

# If We Offer It, Will Children Buy It? Sales of Healthy Foods Mirrored Their Availability in a Community Sport, Commercial Setting in Alberta, Canada

Dana Lee Olstad, PhD, RD,<sup>1</sup> Laksiri A. Goonewardene, PhD,<sup>2,3</sup>  
Linda J. McCargar, PhD, RD,<sup>3</sup> and Kim D. Raine, PhD, RD<sup>1</sup>

---

## Abstract

**Background:** Community sports settings are often sources of unhealthy foods for children. Many managers in these settings are reluctant to increase availability of healthy food options because they perceive that healthy foods are not profitable. This study assessed the independent contribution of increased availability of healthy foods to their sales in a community sport, commercial context. Change in revenues per patron was also examined.

**Methods:** The availability of healthy items was increased from 9.1% at baseline (35 days) to 25.0% during the intervention period (40 days), returning to 9.1% postintervention (6 days). Purchases of all patrons who bought foods/beverages ( $n=17,262$  items sold) from two concessions at an outdoor community pool were assessed from baseline to postintervention. Chi-square analyses assessed differences in the proportion of healthy and unhealthy items sold, as well as in the proportion of total revenues per patron across periods. A trained observer also recorded qualitative observations pertaining to a subset of patrons' ( $n=221$ ) dietary behaviors and activities.

**Results:** Healthy items represented 7.7%, 22.7%, and 9.8% of sales during the preintervention, intervention, and postintervention periods, respectively ( $p<0.01$ ). Sales of healthy beverages exceeded sales of all other product types. The proportion of total revenues per patron did not differ by period.

**Conclusions:** Food availability was an important environmental determinant of food purchasing behaviors in this community commercial context, given that sales of healthy foods closely mirrored their availability. Increased availability of healthy foods in community and commercial settings is important because concurrent changes within multiple environments will be required to improve children's dietary behaviors.

## Introduction

The intractable nature of the obesity epidemic illustrates the power of environmental forces to overwhelm individuals' rational decision-making abilities and best intentions, because given the choice, most individuals would not choose to be obese. That many individuals persist in unhealthy dietary behaviors despite knowing what they "ought" to do is consistent with behavioral economic theory, which posits that many decisions, and, in particular, food-related decisions, are made rapidly, in a noncognitive manner, and in response to en-

vironmental stimuli.<sup>1</sup> Thus, individuals make quick judgments about what to eat based not on whether foods will maximize their long-term health, but primarily for short-term hedonic pursuits.<sup>2</sup> This account of human behavior suggests that environmental changes that facilitate healthier choices may hold the key to improving population-level dietary behaviors.<sup>3</sup>

Increasing the availability of healthier foods within homes<sup>4-6</sup> and schools<sup>7,8</sup> is one type of environmental change that has been consistently associated with improved dietary behaviors among children. Nevertheless, the potential effectiveness of this strategy within the broader

---

<sup>1</sup>School of Public Health, University of Alberta, Edmonton, Alberta, Canada.

<sup>2</sup>Alberta Agriculture and Rural Development, Government of Alberta, Edmonton, Alberta, Canada.

<sup>3</sup>Department of Agricultural, Food and Nutritional Science, University of Alberta, Edmonton, Alberta, Canada.

community, including the commercial sector, is not known, given that few studies exist. Positive findings from several studies, however, suggest that increasing the availability of healthier foods in these settings has potential to improve food purchases.<sup>9–12</sup> If changes to food environments within homes and schools are to improve health, concurrent, parallel changes must be implemented in other settings, creating a layering effect, such that a large proportion of children are consistently exposed to a diverse array of healthy food options. Rigorous evaluation of the impact of increased availability of healthy foods on dietary behaviors in multiple contexts is therefore essential.

In Canada, community sports facilities are publicly funded sport complexes primarily frequented by children and their families. These facilities are an important resource for health promotion because they house a variety of community events and provide access to affordable physical activities (both competitive and recreational in nature). However, despite their health mandate, the availability of healthy foods in community sports facilities is limited.<sup>13–15</sup> Sports settings in other nations have similarly been identified as venues for unhealthy eating.<sup>16–20</sup> Managers in these settings are often reluctant to voluntarily offer healthy options because they perceive that healthy foods are not profitable.<sup>21–23</sup> Moreover, the appropriateness of increasing availability of healthy options through voluntary or mandated measures in sports settings is contested, in part because unhealthy options are normative in these settings and many believe that individuals are sufficiently active while there to offset their caloric intake.<sup>24</sup> Thus, studies are needed to investigate how to improve food selection in this community context.

The aim of this study was to assess the independent contribution of increased availability of healthy foods to their sales in a real-world, community sport, commercial setting. We hypothesized that sales of healthy items would increase significantly when they were more available. As a secondary outcome, we examined change in sales and revenues per patron.

## Methods

### *Study Design: Overview*

The study took place at an outdoor community pool adjacent to a community sports facility in an urban setting in Alberta, Canada. The current analysis was part of a larger study that examined the impact of successive environmental interventions in cueing healthier dietary behaviors at the pool.<sup>25</sup> Given the northern location, the pool was only open between May and September each year. Two concessions (*i.e.*, food outlets) were present on-site. The first, a municipally operated concession, was open for the full pool operating season (*i.e.*, May through September). This concession sold exclusively prepackaged items, including a variety of candy, ice cream novelties, granola bars, dessert squares, potato chips, sugar-sweetened beverages (SSBs), fruit juices, diet sodas, and water. The

second, hereafter referred to as the target concession, was privately operated and was open only from July to August each year. This concession offered a larger menu consisting of main dishes (sandwiches and wraps), beverages (water, SSBs, fruit smoothies, and slushes), snacks, and desserts (a variety of ice cream and fruit-based dishes), many of which were prepared on-site.

