OXFORD

Local Environment Action on Food project: impact of a community-based food environment intervention in Canada

Breanne L. Aylward [1], **Krista M. Milford**[1], **Kate E. Storey** [2],
Candace I. J. Nykiforuk [1], **and Kim D. Raine**[1,*]

[1]School of Public Health, University of Alberta, 11405-87 Avenue, Edmonton, Alberta T6G 1C9, Canada and
[2]School of Public Health, University of Alberta, 8303-112 Street, Edmonton, Alberta T6G 2T4, Canada

*Corresponding author. E-mail: kim.raine@ualberta.ca

Summary

Children are exposed to food environments that make nutrient-poor, energy-dense food cheap, readily available and heavily marketed; all conditions with potential negative impacts on diet and health. While the need for programmes and policies that improve the status of food environments is clear, greater public support is needed for governments to act. The purpose of this qualitative collective case study was to examine if community engagement in the Local Environment Action on Food (LEAF) project, a community-based food environment intervention in Alberta, Canada, could build public support and create action to promote healthy food environments. Semi-structured interviews with a purposeful sample of 26 stakeholders from 7 communities explored LEAF's impact and stakeholder experiences creating change. Data collection and analysis were iterative, following Charmaz's constant comparative analysis strategy. Participants reported environmental and community impacts from LEAF. Notably, LEAF created a context-specific tool, a Mini Nutrition Report Card, that communities used to promote and support food environment action. Further, analysis outlined perceived barriers and facilitators to creating community-level food environment action, including level of engagement in LEAF, perceived controllability, community priorities, policy enforcement and resources. Findings from this study suggest that community-based interventions, such as LEAF, can help build community capacity and reduce existing barriers to community-level food environment action. Thus, they can provide an effective method to build public awareness, demand and action for healthier food environments.

Key words: community-based intervention, qualitative methods, health-promoting environments, community engagement, children

INTRODUCTION

Food environments, structural factors that influence dietary behaviours (Swinburn *et al.*, 2013), shape the availability, affordability and social acceptability of dietary patterns, including the practices of children. Experts have described the status of Canada's food environments as unsupportive to maintain healthy dietary patterns because nutrient-poor, energy-dense food items are

cheaper, more readily available and more heavily marketed than healthy food items (Vanderlee *et al.*, 2017). The current state of Canada's food environments is problematic, given the impact of food environments on diet-related health outcomes (Swinburn *et al.*, 2011; Osei-Assibey *et al.*, 2012; Engler-Stringer *et al.*, 2014). Governments, the food industry and the general public all play a role in determining the status of food environments (Swinburn *et al.*, 2013). Collaborative relationships between these parties could lead to the creation of healthy food environments for children and adults. In particular, strong government policies and programming have tremendous potential to shift food environments to those that are supportive of health. For example, local governments can influence food availability and accessibility through zoning by-laws that limit the proliferation of fast food and convenience stores selling predominantly less healthy options (Mah *et al.*, 2016; Minaker, 2016). At an even more local level, schools can adopt policies that ensure provision of healthy foods on site; such policies have been associated with improved diet among children (Micha *et al.*, 2018). Without strong public support, however, governments may be unwilling to implement supportive policies (Diepeveen *et al.*, 2013).

Although there has been recent public support for action to create healthier food environments in Canada (Bhawra *et al.*, 2018; Kongats *et al.*, 2019), more pressure from the general public is needed to create successful programmes and policies. Community-based interventions that include members of the target community during intervention development and implementation represent one possible strategy to build the needed public pressure and action. Collaboration with residents could help create contextually appropriate food environment interventions, an important consideration given that community factors may determine the influence of certain aspects of the food environment (Health Canada, 2013). Aligned with this approach is the Local Environment Action on Food (LEAF) project, a community-based intervention that engages local communities in monitoring and acting on their own food environments.

LEAF is an ongoing community-based health promotion intervention implemented in 17 communities across Alberta, Canada, beginning in 2017. LEAF is one component of a multi-pronged research project, under the umbrella of an annual assessment of the province's food environments and nutrition policies, *Alberta's Nutrition Report Card on Food Evironments for Children & Youth* (provincial NRC), which assesses the status of five food environments (Brennan *et al.*, 2011): the

physical (what food is available), communication (food and nutrition messages), economic (food affordability), social (norms and values about food) and political (rules and policies) environments [see Olstad *et al.* (Olstad *et al.*, 2014) for details, and Ferdinands *et al.* (Ferdinands *et al.*, 2020) for progress since its implementation in 2015]. Engaging local communities represented a supplemental opportunity to improve provincial food environments.

