

Associations between deprivation, attitudes towards eating breakfast and breakfast eating behaviours in 9–11-year-olds

Graham F Moore*, Katy Tapper, Simon Murphy, Rebecca Lynch, Larry Raisanen, Claire Pimm and Laurence Moore

Cardiff Institute of Society, Health and Ethics, Cardiff University, 53 Park Place, Cardiff CF10 3AT, UK

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Abstract

Objectives: To examine school-level relationships between deprivation and breakfast eating behaviours (breakfast skipping and the healthfulness of foods consumed) in 9–11-year-old schoolchildren and to examine whether attitudes towards eating breakfast mediated these relationships.

Design: Cross-sectional survey.

Setting: One hundred and eleven primary schools in Wales.

Subjects: Year 5 and 6 pupils within the 111 primary schools. Measures were completed by 4314 children. Analysis was conducted at the group (school) level, with each school representing one group.

Results: Deprivation was positively associated with breakfast skipping and consumption of 'unhealthy' items (i.e. sweet snacks, crisps) for breakfast. A significant negative association was found between deprivation and consumption of 'healthy' items (i.e. fruit, bread, cereal, milk). Deprivation was significantly inversely associated with attitudes towards eating breakfast. The relationships between deprivation and (1) breakfast skipping and (2) consumption of 'healthy' items for breakfast were mediated by attitudes towards eating breakfast. The hypothesis that attitudes mediated the relationship between deprivation and consumption of 'unhealthy' breakfast items was unsupported.

Conclusions: Deprivation is associated with adverse breakfast eating behaviours amongst children aged 9–11 years, in terms of breakfast skipping and the quality of breakfasts consumed. Socio-economic differences in attitudes towards eating breakfast are apparent amongst this age group, and appear to relate to social gradients in breakfast eating behaviours. Research is needed to examine the causal nature of these trends and to elucidate factors underlying the development of socio-economic differences in eating-related cognitions.

Keywords
Breakfast
Attitudes
Socio-economic status
Children
Diet
Nutrition
Health

In recent years, the gap between rich and poor in terms of chronic disease morbidity and life expectancy has widened, increasing awareness of the need to identify and address social inequalities in the determinants of health^{1,2}. Whilst a number of structural, social and environmental factors contribute to this gradient^{3–6}, health behaviours appear to be important factors⁷. Higher rates of smoking⁸, physical inactivity and alcohol consumption are typically observed in groups of lower socio-economic status (SES)⁷. Class discrepancies in nutritional behaviours are observed throughout the life course, developing in childhood before tracking into adolescence and beyond⁹. Intervention to support health-enhancing nutritional behaviours in childhood may therefore form an important part of a wider strategy to address inequalities in health.

Childhood nutritional interventions often target the school environment due to the capacity of this approach to

reach large numbers of children simultaneously. Much school-based intervention, both in the USA¹⁰ and the UK¹¹, has centred around the provision of breakfast. There are a number of compelling justifications for this decision. Recent research suggests that skipping breakfast may have a variety of detrimental effects such as dental caries¹², dysmenorrhoea¹³ and reduced weight control¹⁴. Breakfast eating appears to contribute to the overall nutritional adequacy of the diet^{15,16} and may provide an opportunity to consume foods such as grain products and fruits, widely regarded as important in the prevention of chronic disease^{17,18}. Furthermore, substantial evidence suggests that eating breakfast acutely improves cognitive performance in terms of concentration and memory^{19–21}, with potential implications for educational attainment.

Breakfast skipping is more commonly observed in children of lower-SES parents^{22,23}, with potential implications for inequalities in health. Furthermore, given the

aforementioned educational benefits of breakfast eating, socio-economic differences in breakfast eating behaviours may also contribute to inequalities in educational attainment, which in turn appear to be intrinsically associated with health behaviours^{24–26}. Examining the nature of associations between deprivation and breakfast eating behaviours and exploring factors which may mediate these trends are therefore of significant interest from both public health and educational perspectives.

