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Article

The association between perceived adequacy and capacity for school food policy implementation on food availability and policy adherence in Nova Scotia, Canada

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Abstract: Supporting the implementation of school food and nutrition policies (SFNPs) is an international priority to encourage healthier eating among children and youth. Schools are an important intervention setting to promote childhood nutrition, and many jurisdictions have adopted policies, guidelines, and programs to modify the school nutrition environment and promote healthier eating. The purpose of this study was to explore the association between perceived adequacy and capacity for SFNP implementation on food availability and policy adherence in the province of Nova Scotia (NS), Canada, one of the first regions in Canada to launch a comprehensive SFNP. A cross sectional online survey was conducted in 2014-15 to provide a current-state of policy implementation and adherence. Adequacy and capacity for food policy implementation was used to assess policy adherence through the availability of prohibited 'minimum' nutrition foods. An exploratory factor analysis was conducted on a selected of available foods and 'slow' and 'quick' service food composition measures were dichotomized for food availability. Schools with above perceived average adequacy and capacity for policy implementation had more than three times (3.62) greater odds of adhering to a lunch policy, while schools that adhered to a snack and lunch policy had 52% and 82% lower odds of serving quick service foods, respectively. This study identified the need for appropriate adequacy and capacity for policy implementation to ensure policy adherence and improve the school food environment. These findings highlight the potential of SFNPs to have a positive impact on childhood nutrition, but adequately supporting their implementation is critical to ensure their impact.

Keywords: school health; child/adolescent health; health education; health promotion; school nutrition; school health; policy

1. Introduction

Supporting the implementation of strategies to encourage healthier eating is an international priority to address poor diet quality among children and youth [1]. Schools are an important intervention setting to promote childhood nutrition, and many jurisdictions have adopted policies, guidelines, and programs to modify the school nutrition environment and promote healthier eating

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[2,3]. Nutrition policies can help to create healthier school environments by influencing the availability of food and beverages, which subsequently may impact the nutrition behaviours of students[4-9]. A recent systematic review suggested that school policies have a positive effect on behavioural risk factors for non-communicable diseases (NCD), particularly when they are implemented as part of a comprehensive approach [10]. For example, policies aimed at reducing sugar-sweetened beverage intake or increasing fruit and vegetable intake in schools had corresponding impacts on consumption patterns, although findings were mixed for other NCD risk factors [10]. However, the authors noted that greater consideration of environmental or structural factors that help or hinder individual behaviours might offer a more equitable approach to policy implementation [10]. Thus, for policy implementation to effect the degree of change necessary for sustained impact, there is a need to identify specific aspects of the school environment that will best support sustainable positive changes to childhood nutrition in school settings [10-12].

The east coast province of Nova Scotia (NS) Canada has a rich history of policy action to support children's health in schools. In 2006, the province was one of the first in Canada to launch a school nutrition policy providing standards for foods and beverages served and sold in schools [13]. These mandated standards included directives for school eating practices such as pricing, programming and advertising, and guidelines that encourage schools to foster community partnerships and support local food products [13]. Since the policy was introduced, funding has been distributed each year to support implementation in schools but there are gaps in implementation of directives that limit its potential for impact [14]. One such gap is in the ability for each school to implement policy directives based on adequacy of facilities or equipment and capacity of staff to support policy implementation. The purpose of this study was to explore the association of combined factors of perceived adequacy and capacity for policy implementation with food availability and policy adherence in schools across NS. It was hypothesized that schools with greater perceived adequacy and capacity for policy implementation would be more able to adhere to the school nutrition policy and to serve healthier foods.

2. Materials and Methods

A cross-sectional study was conducted in 2014-15 to provide an assessment of policy implementation and adherence across NS, as they relate to the directives of the 2006 policy. An online survey was developed and administered to assess implementation of the nutrition policy across all public schools in NS (elementary, junior and senior high). The online survey was hosted on a secure web-based platform and took about 15 minutes to complete. With permission and support from each school board key contact, school principals were contacted by email to request their participation in the online survey. The process (by research team or school board) and timing for contacting school principals was determined through the advice of our key school board contacts. Principals were instructed that they could also identify an appropriate designate with experience in school food service to complete the survey on behalf of the school. Reminders to complete survey were sent via email and through social media.

