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Food for thought: analysing the internal and external school food environment

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Abstract

Purpose – Availability and access to food is a determinant of obesity. The purpose of this paper is to examine food availability within and outside of post-primary schools in Ireland.

Design/methodology/approach – Data on the internal school food environment were collected from 63 post-primary schools using questionnaires. The external school food environment for these 63 schools was assessed by mapping food businesses within 1 km of schools, using a Geographic Information System (GIS). Food businesses were categorised based on type of food sold.

Findings – A total of 68.3 per cent of schools had a canteen, 52.5 per cent had a small food shop and 37.1 per cent had a vending machine. A total of 32.7 per cent of schools reported selling chips (French fries) in their canteen while 44.2 per cent of schools reported selling energy-dense nutrient-poor foods in their school shop. Of the schools surveyed, there was an average of 3.89 coffee shops and sandwich bars, 3.65 full service restaurants, 2.60 Asian and other “ethnic” restaurants, 4.03 fast food restaurants, 1.95 supermarkets, 6.71 local shops and 0.73 fruit and vegetable retailers within a 1 km radius of the post-primary schools. Findings are presented by geography (urban/rural), disadvantage (Delivering Equality of Opportunity in School (DEIS)/non DEIS), gender (girls/boys/mixed) and food policy in place at the school (yes/no).

Practical implications – These data will facilitate schools working on the framework for Health Promoting Schools in Ireland.

Social implications – This work can contribute to current discussions on restricting accessibility to certain foods and food premises for school children.

Originality/value – The study explores the internal and external school food environment. GIS have been used to link the external food environment to specific schools thus allowing a comprehensive analysis of the schools’ food environment. To the authors knowledge, this is the first time that both environments are explored simultaneously.

Keywords Students, Ireland, Health promotion, Health promoting schools, Schools, Health, Children, Obesity, Childhood obesity, Food and nutrition

Paper type Research paper

Introduction

Overweight and obesity is a significant public health problem in Ireland, with rates among school children of particular concern. It is estimated that over 300,000 children in Ireland are overweight and obese, with a projected increase of 10,000 in these rates annually (The National Taskforce on Obesity, 2005). More recent reports demonstrate that between 20 and 25 per cent of primary school children are overweight and obese

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(Whelton *et al.*, 2007; Layte and McCrory, 2011; O'Neill *et al.*, 2007; Irish Universities Nutrition Alliance, 2005) and 19 per cent of teenagers are overweight and obese (IUNA, 2008). While there is some indication of a decrease in overweight and obesity levels among seven year olds in Ireland, this is not observed among older children (Heinen *et al.*, 2014).

Overweight and obesity in childhood increases the risk of both immediate and long-term health conditions (Reilly, 2007) and can also track into adulthood (Maffeis and Tato, 2001; Reilly, 2007). There are inequalities in obesity among socioeconomic groups, with the most deprived being more at risk (Stamatakis *et al.*, 2010); this is evident among both nine (Walsh and Cullinan, 2014) and three year old children in Ireland (Williams *et al.*, 2013).

The causes of obesity have been extensively researched and documented and there are numerous social, physical and individual factors involved (Finegood *et al.*, 2010; Butland *et al.*, 2007). A body of literature is evolving that examines the built environment and its relationship with the obesity epidemic (Frank *et al.*, 2007; Singh *et al.*, 2010). Such “obesogenic” environments (Egger and Swinburn, 1997; Lake and Townshend, 2006) include a range of social, cultural and infrastructural conditions that influence an individual’s ability to adopt a healthy lifestyle (Foresight, 2007). Parallel to the determinant approach to obesity, another body of work has emerged that argues against the idea that being fat is problematic; highlights the ethical implications of weight loss interventions and confronts the stigma associated with body size (Colls and Evans, 2013). This latter work focuses on how social, cultural and political environments can make living with obesity problematic rather than identifying factors that determine fatness and thus are in need of intervention. “Health at Every Size” (HAES) also argues for a shift in focus to weight neutral outcomes and a focus on improved weight behaviours for all sizes, without weight loss as a mediator (Bacon and Aphramor, 2011). The latter viewpoint encourages a critical approach to obesity research which is welcome.

The current study takes a determinant approach to obesity, with a focus on local food environments. We argue that environments that enable healthy behaviours, including healthy dietary habits, should be the goal, particularly in the case of children, for whom, as a society, we are responsible. This study is also underpinned by a health promotion approach with food environments conceptualised as a “supportive environment for health”, a key action area within the Ottawa Charter (World Health Organisation, 1986). Food environments can be broadly defined as a combination of physical, economic, policy and socio-cultural surroundings, opportunities and conditions that influence food choice (Vandevijvere and Swinburn, 2014).