Whilst most studies into cognitive determinants of children's health behaviour have been conducted with older samples²⁷, associations between health attitudes and behaviours have been demonstrated in children aged as young as 9 years²⁸. A number of recent attempts have been made to explore cognitive correlates of children's breakfast eating behaviours. Data for the present study are derived from the evaluation of the Welsh Assembly Government's Free School Breakfast Initiative¹¹. A recent study focusing upon a sub-sample from this evaluation found that, amongst children aged 9–11 years, attitudes towards eating breakfast were significantly associated with the likelihood of skipping breakfast²⁹. Furthermore, attitudes were associated with the quality of breakfast consumed, in that they were positively correlated with the total number of fruits, bread, cereals and milk products consumed and negatively correlated with the total numbers of sweet items and crisps. Similarly, a recent study demonstrated amongst 12–14-year-old children that attitudes towards eating breakfast were predictive of breakfast consumption, with both attitudes and subjective norms predicting intentions to eat breakfast more regularly in the next six months³⁰.

In adults, cognitive and motivational determinants of eating behaviour have been described as mediators of the social gradient in health behaviours such as diet³¹. That is, low SES leads to the formation of adverse cognitive structures relating to health behaviours, which in turn predict poorer health behaviours. Whilst little such research has been conducted with children, there is strong plausibility in the hypothesis that lower SES may be associated with less positive health-related cognitions in childhood, with implications for childhood nutritional inequalities. Whilst cognitions can be viewed as intrinsic to the individual, they are not static entities and external factors contribute to their formation and maintenance. Eating can essentially be viewed as a learned behaviour³² developed through interaction with the social environment, and research supports the view that children from more deprived backgrounds typically interact with an environment which is less supportive of positive health-related cognitions and behaviours than their wealthier peers.

Social Learning Theory³³ provides a theoretical framework for understanding the role of social interactions in determining individual cognitions and behaviours. A central aspect of this theory is the importance of behavioural modelling, or vicarious learning through the examples of significant others. Consistent with this notion,

research demonstrates that perceptions of parental eating behaviour such as breakfast eating habits are highly influential in determining the cognitions and behaviours of the child^{27,30,34}. Given that adults of lower SES tend to consume less healthful diets³⁵, parental behavioural modelling may be expected to result in more adverse cognitive belief structures and behaviours in their offspring. Research has also identified class differences in food rules applied by mothers as relating to social class differences in children's nutritional behaviour³². The provision of positive feedback for adherence to prescribed behaviours, or conversely negative feedback for breaking prescribed food rules, likely imparts messages about the perceived importance and outcome expectancies associated with eating behaviour, shaping and reinforcing beliefs and behaviours.

Studies applying ecological perspectives to the study of inequalities in adults' health behaviours have described SES as indicative of a broad social context which supports the development of poor health behaviours³⁶. According to these perspectives, SES may impact upon behaviour by influencing the daily contexts of the individual, such as home and work environments (or in the case of children, school environments), the wider physical environment and macrosystemic influences. Furthermore, experiences of these daily contexts may influence behaviour through shaping the proximal cognitive determinants of behaviour³⁶ such as attitudes. However, little such research has been conducted with children.

The present paper examines relationships between deprivation and breakfast eating behaviours, in terms of both breakfast skipping and the quality of breakfast. It is hypothesised that increased levels of deprivation will be associated with increased levels of breakfast skipping and consumption of less healthful breakfasts. Deprivation is also expected to be associated with more negative attitudes towards eating breakfast. Furthermore, it is hypothesised that attitudes towards eating breakfast will mediate the relationship between deprivation and breakfast eating behaviours. That is, deprivation leads to the formation of negative attitudes towards eating breakfast, which in turn leads to less healthful breakfast eating behaviours.

All of these variables are measured at the school level, with deprivation assessed in terms of the percentage of children within the school receiving free school meals. Exploring school-level trends in relation to dietary behaviours is useful as intervention largely occurs at this level, and hence identification of characteristics which determine school-level need for intervention may be of use in informing such intervention.

Methods

Participants

Participants were Year 5 and 6 (i.e. 9–11-year-old) primary-school children from 111 schools in nine Local

Education Authorities across Wales. In each school, one class from Year 5 and one from Year 6 were randomly selected to complete the attitudes and recall questionnaires. Measures were completed by 4314 children in total. Initial data screening revealed substantial missing data for 103 children. These children were excluded from analysis, resulting in a sample size of 4211 children.

Measures

Socio-economic deprivation

Socio-economic deprivation was assessed using details of the percentage of children within each school receiving free school meals. This information was provided by the Welsh Assembly Government.

