



Food policies for Aboriginal and Torres Strait Islander health (FoodPATH): A systems thinking approach

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ABSTRACT

First Nations peoples have the right to participate in all decisions affecting them. This includes food policy decision-making. In the Australian state of Victoria, the Food Policies for Aboriginal and Torres Strait Islander Health (FoodPATH) project aimed to determine the food policy actions that are likely to be effective and acceptable for Victorian Aboriginal Communities. Community-based workshops were held with six Aboriginal Community-Controlled Organisations (ACCOs) in urban and regional Victoria during 2022. A team of at least three Aboriginal and Torres Strait Islander facilitators guided participants (n = 53) through a series of workshop activities using group model building methods. Group model building is a participatory systems science research method which enables community stakeholders to develop a shared understanding of the system-level drivers of complex problems and co-design actions to address them. Workshop discussions coincided with real-time creation of a visual system map of the interconnected determinants of food choice. Participants used these maps to develop and prioritise actions for improving food environments and nutrition in the community. Participants identified a diverse array of interconnected factors influencing food choice and nutrition in Aboriginal Communities across Victoria. Food access and affordability, junk food marketing, food knowledge and skills and diet and disease were common themes across all sites, while access to junk food, growing local food, traditional Aboriginal foods, and family, Community and culture were key themes in most sites. Results informed a Community-driven agenda, comprising five Community-led actions and five government policy recommendations for improving food environments and nutrition for Victorian Aboriginal Communities.

1. Introduction

1.1. Background

First Nations peoples encompass a global community of over 5000

culturally diverse Indigenous groups around the world, each maintaining historical ties to their ancestral lands prior to colonisation (United Nations, 2021). Across the globe, First Nations people cultivated healthy and sustainable food systems grounded in traditional knowledge and cultural practices passed down through generations (Kuhnlein, 2015).

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Biodiverse plant and animal foods and sophisticated hunting, fishing, farming and harvesting techniques maintained human and planetary health for millennia (Pascoe, 2018). Colonisation and introduction of Western agriculture and ultra-processed foods have severely disrupted First Nations food systems and, by extension, health and cultural wellbeing for First Nations peoples worldwide (United Nations Economic and Social, 2023). As a result, First Nations peoples in colonised countries disproportionately experience food insecurity and diet-related chronic disease (Kuhnlein, 2015). The United Nations Declaration on the Rights of Indigenous peoples recognises the inherent right of First Nations peoples to participate in decision-making processes that affect their rights (United Nations, 2007). In alignment with this declaration, the Indigenous food sovereignty movement seeks to empower First Nations communities to revitalise cultural foodways in exercising self-determination over their food systems (Coté, 2016).

Methods from systems science are increasingly being applied to address complex problems, including healthy food policy (Allender et al., 2019; Freedman et al., 2022; Friel et al., 2017). Rather than reducing food-related health issues to the dietary behaviours of individuals, a system approach conceptualises public health problems, including nutrition inequity, as emerging from the structure of complex adaptive systems (Friel et al., 2017). A complex adaptive system is a set of interconnected variables that interact and change over time, often producing counterintuitive responses that cannot be predicted by studying system elements in isolation (Hovmand, 2014; Meadows, 2008). Complex systems are adaptive, in that they respond to external stimuli, such as technological advancements, commercial interests and policy interventions (Nobles et al., 2022). A systems science approach is useful for interrogating the underlying complex and interrelated drivers of food and nutrition and identifying potential food policy actions to improve population health.

In the past decades, the emergence of systems thinking in Western public health and food policy research has been considered revolutionary (Mabry et al., 2010); however, First Nations peoples have long embodied and preserved the principles of irreducible wholeness, relationality and non-linearity (Goodchild, 2022). Described as “circular, multi-dimensional” and underpinned by a holistic understanding of an interconnected universe (Ray et al., 2022, p. 3), First Nations worldviews are adaptive, can evolve and work both within and outside of Western reductionist approaches. Similarly, the concept of relationality, defined by Moreton-Robinson (2013, p. 341) as “our embodied connection to our respective countries, all living entities and our ancestors”, is at the heart of ontology and epistemology for numerous First Nations scholars (Martin & Mirraoopa, 2003; Moreton-Robinson, 2013; Wilson, 2008).

Reflecting this ancient way of thinking, First Nations scholars are applying Indigenous systems knowledge to find new solutions to complex global problems (Fletcher et al., 2023; Yunkaporta, 2019). Even within Western research paradigms, it has been suggested that participatory systems approaches, if applied appropriately, can align with First Nations worldviews (Browne, et al., 2021a; Heke et al., 2019). As such, systems thinking approaches are beginning to be applied in community-based research projects with First Nations peoples, with examples in North America (Estradé et al., 2023; LaVallee et al., 2016), Australia (Beks et al., 2022; Muthayya et al., 2020), Aotearoa/New Zealand (Heke et al., 2019; McKelvie-Sebileau et al., 2022) and the Pacific (Waqa et al., 2017; Webster et al., 2022). This emerging literature suggests systems approaches can provide a platform for First Nations community-driven food policy action (Brimblecombe et al., 2017; McKelvie-Sebileau et al., 2022).

In this article, we report the findings of the Food Policies for Aboriginal and Torres Strait Islander Health (FoodPATH) project, a community-based systems approach to advancing food policy for First Nations communities in Victoria, Australia. In the context of this study, we respectfully use the word “Aboriginal” when referring to First Nations peoples living on the lands now known as Victoria as this is an

accepted umbrella term in mainland Australia, though we acknowledge it represents many nations, cultures and language groups. We continue to use the term “First Nations peoples” when referring to Indigenous peoples globally. The FoodPATH project aimed to empower Aboriginal people to determine the actions needed to create healthier food environments for their communities. A secondary aim of the project was to advance systems thinking as a methodological approach for building policy momentum among Aboriginal organisations and communities. In this paper we set out to answer the following research question:

What are considered acceptable and effective policy actions to improve food environments and nutrition in Victorian Aboriginal Communities?

1.2. Context and setting

Australia, as it is now known, is a federation of six states and two territories that was established in 1901 following colonisation by the British Empire in the late eighteenth century. Prior to this, Aboriginal and Torres Strait Islander peoples lived on and cared for their traditional Country based on their own laws and customs for over 60,000 years, making Aboriginal people the world’s oldest continuous culture (Rasmussen et al., 2011). Aboriginal and Torres Strait Islander peoples have never ceded their sovereignty and, unlike other colonised countries, a treaty between Aboriginal and Torres Strait Islander peoples and the Crown has not been signed (Referendum Council, 2017).

Historical and ongoing processes of colonisation have had a profound effect on Aboriginal and Torres Strait Islander peoples and their food systems, disrupting cultural food knowledge and replacing traditional diets with government-controlled rations and Western ultra-processed foods (Sebastian & Donnelly, 2013; Wilson et al., 2020). As a result, Aboriginal and Torres Strait Islander peoples experience unacceptable nutrition inequities, with approximately 10 % of the gap in health outcomes between Aboriginal and Torres Strait Islander and non-Indigenous Australians attributed to food (Australian Institute of Health and Welfare, 2022). Despite extensive and long-term assimilationist policies, many Aboriginal and Torres Strait Islander peoples maintain strong connection to their traditional Country, cultures and food practices (Cubillo et al., 2023; Wilson et al., 2020).

The lands now known as the state of Victoria, situated in south-eastern Australia, are home to approximately 78,000 Aboriginal and Torres Strait Islander peoples. As the most densely populated state in Australia, 1.2 % of Victorians identify as Aboriginal or Torres Strait Islander compared to 3.8 % of the total Australian population (Australian Bureau of Statistics, 2021). Across the state there are 33 Aboriginal Community Controlled Organisations (ACCOs) dedicated to delivering holistic, culturally safe health and social services tailored to their local communities. These ACCOs are supported by their peak representative body, the Victorian Aboriginal Community Controlled Health Organisation (VACCHO). Responsibility for food policy is shared between federal, state and local governments and various government departments and agencies relevant to the food system (Naudiyal et al., 2021). The present study was undertaken in partnership with VACCHO and was concerned with food policy at all government levels as well as organisational policy within the ACCO sector.