The rise in out of home eating and the facilities and opportunities to eat on the go (Mikkelsen, 2011) has sparked policy interest in this setting as one amenable to change (World Health Organisation, 2006; Commission of the European Communities, 2007). Moreover, obesogenic food environments in communities, towns and schools that facilitate the overconsumption of energy-dense, nutrient poor foods have been the focus of considerable research in recent times (Héroux *et al.*, 2012; Burgoine *et al.*, 2011; Seliske *et al.*, 2009, 2013; Burgoine *et al.*, 2014; Laxer and Janssen, 2014). Héroux *et al.* (2012) examined self-reported lunch time eating behaviours, obesity and the relation with chain food retail environments within 1 km of schools in Canada, Scotland and the USA. No associations were observed between density of retailer and obesity. Alviola *et al.* (2014) focused on objective school level obesity rates in Arkansas which they found were negatively affected by the number of fast food restaurants within a mile of the school. These two examples illustrate the difference in study design and outcomes measured. Thus it is not surprising that the impact of the food retail environments

around schools on food choice and or obesity cross-nationally is not uniform (Burgoine *et al.*, 2014; Héroux *et al.*, 2012; Seliske *et al.*, 2009, 2013). Differences in food environments by country and the equivocal impact on diet and obesity could also be due to cultural, environmental, behavioural and planning or regulatory factors. In addition, methodological issues and/or the environmental data sources employed may also contribute to the discrepancy between studies (Lake *et al.*, 2010; Burgoine *et al.*, 2013; Caspi *et al.*, 2012). Irrespective of the findings to date and the challenges of this research, food environments continue to be of interest. Indeed, monitoring retail food environments and policies and actions to improve food environments globally is the remit of the International Network for Food and Obesity/Non Communicable Disease Research, Monitoring and Action Support (INFORMAS) (Swinburn *et al.*, 2013). A framework for monitoring food in schools (L'Abbe *et al.*, 2013) and community food retailers, including schools, have been proposed (Ni Mhurchu *et al.*, 2014).

The need for healthier environments and making the healthier choice the easier choice as part of a strategy to combat obesity and improve dietary quality is well documented in Ireland (The National Taskforce on Obesity, 2005; Health Service Executive (HSE), 2010; High Level Group on Nutrition and Physical Activity, 2014; HSE, 2011). Policy makers in Ireland have also engaged with the possibility of obesogenic food environments negatively impacting on dietary choices and obesity. Restricting the opening of fast food businesses within close proximity to schools has been discussed (Riegel, 2014a; Department of the Environment, Community and Local Government (DECLG), 2013). Indeed three separate planning applications for fast food retail outlets which were close to post-primary schools in Ireland have either been revoked or refused. Objections to such planning applications were put forward, including by local politicians, Community Groups, Schools and by the Health Service Executive (HSE) Lead on Obesity in Ireland. While these objections alone were not responsible for the outcome, it demonstrates the level of interest and concern around such planning issues.

Schools are often identified as a site for intervention (Walton *et al.*, 2010) and internal school food environments have for some time received considerable attention as a route to improve childhood nutrition and obesity rates. Standards for school meals and explicit school nutrition policies have been proposed as mechanisms to address obesity prevalence among children (Finkelstein *et al.*, 2008; Institute of Medicine (US) Committee on Prevention of Obesity in Children and Youth, 2005) and particularly so for post-primary school children (Neumark-Sztainer *et al.*, 2005). Indeed the report of the National Taskforce on Obesity in Ireland (2005) included 22 recommendations for the education sector, including the need for nutrition policies, the provision of healthy food in schools and a code of practice for vending machines and for industry sponsorship and funding in schools and communities. The implementation of the Health Promoting Schools (HPS) concept in Ireland also forms part of Ireland's more recent strategy to combat obesity (HSE, 2010; HSE, 2011) and a framework for developing a HPS in Ireland was recently launched (HSE, 2012), which is being steered by a national HPS coordinator. The framework offers information and guidance to schools on the HPS concept and outlines the process of work involved in becoming a HPS. The process includes 11 stages; such a phased process helps to ensure sustainable and systemic change within schools. While the Department of Education and Skills (DES) provided input into the framework, it is not anchored in educational policy in Ireland and thus there is no onus or mandate for schools to engage in the process. The four key action areas within the framework include: environment; curriculum and learning; policy and

planning; and partnerships with each area influencing and supporting the other (HSE, 2012). Within schools, the HPS team, through consultation, identify themes for action. Schools could use food and nutrition as a priority and achieve progress in each of these four action areas. Thus school food provision, policies on healthy eating, nutrition and health in the curriculum and working with parents and communities on retail planning regulations surrounding schools are examples of possible activities that could help schools towards recognition as a HPS. The internal and external food environment links explicitly to both environment and policy and planning.

