



EDPHiS



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EDPHiS

Environmental Determinants of Public Health in Scotland

D.3 – Literature Review: Obesity Case Study

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EDPHiS



Obesity case study

Scoping report

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FOREWORD

EDPHiS and its role in relation to Good Places, Better Health

EDPHiS (Environmental Determinants of Public Health in Scotland) is a multi-disciplinary collaborative scientific project, funded by the Scottish Government, and designed to inform the development of policy on environment and health in Scotland. As such, EDPHiS is one of the four components of the Intelligence Partnership of Good Places, Better Health (GPBH), whose current (Prototype) phase focuses on how young people in Scotland experience the physical environment, and how that impacts on the four GPBH priority health-related effects of obesity, unintentional injuries, asthma, and mental health and well-being.

GPBH is concerned ultimately with protecting and improving the health of Scotland's young people, and reducing health inequalities among them, by identifying and informing the implementation of policies and actions which protect and improve health through improvements to the physical environment in Scotland, and how young people interact with it. Within the GPBH Intelligence Partnership (IP), and working closely with the other IP partners, EDPHiS helps to inform this development of policy by:

- a. Providing evidence reviews of the international scientific literature concerning how the environment affects the lives and health of young people, up to ages 8 or 9 years; and in particular (i) how environmental exposures of young people affect their risks and chances in relation to the four priority health-related effects of GPBH; and (ii) what evidence there is from studies internationally of the success (or not) of interventions intended to improve children's health via the environment.
- b. Working with others in the IP and in Scotland more widely to identify relevant sources of information about Scotland in terms of population, environment, health and other contextual factors that may affect the relationships between environment and health.
- c. Linking these to provide – as far as the scientific evidence and data allow – estimates of the likely benefits to children in Scotland of policies and actions that may affect their health via changes to the environment and/or how children interact with that environment. These estimates also will include an assessment of how the public health effects are distributed across age, gender, urban-rural and indices of social deprivation.

Evidence reviews of the international literature

These were designed to consider in turn the four priority health impacts of the GPBH Prototype, and to be carried out in two phases: First, a preliminary assessment of the evidence to scope approximately the issues to be addressed and to see what kind of evidence there was about them (Phase 1); then, a more detailed and focused assessment aiming to provide quantitative evidence of those relationships which were identified as most relevant and important (Phase 2).

The present set of preliminary evidence assessments

The present set of preliminary evidence assessments took as a starting-point a diagrammatic representation (a 'map') of the relationships linking environment, exposure and health effect, developed using the modified DPSEEA modelling framework (Morris et al., 2006: Getting Strategic about the Environment and Health) adopted by GPBH. These maps were developed in a series of workshops, led by George Morris and Sheila Beck, where experts summarised current best thinking about how the environment relates to and affects public health.

Where maps were as yet unavailable for the priority health effects in young people, or were limited in scope, they were developed further or from new by the EDPHiS team as part of the preliminary evidence assessment. The main focus of the work thereafter was to consider the relationships proposed by the DPSEEA maps and to make a first assessment of the strength of evidence underlying them, especially insofar as that evidence is relevant to Scotland and its young people.

Following the DPSEEA framework, the Phase 1 reports focus both on (i) the Drivers and Pressures which influence the State of the environment, and the behaviours of children in interacting with it, and (ii) relationships between State of the environment, Exposures (i.e. interactions, whether favourable or unfavourable to health, of young people with the environment), and health Effects; with attention throughout on Actions which might improve children's environment and health.

The present set of four reports is the outcome of these preliminary assessments, which largely were completed about 12 months ago. Each of the four reports is the work of a particular multi-disciplinary team within EDPHiS, and so the reports are individually authored accordingly.

Taking the reports as a set, they represent a compromise between a desire for consistency of approach, and the need to allow differences according to (i) health effect, what it means and how it is measured; (ii) the complexity of the issues that arise in the relationships of environment to that health effect in children; and (iii) the strength and maturity of evidence concerning those relationships. Co-ordination of these compromises between the four case studies was overseen by my colleague Hilary Cowie, who is in effect scientific co-ordinator of EDPHiS and Editor-in-Chief of this set of reports.

We welcome comments and suggestions...

We welcome comments and suggestions on these Phase 1 reviews – on how they are useful, on what needs to be changed and on what in addition should be included – relative to their purpose within GPBH, which is to help ensure that proposed policies and actions are informed by evidence. We hope you enjoy reading them, and please use the EDPHiS website to let us know what you think: www.edphis.org.

Meanwhile work is now ongoing on more detailed assessments, and on some cross-cutting issues (methodology; what states of the environment have wide impacts across several health endpoints; information needs), as part of the EDPHiS

contribution to the Intelligence Partnership of GPBH; and we plan to complete and publish these in the coming months.

Fintan Hurley,
EDPHiS Principal Investigator
IOM Edinburgh, September 2010

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SUMMARY

Background

Childhood obesity is already epidemic in some countries and on the rise in others including both industrialised and increasingly developing nations. It is associated with substantial co-morbidity during childhood and adulthood. In Scotland for example, adult obesity is associated with nearly 500,000 cases of high blood pressure, 30,000 cases of type 2 diabetes, and similar numbers of cases of osteoarthritis and gout, and its consequences cost the NHS in Scotland an estimated £171 million in 2001.

In the UK, childhood obesity continues to be a major concern with 13.7% of 2-10 year olds currently being classified as obese. In Scotland, there has been an increase in overweight (including obesity) (defined as above the 85th BMI percentiles of the U.K reference curves) from 28.8% (boys) and 31.1% (girls) in 1998 to 37.3% (boys) and 32.8% (girls) in 2003.

