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Understanding food insecurity in England: a systems-based approach

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ABSTRACT

Food insecurity is a significant public health issue in England. National and local policies have not been able to adequately address its complex drivers, in part due to unintended consequences that arise from the way these policies interact with the system. Through an integrative review and group model building workshops with 17 subject matter experts, we developed four causal loop diagrams (CLDs) to map the interactions between food insecurity drivers and major policies such as Universal Credit, Healthy Start, and School Meal programs. The CLDs reveal that while these policies and interventions are intended to reduce food insecurity, specific implementation issues can unintentionally perpetuate food insecurity. These unintended consequences result in a shift in responsibility between governments and communities, with a subsequent erosion of public trust in governments and policies. This study highlights the need for redistributing responsibility back to governments, rebuilding trust and mitigating unintended consequences of current policies. By addressing the feedback mechanisms driving food insecurity, this research provides actionable insights and policy recommendations for creating equitable and effective policies.

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1. Introduction

Food insecurity is a significant public health issue in England and globally (Food and Agriculture Organization 2024). The Food and Agriculture Organization (FAO)

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defines food insecurity as a lack of regular access to enough safe and nutritious food for normal growth, development, and an active and healthy life (Jenkins, Aliabadi, Vamos, Taylor-Robinson, Wickham, Millett, et al. 2021; Food and Agriculture Organization 2024). In England, household food insecurity has been exacerbated by the COVID-19 pandemic and the current cost-of-living crisis. Currently, 14% of UK households are experiencing moderate or severe food insecurity (Jenkins, Aliabadi, Vamos, Taylor-Robinson, Wickham, Millett, et al. 2021; The Food Foundation, 2024), including having smaller meals, skipping meals, not eating despite being hungry, or not eating for a whole day (The Food Foundation, 2024). Food-insecure households often rely on ultra-processed foods, and have diets low in fruits, vegetables, protein and fiber (Loopstra, Reeves, and Tarasuk 2019; Johnstone and Lonnie 2023). Less healthy food is cheaper than healthy food, leaving those from the poorest households with insufficient food or no option but to purchase energy-dense, nutrient-poor foods (Johnstone and Lonnie 2023). This increases the risk of obesity and other physical and mental health conditions (Johnstone and Lonnie 2023). Beyond its direct impact on diet-related poor health, food insecurity is a social determinant of health and a symptom of broader issues, such as poverty (Johnstone and Lonnie 2023).

Several policies and interventions targeting food insecurity have been implemented at local and national levels in England. In England, national government departments (e.g. Department for Work and Pensions, Department for Education and more) are responsible for developing policies, while local authorities, which depending on the area are represented by county councils, district councils, or single-tier councils (councils that combine county and district functions) are responsible for implementing the policies locally and providing additional local support to complement and enhance these policies based on local needs (Sosenko, Bramley, and Bhattacharjee 2022; Yang et al. 2022; Page and Marshall 2023; House of Commons Library 2025). Given that no single government level or department holds statutory responsibility for the management of food insecurity, which intersects multiple policy domains, such as housing, health, and education, policies targeting food insecurity are diverse and implemented at various government levels. (House of Commons Library 2025) These policies act either through the direct provision of food, or by targeting socio-economic drivers of food insecurity, such as welfare policies. Food aid, typically delivered at a local level by community groups or charity services (third sector) with some support from local authorities, provides food to those who cannot afford it, by providing access to food banks and food pantries. Universal Credit, administered by the national government, is the main social security policy in the UK and directly targets income, an important driver of food insecurity. However, the introduction of Universal Credit, originally intended to decrease government spending and combine benefits into a single policy, has been shown to inadvertently exacerbate food bank usage due to its complex administrative process, eligibility criteria, and delays in benefit payments (Jenkins, Aliabadi, Vamos, Taylor-Robinson, Wickham, Millett, et al. 2021; Sosenko, Bramley, and Bhattacharjee 2022). Similarly, other national government policies, such as Universal Free School Meals and Healthy Start vouchers, provide food to children from low-income households, but have also faced criticism for being short-term solutions with poor implementation and stringent eligibility thresholds (McFadden et al. 2015; Yang et al. 2022; Page and Marshall

2023). These implementation and calibration issues generate unintended consequences that can undermine otherwise well-intentioned policy efforts, ultimately contributing to ongoing food insecurity (Sterman 2006).

Systems thinking is a methodological approach that can be used to understand unintended consequences by identifying the underlying drivers of complex problems and mapping how they interact over time. Unintended consequences are outcomes that are not anticipated during policy design and implementation (Sterman 2006; Ford 2019) and can result in undesired outcomes. This occurs when policies fail to address the problem they were designed to address due to their interactions with factors within the system they operate (see Table 1 for full definitions) (Sterman 2006). Systems thinking can help identify and overcome unintended consequences by facilitating the identification and understanding of feedback loops created by these interactions (Sterman 2006; Ford 2019). Feedback loops are circular processes where the outcome of a cause can come back and impact the original cause (Béland and Schlager 2019). These loops can either weaken the initial effect (balancing loop) or amplify it (reinforcing loop) (Ford 2019), potentially leading to weakening intended effects or exacerbating unanticipated effects of policies (see Table 1 for full definition) (Sterman 2006; Ford 2019). Finally, systems thinking focuses on capturing delayed effects of policy actions, where their impacts may not be immediately realized and can accumulate over time, leading to delayed or inadequate responses (Sterman 2006). Thus, a systems thinking approach can improve our understanding of food insecurity and current policies by revealing complex interactions between their drivers, feedback loops, and delays. This improved understanding can help inform more effective policy solutions (Sterman 2006; Király and Miskolczi 2019; Sosenko et al. 2019).

Table 1. Glossary of common system thinking concepts.

Term	Definition
Unintended consequences	Outcomes that were not anticipated or planned for when an action or policy was implemented (Ford 2019)
Systems thinking	A methodology which focuses on understanding complex systems and how they change over time. It aims to understand the interactions and relationships between the many interconnected components and how these interactions generate the system's form and behavior (Sterman 2006; Ford 2019; Darabi and Hosseinichimeh 2020; Farrell et al. 2021)
Causal loop diagram	A qualitative tool often used in systems thinking which provides a visual representation of the variables and interconnections within a system. These interconnections form feedback loops that drive system behavior (Baker et al. 2019; Ford 2019; Muir et al. 2023)
Group model building	A participatory approach that involves stakeholders in the development of conceptual models such as casual loop diagrams to understand complex systems. This process uses a collaborative practice to engage with participants to contribute their knowledge and expertise to identify key variables, relationships and feedback loops (Ford 2019; Király and Miskolczi 2019)
Scripts	A structured exercises designed to facilitate interactions amongst participants during group model building workshops (Mui et al. 2019)
Balancing feedback loop	A type of feedback loop which counteracts an initial change in a system (Ford 2019)
Reinforcing feedback loop	A type of feedback loop loops that amplifies or accelerates change in the same direction as the initial change (Ford 2019; Quinteros-Reyes et al. 2024).

In England, there is a large evidence base regarding the drivers of food insecurity, yet how these drivers interact with each other and how this might be used to inform more successful policies remains unclear (Sosenko, Bramley, and Bhattacharjee 2022; Lambie-Mumford, Loopstra, and Okell 2023). Understanding these interactions is essential for designing policies that address food insecurity more effectively. In this paper we aim to develop a systems-based conceptual framework of household food insecurity in England to understand how its drivers interact, using an integrative literature review and group model building (GMB) workshops with experts.

2. Methods

We conducted an integrative review and GMB workshops with experts to develop a causal loop diagram (CLD). A CLD is a qualitative tool that visually demonstrates variables and their interconnections, forming feedback loops that drive system behavior (Ford 2019). An integrative review is a literature review approach which synthesizes findings from diverse study designs and evidence to develop a comprehensive understanding of a topic (Whittemore and Knafl 2005; Schick-Makaroff et al. 2016). The GMB workshops facilitated insight from experts on the complex interactions within the system to aid CLD development. GMB is a participatory systems thinking approach that engages stakeholders in developing conceptual models, such as CLDs to understand complex systems (Ford 2019; Király and Miskolczi 2019). The final CLD mapped the interactions of food insecurity drivers with major food insecurity policies. Key systems thinking concepts are defined in Table 1.