Attitudes towards eating breakfast

Attitudes were assessed using a questionnaire containing 13 statements referring to a variety of domains, such as concentration and behaviour, energy, and the general importance placed on breakfast. Children were asked to indicate the extent to which they agreed or disagreed with each statement by placing a tick in one of five boxes (agree a lot/agree a bit/don't agree or disagree/disagree a bit/disagree a lot). This measure was developed and validated with an independent sample prior to administration and further examination of validity and reliability was conducted using a sub-sample of participants from the present study. The measure demonstrated good construct and convergent validity²⁷, and in the present study the measure demonstrated acceptable internal consistency ($\alpha = 0.753$). For a fuller description, see Tapper *et al.*²⁹.

Dietary recall questionnaire

The questionnaire was a modified version of the Day in the Life Questionnaire³⁷. Children were asked to list all foods and drinks consumed at chronologically ordered time points throughout the day (e.g. at home before school, on the way to school, at school before class started). Details of breakfast on the day of reporting (i.e. any foods consumed before the start of classes) were collected first, followed by details of the previous day's dietary intake. Only data relating to the two breakfast occasions were analysed for the purposes of the present study. Food-related questions were embedded within items related to the child's activities (e.g. 'Did you watch television at home yesterday morning before school started?' preceding the item 'Did you have anything to eat or drink at home yesterday morning before school started?') Activity-related items served a twofold purpose: first acting as prompts to enhance recall and second as distractions from the researcher's interest in eating behaviours, hence minimising social desirability biases. Children's accounts of portion size are generally unreliable^{38,39} and these details were therefore not requested. This helped keep the questionnaire brief and easy to administer in large group settings with minimal supervision. As the questionnaire

requests details of only two breakfast occasions (i.e. the morning of reporting and the previous morning) it is therefore most likely to be of most use at the group rather than individual level. This measure has been validated against 24-hour recall interviews with a sub-sample of children from the present study and offers an acceptable level of validity and reliability. For a fuller description of the measure and coding procedures, see Moore *et al.*⁴⁰.

Procedure

Parents were informed of the research in advance by means of a letter and information sheet sent home with children and were asked to contact the school if they did not wish their child to participate in the study. At each data collection, children were also informed that they were under no obligation to participate. Parents of 15 children requested that their child be excluded. The study received ethical approval from the Cardiff University Social Science Ethics Committee.

Both measures were completed in the morning as a supervised classroom exercise with a maximum class size of 40 children. For the attitudes questionnaire, to minimise conferring and ensure that children worked at the same pace and did not distract one another, the researcher read out the statements one by one and children marked their response for each statement after it was read out. For the dietary recall measure, the researcher read out the instructions and asked children to complete the questionnaire independently from one another. Children were asked to put their hands up when they had finished or if they needed help with spelling or further clarification of questions. Three members of the research team were present to assist children.

Statistical analysis

For each of six food categories (fruit, bread, cereal, milk products, sweet items and crisps), school-level mean intakes were calculated for each school, by adding intakes for each child during both breakfast occasions combined and dividing by the number of children within the school. Relationships between deprivation and each food category were then explored. Spearman's rank correlation was used for comparisons involving the variables fruit, sweet items and crisps, as data for these variables were positively skewed. Pearson's product moment correlation was used for all remaining comparisons, as data for these variables were normally distributed.

School-level mean attitudes scores were calculated for each school, by summing attitudes scores for each child and dividing the total by the number of children within the school. Exploration was then made of the relationship between attitudes towards eating breakfast and each of the six food categories, using Spearman's correlation for comparisons involving fruit, sweet items and crisps, and Pearson's correlation for all other comparisons.

From original individual-level data, the six food categories were then collapsed to form two variables:

(i) total number of 'healthy' items consumed for breakfast across the two breakfast occasions (i.e. cereals, bread, milk products, fruit) and (ii) total number of 'unhealthy' items consumed for breakfast across the two breakfast occasions (i.e. sweet items and crisps). School-level means for each of these two variables were then calculated and analysed as dependent variables. A further dependent variable, (iii) percentage of breakfasts skipped, was calculated for each school. In calculating this variable, breakfast occasions where non-codable responses had been recorded were excluded. Data for variable (i) were normally distributed. However, data for variable (ii) and (iii) were positively skewed and log transformations were used to improve the distributions of these variables in preparation for the construction of regression models.