Adopting a citizen science approach (Scientize Consortium, 2013; Den Broeder *et al.*, 2018), participating communities worked with the LEAF research team to create a *Mini Nutrition Report Card on Food Environments for Children and Youth* (Mini NRC) (see Supplementary Material 1 as an example). While recruitment for LEAF occurred through several means, all participating communities were self-selected (detailed description of the LEAF process to be published elsewhere). Typically, LEAF was led by one or two staff members (hereafter referred to as LEAF project leads) from our organizational partners, who were supported during the LEAF process by existing community groups. The composition of these community groups varied, including a combination of volunteers that were concerned citizens and staff representation from a wide range sectors (e.g. Public Health, Education, Parks and Recreation, Municipal Governments, etc.). Although modifiable to community needs and priorities, the LEAF process usually involves eight steps: an orientation, selection of settings to assess, data collection, data analysis, a meeting to validate the collected data, two recommendation meetings and a final Mini NRC launch. This study's primary objective was to examine if community engagement in LEAF could build support and create action to promote healthy food environments. Specifically, we sought to answer two main questions: (i) if and how LEAF and locally driven recommendations stimulated local action for change towards environments that support healthy eating and (ii) what are the perceived barriers and facilitators to LEAF's success and sustainability?

METHODS

Setting
The first seven communities to complete LEAF were included in this study. This sample was deemed sufficient because it allowed us to obtain a diverse sample of communities and provided enough data to adequately address the research questions. Study communities were diverse in size, including one medium population centre

(∼65 000 people), four small population centres (∼2500–15 000 people) and two rural areas (∼950 people). Study communities were spread across Alberta, a geographically large western Canadian province, with two in the south zone, four in the central zone and one in the north zone (Alberta Health Services, n.d.). Study communities varied on other contextual factors, such as foci of local government priorities, and their histories with healthy eating and food-related initiatives.

Study design

This research employed a qualitative collective case study design (Stake, 1995), where each included LEAF community represented a separate case. Stake's constructivist approach (Stake, 1995), which asserts that knowledge is co-created by the researcher and participant, was chosen to guide this research because of the approach's focus on context. Examining contextual similarities and differences between the study communities was essential, as critics have cited insufficient attention to context to explain the lack of success of previous community-based initiatives (McLaren *et al.*, 2007). We chose qualitative methods for their ability to aid in understanding the complex and sometimes unexpected mechanisms through which interventions enact change (Moore *et al.*, 2015). Ethics approval for this study was granted from the Research Ethics Board at the University of Alberta (Pro00084508). Informed written consent was obtained from participants prior to interviews.

Data collection

In each study community, data collection began after the LEAF process was complete. We used purposive sampling to select individual participants: all participants were stakeholders who were involved in or had knowledge of LEAF in the study communities (i.e. LEAF stakeholders). The first author conducted individual semi-structured telephone interviews with 26 LEAF stakeholders between December 2018 and March 2020. Interviews lasted between 13 and 95 min, with an average interview time of 39 min. The variability in interview length reflected the diverse range of interview participants, with some playing relatively minor roles (e.g. only collecting data), and others being intimately involved in all aspects of LEAF. Semi-structured interviews were chosen for their flexibility to explore unexpected insights, seek clarity in interviewees' responses and enable the interviewees to outline their experience (Bryman and Bell, 2016). In each study community, timelines for conducting participant interviews were dictated by community and participant needs. Recruitment

typically began at the community's Mini NRC launch, the last stage of the LEAF process. Interviews addressed LEAF stakeholders' experiences using their Mini NRCs and the barriers and facilitators to future Mini NRC use or local food environment action (see Supplementary Material 2 for the full interview guide). Interviews also provided LEAF stakeholders with an opportunity to report improvements made to their local food environments. All interviews were audio-recorded and transcribed verbatim. Data collection and analysis were conducted concurrently to explore unexpected findings and thus develop a deeper understanding of LEAF's impact.

Data analysis

The first author analysed all interviews using the constant comparison analysis strategy, a 'process whereby each interpretation and finding is compared with existing findings as it emerges from the data analysis' [(Parry, 2004), p. 181]. In particular, we followed Charmaz's constructivist approach (Charmaz, 2014), using an inductive and multiphase process. The first phase was a manually conducted within-case analysis that consisted of detailed initial coding followed by focussed coding. Initial coding was an open-ended process of line-by-line coding, beginning the search for analytic ideas and helping to guide subsequent data collection and analysis. During focussed coding, all data and corresponding codes were re-read, searching for codes that occurred most frequently or codes that were most significant (i.e. those that summarized the data more thoroughly). Comparisons were made between initial codes to generate focussed codes, and then between focussed codes to generate preliminary conceptual categories. Once preliminary categories were developed for each case, the second phase of data analysis began. The second phase was a cross-case comparison where cross-case categories and themes were identified by examining for patterns that were common to all cases (Chmiliar, 2010). Excel matrices and NVivo analytic software were used during this phase. The first author used spontaneous and unstructured memo-writing throughout the process of data analysis to clarify data and increase data abstraction (Charmaz, 2014).

We used several strategies to establish and maintain the rigour of the study (Mayan, 2016). First, there was prolonged engagement between the research team and the study population. The first author attended LEAF meetings (*n* = 4) and Mini NRC launches (*n* = 5), where she was introduced to several LEAF project leads and LEAF stakeholders. These interactions helped build

rapport and may have facilitated a more honest, authentic interview between the first author and participants. Second, the first author engaged in member checking during participant interviews by summarizing participants' response and immediately repeating it back to them to check for understanding. Third, the first author engaged in reflexive activities, such as documenting and analysing the rationale for research decisions in a journal. Finally, we used several verification strategies as outlined by Morse *et al.* (Morse *et al.*, 2002), including research team meetings to ensure methodological coherence and discuss emerging findings, appropriate sampling by only recruiting participants that were involved in or had knowledge of LEAF, and collecting and analysing data concurrently.