There is limited peer-reviewed work on food environments in Ireland. Among Irish adults, those living close (1-2 km) to larger food outlets or who live in an area with a higher density of larger food outlets (supermarkets) were found to have a significantly better diet in terms of risk for cardiovascular diseases (CVD) (Layte *et al.*, 2011). CVD risk was assessed using the Dietary Approaches to Stop Hypertension (DASH) score. Dietary habits were assessed with an FFQ assessing intake over the previous year and validated for the Irish population. Socioeconomic characteristics of individuals and their households were controlled for. No significant effect on DASH score for either the distance to the nearest convenience store or density of local convenience stores was found. Overall the study demonstrated a small but significant role for food availability on diet among Irish adults (Layte *et al.*, 2011). Irish children's dietary quality also seems to be influenced by local food environments, at least among girls (Layte and McCrory, 2011). Children's dietary quality, assessed from responses to 20 questions by the primary caregiver, was negatively associated with distance from home to both supermarkets and convenience stores. Notably, although still significant, distance to convenience stores was less important than to supermarkets as a determinant of dietary quality among girls. The reason underlying the lack of effect of distance to retailers on boys' diets is not clear. Moreover the proportionate change in diet for a unit change in distance to supermarkets was 20 per cent for girls compared to 1 per cent for the adults (Layte *et al.*, 2011). Why and how distance to retailers appears more important for girls than adults' diets is unclear. These data from Ireland focus on access and distance to food retail businesses from the home environment. No data are available on access and availability to food environments from schools. Moreover, few available peer-reviewed studies on school food environments in Ireland exist. While some studies have tried to capture food outlets and food availability within schools (Kelly *et al.*, 2010; Department of Education and Skills, DES, 2014a) no study has simultaneously examined both the internal and external school food retail environment.

The impetus to examine food availability and choice both within and surrounding schools in Ireland was sparked by a number of factors including the prevalence of obesity in Ireland, the time children spend at school, including travelling to and from school, the increase in eating out of home at a societal level and the resurgence of the HPS movement in Ireland. This paper focuses on post-primary schools as their students generally have greater freedom and more purchasing power than primary school children. They are also usually permitted to leave the school at lunch time, increasing their exposure to the external food environment. Moreover, post-primary school children can purchase and consume snacks while travelling to and from school, whether travelling independently, with friends or, indeed, with family. Children are social actors in their own worlds (Prout, 2002; Barker, 2003) with their own experiences and perceptions of their neighbourhoods (Kearns *et al.*, 2003; Mitchell *et al.*, 2007). A focus on Irish schools is warranted because they differ widely in location, levels of disadvantage and gender composition of their students (DES, 2014b). Single sex schools

were common in Ireland until relatively recently with newer, mixed gender schools, though better equipped than older schools, located on the periphery of towns rather than in the city centre. Schools designated as disadvantaged often educate children from lower socioeconomic communities, yet such schools are often resourced with additional facilities and supplies compared to other schools. Recognising the nuances of school communities, whether by type, location or composition is likely to be important in Ireland. Moreover, the provision of school meals is not mandatory in Ireland and “free” school meals are only available to students in schools designated as disadvantaged, but only if the school chooses to avail of this scheme. These aspects may be a source of variation when looking at the school food environment.

The aim of this study was to examine food availability within and outside of post-primary schools in Ireland. Using an adapted version of the international 2009/10 Health Behaviour in School-aged Children (HBSC) school level questionnaire, we describe the internal and external school food environment, including sources and types of foods, and food premises in close proximity to the school. We also describe variations in these environments by geography (urban or rural), by disadvantage (Delivering Equality of Opportunity in School (DEIS) or non DEIS status) by gender of the school (single sex or mixed) and by presence or absence of a school healthy eating policy.

Methods

Data sources

This paper presents school level data. Data for this paper were collected from five sources – the school listings from the DES (formally the Department of Education and Science) web site, the Health Behaviour in School-Aged Children (HBSC) Ireland school level questionnaire, population statistics from the Central Statistics Office, Ireland (CSO), GeoDirectory and online business sources such as Google Street view and Irish businesses directories. The school level data included information on type, gender, deprivation status and size of school and the school level questionnaire included data on food premises and types of food sold inside the school. GeoDirectory is a commercial address database available under licence from An Post GeoDirectory Limited. It provides a spatial reference or geocode for every property (domestic and commercial) in the Republic of Ireland (GeoDirectory, 2014). It was used to source information on the location of schools and of the names and addresses of food premises within 1 km of schools. Business directories provide information for local businesses such as address, category of business and contact details.

Study sample

The sample frame was based on post-primary schools that took part in the 2010 Irish School-aged Children (HBSC) survey (Kelly *et al.*, 2012). A total of 114 schools were contacted and invited to participate in an online school level questionnaire. Questionnaires were completed by a member of school staff. The questionnaire included questions on school characteristics, nutrition, physical activity, violence/bullying and the school neighbourhood. The response rate for the school level questionnaire was 56 per cent.

Measures used

Gender. Schools were placed into three mutually exclusive categories based on the gender of attending students: girls (all girls school), boys (all boys school) and mixed schools (both girls and boys school).