1.3. Governance

VACCHO plays a pivotal role in food and nutrition policy and advocating for the health and wellbeing of Aboriginal and Torres Strait Islander peoples living in Victoria (Genat et al., 2016; MacDonald et al., 2016). The initial concept for the FoodPATH project originated with VACCHO’s nutrition team, who identified a need to shift the focus of nutrition promotion from individual behaviour to the broader food environment. In 2019, a former VACCHO nutrition team member (JB) commenced a research position at [removed for blind peer review] University and partnered with VACCHO to secure grant funding for the

FoodPATH project.

To formalise the partnership, a research agreement was signed by VACCHO and [removed for blind peer review] University. The agreement outlined the terms of the collaboration, lead staff from each organisation, and their roles and responsibilities. It also included a specific clause stipulating that intellectual property created, developed, or discovered during the project would be jointly owned by VACCHO and [removed for blind peer review] University in equal shares and ownership of intellectual property existing prior to the commencement of the partnership would remain unchanged. Once the partnership was formalised, a core group of Aboriginal and Torres Strait Islander and non-Indigenous team members from [removed for blind peer review] University and VACCHO met regularly to plan and implement the project. The project was advised and monitored by a reference group, comprising senior staff members from VACCHO and [removed for blind peer review] University, as well as representatives from the funding body and the Victorian State Government Department of Health.

2. Materials and methods

2.1. Researcher positionality

This study was undertaken by a team of Aboriginal and Torres Strait Islander and non-Indigenous researchers and practitioners who sought to privilege Aboriginal worldviews and voices throughout the research process. The lead authors are a non-Indigenous nutritionist and public health researcher (JB) and an Aboriginal nutrition researcher and chiropractic clinician (TW), both with extensive experience working with Aboriginal organisations and communities in Victoria. Over the course of the project, the lead author worked closely with a core team of Aboriginal (FM, ST, JR, SS) and Torres Strait Islander (KH) researchers and key staff from VACCHO (HB, AR, AR) to design, implement and disseminate the research in a manner that reflects the values and priorities of Aboriginal people in Victoria. This core team was supported by Aboriginal (YP) and non-Indigenous (MJ, KB, SA, AB) researchers with expertise in Aboriginal health, systems science, food policy and public health research.

As an author team, we acknowledge the strengths and diversity of Aboriginal and Torres Strait Islander peoples across Australia. We also acknowledge the potential for research to perpetuate power imbalances and the ongoing harms of colonisation. For this reason, we strived to adhere to guidelines for quality, transparency and ethical conduct in Aboriginal and Torres Strait Islander health research (Harfield et al., 2020; National Health and Medical Research Council, 2018), as well as the CONSOLIDated critERia (the CONSIDER statement) for strengthening reporting of health research involving Indigenous peoples (Huria et al., 2019).

2.2. Ethics

This study was approved by the [removed for blind peer review] University Human Research Ethics Committee, who consult with Aboriginal representatives for projects involving Aboriginal and/or Torres Strait Islander peoples (approval number 2021–101). Written informed consent was obtained from all participating organisations and individuals. Participants were reimbursed for their time with a grocery voucher worth AU\$50 at the end of each workshop. To protect Indigenous intellectual and cultural property, it was explicitly stated in the ethics application that research data would not be shared with third parties.

2.3. Methodological approach

We employed a system dynamics methodological approach to uncover structural drivers of dynamic behaviour in complex systems (Hovmand, 2014). System dynamics develops models of complex

systems identifying relationships of cause and effect between variables within a system and understanding relationships of feedback which drive a system's behaviour over time (Hovmand, 2014). Within system dynamics, group model building is a participatory research method which actively engages key community members to develop a shared understanding of a priority problem and, collaboratively, design system change solutions (Vennix, 2001). The group model building process comprises facilitated workshop activities to enable participants to identify the variables related to the problem, how these have changed over time and their feedback relationships to one another (Hovmand et al., 2012). This information is used to create a causal loop diagram or "system map", which visually represents the group's shared understanding of the problem's underlying causal relationships (Hovmand, 2014). The systems map can be divided into thematic areas and used by participants to formulate interventions for achieving system change (Allender et al., 2015).

Over the past 15 years, community based system dynamics (CBSD) has evolved as a way to integrate system dynamics into communities to understand problems and take appropriate action (Hovmand, 2014). CBSD is characterised by deep, long-term engagement capacity development with a community to address community-defined health and well-being priorities (Király & Miskolczi, 2019). Rural and regional communities in southwest and northeast Victoria began implementing a CBSD approach in 2014 (Allender et al., 2016; Whelan et al., 2022). As CBSD became more embedded as an approach in the area, an initial project using system dynamics was undertaken on Gunditjmara Country (Western Victoria) in partnership with a local Aboriginal organisation (Beks et al., 2022).

CBSD's applications across Victoria, and in particular the initial work with Aboriginal Communities, created interest in the potential of using system dynamics more widely with Aboriginal Communities across Victoria. A core principle of CBSD is the recognition of the need to tailor group model building and other system dynamics activities to the local community in partnership with the local community. Therefore, in spite of the use of CBSD in previous studies with Aboriginal Communities (Beks et al., 2022; Muthayya et al., 2020), there was a need to seriously consider if and how system dynamics and group model building could be made appropriate and useful in this broader context. Given the history of subjugation of Aboriginal knowledge in Australian food policy and research (Cubillo et al., 2023; Wilson et al., 2020), we sought to privilege Aboriginal values and perspectives in designing the current study. We undertook formative research to establish the value and acceptability of group model building as a methodology for research with Aboriginal Communities (Browne et al., 2021a). Subsequently, in collaboration with Aboriginal team members and in alignment with best practice in CBSD (Hovmand, 2014), we designed, pilot-tested and refined group model building workshop activities for use with Victorian Aboriginal Communities and trained a cohort of Aboriginal group model building facilitators.

2.4. Site and participant recruitment

All ACCOs based in Victoria were invited to participate as FoodPATH project sites. Site recruitment was led by VACCHO investigators (HB, AR) who emailed all VACCHO member ACCOs (n = 32 at the time) calling for expressions of interest to be involved in the project. To participate, the ACCO needed to return a signed organisational consent form and nominate a staff member to be the site coordinator and point-of-contact for the project. All sites that expressed interest were invited to participate. Once the sites (n = 6) were selected, the site coordinators, who were predominantly ACCO practice managers or health promotion coordinators, selected appropriate dates and venues for the FoodPATH workshops and led participant recruitment through their local networks. VACCHO investigators supported participant recruitment by providing site coordinators with information about the project to circulate via newsletters, social media posts and email networks. We aimed to recruit

between 10–15 participants at each project site.

2.5. FoodPATH workshops

At each of the six sites, site coordinators convened groups comprising Aboriginal health staff, Elders and community members with an interest in food and nutrition. Data were collected over two half-day group model building workshops at each site, with the second workshop occurring between two days to two weeks after the first, based on community preferences. All workshops were led by teams of at least three Aboriginal (TW, ST, FM, JR) and/or Torres Strait Islander facilitators (KH) with rotating roles of lead facilitator, modeler and note taker. A second note taker (HB) was also present at each session. Each workshop began with an overview of the FoodPATH project and screening of a short cultural animation video, developed by VACCHO, that asked participants to consider the changes to the food environment in Aboriginal Communities since colonisation. Facilitators then led a group discussion based around the question: *What has contributed to food choices in the Aboriginal Community in recent years?*

In system dynamics, problems are framed in terms of reference modes, prompting examination of factors that have changed over time and consideration of hoped and feared future behaviour. In this case, the focus was the impact of colonisation over time on the food system in Australia, and the resulting impact on food choices. The factors considered could include those that either enabled or constrained healthy eating. The group model building process then proceeded through the following participatory workshop activities (described below): stories of change over time, connection circles, and developing a system map of the drivers of food choice in the Aboriginal Community (henceforth, 'Community'). No individual level data were collected, and participants were asked to respect Community members' privacy during group discussions.