Data were collected in 2012. This study was approved by the Human Research Ethics Board at the University of Alberta (Edmonton, Alberta, Canada) and adhered to the ethical standards of the Helsinki Declaration. Concession and municipal managers provided written, informed consent to provide data for the study.

### *Menus*

Researchers counted the number of distinct items listed on each concession's menu. Items were considered distinct if they differed in ingredients and/or form. For example, different flavors of potato chips and different-sized potato chip bags were counted as a single item (only one brand was available) given that their main ingredients were identical. Different types of sandwiches were counted as distinct items because their fillings differed. Fruit slushes were deemed distinct from whole fruits because, although they had similar ingredients, they differed in form (*i.e.*, liquid vs. solid).

The Alberta Nutrition Guidelines for Children and Youth are intended to facilitate children's access to healthier foods in recreation and sports settings and therefore provided a basis to classify the healthfulness of menu items offered in both concessions.<sup>26</sup> These guidelines classify foods and beverages as "choose most often," "choose sometimes," and "choose least often" on the basis of their energy (kcal), fat (g), saturated fat (g), trans fat (g), fiber (g), protein (g), sodium (mg), calcium (% daily value), vitamin D (% daily value), and artificial sweetener (presence/absence) content. Choose most often foods are nutrient-dense foods that contain little to no added fat, sugar, or salt and were classified as healthy. Choose sometimes and choose least often foods were classified as unhealthy given that these foods are higher in energy, fat, sugar, and/or salt. According to these criteria, 44.4% of items on the target concession's menu were healthy, whereas 9.1% of items on the municipally operated concession's menu were healthy (Table 1).

### *Periods*

The study had three periods that varied with respect to the availability of healthy items.

*Preintervention.* During the 35-day preintervention period, only the municipally operated concession was open, and therefore the availability of healthy items was low (9.1%).

*Intervention.* Both concessions were open throughout the 40-day intervention period. The opening of the target concession increased the availability of healthy items at the pool from 9.1% to 25.0% overall (44.4% within the target concession itself).

**Table 1. Nutritional Rating of Concession Menus**

	Target concession		Municipal concession	
	Healthy <sup>a</sup> (%)	Unhealthy <sup>a</sup> (%)	Healthy <sup>a</sup> (%)	Unhealthy <sup>a</sup> (%)
Main dishes	25.0	75.0	0	100
Snacks and desserts	50.0	50.0	3.6	96.4
Beverages	55.6	44.4	40.0	60.0
Total	44.4	55.5	9.1	90.9

<sup>a</sup>Healthy items met the definition of “choose most often” in the Alberta Nutrition Guidelines for Children and Youth,<sup>26</sup> whereas unhealthy items met the definition of “choose sometimes” and “choose least often.”

*Postintervention.* Following the intervention period, the target concession closed, and the municipally operated concession remained open for the duration of the pool operating season. Owing to inclement weather, this period was 6 days in length.

As previously described,<sup>25</sup> on several days during the 40-day intervention period, we attempted to increase sales of healthy items through signage (8 days), signage+taste testing (8 days), and signage+taste testing+30% price reductions (8 days). Despite a well-powered analysis ( $n=6175$  items sold), sales of healthy items during these three periods (42.3%, 35.7%, and 46.5% of items sold were healthy in each of the three respective periods) did not differ from sales of healthy items during the 2×8-day periods with no promotions (35.7% and 40.0% of items sold were healthy in each of the two respective periods). Therefore, sales data for all 40 days were combined for the current analysis. There were no other changes to the food environment in either concession during the course of the study.

#### *Data Collection: Sales Data*

Itemized daily cash register sales data for all items sold were provided by both concessions throughout the study. These data were used to calculate the quantity of each item sold and total revenues on a daily basis. Profit data are not presented because the municipal concession was unwilling to provide these data. The municipality provided information regarding the number of pool patrons each day.

*Quality assurance.* Concession staff were taught to key menu items on the cash registers using individual codes for each item. Staff at the target concession were additionally trained to prepare all menu items in a consistent manner. A 5-day trial period was instituted to allow staff to familiarize themselves with study procedures. Sales data from both concessions collected during this period were excluded from the analyses. Managers and research staff were present

continuously throughout the study to monitor keying of purchases on the cash registers and ensure that all menu items were consistently available and prepared correctly.

#### *Observations*

To provide context for sales data, a trained observer recorded quantitative and qualitative observations regarding patrons' dietary behaviors and activities at the pool for 11 days during the intervention period, including weekdays and weekends. The 11 days were selected to maximize opportunities for data collection (*i.e.*, busy days) and included between one and three observation periods per week. The observer used predefined rules based on time of arrival and seating location to select patrons to observe in an unbiased manner. Groups that arrived at a prespecified time and whose picnic location was in close proximity to the observer were followed throughout their visit, or for up to 5 hours. When groups departed, the observer used the same set of decision rules to select new groups to follow. Patrons were not aware that they were being observed.