DEIS (disadvantage) status. DEIS provides for a standardised system for identifying levels of disadvantage and an integrated School Support Programme (SSP). Schools were assigned as being disadvantaged or not, on the basis of the characteristics of the DEIS action plan for educational inclusion. DEIS provides for a standardised system for addressing and prioritising the educational needs of children and young people from disadvantaged communities and is a policy instrument used by the DES (2014c). There are three levels of DEIS schools: DEIS Band 1 schools, DEIS Band 2 schools and DEIS rural schools, each of which may have access to different additional support. Support includes designated staffing numbers, additional funding and access to school meal programs and other services.

Urban/rural status. Schools were also assigned to an urban or a rural category based on the urban/rural status of the electoral district (ED) in which the school was located. This was calculated using population statistics from the Central Statistics Office of Ireland based on the OECD definition of urban/rural (rural, population density < 150 persons per km², urban, population density > 150 persons per km²). Areas covered by water bodies were excluded from this calculation (Teljeur and Kelly, 2008).

School food environment. The internal food environment was assessed using the following questions from the school level questionnaire: “Does your school have any of the following? One or more vending machine(s); A school tuck shop; A canteen” with response options: “Yes”; “No”; “Don’t know”. A school tuck shop is a small retailer where food and other items such as stationary may be purchased. A canteen is a dining hall where food may be purchased and eaten. A member of school staff was asked to select food available for sale within each of the food premises in the school. The survey was mostly completed by principals at 80 per cent, followed by vice principals at 6.7 per cent, teachers at 5.0 per cent, school secretaries at 5.0 per cent and others (assistant principal and SPHE coordinator) at 3.3 per cent. The list of foods available were those typically found in schools such as fruit, vegetables, beverages, sandwiches, dairy products and energy-dense foods and snacks (Kelly *et al.*, 2010; Vereecken *et al.*, 2005). Using these data, we created binary (yes/no) variables that indicated the presence or absence of the different food types within each school.

There was also a question on if there was a healthy eating policy in place at the school: “Does your school have a policy to increase the consumption of healthy foods (e.g. fruit and vegetables) during the school day?” with response options: “Yes (written policy)”; “Yes informal policy (verbal agreement)”; “No”; “N/A (School has no nutrition policy)”. These data were recoded into a binary (yes/no) variable indicating presence or absence of a healthy eating policy.

GeoDirectory was used to georeference and map the post-primary schools that took part in the school level questionnaire. Georeferencing refers to the process of assigning x , y location data to geographic objects within a spatial reference frame. All school addresses were filtered and exported from Geodirectory. Addresses with the same street name as the school to be georeferenced were selected. Schools were manually matched based on the school name and address. The corresponding school name, address and x , y coordinates were exported from the GeoDirectory subset to a new database created using MS Excel. This data set was then imported into the Geographic Information System (GIS) software program ArcMap 10 and the address points were displayed using the display XY data function in ArcMap 10.

The Buffer wizard tool in ArcToolbox was used to create a buffer of 1 km around each school. A distance of 1 km was chosen in line with other studies (Héroux *et al.*, 2012;

Seliske *et al.*, 2009). GeoDirectory was used to obtain and map the 8,762 addresses for all businesses located within a 1 km radius of the schools. While other studies have used either road networks (Laska *et al.*, 2010) or circular buffers (Davis and Carpenter, 2009) to determine the number of food premises within a certain distance; it is not clear whether using a road network or a circular buffer is optimal for access to the food environment (Seliske, 2012). Road network data were not available to researchers for this study. Addresses were exported to MS Excel and displayed in ArcMap 10 using the display XY data function. Addresses within the 1 km buffer of schools were selected, exported and added as a layer to ArcMap. Businesses were assigned categories based on type of business and, where relevant, the type of food sold using a combination of the businesses own official web site, Google Street View imagery or commercial online directories such as the Golden Pages. Not all businesses had all of these verification sources; first the official web site was searched for, followed by online directories and Street View where necessary. For the official web site and the online business directories, a combination of the business name and address were used in the search. Using Street View, the street name was used to locate the area in which the premises were located and the premises were then found manually.

A database containing the addresses of coffee shops and sandwich bars, full service restaurants, Asian and other “ethnic” restaurants, fast food retailers, supermarkets, local shops and fruit and vegetable retailers was created. In total, 1,402 food selling premises were identified. The relevant data fields retained included the food retailers name, address, category and unique identification number. The completed datasheet was displayed in ArcMap using the address display function and the food premises surrounding the 63 post-primary schools were mapped. All data were quality checked for inter-rater reliability – a random sample of 10 per cent of the total number of categories were checked and compared to the original sample categorisation to identify if there were discrepancies in the data set. There were 69 discrepancies identified out of the 928 premises checked (7.4 per cent), of which 49 were of minor importance for the analysis (e.g. chip shop vs fast food outlet), and 20 were classified as of more major importance (e.g. Fast food outlet vs Bed and Breakfast). All discrepancies were resolved prior to data analysis.