Reviews have concluded repeatedly that obesity prevention and control in children have produced modest results. One aspect of this is that people find it difficult to operate in environments which increasingly promote a high energy intake and sedentary behaviours ("obesogenic" environment). Thus the success of obesity prevention at the population level is not likely to occur until environmental influences are identified and modified.

According to the Foresight report (2007), children are a critical area of policy overlap, and intervention in early life is likely to generate the highest average impact on obesity prevention. Therefore the scope of the measures taken to secure healthy children will be a key test, not only for any obesity strategy but also for child-specific policies.

This scoping report looks at the strength of evidence of the EDPHiS DPSEEA chains in childhood (≤ 10 years) obesity, from major reports and reviews.

DPSEEA chains

At the start of the project workshops were held with stakeholders to identify chains of Drivers, Pressures, States, Exposures, Effects and Actions according to the DPSEEA MODEL. Sixteen chains were produced for diet and 15 for physical activity. These chains were reviewed by four members of the EDPHiS team in Aberdeen and a revised list circulated to all members for further comments and modifications. Four chains for diet and four for physical activity were removed, all but one because they were not relevant to children. Three new chains were added for diet, three for physical activity and three for both diet and physical activity.

The chains are shown graphically in Figures 1 and 2 overleaf.

Figure 1: EDPHiS DPSEEA chains for diet and physical activity (GPBH)

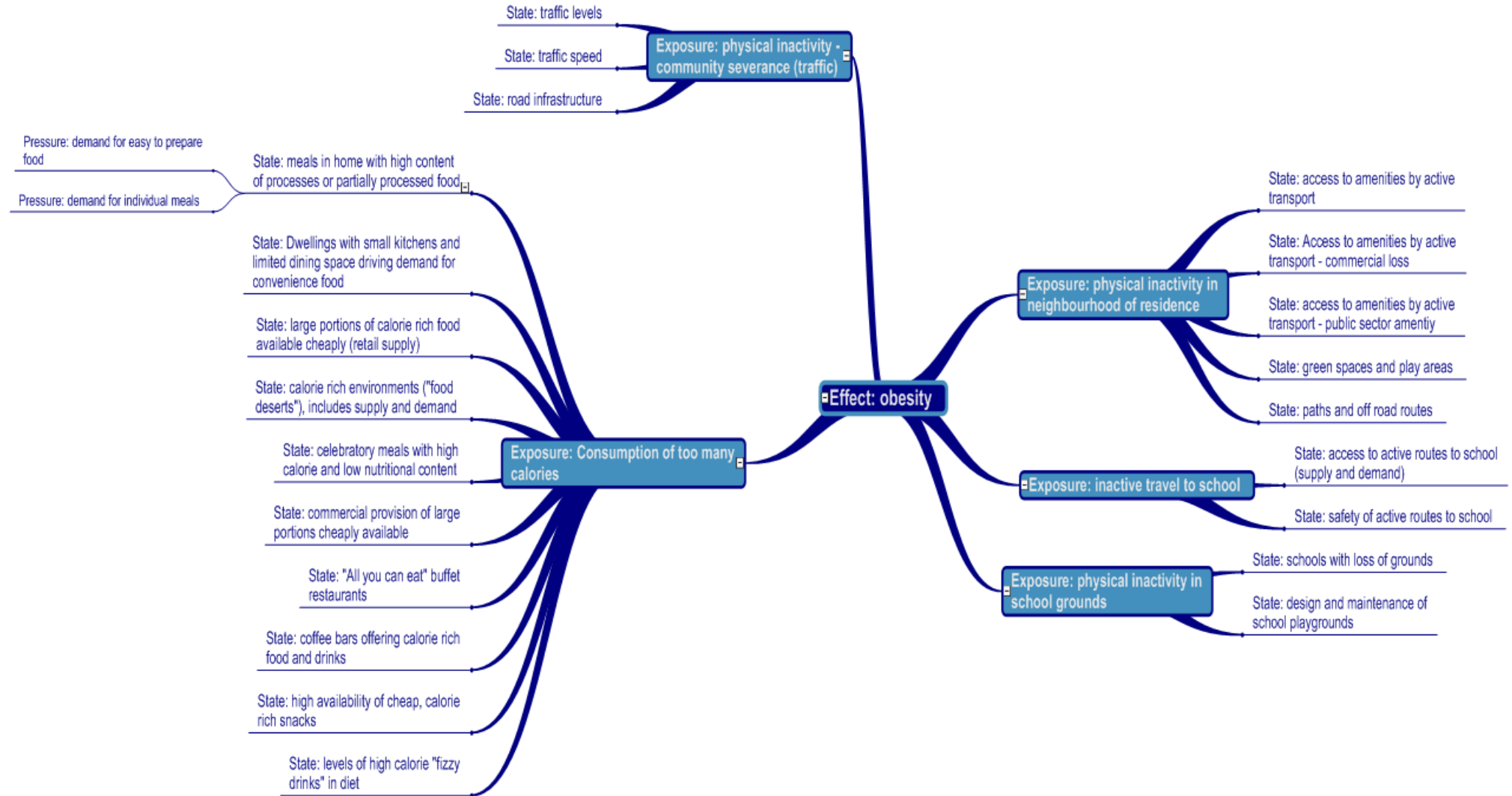
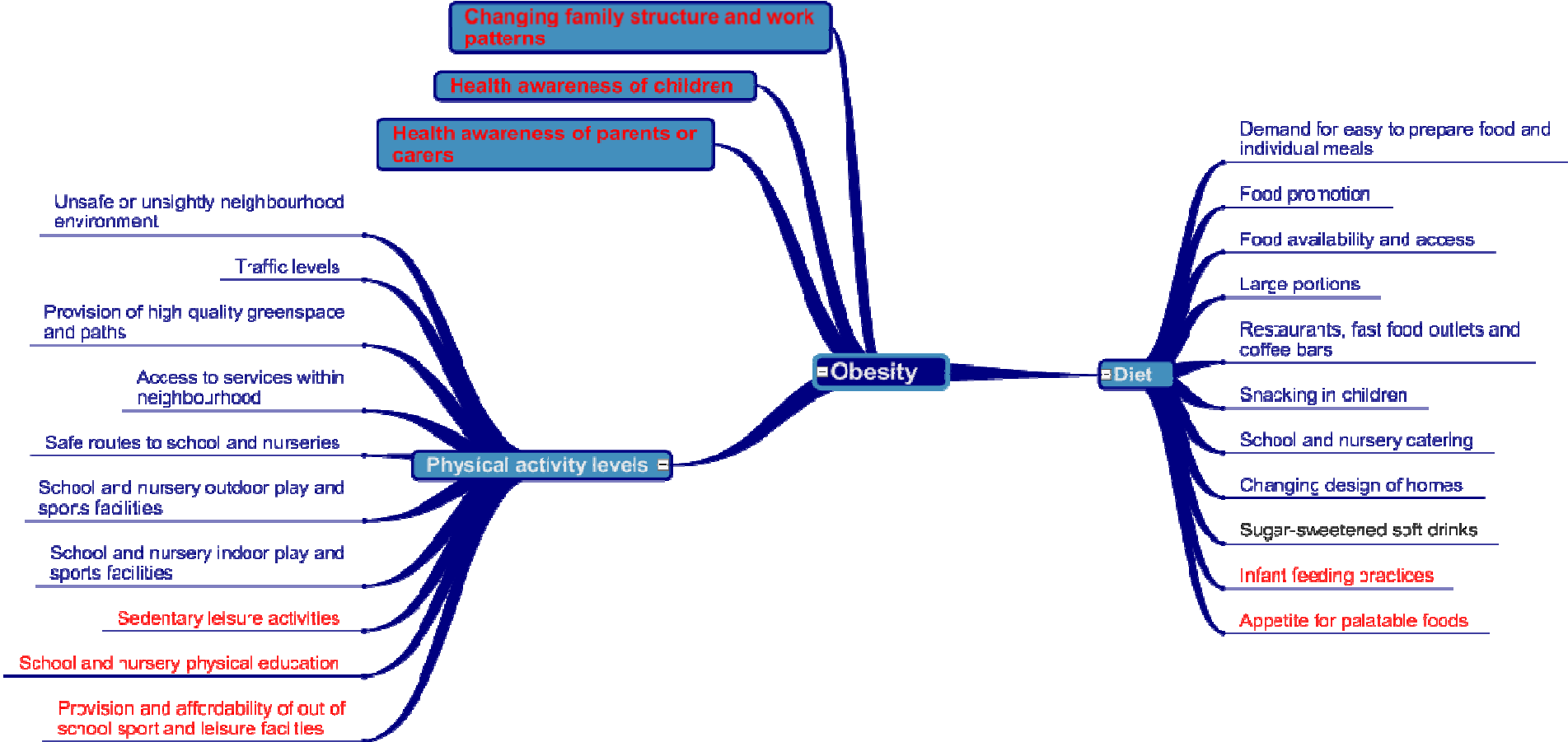