The measures in the survey were based on the psychometric properties of scales from similar research conducted in Canada [15] and comprised questions related to the school food environment. These included organizational factors, school climate, policy institutionalization and perceived adequacy and capacity for policy implementation. The survey for this study added questions pertaining to the directives and guidelines of the NS school nutrition policy (available from the authors by request). Content review of the measures was completed by government stakeholders to determine the relevance of constructs and measures for the NS context.

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The perceived adequacy and capacity for policy implementation represented a composite measure based on two dimensions that were self-reported by survey participants. These perceived adequacy and capacity constructs were derived from questions related to staffing, facilities and equipment available for food preparation when compared to other schools. Responses to these questions were then characterized as 'below average', 'average' or 'above average' in relation to perceived adequacy and capacity. Adherence to a breakfast, snack and lunch policy was self-reported through the availability of certain foods that were classified into food service types, that reflected foods that are likely to be 'quick' and 'slow' to prepare. Policy adherence was framed through asking '*To the best of your knowledge, to what extent are minimum nutrition food and beverages sold or served in…*'. Policy adherence for each type of school policy was then dichotomized to reflect that 'no minimum nutrition foods served' represented 'policy adherence'.

Food service was then assessed within each school by asking *'How often are the following foods and beverages served or sold from the school cafeteria, vending machines(s), snack bar or school store during school hours?*'. Food availability for each food was dichotomized as any frequency ('daily', 3-4 times per week, 1-2 times per week, 1-3 times per month or less than once per month') or 'never'. In order to select relevant foods served within schools we conducted exploratory factor analysis on a selection of policy relevant foods. We extracted a 2-factor solution using principal component analysis with promax rotation. The first component included nachos and poutine, garlic fingers, hamburgers and French fries which we labeled as 'quick service foods'; the second component included prepared fresh fruit, cooked or raw vegetables, sandwiches and subs, baked chicken or baked pasta dish which we labeled as 'slow service foods'. The two 2-factor solution explained 65% of the variance and each scale had adequate internal consistency (Cronbach alpha) with alpha = .89 and .78 respectively. Slow and quick service food composition measures were dichotomized as foods served at any frequency (i.e. food available) or never serving one of the included foods.

In terms of covariates, self-reported survey questions were used to assess school grades, number of students and number of staff within each school. To provide an indicator of community socioeconomic status, the median community income was assessed using 2016 census data and matched with the school community name. School rurality was assessed using the second character of school postal codes (0 representing rural, 1 representing urban). Descriptive statistics were used to summarize school characteristics, the combined measure of perceived adequacy and capacity for policy implementation, policy adherence, and food availability (both individual foods and composite measures) across school grades. Binary logistic regressions were first used to evaluate breakfast, snack and lunch policy adherence by level of perceived staffing and facility adequacy and capacity (unadjusted). Models were then adjusted for school size, community median income and rurality. Binary logistic regression were also used to evaluate slow and quick service food availability composite measures by adherence to breakfast, snack and lunch policy (unadjusted). Models were then adjusted for school size, community median income and rurality. Complete case analysis was used for missing outcome data, while missing exposure or covariate values were examined, with no significant differences in percentages across exposure levels or outcomes. Missing values were categorized for each variable and included in appropriate models to avoid additional case deletion (i.e. missing indicator approach). Analyses were conducted using Stata 12.

3. Results

Our sample included 237 schools across Nova Scotia, Canada (59% of all schools). Several schools comprised more than one grade level, and these included 170 elementary grades (primary/kindergarten to grade 6, ages 5-11 years), 85 junior high grades (grades 7 to 9, ages 12-14 years) and 56 high school grades (grades 10 to 12, ages 15-18 years) with an average of 332 students,

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and 33 staff per school (Table 1). Median community income across school locations was $30,627 CDN and 63% of schools were located in urban areas. Adequacy and capacity for policy adherence were mostly reported as average; in some instances, greater percentages were below rather than above average. Staffing resources were reported as above average by 8.4%, below average by 24% and average by 59% of schools. Facility resources were reported as above average by 28%, below average by 22% and average by 43% of schools. Twenty five percent of schools reported breakfast policy adherence, while snack policy adherence was reported by 22% and lunch policy adherence was reported by 19% of schools. Quick service foods were served in 64% of schools, while slow service foods were served in 89% of schools.