2.5.1. Workshop 1: Creation of the system map

First, participants shared *stories of change over time*, reflecting on key factors contributing to food choice in the Community, how these had changed since the previous generations and how they may look for future generations. For example, participants shared stories about the increasing number of takeaway outlets in their communities, the rising cost of healthy food and the growth in marketing of unhealthy food and beverages. As each factor was shared with the larger group, it was added to the *connection circle* (a large circle projected onto the wall) using the Systems Thinking in Community Knowledge Exchange (STICKE) Version 3 system mapping software (Hayward et al., 2020). Participants were then invited to share stories about the connections between the factors around the circle including the nature and direction of cause and effect. These causal relationships were documented in real-time using STICKE, which enables arrows to be drawn between variables, with solid lines indicating variables changing in the same direction and dotted lines indicating variables changing in the opposite direction. Participants were encouraged to add extra factors and connections as required to ensure their causal stories were fully stepped out. STICKE was then changed to 'map view' which transforms the connection circle into a causal loop diagram, providing a visual *system map* of the interrelated factors influencing food choice.

After the initial workshop, a map review and clean-up process was undertaken to improve readability of the system map. One investigator (JB) cross-checked the initial system map against the workshop notes to ensure all details were captured. Additional variables and connections were added to the map as needed, then these additions were discussed with the facilitation team and with an experienced system dynamics modeller (AB). Once the team reached consensus, the map's variables were organised into themes, indicated by different colours in STICKE. The updated map was presented to participants at the beginning of Workshop 2, giving them the opportunity to review, confirm or propose further revisions. Once the group agreed on the final version, all

participants received a printed copy of the system map for use in Workshop 2.

2.5.2. Workshop 2: Food policy action

The second FoodPATH workshop was focussed on identifying and prioritising potential policy actions for improving food and nutrition for the local Aboriginal Community. Working in small groups, participants used the printed maps to identify areas for system change. This process involved differentiating actions that could be adopted and implemented by the Community and those that require government intervention. Next, participants identified as many action ideas as they could, including both Community-led and government-led actions, detailing how each action would impact the system. As participants shared their action ideas with the group, they were added to the system map in STICKE. Facilitators then proposed additional actions to the group, based on the findings of a systematic review of the effectiveness of food policy actions for First Nations communities (Browne et al., 2019). Participants collectively decided whether to add these evidence-informed actions to their system map. To prioritise the action ideas, each participant voted for the three Community-led and three government-led action ideas, considering which actions would have the biggest system impact in improving food environments.

2.6. Data analysis and synthesis

Data on the determinants of food choice from the system maps created at all FoodPATH project sites were extracted from STICKE and imported into Microsoft Excel. After duplicate variables were removed, two investigators (KH and JB) independently coded the variables to standardise their names and consolidate similar concepts into single variables. For example, the variables "food prices", "cost of food", "price of healthy food" and "cost of fresh food" were combined into the single variable named "cost of healthy food". Similarly, theme names "access to unhealthy food", "access to junk food" and "availability of fast food" were consolidated to form the single theme "access to unhealthy food". Differences in coding were discussed with additional investigators until consensus was reached on variable names (TW and AB) and theme names (TW, ST, FM, SS). Duplicate variables were merged via a software code, preserving connections, with polarity conflicts resolved through discussion. The merged variables and connections were imported back into STICKE and an experienced system modeller (MJ) produced new causal loop diagrams for each of the common themes using combined data from all six sites. Thematic maps were manually checked to ensure the direction and polarity of connections between variables remained consistent with the original system maps.

A similar approach was employed to synthesise the priority actions from the different sites. The action ideas proposed at each site were extracted as variables from STICKE into Microsoft Excel, where similar actions were merged, and names were standardised using the process described above. This updated list of actions was cross-checked with the notes taken during Workshop 2 by one investigator (JB). The number of sites proposing each action, the total number of votes each action received across all sites, and the number of sites who included each action in their top priorities was tabulated. These data were discussed with site facilitators (KH, TW, FM, ST, JR) to finalise the top five Community-led actions and the top five Government policy actions arising from the FoodPATH project. To ensure local issues and priorities were represented in combined themes and recommendations, preliminary findings were presented to representatives of each participating FoodPATH site for feedback and endorsement.

3. Results

3.1. Sites and participants

Between March and September 2022, FoodPATH workshops were

completed in six sites, in collaboration with VACCHO and five of its member ACCOs. The sites were located across Victoria, with two in metropolitan areas, one in a regional centre and three in rural areas. Across the six sites, a total of 53 people participated in the FoodPATH workshops, with participant numbers at individual sites ranging from six to 13 people. Most participants were employees of ACCOs, including Aboriginal health practitioners, Aboriginal health promotion staff and managers/directors. At some sites, Aboriginal staff from external organisations, Aboriginal Community members and Elders also attended the workshops.

3.2. Key themes arising from the FoodPATH workshops

Each site produced a unique system map of the key factors influencing food choice for the local Aboriginal Community. When combined, the maps yielded 155 interconnected variables representing the determinants of food choice, which we organised into nine thematic subsystem maps. The complete set of maps, themes and priority actions from each site can be viewed in [Supplementary file 1](#) and in the FoodPATH Community Report (Browne et al., 2023). Below we present a summary of the key themes related to the determinants of food choice arising from the FoodPATH workshops and a visual representation, by a Gunditjmara (Aboriginal) artist, of how the themes are linked (Fig. 1). Food access and affordability, junk food marketing, food knowledge and skills, nutrition in schools and diet and disease were common themes across all sites, while access to junk food, growing local food, traditional foods and family, Community and culture were key themes in most (at least 4/6) sites.

In the following sections, we describe the key themes with a particular focus on feedback loops within the complex system driving food choice. System dynamics places a unique focus on how feedback loops can explain the behaviour over time of a factor of interest (Hovmand, 2014). In this case, this project sought to uncover the perspectives of Aboriginal people living in Victoria on how the circular processes over time continue to perpetuate the many impacts of colonisation on the food system. We illustrate our explanation of each theme with feedback loops derived from the thematic subsystem maps ([Supplementary file 2](#)),

constructed from the collective stories shared by participants during the FoodPATH workshops. These feedback loops potentially include leverage points for Community and policy action to improve the food environment.

3.2.1. Traditional foods

Traditional Aboriginal foods were a focal point of discussion for most Communities, with several feedback loops emerging from the workshops (Fig. 2). Workshop attendees shared stories about the interplay between traditional foods and connection to ancestral lands (Country) and Aboriginal cultures. A key story in the system was how the ongoing impacts of colonisation significantly reduced access to land, thereby constraining opportunities to access traditional foods, further compounding disconnection from Country and Culture as part of the ongoing process of colonisation (see feedback loop at the top of Fig. 1). Participants agreed that traditional foods are highly nutritious so having access to them is important for optimising the nutritional content of the diet, as part of the holistic approach to Aboriginal health. This story forms part of another important feedback loop as maintaining health and nutrition is important for prolonging the life-expectancy of Elders to facilitate the invaluable transmission of ancestral knowledge so future generations will have access to traditional foods that they can eat to maintain their own nutritional health, while ensuring the continuity of healthy generational food patterns and passing down of traditional food knowledges (see feedback loops in the bottom half of Fig. 2).

