

The more schools do to promote healthy eating, the healthier the dietary choices by students

Nick Townsend,¹ Simon Murphy,² Laurence Moore²

¹University of Oxford, National Obesity Observatory, British Heart Foundation Health Promotion Research Group, Oxford, UK

²Cardiff Institute of Society Health and Ethics, School of Social Sciences, Cardiff University, Cardiff, UK

Correspondence to

Dr Nick Townsend, University of Oxford, BHF HPRG, Old Road Campus, Headington, Oxford OX3 7LF, UK; nicholas.townsend@dphpc.ox.ac.uk

Accepted 28 October 2010

Published Online First

30 November 2010

ABSTRACT

Background The importance of a multifactorial whole school approach to healthy eating is gaining much recognition among policy makers; however, there is little conclusive evidence on the effectiveness of such an approach. The main aim of this study was to examine whether there is any association between the number of actions schools are taking to promote healthy eating and the dietary behaviour of schoolchildren.

Methods A multilevel analysis investigated the association between school (n=64) approaches to promoting dietary choice, collected through teacher (n=289) postal surveys, and the reported dietary choices of students collected from students aged 11 to 16 (n=6693) in Wales through the 2005/2006 Health Behaviour in School-aged Children study.

Results Once controlling for all student-level and school-level variables, students in schools with the most actions to promote healthy eating in place had 1.91 (CI=1.13 to 3.24) times the odds of agreeing to eat fruit for lunch, 1.54 (CI=1.07 to 2.22) times the odds of reporting to eating fruit or vegetables on a daily basis and 0.52 (CI=0.29 to 0.95) the odds of agreeing that they eat sweets for lunch, in comparison with students in schools with the lowest number of actions in place.

Conclusion The number of actions that secondary schools have in place to promote healthy eating is significantly associated with healthy food choices made by students. Further research is needed to identify which specific actions are most strongly associated with students' dietary behaviour, and the barriers to more widespread adoption of a whole school approach.

INTRODUCTION

Improving the diet of school-aged children is a policy priority in the UK, given impetus by the concern over the growing prevalence of child obesity.^{1 2} Dietary recommendations focus on the need to increase intake of fruit and vegetables, and reduce intake of foods high in sugar, salt and fat.³

Schools are logical settings for efforts to promote healthy eating, as they provide unparalleled access to children.^{4 5} However, systematic reviews and research studies consistently find that individual school-based healthy-eating initiatives rarely produce significant changes in behaviour.^{6–9} Recent evidence suggests that the most promising approach to health promotion in schools seems to be that of multifactorial interventions acting at multiple levels,^{10–12} implemented through the 'settings'-based health promoting school (HPS) concept¹³ and developed from the application of a socio-ecological model to health promotion as advocated by the Ottawa Charter for Health Promotion.¹⁴

The HPS concept has been widely adopted by policy makers in efforts to improve students' health behaviours, including diet,^{15–18} leading to a whole school approach (WSA) to healthy eating in which the education of healthy eating is supported in all aspects and areas of food and nutrition promotion in the school.^{17 19 20}

The Welsh Assembly government followed other UK governments^{21 22} publishing non-statutory guidance into 'Developing a Whole School Food and Fitness Policy' in 2007,¹⁷ after data collection for the study had been completed. This came after a number of Assembly publications that promoted a WSA within schools in Wales,^{23–25} starting with the recommendation that the 2001 minimum nutritional standards would only succeed if they formed one part of a WSA.²⁶ Although Local Education Authorities were responsible for ensuring that these nutritional standards were met, they were not required to ensure that schools adopted a WSA.²⁷

Grants to enable schools to develop WSAs have also been made available,²⁸ while Estyn, the schools inspectorate in Wales, began to inspect for work schools were doing to promote healthy eating in April 2007.²⁹ The most recent nutritional guidelines proposed in the 'Appetite for Life action plan' covering all food and drink served in schools also proposed a WSA.³⁰ The implementation of these guidelines was being tested through an action research project that is expected to be published in November 2010 (Hare J. Personal communication. Children, Young People and School Effectiveness Group. Cardiff: Welsh Assembly Government, 2010).

Despite there being a variation in the quantity and quality of actions promoting healthy eating in schools,^{31 32} there has been little published research to determine whether implementation of multiple actions is associated with improved dietary outcomes. Previous attempts have lacked statistical power to identify such associations but have provided evidence to support the value of multiple approaches through qualitative investigation.^{33–35}

A number of studies using a multilevel analysis to investigate the effect of school on student dietary choice found no significant interschool variation in dietary choice once controlling for student characteristics.^{36–39}

This paper reports a multilevel analysis of the association between the number of actions schools are taking to promote healthy dietary choices and the dietary behaviour of schoolchildren, adjusting for student and school-level confounding variables.