Table 1: School characteristics for analytical sample by grades within each school, N= 237[1]

Classification	Characteristic	School grades			
		Elementary school	*Jr. High school*	*High school*	*Total[1]*
Socio-demographic					
School	Number of school grades (N)	170	85	56	311
	Number of students (mean, SE)	268 (14)	340 (19)	537 (19)	332 (16)
	Number of staff (mean, SE)	29.8 (1.5)	36.0 (1.7)	47.9 (3.3)	33.4 (1.2)
Socio-economic	Community income (median, IQR)	$30,627 (7130)	$29,973 (7223)	$28,968 (5687)	$30,627 (7130)
School rurality	Urban % (N)	58% (99)	55% (47)	50% (28%)	63% (150)
Policy implementation					
Staffing/Financial capacity	Average % (N)	60% (102)	40% (57)	57% (32)	59% (141)
	Below average % (N)	24% (41)	18% (15)	27% (15)	24% (57)
	Above average % (N)	7.0% (12)	7.0% (6)	14% (8)	8.4% (20)
Adequacy of Facilities	Average % (N)	44% (75)	41% (35)	41% (23)	43% (103)
	Below average % (N)	24% (41)	22% (19)	14% (8)	22% (53)
	Above average % (N)	25% (42)	31% (26)	43% (24)	28% (67)
Policy Adherence [2]					
Breakfast	No minimum nutrition % (N)	27% (47)	22% (19)	16% (9)	26% (61)
	At least some % (N)	63% (107)	65% (55)	79% (44)	63% (149)
Snack	No minimum nutrition % (N)	24% (42)	14% (12)	11% (6)	22% (53)
	At least some % (N)	62% (106)	72% (61)	79% (44)	63% (150)
Lunch	No minimum nutrition % (N)	22% (37)	14% (12)	13% (7)	19% (45)
	At least some % (N)	69% (117)	71% (60)	82% (46)	70% (165)
Food availability [3]					
Quick service foods	Nacho and poutine % (N)	22% (37)	42% (36)	46% (26)	26% (63)
	Never % (N)	72% (122)	47% (40)	48% (27)	65% (154)
	Garlic fingers % (N)	33% (57)	42% (36)	54% (30)	34% (81)
	Never % (N)	60% (102)	46% (39)	41% (23)	57% (136)
	Hamburger % (N)	48% (81)	65% (55)	73% (41)	52% (123)
	Never % (N)	46% (78)	25% (21)	21% (12)	40% (94)
	French fries % (N)	48% (82)	62% (53)	77% (43)	53% (126)
	Never % (N)	44% (75)	25% (21)	14% (8)	37% (88)
Quick service foods composite					
	Quick foods served % (N)	59% (101)	73% (62)	88% (49)	64% (151)
	Never % (N)	35% (59)	16% (14)	7% (4)	28% (67)
Slow service foods	Fresh fruit % (N)	79% (135)	79% (67)	91% (51)	80% (188)
	Never % (N)	15% (25)	12% (10)	5% (3)	13% (31)
	Cooked/raw vegetables % (N)	74% (126)	78% (66)	91% (51)	75% (176)
	Never % (N)	20% (35)	14% (12)	5% (3)	19% (44)
	Sandwiches and subs % (N)	73% (125)	74% (63)	89% (50)	73% (175)
	Never % (N)	20% (35)	15% (13)	4% (2)	18% (43)
	Baked chicken % (N)	62% (106)	66% (56)	77% (44)	62% (148)
	Never % (N)	30% (52)	22% (19)	16% (9)	28% (67)
	Baked pasta dish % (N)	166% (112)	72% (61)	91% (51)	68% (163)
	Never % (N)	26% (45)	16% (14)	5% (3)	22% (53)
Slow service foods composite					
	Slow foods served % (N)	92% (156)	87% (74)	96% (54)	89% (211)
	Never % (N)	4% (7)	5% (4)	0% (0)	5% (11)

[1] Several schools are combined, therefore the number of school grades will be greater than the total number of schools
[2] Minimum nutrition foods served 'never'
[3] Food availability is % of schools that serve foods more than 'never'; composite measures are for serving any of the quick or slow foods.

