt to review this literature. The objectives of this review are to scope the extent and nature of studies using qualitative systems mapping to facilitate the development of CLDs by stakeholders to understand food environments, including settings and populations represented, key findings and the methodological processes employed. It also seeks to identify gaps in knowledge and implications for policy and practice.

Methods and analysis This protocol describes a scoping review guided by the Joanna Briggs Institute manual, the framework by Khalil and colleagues and the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews checklist reporting guidelines. A search strategy was iteratively developed with two academic librarians and the research team. This strategy will be used to search six databases, including Ovid MEDLINE, Embase, EmCare, Web of Science, Scopus and ProQuest Central. Identified citations will be screened by two independent reviewers; first, by title and abstract, and then full-text articles to identify papers eligible for inclusion. The reference lists of included studies and relevant systematic reviews will be searched to identify other papers eligible for inclusion. Two reviewers will extract information from all included studies and summarise the findings descriptively and numerically.

Ethics and dissemination The scoping review will provide an overview of how CLDs developed by stakeholders have been elicited to understand food environments, diet and obesity, the insights gained and how the CLDs have been used. It will also highlight gaps in knowledge and implications for policy and practice. The review will be disseminated through publication in an academic journal and conference presentations.

INTRODUCTION

Food systems shape dietary behaviour and obesity outcomes in complex ways. Conceptual frameworks, including the foresight obesity systems map1 and Glanz’s model of community nutrition environments,2 have advanced understanding of unhealthy diet and obesity risk as a complex, multiscale problem influenced by individual, interpersonal and environmental factors.1,3 Food environments with limited or no access to healthy food (also referred to as food deserts) have been recognised as important drivers of unhealthy diet and obesity. Understanding the complexities of these food systems along with the forces that create and perpetuate dietary patterns and obesity is critical for identifying and designing effective policies.

Complexity theory can advance understanding of food systems by providing a lens and a set of tools for thinking about system

STRENGTHS AND LIMITATIONS OF THIS STUDY

⇒ This scoping review will be the first to scope the extent and nature of studies using qualitative causal loop diagrams that have been developed through stakeholder engagement to understand food environments, diet and obesity.

⇒ To ensure methodological rigour, the conduct of this review will be guided by the Joanna Briggs Institute manual and the framework by Khalil and colleagues, and the reporting guidelines informed by the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews checklist.

⇒ The search strategy was developed in consultation with two academic librarians and will span six databases: Ovid MEDLINE, Embase, EmCare, Web of Science, Scopus and ProQuest Central.

⇒ The review will descriptively and numerically summarise the study characteristics, methodological processes and key findings of included studies.

⇒ Given the review’s broad scope and an absence of quality appraisal metrics for systems mapping studies, the methodological quality of included studies will not be evaluated.

© Author(s) (or their employer(s)) 2023. Re-use permitted under CC BY-NC. No commercial re-use. See rights and permissions. Published by BMJ.

For numbered affiliations see end of article.

Correspondence to Dr Ivana Stankov; is379@drexel.edu

check for updates

BMJ Open: first published as 10.1136/bmjopen-2022-066875 on 17 March 2022. Downloaded from http://bmjopen.bmj.com/ on September 23, 2023 by guest. Protected by copyright.
structure, as well as the dynamic functioning of systems. As its central premise, complexity theory—which encompasses chaos theory and the complex adaptive systems framework—views systems as comprising highly interconnected components and feedback loops which may variously stabilise or amplify dynamics within the system, ultimately giving rise to non-linear and, at times, unexpected behaviour.\(^5\) \(^6\) For example, Dharmasena and Capps\(^7\) used survey data from four regions of the USA to estimate the impact of a sugar-sweetened beverage tax on household purchasing of various beverage categories. The authors found that while the tax would have the intended effect of reducing soft drinks consumption, the interdependencies in the system would likely result in compensatory and unintended consequences, including increased purchasing of fruit juices containing natural sugars as well as caffeinated drinks. There are two types of approaches employed within the field: qualitative systems modelling and qualitative methods, which are often used in conjunction to understand system behaviour.

