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RESEARCH ARTICLE

Operationalising Agency: A Personalised Approach to Public Health

Leah Anne Teeters^{1*}, Marcy Singer-Gabella², Ryan Seth Jones³, Juan Escarfuller, William J Heerman⁴

¹School of Education, University of Colorado Boulder, 1134 CO-93, Boulder, CO, USA

²Peabody College of Education, Vanderbilt University, 230 Appleton Place, Nashville, TN, USA

³College of Education, Middle Tennessee State University, 1301 East Main Street, Murfreesboro, TN, USA

⁴Division of General Pediatrics, Vanderbilt University, 2146 Belcourt Avenue, 2nd Floor, Nashville, TN, USA

*Corresponding author: Leah Anne Teeters; Teeters@colorado.edu

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Abstract

Our work brings together theories and methodologies from public health and the learning sciences to develop a culturally relevant community-based intervention aimed at promoting healthy childhood development. We present our approach to personalising a community-based family intervention to prevent childhood obesity that aims to enhance participants' agency. We argue that situating obesity within the individual's multi-layered context not only provides a more robust understanding of the causes, but also generates sustainable options for promoting healthy lifestyles. Our findings emphasise the importance of a situated approach to learning that leverages social systems as a key resource for better navigating the environmental, material and ideational infrastructures that support healthy lifestyles.

Keywords

personalised health, community engagement, obesity prevention, community health education, community intervention

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Introduction

Maintaining a healthy lifestyle is critical to the prevention of chronic disease. Health-related behaviors – such as unhealthy diets, physical inactivity, tobacco use and illicit drug/alcohol use – account for 80 per cent of heart disease, stroke and type 2 diabetes, and 40 per cent of cancers (Ezzati et al. 2004; Spring, Moller & Coons 2012). These unhealthy practices are common and rarely occur alone: data from large national health surveys indicate that over 50 per cent of Americans do not meet dietary or physical activity recommendations; the average number of unhealthy practices is 1.7 per US adult; and 17 per cent of US adults report more than three unhealthy practices (Fine et al. 2004). These unhealthy practices are directly linked to obesity, and when they start in early childhood, put children at risk of lifelong health complications.

Indeed, our society is currently facing a childhood obesity epidemic. The most recent estimates suggest that 17 per cent of children in the United States are obese, and 33 per cent are overweight (Ogden et al. 2015). This childhood obesity epidemic will have lasting consequences, including increased rates of heart disease, diabetes and cancer (Calle et al. 2003; Leunissen et al. 2009). If trends in childhood obesity are left unabated, 30 to 40 per cent of today's children may eventually develop Type 2 Diabetes and will be the first generation of Americans to have a shorter life expectancy than their parents (Olshansky et al. 2005).

In the last two decades, public health scientists have conducted over 300 behavioural interventions to support healthy childhood behaviours and reduce childhood body mass index (BMI), which have achieved modest success (Birch & Ventura 2009; Institute of Medicine 2006; Summerbell et al. 2005). These interventions often have been neither sustainable nor successful with culturally and linguistically diverse populations. Childhood obesity is the result of multiple factors at the level of the individual, the family, the community and the larger society (Huang et al. 2009). The multi-layered nature of childhood obesity makes prevention a complex undertaking.

Public health recognises the complexity of behaviour change and has developed models that account for the social determinants of health (CSDH 2008; Marmot & Wilkinson 2006). While public health has done significant work to reduce health disparities, much of these efforts are orientated towards improving access, coverage and quality of healthcare (Starfield 2006). Although medical care is important, it is only one component of improving health (McGinnis & Foege 1993). A complementary approach includes developing interventions that address social determinants of health and prevent the onset of disease. As such, increasing attention is being given to developing culturally responsive health interventions (Bernal 2006). However, most health interventions aimed at meeting the needs of culturally and linguistically diverse populations orient their approach dominantly around the inclusion of bilingual, culturally competent community health workers (Henderson, Kendall & See 2011).

In the following pages, we argue that developing sustainable and successful interventions for diverse populations requires a novel paradigm informed by insights from the learning sciences, which have a long history of developing personalised interventions for culturally and linguistically diverse populations. By drawing on the learning sciences, we further situate human action in the social world, casting learning as an aspect of a learner's participation within a culturally and historically situated community of practice (Lave & Wegner 1991). Conceptualising health-related practices as socially situated necessitates approaches to learning that account for the variance in social and cultural practices and ways of knowing. However, medical interventions are typically conceptualised as one-size-fits all, meaning that

they often are not responsive to culturally and linguistically diverse populations. This raises a critical problem around equity. Rates of childhood obesity are exacerbated in economically disadvantaged and non-dominant communities (Ogden et al. 2015). Thus, the frontier of childhood obesity research asks how we can develop personalised and sustainable solutions to establishing health-related practices in early childhood to prevent the subsequent lifelong consequences of obesity.