METHODS

Student-level data

Data on the dietary behaviour of secondary school students aged 11–16 and student-level confounding variables were collected through the Wales sample of the Health Behaviour in School-aged Children (HBSC) study.⁴⁰ The sampling and data-collection protocol for the 2005/2006 HBSC⁴¹ followed that for the 2001/2002 survey.^{40 42}

The student survey was administered between January and April 2006, as a self-completion in-school questionnaire to all sampled students attending school on the day of the survey; absent students were not followed up. All students were informed that participation was voluntary and provided with individual unmarked envelopes in which to seal their questionnaires.

Dependent variables

Two types of self-report dietary behaviour measure were used as dependent variables: first, summary measures of the frequency of consumption of (i) healthy and (ii) unhealthy food items; and second, measures of whether or not three different foods were eaten at lunch time.

For the frequency measures, students were asked: 'how many times a week do you usually eat...?' for two different healthy food items (fruit/vegetables) and four different unhealthy food items (cola and other soft drinks/sweets and chocolate/crisps/chips). For each food item, there were seven possible responses (Never, Less than once a week, Once a week, 2–4 days a week, 5–6 days a week, Once a day every day, Every day more than once). Each of the two summary measures was obtained by counting, for each student, the number of healthy (0–2) or unhealthy (0–4) items reported as consumed at least daily.

For the foods eaten at lunch time, dichotomous variables were derived to indicate those students that agreed (1) or disagreed (0) that they ate the food for lunch. This was based on responses to questions which asked students to indicate their agreement with the statement: 'I eat (food) for lunch' asked for three food items (fruit/chips/sweets and chocolate) on a seven-point scale. Those indicating that they 'Agree very strongly,' 'Agree strongly' or 'Agree slightly' were coded as agreeing that they ate that food item for lunch. These questions were taken from a study on adolescent food choice.⁴³ They were included in this study to provide a measure of student lunch choices, since it was hypothesised that lunch behaviour may be more strongly associated with school actions than food frequencies over the week.

School-level data

School-level data were collected through postal questionnaires sent to members of teaching staff within schools in which the HBSC study was carried out, alongside information provided by the Welsh Assembly government.

The postal questionnaires collected data on school approaches to healthy eating, including: education about a healthy diet, healthy-eating policy, healthy-eating schemes, the provision of food and the food environment. The majority of school-level variables came from precoded close ended questions that provided variable categories as responses.

Data collection from schools aimed to achieve two or more completed questionnaires from each school, allowing modal responses of staff within the school to be used in the derivation of variables. Questionnaires were sent to eight members of staff within each school. It was hoped to randomly select individual teachers from staff lists; as only 14 schools agreed to provide staff lists, this was not possible, and in the remaining 56 schools,

contacts within the school distributed questionnaires. Although instructions were provided for these contacts to select staff randomly, this may not have happened.

School-level variables were included in the analysis, as they were characteristics found to influence student dietary choice and other health behaviours, or were used in HBSC sampling. These variables included the healthy-eating promoting actions schools had in place and fixed school characteristics that schools could not influence.

Healthy-eating promoting actions

All variables included as healthy-eating promoting actions came from the teacher survey, except for information on school involvement in the Welsh Network of Healthy School Schemes (WNHSS) that was provided by the Welsh Assembly government. The WNHSS encourages the development of health-promoting schools in Wales. Schools involved in health-promoting school networks have been found to make significant moves towards developing a WSA to food and nutrition.⁴⁴ Within the WNHSS, schools complete phases in which they implement a number of health-promoting actions. Although healthy-eating promotion is not compulsory within the WNHSS, many schools choose this as an area to improve, with funding made available for schools in the WNHSS to develop food and fitness projects in 2006,²⁴ after data collection for this study had been completed. Once schools are adjudged to have completed one phase, through inspection by outside parties, they move on to the next.⁴⁵

Number of actions schools have in place

A variable indicating the number of actions to promote healthy eating schools had in place was calculated by standardising each of the school-level variables (table 1) to have a range of 0 to 1 and then summing them. The maximum number of actions a school could have in place was 12.

Standardised count variable

The composite count variable was standardised with a minimum score of 0 and a maximum score of 1.⁴⁶ This allowed ORs to be calculated that could be interpreted as the increase in odds of the outcome associated with being in the school with the most actions, compared with being in the school with the least.