The hypothesised relationships between deprivation and each of the dependent variables, and the mediating influence of attitudes upon these relationships, were tested using a series of simple and multiple linear regression models in accordance with the procedures for mediational analysis set out by Baron and Kenny⁴¹. First, the hypothesised mediator variable (attitudes) was regressed on the independent variable (deprivation). Each dependent variable ('healthy' items, 'unhealthy' items and percentage of breakfasts skipped) was then regressed on the independent variable. Each dependent variable was then regressed on the mediator variable.

Where exploratory analysis revealed significant relationships between (1) the independent variable (deprivation) and the hypothesised mediator variable (attitudes), (2) the independent variable and the dependent variable and (3) the hypothesised mediator variable and the dependent variable, multiple regression models were constructed, with deprivation and attitudes entered as independent variables. Where the significance of the contribution of deprivation was reduced by entry of the mediator variable, but both items remained significant, this was interpreted as partial mediation. Where entry of the hypothesised mediator variable lowered the significance of deprivation beyond the 5% level, with the mediator remaining significant, this was considered full mediation.

Results

Sample description

The percentage of children in each school entitled to free school meals ranged from 3.1% to 65.9% with the mean (26.1, standard deviation (SD) = 13.5) being higher than the national average of 17%. Mean scores of attitudes towards breakfast ranged from 3.03 to 4.09 (mean = 3.69, SD = 0.17). As a score of 3 corresponded to a neutral score, with anything above reflecting more positive than negative responses and vice versa, this indicates that school-level average responses were generally somewhat positive. Mean and SD intakes of foods from each of the six food categories are summarised in Table 1.

Table 1 Mean and standard deviation (SD) school-level consumption of items from each of six food categories, across two breakfast occasions ($n = 111$)

	Fruit	Bread	Cereal	Milk	Crisps	Sweets
Mean	0.19	0.70	0.96	0.47	0.07	0.23
SD	0.13	0.21	0.20	0.19	0.07	0.15

Associations between deprivation, attitudes towards eating breakfast and breakfast food categories

Correlation coefficients for the associations between school-level mean consumption of items from each of the six food categories and (1) deprivation and (2) attitudes towards eating breakfast are displayed in Table 2. These indicate that deprivation was inversely associated with consumption of fruit and cereal for breakfast, so that as deprivation increases intakes of these foods decrease, and positively associated with consumption of sweet items and crisps. Similarly, attitudes towards eating breakfast were positively associated with consumption of cereals and fruit and inversely associated with consumption of sweet items and crisps. Neither deprivation nor attitudes was significantly associated with consumption of milk or bread for breakfast.

Association between deprivation and attitudes towards eating breakfast

A simple linear regression model demonstrated that deprivation was significantly associated with attitudes towards eating breakfast, such that as deprivation increased, attitudes towards eating breakfast became increasingly negative ($\beta = -0.005$, $P < 0.001$). Deprivation explained 15.4% of the variance in attitudes towards eating breakfast.

Mediation of the relationship between deprivation and consumption of 'healthy' items by attitudes towards eating breakfast

Simple regression models indicated: (1) a significant negative association between deprivation and the school-level mean number of healthy items eaten for breakfast ($\beta = -0.007$, $P < 0.05$), so that as deprivation increased, consumption of healthy items for breakfast decreased; and

Table 2 Correlations between school-level deprivation and consumption of items from six food categories at breakfast and between attitudes towards breakfast and consumption of items from six food categories at breakfast ($n = 111$)

	Bread*	Cereal*	Milk*	Fruit†	Crisps†	Sweets†
Deprivation	-0.03	-0.22‡	-0.10	-0.25§	0.40§	0.28§
Attitudes	0.07	0.40§	0.06	0.29§	-0.18‡	-0.30§

* Pearson's product moment correlation.
 † Spearman's rank correlation coefficient.
 ‡ Correlation is significant at the 5% level.
 § Correlation is significant at the 1% level.

(2) a significant positive association between attitudes towards eating breakfast and consumption of healthy items for breakfast ($\beta = 0.822$, $P < 0.001$). Entry of both deprivation and attitudes as independent variables in a multiple regression model resulted in a reduction of the significance of deprivation (see Table 3), with attitudes emerging as the sole predictor. The hypothesis that attitudes towards eating breakfast significantly mediated the relationship between deprivation and the consumption of healthy breakfast items was therefore supported.