Figure 2: EDPHiS DPSEE chains for diet and physical activity (Obesity Case Study Team)

Those chains which have been developed solely by EDPHiS are indicated in red type. All others map to specific chains generated for Scottish Government by NHS Health Scotland.



Summary of evidence

Table 1: Review of evidence of revised EDPHiS DPSEEA chains by the Obesity Case Study Team
 (Evidence was obtained from major reports/reviews and a quick Pubmed search)
 (Chains: A= diet, B= physical activity, and C= both diet and physical activity)

Chain	Drivers, pressures and effect	Evidence of association with obesity
A1. Demand for easy to prepare food and individual meals	Availability of palatable processed foods; time pressure on working parents; Over-consumption of calories, excess weight gain	5 studies reported association, and 1 study reported no association
A2. Food promotion	Heavy marketing and advertising of unhealthy foods; low price of unhealthy foods; Over-consumption of calories, excess weight gain	1 study reported association, another reported no association
A3. Food availability	Supermarket dominance; readily available energy dense foods; Over-consumption of calories, excess weight gain	5 studies reported association, and 1 reported no association
A4. Large portions	Profit-led food industry, increasing portion size; Over-consumption of calories, excess weight gain	3 studies reported association, and 1 study reported no association
A5. Restaurants, fast food outlets and coffee bars	Food as a treat; availability of high fat, high sugar foods and drinks; Over-consumption of calories, excess weight gain	2 studies reported association and 1 study reported no association
A6. Snacking in children	Availability of snack foods; advertising of snack foods to children, free access to snacks; Over-consumption of calories, excess weight gain	2 studies reported direct association and 1 study reported no association
A7. School and nursery catering	Low budget and the need to produce foods which children will eat; Over-consumption of calories, excess weight gain	1 study made direct association (only school catering)
A8. Changing design of homes	Lack of food preparation and dining areas; TVs available during mealtimes; Over-consumption of calories, excess weight gain	No evidence
A9. Sugar-sweetened soft drinks	Availability of sugar-sweetened drinks; giving sweet drinks to children; Over-consumption of calories, excess weight gain	7 studies reported association and 1 study reported no association
A10. Infant feeding practices	Promotion of formula milk; Lack of post-natal support for breast feeding; Over-consumption of calories, excess weight gain	2 studies reported association and 1 study reported no association
A11. Desire for highly palatable foods	Appetite for fat and sugar; tendency for fat, sugar and salt to be added during food processing; Over-consumption of calories	2 studies reported association
B1. Unsafe and unsightly environment	Unsafe neighbourhoods for children; low levels of lighting, dog ownership; Low levels of physical activity; excess weight gain	No evidence
B2. Traffic levels	Increasing car ownership, lack of public transport alternatives; Children remain indoors or transported by car, Low levels of activity, excess weight gain	4 studies reported association and 2 studies reported no association