2.1. Integrative review and CLD development

We conducted an integrative review to identify key drivers of food insecurity in high-income countries. First, we conducted an exploratory search to identify relevant conceptual frameworks and reviews across four electronic databases: MEDLINE, EMBASE, Google Scholar and Scopus. The search strategy included terms and synonyms of food insecurity/security and frameworks or reviews (available in the Supplementary Material Figure 1). Additionally, we conducted targeted searches on international organization websites (e.g. FAO, WHO) and relevant charity or government policy documents. Full papers and webpages were screened by CB, and those that met the inclusion criteria (Table 2) were read in full. As frameworks were identified, drivers including individual, household, community-level, national-level, economic, and socio-cultural factors, were extracted by CB into an Excel spreadsheet. We continued to review search results and extract drivers until saturation.

We followed Kim's 'Guidelines for Drawing Causal Loop Diagrams', which provide standardized conventions for clearly naming variables, identifying link polarity, and developing feedback loops from review findings, to create the CLD using Kumu.io (Kim 1992). Extracted drivers were used to generate initial names for CLD variables. Links between variables were added to represent direct impacts on or by food insecurity, as suggested by the frameworks, forming causal links and feedback loops.

Table 2. Inclusion criteria for studies included in the integrative review.

Domain	Inclusion
Language	English
Location	High-income countries (The World Bank 2024)
Population	Healthy participants of all ages
Outcome/Exposure	Food insecurity
Study design	Systematic reviews, narrative reviews and studies (qualitative, quantitative or mixed methods) that developed conceptual frameworks

Emerging feedback loops converged into a CLD, which was further refined and validated through additional literature searches (Supplementary Material).

2.2. Subject matter expert workshops

We conducted two separate online workshops via Zoom with 17 experts, out of 25 experts invited, to validate the preliminary CLD. Experts included academics and researchers from English Higher Education Institutions ($n = 15$, 11 early career researchers, 4 senior researchers/research staff), representatives of national food insecurity charities ($n = 1$) and members from English local government ($n = 1$). No participants dropped out during the sessions. Experts were identified through authors of relevant published literature related to food insecurity in England, specific organization webpages and using snowballing techniques. Experts were emailed by CB, recruited in February 2024 and invited to attend workshops in April 2024.

Both workshops lasted two hours each and followed a GMB approach, a collaborative practice to engage participants in identifying causal relationships through structured scripts (Király and Miskolczi 2019). Scripts (Andersen et al. 2022), are specific exercises used to facilitate GMB workshops, designed to elicit the sharing of knowledge (Mui et al. 2019). In each workshop, participants were divided into two breakout groups during the Structure Elicitation activity (see Table 3 for full workshop activities) which were facilitated by CB, supported by PS, and followed the same facilitation structure (see Table 3 for workshop activities and Supplementary Material Table 2 and 3 for full facilitation manual). The workshop followed methods similar to previous studies (Karapici and Cummins 2024). All workshops and breakout sessions were recorded with participant consent.

2.3. CLD synthesis

After the workshops, CB reviewed workshop recordings and made detailed notes. The notes yielded an additional artifact, which is a product produced or collected throughout the GMB workshop that can be used as an input in creating a CLD (Quinteros-Reyes et al. 2024). All artifacts from the workshops were collated to create four CLDs, one for each breakout group, capturing information shared during the workshops (Figure 1). These were then reviewed by both facilitators to ensure completeness (Quinteros-Reyes et al. 2024).

The four workshop-generated CLDs underwent synthesis, an iterative process of combining and aggregating individual CLDs into a single or multiple CLDs (Quinteros-Reyes et al. 2024). We cross-referenced workshop generated CLDs with

Table 3. Activities included in the GMB workshops.

Activity	Script	Description
Introduction	n/a	Presentation of systems thinking notions and preliminary CLD.
Variable elicitation	Graphs over time	Using the online platform Miro, experts were prompted to think of a variable that is impacted by food insecurity or impacts food insecurity. They were then prompted to draw a graph of how this has changed over time.
Structure elicitation	Causal loop mapping in small groups	Experts were divided into two breakout groups. Facilitator introduced selected feedback loops and asked participants to add relevant variables and describe the relationships between them. Facilitators updated the CLD on Kumu.io live during the workshop.

the preliminary CLD created from the integrative review to ensure all relevant variables and feedback loops were included. We also conducted targeted searches for additional literature to validate any new links that emerged (Supplementary Material Table 1). The synthesizing process focused on identifying feedback loops related to food insecurity policies and resulted in four final synthesized CLDs, each focusing on a different policy or intervention at either national or local authority level.

3. Results

3.1. Integrative review results

Seven published studies and one grey literature report were included in the integrative review. Five studies developed a framework to conceptualize the variables which impact food insecurity (Alaimo 2005; Huberland, Semaille, and Kacenelenbogen 2019; Piaskoski, Reilly, and Gilliland 2020; Simelane and Worth 2020; Beacom et al. 2021). Study designs varied, including 1 systematic review (Piaskoski, Reilly, and Gilliland 2020), 1 rapid review (Aceves-Martins et al. 2018), 1 scoping review (Bartelmeß et al. 2024), 2 theoretical papers (Alaimo 2005; Simelane and Worth 2020) and 2 studies that used interviews to develop their frameworks (Huberland, Semaille, and Kacenelenbogen 2019; Beacom et al. 2021). The grey literature report and rapid review were specific to the UK context (Aceves-Martins Mccf 2018; Sosenko et al. 2019). The remaining studies focused on other high-income countries (Alaimo 2005; Huberland, Semaille, and Kacenelenbogen 2019; Piaskoski, Reilly, and Gilliland 2020Simelane and Worth 2020). The preliminary CLD based on the review is available in the Supplementary Material (Figure 2).

3.2. CLD overview

Synthesized CLDs illustrate the dynamics of food insecurity and relevant policies in England (Figures 2, 3, 4, and 5). Feedback loops are noted using 'B' for balancing feedback loops, which stabilize a system by counteracting changes, and 'R' for reinforcing feedback loops, which perpetuate change in the same direction as the initial change (Ford 2019; Quinteros-Reyes et al. 2024).

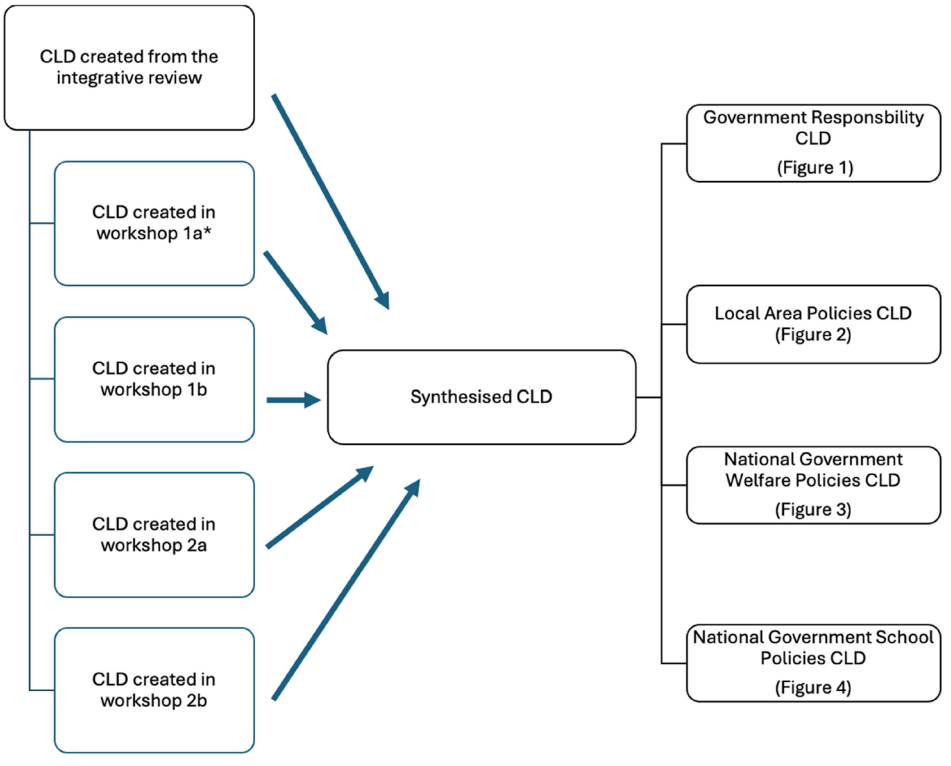

Figure 1. Overview of causal loop diagrams (CLDs) synthesis process.
*Workshop a/b indicates the same workshop, but different breakout groups