3.2.2. Family, Community and culture

Closely linked to family passing down traditional food knowledge was the theme of family, Community and culture. Participants shared stories about the importance of nutrition programs, as a determinant of healthy eating that fosters Community connections and provides opportunities to come together and share food and culture. There was discussion about the potential of integrating nutrition education and support for parents into Community food sharing programs as participants suggested this could increase family role models around food, thereby providing more opportunities for Community food sharing (see feedback loop at the bottom right of Fig. 3). Participants further

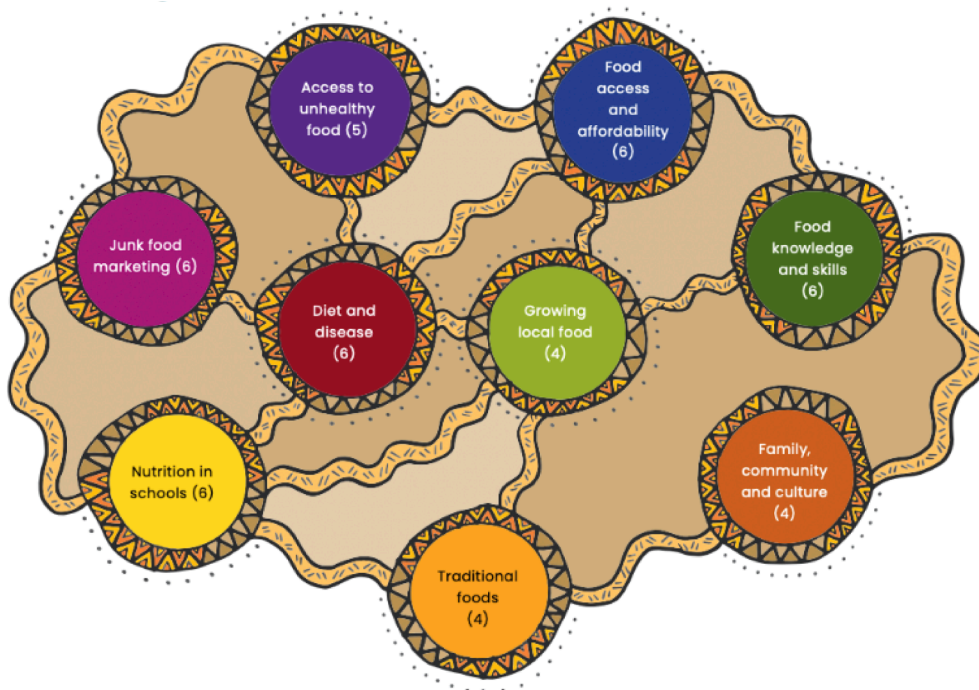


Fig. 1. Combined themes representing determinants of food choice from six Community system maps (numbers in brackets indicate the number of sites corresponding to each theme).

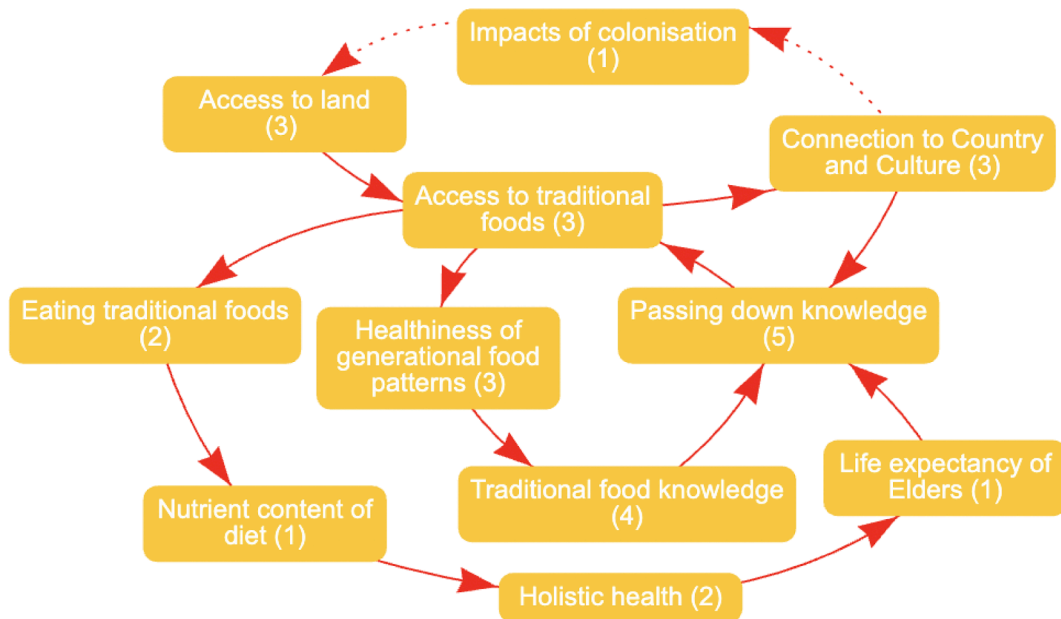


Fig. 2. Traditional foods feedback loops. Legend: (numbers in brackets = no. of sites that raised each factor). —> Factors that change in the same direction - - - -> Factors that change in opposite directions.

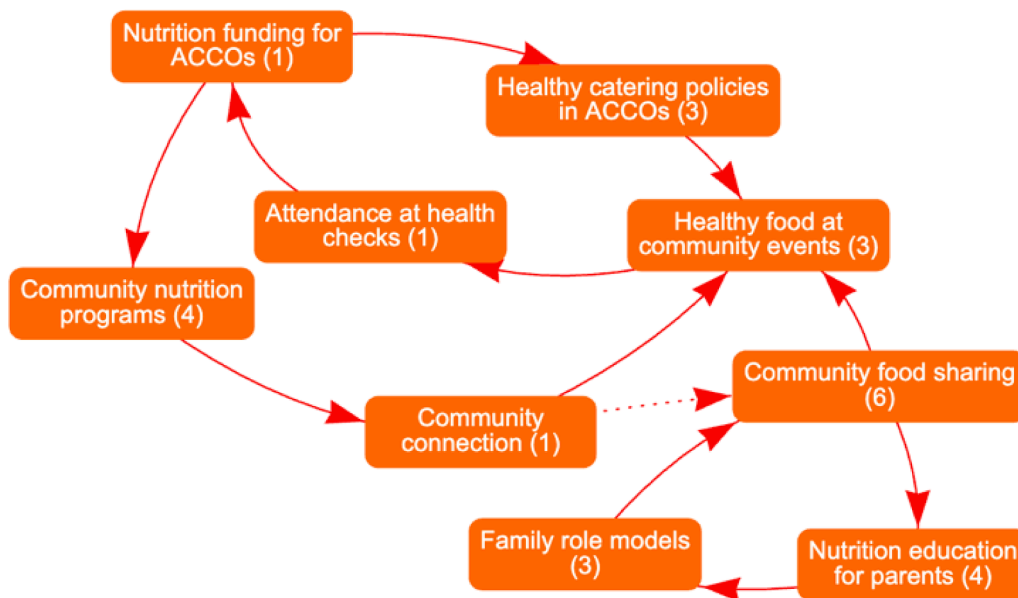


Fig. 3. Family, Community and culture feedback loops. Legend: (numbers in brackets = no. of sites that raised each factor). —> Factors that change in the same direction - - - -> Factors that change in opposite directions.

underscored the pivotal role of ACCOs in implementing healthy catering policies to facilitate the provision of healthy food at Community events. Providing food at Community events can increase attendance at health checks, which is one way for ACCOs to generate revenue. The funds derived from health checks could fortify the resources available to ACCOs to deliver culturally-grounded Community nutrition programs, thus initiating another feedback loop (see top of Fig. 3).

3.2.3. Growing local food

The ability to grow one’s own food emerged as a key point of discussion at most sites, especially in the context of buying and eating local food. Participants described how, since colonisation, Aboriginal peoples have had to rely more on supermarkets due to increasingly limited access to land for food procurement and cultivation. It was suggested

introducing more local food options could reshape this dynamic, encouraging increased consumption of local produce and subsequently reducing reliance on supermarkets, which, in turn, would strengthen the practice of growing one’s own food and buying food from local producers (see the feedback loop in the centre of Fig. 4). Another key story in this system was how consuming local food also contributes to mitigating the environmental impact of food choices. This feeds into another feedback loop whereby a healthier environment bolsters farmers’ capacity to grow food, thereby increasing food available for purchasing local produce (see feedback loop at the bottom of Fig. 4). Participants also identified how enabling people to grow their own food could support more Community food sharing which could increase nutrition awareness in the Community, including the knowledge and skills required to grow food (see feedback loop at the top of Fig. 4).



Fig. 4. Growing local food feedback loops. Legend: (numbers in brackets = no. of sites that raised each factor). —> Factors that change in the same direction — - - -> Factors that change in opposite directions.