Quantitative systems modelling focuses on exploring the dynamic functioning of systems using mathematical and simulation-based tools such as microsimulation, system dynamics (SD), agent-based modelling and network analysis.\(^5\) \(^8\) These modelling approaches also permit the exploration of diverse counterfactual scenarios relevant to policy development and planning. For example, they can be used by policymakers to assess the potential effectiveness of large-scale, population-level interventions that would otherwise be too expensive or impractical to test.\(^9\)

Qualitative methods, also referred to as systems thinking or systems mapping approaches, use causal loop diagrams (CLDs) to visually depict the structure of systems. Within these diagrams, directional arrows with polarity (both positive and negative) are used to represent the causal relationships between variables in the system, which collectively form reinforcing and balancing feedback loops which underpin the functioning of a system. CLDs are created by appealing to stakeholders’ mental models,\(^10\) \(^11\) which are idiosyncratic cognitive representations that encapsulate individuals’ internal representations of their external reality.\(^12\) \(^13\) They are shaped by beliefs, intuitions and societal contexts, and reflect an individual’s unique set of personal experiences, goals and values. Systems mapping approaches traditionally involve an iterative process of consensus building whereby skilled modellers facilitate participants’ engagement in a series of scripted activities designed to translate their mental models into CLDs that embody stakeholders’ collective understanding of the system.\(^14\) \(^15\) Group model building and community-based SD represent two such approaches,\(^16\) \(^17\) \(^18\) which may also involve quantitative model building and testing. Some examples of activities implemented as part of these approaches include: ‘graphs over time’—an activity whereby participants graph the trajectories of key system variables over time; ‘causal loop diagramming’—where participants create CLDs that underpin the dynamic behaviour depicted in the graphs over time exercise, as well as ‘action ideas’—an activity that seeks to understand the impact and feasibility of interventions or policies that may be used to intervene on the systems depicted in the CLD. While there exists a library of activities that may be used as part of the facilitation process,\(^19\) the scripts outlining the structure of activities are very general and need to be tailored to suit the purpose, participants, context and desired outcomes of each study. The knowledge captured using these approaches may enrich understanding of a particular problem, and can extend stakeholders’ own mental models and assist in their promotion of possible solutions.\(^8\) The information encoded in CLDs may also be used to inform quantitative systems modelling, including the development of SD and agent-based models.

CLDs of food systems, dietary behaviour and obesity are increasingly being used as tools to support knowledge creation, consensus building, intervention design and policymaking processes.\(^20\) \(^22\) Systems mapping approaches are especially important in attempts to understand inequities and issues that affect disadvantaged and minority communities whose insights and perspectives have been under-represented in policymaking processes.\(^23\) For example, CLDs have been used to better understand how the structure and functioning of systems can shape inequities in healthy eating\(^24\) and the strategies that could lead to more equitable access to healthy food.\(^25\)

Stakeholders have unique knowledge about the structure and functioning of food systems and the complex ways these systems shape dietary behaviour and obesity. As such, stakeholders should be engaged in meaningful efforts both to understand these systems and to make impactful change. To date, however, there has been no attempt to review qualitative systems mapping approaches that have been used to engage stakeholders in the development of the CLDs concerned with understanding food environments, dietary behaviour or obesity. This represents a barrier to advancement, as there does not exist a unified body of knowledge characterising how qualitative systems mapping has been applied in this space, including the methods and approaches used to enable the development of CLDs (including adaptations of existing scripted activities or newly created processes), the tools and processes used to evaluate their effects (on participants themselves or other outcomes), the contexts in which these studies were conducted and the participants engaged, the types of outcomes and knowledge generated and intended uses of the CLDs created. While several systematic reviews focused on applications of quantitative systems models have been published in this space, these reviews have all explicitly excluded studies focused on qualitative systems mapping approaches.\(^26\) \(^29\)

In fact, to the best of our knowledge, there exists only one review that broadly reviews the use of CLDs in public health research.\(^30\) The aim of our review therefore is to bridge this gap by scoping the literature using qualitative systems mapping approaches to guide stakeholders in the development of CLDs focused on food environments,
diet and obesity. By summarising the approaches used (including their limitations) and the knowledge gained across contexts, our scoping review may help inform the design of future qualitative systems mapping approaches, highlight gaps in the understanding of food systems and identify typologies of stakeholders whose perspectives are (and are not) represented.

**METHODS AND ANALYSIS**

Our scoping review will be conducted in accordance with the Joanna Briggs Institute scoping review manual and the methodological framework outlined by Khalil et al., which is based on, and extends, the widely cited works of Arksey and O’Malley, and Levac et al. Additionally, the Preferred Reporting Items for Systematic Reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) checklist will be used to ensure methodological rigour in the reporting of the review process and results. We will not evaluate the quality of included studies for two key reasons. First, to the best of our knowledge, there do not exist an agreed-on set of metrics for appraising the quality of systems mapping studies. Second, unlike systematic reviews which have a narrow focus, scoping reviews generally do not include an appraisal of methodological quality as they seek to provide a much broader overview or scope of the evidence.