The results of the regression analysis showed no association between staffing resources and policy adherence. However, schools reporting above average facility resources were associated with greater odds of adhering to a school lunch policy after adjustment (OR=3.62, CI=1.56,8.40), but not a snack or breakfast policy (Table 2).

Table 2. Odds ratios and 95% confidence intervals for breakfast, snack and lunch policy adherence by combined adequacy and capacity

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Odds of policy adherence [1]	Combined Adequacy and Capacity for Policy Implementation		
	Average	Above average	Below average
Staffing Capacity			
Breakfast policy (n=199)			
Unadjusted	REF	0.88 [0.43, 1.82]	0.97 [0.32, 2.92]
Adjusted[2]	REF	0.87 [0.42, 1.82]	0.87 [0.28, 2.66]
Snack policy (n=192)			
Unadjusted	REF	1.00 [0.47, 2.11]	1.80 [0.60, 5.36]
Adjusted[2]	REF	0.83 [0.38, 1.82]	1.85 [0.57, 5.99]
Lunch policy (n=196)			
Unadjusted	REF	1.43 [0.66, 3.09]	1.32 [0.40, 4.41]
Adjusted[2]	REF	1.36 [0.62, 2.96]	1.44 [0.42, 4.95]
Facilities Adequacy			
Breakfast policy (n=203)			
Unadjusted	REF	1.12 [0.51, 2.47]	0.96 [0.47, 1.95]
Adjusted[2]	REF	1.15 [0.52, 2.56]	0.99 [0.46, 2.13]
Snack policy (n=197)			
Unadjusted	REF	1.68 [0.76, 3.70]	0.82 [0.38, 1.77]
Adjusted[2]	REF	1.49 [0.66, 3.35]	1.26 [0.54, 2.91]
Lunch policy (n=201)			
Unadjusted	REF	**3.78 *** [1.64, 8.71]**	1.36 [0.58, 3.18]
Adjusted[2]	REF	**3.62 *** [1.56, 8.40]**	1.51 [0.62, 3.69]

[1] No minimum nutrition foods served
[2]Adjusted for school size, community median income and rurality
*p<0.05, **p<0.01, ***p<0.001

Additional results showed no association between adherence to a breakfast, snack or lunch policy and slow service foods. However, schools that reported adherence to a snack and lunch policy was associated with lower odds of having quick service foods available within the school after adjustment OR=0.48, CI=0.23,1.01 and OR=0.18, CI=0.08,0.41, respectively (Table 3).

Table 3. Odds ratios and 95% confidence intervals for slow and quick serve food availability by breakfast, snack and lunch policy adherence

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Odds of food availability [1]	Do not adhere to policy[2]	Adhere to breakfast policy	Adhere to snack policy	Adhere to lunch policy
Slow service foods (n=208)				
Unadjusted	REF	2.93 [0.35, 24.33]	0.58 [0.13, 2.51]	0.82 [0.16, 4.22]
Adjusted[3]	REF	3.04 [0.35, 26.28]	0.77 [0.16, 3.69]	1.13 [0.21, 6.15]
Quick service foods (n=205)				
Unadjusted	REF	0.74 [0.38, 1.41]	**0.37***[0.19, 0.72]**	**0.20*** [0.10, 0.40]**
Adjusted[3]	REF	0.76 [0.36, 1.59]	**0.48* [0.23, 1.01]**	**0.18*** [0.08, 0.41]**

[1] Slow or quick foods provided daily, weekly or monthly within the school
[2] No minimum nutrition foods served = policy adherence
[3]Adjusted for school size, neighbourhood median income and rurality
*p<0.05, **p<0.01, ***p<0.001

4. Discussion

This study sought to explore the association between adequacy and capacity for policy implementation on food availability and policy adherence in NS. It was hypothesized that schools with greater adequacy and capacity for policy implementation and adherence to the school nutrition policy would be more likely to serve healthier foods. Our results suggest that schools with above average facilities had more than three times (3.62) greater odds of adhering to a lunch policy, while schools that adhered to a snack and lunch policy had 52% and 82% lower odds of serving quick service foods, respectively.