Fixed school characteristics

Fixed school characteristics were school-level factors that the school could not influence and were not healthy-eating promoting actions. The Welsh Assembly government provided information on three fixed school characteristics considered in the sampling framework of the HBSC survey: school type (state (publicly funded)/independent (fee-paying)), number of students in the school years 7–11 and percentage of students eligible for free school meals. It was important to control for these characteristics, as they were found to be associated with the number of actions school had in place. Independent schools had more actions in place than state schools; an inverse relationship was found between percentage of pupils in the school eligible for free school meals and number of actions, while an inverted-U relationship was found with school size, with the smallest and largest schools having the most number of actions in place. The fourth fixed school characteristic, whether there was a shop close to the school from which students could buy food, came from the teacher postal survey.

Table 1 School-level variables against percentage of schools by modal response of staff

Variable type	School-level variable	Percentage	School-level variable	Percentage	
Fixed school characteristics controlled for in analysis	School type* (n=64)		Shop close to school (n=64)		
	State	92.2	Yes	53.1	
	Independent	7.8	No	46.9	
	No of pupils in school* (n=64)		Percentage of pupils eligible for free school meals* (n=64)		
	Min	152	Min	0	
	Max	2045	Max	40.90	
	Mean	922	Mean	15.79	
	Healthy eating promoting actions used in calculating number of actions variable	Healthiness of school food complements education (n=64)		No of subjects healthy eating taught in (n=64)	
		No	59.4	2 subjects	4.7
		Indistinct mode	4.7	3 subjects	29.7
Yes		35.9	4 subjects	65.6	
Whole school campaigns on healthy eating (n=64)			Free samples of healthy food (n=64)		
No		62.5	No	93.8	
Yes		37.5	Yes	6.3	
Links to community healthy-eating initiatives (n=64)			Quality of information provided on healthy eating (n=64)		
No		87.5	Not good	60.9	
Yes		12.5	Good	39.1	
Healthy-eating policy (n=64)			Length of lunch break (n=64)		
No policy known		18.8	Min minutes	15.00	
Informal policy		25.0	Max minutes	62.50	
Written policy		56.3	Mean minutes	48.27	
School has a SNAG (n=64)			Snack vending in school (n=64)		
No		85.9	Yes	53.1	
Yes		14.1	No	46.9	
No of years allowed off premises for lunch (n=64)			School in WNHSS† (n=64)		
0 Years		15.9	Not in WNHSS	34.3	
1 Year		7.9	Phases 0–1	21.4	
2 Years	9.5	Phases 2–3	38.6		
3 Years	12.7	Phases 4 or more	5.7		
4 Years	1.6				
5 Years	52.4				
No of actions schools have in place	Minimum no of actions	1	Maximum no of actions	10	
	Mean no of actions	4.67	SD for no of actions	2.00	
	IQR of no of actions	3	Mode no of actions	4	

*School type, no of pupils on the school roll for years 7–11 and percentage of pupils eligible for free school meals are fixed school characteristics that are not a part of a whole school approach to healthy eating. These characteristics may impact on health behaviours and were used in the sampling frame for the Health Behaviour in School-aged Children study. Data concerning these were obtained from the Welsh Assembly government. Shop close to the school from which pupils can buy food is also a fixed school characteristic that schools cannot influence. This was controlled for in the analysis; data for this variable came from the school staff postal surveys.

†All the healthy-eating promoting-action variables used in calculating the number of actions variable came from the school staff postal survey except the variables on school activity in the Welsh Network of Healthy School Schemes (WNHSS), which came from information supplied by the Welsh Assembly government. SNAG, School Nutrition Action Group.

Data analysis

Two-level random effects models were run in MLWin 2.1 for each dependent variable. These were logistic for the binary lunch variables and ordinal logistic for the frequency variables. For each of the dependent variables, the following models were estimated:

- Null models—random effects model adjusting for no covariates;
- Multivariable model with student-level covariates—model (i) repeated, with the addition of all student-level independent variables;
- Multivariable model with student-level covariates and school-level covariates—model (ii) repeated, with addition of number of actions count variable and fixed school characteristics.

Any individual case with any variable missing was excluded before analysis so that results for each of these models could be comparable.

RESULTS

In the final sample, 70 schools completed the HBSC survey, with 7300 students completing the questionnaire. Only 64 schools

completed two or more teacher questionnaires (total n=289), and thus school and student data from these schools only could be included in the analysis. This resulted in a final sample for the analysis of 6693 students in 64 schools in Wales.

All schools that did not return two or more questionnaires were state schools. This resulted in 90% of the state schools from the HBSC sample being retained for the analysis, equating to 26% of the state schools in Wales. There were no significant differences between schools that did and did not return two or more questionnaires in terms of location, language medium of school, number of students in the school and proportion of students eligible for free school meals.