RESULTS

Participants described numerous environmental impacts (Table 1), which are summarized descriptively. Analysis identified two main themes: *community impacts* and *barriers and facilitators*.

Environmental impacts

Participants reported impacts in a wide variety of settings and all assessed food environments (i.e. physical, communication, economic, social and political). Although communities reported environmental impacts in schools, recreation facilities and other community settings, only the two rural centres reported environmental impacts in retail food environments (i.e. grocery stores or restaurants). Across all communities, most environmental impacts were reported in the physical and communication environments. In the physical environment, schools, recreation centres and other public facilities commonly reported increasing the availability of healthy food options in their vending machines, concessions and cafeterias. In the communication environment, communities reported marketing healthy eating through signage and healthy sample options. However, impact in the social, political and economic environments was limited. Only two communities described impacts in their economic environment: one community reported subsidizing fruit and vegetables for students at a school; another community reported sponsoring a healthy snack for

Table 1: Reported environmental impacts of LEAF

Environment	Action	Setting
Physical	Increasing availability of healthy options and/or decreasing the availability of unhealthy options	Schools ($n=5$)
		Recreation facilities and arenas ($n=4$)
		Golf course ($n=1$)
		Hospital gift shop ($n=1$)
	Closing campus—students cannot leave premise	Schools ($n=1$)
	Removing vending machines	Recreation facilities ($n=1$)
Communication	Marketing healthy options or healthy eating (through posters or other signage, menu boards, sampling and email newsletters)	Schools ($n=2$)
		Childcare facilities ($n=1$)
		Recreation facilities ($n=3$)
		Grocery stores ($n=2$)
		Other public or private facilities ($n=3$)
	Removing marketing of unhealthy options	Schools ($n=1$)
	Giving advice or sharing resources related to healthy eating	Schools ($n=5$)
		Library ($n=1$)
		Childcare facilities ($n=2$)
	Menu labelling	Golf course ($n=1$)
Economic	Subsidizing fruit and vegetables	Schools ($n=1$)
	Sponsoring a healthy snack	Recreation facilities ($n=1$)
Social	Sharing or displaying breastfeeding welcome signs	Childcare facilities ($n=1$)
		Public facilities ($n=1$)
Political	Enforcing nutrition policies	Schools ($n=2$)
	Planning review of nutrition policies	Schools ($n=1$)
	Creating a wellness policy	Town ($n=1$)

Note. n is the number of communities that reported the impact.

children's bowling league. Only one community described impacts in their social environment: they shared and displayed signs to promote breastfeeding. Lastly, three communities described impacts in their political environments: one community described creating a new supportive policy, whereas two other communities began monitoring and enforcing existing school nutrition policies.

Community impacts

Beyond the short-term impacts to food environments, participants reported community impacts from LEAF, which were longer-term strategies for building and sustaining momentum to create healthier local food environments. For example, participants felt that LEAF sparked community conversations about food environments and provided them with a context-specific tool (the Mini NRC) to promote and support food environment action. Thus, LEAF promoted community engagement in food environment efforts beyond the project's end. As explained by one participant:

> Having gone through the report, the conversations, and the meetings that we had, has really opened the door for conversation. And so, I think that continuing that conversation—continuing to be a support to schools, getting them some resources and some materials... that's really key. Because if we can keep that conversation going, then we can continue to make changes (P18).

Categories within the community impacts theme represented participants' main goals of using the Mini NRC, *gaining buy-in* and *guiding action*, and how they attempted to achieve these goals, *raising awareness*, *framing conversations* and *aligning priorities*.

Gaining buy-in

Participants perceived gaining buy-in, or active support, for healthy food environments as one of the main goals of developing and using the Mini NRC. Participants wanted broad, community-wide support for healthy food environments but often described the need to gain support from decision-makers. Although a few participants reported increased buy-in as an outcome of LEAF, many commented on the need for continued conversations to increase active support for healthy food environments, which they felt was a challenging task:

> Part of the challenge is getting people involved in a really meaningful way. I mean, a lot of people will come out to a meeting... but I mean getting people really involved... like they'll speak to their agency, they're willing to help do the leg work that's required (P11).

Guiding action

Another perceived goal of the Mini NRC was to guide community stakeholders' actions for creating healthy local food environments. Participants described several aspects of the Mini NRC that facilitated this process. First, it provided a baseline assessment that community stakeholders could use to monitor progress. Second, by breaking settings down into environments and indicators, participants felt that the Mini NRC enabled community stakeholders to focus on realistic goals and tangible tasks. Participants felt that tangible tasks increased community stakeholders' perceived capacity to create healthy food environments because tangible tasks provided a starting point and enabled incremental change. As explained by one participant, 'the [school] divisions only want to have healthier school communities. That is their goal. And sometimes they just don't know how to do that (P13)'. Finally, participants felt that the Mini NRC helped guide the work of health professionals, such as Public Health Dieticians, in a nonprescriptive manner by outlining community-informed priorities. By using the Mini NRC to guide conversations instead of prescribe action, participants described working with community stakeholders to devise food environment actions that the community stakeholders deemed feasible. As explained by one participant:

> She's [school food provider] usually able to kind of digest the information, and [then she] comes back with something that is much healthier in place of what she had. Maybe not perfect, but a good middle ground for the time being as we kind of move towards the final goal (P19).