Applying a transdisciplinary approach that joins together public health and the learning sciences has several advantages in the attempt to personalise and contextualise learning of health-related practices. The medical literature cites the immediate cause of the development of obesity as the energy imbalance between energy intake and energy expenditure. As such, obesity has historically been seen as an individual-based problem due to an inability to regulate this energy balance. Although this model is sufficient to predict obesity likelihood based on energy intake, it fails to account for the complexity of health-related practices and circumstances that contribute to obesity. Food practices and energy expenditures are shaped by culturally situated practices and are enabled or constrained by environmental, material, ideational and social resources (Gordon-Larsen et al. 2006). The environmental dimension of health refers to the built environment; the material refers to technical tools that support access to health information; the ideational refers to knowledge related to health promotion; and the social refers to the relational resources that can enable healthy lifestyles. Improving health fundamentally involves the learning of new practices that can facilitate navigation of the many factors that influence health outcomes – an area of research that is well known to the learning sciences.

In the next sections, we present our approach to personalising a community-based family intervention for childhood obesity with the intent of moving away from the ‘treatment’ of individuals and towards an approach that seeks to enhance participants’ agency to navigate the environmental, material, ideational and social world of health. Our approach bridges the fields of learning sciences and public health, with the aim of contributing to the methodological and theoretical understanding of sustainably changing health practices. We argue that situating obesity within the individual’s multi-layered context not only provides a more robust understanding of the causes, but also generates sustainable options for promoting healthy lifestyles. Our findings emphasise the importance of a situated approach to learning that leverages social systems as a key resource to better navigating the systems that support healthy lifestyles.

Conceptual framework

The paradigm of personalised medicine considers how best to tailor treatments to meet the unique needs of individuals. But, recognising which treatments work best and for whom has been traditionally limited to the fields of pharmacology and genetics. Bringing together conceptual frameworks from the public health and learning sciences, our goal is to advance the paradigm of personalised medicine by (1) developing a personalised approach to supporting *healthy behaviours in childhood to reduce obesity*, and (2) using a multi-level framework to consider a *broad range of contextual factors* as potential determinants of an appropriately tailored treatment plan. In the context of childhood obesity, we draw on frameworks from health sciences to develop a multi-level understanding of the determinants of childhood obesity grounded in (1) self-determination theory, which helps articulate the role of competence, autonomy and relatedness in developing motivation, and (2) social cognitive theory, which posits that learning is a reciprocal interaction between individual, environment and behaviours.

We also draw on theoretical frameworks from the learning sciences including (1) competency-based learning, which focuses on personalised instruction that supports learners in developing competency in specific skills, and (2) scales of practice, which speak to the need to make learning sustainable over time, socially relevant and geographically situated. In our work, we aim to understand the conceptual overlaps and distinguishing factors between these disciplines, illustrating the value of transdisciplinary approaches to address complex social problems.

Two of the most common theories used to explain variation in health practices that contribute to childhood obesity are Bandura's social cognitive theory (Bandura 1977) and self-determination theory (Ryan & Deci 2000). Bandura posits that a person's health practices are triadically and reciprocally influenced by social, cognitive and environmental factors. A central tenet of social cognitive theory is self-efficacy, where one of the main determinants of health is a person's confidence in their ability to enact health-related practices. As individuals build confidence and competence, they become more likely to sustainably engage in health-related practices (Davis et al. 2015). In self-determination theory people are thought to gain value through the development of competency, relatedness and autonomy. A theme common to both social cognitive theory and self-determination theory's explanation of health-related practices is competency. In other words, gaining competency in health-related practices is an important determinant in supporting sustainable health-related practices and the resultant benefits to health and psychological wellbeing.

Competency development is a longstanding area of focus in educational research. In the context of childhood obesity, competency-based learning theory frames individual gains in proficiency over health behaviours (e.g. diet and physical activity) as the gaining of competency over specific skills and knowledge relevant to the health behaviour in question. For decades, experts in learning theory have recognised that reducing variation in learning outcomes requires increasing variation in instruction (i.e. a personalised approach) (Bloom 1971). In 2007, Guskey elaborated on this approach, highlighting two specific components of this type of learning: (1) actionable feedback, correctives and enrichment, and (2) instructional alignment through the development of clear, attainable objectives (see Figure 1). This approach also allows for alteration of formative assessments depending on the nature of the learning objective, a degree of flexibility necessary for culturally tailoring of behaviour change interventions. Competency-based learning has proven particularly effective in advanced cognitive functions like problem solving, which are important building blocks for effective behaviour change (Bandura 1986).