Dependent variables

Of those surveyed, 54.1% of students reported that they ate neither fruit nor vegetables on a daily basis, and 20.3% reported that they ate both daily; 51.9% of students reported that they ate none of the unhealthy foods on a daily basis, while 3.7% reported that they ate all of them daily (table 2); and 50.5% of

students agreed that they ate fruit for lunch, 26.3% chips and 36.9% sweets.

Independent variables

Student-level variables

Table 3 displays the student-level independent variables included in the analysis, the value for each variable and the percentage of responses from students. All student-level variables were included in the final models.

School-level variables

Table 1 displays the school-level independent variables included in the analysis. This includes the healthy-eating promoting actions included in the count of number of actions variable and the fixed school characteristics that were controlled for. The table also displays the values for each variable and the modal responses from schools, as well as descriptive statistics for the overall number of actions schools had in place.

The number of actions to promote healthy eating schools had in place ranged from 1 to 10, with a possible maximum of 12, and the mean number of actions schools had in place was 4.67.

Multilevel regression analysis

Table 4 shows the results of the multilevel logistic regression models for all the dependent variables.

Significant school-level variation ($p=0.05$) was found for each of the dependent variables after controlling for student-level characteristics. In the final model, controlling for student-level and fixed school characteristics, significant associations were found between the number of actions schools had in place and three dependent variables. Students in schools with the most actions to promote healthy eating had 1.91 times the odds of agreeing that they ate fruit for lunch, 0.52 the odds of agreeing that they ate sweets for lunch and 1.54 times higher odds of reporting that they ate fruit or vegetables on a daily

basis than students in schools with the least number of actions in place.

DISCUSSION

We found that once controlling for student characteristics, the greater the number of actions a school has in place to promote healthy eating, the greater the odds that students within that school will report that they eat fruit for lunch and fruit and vegetables on a daily basis and the lower the odds that they will report eating sweets for lunch.

This study had access to data from a large sample of secondary school students from many schools within Wales. Using these data alongside those collected from teachers within the schools, an analysis could be performed involving a large number of individual and school-level characteristics. By using multilevel modelling, we were able to separate determinants operating at the individual-level from those operating at the school level. The final models explained between 61% and 93% of the school-level variation for the dependent variables, suggesting that many of the factors influencing student dietary choice had been included. The student characteristics explained more of this than the school-level factors.

The first limitation of the present study is that the variables come from self-report questionnaires, which may mean the food choices reported by students, found to be associated with school approaches, are not reflected in actual behaviour. Many studies use self-report dietary choice with children and adolescents,^{36 37 39} often through instruments such as food diaries and repeated 24 h recall questionnaires which have been validated in previous studies.⁵¹ These methods are not possible within the HBSC survey, and the food-frequency question is the selected 'method of choice' for the survey.⁵² A validation of this measure showed a good agreement for all the foods included in this study.⁴¹

No validation test was conducted for the lunch questions; these came from a published study and were therefore accepted through peer review.⁴⁵ Although these came from a paper published in 1995, leading to concerns of applicability to the reporting of current adolescent lunch behaviour, these were trialled in case studies prior to the data collection, and results for the lunch questions were strongly correlated with the equivalent from the food recall question.

Many of the school-level variables are crude, unvalidated measures, which are dependent upon teacher responses. Additionally, the count variable was created to provide a measure of the amount schools did to promote healthy eating; it did not include any measure of quality for those actions. Objective observation of the school approaches to healthy-eating promotion could strengthen the validity of these school-level variables and provide a means of judging the quality of the actions. This could be done through visits by researchers to schools included in the study, as performed in other studies.^{6 36}

For both student-level and school-level variables unless there is substantial variation across schools in reporting bias, this should not effect the estimated association in the models. Within this study, the number of actions variable was used to measure how much schools were doing to promote healthy eating. Although these actions were chosen as they are promoted as part of a whole school approach to healthy eating, it does not necessarily follow that the number of actions is a proxy for a school following a WSA. The number of actions may simply reflect the importance the school places on healthy eating. This is still interesting, as the results from this study would suggest that students in schools that view healthy eating as important are more likely to report eating fruit and vegetables.