Raising awareness

Participants perceived raising awareness as the first step to gaining buy-in, guiding action, and ultimately creating healthier local food environments. Raising awareness of the status and impact of local food environments on eating practices was therefore one of the main ways that communities used their Mini NRCs. Additionally, some participants described using LEAF and their Mini NRCs to raise awareness of the available supports and resources that could assist community stakeholders. For example, participants described sharing contact information, healthy eating posters and other relevant resources during LEAF meetings. As described by one LEAF project lead:

> I find the most success with those one-on-one conversations... just encouraging them [community stakeholders] to contact me... And I think the more you have that connection back and forth, the more you can kind

of make people aware that, 'yeah, these are partners that can help'. So, it's making them aware of the need for change and the changes that need to happen, but also making them aware of supports that can help them in that process (P8).

Communities reported sharing and discussing their Mini NRC results through passive and active methods, including email newsletters, blog posts, newspaper articles, radio podcasts and presentations of key Mini NRC findings (e.g. presenting to parent councils, town councils and students). While all communities used their Mini NRCs to raise awareness, they differed on their openness to sharing their results. Communities that made their Mini NRCs publicly available commented on the need to raise widespread awareness. As explained by one LEAF project lead:

> We thought by sharing it publicly it would help bring greater awareness to the impact that settings have on eating. There is still a fair bit of resistance... a little bit of questioning about, 'well, you can't tell people what they should eat, or why a vending contractor should price it [food] a certain way'... And so, you have that conversation about the effect that the eating environment has on people's choices. And how when it's in a public environment... there is that responsibility, I think, that expectation and awareness that you're impacting people's health. So, I think by making that report card public, it would help with some of that awareness and knowledge sharing (P8).

A few participants reported that awareness-raising, aided by aligned priorities, policy enforcement and available resources, created a sense of urgency to act. For example, one participant reported that their Mini NRC results increased a decision-maker's awareness of a school that was not adhering to their school nutrition policy. The participant described how the decision-maker acted quickly, contacting relevant parties to outline expectations. The influence of resources was illustrated in another community: one participant reported that after school decision-makers learned about the high cost of healthy food at their school, they began using existing school nutrition funding to subsidize fruit and vegetables.

Framing conversations

Participants reported using their Mini NRCs to frame conversations and build support for food environment action. They believed that several aspects of the Mini NRC were useful for framing conversations, including its collective approach, community grades and future data collection possibilities.

Participants felt that LEAF was a collective approach in several ways: it was part of a broader provincial strategy, it involved community-wide data collection and it entailed input from numerous sectors. Participants generally viewed the Mini NRC as a collective opinion that was created by various interest groups and was based on evidence and best practices. As explained by one participant:

> It's just nice that it's not my opinion, it is a group's opinion. So, [you can say] 'here's our report card... everybody has kind of agreed that this is our score and where we could be'. It's pretty hard to dodge those results...it basically comes across like gospel (P19).

Some participants believed that highlighting the collective approach and the need for community-wide improvement would increase stakeholders' receptivity to making changes. As described by one LEAF project lead:

> When you see something that's not great, you can't just call someone out on it ... it's easier when you have something like the report card to be like 'this is why I'm here, and we did it with a bunch of other settings'. So [that] people don't feel like it's just them. It's a community-wide approach (P10).

Participants described using their Mini NRC as a reference to improve the local food environments. For settings that scored well, grades provided validation for current actions; for settings scoring poorly, grades provided validation for the need to make changes. Participants reported using their Mini NRC to validate the need for change during discussions with community members and a wide variety of settings, including schools, childcare centres, recreation facilities and town council. In at least one case, the Mini NRC was used to secure grant funding, as the setting's results illustrated their need for improvement. Finally, participants felt that the possibility to re-collect data could be used to motivate change since it would provide community stakeholders with an opportunity to see improvements in their settings (through seeing improvements in their grade).

Aligning priorities

Participants described using the Mini NRC to align community priorities with creating healthy food environments. During the LEAF process, this was particularly evident during the recommendation meetings. Participants that attended recommendation meetings described how they discussed and debated what could be done to improve their community's food environments. In some cases, participants reported engaging

community members external to LEAF to understand what the community would perceive as acceptable. As explained by one participant:

> We also talked to our school council—the group of parents there. 'Cause they represent the parents, so we really want to listen to them. So, it's an interesting conversation among parents…and we kind of went back and forth. And then, as a parent group, we settled on the sugars 'cause it's hard to learn when you're jacked up on, you know, huge super cans of coke and slushes and that kind of stuff (P19).

Participants felt that the Mini NRC gave them a reason to follow up with community stakeholders, enabling them to learn about and respond to the barriers preventing healthy food environments. The importance of aligning priorities was made clear by one LEAF project lead when they said:

> But I think the challenge is just working with all the different partners… and knowing that healthy eating probably isn't their priority. It's certainly mine, but not theirs. So, it's helping them recognize how those eating environments really do contribute, and can contribute, to their bottom line too (P8).