Observations pertaining to each individual in the selected groups were recorded on purpose-developed and pretested forms, excluding pregnant women and children <2 years of age. For each individual observed, the observer recorded her best estimation of their sex, age (child/adult), and weight status (nonoverweight, overweight/obese, or unsure). The observer used figural silhouettes for adults (nine for men and nine for women)<sup>27</sup> and children (seven for boys and seven for girls)<sup>28</sup> to assist in estimating weight status. Consumption of all foods/beverages was recorded, including details regarding each item (*e.g.*, brand, quantity, and flavor) and its source (*e.g.*, home, outside food establishment, and pool concession). The observer also recorded the length of time each person spent in and outside the pool, as well as the total duration of their stay at the pool. Qualitative observations of a general nature were also recorded. Observations ceased once the observer had achieved a thorough understanding of the context and no new observations emerged.

*Quality assurance.* Four joint observation sessions were held between the observer and the first author to provide corroboration, sensitize the observer to other potentially influential environmental factors, and provide opportunities for critical reflection. Emerging patterns in the data and strategies to improve data collection were also identified and discussed.

#### *Data Analysis: Statistical Analysis of Sales Data*

The categorical response model procedure (catmod, which uses a chi-square maximum likelihood test) assessed differences in the proportion of healthy and unhealthy items sold by both concessions combined pre-, during, and postintervention, with the nutritional quality of menu items modeled as a categorical dependent variable (healthy/unhealthy). The main effect considered was treatment

(preintervention, intervention, and postintervention). Subgroup analysis using analysis of covariance (ANCOVA) examined the popularity of menu items on the target concession's menu, categorized as healthy and unhealthy beverages, main dishes, and side dishes (including desserts). The dependent variable means were adjusted for the highest air temperature reached each day (Canadian National Climate Data and Information Archive), hours of operation, and the number of child and adult patrons at the pool (covariates). The number of adult patrons was the only significant covariate. This analysis could not be conducted for the municipally operated concession given that there were too few healthy items sold within each menu-type classification.

The catmod procedure was used to determine whether the proportion of total sales (*i.e.*, number of items sold) per pool patron and the proportion of total revenues per pool patron differed by treatment period for both concessions combined and for the municipally operated concession. All statistical analyses were performed using SAS software (version 9.2, 2008; SAS Institute Inc., Cary, NC) with  $p < 0.05$  denoting significance.

### Observations

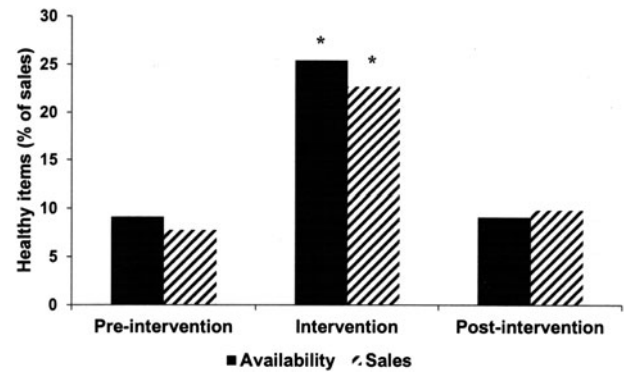
Nutrition information for all items consumed by patrons whose behaviors were directly observed was obtained from each concession, package labels, manufacturer's websites, the Canadian Nutrient File (version 2010; Health Canada), and, where necessary, from Food Processor SQL (version 10.12.0, 2013; ESHA Research Inc., Salem, OR). This information was used to classify items as healthy/unhealthy, as previously described. The mean proportion of each individual's visit spent in the pool was estimated by dividing the time spent in the pool by the total duration of their visit to the pool site.

Qualitative observations of patrons' activities and behaviors in the setting were transcribed and analyzed using thematic content analysis by the first author. Peer debriefing with the observer served to verify the findings. Qualitative and quantitative observations were integrated during interpretation.

## Results

### Sales

The opening of the target concession led to an increase in the overall proportional availability of, and proportional sales of, healthy items, followed by a decline when the target concession closed (Fig. 1). The proportion of items sold that were healthy was significantly higher in the intervention phase (22.7%), compared to pre- (7.7%) and postintervention (9.8%;  $p < 0.0001$ ). The proportion of the total items sold per patron and the proportion of the total revenues per patron did not differ across the three periods for both concessions combined; however, both values declined significantly during the intervention period within the municipally operated concession (Table 2;  $p < 0.001$ ).



**Figure 1.** Comparison of availability and sales of healthy items. \*Significantly different from pre- and postintervention:  $p < 0.0001$ .  $n = 3297$  items sold preintervention;  $n = 13,680$  items sold during the intervention;  $n = 285$  items sold postintervention.

Within the target concession itself, 44.4% of items available for sale were healthy, whereas 40.8% of those sold were healthy. Also within the target concession, sales of healthy beverages represented 28.2% of sales and exceeded (unhealthy beverages, healthy and unhealthy side dishes, and healthy main dishes) or were equal to (unhealthy main dishes) sales of all other product types (Fig. 2;  $p < 0.0001$ ). Together, fruit smoothies and slushes represented 58.0% of sales of healthy items. Table 3 shows the items with the highest sales in each concession.

### Observations

The pool area was enclosed by a fence and consisted of a single L-shaped pool surrounded on three sides by grassy areas where families/groups stationed themselves and their belongings during their visit. All patrons passed by the municipally operated concession upon entry to the pool. The target concession was located near the shallow end of the pool and was also very visible to patrons.