Table 2 Percentage of pupil responses for dependent variables

		Percentage
Daily-intake frequency variables		
Healthy sum score (n=6606)	Eat neither fruit nor vegetables on a daily basis	54.1
	Eat either fruit or vegetable on a daily basis	25.6
	Eat both fruit and vegetables on a daily basis	20.3
Unhealthy sum score (n=6447)	Eat none of the unhealthy foods on a daily basis	51.9
	Eat 1 of the unhealthy foods on a daily basis	23.4
	Eat 2 of the unhealthy foods on a daily basis	13.4
	Eat 3 of the unhealthy foods on a daily basis	7.6
	Eat 4 of the unhealthy foods on a daily basis	3.7
Eat for lunch variables		
Eat fruit for lunch (n=6097)	Agree	50.5
	Do not agree	49.5
Eat chips for lunch (n=6061)	Agree	26.3
	Do not agree	73.7
Eat sweets for lunch (n=6054)	Agree	36.9
	Do not agree	63.1

Table 3 Independent student-level variables against percentage of pupil responses

Pupil-level variable	Percentage
Gender (n=6688)	
Boy	49.7
Girl	50.3
Year group (n=6693)	
Year 7	21.1
Year 8	19.4
Year 9	21.0
Year 10	19.8
Year 11	18.7
Family set-up (n=6693)	
Both parents	64.2
Step family	11.6
Single parent	24.1
TV viewing per day (n=6693)	
Min (h)	0
Max (h)	7.0
Mean (h)	2.68
No of days have breakfast (n=6426)	
Never have breakfast	4.9
1 day	6.3
2 days	10.0
3 days	4.5
4 days	6.1
5 days	9.3
6 days	10.1
7 days	48.9
No of days spend time after school with friends (n=6379)	
Never	11.6
1 day	11.0
2 days	16.2
3 days	20.7
4 days	10.8
5 days	29.7
Health conscious‡ (n=6135) ICC=0.016	
Agree very strongly	10.3
Agree strongly	17.7
Agree slightly	24.3
Neither agree nor disagree	23.9
Disagree slightly	11.3
Disagree strongly	5.4
Disagree very strongly	7.0
On diet (n=6650)	
Yes	20.1
No	79.9
No of subjects useful in learning on healthy eating (n=6291)	
0 subjects	2.4
1 subject	7.6
2 subjects	18.1
3 subjects	32.1
4 subjects	39.8
Family Affluence Scale* (n=6337)	
Low	4.7
Medium	42.6
High	52.7
Engagement with school† (n=5912)	
0	0.7
1	7.1
2	31.8
3	60.5
No of evenings spending time with friends (n=6426)	
Never	13.4
1 evening	12.3

Continued

Table 3 Continued

Pupil-level variable	Percentage
2 evenings	15.5
3 evenings	15.1
4 evenings	10.7
5 evenings	11.1
6 evenings	8.4
7 evenings	13.5
School lunch behaviour (n=6478)	
Eat a school dinner	39.7
Buy a snack at school	10.6
Eat a packed lunch	27.5
Buy lunch outside	13.6
Go to a home for lunch	2.8
Don't have lunch	5.8
Conscious healthy eating‡ (n=6120) ICC=0.015	
Agree very strongly	11.1
Agree strongly	17.9
Agree slightly	25.9
Neither agree nor disagree	25.1
Disagree slightly	9.3
Disagree strongly	4.4
Disagree very strongly	6.3

*Family Affluence Scale is a four-item composite score to judge individual socio-economic status.^{47–49}

†Engagement with school variable is a four-level composite variable derived from three questions in the Health Behaviour in School-aged Children questionnaire.^{50–51} The higher the score, the greater the engagement with school.

‡Two questions on attitudes to healthy eating were included in the student survey. There was some concern that as school approaches may influence attitudes to healthy eating, these would be school-level variables rather than student-level variables. Low intraclass correlation (ICC) scores indicated that these were not school-level variables.

The significant school effect on student dietary choice found within this study, once controlling for student-level characteristics, contradicts the findings from previous multilevel studies.^{36–39} One explanation for this may be the greater sample size within the present study; all these studies^{36–39} collected data from fewer schools and students than the present study.

It should also be acknowledged that the data for the present study are cross-sectional, and as they are not longitudinal, no causality can be inferred between the number of actions schools had in place and the dependent variables; only a significant association can be derived.

From a research focus, this study provides a useful means by which to investigate the influence of the school on student health behaviour. The multilevel analysis of a large sample of schools and pupils enables the school influence to be investigated while controlling for the individual characteristics of the students. To develop this further, objective measurement of school and student actions would provide more confidence in the findings, while a longitudinal approach would allow an inference of causality.