Barriers and facilitators

Participants reported numerous barriers and facilitators that impacted LEAF's success and sustainability in their community, including *level of engagement*, *community priorities*, *perceived controllability*, *policy enforcement* and *resources*. These factors collectively influenced the perceived community capacity to create healthy food environments, often acting together to enable or restrict food environment action. Therefore, participants viewed the Mini NRC as a catalyst that stimulated or supported change, rather than viewing it as the sole cause of change. As explained by one participant:

> Now, I'm not sure if they've [local food environments] changed just as a result of the report card itself… I think the report card came in at the right time—when they [the community] were interested in making change anyways—so it would have helped to make positive change (P1).

Level of engagement

The LEAF process was slightly different in each community, with varying levels of community engagement. Participants typically perceived a lack of stakeholder engagement as a barrier to early LEAF success and extensive stakeholder engagement as a facilitator to early LEAF success. When asked if LEAF had impacted the culture of the community, one LEAF project lead replied, 'No. I think just because we didn't really engage people early on in the process. It's like we're almost starting the engagement phase now' (P10).

Community priorities

Participants felt that community participation in LEAF and food environment action depended on priorities at various levels: individual, setting and community. They described how aligned priorities facilitated engagement in food environment action and often manifested as key individuals, groups or organizations that could champion LEAF in their community. Aligned priorities were not permanent, however, and communities expressed current and historical difficulties sustaining key champions' work due to changing priorities. Changing priorities were seen as a barrier because turnover in whole settings or key individuals often created new priorities. Competing priorities were another reported barrier, as individuals and settings had to weigh nutrition against a multitude of other priorities. In all LEAF communities, financial issues were a reported competing priority that limited and restricted action. For example, several communities cited widespread financial turmoil as a barrier to policy creation. As explained by one participant, 'there's so much other turmoil going on right now with regards to all the cuts that it just—[nutrition] policy for recreation is just not on their agenda right now' (P16).

Perceived controllability

Although LEAF stakeholders were interested in food environment action, they did not always hold authority positions within community settings. When asked what areas were the hardest to impact, one LEAF project lead replied, 'there's challenges with all of them because we don't really have control over any of them' (P8). Participants commonly reported non-local actors, such as chain grocery stores, as a factor that decreased their control over local food environments. The presence of local actors, however, did not always increase stakeholders' perceived controllability. In particular, participants described settings with multiple local food environment actors as less controllable. For example, local third-party vendors, parent councils and school administration were often perceived to influence the status of a school's food environments. Participants also cited the high availability of unhealthy food in LEAF communities as influencing their control, making healthy food provision challenging and time-consuming. Participants expressed difficulty finding healthy options that could be stocked in vending

machines or frozen and easily prepared in concessions or cafeterias. As one LEAF project lead explained:

> I've been non-stop trying to help them find healthy food… but it's impossible. So that's a huge barrier. And it's really discouraging that we're asking people to move towards [healthy food], and not giving them a good mark if they don't hit the target when there isn't even food to access for the vending machines. So, so really, you really can't have vending machines. I mean, it's kind of discouraging (P16).

Policy enforcement

Policy monitoring and enforcement was a reported facilitator for food environment action in some communities. Policy existence, however, was not seen as being sufficient in itself to create action. Participants perceived settings that had policies but lacked enforcement as being dependent on the priorities of relevant decision-makers. This was best exemplified by one participant's interaction with a community setting that lacked enforcement of their existing policy:

> And I spent pretty much like an entire afternoon with them [providing guidance on foods that fit the policy] … and just no change. And I'm just not really sure who— like there's no real accountability there… if you're not following these guidelines, who's the one that says, 'okay, well you've lost your contract'… it's not very clear who that would be (P5).

Resources

Material and human resources also influenced stakeholders' perceived capacity to create healthy food environments. Participants commonly reported funding, staffing and equipment as determining the type and amount of action that settings could take. In particular, the availability of material resources, such as grants, was a perceived facilitator to create action. In part, this was because grants provided settings with flexibility to experiment with providing and promoting healthy food (e.g. sampling healthy options). The influence of community resources on food environment action was demonstrated through participants reporting of LEAF impacts, as they often described how the community's human and material resources helped contribute to making the changes.

DISCUSSION

This study contributes an increased understanding towards creating local support and action to promote healthy food environments. Analysis of the data revealed that LEAF had both environmental and community impacts. Further, participants provided insight into the perceived barriers and facilitators that contribute to sustainable local food environment action. This study's findings are supported by and build on our team's experiences with the provincial NRC (Ferdinands *et al.*, 2020).