Statistical analysis

Characteristics of the schools and their environments were profiled according to: geography (urban or rural), school disadvantage (DEIS or non DEIS), school gender (girls, boys or mixed) and healthy eating policy in place in the school (yes or no). χ^2 tests were used to determine whether the prevalence of foods available inside the school was different across categories of geography, school disadvantage, gender and presence of school healthy eating policy. Analyses of Variance were used to determine the significance of differences in the mean numbers of external food premises by geography, school disadvantage and gender of school. Differences were determined to be statistically significant at a p -value of < 0.05 . Statistical analyses were performed using IBM SPSS Statistics 20.

Results

Table I presents the basic descriptive characteristics of the schools, by geography, disadvantage, gender and available facilities. The majority of the schools in the sample were urban, not classified as disadvantaged and of mixed gender. Most of the schools

Characteristic	<i>n</i>	%	Internal and external school food environment
<i>Geography</i>			
Urban	39	61.9	
Rural	24	38.1	
<i>School disadvantage</i>			
DEIS	13	20.6	
Non DEIS	50	79.4	159
<i>Gender of the school</i>			
Girls	11	17.5	
Boys	15	23.8	
Mixed	37	58.7	
<i>Facilities available</i>			
Canteen	41	69.5	
School shop	31	53.4	
Vending machine(s)	23	37.7	
Note: <i>n</i> = 63			

Table I.
Descriptive analysis
of school
characteristics

had a canteen, while just over half had a school shop and over a third of schools had one or more vending machines.

Figure 1 presents the number of schools by county. The majority of schools were located in Counties Dublin and Cork. There were no schools located in Counties Roscommon, Laois, Kilkenny, Waterford and Tipperary (South).

Foods available for sale within the schools are summarised in Table II by rural/urban status, disadvantaged status, gender and presence of school healthy eating policy. Although 89.3 per cent of schools surveyed reported selling bottled water, over half (51.8 per cent) of schools reported selling regular soft drinks and over a quarter (28.6 per cent) reported selling diet soft drinks. There were significant urban rural differences in the sale of chocolate milk with less rural schools reporting to sell it (9.1 per cent of urban schools vs 35.3 per cent of rural schools; $p = 0.027$). Considerably more rural schools reported having fruit available in the school (68.2 per cent of rural schools vs 44.1 per cent of urban schools; $p = 0.078$). More rural schools were also found to have dairy products available with 54.5 per cent of schools having whole milk ($p = 0.446$) and the same proportion having yoghurt ($p = 0.327$). More rural than urban schools had bread products available (68.2 per cent had whole-grain bread/rolls/wraps; $p = 0.625$, 72.7 per cent had sandwiches; $p = 0.863$ and 72.7 per cent had white bread/rolls/wraps available; $p = 0.203$). Although not statistically significant, overall rural schools were found to have healthier choices available within the school.

Schools that were not designated as DEIS had more dairy products available with 15.2 per cent having skim milk ($P = 0.187$), 52.2 per cent having whole milk ($P = 0.203$) and 52.2 per cent having yoghurt ($p = 0.064$). They also had more access to treat foods with 63 per cent having confectionary ($p = 0.444$), 32.6 per cent having pizza ($p = 0.253$) and 34.9 per cent having chips ($p = 0.586$) available. Overall, non disadvantaged schools were found to have more food choices available within the school than those designated as disadvantaged.

There were also significant differences in the availability of diet soft drinks and pizza with diet soft drinks more available in boys schools (10.0 per cent of girls schools vs 57.1 per cent of boys schools and 21.9 per cent of mixed schools; $P = 0.018$) and pizza more available in single sex schools (50.0 per cent of girls schools and 46.2 per cent of boys



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Figure 1.
Number of schools
by county

schools vs 14.3 per cent in mixed gender schools; $p = 0.032$). Other food items for sale did not differ significantly between school types but are of interest. Considerably more girls and mixed gender schools reported offering 100 per cent fruit/vegetable juices for sale compared to boys schools (70 per cent of girls schools vs 42.9 per cent of boys schools and 71.9 per cent of mixed schools; $p = 0.154$). Noticeably more girls schools than boys or mixed schools had fruits (70.0 vs 28.6 per cent and 59.4 per cent, respectively; $p = 0.081$) and vegetables/salads (60.0 vs 21.4 per cent and 31.3 per cent, respectively; $p = 0.128$) available. Fewer boys schools had access to bread products than did girls or mixed schools (57.1 per cent had whole-grain bread/rolls/wraps; $p = 0.489$, 64.3 per cent had sandwiches; $p = 0.700$ and 50.0 per cent had white bread/rolls/wraps; $p = 0.474$ for sale). More girls schools had yoghurt (70.0 per cent; $p = 0.133$) and skimmed milk (20.0 per cent; $p = 0.657$) for sale. More boys' schools had confectionary for sale than girls or mixed schools (64.3 per cent boys schools vs 60.0 and 59.4 per cent, respectively; $p = 0.951$).