Table 1 contd

Chain	Drivers, pressures and effect	Evidence of association with obesity
B3. Provision of high quality greenspace and paths	Lack of play areas for cycling/walking for children; Children indoors or transported by car, Low activity, excess weight gain	4 studies reported association and 2 studies reported no association
B4. Access to amenities within a neighbourhood	Loss of services within neighbourhoods; Children indoors or transported by car, Low activity, excess weight gain	No evidence
B5. Safe routes to schools and nurseries	Increased car use; lack of walking/cycling routes; concerns about safety; low levels of activity and excess weight gain	3 studies reported association
B6. School and nursery outdoor play and sports facilities	Low priority for physical activity in schools; financial constraints; Less activity during and after school hours; excess weight gain	No evidence
B7. School and nursery indoor play and sports facilities	Low priority for physical activity in schools; financial constraints; Less activity during school hours; excess weight gain	1 study reported no association
B8. School and nursery physical education	Low priority for activity in schools; trend to reduce time for PE; Low levels of activity; excess weight gain	No evidence
B9. Lack of affordable out-of-school active leisure activities	Out-of-school activities only available for children of affluent parents; Low levels of activity; excess weight gain	2 studies reported association
C1. Health awareness of parents & carers	Lack of awareness of overweight, healthy foods and physical activity; Low levels of activity and high calorie intake	5 studies reported association
C2. Health awareness of children	Lack of awareness of overweight, healthy foods and physical activity; Low levels of activity and high calorie intake	6 studies reported association
C3. Changing family structure and work patterns	Extended family support less common; parental separation; parental stress; Low levels of activity; high calorie intake, excess weight gain	4 studies reported association with obesity
C4. Sedentary leisure activities	More time spent watching TV, DVDs and playing computer games; Low levels of activity and high snack food intake; excess weight gain	9 studies reported association with obesity

From table 2, it can be seen that evidence is strong in the following chains:

A6 (snacking in children), A9 (sugar-sweetened soft drinks), A10 (infant feeding practices), C1 (Health awareness of parents and carers), C2 (Health awareness of children), C3 (changing family structure and work patterns), and C4 (sedentary leisure activities).

Recommendations for phase 2

All the chains are deemed important at this stage, since evidence in this report was only obtained from major reports and reviews. It is however thought that a detailed systematic literature search will identify more evidence for some of the chains.

Although a large amount of literature exists for many chains, the majority of the evidence is derived from observational and cross sectional studies, some of which only provided weak evidence of association, and in some cases this was due to the quality of study design. Secondly since this evidence was obtained from major reports and reviews, it is hoped that a detailed literature search may identify more studies that establish strong causal relationships.

The focus of phase 2 would therefore be a systematic search of high quality evidence, particularly longitudinal studies and intervention studies, which are the preferred methods for analysing the relationship between dietary and physical activity factors and obesity development.

1. Childhood obesity: prevalence and consequences

Childhood obesity, which has been described as a global epidemic, has independent health risks, above and beyond its simple association with adult obesity [1]. Childhood obesity is associated with substantial co-morbidity during childhood [2], and also tracks into adulthood, particularly among those children who have one or two obese parents: 26-41% of children who are obese at pre-school age and 42-63% of obese school-age children become obese adults [3, 4, 5].

In Scotland adult obesity is associated with nearly 500,000 cases of high blood pressure, 30,000 cases of type 2 diabetes, and similar numbers of cases of osteoarthritis and gout, and its consequences cost the NHS in Scotland an estimated £171 million in 2001 [6, 7].

In the European Union (EU), there are an estimated 14 million overweight school aged children, of whom 20% are obese [8], and the combined number of overweight and obese children in the EU is rising by around 485,000 per annum [9]. Recent figures from the U.K Office of National Statistics indicate that childhood obesity continues to be a major concern with 13.7% of 2-10 year olds currently being classified as obese [10]. In Scotland, there has been an increase in overweight (including obesity) (defined as above or 85th BMI percentiles of the U.K reference curves) from 28.8% (boys) and 31.1% (girls) in 1998 (figure 1) to 37.3% (boys) and 32% (girls) in 2003 (figure 2) [11].

Figure 1: Prevalence of overweight including obesity in children in Scotland in 1998