3.3. Government responsibility CLD

The Government Responsibility CLD (Figure 2) illustrates how responsibility for managing food insecurity is dispersed between national government, local authority and the local community. Although there is no direct legal obligation to manage food insecurity in the UK, experts used the term 'responsibility' to describe the roles and expectations held by different groups to implement and uphold national and local policies and actions aimed at reducing food insecurity (Figure 2 loop B2) (Williams et al. 2016; Milbourne 2024). Due to England's government structure, while local authorities deliver services locally, the national government retains primary decision-making powers. The introduction of national welfare policies (such as England's benefits system, Universal Credit) and the Localism Act in 2011 aimed to shift decision-making responsibilities for certain public services from national government to local authorities. As local authorities take on these responsibilities, assumed national government responsibility decreases (Figure 2 loop R2) (Williams et al. 2016; Papargyropoulou et al. 2024). However, while the Localism Act devolved responsibilities, it did not transfer equivalent long-term funding or powers to local authorities. These changes resulted in an increased reliance on local authorities to respond to food insecurity, and while they also left them with short-term, ring-fenced funding allocations which limited

Figure 2. Government responsibility CLD.
Synthesized causal loop diagram of how food insecurity policies, responsibilities and trust exist in England. Red arrows indicate negative (−) polarity. Blue arrows indicate positive (+) polarity. B1, B2, B3, B4 and B4 indicate balancing loops. R1, R2, and R3 indicate reinforcing feedback loops. Additional information about this CLD is publicly available at: https://kumu.io/cbijlani/policy-cld-479b.

their capacity to provide adequate support against food insecurity (Figure 2 loop B1) (Localism Act 2011; Smith and Thompson 2023). Similarly, when local authorities fail to provide adequate support, community groups step in to respond to food insecurity (Figure 2 loop R3). These groups provide wraparound support-assistance created to fill in gaps and address unmet needs, such as well-being services, debt advice, and other social support (Sustain, 2024) (Figure 2 loop B3), thereby reducing local authorities' responsibility to manage food insecurity (Figure 2 loops R3) (Williams et al. 2016; Lambie-Mumford 2019; Smith and Thompson 2023).

During the workshops, trust emerged as a key theme. Participants described a perception that the 'state' (national government) is retreating from its role as a provider of a social safety net, resulting in reduced community belief that the government will meet their needs. This was articulated as a loss in the government's reliability and willingness to support individuals experiencing food insecurity. As trust in government declines, community members increasingly look internally for support, leading to greater trust within the community itself and a higher demand for wraparound support from non-statutory services (Figure 2 loop B5/R1) (Williams et al. 2016; Lambie-Mumford 2019; Turcu and Rotolo 2022; Papargyropoulou et al.

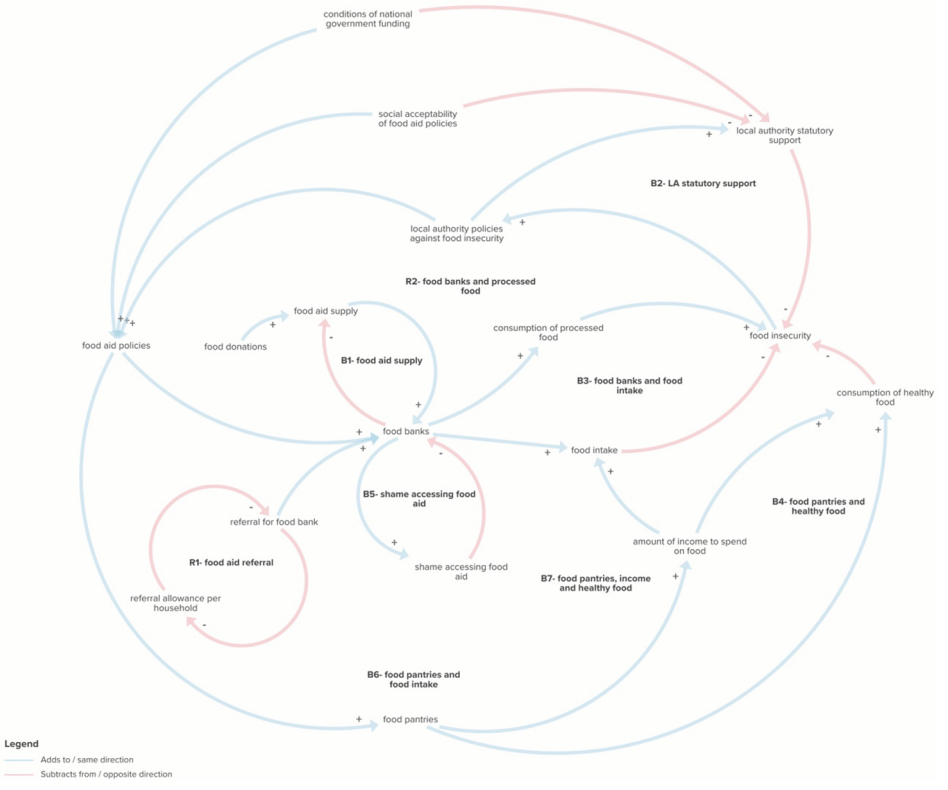

Figure 3. Local Area policies CLD.
Synthesized causal loop diagram of local area food insecurity policies. Red arrows indicate negative (–) polarity. Blue arrows indicate positive (+) polarity. B1–sB7 indicate balancing loops. R1 and R2 indicate reinforcing feedback loops. Additional information about this CLD is publicly available at: https://kumu.io/cbijlani/local-area-policies

2024). However, this shift presents challenges as community support relies on volunteers and typically lacks sustainable funding. This can drain community capacity to effectively respond to food insecurity (Figure 2 loop B4).

3.4. Local area policies CLD

The Local Area Policy CLD (Figure 3) focuses on local-level response to food insecurity, primarily through food aid or statutory support policies (Page and Marshall 2023; Sustain, 2024). Food banks are the most common form of food aid and increase food intake through short-term emergency food provision to households (Figure 3 loop B3) (Purdam, Garratt, and Esmail 2016; Thompson, Smith, and Cummins 2018; Smith and Thompson 2023). Although, food banks offer essential support, many provide highly processed food, due to their lower cost and long shelf life which inadvertently reinforces food insecurity (Figure 3 loop R2) (Garratt 2017; Thompson, Smith, and Cummins 2018; Brown, Mills, and Albani 2022). Food banks often rely on donations, leading to inconsistent food supplies, varying food quality,