From a public health perspective, the findings from the present study are encouraging, as they indicate that school approaches to healthy eating can impact on the food choices students make. This should support the policy focus for schools to implement whole school approaches, in which healthy-eating messages are consistent throughout all areas of the school and institutionalised by integrating into school processes and aims.⁵³ Schools should also be supported in developing WSAs through grants and guidance from local and regional government. An area that needs more investigation is the finding that there are significant associations with the daily intake of healthy foods

Table 4 Results of multilevel analysis for all dependent variables

Dependent variable		(i) Null model	(ii) Multivariable model: student-level variables	(iii) Multivariable model: student-level variables and school-level variables
Fruit for lunch	School-level variance Wald test	46.22	11.41	2.93
	p Value	<0.01*	<0.01*	0.09
	Explained school-level variance (%)	0	67.7	87.3
	Pupil n	5025	5025	5025
	School n	64	64	64
	ORs for no of actions (95% CIs)	—	—	1.91 (1.13 to 3.24)
Chips for lunch	School-level variance Wald test	40.41	13.81	5.40
	p Value	<0.01*	<0.01*	0.02†
	Explained school-level variance (%)	0	37.8	61.0
	Pupil n	5021	5021	5021
	School n	64	64	64
	ORs for no of actions (95% CIs)	—	—	0.99 (0.52 to 2.08)
Sweets for lunch	School-level variance Wald test	24.86	8.84	2.58
	p Value	<0.01*	<0.01*	0.11
	Explained school-level variance (%)	0	69.5	74.8
	Pupil n	5019	5019	5019
	School n	64	64	64
	ORs for no of actions (95% CIs)	—	—	0.52 (0.29 to 0.95)
Healthy-food-frequency variable	School-level variance Wald test	49.40	10.74	1.15
	p Value	<0.01*	<0.01*	0.28
	Explained school-level variance (%)	0	70.1	93.4
	Pupil n	4996	4996	4996
	School n	64	64	64
	ORs for no of actions (95% CIs)	—	—	1.54 (1.07 to 2.22)
Unhealthy-food-frequency variable	School-level variance Wald test	41.00	6.34	1.07
	p Value	<0.01*	0.01†	0.30
	Explained school-level variance (%)	0	76.2	92.8
	Pupil n	4908	4908	4908
	School n	64	64	64
	ORs for no of actions (95% CIs)	—	—	0.78 (0.49 to 1.25)

*Significant, p=0.01.

†Significant, p=0.05.

What is already known on this subject

Previous studies have found a significant school-level variation in the health behaviours of students, although they have not found a significant association between school approaches and diet choice.

What this study adds

To our knowledge, this is the first study to examine the number of actions a school has in place to promote healthy eating against the dietary choice of students. The results demonstrate that the greater the number of actions a school has in place to promote healthy eating, the greater the odds of students making healthy food choices once controlling for individual-level characteristics. These findings provide support for the whole school approach to healthy eating.

but not with unhealthy foods; this may benefit from a qualitative element to gain student perspectives on the diet choices they make. Future research could also focus on the interactive nature of these actions, as described in a socio-ecological model. This could investigate whether groups of actions work together

to be effective, such as the length of lunchbreak, the food served in the canteen and the number of year groups allowed off the school grounds; or whether one or two actions are crucial to the success of a WSA, such as school nutrition policies or support from initiatives like the WNHSS.

There is much policy from UK governments encouraging the use of a whole school approach to healthy eating, but findings from this study indicate there is a great deal of variation in the amount schools are doing to promote healthy eating. Further research should be performed, investigating how this policy and guidance are carried through into schools and the barriers schools face in implementing actions to promote healthy eating as part of a whole school approach.

Acknowledgements HBSC is an international study carried out in collaboration with WHO/EURO. The International Coordinator of the study is C Currie, University of Edinburgh, and the Data Bank Manager is O Samdal, University of Bergen. Within Wales, the HBSC study is coordinated by the Health Promotion Division of the Welsh Assembly government led by C Roberts. For details, see <http://www.hbsec.org>. C Foster is thanked for editing advice.

Funding This study has been carried out with financial support from The Medical Research Council, UK.

Competing interests None.

Ethics approval Ethics approval was provided by the Cardiff University Social Science Research Ethics Committee before commencement of data collection.

Contributors NT was responsible for data collection, analysis and for writing the manuscript. SM and LM acted as supervisors for the study and provided a critical review of the manuscript.

Provenance and peer review Not commissioned; externally peer reviewed.