Patrons whose behaviors were observed ( $n = 221$ ) were primarily children accompanied by their parents. Visits to the pool by children ( $n = 132$ ; 58% female and 4% overweight/obese) averaged  $155 \pm 6$  minutes, whereas adults ( $n = 92$ ; 76% female and 39% overweight/obese) spent, on average,  $138 \pm 6$  minutes at the pool. During their visit, patrons alternated between time spent in and outside the pool. Children spent approximately  $57 \pm 2\%$  of their time in the pool and adults  $42 \pm 3\%$  (overall mean,  $54 \pm 2\%$ ). The atmosphere was characterized by laughter and play. The most common activities performed outside the pool were sedentary, including eating, sunbathing, reading, and conversing. Almost all patrons ate at some point during their visit, and most ate intermittently throughout their visit. Most families packed a picnic lunch and supplemented with items from the concessions. The majority of foods eaten were brought from home (72%), with the most popular picnic items being sandwiches, fruit, and potato chips. Thirty-seven percent of all items eaten on-site, including items from the concessions and brought from outside, were healthy items.

**Table 2. Sales and Revenues during Each Study Period**

	Preintervention (n=35 days)	Intervention (n=40 days)	Postintervention (n=6 days)
No. of patrons at the pool (n)	3679	15,008	236
No. of items sold per patron (n)			
Municipal concession	0.9	0.5	1.2
Target concession	N/A <sup>a</sup>	0.4	N/A <sup>a</sup>
Overall	0.9	0.9	1.2
Revenues per patron (\$)			
Municipal concession	1.73	0.95	2.39
Target concession	N/A <sup>a</sup>	1.23	N/A <sup>a</sup>
Overall	1.73	2.19	2.39

The proportion of the total items sold per patron and the proportion of the total revenues per patron did not differ across the three periods for both concessions combined; however, both values declined significantly during the intervention period within the municipally operated concession ( $p < 0.001$ ).

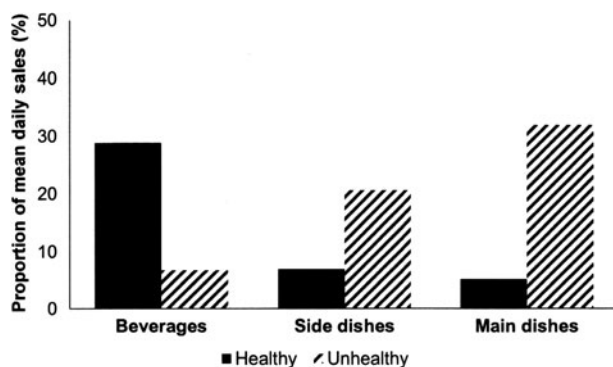
<sup>a</sup>Not applicable (N/A) given that the target concession was not open during the pre- and postintervention phases.

## Discussion

This study was the first to assess the independent impact of food availability on sales of healthy items in a community sports setting with commercial food sales. When few healthy foods were available, their sales were low. However, when a variety of healthy options were made available, healthy items sold in proportion to their availability, with no adverse effects on revenues. Thus, food availability was an important environmental determinant of food-purchasing behaviors in this context. These findings demonstrate that it is possible for patrons, the majority of whom were children, to voluntarily select healthy items despite concurrent availability of popular unhealthy op-

tions. Sales of healthy, calorie-containing beverages (primarily whole-fruit slushes and smoothies) accounted for 58% of sales of healthy items, however, suggesting that additional effort may be required to induce greater selection of healthful, calorie-free beverages, such as water, along with healthy main dishes and snacks.

Food availability has been described as one of the strongest predictors of dietary intake<sup>29–32</sup>; however, much



**Figure 2. Sales according to product type in the target concession.** Significant differences are not indicated in the figure because analysis of covariance (ANCOVA) was used to estimate differences in sales of healthy and unhealthy items. Differences in proportions were not examined. ANCOVA showed that sales of healthy beverages exceeded (unhealthy beverages, healthy and unhealthy side dishes, and healthy main dishes) or were equal to (unhealthy main dishes) sales of all other product types ( $p < 0.0001$ ).

**Table 3. Top 10 Items Sold during the Intervention Period in Each Concession**

Target concession	Municipal concession <sup>a</sup>
Hot dog	Potato chips
Ice cream cone	Pixi sticks candy
<b>Fruit smoothie</b>	Snow cone
<b>Fruit slush</b>	Freezie
Grilled cheese sandwich	<b>Water</b>
<b>Water</b>	Soda pop (regular and diet)
Banana split	Drumstick ice cream
Feta chicken wrap	Maynards candy
Iced coffee	Ice cream sandwich
<b>Teriyaki chicken wrap</b>	Fudgesicle

Items listed in order from highest to lowest sales within each concession. Healthy items in bold.