Overall, there were more healthy food options available at schools that had a healthy eating policy in place. More schools that had a healthy eating policy in place had

Food type	Urban/rural status		DEIS status		School gender			Healthy Eating Policy						
	Yes	Rural	Urban	P value	DEIS	Non DEIS	P value	Boys	Girls	Mixed	P value	Yes	No	P value
Bottled water	89.3	95.5	85.3	0.230	100.0	87.0	0.227	78.6	80.0	96.9	0.105	92.3	87.5	0.573
100% Fruit/vegetable juice	64.3	68.2	61.8	0.625	70.0	63.0	0.677	42.9	70.0	71.9	0.154	69.2	56.3	0.358
Skim (non-fat) or low fat milk	12.5	9.1	14.7	0.535	0.0	15.2	0.187	20.0	20.0	9.4	0.657	10.3	12.5	0.808
Whole milk	48.2	54.5	44.1	0.446	30.0	52.2	0.203	42.9	50.0	50.0	0.898	53.8	31.3	0.127
Warm drinks (coffee, tea, hot cocoa)	48.2	59.1	41.2	0.190	40.0	50.0	0.566	35.7	60.0	48.5	0.479	46.2	56.3	0.496
Chocolate (or other flavoured) milk	25.0	9.1	35.3	0.027	20.0	26.1	0.687	28.6	40.0	18.8	0.375	28.2	18.8	0.465
Regular soft drinks, sports drinks, or fruit drinks (not 100% juice)	51.8	59.1	47.1	0.379	60.0	50.0	0.566	57.1	60.0	46.9	0.691	51.3	50.0	0.931
Diet soft drinks	28.6	36.4	23.5	0.299	10.0	32.6	0.151	57.1	10.0	21.9	0.018	28.2	31.3	0.821
Beverage type														
Fruits	53.6	68.2	44.1	0.078	50.0	54.3	0.803	28.6	70.0	59.4	0.081	59.0	43.8	0.303
Vegetable/Salads	33.9	36.4	32.4	0.757	20.0	37.0	0.305	21.4	60.0	31.3	0.128	35.9	31.3	0.742
Whole-grain bread/rolls/wraps	64.3	68.2	61.8	0.625	50.0	67.4	0.298	57.1	80.0	62.5	0.489	69.2	56.3	0.358
Sandwiches	71.4	72.7	70.6	0.863	60.0	73.9	0.377	64.3	80.0	71.9	0.700	74.4	68.8	0.671
White bread/rolls/wraps	62.5	72.7	55.9	0.203	50.0	65.2	0.368	50.0	60.0	68.8	0.474	59.0	75.0	0.262
Yoghurt	46.4	54.5	41.2	0.327	20.0	52.2	0.064	28.6	70.0	46.9	0.133	51.3	37.5	0.352
Ice-cream	3.9	5.0	3.2	0.750	0.0	4.7	0.534	0.0	10.0	3.6	0.468	5.6	0.0	0.368
Confectionary -	60.7	50.0	67.6	0.187	50.0	63.0	0.444	64.3	60.0	59.4	0.951	56.4	75.0	0.197
Chocolate/sweets/biscuits/cake/crisps	29.4	20.0	35.5	0.236	12.5	32.6	0.253	46.2	50.0	14.3	0.032	30.6	21.4	0.519
Pizza	33.3	30.0	35.5	0.685	25.0	34.9	0.586	46.2	50.0	21.4	0.136	30.6	35.7	0.726
Chips (French fries)														

Note: n = 63

Table II.
Food and beverage
availability within
Irish schools (%)

bottled water (92.3 vs 87.5 per cent; $p=0.573$), 100 per cent fruit/vegetable juice (69.2 vs 56.3 per cent; $p=0.358$), fruits (59.0 vs 43.8 per cent; $p=0.303$), vegetables (35.9 vs 31.3 per cent; $p=0.742$) and whole-grain bread/rolls/wraps (69.2 vs 56.3 per cent; $p=0.358$) on offer. More schools that did not have a healthy eating policy had diet soft drinks (31.3 vs 28.2 per cent; $p=0.821$), confectionary (75.0 vs 56.4 per cent; $p=0.197$) and chips (35.7 vs 30.6 per cent; $p=0.726$) on offer. Schools with a healthy eating policy still had a number of more unhealthy foods on offer; 28.2 vs 18.8 per cent ($p=0.465$) had chocolate or other flavoured milk, 5.6 vs 0.0 per cent ($p=0.368$) had ice-cream and 30.6 vs 21.4 per cent ($p=0.519$) had pizza available.