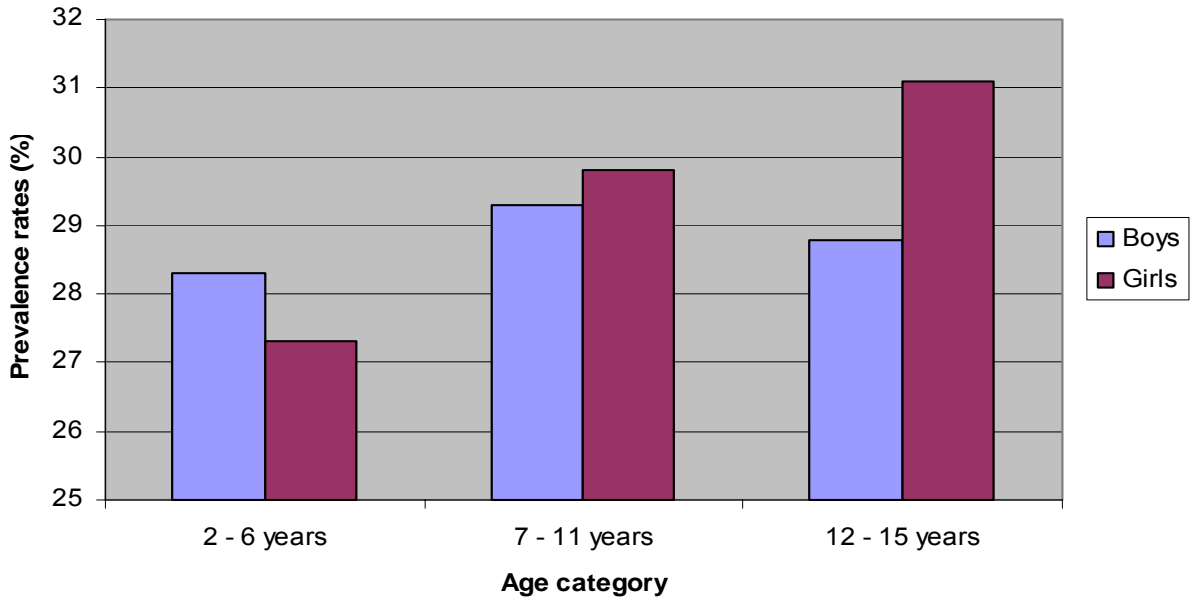
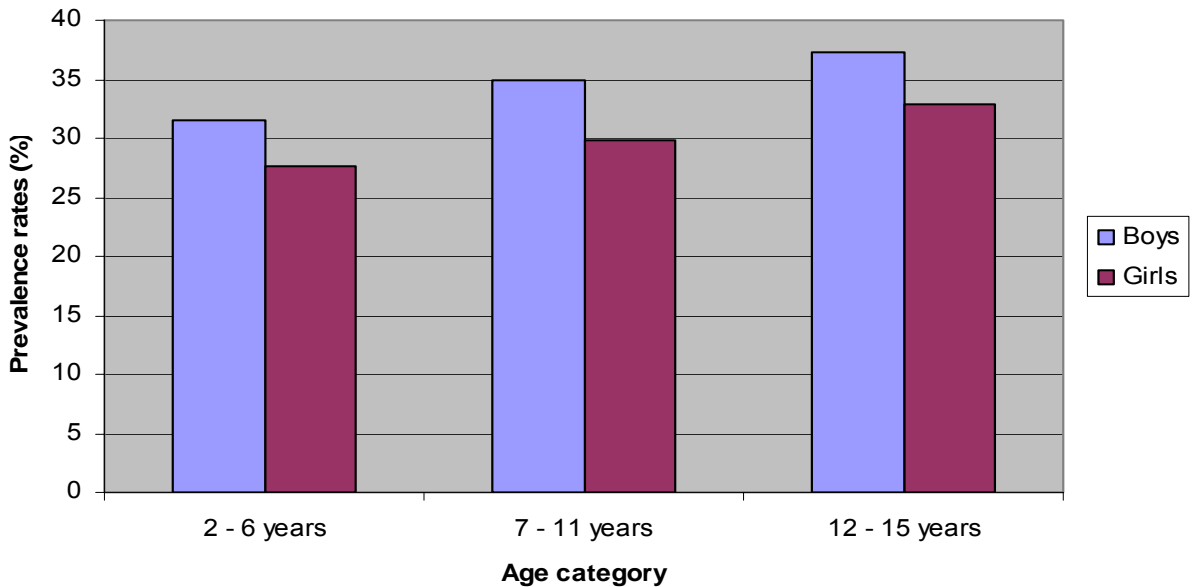
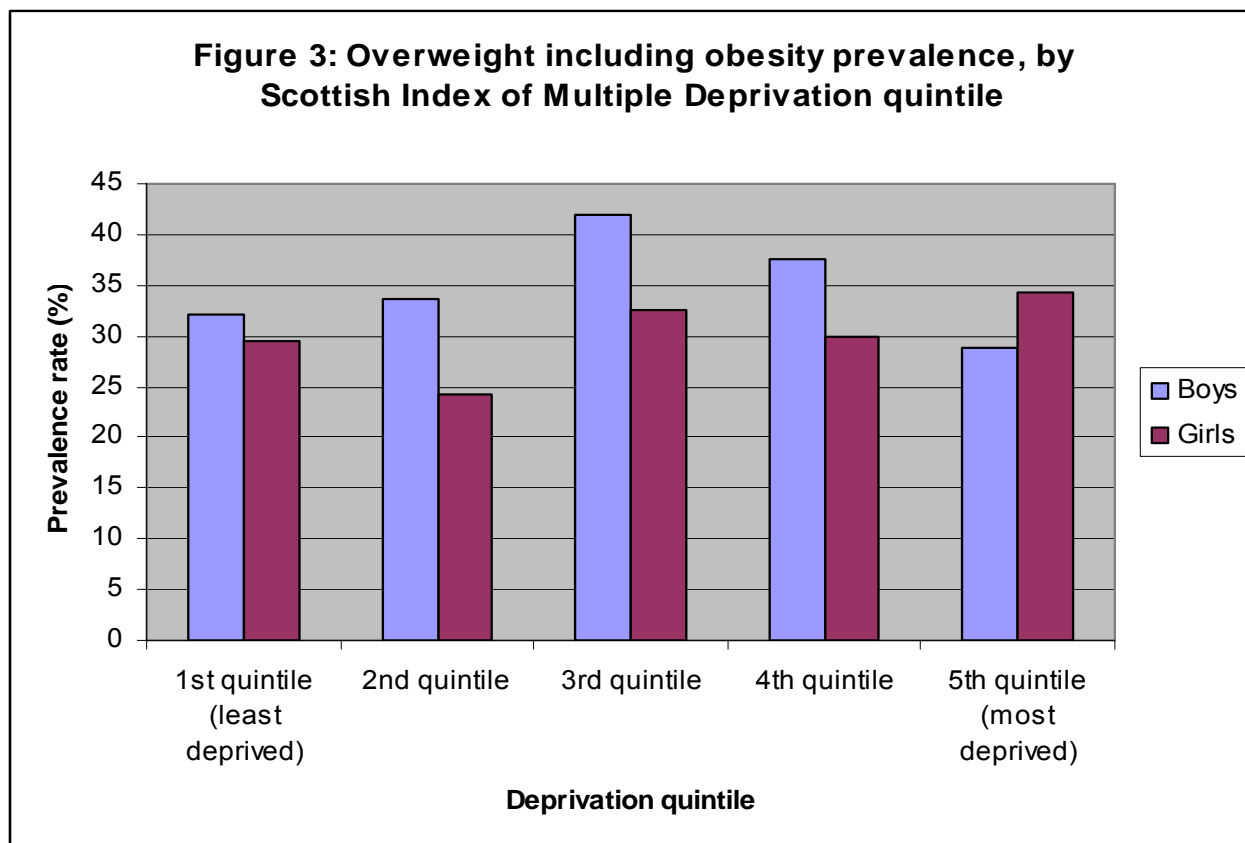