3.2.4. Food knowledge and skills

Food and nutrition knowledge and skills was another important factor, according to participants, influencing dietary choices. Participants discussed the importance of having access to nutrition services and support, especially Aboriginal-led nutrition information. A feedback loop was identified whereby, increased nutrition awareness in the Community fosters more opportunities for Aboriginal-led nutrition information. This could encompass various aspects of food and nutrition, such as cooking programs and using food labels. Such Aboriginal-led programs could expand access to nutrition services and support while enhancing food knowledge and skills, furthering nutrition awareness in the Community (see feedback loop to the right of Fig. 5). Implementing programs to enhance cooking skills could initiate another feedback loop. Participants suggested that Community members equipped with cooking skills may be more likely to prepare nutritious meals, engage in

Community food sharing, and impart their knowledge to younger generations, thereby preserving these essential food and cooking skills within the Community (see feedback loop to the left of Fig. 5).

3.2.5. Nutrition in schools

Closely linked to the theme of food knowledge and skills was the imperative to start nutrition education at an early stage, with children. Nutrition in schools was raised by participants in all sites, with discussions centred around three feedback loops. Participants described how initiating food education in childhood equips children with the knowledge and skills to make healthy food choices which, in turn, will bolster their ability to learn at school (see feedback loop at the bottom of Fig. 6). This learning includes food education as well as fundamental literacy and language skills, which are necessary to enable understanding of and access to healthy foods. Access to healthy food underpins whether there

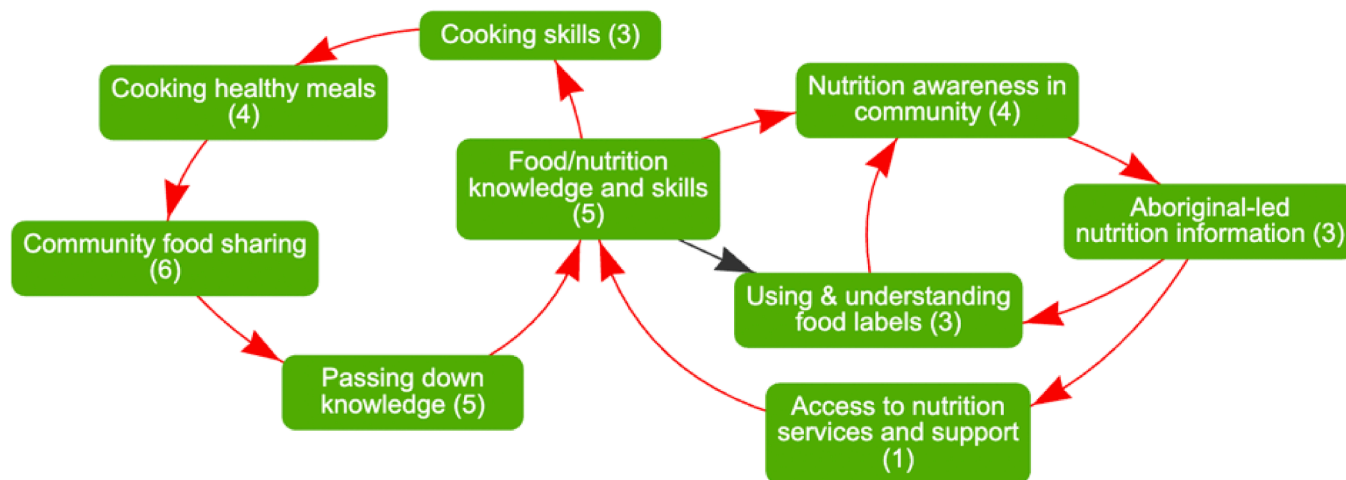


Fig. 5. Food knowledge and skills feedback loops. Legend: (numbers in brackets = no. of sites that raised each factor). —> Factors that change in the same direction — - - -> Factors that change in opposite directions.

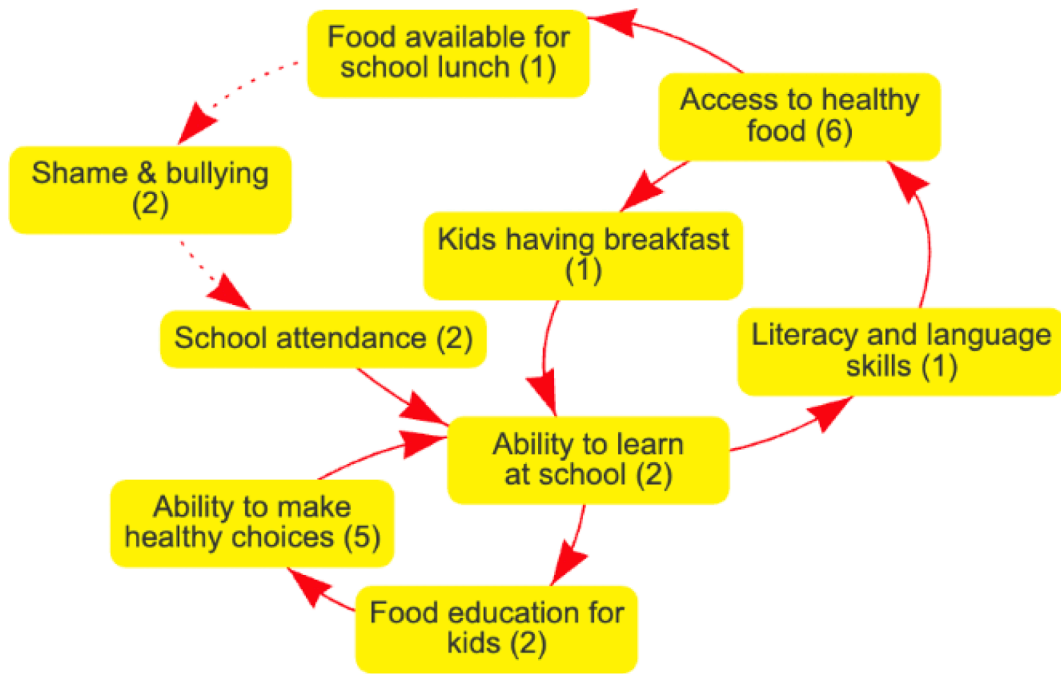


Fig. 6. Nutrition in schools feedback loops. Legend: (numbers in brackets = no. of sites that raised each factor). —> Factors that change in the same direction — - - -> Factors that change in opposite directions.

is food available for breakfast and school lunches. Participants shared the view that many children go to school without having breakfast, impacting their ability to learn at school (see feedback loop to the right of Fig. 6). Likewise, some children encounter feelings of shame and bullying if they are unable to meet expectations regarding school lunches. In certain instances, participants reported these feelings of shame and bullying contribute to reduced school attendance,

compounding the impact on children’s learning potential (see feedback loop at the top of Fig. 6).

3.2.6. Food access and affordability

Food access and affordability was a prominent theme across all six ACCO sites. The feedback loops driving food access and affordability are underpinned by the interrelated concepts of cost of living and income.