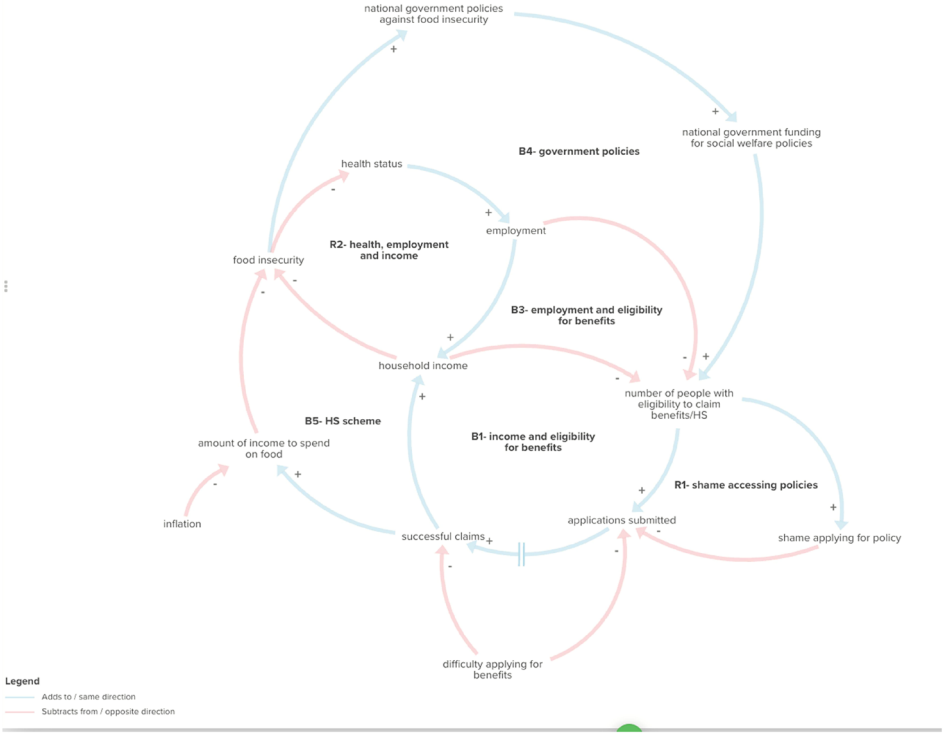

Figure 4. National government welfare polices CLD.
Synthesized causal loop diagram of national welfare policies in England. Red arrows indicate negative (–) polarity. Blue arrows indicate positive (+) polarity. B1–B4 indicate balancing loops. R1 indicates a reinforcing feedback loop. Arrows that are intersected by parallel lines indicate a 'time delay', where the effect of one variable on another does not occur immediately (Whittemore and Knafl 2005). Additional information about this CLD is publicly available at: https://kumu.io/cbijlani/national-government-policies#untitled-map

and lack of culturally appropriate foods (Figure 3 loop B1) (Garratt 2017; Thompson, Smith, and Cummins 2018; Brown, Mills, and Albani 2022; Smith and Thompson 2023; Meadows et al. 2024). Food banks also require a referral and have referral limits, further restricting their use (Figure 3 loop R1) (Purdam, Garratt, and Esmail 2016; Garratt 2017; Thompson, Smith, and Cummins 2018; Smith and Thompson 2023). Some food bank users experience stigma when accessing food aid, which can deter them from using food banks (Figure 3 loop B5) (Purdam, Garratt, and Esmail 2016; Puddephatt et al. 2020; Smith and Thompson 2023).

Experts highlighted the distinction between food pantries and food banks. Food pantries allow households to purchase low-cost, often surplus food items by paying a small donation or fee (Purcell, Tweedie, and Perry 2023; Citizens Advice 2024). Some food pantries stock fresh and frozen fruit and vegetables, which can lead to increased consumption of healthy food (Figure 3 loop B4) (Purcell, Tweedie, and Perry 2023). By providing lower-cost options, food pantries help households allocate more of their income to food that meets their personal and cultural needs, or healthier more expensive food (Figure 3 loop B6 and B7) (Purdam, Garratt, and Esmail 2016; Puddephatt et al. 2020; Thomas et al. 2022; Meadows et al. 2024).

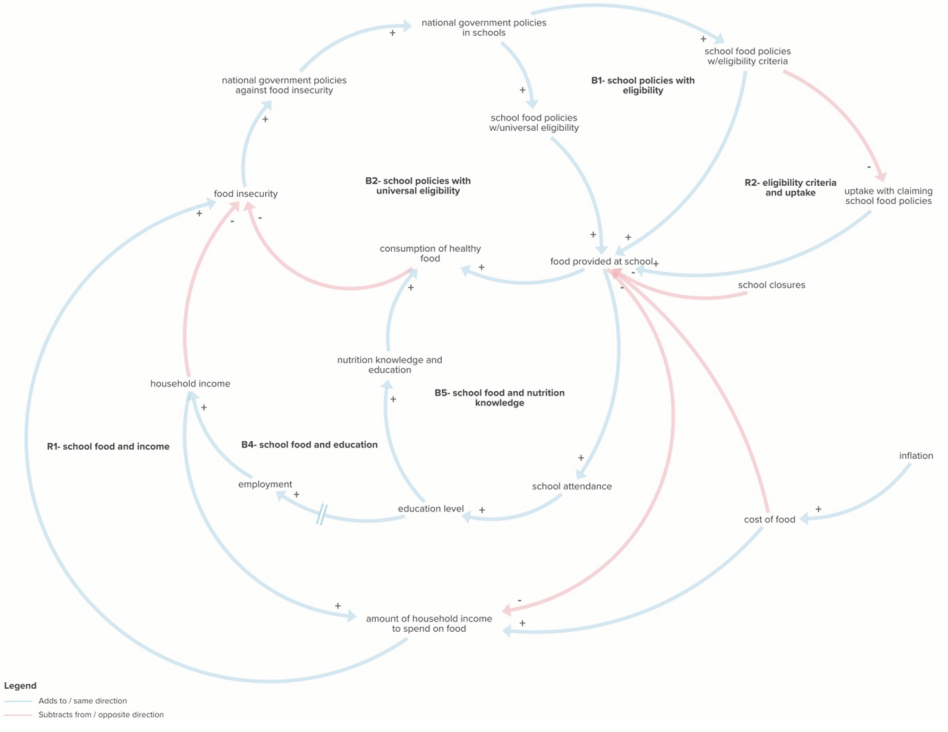

Figure 5. National government school policies CLD.
Synthesized causal loop diagram of how school food policies in England. Red arrows indicate negative (–) polarity. Blue arrows indicate positive (+) polarity. B1- B5 indicate balancing loops. R1 indicates a reinforcing feedback loop. Arrows that are intersected by parallel lines indicate a 'time delay', where the effect of one variable on another does not occur immediately (Whittemore and Knafl 2005). Additional information about this CLD is publicly available at: https://kumu.io/cbijlani/school-food-policies-29ad.

Local authorities can address food insecurity through statutory support policies-legally mandated government-led interventions such as welfare and social care policies designed to target underlying factors such as poverty (Figure 3 loop B2) (Loopstra et al. 2018; Page and Marshall 2023; Sustain, 2024). However, experts noted that the social acceptability of food aid and funding constraints, including restrictions on what national funding can be used for and an overall reduction in available funding for local authority services, often leads local authorities to prioritize food aid over investing in statutory support policies (Smith and Thompson 2023).

3.5. National government welfare policies CLD

The National Government Welfare Policies CLD (Figure 4) illustrates how national government-funded welfare policies, Universal Credit and Healthy Start, impact food insecurity by targeting some of its key economic drivers. Universal Credit combines several benefits into a single scheme to provide income to eligible households (Figure 4 loop B1) (Jenkins, Aliabadi, Vamos, Taylor-Robinson, Wickham, Millett, et al. 2021; Sosenko, Bramley, and Bhattacharjee 2022). Healthy Start provides food vouchers to eligible households to purchase fruits and vegetables, infant formula or milk

(Figure 4 loop B5). Both policies (Figure 4 loop B4) are designed to support vulnerable households but have strict and conditional eligibility criteria, meaning many households experiencing poverty are unable to access them (Jenkins, Aliabadi, Vamos, Taylor-Robinson, Wickham, Millett, et al. 2021; Sosenko, Bramley, and Bhattacharjee 2022; Smith and Thompson 2023; Barrett, Spires, and Vogel 2024). Eligible households often encounter difficulties with the complex application processes for these policies, resulting in incorrect applications and households missing out on benefits. Even for those who successfully apply and receive benefits, the amount provided is not in line with inflation, limiting the policy's effectiveness in meeting their needs (The Food Foundation. Food Insecurity in Households in Receipt of Benefits 2022).