<sup>a</sup>The top 10 items sold during the pre- and postintervention periods was very similar to those sold during the intervention period in the municipal concession. The only meaningful difference was that water had the fourth highest sales during the pre- and postintervention periods.

of the evidence in support of this statement comes from individual-level surveys,<sup>33–36</sup> focus groups,<sup>32,35</sup> ecological observational studies of the type and proximity of food stores in residential communities,<sup>37,38</sup> and studies of food availability within homes<sup>4,5</sup> and schools.<sup>8,39,40</sup> The independent role of increased availability of healthier foods within community commercial settings in supporting their purchase and consumption is less certain given that, although suggestive evidence is available from multicomponent studies,<sup>41,42</sup> fewer have isolated the independent contribution of food availability to selection of healthier items. The current findings are in line with a small body of evidence that suggests a positive impact of increased availability of healthy items on their sale in similar settings.<sup>9–12</sup> Remarkably, purchase of healthy items closely mirrored their availability throughout the study, a pattern also observed in some other investigations.<sup>10,39,43,44</sup> Extension of previous work on food availability within homes and schools to the community and commercial sectors is critical, because the health impact of interventions based in a single setting can be diminished by the absence of complementary supports in other environments.<sup>45</sup>

Studies confirm that limited availability of healthy foods in sports settings is a problem with international relevance.<sup>17,24,46</sup> Availability of healthy items in children's sports settings is particularly critical for families, given that time constraints associated with balancing parental work schedules with youth sporting activities may force families to purchase and consume meals in sports venues or from conveniently located fast food outlets.<sup>24,47</sup> Parents of youth involved in sport report that many of the meals and snacks consumed by children in sports settings are unhealthy and point to food availability as one of the key factors that determines what their children eat in these settings.<sup>24</sup> Increasing access to healthier foods in these venues may therefore positively influence the dietary intake of families who, by virtue of their involvement in sport, may lack the time to prepare and consume healthy meals at home.<sup>47</sup>

Increased availability of healthy items was not sufficient to induce purchase of healthy items by all individuals given that the majority of purchases remained unhealthy. Food availability is only one of many factors that influence food selection. Even highly available junk foods do not sell themselves, and hence it is unlikely that food selection can be optimized merely by manipulating its availability. Important lessons for public health in increasing the sale of healthy items might be gleaned from examining the broad variety of tactics industry has employed to establish unhealthy items as the normative choice in most settings.

Fruit smoothies (consisting of whole fruits, 100% fruit juice, and low-fat dairy products) and slushes (consisting of whole fruits and ice) were the most commonly selected healthy menu items and together accounted for nearly one quarter of all items sold in the target concession. Thus, sales of smoothies and slushes displaced sales of unhealthy

items, a finding of considerable importance given that intake of fruits, vegetables, and dairy products is chronically low among children.<sup>48–53</sup> By contrast, caloric beverages are popular, and account for 13–34% of the daily energy intake of Canadian children and youth,<sup>54</sup> with American 6- to 11-year-olds averaging 370 kcal/day from beverages.<sup>55</sup> Preadolescents, in particular, may prefer to consume fruit juices rather than whole fruits and vegetables.<sup>11</sup> Therefore, although their liquid medium may not be nutritionally ideal,<sup>56–58</sup> because they are both nutrient rich (unlike SSBs) and well-liked (unlike some whole fruits and vegetables), beverages with healthful ingredients may be important vehicles for delivery of key nutrients lacking in children's diets. Ultimately, the health impact of these beverages will depend on how they are consumed, given that any food consumed in excess of energy requirements can promote weight gain.<sup>56,59</sup> Advice to offset calories from healthy beverages by consuming less of other (primarily unhealthy) items should therefore be emphasized.

Managers of community sports facilities contend that they do not provide many healthy foods because patrons do not purchase them.<sup>15,21–23,60</sup> This study showed that proportional sales volumes and proportional revenues per patron in these contexts can be maintained when the availability of healthy menu items is increased. This is a favorable outcome from a public health perspective because it suggests that patrons exchanged unhealthy for healthy items, avoiding the unintended consequence whereby individuals increase, rather than reduce, energy intake in response to various food-related interventions. These results are also favorable from an industry perspective because revenues did not decline. Thus, these findings demonstrate potential to establish mutually beneficial, health-promoting public-private partnerships in community sports settings.

This study has the advantage of providing information regarding patrons' food purchases in a real-world context; however, this advantage comes at the expense of not being able to precisely control features of the setting and of not having demographic information regarding patrons. To partially address this limitation, observations were recorded of the general setting, as well as of the behaviors of a subset of patrons. These observations provide context for the findings and do not constitute a representative sample of patrons' behaviors. Findings showed that, during the intervention period, patrons spent approximately half of their time in the pool, and that eating was an important out-of-pool activity. Given that only 37% of items consumed by this subsample of patrons were healthy, it is possible that individuals consumed more calories at the pool than they expended while there. Indeed, some studies suggest that youth may overcompensate for increased physical activity by eating more.<sup>61</sup> Improving the food environment in community sports venues may therefore assist children to better match energy intake with expenditures over the long term.

### *Strengths and Limitations*

The study was performed in a real-world setting with all of its constraints and supports, increasing the external validity of findings; however, the study design therefore had to accommodate private sector constraints. It was not feasible for the target concession to adopt an entirely new menu mid-way through its operating season. For this reason, the pre- and postintervention periods could only be conducted when the target concession was closed. Though this was not ideal, the stability in the proportional number of items sold and in revenues per patron across all periods strengthens the inference that change in sales of healthy items were truly attributable to the intervention. This stability also demonstrates that patrons found both concession menus to be appealing, although the predominance of freshly prepared items on the target concessions' menu may have strengthened its appeal. The attractive nature of the target concession's healthier menu was by design, however, because the study's intent was to examine whether patrons could be induced to purchase healthy items despite concurrent availability of unhealthy options. Thus, findings remain robust and demonstrate that it is possible for healthy foods offered by a small, local concession to compete with unhealthy products, many of which were well-established brand name items familiar to patrons.