Participants reported impacts in a wide range of settings and in all five food environments. However, reported impacts were not equally distributed across settings and environments, and there was a notable lack of action in retail food settings and in the economic, social and political environments. While this could be interpreted as LEAF having a limited environmental impact, we argue that it provides support for Wallerstein *et al.*'s argument that 'change is not time bound but requires long-term commitment to tackle 'wicked', that is, intractable and multilayer social and health problems' [(Wallerstein *et al.*, 2015), p. 286]. Aligned with findings from other community-based food environment interventions (Naylor *et al.*, 2015; Willems Van Dijk *et al.*, 2015), participants in our study commonly characterized food environment changes as ongoing and incremental, requiring sustained collaboration with community stakeholders. For example, participants would often report on progress related to recommendations and their plans for action. The incrementality of food environment work was reflected in the large number of reported impacts that pertained to sharing resources, such as healthy eating posters, and our use of the present tense in Table 1.

In addition to the environmental impacts, participants reported community impacts from LEAF. LEAF created a context-specific tool that communities could use in diverse ways to promote and support food environment action. Similar to the provincial NRC (Ferdinands *et al.*, 2020) and other community-engaged food environment assessments (Sheats *et al.*, 2017; Pomeroy *et al.*, 2017), results from this study suggest that the Mini NRCs are a tool to raise awareness about the current status and impact of food environments on eating practices. While studies have documented public support for food environment policies and interventions, support is typically higher for interventions that are less intrusive, such as those that provide nutrition information or education (Diepeveen *et al.*, 2013; Bhawra *et al.*, 2018; Kongats *et al.*, 2019). Continued efforts are needed to build public support for a range of food environment interventions, especially those that are considered more intrusive, such as taxation of unhealthy foods.

One particularly compelling finding was the non-prescriptive manner through which the Mini NRC guided community action. Rather than using the Mini

NRC to prescribe action, participants described using it as a discussion tool to gain multi-sectoral buy-in, by engaging different community settings in conversations about food environments. Multi-sectoral engagement in food environment efforts is desirable, as it may help determine which food environment policies and programmes are feasible and acceptable to the wide range of affected stakeholders (Minaker, 2016; Olstad *et al.*, 2019; Sambell *et al.*, 2019). Further, by acting as discussion tool, the Mini NRC helped participants learn about and subsequently reduce the barriers that were preventing community-level food environment action. For example, participants described using their Mini NRC during attempts to align competing community priorities, such as profitability, with creating healthy food environments. This finding supports the need for health promotion intervention approaches that are modifiable, even after they are 'implemented' within the community (Potvin, 2017). We believe that this ongoing adaptability is essential to respond to changing factors that restrict and prevent local food environment action.

Participants perceived level of engagement in LEAF, controllability, community priorities, policy enforcement and resources as barriers and facilitators to food environment action. These factors did not exist in isolation: they acted together to enable, to restrict and to determine the possibilities for change. Many of the identified barriers and facilitators align with previous research on creating community-based change for healthier food environments (Naylor *et al.*, 2010, 2015; Vandevijvere *et al.*, 2019). For example, interviews conducted with change agents in New Zealand revealed concerns about economic barriers, such as the cost of healthy options and a lack of power due to non-local control (Vandevijvere *et al.*, 2019). Promisingly, LEAF may offer a means to overcome some of the barriers found in our study and in extant literature. For example, LEAF could help reduce several community challenges outlined by Willems Van Dijk *et al.* (Willems Van Dijk *et al.*, 2015), including evaluating food environment efforts and employing evidence-informed strategies. Regarding evaluation, participants described using the Mini NRC to help track and monitor their community's food environment progress. Further, if LEAF was repeated, it could provide communities with a way to concretely measure their food environment progress. Regarding the use of evidence, LEAF embeds evidence-informed strategies within the intervention framework, as communities collect data on and work towards achieving evidence-informed benchmarks of healthy food environments.

One strength of this study was the inclusion of multiple communities, allowing a more in-depth exploration of LEAF's impacts. This research was further strengthened by the use of qualitative methods, which can enable researchers to holistically capture community-level processes and outcomes (Wallerstein *et al.*, 2015). Qualitatively exploring LEAF across multiple communities helped generate a greater understanding of the contextual factors that acted as barriers or facilitators to LEAF success, highlighting the specific conditions in which certain findings occurred. Although the inclusion of multiple communities likely increased the transferability of this study's findings, transferability may be limited by the sample communities' shared provincial context and narrow population range.

This study has several limitations. First, findings represent the views of individuals that agreed to participate in this study, many of whom were in favour of LEAF and other healthy eating programmes. It is possible that other LEAF stakeholders had different or opposing experiences with and perceptions of LEAF. Second, reported environmental impacts were limited by participants' awareness of changes: multiple participants reported not knowing the full extent of LEAF impacts because they had limited capacity to follow up with all included settings. Further, the environmental impacts were self-reported by participants and were not verified by the research team or evaluated for their effectiveness. Although outside verification and evaluation of the environmental impacts might prove beneficial, it was outside the scope of this study's purpose.