Food insecurity and associated health status can result in unemployment and subsequently lower household income, further exacerbating food insecurity (Figure 4 loop R2). Although those facing unemployment are eligible to apply for welfare benefits, delays with processing can leave households temporarily without income (Figure 4 loop B3) (Purdam, Garratt, and Esmail 2016; Puddephatt et al. 2020; Sosenko, Bramley, and Bhattacharjee 2022). Benefit sanctions, which reduce or halt payments when the state believes specific conditions have not been met, have also been linked to the rise in food bank usage (Loopstra et al. 2018). Experts highlighted how local authority support focuses on food relief, with community wraparound support (Figure 2. Government Responsibility CLD) are evolving to assist individuals facing benefit sanctions (Loopstra et al. 2018; Beck and Gwilym 2023; Milbourne 2024).

3.6. National government school policies CLD

The National Government School Policies CLD (Figure 5) focuses on the UK school meal policies that provide children with meals at school. These policies can be universally available or based on eligibility criteria and depend on geographic location, both designed to increase access to food at school (Figure 5 loops B1 and B2). However, strict eligibility criteria and stigma can limit access and reduce uptake of the school meal scheme (Figure 5 loop R2) (Parnham et al. 2020; Yang et al. 2022; Parnham, Millett, and Vamos 2023).

School meal policies can also reduce food insecurity through other mechanisms. For example, they allow households to have more available income to spend on food (Figure 5 loop R1). They also contribute to higher rates of school attendance, resulting in increased nutrition knowledge, which may contribute to children and households consuming more healthy food (Figure 5 loop B5) (Taylor 2018; Cohen et al. 2021; Parnham et al. 2022; Parnham, Millett, and Vamos 2023). School attendance also positively impacts educational outcomes and can have long-term impacts on employment opportunities and household income, reducing the risk of food insecurity (Figure 5 loop B4) (Taylor 2018; Chambers et al. 2020; Cohen et al. 2021).

Despite these benefits, school meal policies have inherent limitations that undermine their effectiveness. As noted by experts, rising food costs affect both quality and quantity of school meals (Jessiman et al. 2023; Spence et al. 2024). Tight profit margins for catering companies exacerbate these issues, leading to further declines in food quality and availability (Jessiman et al. 2023; Murphy et al. 2024). Furthermore, school meals are accessible only when schools are open, leaving children without

access during closures or holidays ('holiday hunger'). Although there are attempts at providing food for children outside of term time, this is varies between areas across the UK (Graham et al. 2016; Parnham et al. 2020; Stretesky et al. 2020).

4. Discussion

Using a systems-thinking approach, this study combined an integrative review and GMB workshops to develop four CLDs that explore the interactions between drivers of food insecurity and related policies in England. The findings reveal that responsibility for responding to food insecurity is unevenly distributed across national government, local authorities and community groups, which is further reinforced by government mistrust. Our findings highlight unintended consequences of well-meaning policies, whose current implementation inadvertently exacerbates food insecurity through feedback mechanisms (a summary table can be found in Table 4).

Our study illustrates how the burden for managing food insecurity shifts from national government to local authorities, and community groups. This shift represents a system archetype, i.e. a recurring pattern of behavior that can reveal system structures that drive a problem (Kim 2000). In our CLD, the 'Shifting the Burden' archetype reflects the growing reliance on limited, often volunteer-led, community wraparound support as government involvement decreases (Power et al. 2017; Blake 2019; Strong 2020; Smith and Thompson 2023). While this reliance may address immediate needs, it risks further entrenching food insecurity by relying on temporary solutions without sufficient resources. Additionally, our findings highlighted

Table 4. Summary of CLD insights, systems thinking insights, and policy recommendations.

CLD Title	Insights provided from using a systems thinking approach	Policy recommendation
Government responsibility CLD	Using a systems thinking approach, the CLD highlights the unintended consequences of community wraparound support (loop B3) filling the gap left by reduced national (loop R2) and local government (loop R3) responsibility. This dynamic results in declining trust in government (loop B5) and increased trust in the local community (loop R1).	Alongside existing community support, the responsibility for managing food insecurity should shift toward national and local policies which address societal inequalities and focus on rebuilding trust in government.
Local area policies CLD	The CLD highlights how food banks (loop B3) can unintentionally reinforce food insecurity by becoming embedded in the local food system. Additionally, it shows food pantries enable households to purchase more food (loop B7) and support healthier food choices (loop B4).	Local authorities should support food banks to transition toward a food pantry model and consider 'cash-first' approaches.
National Government Welfare Policies CLD	The CLD shows how national welfare policies create reinforcing loops (loops R1 and B5) that exacerbate food insecurity through complex eligibility criteria and delays. Delays between application and benefit receipt create immediate food insecurity.	Streamline application processes for Universal Credit and Healthy Start and reduce delays between application and benefit disbursement.
National Government School Policies CLD	The CLD reveals how school meal policies can have long-term benefits by improving school attendance and future employment (loop B4), though this is undermined by eligibility criteria (loop R2), which create stigma and discourage uptake, reinforcing food insecurity.	Move toward an 'auto-enrolment' policy to reduce stigma and ensure public health spending supports expanding eligibility criteria

community trust in government as an important driver of food insecurity policy success. Previous literature has advocated for shifting responsibility back to government (Dowler and O'Connor 2012; Blake 2019; Turcu and Rotolo 2022), however, our findings suggest that new policies may be ineffective if trust in government is eroded. While community-level support is crucial, it cannot address the major societal inequalities that are the consequence of government policies and so are best corrected with a fairer distribution of resources, which is primarily controlled by national and local government (Dowler and O'Connor 2012).

This study confirmed several previously identified unintended effects of food banks (Purdam, Garratt, and Esmail 2016; Garratt 2017; Loopstra 2018), but also highlighted that these effects are exacerbated through feedback mechanisms. In contrast, food pantries may offer an alternative to food banks. Food pantries are varied and there is no universal way in which they operate, resulting in limited literature assessing their effectiveness (Nayak and Hartwell 2023). However, our results suggest that food pantries help stretch household budgets, enabling individuals to buy healthier food and meet their dietary needs in alignment with their cultural and personal preferences (Nayak and Hartwell 2023), but do continue to rely on the voluntary sector. Local authorities may prioritize food aid, as food banks have become part of the local food environment. However, they have limited effectiveness in tackling the underlying drivers of food insecurity, such as poverty. Our findings suggest that local authorities support food banks to transition toward a food pantry model which should be complemented by stronger government support to ensure long-term sustainability rather than relying on the voluntary sector, Additionally, local authorities should consider 'cash-first' approaches, as recommended by Sustain and the UK Independent Food Aid Providers (IFAN), which directly address poverty by increasing household income (Independent Food Aid Network 2024; Sustain, 2024).

Our study reveals the shared unintended consequences of national welfare policies such as Universal Credit and Healthy Start (Jenkins, Aliabadi, Vamos, Taylor-Robinson, Wickham, Millett, et al. 2021; Barrett, Spires, and Vogel 2024). Strict eligibility criteria and complex application processes limit access and create a reinforcing cycle that exacerbates food insecurity (Loopstra et al. 2018; Puddephatt et al. 2020; The Food Foundation. Food Insecurity in Households in Receipt of Benefits 2022; Barrett, Spires, and Vogel 2024). Our study highlights how delays in benefit disbursement results in further food insecurity, particularly for households that may already be impacted by poor health due to food insecurity and employment (Purdam, Garratt, and Esmail 2016; Sosenko, Bramley, and Bhattacharjee 2022). To address these consequences, streamlining the application processes for Universal Credit and Healthy Start is crucial (Barrett, Spires, and Vogel 2024). Additionally, reducing the delays between a successful application and receiving benefits can ensure that the most vulnerable households receive support in a timely manner.