The study design and setting (*i.e.*, single-component intervention, both concessions present on a single site, direct objective measures of sales rather than relying on self-reported purchases, and successive control and intervention periods) minimized many sources of confounding; however it is possible that factors other than the availability of healthy foods also influenced sales of healthy items. For instance, although many popular unhealthy items were included on the menu (*e.g.*, grilled cheese sandwiches, hot dogs, and ice cream cones), others were not, such as hamburgers and French fries. In addition, many of the healthy items on the target concession's menu were fruit based and thus the generalizability of findings to sales of other types of healthy foods is unclear. The study was conducted at a single site over a short time frame, and therefore results may differ in other contexts and over the longer term. These limitations do not, however, diminish the significance of the finding that increased availability of healthy foods supported their sale and suggests that there may be potential to observe similar findings in comparable settings.

Although this study did not directly evaluate change in food consumption, it did evaluate change in food selection, which has been shown to influence consumption.<sup>62</sup> Because we did not assess change in items brought from home, we cannot be sure that children did not substitute healthy calorie-containing beverages from the target concession for water brought from home; however, the stability in proportional revenues and number of items sold per pool patron across all periods argues that substitutions were made in terms of concession purchases, rather than in items brought from home, and are therefore likely to be

represented in the current analysis. It is not possible to determine whether patrons were similar across all periods; however, the municipality indicated that many patrons were facility pass holders, which suggests a greater likelihood of repeat visits. Concession and study staff also noticed repeat customers. Finally, although proportional revenues remained stable, it is unclear whether profits changed during the course of the study. However, managers indicated that change in revenues provided a reliable proxy of change in profits.

### Conclusions

The epidemic of obesity has made it abundantly clear that even well-intentioned, knowledgeable individuals can be influenced to make poor dietary choices by environmental factors operating outside of their conscious awareness. Individuals cannot make healthy choices if they are not available, and children, in particular, are unlikely to do so in environments replete with unhealthy choices. This study is one of the first to examine the independent contribution of increased availability of healthy foods to their sales in a community commercial setting, finding that sales of healthy foods and, especially, healthy beverages closely mirrored their availability. Results suggest that increasing the availability of healthy items may be a powerful means to positively influence food selection in community commercial contexts. Although necessary, increased availability of healthy items may not be sufficient to induce selection of healthy items by most individuals, however, given that the majority of items sold remained unhealthy. Complementary measures should therefore be explored.

Studies to date have primarily examined the impact of increased availability of healthier items within homes and schools on dietary intake. However, changes within schools and homes alone, without consideration of the broader context of unhealthy food environments that children encounter on a daily basis, will not be sufficient. Shifting the dietary behaviors of a large segment of children in health-promoting directions will require widespread environmental changes that influence children wherever they are, such that healthier behaviors become normative in all settings. Findings from this study suggest that increasing the availability of healthy foods may be a potent mediator of healthier dietary behaviors among children with potential for more widespread application.

### Acknowledgments

This study was funded by the Canadian Foundation for Dietetic Research. D.L.O. has received scholarship support from a Vanier Canada Graduate Scholarship; the Alberta Centre for Child, Family and Community Research; a Canadian Institutes of Health Research/Heart and Stroke Foundation of Canada Training Grant in Population Intervention for Chronic Disease Prevention; and the Canadian Federation of University Women. K.D.R. was funded

by a Canadian Institutes of Health Research/Heart and Stroke Foundation of Canada Applied Public Health Chair.

The authors are grateful for the willingness of the municipality and the privately operated concession to participate in this study. Kylie McLean, Nicole Giacobbo, Shelby Cender, Crystal Narten, and Anran Zhang provided excellent assistance with data collection and analysis.

### Author Disclosure Statement

No competing financial interests exist.