Figure 2: Prevalence of overweight including obesity in children in Scotland in 2003

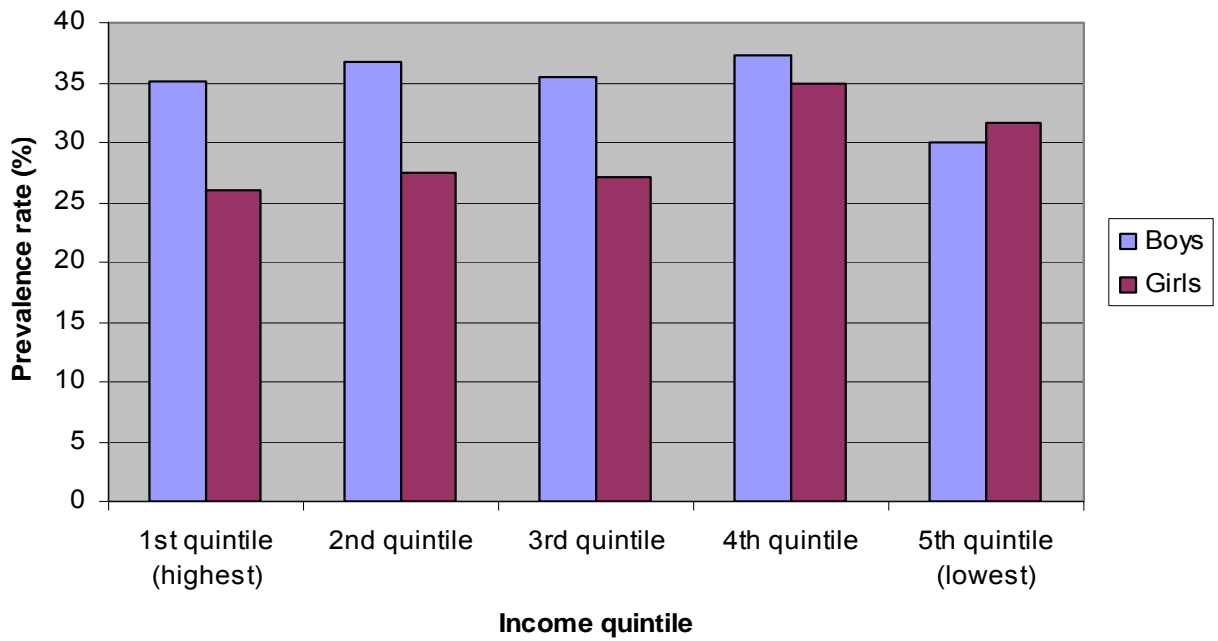


Childhood obesity in Scotland is also strongly socially patterned as elsewhere in the developed world. For boys, the prevalence of overweight including obesity was about 32.2% in the least deprived and 28.9% in the most deprived (figure 3). However for girls, the rate was around 29.5% in the least deprived to 34.3% in the most deprived (figure 3) [11].



Prevalence of childhood overweight and obesity in Scotland also differed by equivalised household income. Boys in the lowest income group/quintile had the lowest prevalence of overweight, including obesity (30.0%), while the prevalence for the other groups was fairly similar (ranging between 35.1% in the highest quintile and 37.3% in the 4th quintile) (figure 4). Among girls, the relationship between the prevalence of overweight and income was the reverse of that seen for boys. Those in the lowest income quintiles (4th and 5th) had the highest prevalence of overweight including obesity (34.9% and 31.7% respectively). The prevalence was very similar in the other quintiles (ranging between 26.0% and 27.5%) (figure 4) [11].

Figure 4: Overweight including obesity prevalence, by equivalised household income quintile



2. Environmental Determinants of obesity

Obesity occurs when there is positive energy balance between energy intake and expenditure. Energy-related behaviours are however affected by environmental factors [12]. Swinburn and Eggar [13] have termed the expression the “obesogenic” environment, defined as the ‘sum of the influences that the surroundings, opportunities or conditions of life have on promoting obesity in individuals and populations’.