Following an exploratory factor analysis, this study considered two types of foods, 'quick' versus 'slow' service foods, as a proxy for the healthfulness of the types of foods available in schools. To our knowledge, this is the first data-driven use of this type of conceptualization for foods available in schools. Research has previously considered the impact of less healthy foods on the diets of children using terms such as 'convenience or commercially-prepared foods' [16] or 'fast-food' [17]. One study examined the effect of fast-food and full-service restaurant consumption among children and youth and found that both were associated with higher energy intake and better diet quality [18]. Although 'slow' service foods may be considered intuitively healthier, further research is needed to determine how these, and how 'quick' service foods, are associated with children's diet quality.

This study found that schools with well-equipped facilities were more likely to adhere to the school nutrition policy for lunch programs, suggesting that improvements to the physical infrastructure of schools may be necessary to ensure access to proper equipment to prepare healthier foods for students. Alternatively, these schools might simply have a more structured approach to policy implementation as a function of being well-equipped. These differences may be particularly important for schools within communities of lower socioeconomic status as research has found that these schools struggle with the resources required for policy implementation [19-25], whereas schools in communities with higher socioeconomic status had more resources and opportunities and were better able to implement nutrition policies [26-29].

A strength of this study is the use of a data-driven approach that builds on the evidence from the aforementioned qualitative studies. The sample of schools, at 59% of all schools in the province, is also large. A key limitation is the use of self-reported data in assessing the school food environment. Self-report is known to be subject to bias, and in this context, may lead to optimism bias, whereby the

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foods provided in schools are considered to be healthier than when assessed using objective measures. Our classification of foods as 'slow' or 'quick' service, while data driven, may also not fully align with other examples from dietary pattern analyses, thereby limiting comparison with other studies [30].

5. Conclusions

School nutrition policies have the potential to have a positive effect on childhood nutrition, but supporting their implementation is critical to ensure their impact. A recent scoping review mapped the broad and local-system factors that influence policy implementation, identifying the importance of structural features of school communities, including school infrastructure [31]. This study builds on the existing evidence by identifying the importance of school adequacy and capacity for policy implementation to ensure policy adherence and improve the school food environment. Understanding the potential impact of these school-level factors on policy implementation helps to identify opportunities for intervention to support sustainable positive changes to childhood nutrition.

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References

1. World Health Organization (2003) *Diet, nutrition and the prevention of chronic diseases*. Geneva, Switzerland.
2. Blanck HM & Kim SA (2012) Creating supportive nutrition environments for population health impact and health equity: an overview of the Nutrition and Obesity Policy Research and Evaluation Network's efforts. *Am. J. Prev. Med.* **43**, S85-90.
3. Story M, Kaphingst KM, Robinson-O'Brien R, et al. (2008) Creating healthy food and eating environments: policy and environmental approaches. *Annu. Rev. Public Health* **29**, 253–272.
4. Probart C, McDonnell ET, Jomaa L, et al. (2010) Lessons from Pennsylvania's mixed response to federal school wellness law. *Health Aff. Proj. Hope* **29**, 447–453.
5. Brener ND, Chriqui JF, O'Toole TP, et al. (2011) Establishing a Baseline Measure of School Wellness-Related Policies Implemented in a Nationally Representative Sample of School Districts. *J. Am. Diet. Assoc.* **111**, 894–901.
6. Evenson KR, Ballard K, Lee G, et al. (2009) Implementation of a school-based state policy to increase physical activity. *J. Sch. Health* **79**, 231–238, quiz 244–246.
7. Kelder SH, Springer AS, Barroso CS, et al. (2009) Implementation of Texas Senate Bill 19 to Increase Physical Activity in Elementary Schools. *J. Public Health Policy* **30**, S221–S247.
8. Barroso CS, Kelder SH, Springer AE, et al. (2009) Senate Bill 42: implementation and impact on physical activity in middle schools. *J. Adolesc. Health Off. Publ. Soc. Adolesc. Med.* **45**, S82-90.
9. Chriqui JF, Pickel M & Story M (2014) Influence of school competitive food and beverage policies on obesity, consumption, and availability: a systematic review. *JAMA Pediatr.* **168**, 279–286.
10. Singh A, Bassi S, Nazar GP, et al. (2017) Impact of school policies on non-communicable disease risk factors - a systematic review. *BMC Public Health* **17**, 292.