Our study aligns with existing research on the benefits of school meal policies such as improved attendance and educational attainment (Taylor 2018; Chambers et al. 2020; Cohen et al. 2021; Parnham, Millett, and Vamos 2023), while providing additional insights from a systems-thinking approach. School meal policies have long-term potential to improve employment opportunities, although evidence in this area is limited due to the challenges of longitudinal research (Nelson 2013). School

meal policies with eligibility criteria have been criticized for restricting access and discouraging uptake due to associated stigma, worsening food insecurity (Parnham et al. 2020; Yang et al. 2022; Parnham, Millett, and Vamos 2023). Researchers have identified school meals as healthier than packed lunches (Parnham et al. 2022); however, our study highlights that since the COVID-19 pandemic, there has been an increase in the cost of food resulting in a decrease in quality and portion size of school food (Jessiman et al. 2023; Parnham, Millett, and Vamos 2023). Many local authorities are moving toward an 'auto-enrolment' policy for school meals as a way to combat low uptake due to stigma, aligning with recommendations by Sustain and The Food Foundation (Sustain, 2024; The Food Foundation, 2024). However, to address the underlying stigma and ensure long-term impact, councils and schools should work toward shifting societal perceptions of free school meals, framing them as an essential policy opposed to a handout. Sustained funding and prioritization of public health spending are essential to support this shift, enabling councils to expand to universal eligibility, reducing stigma.

This study's limitations are worth noting. First, the literature searches were not conducted systematically but followed an integrative approach. While this approach may have limited some of our search results, our findings were triangulated by experts and additional strategic searches. The CLDs relied on study designs, including qualitative research and grey literature, that make it difficult to establish causality between variables. However, integrating mixed-method studies strengthened the robustness of the CLD by capturing beliefs and mindsets that are important drivers of complex system behaviors (Sterman 2006). Additionally, we conducted workshops online, which facilitated broader geographic participation, but may have led to hesitation for some participants to speak up, a limitation which has been previously reported (Wilkerson et al. 2020).

The decision to conduct only one workshop per group meant that experts were unable to contribute to all parts of the CLD. While this allowed for more in-depth discussion of specific dynamics, it may have limited the diversity of inputs. Finally, while this study focuses on England, which may limit its generalizability, the insights highlighting issues with well-intentioned policies, shifting responsibilities, and community-led support may be relevant to other high-income countries experiencing rising rates of food insecurity. Future work can engage with experts from different geographies to explore how our findings can be translated across diverse settings.

5. Conclusion

By incorporating insights from an integrative review and GMB workshops with experts, we identified critical interactions between policies against food insecurity and the unintended consequences they generate. Our results highlighted the unintended shifting of responsibility for managing food insecurity from national government to under-resourced community wraparound support, leaving local communities to bridge the gaps in support and contributing to the erosion of trust in government. We also highlight how well-meaning responses to food insecurity, such as food banks, inadvertently drive food insecurity, normalizing it as an

inevitable social challenge and, thereby, reducing pressure on governments to address it. Finally, we showed that for national government policies to adequately support households experiencing food insecurity, it is essential to address the unintended consequences related to their poor implementation, including delays, complex application processes, and inadequate coverage. Policy recommendations include redistributing responsibility back to government, transitioning food banks toward more sustainable food pantry models, or cash-first approaches, and improving the implementation of national welfare policies to reduce unintended negative impacts.

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Disclosure Statement

The authors declare no competing interests.

Ethical Statement and Consent to Participate

Ethical approval for the GMB workshops was granted by Imperial College London Research Governance and Integrity Team (ref: 6713739). Participants provided written informed consent and participation was voluntary.

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References

Aceves-Martins Mccf, Magaly. 2018. *Child Food Insecurity in the UK: A Rapid Review*. Southampton: National Institute for Health Research;

Aceves-Martins, M., M. Cruickshank, C. Fraser, and M. Brazzelli. 2018. "Child Food Insecurity in the UK: A Rapid Review." *Public Health Research* 6 (13): 1–162. https://doi.org/10.3310/phr06130.

Alaimo, K. 2005. "Food Insecurity in the United States An Overview." *Topics in Clinical Nutrition* 20 (4): 281–298. https://doi.org/10.1097/00008486-200510000-00002.

Andersen, D. F., A. Calhoun, P. S. Hovmand, T. Hower, E. Rouwette, E. Steins, et al. 2022. "Scriptapedia." Available from https://en.wikibooks.org/wiki/Scriptapedia.

Baker, Phillip, Andrew D. Brown, Kate Wingrove, Steve Allender, Helen Walls, Katherine Cullerton, Amanda Lee, et al. 2019. "Generating Political Commitment for Ending Malnutrition in All Its Forms: A System Dynamics Approach for Strengthening Nutrition Actor Networks." *Obesity Reviews: An Official Journal of the International Association for the Study of Obesity* 20 Suppl 2 (S2): 30–44. https://doi.org/10.1111/obr.12871.

Barrett, M., M. Spires, and C. Vogel. 2024. "The Healthy Start Scheme in England is a Lifeline for Families but Many Are Missing out: a Rapid Qualitative Analysis." *BMC Medicine* 22 (1): 177. https://doi.org/10.1186/s12916-024-03380-5.

Bartelmeß, T., S. Jasiok, E. Kühnel, and J. Yildiz. 2024. "A Scoping Review of the Social Dimensions in Food Insecurity and Poverty Assessments." *Frontiers in Public Health* 12: 1490591. https://doi.org/10.3389/fpubh.2022.994368.

Beacom, E., S. Furey, L. Hollywood, and P. Humphreys. 2021. "Conceptualising Household Food Insecurity in Northern Ireland: risk Factors, Implications for Society and the Economy, and Recommendations for Business and Policy Response." *SN Business & Economics* 1 (5): 67. https://doi.org/10.1007/s43546-021-00070-9.

Beck, D. J., and H. Gwilym. 2023. "The Food Bank: a safety-Net in Place of Welfare Security in Times of Austerity and the Covid-19 Crisis." *Social Policy and Society* 22 (3): 545–561. https://doi.org/10.1017/S1474746421000907.

Béland, D., and E. Schlager. 2019. "Varieties of Policy Feedback Research: Looking Backward, Moving Forward." *Policy Studies Journal* 47 (2): 184–205. https://doi.org/10.1111/psj.12340.

Blake, M. 2019. "More than Just Food: Food Insecurity and Resilient Place Making through Community Self Organising."

Brown, H., S. Mills, and V. Albani. 2022. "Socioeconomic Risks of Food Insecurity during the Covid-19 Pandemic in the UK: findings from the Understanding Society Covid Survey." *BMC Public Health* 22 (1): 590. https://doi.org/10.1186/s12889-022-12964-w.

Chambers, S., N. Boydell, A. Ford, and D. Eadie. 2020. "Learning from the Implementation of Universal Free School Meals in Scotland Using Normalisation Process Theory: Lessons for Policymakers to Engage Multiple Stakeholders." *Food Policy* 95: 101936. https://doi.org/10.1016/j.foodpol.2020.101936.

Citizens Advice. 2024. "Using a Food Bank." Available from: https://www.citizensadvice.org.uk/debt-and-money/using-a-food-bank/.

Cohen, J. F. W., A. A. Hecht, G. M. McLoughlin, L. Turner, and M. B. Schwartz. 2021. "Universal School Meals and Associations with Student Participation, Attendance, Academic Performance, Diet Quality, Food Security, and Body Mass Index: A Systematic Review." *Nutrients* 13 (3): 911. https://doi.org/10.3390/nu13030911.

Darabi, N., and N. Hosseinichimeh. 2020. "System Dynamics Modeling in Health and Medicine: A Systematic Literature Review." *System Dynamics Review* 36 (1): 29–73. https://doi.org/10.1002/sdr.1646.

Dowler, Elizabeth A., and Deirdre O'Connor. 2012. "Rights-Based Approaches to Addressing Food Poverty and Food Insecurity in Ireland and UK." *Social Science & Medicine* 74 (1): 44–51. https://doi.org/10.1016/j.socscimed.2011.08.036.