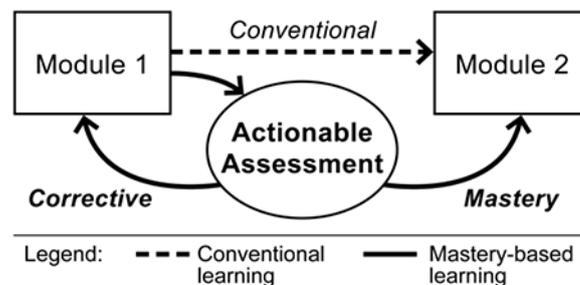


Figure 1 Personalised approach to learning, adapted from Guskey (2007).

However, we also recognise that for healthy practices to be consequential for participants they need to be sustainable over time, socially relevant and geographically situated. Therefore,

our aim is to design learning opportunities that will be meaningful across scales of practice. Scales of practice refer to the ways that ideas, technologies and practices are taken up across geographic (local, national, international), temporal (historical, present, future) and social (family, community) trajectories (Jurow & Shea 2015; Nespor 1994; Tsing 2004). In our design for learning, we consider how to coordinate these scales of practice, asking how we can leverage participants' knowledge so as to support them in expanding their agency in creating healthy lives for their families. We thus conceptualise attaining competency in health-related behaviours as developing agency to navigate health-related decisions within contexts in which they arise.

By bringing these theoretical approaches together, we aim to develop a multi-level approach to promoting healthy childhood growth. Combating obesity means more than eat less and exercise more. In our work, we recognise that health determinants include both macro-level influences (e.g. neighbourhoods, family, social norms) and micro-level influences (e.g. genetics, epigenetics, satiety set points) (Huang et al. 2009). In our current project, we operationalise these health determinants by recognising the role of the built environment (e.g. limited access to healthy food, neighbourhoods without parks and footpaths), the material infrastructure (e.g. technology applications, fitness monitors), the ideational infrastructure (e.g. understanding nutritional needs) and the social infrastructure (e.g. immigration resulting in a small network of support) as key health determinants.

Research design

An enduring aim of learning research is to understand human activity in context and the resultant implications for the design and organisation of learning. In pursuit of generating more equitable research, we ask how can we design for learning and promote healthier lives in a manner that is consequential and relevant for participants? This leads to questions such as how do participants generate new and valued means of participating in the world, and for whom and under what circumstances can new practices be taken up, and how are they sustained? To answer these complex questions, we turn towards community-based approaches to studying learning in diverse settings (Bang et al. 2010; Hall & Jurow 2015). Generating research designs to support learning and healthy practices involves designing interventions *with* community members, foregrounding ideas and methods that are relevant to their everyday lives (Teeters & Jurow 2016).

The research study was developed by an interdisciplinary team in the Department of Pediatrics at a Medical Center at a university in the south of the United States. The research team dedicated to the focal project is interdisciplinary, bringing in expertise from paediatrics, community organising and the learning sciences. We drew on this diverse team to engage in recruitment efforts to draw in Spanish-speaking community members from throughout the metropolitan area surrounding the university. We leveraged the lab's existing relationship with local community centres to establish sites to implement our programming.

The goal of our research was not to create a *de novo* health intervention. Rather, our goal was to modify an existing intervention by developing a systematic and replicable approach to personalising the content of the intervention with sustainable behaviour change in mind. To this end, we used a previously tested and efficacious childhood obesity intervention called *Salud con la Familia* (Healthier Families). *Salud con la Familia* was a multi-level family-based behavioural intervention implemented in community Parks and Recreation centres. In a randomised controlled trial of 106 parent–preschool child pairs, *Salud con la Familia*

demonstrated reduction in paediatric obesity in a low-income minority population (Barkin et al. 2012). The intervention focused on the parent–preschool child pair, recognising both the importance of parents as agents of change for their children and the close relationship between parent behaviours and child behaviours. The intervention consisted of 12 weekly group-based sessions that taught principles of behaviour change (goal setting, self-monitoring and problem solving) around key content areas important for healthy childhood growth (diet, physical activity, sleep, media use and engaged parenting).

Our approach positioned participants as key informants, and thus afforded the research team the opportunity to learn *with* Latino community members about how to develop a community-based program to provide families with the skills to navigate environmental, material, ideational and social infrastructures so as to promote healthy childhood growth. With the previously mentioned theoretical frameworks in mind, our goal was to develop tools and conceptual models for operationalising participants' agency in navigating these systems, so as to be active agents within their social–ecological system, all in the service of supporting childhood health-related practices.

The development phase underwent four cycles of design, where analysis and iteration were embedded into each stage: (1) community interviews and conceptualisation, (2) pilot testing, (3) co-design, and (4) pilot iteration. The community interviews, conceptualisation and pilot testing were undertaken in the autumn of 2016 and the co-design and follow-up sessions were conducted late in the winter of 2017.