Mediation of the relationship between deprivation and consumption of 'unhealthy' items by attitudes towards eating breakfast

Simple regression models indicated: (1) a significant positive association between deprivation and the mean number of unhealthy items eaten for breakfast, so that as deprivation increased, consumption of unhealthy items for breakfast increased ($\beta = 0.004$, $P < 0.001$); and (2) a significant negative association between attitudes towards eating breakfast and the number of unhealthy items eaten for breakfast ($\beta = -0.261$, $P < 0.01$). A multiple regression model with both variables entered as predictors indicated that both were significant independent predictors of the number of unhealthy items eaten for breakfast. Only a negligible reduction in the significance of deprivation was observed after the entry of attitudes (see Table 4). The hypothesis that attitudes towards eating breakfast mediated the relationship between deprivation and consumption of unhealthy items for breakfast was therefore unsupported.

Mediation of the relationship between deprivation and breakfast skipping by attitudes towards eating breakfast

Simple regression models indicated: (1) a significant positive association between deprivation and the percentage of breakfasts skipped within the school ($\beta = 0.011$, $P < 0.01$), so that as deprivation increased, breakfast skipping increased; and (2) a significant negative association between attitudes towards eating breakfast and the percentage of breakfasts skipped ($\beta = -1.152$, $P < 0.01$). A multiple regression model with both variables entered as predictors is summarised in Table 5. In this

Table 3 Linear regression model summary for prediction of healthy items consumed for breakfast by the independent variable alone (Step 1) and by the independent variable and the mediator variable combined (Step 2) ($n = 111$)

		<i>B</i>	SE	<i>T</i>	Significance
Step 1	Deprivation	-0.007	0.002	-3.051	0.003
Step 2	Attitudes	0.707	0.193	3.669	0.000
	Deprivation	-0.004	0.003	-1.523	0.131

SE – standard error.

Step 1 – $R^2 = 0.079$; Step 2 – $R^2 = 0.18$.

Table 4 Linear regression model summary for prediction of unhealthy items consumed for breakfast by the independent variable alone (Step 1) and by the independent variable and the mediator variable combined (Step 2) ($n = 111$)

		<i>B</i>	SE	<i>T</i>	Significance
Step 1	Deprivation	0.004	0.001	4.539	0.000
Step 2	Attitudes	-0.158	0.076	-2.067	0.041
	Deprivation	0.003	0.001	3.426	0.001

SE – standard error.

Step 1 – $R^2 = 0.16$; Step 2 – $R^2 = 0.19$.

model, attitudes were the sole significant predictor of breakfast skipping, with the contribution of deprivation reduced below a significant level by the entry of the mediator variable. The hypothesis that attitudes towards eating breakfast mediate the relationship between deprivation and breakfast skipping was therefore supported.

Discussion

Consistent with previous research, the hypothesis that deprivation is related to increased breakfast skipping in 9–11-year-old schoolchildren was supported^{22,23}. The present study adds to these findings evidence to suggest that deprivation is not only associated with breakfast skipping, but also with a decreased likelihood of consuming healthy breakfast items and an increased likelihood of consuming less healthy items before school. In particular, deprivation appeared to be associated with decreased consumption of fruits and cereals for breakfast and an increased likelihood of consuming sweets and crisps. Interventions aiming to address social inequalities in breakfast eating behaviours must therefore focus not only upon the promotion of breakfast eating *per se*, but also upon the promotion of healthy breakfast foods.

Attitudes towards eating breakfast were significantly associated with breakfast skipping, consistent with recent research³⁰. Furthermore, attitudes towards eating breakfast were significantly associated with both increased consumption of healthy breakfast items and decreased consumption of unhealthy breakfast items. This reinforces and extends the generalisability of the findings of a recent study investigating these trends in a particularly deprived sub-sample of children participating in the present

Table 5 Linear regression model summary for prediction of breakfast skipping by the independent variable alone (Step 1) and by the independent variable and the mediator variable combined (Step 2) ($n = 111$)

		<i>B</i>	SE	<i>T</i>	Significance
Step 1	Deprivation	0.011	0.003	3.329	0.001
Step 2	Attitudes	-0.967	0.263	-3.679	0.000
	Deprivation	0.006	0.003	1.790	0.076

SE – standard error.