Table III describes the food environment within 1 km of Irish schools. The average number of local shops within 1 km of schools was 6.71 while 4.03 was the average number of fast food outlets around schools. In total, 75 per cent of schools were found to have one or more fast food outlets while 29.7 per cent of schools had five or more fast food outlets within 1 km of the school. The number of food premises differed significantly between urban and rural schools with urban schools having more proximate food premises than rural schools. Schools that were designated as not disadvantaged were found to have a significantly higher average of full service restaurants ($p=0.019$) and Asian and other “ethnic” restaurants ($p=0.011$) within 1 km. There were also significant differences between girls, boys and mixed schools. There were a higher average number of coffee shops ($p=0.030$), full service restaurants ($P=0.001$), local shops ($p=0.006$) and fruit and vegetable retailers ($p=0.013$) around boys-only schools. There were significantly fewer full service restaurants ($p=0.001$), Asian and other “ethnic” restaurants ($p=0.017$) and supermarkets ($p=0.006$) around mixed gender schools as opposed to single sex schools. There was also a significant difference in the number of fast food outlets around girls, boys and mixed schools ($p=0.019$), with more fast food outlets around boys-only than other schools. Overall, there was a higher average of food outlets around boys schools, followed by girls school with a lower average around mixed schools.

Discussion

Childhood obesity has become the most common childhood disease in Europe (The National Taskforce on Obesity, 2005). School-aged children spend over half of their day at school where they can consume breakfast, snacks and lunch and are also exposed to food premises on their journeys to and from school, making the food available in and around school an important issue for children’s health and well-being.

This study presents the food-related choices available to students on a daily basis. Positive findings were that bottled water was available in the majority of schools (89.3 per cent), fruits were available in over half the schools (53.6 per cent) and vegetables/salads were available in just over a third of the schools (33.9 per cent). However, these findings also illustrate the need for improving the availability of healthy foods in many schools and decreasing unhealthy food provision, such as soft drinks and confectionary, which were available in 52 and 60 per cent of schools, respectively. This corresponds with another Irish study of post-primary schools where nutritious foods were available but so too were energy-dense nutrient poor foods (Kelly *et al.*, 2010). In that same 2010 survey, the majority of schools (> 80 per cent) had a canteen or tuck shop (shop selling snacks), and almost 25 per cent of schools had both facilities. Drinks and snack vending machines were reported in 45 and 28 per cent, respectively, compared to 40 per cent in this current study. The “Lifeskills” survey, a DES initiative found that 30 per cent of schools reported the use of vending machines and 64 per cent had a facility for selling fresh fruit (DES, 2014a). The government in Ireland have recently advised that they will

Food businesses	Mean	Urban/rural status		DEIS	DEIS status		<i>p</i> -value	Girls	School gender		<i>p</i> -value
		Rural	Urban		Non DEIS	DEIS			Boys	Mixed	
Coffee shops and sandwich bars	3.89	1.21	5.54	3.15	4.08	0.614	4.82	6.20	2.68	0.030	
Full service restaurants	3.65	1.33	5.08	1.62	4.18	0.004	3.73	7.67	2.00	0.001	
Asian and other "ethnic" restaurants	2.60	0.79	3.72	1.23	2.96	0.000	4.00	4.00	1.62	0.017	
Fast Food outlets	4.03	1.08	5.85	2.46	4.44	0.000	4.91	7.07	2.54	0.019	
Supermarkets	1.95	0.83	2.64	1.69	2.02	0.000	3.09	2.40	1.43	0.000	
Local Shops	6.71	3.92	8.44	4.92	7.18	0.001	8.09	10.07	4.95	0.006	
Fruit and Vegetable retailers	0.73	0.13	1.10	0.46	0.80	0.000	1.09	1.33	0.38	0.013	

Note: *n* = 1,402

Internal and
external
school food
environment

Table III.
Mean values of food
retail businesses
within 1 km of Irish
schools

be issuing new guidelines on the provision of food through vending machines (Ahlgren, 2014). However, it is anticipated that this will not be mandatory and will be up to each individual school to implement. It is also anticipated that the advice will follow that which is detailed in the recent HSE Policy for developing Healthy Vending on HSE premises. This policy details that products offered in vending machines should be provided at 60 per cent "Better Choice" to 40 per cent "Other Choice" (HSE, 2014).

Differences in food availability between schools is fundamentally a result of having no standards for school food and no legislation on school food provision. This is unlike other countries like England (Department for Education, 2014) and Scotland (The Scottish Government, 2008) where food and nutrient standards for school food have been in place for some time. For example, in England, since 2009, local authority-maintained secondary schools are required to meet the government's food and nutrient based standards for school lunches and for food consumed in schools outside of lunch time. The standards cover breakfast clubs, mid-morning break services, vending machines, tuck shops and after school snacks and meals. They require that schools must provide fruit in all school outlets, free drinking water and healthier drinks throughout the day. Confectionary and snacks must not be available and certain food products such as cake and biscuits are restricted outside of lunch hours (Childrens Food Trust, 2007). In contrast, post-primary schools in Ireland do not have national food or nutrient standards for food prepared or sold within the school setting. Food supplied in Irish schools may be as a result of; certain foods (e.g. diet coke, pizza) being more popular than others, different suppliers to schools, with national or local food companies being involved which can impact on foods available for sale within schools.