Systematic reviews have concluded repeatedly that approaches to obesity prevention and management in children (e.g. educational messages on healthy eating and activity choices) have produced modest improvement, and in most cases short-lived improvements [14]. One aspect of this is because people find it difficult to operate in environments which increasingly promote a high energy intake and sedentary behaviours. In a study of school children in Rotterdam (The Netherlands), van der Horst et al [12], identified the following as behaviours that affect obesity in children:

- consumption of foods high in fat,
- fruit and vegetable consumption,
- soft drink consumption,
- skipping breakfast,
- portion sizes,
- dining out,
- watching TV,
- computer use,
- sports and physical education,
- transport to school, and
- leisure time activities.

Interest in the role that the environment plays in shaping the dietary and physical activity behaviours has therefore increased, as it has been suggested that the success of obesity prevention at the population level is not likely to occur until environmental influences are identified and modified [14]. Additionally, environmental or ‘systems level’ changes are cost-effective and have a more lasting effect on behaviour change because they become incorporated into structures, systems, policies, and socio-cultural norms [15].

According to the Foresight report (2007) [16], children are a critical area of policy overlap, and intervention in early life is likely to generate the highest average impact on obesity prevention. Therefore the scope of the measures taken to secure healthy children will be a key test, not only for any obesity strategy but also for child-specific policies.

3. EDPHiS Project

The Scottish government has set up a multi-disciplinary collaborative research project known as EDPHiS (Environmental Determinants of Public Health in Scotland) to quantify the evidence on the interconnections between people and their environments in relation to public health, in order to inform the development of public health policy and prevention strategies. As part of the EDPHiS project, we will review the evidence on environmental determinants of childhood obesity. This scoping report, which is a rapid review process, looks at the strength of evidence of environmental maps and chains in childhood (≤ 10 years) obesity, put together by the EDPHiS case study team from major reports and reviews. The second phase will be a systematic search of the literature.

4. EDPHiS DPSEEA chains put together by Obesity Case Study Team

At the start of the project workshops were held with stakeholders to identify chains of Drivers, Pressures, States, Exposures, Effects and Actions according to the DPSEEA MODEL. Sixteen chains were produced for diet and 15 for physical activity. These chains were reviewed by four members of the EDPHiS team (GO, GMcN, JM, SS) in Aberdeen and a revised list circulated to all members for further comments and modifications. Four chains for diet and four for physical activity were removed, all but one because they were not relevant to children. Three new chains were added for diet, three for physical activity and three for both diet and physical activity. Details of the changes from the original are given below:

Revised chains for diet

1. Demand for easy to prepare food and individual meals
2. Food promotion
3. Food availability and access
4. Large portions
5. Restaurants, fast food outlets and coffee bars
6. Snacking in children
7. School and nursery catering
8. Changing design of homes

New chains for diet

9. Sugar-sweetened soft drinks
10. Infant feeding practices
11. Appetite for palatable foods

New chains for diet and physical activity

12. Health awareness of parents and other carers
13. Health awareness of children
14. Changing family structure and work patterns

Revised chains for physical activity

15. Unsafe and unsightly environment
16. Traffic levels
17. Provision of high quality greenspace and paths
18. Access to services within a neighbourhood
19. Safe routes to schools and nurseries
20. School and nursery outdoor play and sports facilities
21. School and nursery indoor play and sports facilities

New chains for physical activity

22. Sedentary leisure activities
23. School and nursery physical education
24. Provision and affordability of out-of-school sport and leisure facilities

Diet chains removed

Adults and snacks
Adults and snacks in the workplace
Alcohol contribution to calorie intake
Lack of community demand for healthy diet

Physical activity chains removed

Workplaces discouraging active commuting (seen as not relevant to children)
Knowledge-based economy and use of workstations (seen as not relevant to children)

Adults, green-space and amenity provision within neighbourhoods (seen as not relevant to children)

Use of nanotechnology to remediate contaminated land (seen as not relevant to children)

The final chains (11 for diet, 3 for diet and physical activity and 10 for physical activity) are given in table 1.

Table 1: EDPHiS obesity case study: details of revised chains for diet and physical activity v1.3 (20th April 2009)

Chain	Drivers	Pressures	State	Exposure	Effect	Contexts
A1. Demand for easy to prepare food and individual meals	Availability of a wide range of palatable processed foods, esp. individual portions	Time pressure on working parents; not cooking seen as social norm; risk, waste and mess aversion, lack of motivation / desire to cook	Use of processed foods in meals for children	Over-consumption of calories	Excess weight gain	Working hours and motivation
A2. Food promotion	Heavy marketing of foods; low price of fat and sugar; high prices for 'healthy foods'; advertising of 'unhealthy' foods	BOGOFs and other promotions; low prices for unhealthy foods; promotion of food for celebrations; perceived cost of 'healthy eating'	Large quantities of high calorie foods easily available	Over-consumption of calories	Excess weight gain	Socio-economic
A3. Food availability and access	Supermarket dominance; increasing neighbourhood take-away shops	Readily available energy dense foods, increased choice of foods (children can all have different meals within the same family if desired)	Large quantities of high calorie foods easily available	Over-consumption of calories	Excess weight gain	Rural/urban
A4. Large portions	Profit-led food industry	Increasing portion size, desire for value for money	Large quantities of high calorie foods easily available	Over-consumption of calories	Excess weight gain	
A5. Restaurants, fast food outlets and coffee bars	Food as a treat; lack of planning control	Easy availability of large portions of low cost, high fat, high sugar foods and drinks	Large quantities of high calorie foods easily available	Over-consumption of calories	Excess weight gain	
A6. High energy snack consumption in children	Availability of child-oriented snack foods; multipacks; advertising of snack foods to children	Demand for snack foods; children have free access to food between meals	Large quantities of high calorie foods easily available	Over-consumption of calories	Excess weight gain	
A7. School and nursery catering	Low budget; need to produce foods which children will eat	Use of processed foods and lower quality fresh foods	Children avoid less energy-dense foods	Over-consumption of calories	Excess weight gain	
A8. Changing design of homes	Demand for lower cost, smaller size housing; availability of easy-to-prepare foods;	Lack of food preparation and separate dining space; TVs available during mealtimes	Tendency to graze; reduced social function of mealtimes	Over-consumption of calories	Excess weight gain	Socio-economic