CONCLUSION AND RECOMMENDATIONS

By developing a context-specific, non-prescriptive tool to engage community members, LEAF acted as a stimulus or support for food environment action. Community-based interventions, such as LEAF, can help build community capacity and reduce existing barriers that prevent community-level food environment action. Thus, such interventions could provide an effective method to build public awareness, demand and action for healthier food environments. Future community-based food environment interventions could benefit by accounting for the barriers and facilitators found by this study and their implications for the sustainability of food environment efforts. In addition, policies that support community-based food environment efforts and ensure adequate financial and human resources could promote the sustainability of this work. For example, results from this study suggest that embedding LEAF within relevant health professionals' roles would provide a tool for those best positioned to use it. Given the novelty of this intervention, however, additional research is warranted to determine its effectiveness. We suggest that future research integrate quantitative methods

to more robustly measure the short, medium and long-term effects of monitoring and acting on local food environments. Future research should be conducted to better understand the feasibility and nuances of monitoring and acting on food environments in larger communities and other jurisdictions driven by alternate markets. If deemed successful, this approach could be applied to communities elsewhere to create widespread action towards food environments that are driven by the needs of local communities and promote health and wellbeing.

SUPPLEMENTARY MATERIAL

Supplementary material is available at *Health Promotion International* online.

ETHICS INFORMATION

Ethics approval for this study was granted from the Research Ethics Board at the University of Alberta (Pro00084508). Informed written consent was obtained from participants prior to interviews.

CONFLICT OF INTEREST STATEMENT

The authors report no conflicts of interest with respect to this manuscript.

REFERENCES

Alberta Health Services (n.d.) Alberta Health Services *Zone Map*. https://www.albertahealthservices.ca/assets/zone/ahs-map-ahs-zones.pdf (last accessed 17 December 2020).

Bhawra, J., Reid, J. L., White, C. M., Vanderlee, L., Raine, K. and Hammond, D. (2018) Are young Canadians supportive of proposed nutrition policies and regulations? An overview of policy support and the impact of socio-demographic factors on public opinion. *Canadian Journal of Public Health = Revue Canadienne de Sante Publique*, **109**, 498–505.

Brennan, L., Castro, S., Brownson, R. C., Claus, J. and Orleans, C. T. (2011) Accelerating evidence reviews and broadening evidence standards to identify effective, promising, and emerging policy and environmental strategies for prevention of childhood obesity. *Annual Review of Public Health*, **32**, 199–223.

Broeder, L. D., Devilee, J., Van Oers, H., Scuit, A. J. and Wagemakers, A. (2018) Citizen science for public health. *Health Promotion International*, **33**, 505–514.

Bryman, A. and Bell, E. (2016) *Social Research Methods*, 4th Canadian edition. Oxford University Press, Don Mills, ON.

Charmaz, K. (2014) *Constructing Grounded Theory*, 2nd edition. SAGE Publications. Thousand Oaks, CA.

Chmiliar, L. (2010) Multiple-case designs. In Mills, A. J., Durepos, G. and Wiebe, E. (eds), *Encyclopedia of Case Study Research*, SAGE Publications, Inc., Thousand Oaks, CA, pp. 583–584.

Diepeveen, S., Ling, T., Suhrcke, M., Roland, M. and Marteau, T. M. (2013) Public acceptability of government intervention to change health-related behaviours: a systematic review and narrative synthesis. *BMC Public Health*, **13**, 756.

Engler-Stringer, R., Le, H., Gerrard, A. and Muhajarine, N. (2014) The community and consumer food environment and children's diet: a systematic review. *BMC Public Health*, **14**, 522–515.

Ferdinands, A. R., Olstad, D. L., Milford, K. M., Maximova, K., Nykiforuk, C. I. J. and Raine, K. D. (2020) A Nutrition Report Card on food environments for children and youth: 5 years of experience from Canada. *Public Health Nutrition*, **23**, 2088–2099.

Health Canada (2013) *Measuring the Food Environment in Canada*. https://www.canada.ca/en/health-canada/services/food-nutrition/healthy-eating/nutrition-policy-reports/measuring-food-environment-canada.html (last accessed 17 December 2020).

Kongats, K., McGetrick, J. A., Raine, K. D., Voyer, C. and Nykiforuk, C. I. J. (2019) Assessing general public and policy influencer support for healthy public policies to promote healthy eating at the population level in two Canadian provinces. *Public Health Nutrition*, **22**, 1492–1502.

Mah, C. L., Cook, B., Rideout, K. and Minaker, L. M. (2016) Policy options for healthier retail food environments in city-regions. *Canadian Journal of Public Health = Revue Canadienne de Sante Publique*, **107**, eS64–eS67.

Mayan, M. J. (2016) *Essentials of Qualitative Inquiry*. Routledge. New York, NY.

McLaren, L., Ghali, L. M., Lorenzetti, D. and Rock, M. (2007) Out of context? Translating evidence from the North Karelia project over place and time. *Health Education Research*, **22**, 414–424.

Micha, R., Karageorgou, D., Bakogianni, I., Trichia, E., Whitsel, L. P., Story, M. *et al.* (2018) Effectiveness of school food

environment policies on children's dietary behaviors: a systematic review and meta-analysis. *PLoS One*, **13**, e0194555.

Minaker, L. M. (2016) Retail food environments in Canada: maximizing the impact of research, policy and practice. *Canadian Journal of Public Health*, **107**, eS1–eS3.

Moore, G. F., Audrey, S., Barker, M., Bond, L., Bonell, C., Hardeman, W. *et al.* (2015) Process evaluation of complex interventions: medical Research Council guidance. *BMJ (Clinical Research ed.)*, **350**, h1258.