It is not clear why differences were found in the variance of food retailers surrounding schools by gender of the school. Traditionally, single sex schools were more common in Ireland. These schools are located in urban areas possibly accounting for the differences observed between single sex and mixed schools. Schools in Ireland vary in size, gender composition and management structures. Unlike many other European countries, a large proportion of post-primary schools are single sex schools (DES, 2014b). The majority of post-primary schools are also in urban areas and school children can leave the school premises at lunch, making the food choice available within walking distance to school also important. The number of food retailers around urban schools was greater than for rural schools, which was to be expected due to larger population densities in these areas.

The type and density of food outlets surrounding schools is not known in Ireland. Clearly any changes to planning regulations for food businesses must be informed by the extent and density of current food environments. In the external food environment, there were substantial concentrations of local shops (6.71) within 1 km of schools. Local shops are smaller convenience stores and they sell a range of items from fruit and vegetables to confectionary. Some local shops may also have a hot food "deli". Local shops and supermarkets also have affordable "special offers/meal deals" available, which are typically energy-dense, nutrient poor food items which could also be an area which could be improved. Supermarkets and local shops are largely present in the Irish food retail market. There have been recent attempts to improve the health of customers of supermarkets. One of the largest supermarkets in Ireland, Tesco, has recently removed confectionary products from their tills in Ireland in a bid to help customers live healthier (Ring and Clarke, 2014). This could also be actioned in local shops which could improve the food environment surrounding schools, given the number of local shops around schools in Ireland. We found that at the time of data collection, there was

an average of 4.03 fast food outlets within a 1 km radius of the post-primary schools, with an average of 6.57 outlets within 1 km of boy's schools. In a further attempt to improve the school food environment, there have been recent media reports (Riegel, 2014a, b) that the Irish government are considering the introduction of a 1.5 km fast food exclusion zone around schools (DECLG, 2013). The new planning guidelines would affect applications by new fast food outlets on where they locate. It is proposed that existing fast food outlets would not be affected unless they have to reapply for planning permission. In England, a number of local authorities have already prohibited fast food outlets operating within 400 m of schools (Cavill and Rutte, 2014). Fast food outlets are common sources of competitive foods which often contain low nutrient, energy-dense foods and beverages, such as foods high in fat and sugar sweetened soft drinks.

The success of public policy measures to address obesity is often dependent on public attitudes to such measures. In a recent survey in Ireland, 82 per cent of adults were positive towards mandating a ban of vending machines in all schools and 66 per cent were supportive of planning restrictions for fast food outlets in towns and cities (Safefood, 2014). Such high levels of support for obesity-oriented policies should help bring about such changes and possible improvements in both nutrition and health of young people.

In relation to the strengths and limitations of this study, the current study is novel in its design as we believe this is the first time that food availability surrounding and within schools have been explored simultaneously. There are also no current planning guidelines in relation to the location of food premises in close proximity to schools. National-level data linking the internal and external food environment of schools is lacking in Ireland. Our results could be used to inform current debates over the location of food premises within proximity of schools. The school level questionnaire required self-reported responses by a member of school staff, which may give rise to under reporting of less favourable outcomes (social desirability). It is also unclear how well our results generalise to the all post-primary schools in Ireland even though the sample is generally representative of the Irish HBSC post-primary school locations in Ireland, in terms of urban rural status. Not all of the food premises had their own official web site, thus where necessary Street view and online directories were used to categorise food premises which is also a limitation of this study. However quality checks were in place throughout. In addition, the actual locations of the food premises taken from GeoDirectory and the food sold in each of the premises were not "ground" checked. A further limitation of this study is the use of one measure for urban rural status, although areas covered by water bodies we excluded in the population density calculation (Teljeur and Kelly, 2008). The school response rate (56 per cent) is similar to other studies (Kelly *et al.*, 2010).

The findings presented here illustrate the complex nature of the school food environment in Ireland.

It is anticipated that our research will contribute to an understanding of ways in which policies supporting healthier food environments could be translated into practice in schools and communities. Our analyses could provide useful information for schools and policy makers. Our results suggest that it would be helpful to work with the relevant stake-holders to increase healthier choices available within the school and our data could also be considered in local planning to ensure the healthy choice is the easier choice for school children. This paper could also help inform the key action areas for schools working towards the status of a HPS as identified in the framework for

developing a HPS in Ireland. To date it appears that 37 per cent of post-primary schools in Ireland are either part of, or are becoming engaged in, the HPS initiative (DES, 2014b).

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