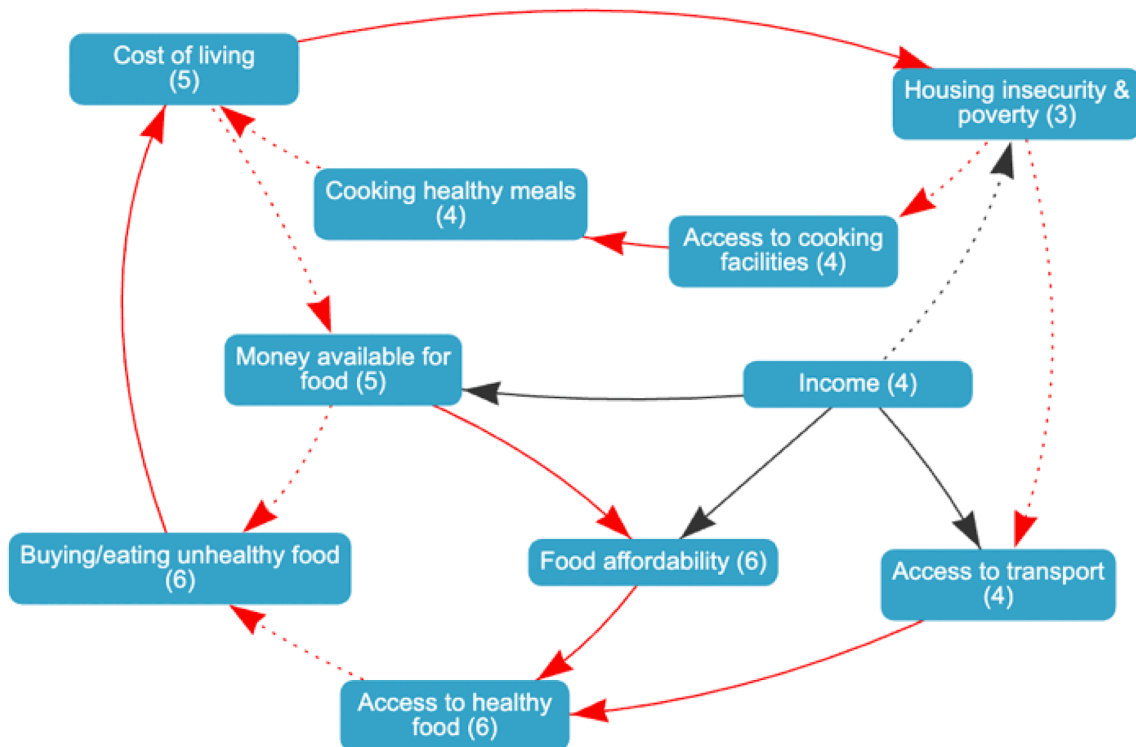


Fig. 7. Food access and affordability feedback loops. Legend: (numbers in brackets = no. of sites that raised each factor). —> Factors that change in the same direction — - - -> Factors that change in opposite directions.

Participants discussed the stressors stemming from mounting expenses associated with cost of living, including escalating food prices. This financial burden reduces money available for food in families' budgets. As a result, food affordability was reported to be a key factor constraining access to fresh, healthy food and driving people to buy less healthy options, which contribute to overall cost of living (see feedback loop to the left of Fig. 7). As well as limiting money available for food, participants highlighted that having a lower income also increases housing insecurity and poverty which reduces access to cooking facilities. Consequently, cooking healthy meals at home becomes more challenging, increasing reliance on convenience food and compounding the cost of living pressures that contributes to housing insecurity (see feedback loop at the top of Fig. 7). Income and housing insecurity also affect access to transport, thereby impeding people's ability to travel to supermarkets where groceries may be more affordable. This reinforces the cycle restricting food access and driving people to buy unhealthy products, thus perpetuating the ongoing strain on living expenses (see large feedback loop around the outside of Fig. 7).

3.2.7. Access to unhealthy food

The number of fast-food outlets in many Communities was central to discussions about access to unhealthy food during the majority of workshops. As Fig. 8 illustrates, a feedback loop is created when the proliferation of fast-food outlets drives consumption of unhealthy fast-food. Increased purchasing of fast-food contributes to the profits of these companies, thereby facilitating the expansion of their operations resulting in a continued surge in fast-food outlets. This feedback loop (see left of Fig. 8) drives access to and, consequently, increased consumption of unhealthy food in many Communities. The rise of food delivery mobile phone applications reinforces this cycle by further increasing the convenience of takeaway. Moreover, as the number of fast-food outlets grows, there will be a parallel expansion in the variety of food delivery options (see feedback loop to the right of Fig. 8).

3.2.8. Junk food marketing

The issue of 'junk food' marketing was a significant concern across all six sites. Five feedback loops related to this theme emerged from the workshops (Fig. 9). Participants discussed the ways in which companies strategically market their products, not only via advertisements but also through sports sponsorship and placing their products at eye-level in supermarkets. These marketing strategies increase the appeal of junk food, thus increasing purchasing of these products. This in turn fuels the companies' profits, enabling them to further amplify their marketing efforts. Over time, this creates a feedback loop where increased company profits bolster further marketing, driving greater consumption of unhealthy food and even higher profits (see feedback loops to the right

of Fig. 9). Participants at some sites also highlighted that as companies amass greater profits, their influence expands, enabling them to lobby governments to reduce food industry regulation. Weaker regulation allows junk food companies to intensify their marketing efforts and further increase their profits and consolidate the food industry's power in the system. As a result, individuals are increasingly buying and eating more unhealthy foods (see feedback loop around the outside of Fig. 9).

3.2.9. Diet and disease

All sites discussed the links between unhealthy diets and the chronic diseases which are prevalent in Aboriginal Communities, particularly type 2 diabetes. There was also considerable discussion about the interrelationship between diet, chronic disease and mental health. Participants explained how mental health challenges, including stress and addiction, makes it more difficult for individuals to prioritise healthy food. During stressful periods, the appeal of comfort foods is heightened, prompting increased consumption of unhealthy products. Participants observed that consumption of processed foods had the potential to exacerbate mental health issues, establishing a cycle of unhealthy eating patterns and deteriorating mental wellbeing (see feedback loops at the centre and bottom of Fig. 10). Another key story in this system was about how continued unhealthy eating increases the risk of diet-related illness. Participants highlighted how the stress associated with chronic disease creates additional barriers to prioritising healthy food, thereby reinforcing the cycle of diet, disease and reduced mental wellbeing (see feedback loop around the outside of Fig. 10).

3.3. Priority actions

Participants at each workshop site used their system map to generate a list of priority actions aimed at improving food environments and nutrition for their local Aboriginal Community. The priorities of each individual site are detailed in the FoodPATH Community Report (Browne et al., 2023). Table 1 outlines the combined policy recommendations derived from the six workshop sites, based on the actions that received the highest number of votes across all sites. These are divided into two distinct categories; Community actions, which should be driven by local Aboriginal Communities but often require sustainable funding; and, government actions, which should be developed in consultation with Aboriginal and Torres Strait Islander Communities. This dual approach recognises the importance of both government policy and grassroots action to improve the system of factors influencing food and nutrition outcomes.

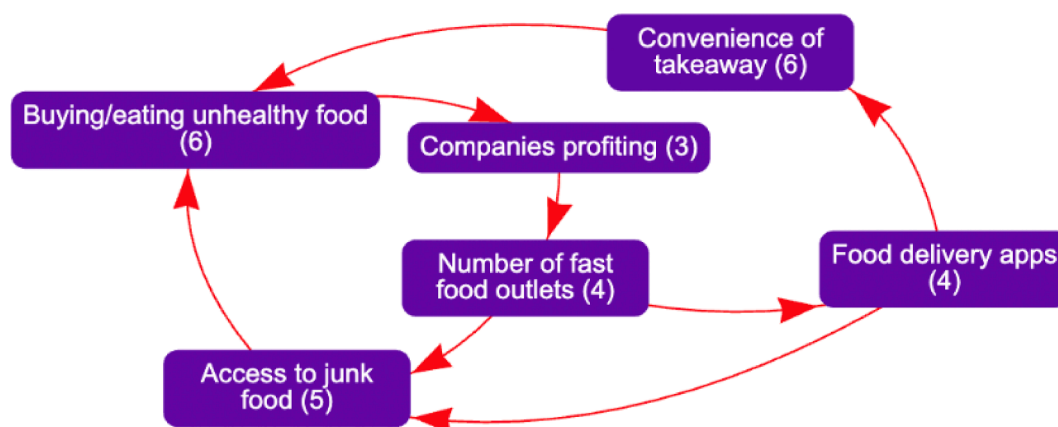


Fig. 8. Access to unhealthy food feedback loops. Legend: (numbers in brackets = no. of sites that raised each factor). —> Factors that change in the same direction - - - -> Factors that change in opposite directions.