We will follow the five-stage process described by Khalil et al. to conduct the scoping review. These stages include: (1) identifying the research question(s); (2) identification of relevant studies; (3) selection of studies to be included in the review; (4) reporting of extracted data; and (5) summarising and identifying the implications of findings.

**Stage 1: Identifying the research question(s)**
The objectives of this review are to: (a) scope the extent and nature of studies using qualitative systems mapping approaches to facilitate the development of CLDs by stakeholders to understand food environments, diet and obesity; (b) explore the methodological and evaluation processes employed, settings and populations represented and key findings identified; and (c) identify the intended use of the CLDs, gaps in knowledge and implications for policy and practice. To achieve these objectives, the working group identified a series of research questions:

1. How have qualitative systems mapping approaches that engage stakeholders been used to facilitate the creation of CLDs focused on understanding food environments, diet and obesity? (objectives a and b)
2. In which geographical and stakeholder contexts have the CLDs been created? (objectives a and b)
3. What are the variables and feedback loops represented in CLDs focused on food environments, diet and obesity? (objectives b and c)
4. What are the intended and/or reported uses of the CLDs created? (objectives a and c)
5. Which evaluation processes or tools have been employed to evaluate the implementation and/or outcomes of qualitative systems mapping approaches that engage stakeholders? (objectives a and b)
6. What limitations are described in the studies employing qualitative systems mapping to elicit CLDs focused on food environment, diet and obesity? (objective c)

**Stage 2: Identification of relevant studies**

Following consultation with two academic librarians experienced in health sciences research, six electronic databases were identified and will be searched from inception as part of the review. These include ProQuest Central, Scopus, Web of Science, MEDLINE, Embase and EmCare. The Population, Concept, Context (PCC) framework recommended by the Joanna Briggs Institute was used to iteratively guide formulation of the search strategy. An initial set of MeSH and keywords was identified for MEDLINE in consultation with the two librarians and through a review of relevant keywords from papers familiar to the research team. The search strategy was implemented in MEDLINE with a focus on keywords in the title and abstract to assess the volume of literature and the alignment between the identified studies and our research questions. The search terms and syntax were iteratively refined, and the results screened with each iteration. To help validate the search strategy, we additionally screened the citations to determine the extent to which relevant studies previously known to the research team were captured (including, for example, ).

**Stage 3: Selection of studies to be included in the review**

All studies captured in the six databases will be imported into EndNote where duplicate citations will be identified and removed. The remaining papers will be imported into Covidence, a review management platform used to facilitate citation screening and data extraction by multiple users.

**Inclusion and exclusion criteria**

We will use the below criteria to guide the screening process and to help determine eligibility for inclusion in the review. These criteria may be refined throughout the screening process as disagreements between reviewers arise. Studies will only be included if they meet all the inclusion criteria listed in **table 2** and excluded if they meet any one or more of the exclusion criteria.

To ensure a wide scope of the literature pertaining to this topic, we will not impose any restrictions on population, geography or publication year. As reflected in the
screening criteria, we will, however, restrict inclusion to studies focused on food environments, food access/availability/ supply/ (in)security and food purchasing from a consumer-based perspective (ie, studies concerned with consumer’s access to food). This is because studies focused on these contexts from a production perspective tend to deal with a broader set of macrolevel determinants including climate (eg, water scarcity, pests, heat) and other factors impacting the viability of farming and agricultural practices or land use, which have vastly different policy levers. For pragmatic reasons and to ensure cohesion in the information synthesised, we will not be including these types of studies.

### Citation screening

In accordance with the Joanna Briggs Institute guidelines, we will use a two-step process to evaluate studies for inclusion in our scoping review, including title and abstract, and subsequently full-text screening within Covidence. First, two reviewers will independently screen the titles and abstracts of all studies captured by the search strategy and decide whether they meet the inclusion criteria of the review. Citations that clearly do not meet eligibility for inclusion in the review will be excluded. Any disagreements related to eligibility will be resolved through discussion and refinement of the inclusion/exclusion criteria if appropriate. Second, we will retrieve the full-text manuscripts of potentially relevant papers; these will be screened by two reviewers. Studies that appear to meet all the review’s inclusion criteria will be discussed and any differences between reviewers reconciled by reflecting on the inclusion/exclusion criteria and through discussions with the working group. The reasons for excluding papers during the full-text screening phase will be recorded. While systematic reviews captured by the search strategy will not be included, these reviews and the reference lists of included studies will be screened to help identify other studies that may be eligible for inclusion. More broadly, the study selection process will be recorded in the PRISMA flow diagram.