Morse, J. M., Barrett, M., Mayan, M., Olson, K. and Spiers, J. (2002) Verification strategies for establishing reliability and validity in qualitative research. *International Journal of Qualitative Methods*, **1**, 13–22.

Naylor, P. J., Olstad, D. L. and Therrien, S. (2015) An intervention to enhance the food environment in public recreation and sport settings: a natural experiment in British Columbia. *Childhood Obesity*, **11**, 364–374.

Naylor, P. J., Vander Wekken, S., Trill, D. and Kirbyson, A. (2010) Facilitating healthier food environments in public recreation facilities: results of a pilot project in British Columbia, Canada. *Journal of Park and Recreation Administration*, **28**, 37–58.

Olstad, D. L., Raine, K. D. and Nykiforuk, C. I. J. (2014) Development of a report card on healthy food environments and nutrition for children in Canada. *Preventive Medicine*, **69**, 287–295.

Olstad, D. L., Raine, K. D., Prowse, R. J. L., Tomlin, D., Kirk, S. F., McIsaac, J.-L. D. *et al.* (2019) Eat, play, live: a randomized controlled trial within a natural experiment examining the role of nutrition policy and capacity building in improving food environments in recreation and sport facilities. *International Journal of Behavioral Nutrition and Physical Activity*, **16**, 51.

Osei-Assibey, G., Dick, S., MacDiarmid, J., Semple, S., Reilly, J. J., Ellaway, A. *et al.* (2012) The influence of the food environment on overweight and obesity in young children: a systematic review. *BMJ Open*, **2**, e001538.

Parry, K. W. (2004) Constant comparison. In Lewis-Beck, M. S., Bryman, A. and Liao, T. F. (eds), *The SAGE Encyclopedia of Social Science Research Methods*. SAGE Publications Inc., Thousand Oaks, CA, pp. 181.

Pomeroy, S. J., Minaker, L. M. and Mah, C. L. (2017) An exploration of citizen science for population health research in retail food environments. *Canadian Journal of Public Health = Revue Canadienne de Sante Publique*, **108**, e636–e638.

Potvin, L. (2017) Developing a health promotion research agenda: learning from population health intervention research. In Rootman, I, Pederson, A., Frohlich, K. L. and Dupéré, S. (eds), *Health Promotion in Canada: New Perspectives on Theory, Practice, Policy, and Research*, 4th edition, Chapter 19. Canadian Scholars, an imprint of CSP Books Inc.,Toronto, ON, pp. 357–373.

Sambell, R., Andrew, L., Godrich, S., Wolfgang, J., Vandenbroeck, D., Stubley, K. *et al.* (2019) Local challenges and successes associated with transitioning to sustainable food system practices for a west Australian context: multi-sector stakeholder perceptions. *International Journal of Environmental Research and Public Health*, **16**, 2051.

Sheats, J. L., Winter, S. J., Romero, P. P. and King, A. C. (2017) FEAST: empowering community residents to use technology to assess and advocate for healthy food environments. *Journal of Urban Health: Bulletin of the New York Academy of Medicine*, **94**, 180–189.

Socientize Consortium (2013) Green paper on citizen science. *Citizen Science for Europe. Towards a Better Society of Empowered Citizens and Enhanced Research*. European Commission, Socientize Consortium, Brussels.

Stake, R. E. (1995) *The Art of Case Study Research*. Sage Publications, Thousand Oaks, CA.

Swinburn, B., Sacks, G., Hall, K. D., McPherson, K., Finegood, D. T., Moodie, M. L. *et al.* (2011) The global obesity pandemic: shaped by global drivers and local environments. *The Lancet*, **378**, 804–814.

Swinburn, B., Sacks, G., Vandevijvere, S., Kumanyika, S., Lobstein, T., Neal, B. *et al.* (2013) INFORMAS (International Network for Food and Obesity/non-communicable diseases Research, Monitoring and Action Support): overview and key principles. *Obesity Reviews*, **14**, 1–12.

Vanderlee, L., Goorang, S., Karbasy, K., Schermel, A. and L'Abbé, M. (2017) *Creating Healthier Food Environments in Canada: Current Policies and Priority Actions*. http://labbelab.utoronto.ca/wp-content/uploads/2017/12/FoodEPI_ON_Report_WEB-FINAL.pdf (last accessed 17 December 2020).

Vandevijvere, S., Williams, R., Tawfiq, E. and Swinburn, B. (2019) A food environments feedback system (FoodBack) for empowering citizens and change agents to create healthier community food places. *Health Promotion International*, **34**, 277–290.

Wallerstein, N., Minkler, M., Carter-Edwards, L., Avila, M. and Sanchez, V. (2015) Improving health through community engagement, community organization, and community building. In Glanz, K., Rimer, B. K. and Viswanath, K. (eds), *Health Behavior: Theory, Research, and Practice*, 5th edition, Chapter 15. Jossey-Bass A Wiley Brand, San Francisco, CA, pp. 277–300.

Willems Van Dijk, J. A., Catlin, B., Cofsky, A. and Carroll, C. (2015) Challenges and lessons learned from communities using evidence to adopt strategies to improve healthy food environments. Health. *Health Affairs (Project Hope)*, **34**, 1979–1985.