### References

- Cohen DA, Babey SH. Contextual influences on eating behaviours: Heuristic processing and dietary choices. *Obes Rev* 2012;13:766–779.
- Just DR, Payne CR. Obesity: Can behavioral economics help? *Ann Behav Med* 2009;38(Suppl 1):S47–S55.
- Swinburn BA, Sacks G, Hall KD, et al. The global obesity pandemic: Shaped by global drivers and local environments. *Lancet* 2011;378:804–814.
- Pearson N, Biddle SJ, Gorely T. Family correlates of fruit and vegetable consumption in children and adolescents: A systematic review. *Public Health Nutr* 2009;12:267–283.
- van der Horst K, Oenema A, Ferreira I, et al. A systematic review of environmental correlates of obesity-related dietary behaviors in youth. *Health Educ Res* 2007;22:203–226.
- Rasmussen M, Krølner R, Klepp KI, et al. Determinants of fruit and vegetable consumption among children and adolescents: A review of the literature. Part I: Quantitative studies. *Int J Behav Nutr Phys Act* 2006;3:22.
- Kocken PL, Eeuwijk J, Van Kesteren NM, et al. Promoting the purchase of low-calorie foods from school vending machines: A cluster-randomized controlled study. *J Sch Health* 2012;82:115–122.
- Bere E, Hilsen M, Klepp KI. Effect of the nationwide free school fruit scheme in Norway. *Br J Nutr* 2010;104:589–594.
- van Kleef E, Otten K, van Trijp HC. Healthy snacks at the checkout counter: A lab and field study on the impact of shelf arrangement and assortment structure on consumer choices. *BMC Public Health* 2012;12:1072.
- Wilbur CS, Zifferblatt SM, Pinsky JL, et al. Healthy vending: A cooperative pilot research program to stimulate good health in the marketplace. *Prev Med* 1981;10:85–93.
- Di Noia J, Contento IR. Fruit and vegetable availability enables adolescent consumption that exceeds national average. *Nutr Res* 2010;30:396–402.
- Curhan R. The effects of merchandising and temporary promotional activities on the sales of fresh fruits and vegetables in supermarkets. *J Mark Res* 1974;11:286–294.
- Naylor PJ, Bridgewater L, Purcell M, et al. Publically funded recreation facilities: Obesogenic environments for children and families? *Int J Environ Res Public Health* 2010;7:2208–2221.
- Chaumette P, Morency S, Royer A, et al. [Food environment in the sports, recreational and cultural facilities of Quebec City: A look at the situation]. [Article in French]. *Can J Public Health* 2009;100:310–314.
- Olstad D, Downs S, Raine K, et al. Improving children's nutrition environments: A survey of adoption and implementation of nutrition guidelines in recreational facilities. *BMC Public Health* 2011;11:423–435.
- Drygas W, Ruszkowska J, Philpott M, et al. Good practices and health policy analysis in European sports stadia: Results from the 'Healthy Stadia' project. *Health Promot Int* 2013;28:157–165.
- Kelly B, Chapman K, King L, et al. Double standards for community sports: Promoting active lifestyles but unhealthy diets. *Health Promot J Austr* 2008;19:226–228.
- Kokko S, Kannas L, Villberg J. Health promotion profile of youth sports clubs in Finland: Club officials' and coaches' perceptions. *Health Promot Int* 2009;24:26–35.
- Crawford PB, Gosliner W, Kayman H. The ethical basis for promoting nutritional health in public schools in the United States. *Prev Chronic Dis* 2011;8:A98–A104.
- Ireland R, Watkins F. Football fans and food: A case study of a football club in the English premier league. *Public Health Nutr* 2010;13:682–687.
- Thomas HM, Irwin JD. Food choices in recreation facilities: Operators' and patrons' perspectives. *Can J Diet Pract Res* 2010;71:180–185.
- Olstad DL, Raine KD, McCargar LJ. Adopting and implementing nutrition guidelines in recreational facilities: Tensions between public health and corporate profitability. *Public Health Nutr* 2013;16:815–823.
- Vander Wekken S, Sorensen S, Meldrum J, et al. Exploring industry perspectives on implementation of a provincial policy for food and beverage sales in publicly funded recreation facilities. *Health Policy* 2012;104:279–287.
- Thomas M, Nelson TF, Harwood E, et al. Exploring parent perceptions of the food environment in youth sport. *J Nutr Educ Behav* 2012;44:365–371.
- Olstad DL, Goonewardene LA, McCargar LJ, et al. Choosing healthier foods in recreational sports settings: A mixed methods investigation of the impact of nudging and an economic incentive. *Int J Behav Nutr Phys Act* 2014;11:6.
- Alberta Health and Wellness. The Alberta Nutrition Guidelines for Children and Youth. 2011. Available at [www.healthyalberta.com/HealthyEating/ANGCY.htm](http://www.healthyalberta.com/HealthyEating/ANGCY.htm) Last accessed September 10, 2014.
- Stunkard AJ, Sorenson TI, Schulsinger F. Use of the Danish adoption register for the study of obesity and thinness. In: Kety S (ed), *The Genetics of Neurological and Psychiatric Disorders*. Raven: New York, 1983, pp. 115–120.
- Warschburger P, Kröllner K. Maternal perception of weight status and health risks associated with obesity in children. *Pediatrics* 2009;124:e60–e68.
- Blanchette L, Brug J. Determinants of fruit and vegetable consumption among 6–12-year-old children and effective interventions to increase consumption. *J Hum Nutr Diet* 2005;18:431–443.
- Cullen KW, Baranowski T, Rittenberry L, et al. Child-reported family and peer influences on fruit, juice and vegetable consumption: Reliability and validity of measures. *Health Educ Res* 2001;16:187–200.
- Tak NI, Te Velde SJ, Brug J. Are positive changes in potential determinants associated with increased fruit and vegetable intakes among primary schoolchildren? Results of two intervention studies in the Netherlands: The Schoolgruuten Project and the Pro Children Study. *Int J Behav Nutr Phys Act* 2008;5:21.
- Jago R, Baranowski T, Baranowski JC. Fruit and vegetable availability: A micro environmental mediating variable? *Public Health Nutr* 2007;10:681–689.
- Bere E, Klepp KI. Correlates of fruit and vegetable intake among Norwegian schoolchildren: Parental and self-reports. *Public Health Nutr* 2004;7:991–998.