### Stage 4: reporting of extracted data

The research team developed an extraction table to capture key information relevant to this review. As recommended by the Joanna Briggs Institute guidelines, we will extract information relevant to all aspects of the PCC framework, including Participants (and their characteristic), Concepts (the CLDs and the approaches used to create these) and Context (ie, aspects of the food system investigated, and the geographical locations explored). This information will be organised across three domains:

---

**Table 1** Syntax of search strategy in Ovid MEDLINE outlined in accordance with the PCC framework

<table>
<thead>
<tr>
<th>Population</th>
<th>Unrestricted</th>
</tr>
</thead>
<tbody>
<tr>
<td>Concept</td>
<td></td>
</tr>
<tr>
<td>1.</td>
<td>(causal adj2 (loop* or diagram* or map*)).ab,kf,ti.</td>
</tr>
<tr>
<td>2.</td>
<td>(mind adj2 (map*) or (system$1 adj2 (map* or think*)).ab,kf,ti.</td>
</tr>
<tr>
<td>3.</td>
<td>(participatory adj2 (model* or map*)).ab,kf,ti.</td>
</tr>
<tr>
<td>4.</td>
<td>Or/1–3</td>
</tr>
<tr>
<td>Context</td>
<td></td>
</tr>
<tr>
<td>5.</td>
<td>exp Food Supply/</td>
</tr>
<tr>
<td>6.</td>
<td>(food adj1 (system* or suppl* or secure* or insecure* or environment* or access* or availab* or desert* or swamp* or garden* or outlet* or store* or purchase* or consume* or intake*).ab,kf,ti.</td>
</tr>
<tr>
<td>7.</td>
<td>(foodscape* or obese/obesogenic environment* or nutrition* environment* or grocery store* or supermarket* or convenience store* or corner store* or fast food* or junk food* or restaurant or takeaway*).ab,kf,ti.</td>
</tr>
<tr>
<td>8.</td>
<td>(urban adj1 (agriculture or farm* or garden*) or community garden* or food production or home garden* or allotment garden* or collective garden*).ab,kf,ti.</td>
</tr>
<tr>
<td>9.</td>
<td>diet/</td>
</tr>
<tr>
<td>10.</td>
<td>obesity/</td>
</tr>
<tr>
<td>11.</td>
<td>((diet* or nutrition* or eat* or obese* or overweight or overeat* or overweight) or overfeed*).ab,kf,ti.</td>
</tr>
<tr>
<td>12.</td>
<td>Or/5–10</td>
</tr>
<tr>
<td>Combined</td>
<td>13. 4 AND 12</td>
</tr>
</tbody>
</table>

Ovid MEDLINE field alias definitions: ab, abstract; kf, keyword heading word; ti, title.

---

**Table 2** Inclusion and exclusion criteria

<table>
<thead>
<tr>
<th>Inclusion criteria</th>
<th>Exclusion criteria</th>
</tr>
</thead>
<tbody>
<tr>
<td>Aims or research questions focused on food environments, food access/ availability/ supply/ (in)security and food purchasing from a consumer-based perspective (including community/ urban gardens and farms), and/or dietary behaviour, obesity, and/or interventions/policymaking focused on targeting these contexts.</td>
<td>Aims or research questions focused on food environments, food access/ availability/ supply/ (in)security or food purchasing from an agricultural or production perspective (eg, those focused on animal farming, crop production, aquaculture, soil management, land use and the food-energy-water nexus).</td>
</tr>
<tr>
<td>Feature a causal loop diagram created by stakeholders using a qualitative systems mapping approach which is described.</td>
<td>Feature a diagram or theoretical model which does not conform to causal loop diagram conventions (ie, does not include at least one closed loop/ feedback loop, and directional causal links/ arrows with polarity).</td>
</tr>
<tr>
<td>Does not describe a qualitative systems mapping approach whereby stakeholders develop causal loop diagrams (eg, studies depicting the findings of a literature review in the form of a causal loop diagram, or simulation-based studies that feature a causal loop diagram but do not report the process that led to its creation).</td>
<td></td>
</tr>
<tr>
<td>Include original research published in English and in a peer-reviewed journal or as a peer-reviewed conference proceeding paper.</td>
<td>Written in language other than English.</td>
</tr>
<tr>
<td>Dissertations, systematic reviews, protocols and all non-peer-reviewed paper formats, including newspaper articles, working papers, preprints, magazines and commentaries.</td>
<td></td>
</tr>
</tbody>
</table>
(1) study characteristics, (2) process and (3) outputs. To capture relevant information relating to study characteristics, we will extract the title, publication year, study purpose (ie, aims and main research objectives/questions), geographical context (city/ town, county, state/ province/ territory, country, urbanicity), population context (entire population, subpopulation or within-population comparison) and reason(s)/ justification(s) for developing a CLD. In terms of process, we will extract the name of the qualitative mapping method or approach used to develop the CLD, information about the stakeholder recruitment strategy, types of stakeholders and facilitators included and the extent to which these represent populations most impacted by the issue/ topic studied, if workshops were used; the number of workshops, number of participants per workshop and stakeholder group, participant characteristics (eg, age, sex, race/ ethnicity), length of time of each workshop, facilitation process (ie, number and types of facilitation roles by stakeholder type) and facilitation activities. We will also extract outcome information from the CLD created, including number of variables and their names, number and names of loops described, number and names of action ideas identified, as well as an image of the CLD (for the appendix). Additionally, we will collect information about process outcomes including key limitations identified, tools or processes used for evaluation, methods of reporting back findings to participating stakeholders or the larger community and any information relating to the intended future use of the CLDs created.