Step 1 – $R^2 = 0.09$; Step 2 – $R^2 = 0.19$.

study²⁹. In terms of individual food categories, associations with attitudes were strikingly similar to those observed for deprivation, although with the direction of correlations inverted. Attitudes towards eating breakfast were positively associated with consumption of fruits and cereals and inversely associated with consumption of sweet items and crisps.

Consistent with hypotheses, a strong social gradient in attitudes towards eating breakfast was observed, with high levels of deprivation associated with comparatively negative attitudes towards eating breakfast. Furthermore, the relationships between deprivation and both breakfast skipping and consumption of healthy items were mediated by attitudes towards eating breakfast. The mediating influence of attitudes upon the relationship between deprivation and consumption of less healthful breakfast items was however not significant.

Social gradients in terms of proximal cognitive determinants have not been researched extensively, and previous research has been limited to adults³¹. The present study indicates an association between deprivation and attitudes towards eating breakfast which appears to relate to social inequalities in breakfast eating behaviours at a young age. Intervention to improve attitudes towards eating breakfast in childhood may therefore impact significantly upon nutritional inequalities. However, the fact that the relationship between deprivation and consumption of sweet items and crisps consumed for breakfast was not mediated by attitudes perhaps suggests that environmental factors may be more influential in determining intakes of these foods, and such speculation merits further investigation.

Whilst the present study focuses upon a key cognitive determinant of behaviour, this is not intended to undermine the importance of wider social and environmental determinants of nutritional inequalities such as economic factors⁴² and food availability⁴³. These findings should not be interpreted as indicating that changing eating behaviours is simply a matter of addressing individual differences. Rather, the strength of non-random patterning of attitudes at the school level, between groups defined by overall levels of deprivation, indicates that social and environmental processes associated with deprivation may impact upon the formation of these cognitions relatively early in life. Indeed, an examination of the influence of other variables such as food availability and food preferences on both attitudes towards breakfast and breakfast eating behaviours would be informative.

In addition, a greater understanding is needed of when and how eating-related cognitions develop, and how the different social contexts experienced by children from more deprived backgrounds impact upon the formation of these cognitions. Future research should focus upon further developing this field of research, applying principles of developmental psychology to understanding the formation and maintenance of these cognitions and

identifying points at which they may be most amenable to positive change.

A number of strengths and weaknesses of the present study merit consideration when assessing its contribution to the evidence base. Key strengths include the use of measures of attitudes²⁹ and dietary behaviours⁴⁰ that have been rigorously validated for use with the present sample, and the use of a large, socio-economically diverse sample. Furthermore, analysis of trends relating to a continuous rather than categorical measure of SES is considered a strength as research demonstrates a graded relationship between SES and health outcomes⁴⁴, with health status continuing to decrease as deprivation increases⁴⁵ in contrast to the lay perception of a dichotomous gap between rich and poor.

Data were however cross-sectional and therefore causal inferences cannot be fully established; thus longitudinal research is needed to explore the causal nature of the relationships reported. Furthermore, analysis was restricted to the group level, and individual sources of variation within these groups were not explored. The interactions between the social contexts associated with deprivation and individual factors in determining nutritional behaviour deserve significant attention and strong inferences about individual-level trends cannot be drawn from aggregate data. Obtaining valid, individual-level dietary data on a large scale is, however, problematic and exploratory findings from group-level data, such as those reported in the present study, are an important step in informing such research.