COMMUNITY INTERVIEWS AND CONCEPTUALISATION

To begin, we conducted focal interviews with five community members to understand the barriers to living a healthy lifestyle that they faced with their family, how they related to goal setting and progress monitoring and if they would use digital tools, and how they related to healthy behaviour change. We conducted the interviews in local parks, libraries and community centres. We analysed the interviews, looking for themes across environmental, material, ideational and social scales of practice to help us understand how participants engaged with different constructs affecting health.

INITIAL PILOT TESTING

After revising the *Salud con la Familia* intervention material based on the community interviews, we tested a two-week pilot program with 18 families. The pilot session was led by facilitators who had experience facilitating *Salud con la Familia*. The facilitators were native Spanish speakers and were trained in the conceptual elements unique to this pilot session. We collaboratively developed Construct Maps to support facilitators in assessing the participants' shifting competencies. The facilitators engaged in practice sessions before engaging in live sessions with participants. Our pilot sessions were held in a local community centre.

The retention rate was 100 per cent for the duration of the pilot sessions as well as for the follow-up focus groups. The two-week pilot consisted of two core classes: Choose Healthy Foods and Plan Healthy Meals. Choose Healthy Foods was designed to support participants in understanding the nutritional content of foods, deciphering nutrition labels and learning new cooking techniques. Plan Healthy Meals supported participants in planning healthy meals and provided strategies for working with constraints such as time, money and access to grocery stores. Each of these sessions lasted two hours. In between sessions, participants filled out a digital goal-setting form asking them: (1) what goal they had set in the last session; (2) to

evaluate their progress in meeting their goal; (3) what resources supported them in achieving their goal; (4) how the facilitators could support them with their goal; (5) what challenges they were facing; (6) and what elements from the previous class they would like to revisit in the upcoming class.

The pilot program was audio recorded, and in the sessions we took detailed field notes with attention to participation structures, engagement and dialogue so as to understand which ideas were being taken up and how. We analysed data from the sessions and the digital goal-setting forms as we went along, sharing our findings with participants and incorporating the findings into the design and substance of subsequent sessions. In this way, data collection, analysis and iteration were mutually informative and ongoing. We conducted follow-up focus groups to understand how to further develop the program, and to understand if participants understood their engagement with healthy practices.

CO-DESIGN

After our pilot test and follow-up focus groups with participants, we analysed our data from the pilot sessions and focus groups with attention to how participants related to their own learning and agency to implement healthy changes in their lives. Using our data, we drew out key themes and drafted ideas to address participants' needs and concerns. We then invited participants back to engage in co-design studios. In the co-design studios, we shared our findings and ideas, and mutually envisioned curricular materials that could address the needs of the community. After these co-design sessions, we designed sessions that would personally attend to participants' needs, supporting them in enhancing their own agency, all the while maintaining attention on creating a program that could be replicated with different participants in various settings. We subsequently piloted two of these revised sessions, conducting follow-up focus groups to assess implementation and gather participant feedback.

ITERATIVE PILOT TESTING

After our initial pilot test and our co-design sessions, we reorganised the structure of our sessions to include a section in each session that was orientated to the unique needs of participants. The focus of this additional section was to be determined by participants' self-evaluations, both in class and in the digital goal-setting forms. In our follow-up pilot sessions, we implemented two sessions: Be an Active Family, which focused on ways to increase physical activity, and Healthy Snacks and Drinks, which supported participants in identifying healthy snack and drink options. The aim of these two sessions was to understand how we could incorporate personalised choice of content, based on the unique needs of participants.

Site and participants

Given our goal of mitigating health disparities, our research focused on a predominantly Latino lower income community. Developing an intervention to support participants in improving their health involves not just individuals and families, but also their support systems. Therefore, we drew upon existing social networks as a key recruitment strategy. The members of our research team had diverse cultural and ethnic backgrounds (Puerto Rican, White, Dominican, Mexican), as well as diverse professional expertise (paediatrician, community organiser, educator). We drew on our diverse expertise and positionalities, strategically leveraging existing social networks and co-membership (Erickson & Shultz 1982). Specifically, we leveraged relationships with colleagues working in libraries, community

health clinics, immigrant coalitions and Parks and Recreation centres to use these sites to meet potential participants. Interviews, pilot sessions and focus groups were conducted in Spanish. After informed consent, IRB approved this study.

Our recruitment efforts resulted in partnering with 19 Spanish-speaking mothers between the ages of 19 and 58. Participants had between one and six children. One participant was a grandmother. Participants were all immigrants, from El Salvador, Ecuador, Honduras and Guatemala. Seventy-five per cent of the participants reported speaking and reading only in Spanish; 25 per cent reported speaking and reading in Spanish more than English; 50 per cent of participants reported thinking only in Spanish; 17 per cent reported thinking in Spanish more than English; and 33 per cent reported thinking in both equally. Participants self-reported that they regularly used technology. During our pilot, all participants used smart phones to access intervention resources, though the majority reported also having computers in their home.