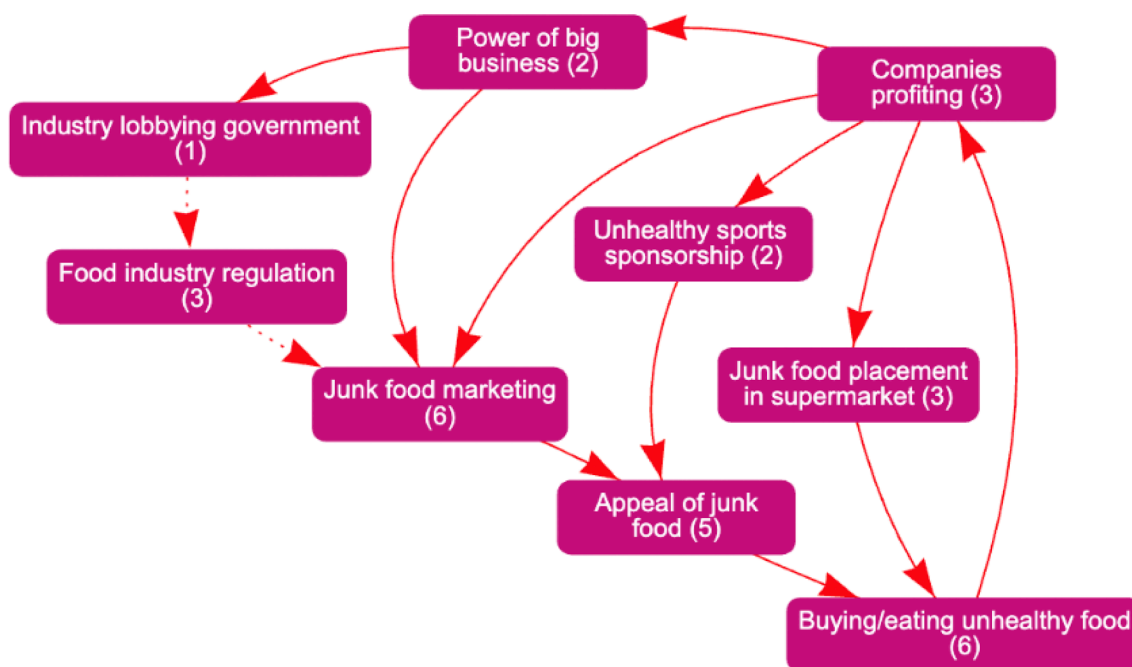


Fig. 9. Junk food marketing feedback loops. Legend: (numbers in brackets = no. of sites that raised each factor). —> Factors that change in the same direction
 - - - -> Factors that change in opposite directions.

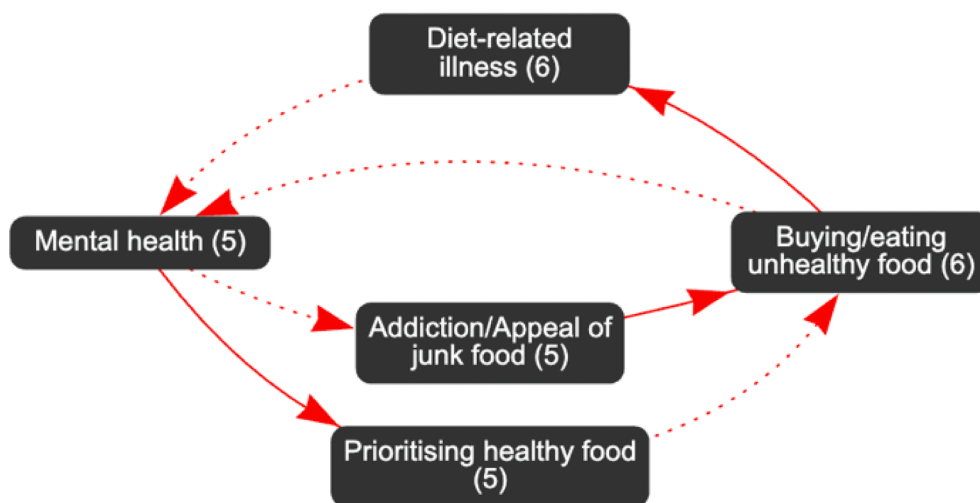


Fig. 10. Diet and disease feedback loops. Legend: (numbers in brackets = no. of sites that raised each factor). —> Factors that change in the same direction
 - - - -> Factors that change in opposite directions.

4. Discussion

FoodPATH used a system dynamics approach to collaborate with Aboriginal organisations in developing a shared understanding of the determinants of food choice and Community-led food policy agenda. Participatory workshops with six ACCOs revealed feedback loops across nine central themes within a complex system underpinned by colonisation. Our findings highlight the enduring significance of traditional foods for Aboriginal people living in Victoria, embodying nutrition, cultural connection, Country, and ancestral knowledge. This equilibrium has been disrupted by colonisation; however, our findings emphasise the pivotal roles of Community nutrition programs and ACCOs in upholding connections to family, Community and culture. In this context, growing local food, enhancing nutrition knowledge and skills and optimising nutrition for children were all seen as vital. The imposition of Western economic and food systems has accentuated

concerns about food access and affordability, the proliferation of fast-food outlets and exposure to junk food marketing. Our findings underscore the complex interplay between the various factors influencing food choice, chronic disease and wellbeing for Aboriginal people, as well as the Community-controlled sector’s aspiration to respond through comprehensive system-wide actions to improve food environments.

4.1. Comparison with the literature

Applying a ‘systems thinking’ approach through Aboriginal-led group model building workshops empowered participants to articulate a holistic conceptualisation of the interconnected factors shaping nutrition outcomes within their Communities and to identify actions for intervention. Previous research on Aboriginal food systems has been narrower in scope, focussing on important sub-systems such as community food security (Booth et al., 2023; Brimblecombe et al., 2017;

Table 1
Priority Actions.

Community actions	Government actions
1. ACCO-led self-determined Community nutrition programs	1. Ban junk food marketing (in all its forms), including unhealthy sport sponsorship
2. Community gardens to grow and share food among Community members; these could be linked to food packages or cooking programs	2. Mandate nutrition and cooking education in schools
3. Workshops/Yarning circles with Elders to educate Community about traditional foods	3. Make the Health Star Rating food labelling system mandatory across all packaged food
4. Community based parenting programs, incorporating nutrition and cooking healthy meals.	4. Set limits on the amount of sugar, salt and saturated fat allowed in packaged food
5. ACCO early years programs focused on healthy eating in pregnancy and early childhood nutrition.	5. Keep the goods and services tax (GST) off fresh food

Muthayya et al., 2020), food retail (Brimblecombe et al., 2020; Ferguson et al., 2018; Lee et al., 2016) and traditional foods (Cubillo et al., 2020; Cubillo et al., 2023; Ferguson et al., 2017), predominantly in remote Australia. In contrast, research in Victoria has examined nutrition policy and program implementation at the local government and ACCO level (Doyle et al., 2016; Genat et al., 2016; Helson et al., 2017; MacDonald et al., 2016; Murray et al., 2014). The present study provides a unique contribution as it generated a comprehensive food policy action agenda for both governments and the ACCO sector drawing from community-driven research. Further, applying a systems thinking approach enabled the western construct of ‘food policy’ to be conceptualised in a manner that aligns with Aboriginal worldviews where “everything is interrelated and interdependent” (Kwaymullina & Kwaymullina, 2010, p. 146). Goodchild (2022) calls this convergence of knowledge systems *relational systems thinking*, emphasising that connection and mutual benefit are the foundational principles for transformative system change.

Our findings align with a systematic review of qualitative evidence reporting the perspectives of Aboriginal and Torres Strait Islander peoples regarding factors influencing diet and priority actions to improve nutrition (Christidis et al., 2021). Christidis et al. (2021) highlighted key factors such as food access and affordability, junk food availability and marketing, food knowledge and skills, connection to family and culture and traditional foods in shaping food choice for Aboriginal and Torres Strait Islander people across Australia. Our current study corroborates that these issues are also pertinent for Aboriginal people in Victoria. Furthermore, a group model building study conducted with Māori communities also identified feedback loops related to junk food marketing, healthy food access and affordability; cooking skills; family eating habits, schools, cultural connections and mental health (McKelvie-Sebileau et al., 2022). These findings suggest that many of the determinants of food choice may be shared by First Nations peoples in Australia and Aotearoa/New Zealand. Whilst lessons could be shared between these First Nations Communities regarding how to intervene, actions must be community and context-specific.