34. Cullen KW, Baranowski T, Owens E, et al. Availability, accessibility, and preferences for fruit, 100% fruit juice, and vegetables influence children's dietary behavior. *Health Educ Behav* 2003;30:615–626.
35. Faith MS, Fontaine KR, Baskin ML, et al. Toward the reduction of population obesity: Macrolevel environmental approaches to the problems of food, eating, and obesity. *Psychol Bull* 2007;133:205–226.
36. Larson N, Laska MN, Story M, et al. Predictors of fruit and vegetable intake in young adulthood. *J Acad Nutr Diet* 2012;112:1216–1222.
37. Larson N, Story M. A review of environmental influences on food choices. *Ann Behav Med* 2009;38(Suppl 1):S56–S73.
38. Caspi CE, Sorensen G, Subramanian SV, et al. The local food environment and diet: A systematic review. *Health Place* 2012;18:1172–1187.
39. Kubik MY, Lytle LA, Hannan PJ, et al. The association of the school food environment with dietary behaviors of young adolescents. *Am J Public Health* 2003;93:1168–1173.
40. Hoerr SM, Loudon VA. Can nutrition information increase sales of healthful vended snacks? *J Sch Health* 1993;63:386–390.
41. Gittelsohn J, Rowan M, Gadhoke P. Interventions in small food stores to change the food environment, improve diet, and reduce risk of chronic disease. *Prev Chronic Dis* 2012;9:E59.
42. Seymour JD, Yaroch AL, Serdula M, et al. Impact of nutrition environmental interventions on point-of-purchase behavior in adults: A review. *Prev Med* 2004;39(Suppl 2):S108–S36.
43. Lytle LA, Kubik MY, Perry C, et al. Influencing healthful food choices in school and home environments: Results from the TEENS study. *Prev Med* 2006;43:8–13.
44. Olstad DL, Raine KD, McCargar LJ. Adopting and implementing nutrition guidelines in recreational facilities: public and private sector roles. A multiple case study. *BMC Public Health* 2012;12:376.
45. Hollar D, Messiah SE, Lopez-Mitnik G, et al. Effect of a two-year obesity prevention intervention on percentile changes in body mass index and academic performance in low-income elementary school children. *Am J Public Health* 2010;100:646–653.
46. Kelly B, Baur LA, Bauman AE, et al. Examining opportunities for promotion of healthy eating at children's sports clubs. *Aust N Z J Public Health* 2010;34:583–588.
47. Chircop A, Shearer C, Pitter R, et al. Privileging physical activity over healthy eating: 'Time' to Choose? *Health Promot Int* 2013 Aug 26. [Epub ahead of print]. doi: 10.1093/heapro/dat056.
48. Black JL, Billette JM. Do Canadians meet Canada's Food Guide's recommendations for fruits and vegetables? *Appl Physiol Nutr Metab* 2013;38:234–242.
49. Garriguet D. Overview of Canadians' eating habits. Nutrition. Findings from the Canadian Community Health Survey. 2004. Available at <http://publications.gc.ca/Collection/Statcan/82-620-M/82-620-MIE2006002.pdf> Last accessed October 3, 2014.
50. Guenther PM, Dodd KW, Reedy J, et al. Most Americans eat much less than recommended amounts of fruits and vegetables. *J Am Diet Assoc* 2006;106:1371–1379.
51. Holman DM, White MC. Dietary behaviors related to cancer prevention among pre-adolescents and adolescents: The gap between recommendations and reality. *Nutr J* 2011;10:60.
52. Sebastian RS, Wilkinson Enns C, Goldman JD. US adolescents and MyPyramid: Associations between fast-food consumption and lower likelihood of meeting recommendations. *J Am Diet Assoc* 2009;109:226–235.
53. Kimmons J, Gillespie C, Seymour J, et al. Fruit and vegetable intake among adolescents and adults in the United States: Percentage meeting individualized recommendations. *Medscape J Med* 2009;11:26.
54. Danyliw AD, Vatanparast H, Nikpartow N, et al. Beverage intake patterns of Canadian children and adolescents. *Public Health Nutr* 2011;14:1961–1969.
55. Lasater G, Piernas C, Popkin BM. Beverage patterns and trends among school-aged children in the US, 1989–2008. *Nutr J* 2011;10:103.
56. Houchins JA, Burgess JR, Campbell WW, et al. Beverage vs. solid fruits and vegetables: Effects on energy intake and body weight. *Obesity (Silver Spring)* 2012;20:1844–1850.
57. Faith MS, Dennison BA, Edmunds LS, et al. Fruit juice intake predicts increased adiposity gain in children from low-income families: Weight status-by-environment interaction. *Pediatrics* 2006;118:2066–2075.
58. Mourao DM, Bressan J, Campbell WW, et al. Effects of food form on appetite and energy intake in lean and obese young adults. *Int J Obes (Lond)* 2007;31:1688–1695.
59. Krolner R, Rasmussen M, Brug J, et al. Determinants of fruit and vegetable consumption among children and adolescents: A review of the literature. Part II: Qualitative studies. *Int J Behav Nutr Phys Act* 2011;8:112.
60. Olstad DL, Raine KD, McCargar LJ. Adopting and implementing nutrition guidelines in recreational facilities: Public and private sector roles. A multiple case study. *BMC Public Health* 2012;12:376.
61. Sonneville KR, Gortmaker SL. Total energy intake, adolescent discretionary behaviors and the energy gap. *Int J Obes (Lond)* 2008;32(Suppl 6): S19–S27.
62. Gray C, Lytle LA, Mays R, et al. Foods on students' trays when they leave the cafeteria line as a proxy for foods eaten at lunch in a school-based study. *J Am Diet Assoc* 2002;102:407–409.

Address correspondence to:  
Dana Lee Olstad, PhD, RD  
Research Fellow

Centre for Physical Activity and Nutrition Research  
Deakin University  
221 Burwood Highway  
Burwood, VIC 3125  
Australia

E-mail: [dana.olstad@deakin.edu.au](mailto:dana.olstad@deakin.edu.au)