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References

- 1 Exworthy M, Blane D, Marmot M. Tackling health inequalities in the United Kingdom: the progress and pitfalls of policy. *Health Services Research* 2003; **38**(6): 1905–21.
- 2 Wanless D. *Securing Good Health for the Whole Population*. London: HM Treasury, 2004.
- 3 von Rueden U, Gosch A, Rajmil L, Bisegger C, Ravens-Sieberer U. Socioeconomic determinants of health related quality of life in childhood and adolescence: results from a European study. *Journal of Epidemiology and Community Health* 2006; **60**(2): 130–5.
- 4 Rahkonen O, Laaksonen M, Martikainen P, Roos E, Lahelma E. Job control, job demands, or social class? The impact of working conditions on the relation between social class and health. *Journal of Epidemiology and Community Health* 2006; **60**(1): 50–4.
- 5 Wheeler BW, Ben-Shlomo Y. Environmental equity, air quality, socioeconomic status, and respiratory health: a linkage analysis of routine data from the Health Survey for England. *Journal of Epidemiology and Community Health* 2005; **59**(11): 948–54.
- 6 Deeming C. Keeping healthy on a minimum wage. *British Medical Journal* 2005; **331**(7521): 857–8.
- 7 Schnohr C, Hojbjerg L, Riegels M, Ledet L, Larsen T, Schultz-Larsen K, *et al.* Does educational level influence the effects of smoking, alcohol, physical activity, and obesity on mortality? A prospective population study. *Scandinavian Journal of Public Health* 2004; **32**(4): 250–6.
- 8 Graham H, Francis B, Inskip HM, Harman J; SWSS Study Team. Socioeconomic lifecourse influences on women's smoking status in early adulthood. *Journal of Epidemiology and Community Health* 2006; **60**(3): 228–33.
- 9 James WPT, Nelson M, Ralph A, Leather S. Socioeconomic determinants of health – the contribution of nutrition to inequalities in health. *British Medical Journal* 1997; **314**(7093): 1545–9.
- 10 Taras H. Nutrition and student performance at school. *Journal of School Health* 2005; **75**(6): 199–213.
- 11 Tapper K, Murphy S, Moore L, Lynch R, Clark R. Evaluating the Free School Breakfast Initiative in Wales: methodological issues. *British Food Journal* 2007; in press.
- 12 Bruno-Ambrosius K, Swanhof G, Twetman S. Eating habits, smoking and toothbrushing in relation to dental caries: a 3-year study in Swedish female teenagers. *International Journal of Paediatric Dentistry* 2005; **15**(3): 190–6.
- 13 Fujiwara T. Skipping breakfast is associated with dysmenorrhoea in young women in Japan. *International Journal of Food Sciences and Nutrition* 2003; **54**(6): 505–9.
- 14 Berkey CS, Rockett HRH, Gillman MW, Field AE, Colditz GA. Longitudinal study of skipping breakfast and weight change in adolescents. *International Journal of Obesity and Related Metabolic Disorders* 2003; **27**(10): 1258–66.
- 15 Nicklas TA, Bao W, Webber LS, Berenson GS. Breakfast consumption affects adequacy of total daily intake in children. *Journal of the American Dietetic Association* 1993; **93**(8): 886–91.
- 16 Sjoberg A, Hallberg L, Hoglund D, Hulthen L. Meal pattern, food choice, nutrient intake and lifestyle factors in The Goteborg Adolescence Study. *European Journal of Clinical Nutrition* 2003; **57**(12): 1569–78.
- 17 US Department of Health and Human Services (DHHS). *Healthy People 2010; Understanding and Improving Health*. Washington, DC: US DHHS, 2000.
- 18 Liu SM, Sesso HD, Manson JE, Willett WC, Buring JE. Is intake of breakfast cereals related to total and cause-specific mortality in men? *American Journal of Clinical Nutrition* 2003; **77**(3): 594–9.
- 19 Pollitt E, Gersovitz M, Gargiulo M. Educational benefits of the United States school feeding program: a critical review of the literature. *American Journal of Public Health* 1978; **68**(5): 477–81.
- 20 Pollitt E. Does breakfast make a difference in school? *Journal of the American Dietetic Association* 1995; **95**(10): 1134–9.
- 21 Rampersaud GC, Pereira MA, Girard BL, Adams J, Metz J. Breakfast habits, nutritional status, body weight, and academic performance in children and adolescents. *Journal of the American Dietetic Association* 2005; **105**(5): 743–60.
- 22 Keski-Rahkonen A, Kaprio J, Rissanen A, Virkkunen M, Rose RJ. Breakfast skipping and health-compromising behaviors in adolescents and adults. *European Journal of Clinical Nutrition* 2003; **57**(7): 842–53.
- 23 Hulshof K, Brussaard JH, Kruizinga AG, Telman J, Lowik MRH. Socio-economic status, dietary intake and 10 y trends: the Dutch National Food Consumption Survey. *European Journal of Clinical Nutrition* 2003; **57**(1): 128–37.
- 24 Laaksonen M, Prattala R, Helasoja V, Uutela A, Lahelma E. Income and health behaviours. Evidence from monitoring surveys among Finnish adults. *Journal of Epidemiology and Community Health* 2003; **57**(9): 711–7.
- 25 Leganger A, Kraft P. Control constructs: do they mediate the relation between educational attainment and health behaviour? *Journal of Health Psychology* 2003; **8**(3): 361–72.
- 26 Koivusilta LK, Rimpela AH, Rimpela MK. Health-related lifestyle in adolescence – origin of social class differences in health? *Health Education Research* 1999; **14**(3): 339–55.
- 27 Rimal RN. Intergenerational transmission of health: the role of intrapersonal, interpersonal, and communicative factors. *Health Education & Behavior* 2003; **30**(1): 10–28.
- 28 Martin SC, Jacobsen PB, Lucas DJ, Branch KA, Ferron JM. Predicting children's sunscreen use: application of the theories of reasoned action and planned behavior. *Preventive Medicine* 1999; **29**(1): 37–44.
- 29 Tapper K, Murphy S, Lynch R, Clark R, Moore G, Moore L. Development of a scale to measure 9–11 year olds' attitudes towards breakfast. *European Journal of Clinical Nutrition*, submitted.
- 30 Martens MK, van Assema P, Brug J. Why do adolescents eat what they eat? Personal and social environmental predictors of fruit, snack and breakfast consumption among 12–14-year-old Dutch students. *Public Health Nutrition* 2005; **8**(8): 1258–65.
- 31 Wardle J, Herrera ML, Cooke L, Gibson EL. Modifying children's food preferences: the effects of exposure and reward on acceptance of an unfamiliar vegetable. *European Journal of Clinical Nutrition* 2003; **57**(2): 341–8.
- 32 Hupkens CLH, Knibbe RA, Van Otterloo AH, Drop MJ. Class differences in the food rules mothers impose on their children: a cross-national study. *Social Science & Medicine* 1998; **47**(9): 1331–9.
- 33 Bandura A. *Social Learning Theory*. London: Prentice Hall, 1977.
- 34 Tinsley BJ. Multiple influences on the acquisition and socialization of children's health attitudes and behavior – an integrative review. *Child Development* 1992; **63**(5): 1043–69.
- 35 Inglis V, Ball K, Crawford D. Why do women of low socioeconomic status have poorer dietary behaviours than women of higher socioeconomic status? A qualitative exploration. *Appetite* 2005; **45**(3): 334–43.
- 36 Grzywacz JG, Marks NF. Social inequalities and exercise during adulthood: toward an ecological perspective. *Journal of Health and Social Behavior* 2001; **42**(2): 202–20.
- 37 Edmunds LD, Ziebland S. Development and validation of the Day in the Life Questionnaire (DILQ) as a measure of fruit and vegetable questionnaire for 7–9 year olds. *Health Education Research* 2002; **17**(2): 211–20.