This extraction table will be pilot tested in Covidence by two independent reviewers on five full-text articles. The extractions will be compared and iteratively adjusted to ensure that the appropriate information is consistently collected by both reviewers. The pilot testing will also provide an opportunity to expand or make any necessary adjustments to the categorical response categories available to the reviewers for a given variable. Once the extraction table has been finalised, two reviewers will extract the relevant information from all included studies within the Covidence platform.

Stage 5: summarising and identifying the implications of findings

The extracted information will be summarised to highlight the scope of the literature. We will use a combination of tables and figures, along with descriptive and numerical summaries to answer the research questions of the review. The main table will describe the characteristics of included studies, including author, year, city/ country/ urbanicity, study purpose, the number and characteristics of stakeholders engaged in the development of the CLDs and the qualitative processes used to facilitate the creation of the CLD focused on understanding food environments, diet and obesity. We will also include a figure showing the number of publications on this topic each year. Depending on the nature of the information collected, we will synthesise the variables that appear in the CLDs, and any interventions/policies discussed by consolidating variables that refer to the same concept under the same variable label. Through this process we will create a frequency plot which captures the number of times each variable appeared in a CLD across included studies. We will also synthesise the feedback loops represented across studies and group them by theme.

Patient and public involvement

Members of the public were not involved in the design or dissemination plans of this protocol.

Study status

As of December 2022, we are in the process of citation screening (stage 3). We anticipate the completion of stage 4 (reporting of the extracted data) at the end of January/early February 2023 and the completion of the review in March 2023.

ETHICS AND DISSEMINATION

The scoping review produced as part of this protocol will be used to provide an overview of the literature using CLDs, created using qualitative systems mapping approaches, to understand food environments, diet and obesity. It will also highlight gaps in knowledge and implications for policy and practice. As such, the review will be of interest to a range of stakeholders, including academic researchers, community advocates and policymakers seeking to understand and intervene on food systems. The findings of the scoping review will be disseminated primarily through publication in a peer-reviewed scientific journal and through conference presentations. This review will not require ethics approval as it will involve the screening and extraction of publicly available information.

Author affiliations

1Urban Health Collaborative, Drexel University, Philadelphia, Pennsylvania, USA
2UniSA Allied Health & Human Performance, University of South Australia, Adelaide, South Australia, Australia
3Department of Health Management and Policy, Drexel University, Philadelphia, Pennsylvania, USA
4Department of Community Health and Prevention, Drexel University, Philadelphia, Pennsylvania, USA
5Department of Public Health Policy and Management, New York University, New York, New York, USA

Twitter Ivana Stankov @ _ivana_stan

Acknowledgements The authors thank Ms Tracy Quixley for assistance in formulating the search strategy, as well as Assistant Professor MP Chaparro, Professor AV Diez Roux and Professor AH Auchincloss for thoughtful discussions and feedback.

Contributors IS and RMH developed the initial draft of the protocol. IS, RMH, IH, JP and BAL reviewed the initial draft and resubmission, provided feedback and approved the final manuscript submitted for publication.

Funding This work was supported by the National Institute on Minority Health and Health Disparities (NIMHD; grant number: R01MD015107).

Competing interests None declared.

Patient and public involvement Patients and/or the public were not involved in the design, or conduct, or reporting, or dissemination plans of this research.