Farrell, A., M. Hu, E. Evbuoma, W. Liem, and E. Ballard. 2021. "Characteristics of Complex Problems."

Food and Agriculture Organization. 2024. "Hunger and Food Insecurity." Available from https://www.fao.org/hunger/en/.

Ford, D. N. 2019. "A System Dynamics Glossary." *System Dynamics Review* 35 (4): 369–379. https://doi.org/10.1002/sdr.1641.

Garratt, E. 2017. "Please Sir, I Want Some More: An Exploration of Repeat Foodbank Use." *BMC Public Health* 17 (1): 828. https://doi.org/10.1186/s12889-017-4847-x.

Graham, Pamela Louise, Eilish Crilley, Paul B. Stretesky, Michael A. Long, Katie Jane Palmer, Eileen Steinbock, Margaret Anne Defeyter, et al. 2016. "School Holiday Food Provision in

the UK: A Qualitative Investigation of Needs, Benefits, and Potential for Development." *Frontiers in Public Health* 4: 172. https://doi.org/10.3389/fpubh.2016.00172.
House of Commons Library. 2025. "Local Government in England: structures."
Huberland, V., P. Semaille, and N. Kacenelenbogen. 2019. "Identification of Food Insecurity Factors in French-Speaking Belgium: A Qualitative Study." *BMC Public Health* 19 (1): 1643. https://doi.org/10.1186/s12889-019-7860-4.
Independent Food Aid Network. 2024. "Taking a Cash First Approach to Food Insecurity." Available from: https://www.foodaidnetwork.org.uk/why-cash-first.
Jenkins, R., S. Aliabadi, E. Vamos, D. Taylor-Robinson, S. Wickham, C. Millett, et al. 2021. The relationship between austerity and food insecurity in the UK: a systematic review.
Jenkins, Rosemary H., Shirin Aliabadi, Eszter P. Vamos, David Taylor-Robinson, Sophie Wickham, Christopher Millett, Anthony A. Laverty, et al. 2021. "The Relationship between Austerity and Food Insecurity in the UK: A Systematic Review." *EClinicalMedicine* 33: 100781. https://doi.org/10.1016/j.eclinm.2021.100781.
Jessiman, Patricia E., Victoria R. Carlisle, Katie Breheny, Rona Campbell, Russell Jago, Marcus Robinson, Steve Strong, et al. 2023. "A Qualitative Process Evaluation of Universal Free School Meal Provision in Two London Secondary Schools." *BMC Public Health* 23 (1): 300. https://doi.org/10.1186/s12889-023-15082-3.
Johnstone, A. M., and M. Lonnie. 2023. "Tackling diet inequalities in the UK food system: Is food insecurity driving the obesity epidemic? (The FIO Food Project)." In *Proceedings of the Nutrition Society*. 1–9.
Karapici, A., and S. Cummins. 2024. "A Participatory Approach to Model the Neighbourhood Food Environment." *PloS One* 19 (1): e0292700-e. https://doi.org/10.1371/journal.pone.0292700.
Kim, D. 1992. "Guidelines for Drawing Causal Loop Diagrams." Available from: https://thesystemsthinker.com/guidelines-for-drawing-causal-loop-diagrams-2/.
Kim, D. H. 2000. "Systems Archetypes I: Diagnosing Systemic Issues and Designing High-Leverage Interventions."
Király, G., and P. Miskolczi. 2019. "Dynamics of Participation: System Dynamics and Participation—An Empirical Review." *Systems Research and Behavioral Science* 36 (2): 199–210. https://doi.org/10.1002/sres.2580.
Lambie-Mumford, H. 2019. "The Growth of Food Banks in Britain and What They Mean for Social Policy." *Critical Social Policy* 39 (1): 3–22. https://doi.org/10.1177/0261018318765855.
Lambie-Mumford, H., R. Loopstra, and A. Okell. 2023. "Household Food Insecurity in the UK: data and Research Landscape."
Localism Act. 2011.
Loopstra, R. 2018. "Rising Food Bank Use in the UK: Sign of a New Public Health Emergency?" *Nutrition Bulletin* 43 (1): 53–60. https://doi.org/10.1111/nbu.12306.
Loopstra, R., A. Reeves, and V. Tarasuk. 2019. "The Rise of Hunger among Low-Income Households: An Analysis of the Risks of Food Insecurity between 2004 and 2016 in a Population-Based Study of UK Adults." *Journal of Epidemiology and Community Health* 73 (7): 668–673. https://doi.org/10.1136/jech-2018-211194.
Loopstra, R., J. Fledderjohann, A. Reeves, and D. Stuckler. 2018. "Impact of Welfare Benefit Sanctioning on Food Insecurity: A Dynamic Cross-Area Study of Food Bank Usage in the UK." *Journal of Social Policy* 47 (3): 437–457. https://doi.org/10.1017/S0047279417000915.
McFadden, A., J. M. Green, J. McLeish, F. McCormick, V. Williams, and M. J. Renfrew. 2015. "Healthy Start Vitamins—a Missed Opportunity: findings of a Multimethod Study." *BMJ Open* 5 (1): e006917. https://doi.org/10.1136/bmjopen-2014-006917.
Meadows, Jade, Miranda Montano, Abdelrahman J. K. Alfar, Ömer Yetkin Başkan, Caroline De Brún, Jennifer Hill, Rachael McClatchey, et al. 2024. "The Impact of the Cost-of-Living Crisis on Population Health in the UK: rapid Evidence Review." *BMC Public Health* 24 (1): 561. https://doi.org/10.1186/s12889-024-17940-0.

Milbourne, P. 2024. "Beyond 'Feeding the Crisis': Mobilising 'More than Food Aid' Approaches to Food Poverty in the UK." *Geoforum* 150: 103976. https://doi.org/10.1016/j.geoforum.2024.103976.

Mui, Y., E. Ballard, E. Lopatin, R. L. J. Thornton, K. M. Pollack Porter, and J. Gittelsohn. 2019. "A Community-Based System Dynamics Approach Suggests Solutions for Improving Healthy Food Access in a Low-Income Urban Environment." *PloS One* 14 (5): e0216985-e. https://doi.org/10.1371/journal.pone.0216985.

Muir, S., P. Dhuria, E. Roe, W. Lawrence, J. Baird, and C. Vogel. 2023. "UK Government's New Placement Legislation is a 'Good First Step': A Rapid Qualitative Analysis of Consumer, Business, Enforcement and Health Stakeholder Perspectives." *BMC Medicine* 21 (1): 33. https://doi.org/10.1186/s12916-023-02726-9.

Murphy, M., A. Coffey, M. Pallan, and O. Oyebode. 2024. "Changing the Food Environment in Secondary School Canteens to Promote Healthy Dietary Choices: A Qualitative Study with School Caterers." *BMC Public Health* 24 (1): 1970. https://doi.org/10.1186/s12889-024-19513-7.

Nayak, R., and H. Hartwell. 2023. "The Future of Charitable Alternative Food Networks in the UK: An Investigation into Current Challenges and Opportunities for Foodbanks and Community Markets." *Frontiers in Sustainable Food Systems* 7: 1187015. https://doi.org/10.3389/fsufs.2023.1187015.

Nelson, M. 2013. "School Food Cost–Benefits: England." *Public Health Nutrition* 16 (6): 1006–1011. https://doi.org/10.1017/S136898001200420X.

Page, B., and L. Marshall. 2023. "Food Insecurity–What Can Local Government Do?." The Health Foundation.

Papargyropoulou, E., G. Bridge, S. Woodcock, E. Strachan, J. Rowlands, and E. Boniface. 2024. "Impact of Food Hubs on Food Security and Sustainability: Food Hubs Perspectives from Leeds, UK." *Food Policy*. 128: 102705. https://doi.org/10.1016/j.foodpol.2024.102705.