REFERENCES

- Craig R**, Mindell J, eds. *Health Survey for England 2006. Volume 2: Obesity and Other Risk Factors in Children*. London: The Information Centre for Health and Social Care, 2008.
- Wang Y**, Lobstein T. Worldwide trends in childhood overweight and obesity. *Int J Pediatr Obes* 2006;**1**:11–25.
- World Health Organization**. *Diet, Nutrition and the Prevention of Chronic Diseases*. Geneva: WHO, 2003.
- Pyle SA**, Sharkey J, Yetter G, et al. Fighting an epidemic: The role of schools in reducing childhood obesity. *Psychol Sch* 2006;**43**:361–76.
- Story M**, Kaphingst K, French S. The role of schools in obesity prevention. *Future Child* 2006;**16**:109–42.
- Nelson M**, Bradbury J, Poulter J, et al. *School Meals in Secondary Schools in England*. King's College London, National Centre for Social Research, Nutrition Works!, 2004.
- Knai C**, Pomerleau J, Lock K, et al. Getting children to eat more fruit and vegetables: A systematic review. *Prev Med* 2006;**42**:85–95.
- Summerbell CD**, Waters E, Edmunds L, et al. The Cochrane Collaboration. *Interventions for Preventing Obesity in Children (Review)*. Chichester: John Wiley & Sons, Ltd, 2006.
- Thomas H**. Obesity prevention programs for children and youth: why are their results so modest? *Health Educ Res* 2006;**21**:783–95.
- Lister-Sharp D**, Chapman S, Stewart-Brown S, et al. Healthy promoting schools and health promotion in schools: two systematic reviews. *Health Technology Assessment* 1999;**3**.
- Lynagh M**, Schofield MJ, Sanson-Fisher RW. School health promotion programs over the past decade: a review of the smoking, alcohol and solar protection literature. *Health Promot Int* 1997;**12**:43–60.
- Sowden AJ**, Stead LF. Community interventions for preventing smoking in young people. *Cochrane Database of Systematic Reviews* 2003;(1). doi:10.1002/14651858.CD001291. Art. No.: D001291.
- Dooris M**. Holistic and sustainable health improvement: the contribution of the settings-based approach to health promotion. *Perspect Public Health* 2009;**129**:29–36.
- World Health Organization**. *Ottawa Charter for Health Promotion*. Geneva: WHO, 1986.
- Scottish Executive**. *Hungry for Success: A Whole School Approach to School Meals in Scotland*. Edinburgh: The Stationery Office, 2002.
- Department of Education Northern Ireland**. *New Nutritional Standards for School Lunches and Other Food in Schools*. Belfast: DENI, 2008.
- Welsh Assembly Government**. *Developing a Whole School Food and Fitness Policy*. Cardiff: Public Health Improvement Division, 2007.
- National Institute for Health and Clinical Excellence**. *Obesity Guidance on Prevention, Identification, Assessment and Management of Overweight and Obesity in Adults and Children. NICE Clinical Guideline 43*. London: Developed by the National Collaborating Centre for Primary Care and the Centre for Public Health Excellence at NICE, 2006.
- British Nutrition Foundation**. *Establishing a Whole School Food Policy*. London: BNF, 2003.
- Food Standards Agency**. *School-Based Food Initiatives*. London: Food Standards Agency Publications, 2006.
- Scottish Executive**. *Hungry for Success: A Whole School Approach to School Meals in Scotland*. The Stationery Office: Edinburgh, 2002.
- School Meals Review Panel**. *Turning the Tables: Transforming School Food. Main Report*. London: DCSF, 2005.
- Welsh Assembly Government**. *Health Challenge Wales—Action on Food and Fitness for Children and Young People*. Cardiff: Public Health Improvement Division, 2005.
- Welsh Assembly Government**. *Food and Fitness—Promoting Healthy Eating and Physical Activity for Children and Young People in Wales, 5 Year Implementation Plan, Public Health Improvement Division*. Cardiff: Public Health Improvement Division, 2006.
- Welsh Assembly Government**. *Appetite for Life*. Cardiff: Public Health Improvement Division, 2006.
- Welsh Assembly Government**. *The Education (Nutritional Standards for School Lunches) (Wales) Regulations 2001*. Cardiff: National Assembly for Wales, 2001.
- Welsh Assembly Government**. *Nutritional Standards for School Lunches. National Assembly for Wales, Circular No:03/2003*. Cardiff: National Assembly for Wales, 2003.
- Health in Wales**. *£4.3m Package for Improving School Food*. NHS, Wales, 2006. <http://www.wales.nhs.uk/news/5735>.
- Estyn**. *School Meals: Advice on the Role of Inspection in Monitoring School Meal Standards*. Cardiff: Estyn Publication Centre, 2006.