Below we describe what we learned from our pilot and co-design sessions and how we operationalised these findings to generate a community-based program that could enhance children's health outcomes.

Findings from the pilot

In presenting our results, we integrate data from the interviews, focus groups, pilot tests and co-design studios along four constructs recognised in recent conceptualisations of behavioural health as associated with obesity (Gordon-Larsen et al. 2006) and learning (Nasir 2012): environmental, material, ideational and social infrastructure. We found these constructs helpful in understanding how participants understood and enacted changes for themselves and their families in their health-related practices. In the discussion, we report on how we operationalised these findings to generate a novel community-based health curriculum that supports participants in creating healthier lives for themselves and their families.

ENVIRONMENTAL

The built environment can both enable and constrain health-related activities. When asking about participants' experiences in navigating the process of attaining healthy food and finding places to engage in physical activity, participants reported no difficulty with either aspects of the built environment. Participants shared that access to healthy grocery stores or fresh, affordable produce was not a limitation to eating healthily. However, some participants did not have consistent access to a car and/or did not have a driver's licence. Therefore, the activity of shopping for groceries was dependent on a family member or friend. Similarly, participants did not cite access to places to exercise as a limiting factor to physical activity. Rather, they shared that they were more motivated when they had peers to 'hold [them] accountable' and with whom to visit new healthy restaurants and attend new exercise classes.

When we invited participants to think with us regarding the logistics of planning a 15-week healthy family program, concerns over the built environment became more tangible. Participants lived in different parts of the city and expressed that getting to the community centre was a concern. They reported that they did not use the local bus, citing tight schedules, the need to pick up children, and ease as reasons against using the city's (limited) public transportation. One participant shared that she did not drive and had arranged to get a ride from a friend to attend the pilot session. But when the friend's child was sick on the day of the session, she scheduled a ride share via Uber so that she could arrive at the centre on time.

One participant who lived 16 kilometres from the community centre shared that she had driven to the community centre, even though she did not have a US driver's licence. She added that, since the inauguration of President Trump and his Executive Order aimed at immigrant populations, she was no longer comfortable driving outside of her neighbourhood. Other participants echoed her concern.

In addition to the unease about exposing themselves to too much time on the road, participants expressed concern with regard to the site where the sessions would be held. For them to attend three months of classes, the location had to be 'safe', 'comfortable', 'inviting'. When asked at what type of institution they would prefer to meet, participants all suggested three spaces: (1) local schools, (2) churches, and (3) participants' homes. Participants shared that they felt comfortable, safe and relaxed in schools. With regard to churches, participants explained that the denomination or faith of the church didn't matter, and that they would feel comfortable in any faith-based institution. Lastly, participants were eager to suggest their own homes or homes of their friends. Only when our research team probed and specifically asked how they felt about having the sessions at a community recreation centre did they confirm that yes, that would work, and that yes, they were comfortable at the community centre. They did, however, say that which community centre and its proximity to their own home mattered significantly. It is important to note that all of our pilot and co-design sessions occurred in a community centre. We located them at two different community centres in different regions of the city where the participants lived. During this time, participants became familiar with both the staff and the facility, a process brokered by our research team.

Although participants did not directly share that finding locations to engage in physical activity or to acquire healthy foods was a constraint, throughout the course of our collaboration we were able to understand the less visible ways that environmental factors did in fact constrain the ways that participants navigated the built environment. These less visible factors, such as feeling uncomfortable driving outside of the neighbourhood and the need for safe meeting places, correlate to macro factors (the current political environment of the US and anti-immigrant policies). Changing behaviours and developing competency involves supporting participants in identifying the less tangible factors that constrain their participation in healthy activities.

MATERIAL

When considering adapting health practices or adopting new health practices, technical infrastructure can be a key tool to support participants as well as facilitators. However, the plethora of options to track diet and exercise can be overwhelming and the inundation of information can be confusing. Our research team aimed to identify which technical tools could be helpful supports for participants and how. We invited them to share the platforms that they were currently using and to think about possible technical support they may need.

In our interviews with community members, all participants shared that they regularly used a smartphone and many also used a computer or tablet. They used technology to communicate with family and friends over applications such as Facebook, text messaging and WhatsApp. Only one interview participant indicated that she used the internet to search for healthy recipes, but all interview participants shared that they used the internet when they had health-related questions for themselves and/or their child.

An integral component of behaviour change is goal setting and progress monitoring. The original intervention, *Salud con la Familia*, incorporated goal setting and progress

monitoring as a central element of the program: participants set goals on paper and charts and reviewed them in sessions on a weekly basis. However, since the program's inception seven years ago, access to and use of technology has proliferated. In our work with immigrant populations, whose families are in other countries, participants shared that they rely heavily upon technology to stay connected to their families and communities around the world. We therefore aimed to explore how technology could be used to support participants to remember, monitor and achieve their goals.