Peer-reviewed version available at Int. J. Environ. Res. Public Health 2019, 16, 1974; doi:10.3390/ijerph16111974

11. Taylor JP, McKenna ML & Butler GP (2010) Monitoring and evaluating school nutrition and physical activity policies. *Can. J. Public Health Rev. Can. Santé Publique* **101 Suppl 2**, S24-27.
12. Kumanyika SK (2014) Five Critical Challenges for Public Health. *Health Educ. Behav.* **41**, 5–6.
13. Province of Nova Scotia (2008) Food and Nutrition Policy Documents. *Food Nutr. N. S. Sch.* http://www.ednet.ns.ca/healthy_eating/ (accessed October 2012).
14. McIsaac J-LD, Chu YL, Blanchard C, et al. (2015) The impact of school policies and practices on students' diets, physical activity levels and body weights. A province-wide practice-based evaluation. *Can. J. Public Health.* **106**, e43-51.
15. Mâsse LC & de Niet JE (2013) School nutritional capacity, resources and practices are associated with availability of food/beverage items in schools. *Int. J. Behav. Nutr. Phys. Act.* **10**, 26.
16. Alexy U, Libuda L, Mersmann S, et al. (2011) Convenience foods in children's diet and association with dietary quality and body weight status. *Eur. J. Clin. Nutr.* **65**, 160–166.
17. Braithwaite I, Stewart AW, Hancox RJ, et al. (2014) Fast-food consumption and body mass index in children and adolescents: an international cross-sectional study. *BMJ Open* **4**, e005813.
18. Powell LM & Nguyen BT (2013) Fast-food and full-service restaurant consumption among children and adolescents: effect on energy, beverage, and nutrient intake. *JAMA Pediatr.* **167**, 14–20.
19. Aarestrup AK, Jørgensen TS, Jørgensen SE, et al. (2015) Implementation of strategies to increase adolescents' access to fruit and vegetables at school: process evaluation findings from the Boost study. *BMC Public Health* **15**, 86.
20. Bauer KW, Larson NI, Nelson MC, et al. (2009) Socio-environmental, personal and behavioural predictors of fast-food intake among adolescents. *Public Health Nutr.* **12**, 1767–1774.
21. Downs SM, Farmer A, Quintanilha M, et al. (2012) From Paper to Practice: Barriers to Adopting Nutrition Guidelines in Schools. *J. Nutr. Educ. Behav.* **44**, 114–122.
22. Mâsse LC, Naiman D & Naylor P-J (2013) From policy to practice: implementation of physical activity and food policies in schools. *Int. J. Behav. Nutr. Phys. Act.* **10**, 71.
23. Nanney MS, Davey CS & Kubik MY (2013) Rural Disparities in the Distribution of Policies that Support Healthy Eating in US Secondary Schools. *J. Acad. Nutr. Diet.* **113**, 1062–1068.
24. Nathan N, Wolfenden L, Butler M, et al. (2011) Vegetable and fruit breaks in Australian primary schools: prevalence, attitudes, barriers and implementation strategies. *Health Educ. Res.* **26**, 722–731.
25. Phillips MM, Goodell M, Raczynski JM, et al. (2012) Creating and Using Index Scores in the Analysis of School Policy Implementation and Impact. *J. Sch. Health* **82**, 253–261.
26. Walton M, Waiti J, Signal L, et al. (2010) Identifying barriers to promoting healthy nutrition in New Zealand primary schools. *Health Educ. J.* **69**, 84–94.
27. Vine MM & Elliott SJ (2014) Examining local-level factors shaping school nutrition policy implementation in Ontario, Canada. *Public Health Nutr.* **17**, 1290–1298.
28. Vine MM, Elliott SJ & Raine KD (2014) Exploring Implementation of the Ontario School Food and Beverage Policy at the Secondary-School Level: A Qualitative Study. *Can. J. Diet. Pract. Res.* **75**, 118–124.
29. Gregorič M, Pograjc L, Pavlovec A, et al. (2015) School nutrition guidelines: overview of the implementation and evaluation. *Public Health Nutr.* **18**, 1582–1592.
30. Hodge A, Basset J (2016) Editorial What can we learn from dietary pattern analysis? *Public Health Nutr*: **19** (2), 191–194.
31. McIsaac JL, Spencer R, Meisner K, et al. (2018) Factors influencing the implementation of nutrition policies in schools: A scoping review. *Health Educ. Behav.* DOI: 10.1177/1090198118796891