- Welsh Assembly Government**. *Appetite for Life Action Plan*. Cardiff: Public Health Improvement Division, 2007.
- Ofsted**. *Healthy Eating in Schools*. Manchester: Her Majesty's Inspectors of Schools, 2006.
- Estyn**. *Food and Fitness in Schools*. Cardiff: Her Majesty's Inspectorate for Education and Training in Wales, 2008.
- Moon A**, Mulee M, Rogers L, et al. Helping schools to become health-promoting environments—an evaluation of the Wessex Healthy Schools Award. *Health Promot Int* 1999;**14**:111–22.
- Inchey J**, Currie C. *Promoting Healthy Eating in Schools using a Health Promoting School Approach: Final Report from the Healthy Eating Project, European Network of Health Promoting Schools (ENHPS) in Scotland*. Edinburgh: University of Edinburgh, 2003.
- Young I**. Healthy eating policies in schools: an evaluation of effects on pupils' knowledge, attitudes and behaviour. *Health Educ J* 1993;**52**:3–9.
- West P**, Sweeting H, Leyland A. School effects on pupils' health behaviours: evidence in support of the health promoting schools. *Res Papers Educ* 2004;**19**:261–91.
- Maes L**, Lievens J. Can the school make a difference? A multilevel analysis of adolescent risk and health behaviour. *Soc Sci Med* 2003;**56**:517–29.
- Krølner R**, Due P, Rasmussen M, et al. Does school environment affect 11-year-olds' fruit and vegetable intake in Denmark? *Soc Sci Med* 2009;**68**:1416–24.
- Van der Horst K**, Timperio A, Crawford D, et al. The school food environment associations with adolescent soft drink and snack consumption. *Am J Prev Med* 2008;**35**:217–23.
- Currie C**, Smith B. General descriptions of HBSC study. In: Currie C, Samdal O, Boyce W, Smith B, eds. *Health Behaviour in School-Aged Children: A WHO Cross-National Study. Research Protocol for the 2001/2002 Survey*. Edinburgh: HBSC, 2002.
- Currie C**, Gabhainn SN, Godeau E, et al (eds). International Report: Inequalities in Young People's Health. *Inequalities in Young People's Health: International Report from the HBSC 2005/06 Survey*. Copenhagen: WHO Regional Office for Europe, 2008.
- Roberts C**, Francois Y, King A, et al. Description of survey procedures and methods: sampling. In: Currie C, Samdal O, Boyce W, et al, eds. *Health Behaviour in School-Aged Children: A WHO Cross-National Study. Research Protocol for the 2001/2002 Survey*. Edinburgh: HBSC, 2002.
- Dennison CM**, Shepherd R. Adolescent food choice: an application of the Theory of Planned Behavior. *J Hum Nutr Diet* 1995;**8**:9–23.
- Bowker S**, Crosswaite C, Hickman M, et al. The healthy option. A review on food and nutrition by UK schools involved in the European Network of Health Promoting Schools. *Health Educ* 1998;**101**:610–20.
- Bowker S**, Tudor-Smith C. The health-promoting school in Wales: an overview. *Health Educ* 2000;**100**:154–60.
- Haug E**, Torsheim T, Samdal O. Physical environmental characteristics and individual interests as correlates of physical activity in Norwegian secondary schools: The health behaviour in school-aged children study. *Int J Behav Nutr Phys Act* 2008;**5**:47.
- Boyce W**, Torsheim T, Currie C, et al. The Family Affluence Scale as a measure of national wealth: Validation of an adolescent self-report measure. *Soc Indic Res* 2006;**78**:473–87.
- Schnohr C**, Kreiner S, Due E, et al. Differential item functioning of a family affluence scale: validation study on data from HBSC 2001/02. *Soc Indic Res* 2008;**89**:79–95.
- Moore L**, Roberts C, Tudor-Smith C. School smoking policies and smoking prevalence among adolescents: multilevel analysis of cross-sectional data from Wales. *Tob Control* 2001;**10**:177–23.
- Nutbeam D**, Smith C, Moore L, et al. Warning! Schools can damage your health: Alienation from school and its impact on health behaviour. *J Paediatr Child Health* 1993;**29**:S25–30.
- Johnson K**. Dietary intake—How do we measure what people are really eating? *Obes Res* 2002;**10**:63S–8S.
- Maes L**, Vereecken C, Johnston M. *Focus area rationale: eating and dieting*. In: Currie C, Samdal O, Boyce W, et al, eds. *Health Behaviour in School-Aged Children: A WHO Cross-National Study. Research Protocol for the 2001/2002 Survey*. Edinburgh: HBSC, 2002.
- McLeroy K**, Bibeau D, Steckler A, et al. An ecological perspective on health promotion programs. *Health Educ Q* 1988;**15**:351–77.