With input from our interviews, we created a simple digital goal reflection form. We asked participants to set specific, measurable, achievable, realistic and timely (SMART) goals in the session, with support from the facilitator and other participants. We then sent participants a text with the goal-setting tool, which asked them what their goals were, what resources they were using to achieve their goals, what challenges they were encountering, and how facilitators could support them. All participants filled out these surveys. We analysed the surveys to help us prepare for the upcoming lesson, to ensure that participants' needs were addressed in the session. In this way, the technology tool served as a formative tool that allowed for the session to be responsive to participants' unique needs. That is, the technology ended up being a tool to enhance (not replace) the social infrastructure.

In our focus groups after the first pilot, participants shared that the digital tool served as an accountability tool for them, reminding them of their goals. And then, when the session was responsive, incorporating feedback from the surveys, participants shared that it incentivised them to complete the survey and monitor their own goals. As one participant shared, being accountable for one's own goal setting and actions made them feel as though they 'have the ability' (*tengo la capacidad*) to enact behaviour change, sharing also that they wanted more technology resources. In fact, after the first two pilot sessions, participants found both each other and the research team on Facebook and friended them, taking the initiative to enhance their own social network, and creating health-related support systems. Participants exchanged phone numbers and further contact information at the end of the pilot.

Developing new healthy practices requires technical and social support. In our pilot work, we were able to identify the technical tools that participants were currently using so as to leverage those tools, extending their use in new directions. By supporting participants to use their phones and iPads to set and monitor goals and to connect with other participants allowed for technology to be a tool that expanded participants' ideational habits and social participation.

IDEATIONAL

Generating healthy lives involves not only acquiring knowledge about health but creating the structures to implement new practices that promote better health. Taking up new information and creating sustainable practices that promote the health of all family members is neither simple nor linear. In our research, we paid close attention to how participants engaged with ideas about health. We found that modelling of healthy practices and social support were the leading mechanisms for enhancing participants' ability to enact changes to their behaviour.

At the end of each pilot session, co-design studio and focus group, our research team prepared a healthy meal for participants. We conducted the sessions in community centres with kitchens, facilitating this process. We planned meals that were fresh, healthy and easy to prepare for groups. These meals were intended to share our gratitude for participants' time and expertise. However, we learned that they were a key component of our teaching. At every

meal, participants took photos of the brands that we bought, asking what store they could find them in. After a session where we taught participants to read nutrition labels with attention to low sugar and high fibre content, participants looked at the nutrition labels on the bread and deciphered its nutritional content. They then took photos with their phones of the labels and brands. Several participants took the empty bread bags, preprepared salad mix containers, healthy lunch meat wrappers and labels of soda water home with them, to look for the items in their local store. We identified this practice as a desire for experiential learning opportunities.

After the first collective meal where we saw participants engage with the food items as a concrete teaching tool, we then planned our sessions to incorporate more hands-on applications of the lessons and explicitly planned our meals as teaching tools. For example, at one session, we purchased multiple brands of tortillas, whole wheat, corn and white flour. We analysed the labels and compared the tastes with participants, later incorporating them into our lunch.

The meals provided by the research team were designed to make knowledge of healthy eating and meal preparation visible. Importantly, we also incorporated opportunities for participants to share their knowledge with each other. Leveraging collective expertise and knowledge was a key component of supporting participants in enhancing their own agency and transferring new ideas into actual sustainable action.

When discussing their progress towards meeting their goals, engaging in shared problem solving was also a critical component. Participants shared their goals and their struggles to meet their goals, citing challenges such as children who were picky eaters, spouses who were specific about their ideas of a proper meal, and the schedules of family members. Participants readily shared their strategies for addressing these challenges. Hearing how their peers were incorporating new concepts and practices of healthy eating and activity inspired participants to try similar techniques. Seeing their peers as models inspired a sense of agency that they too could enact healthy practices.

Developing new practices around healthy eating involved modelling healthy practices through cooking demonstrations and shared meals. In these sessions, participants had the opportunity to experiment with new cooking techniques and recipes. In this way, the learning that transpired took on an apprenticeship model, where members of the community had the opportunity to engage in meaningful activities, learning how to incorporate new ideas into their repertoire of practices. Participants supported each other in envisioning how new ideas of health could be incorporated into their daily lives. All the while, the research team and facilitator played critical roles of providing new information and probing existing perceptions of healthy behaviour.