Parnham, J. C., A. A. Laverty, A. Majeed, and E. P. Vamos. 2020. "Half of Children Entitled to Free School Meals Did Not Have Access to the Scheme during COVID-19 Lockdown in the UK."

Parnham, J., C. M. Chang, F. Rauber, R. B. Levy, C. Millett, A. A. Laverty, et al. 2022. "The Ultra-Processed Food Content of School Meals and Packed Lunches in the United Kingdom."

Parnham, J., C. Millett, and E. Vamos. 2023. "School Meals in the UK: ultra-Processed, Unequal, and Inadequate."

Piaskoski, A., K. Reilly, and J. Gilliland. 2020. "A Conceptual Model of Rural Household Food Insecurity: A Qualitative Systematic Review and Content Analysis." *Family & Community Health* 43 (4): 296–312. https://doi.org/10.1097/FCH.0000000000000273.

Power, M., B. O. B. Doherty, N. Small, S. Teasdale, and K. E. Pickett. 2017. "All in It Together? Community Food Aid in a Multi-Ethnic Context." *Journal of Social Policy* 46 (3): 473–473. https://doi.org/10.1017/S0047279417000083.

Puddephatt, J.-A., G. S. Keenan, A. Fielden, D. L. Reaves, J. C. G. Halford, and C. A. Hardman. 2020. "Eating to Survive': A Qualitative Analysis of Factors Influencing Food Choice and Eating Behaviour in a Food-Insecure Population." *Appetite* 147: 104547. https://doi.org/10.1016/j.appet.2019.104547.

Purcell, S., F. Tweedie, and J. Perry. 2023. "Your Local Pantry. And so Much More! Social Impact Report 2023."

Purdam, K., E. A. Garratt, and A. Esmail. 2016. "Hungry? Food Insecurity, Social Stigma and Embarrassment in the UK." *Sociology* 50 (6): 1072–1088. https://doi.org/10.1177/0038038515594092.

Quinteros-Reyes, C., P. Seferidi, L. Guzman-Abello, C. Millett, A. Bernabé-Ortiz, and E. Ballard. 2024. "Mapping Food System Drivers of the Double Burden of Malnutrition Using Community-Based System Dynamics: A Case Study in Peru." *BMC Global and Public Health* 2 (1): 15. https://doi.org/10.1186/s44263-024-00045-6.

Schick-Makaroff, K., M. MacDonald, M. Plummer, J. Burgess, and W. Neander. 2016. "What Synthesis Methodology Should I Use? A Review and Analysis of Approaches to Research

Synthesis." *AIMS Public Health* 3 (1): 172–215. https://doi.org/10.3934/publichealth.2016.1.172.
Simelane, K. S., and S. Worth. 2020. "Food and Nutrition Security Theory." *Food and Nutrition Bulletin* 41 (3): 367–379. https://doi.org/10.1177/0379572120925341.
Smith, D. M., and C. Thompson. 2023. *Food Deserts and Food Insecurity in the UK: Exploring Social Inequality*. London: Routledge.
Sosenko, F., G. Bramley, and A. Bhattacharjee. 2022. "Understanding the Post-2010 Increase in Food Bank Use in England: new Quasi-Experimental Analysis of the Role of Welfare Policy." *BMC Public Health* 22 (1): 1363. https://doi.org/10.1186/s12889-022-13738-0.
Sosenko, F., M. Littlewood, G. Bramley, S. Fitzpatrick, J. Blenkinsopp, and J. Wood. 2019. "State of Hunger: A Study of Poverty and Food Insecurity in the UK."
Spence, S., L. McSweeney, J. V. Woodside, and D. Schliemann, GENIUS Network. 2024. "An Online Survey Capturing the Views of Stakeholders on Primary School Food Systems across the Four UK Nations." *BMC Public Health* 24 (1): 719. https://doi.org/10.1186/s12889-024-18149-x.
Sterman, J. D. 2006. "Learning from Evidence in a Complex World." *American Journal of Public Health* 96 (3): 505–514. https://doi.org/10.2105/AJPH.2005.066043.
Stretesky, P. B., M. A. Defeyter, M. A. Long, L. A. Ritchie, and D. A. Gill. 2020. "Holiday Hunger and Parental Stress: Evidence from North East England." *Sustainability* 12 (10): 4141. https://doi.org/10.3390/su12104141.
Strong, S. 2020. "Food Banks, Actually Existing Austerity and the Localisation of Responsibility." *Geoforum* 110: 211–219. https://doi.org/10.1016/j.geoforum.2018.09.025.
Sustain. 2024. "Driving Uptake of Free School Meals through Opt-out Automatic Enrolment." Available from: https://www.sustainweb.org/blogs/mar24-fsm-automatic-enrolment/.
Sustain. 2024. "Good Food Local: The London Report 2024."
Sustain. 2024. Wraparound support. Available from https://www.sustainweb.org/good-food-enterprise/wraparound-support/.
Taylor, C. 2018. "The Reliability of Free School Meal Eligibility as a Measure of Socio-Economic Disadvantage: Evidence from the Millennium Cohort Study in Wales." *British Journal of Educational Studies* 66 (1): 29–51. https://doi.org/10.1080/00071005.2017.1330464.
The Food Foundation. 2024 Outdated opt-in system means 250,000 children missing out on Free School Meals. Available from: https://foodfoundation.org.uk/press-release/outdated-opt-system-means-250000-children-missing-out-free-school-meals.
The Food Foundation. 2024. "Food Insecurity Tracking 2024." Available from: https://foodfoundation.org.uk/initiatives/food-insecurity-tracking.
The Food Foundation. Food Insecurity in Households in Receipt of Benefits. 2022.
The World Bank. 2024. "The World by Income and Region." Available from: https://datatopics.worldbank.org/world-development-indicators/the-world-by-income-and-region.html.
Thomas, Michelle, Elizabeth Eveleigh, Zeynep Vural, Peter Rose, Amanda Avery, Lisa Coneyworth, Simon Welham, et al. 2022. "The Impact of the COVID-19 Pandemic on the Food Security of UK Adults Aged 20-65 Years (COVID-19 Food Security and Dietary Assessment Study)." *Nutrients* 14 (23): 5078. https://doi.org/10.3390/nu14235078.
Thompson, C., D. Smith, and S. Cummins. 2018. "Understanding the Health and Wellbeing Challenges of the Food Banking System: A Qualitative Study of Food Bank Users, Providers and Referrers in London." *Social Science & Medicine* 211: 95–101. https://doi.org/10.1016/j.socscimed.2018.05.030.
Turcu, D. C., and M. M. Rotolo. 2022. "Disrupting from the Ground up: Community-Led and Place-Based Food Governance in London during COVID-19." *Urban Governance* 2 (1): 178–187. https://doi.org/10.1016/j.ugj.2022.04.006.
Whittemore, R., and K. Knafl. 2005. "The Integrative Review: updated Methodology." *Journal of Advanced Nursing* 52 (5): 546–553. https://doi.org/10.1111/j.1365-2648.2005.03621.x.
Wilkerson, B., A. Aguiar, C. Gkini, I. Czermainski de Oliveira, L. K. Lunde Trellevik, and B. Kopainsky. 2020. "Reflections on Adapting Group Model Building Scripts into Online Workshops." *System Dynamics Review* 36 (3): 358–372. https://doi.org/10.1002/sdr.1662.

Williams, A., P. Cloke, J. May, and M. Goodwin. 2016. "Contested Space: The Contradictory Political Dynamics of Food Banking in the UK." *Environment and Planning A: Economy and Space* 48 (11): 2291–2316. https://doi.org/10.1177/0308518X16658292.

Yang, Tiffany C., Madeleine Power, Rachael H. Moss, Bridget Lockyer, Wendy Burton, Bob Doherty, Maria Bryant, et al. 2022. "Are Free School Meals Failing Families? Exploring the Relationship between Child Food Insecurity, Child Mental Health and Free School Meal Status during COVID-19: national Cross-Sectional Surveys." *BMJ Open* 12 (6): e059047–e. https://doi.org/10.1136/bmjopen-2021-059047.