A key feature of this project is that we identified both Community-level and government-level actions required to improve food environments. While previous studies have engaged Community members in developing interventions to improve home, Community and school food environments (Allender et al., 2019; Gerritsen et al., 2019; McKelvie-Sebileau et al., 2022), the FoodPATH project enabled participants to generate recommendations for both Community-led and government-led actions. This is important because, as our findings indicate, nutrition inequities are driven by factors that are often beyond the control of individuals and local food systems (Monsivais et al., 2021). The ten priority actions drawn from workshops with six Aboriginal Communities

align with Australian and international evidence on effective food programs and policies for improving nutrition in Indigenous populations (Browne et al., 2017; Browne et al., 2020).

4.2. Policy implications

Leading the list of Community-level priorities was the call for ACCO-led, self-determined Community nutrition programs. Multifaceted food and nutrition programs initiated and designed by local Aboriginal people that address the underlying drivers of food choice are likely to be effective (Browne et al., 2017). We also identified five food policy actions for governments that were perceived to be effective and acceptable for Victorian Aboriginal Communities. First, there was strong support for restricting unhealthy food marketing in all its forms. This recommendation closely aligns with Australia’s National Preventive Health Strategy and National Obesity Strategy (Department of Health, 2021; Health Ministers Meeting, 2022), as well as an Australian Private Members’ Bill that was recently introduced to the federal parliament (Scamps, 2023). Secondly, participants emphasised the need for compulsory nutrition and cooking education in schools. Although the Victorian education curriculum does include some food and nutrition content (VCAA, 2021), evidence suggests that it is inconsistently implemented in classroom teaching (Aydin et al., 2021; Love et al., 2020). Third, our findings echo calls from others to mandate Australia’s *Health Star Rating* food front-of pack labelling system, which is currently voluntary across all packaged foods (Jones et al., 2019; Shahid et al., 2020). Likewise, participants support for action to limit the levels of sugar, salt and saturated fat in packaged foods underscores the need for stronger reformulation targets than those currently in place under the Australian Government’s voluntary *Healthy Food Partnership* initiative (Coyle et al. 2021a; Coyle et al., 2021b; Rosewarne et al., 2020). Finally, in light of rising food prices, maintaining the goods and services tax (GST) exemption for fresh food in Australia is a critical strategy to safeguard the affordability of healthy food and prevent further food insecurity (Landrigan et al., 2017; Lewis et al., 2023).

The findings of this study have implications for both Aboriginal-specific and population-wide policy in Australia. Despite over 15 years of “Closing the Gap” policy designed to reduce disparities between Aboriginal and Torres Strait Islander peoples and non-Indigenous Australians, targets remain largely unmet and food policy has been conspicuously absent from the Closing the Gap agenda (Browne et al., 2014; Productivity Commission, 2024). A recent policy review underscored the need for government practices to better align with the values of the ACCO sector, with self-determination identified as the ultimate goal. Empowering ACCOs to implement locally relevant programs is essential for addressing the specific needs of Aboriginal Communities in Victoria. Our findings highlight that this is particularly important in the area of nutrition. Moreover, while previous research has demonstrated limited inclusion of Aboriginal organisations in the formulation of population-wide food policy (Browne et al., 2021b), our findings demonstrate the important contributions ACCOs can make to public policy debates on food marketing, it is imperative that population-wide food policy processes actively incorporate the voices and values of Aboriginal and Torres Strait Islander peoples.

4.3. Strengths and limitations

Through a community-based system dynamics approach, grounded in Aboriginal values and perspectives, we were able to harness Aboriginal knowledges and priorities to develop a collective vision for improving food environments through system change. A key strength of the study was the leadership from Aboriginal and Torres Strait Islander researchers, who informed the methodology, facilitated the group model building workshops and played a central role in the interpretation of our findings. This approach enabled “two-way” learning, where researchers developed capacity within ACCOs to develop system maps, while at the

same time non-Indigenous team members learned from Aboriginal researchers and participants about Aboriginal ways of knowing, being and doing (Martin & Mirraoopa, 2003). Systems thinking may represent a tangible response to calls for a paradigm shift in Aboriginal nutrition research (Chittleborough et al., 2023; Wilson et al., 2020). Rather than focusing on dietary deficits, the FoodPATH project enabled collaboration with Aboriginal Community members to understand and address the policy and systemic drivers of food choice. A further strength was our partnership with VACCHO, which facilitated both the participation of ACCOs in the study and dissemination of the research findings to the broader Aboriginal Community-controlled health sector. A Community report and culturally relevant translation materials have been co-created with VACCHO to communicate the findings of this study to a wider audience and to advocate for policy change (Browne et al., 2023).

There were several limitations which need to be considered when interpreting the findings of this study. First, our data were collected with 53 participants from six ACCOs located in different regions of Victoria. While our findings have been endorsed by the members of VACCHO (the peak representative body for Aboriginal health and wellbeing in Victoria), we acknowledge that VACCHO does not represent the perspectives and experiences of all Aboriginal and Torres Strait Islander peoples living in Victoria. While ACCOs play a crucial role in Aboriginal Communities, it is important to recognise that recruiting participants who were not directly affiliated with an ACCO may have yielded different results. Second, although we have demonstrated that group model building is a feasible and acceptable method for food policy research with ACCOs in Victoria, its applicability to culturally and geographically diverse Aboriginal and Torres Strait Islander Communities in other parts of Australia remains unclear. Finally, we recognise that, despite our efforts to incorporate Aboriginal ways of knowing, being and doing into our study design, group model building remains a Western and predominantly university-led research method. Important work is underway to develop Indigenous systems methodologies that more closely align with Indigenous knowledges and governance systems (Fletcher et al., 2023).

5. Conclusion

The FoodPATH project successfully employed a system dynamics approach to understand food policy priorities among Aboriginal organisations and Community members in Victoria. Through Indigenous-led group model building methods, six Aboriginal Communities mapped the systemic drivers of food choice and collaboratively developed an action agenda for improved food environments. The findings yielded a comprehensive understanding of the interconnected factors and feedback mechanisms shaping food choices for Aboriginal people living in Victoria. Our findings underscore the concurrent need for local-level Aboriginal-led food and nutrition programs and government policy to address the macro food environment. Restricting unhealthy food marketing, strengthening food education in schools, mandating front-of-pack nutrition labelling and reformulation targets, and maintaining the GST exemption for fresh foods were priority policy actions that were considered acceptable and effective for improving nutrition in Victorian Aboriginal Communities.

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CRedit authorship contribution statement

Jennifer Browne: Writing – original draft, Project administration,

Investigation, Funding acquisition, Formal analysis, Conceptualization. **Troy Walker:** Writing – review & editing, Investigation. **Karen Hill:** Writing – review & editing, Project administration, Investigation, Formal analysis. **Fiona Mitchell:** Writing – review & editing, Investigation. **Holly Beswick:** Writing – review & editing, Investigation. **Stephanie Thow:** Writing – review & editing, Investigation. **Joleen Ryan:** Writing – review & editing, Investigation. **Simone Sherriff:** Writing – review & editing, Methodology. **Amy Rossignoli:** Writing – review & editing, Project administration, Conceptualization. **Abe Ropitini:** Writing – review & editing, Project administration. **Michael Johnstone:** Writing – review & editing, Visualization, Software. **Yin Paradies:** Writing – review & editing, Supervision. **Kathryn Backholer:** Writing – review & editing, Supervision, Conceptualization. **Steven Allender:** Writing – review & editing, Supervision, Software, Methodology. **Andrew D. Brown:** Writing – original draft, Methodology, Investigation, Conceptualization.

Declaration of competing interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests: [The authors have no interests to declare other than Michael Johnstone and Steven Allender, who are co-inventors of the STICKE software package.]

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Appendix A. Supplementary material

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.foodpol.2024.102676>.

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