SOCIAL

In our pilot sessions, participants reported that the social element of the sessions was extremely important and the most valued tool for learning. After the first pilot sessions, we asked participants in a short survey, 'what motivated you to come to these classes' (*¿Qué le motiva a venir a estas dos clases?*). For some participants 'the conviviality' (*la convivencia*) was the sole motivator. For others, improving the health of their kids and family was the motivating element. And for some, the social element was not a motivating factor. These participants reported being motivated to 'be healthy' (*estar saludable*), 'learn to choose and cook healthier [food]' (*Aprender a escoger y cocinar mas saludable*), 'to avoid many illnesses' (*a evitar muchas enfermedades*). However, when asked what their favourite element of the session was, over

80 per cent of participants included the social element as their favourite part of the healthy living classes: 'to socialize and learn' (*Convivir y aprender*); 'all of the topics covered and that which I learned from my peers' (*todos los puntos que se trataron ya que aprendí de las demás compañeras*); 'the communication' (*la comunicación*); 'the sharing of the experience' (*el compartir la experiencia*); 'I liked making friends' (*Me gustó que hicimos amistades*); 'I liked working as a group' (*Me gustó mucho trabajar como grupo*).

Participants' feedback that the social element of the classes was integral to their learning experience was similarly reflected in their responses captured via digital self-reflections. In a text-based survey that we sent out to help pilot participants self-evaluate, we asked: 'How do you feel about how your family is choosing healthy foods?' The response options were (1) I am starting to understand; (2) We can do it with help; (3) We can do it without help; and (4) We can do it and we can help other families. We intended this to be a scale. But when participants responded, over half selected both (2) and (4), indicating that, though they needed support, they could also support others in the process. This response helped our team understand that the process of health behaviour change is both communal and non-linear. They did not perceive supporting others as an activity that would happen only once their confidence in executing healthy behaviours was solid. Rather, supporting their community was part of their learning process and a tool for increasing agency.

Our field notes from our sessions corroborate this finding that supporting others is a process, and not an outcome, of learning healthy behaviours. Participants engaged in shared problem solving and collective reflection. They listened to each other's experiences, validating them, affirming solidarity, and suggesting potential strategies to navigate the lived experiences of health. At the end of the pilot sessions, participants self-organised to exchange contact information, suggesting ideas such as group meals of healthy food and morning walking groups. This sense of community building was a leading tool for learning and could enable the sustainability of new practices. Participants' social support enabled them to navigate the constraints of the environment, by sharing rides, going to the gym together and creating safe places for gathering. Participants relied on each other and their social networks to develop new ways of using technology and material resources to engage in healthy practices. The social network was key to developing new practices that facilitated uptake of new ideas about healthy practices. From all these actions, we can see how the social infrastructure helped participants navigate the environmental, material and ideational systems so as to create sustainable healthy practices.

Discussion

DESIGN IMPLICATIONS

In our interviews, pilot sessions and focus groups, we found that a key tool in supporting participants to develop new practices of healthy living involved building social infrastructure to support implementation of new ways of engaging with the built environment, as a motivator to use technological tools, and as a critical component in taking up new ideas and incorporating them into routine practice. For participants to navigate the built environment, they needed social networks to organise rides, to be motivated to engage in exercise and to feel comfortable in new places. We felt that technology could be a useful tool to empower participants to monitor their own progress, but its routine use would rely upon a responsive social infrastructure. We found that participants responded most consistently when they

understood that facilitators used their responses on digital platforms to inform content and delivery of instructions. Participants reported that they learned the most from activities we developed that were based on their reflections on their goals. New ideas were most readily implemented and sustained when participants had social systems to hold them accountable and to support them with implementation.

To operationalise these findings, we developed a personalised health curriculum from the pilot that could prove responsive to participants' changing needs. The curriculum foregrounds social infrastructure as a key tool in supporting new ways of participating with environmental, material and ideational resources. The curriculum will be tested in a randomised control trial to test efficacy before considering implementation at scale.

To support participants in developing familiarity with the built environment, we will hold the program in local community recreation centres. We will teach participants how to navigate the fitness classes and amenities together, with each other and their children, so that they can collectively maximise their use of the recreation centres. To address participants' concerns that sessions be held in physical locations that are easy to access, safe and welcoming, we will offer the program at community centres throughout the city, recruiting and assigning participants to sites that are conveniently located to their homes.

To support participants in using technical tools to monitor their goals, we will ensure that facilitators provide participants with timely feedback to support cultivating agency in this regard. This will involve responsive engagement with participants' self-reporting as well as scaffolded learning opportunities that provide multiple opportunities to revisit and understand content. The digital tool will not only ask about the participants' goals and progress towards achieving them, but also the resources they are using for support. This information can then be used by facilitators to identify areas requiring additional support. This feedback will then be used in the ensuing session as part of what we call a 'zoom-in'.