- 38 Livingstone MBE, Robson PJ. Measurement of dietary intake in children. *Proceedings of the Nutrition Society* 2000; **59**(2): 279–93.
- 39 Lytle LA, Nichaman MZ, Obarzanek E, Glovsky E, Montgomery D, Nicklas T, *et al.* Validation of 24-hour recalls assisted by food records in 3rd-grade children. The CATCH Collaborative Group. *Journal of the American Dietetic Association* 1993; **93**(12): 1431–6.
- 40 Moore GF, Tapper K, Murphy S, Lynch R, Clark R, Moore L. Validation of a self-completion measure of breakfast foods, snacks and fruit and vegetables consumed by 9- to 11-year-old schoolchildren. *European Journal of Clinical Nutrition* 2006 Sep 20; [Epub ahead of print].
- 41 Baron RM, Kenny DA. The moderator–mediator variable distinction in social psychological research: conceptual, strategic, and statistical considerations. *Journal of Personality and Social Psychology* 1986; **51**(6): 1173–82.
- 42 Darmon N, Ferguson EL, Briend A. A cost constraint alone has adverse effects on food selection and nutrient density: an analysis of human diets by linear programming. *Journal of Nutrition* 2002; **132**(12): 3764–71.
- 43 Story M, Neumark-Sztainer D, French S. Individual and environmental influences on adolescent eating behaviors. *Journal of the American Dietetic Association* 2002; **102**(3): S40–51.
- 44 Marmot M, Ryff CD, Bumpass LL, Shipley M, Marks NF. Social inequalities in health: next questions and converging evidence. *Social Science & Medicine* 1997; **44**(6): 901–10.
- 45 Marmot MG, Smith GD, Stansfeld S, Patel C, North F, Head J, *et al.* Health inequalities among British civil servants: the Whitehall II Study. *Lancet* 1991; **337**(8754): 1387–93.