We developed the idea of 'zoom-ins' to provide participants with choice in the structure and content of the intervention. A 'zoom-in' is a segment of the class in which participants choose the focus, in order to 'zoom-in' on those areas where they would like extra support. Participants will determine the skills and concepts in which they would like additional support after analysing their personal goals, their progress, and their successes, challenges and obstacles. 'Zoom-ins' will provide the opportunity for participants to continue working on their goals as they achieve greater competency. They will also allow participants to work with one skill or concept via different activities and in different settings. Moreover, the 'zoom-ins' will leverage participants' shared expertise to collectively problem solve. We will dedicate sessions, which we refer to as intercessions, before and after each unit to revisit topics that have been hard to implement. The intercessions will be informed by participants' ongoing feedback and developed so as to promote collective problem solving and leverage participants' shared experiences. As demonstrated via the 'zoom-ins' and intercessions, our emerging curricular approach is dynamic; we identify key constructs that are proven to improve health outcomes, and then develop multiple ways to teach and reinforce those concepts as participants deem necessary. It is via such curricular decisions that we will operationalise the concept of agency within our intervention.

To attend to our finding that the social infrastructure plays a critical role in implementing healthy behaviour change, our intervention design will intentionally build the social system alongside each element of the healthy family program. Facilitators will leverage participants' histories, cultures and lived experiences via shared problem solving, group discussion,

personalised goal setting and progress monitoring. Before and after each unit, we will plan for intercessions, where participants can revisit content that they continue to struggle to implement. These sessions will be organised so as to highlight the knowledge of the group, supporting participants in recognising their own agency to enact healthy behaviour change.

In our pilot sessions, we consistently found that taking up new ideas involved experiential learning of strategies as well as ongoing social support. Experiential learning refers to modelling strategies for incorporating healthy practices. Social support involves leveraging collective expertise and incorporating peer and facilitator feedback. Leveraging collective expertise was an important component of recognising participants' experiences, cultures and practices. Drawing on their experiences and learning from each other, all the while incorporating new concepts and techniques, allowed for healthy practices to be grounded in existing practices, making the process of healthy living more sustainable.

IMPLICATIONS FOR THEORY

In our work, we draw on theories from both public health and learning sciences. Public health recognises the complexity of behaviour change and thus we have developed models of behaviour change that account for the multiple levels, or scales, on which practices are enacted. By drawing on learning sciences, we further situate human action in the social world, casting learning as an aspect of a learner's participation within a culturally and historically situated community of practice. We expand on social cognitive theory by including material resources on social, cognitive (what we refer to as ideational or conceptual) and environmental factors. Our work suggests that, while health is influenced by these factors, changing health practices requires attention to coordination between influencers. For example, if people acquire new ideas regarding health but do not have access to healthy foods, they cannot enact change. Similarly, if an individual acquires new concepts and skills regarding health but does not have the support of their family, enacting change is extremely difficult. As individuals and communities acquire new concepts and skills, they need the context in which to enact change. Therefore, behaviour change has to be thought of as the acquiring of new practices within changing communities of practice (Lave 2012). Consequently, health interventions require attention not only to new practices, but to the configured world in which the participants can enact those new practices.

Moreover, our initial findings expand, and even challenge, notions of competency-based learning. In our findings, we maintain that attaining competency is integral to enacting healthy behaviour change. However, we recognise that achieving competency is neither discrete nor linear. That is, there is not a clear map to competency. As we observed when we asked participants to identify their competency in health-related behaviours, they reported not having high confidence in enacting those skills, yet having high confidence in supporting others. This suggests that there is not a clear trajectory for a skill to be acquired, improved and then shared, but rather a messy process that involves access to resources (e.g. time, healthy food, walking paths) and community support. Health-related choices involve complex and competing decisions. Moreover, our analysis suggests that competency is not a discrete point; rather, participants may attain competency in a concept or skill, their social, environmental or material resources may then shift, and thus their relationship to competency. As we focus on the scales of practice in which healthy behaviours are enacted, it becomes essential that participants not only have the conceptual resources, but also the ability to enact their knowledge and skills so as to navigate the complicated systems in which they live. Thus, rather than foregrounding competency as the desired aim, we expanded this notion to focus

on agency. Our aim has thus become to support participants in attaining a sense of agency to enact change and to recognise the components necessary for sustainability. This pivot from competency to agency is fundamental. By centralising agency, we centre the participant's ability to navigate the world in which they live and identify participants as central agents in control of their own health outcomes.

Conclusion

Preventing diseases is not and cannot be understood as a one-size-fits-all approach. Generating healthier communities necessitates culturally responsive approaches that leverage the assets of culturally and linguistically diverse communities, all the while recognising the institutional challenges surrounding access to health-related resources. Supporting individuals and families in becoming healthier involves generating tailored plans that allow them to increase their agency in navigating the environmental, material, ideational and social contexts that influence health. We recognise the institutional and structural components of health and acknowledge the need for systemic changes. However, we also posit that, as we push to reform structural issues, community-based health programs can enhance health outcomes through supporting individuals and communities to increase their agency in navigating their social and built environment. In our study, we found that enhancing community members' agency to navigate the world of health fundamentally relied upon building a social infrastructure that could support the enactment of healthy behaviours.

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