Chain	Drivers	Pressures	State	Exposure	Effect	Contexts
A9. Sugar-sweetened soft drinks	Low cost and ready availability of sugar-sweetened soft drinks; tap water not always available; lack of knowledge of energy content of soft drinks	Heavy brand marketing; cultural acceptability of giving sweet drinks to young children	High consumption of sugar-sweetened soft drinks at or between meals	Over-consumption of calories	Excess weight gain	
A10. Infant feeding practices	Promotion of formula milk Lack of post-natal support for breast feeding	Cultural acceptability; social norm; financial need or desire to return to work	Low initiation and high early cessation of breast feeding	Mechanisms unclear- likely overconsumption of calories	Excess weight gain	
A11. Desire for highly palatable foods	Appetite for fat, sugar; marketing (low fat foods may be high in sugar)	Tendency for fat, sugar and salt to be added during food processing; 'masking' of fat and sugar by flavourings;	Easily available highly palatable foods	Overconsumption of calories		
B1. Unsafe and unsightly environment	Derelict land, crime levels, litter, low levels of lighting, dog ownership, graffiti	Neighbourhoods perceived as unsafe, especially for children	Children remain indoors or are transported by car	Low levels of physical activity	Excess weight gain and lower fitness	Rural/urban; socio-economic
B2. Traffic levels	Increasing car ownership, lack of public transport alternatives, busy lifestyles	Neighbourhoods perceived as unsafe, especially for children, time pressure to get to school if working parents	Children remain indoors or are transported by car	Low levels of physical activity	Excess weight gain and lower fitness	Rural/urban; weather Working?
B3. Provision of high quality greenspace and paths	Lack of priority in planning strategy, new housing developments away from amenities	Lack of play areas and opportunities for cycling and walking for children, perception of safety	Children remain indoors or are transported by car	Low levels of physical activity	Excess weight gain and lower fitness	Rural/urban; socio-economic
B4. Access to amenities within a neighbourhood	Pressure for new housing developments away from amenities, increasing car ownership,	Loss of services (shops, libraries, post-offices) within neighbourhoods	Children remain indoors or are transported by car	Low levels of physical activity	Excess weight gain and lower fitness	Rural/urban
B5. Safe routes to schools and nurseries	Increased car use for school transport; lack of walking and cycling routes	Concerns about safety; time pressures for working parents	Children transported by car	Low levels of physical activity	Excess weight gain and lower fitness	Rural/urban; working hours; weather

Chain	Drivers	Pressures	State	Exposure	Effect	Contexts
B6. School and nursery outdoor play and sports facilities	Low priority for physical activity in schools; concerns about safety; financial constraints	Limited and low quality playgrounds and school and nursery outdoor sports and play facilities	Less physical activity during and after school and nursery hours	Low levels of physical activity	Excess weight gain and lower fitness	
B7. School and nursery indoor play and sports facilities	Low priority for physical activity in schools; concerns about safety; financial constraints	Limited and low quality playgrounds and school and nursery indoor sports and play facilities	Less physical activity during school and nursery hours	Low levels of physical activity	Excess weight gain and lower fitness	
B8. School and nursery physical education	Low priority for physical activity in schools; concerns about safety; financial constraints; health and safety restrictions	Trend to reduced time for PE; PE generally physically inactive, health and safety restrictions	Children increasingly sedentary	Low levels of physical activity, reduced motor skills	Excess weight gain and lower fitness	
B9. Lack of affordable out-of-school active leisure activities	Financial constraints; lack of transport to leisure facilities	Out-of-school activities only available for children of more affluent parents	Children increasingly sedentary	Low levels of physical activity, reduced motor skills	Excess weight gain and lower fitness	Socio-economic
C1. Health awareness of parents & carers	Lack of awareness of overweight and health risks; overweight becoming the cultural norm	Lack of knowledge of and confusion about fat and sugar content of foods; lack of demand for healthy foods and physical activity	Lack of concern about diet and physical activity	Low levels of physical activity and high calorie intake	Excess weight gain and lower fitness	Socio-economic
C2. Health awareness of children	Lack of awareness of overweight and health risks; overweight becoming the cultural norm	Lack of knowledge (and confusion) of fat and sugar content of foods; lack of demand for healthy foods and physical activity	Lack of concern about diet and physical activity	Low levels of physical activity and high calorie intake	Excess weight gain and lower fitness	Socio-economic
C3. Changing family structure and work patterns	Extended family support less common; parental separation; smaller family size; loss of parental income during 'credit crunch'	Parental stress; children at out-of-school activities to allow parents to work	Less time and energy for child-centred family activities; succumbing to 'pester power', parents compensating for guilt	Low levels of physical activity and high calorie intake	Excess weight gain and lower fitness	Working hours
C4. Sedentary	Increased TV channels,	Increased time spent indoors;	Children increasingly	Low levels of	Excess	Weather,

Chain	Drivers	Pressures	State	Exposure	Effect	Contexts
leisure activities	low cost DVDs and computer games designed for children	increased exposure to advertising of snack foods, snacking while watching TV	sedentary	physical activity and high snack food intake	weight gain and lower fitness	working hours?

5. Review of evidence underlying maps/chains (EDPHiS)

In doing this rapid review, we drew from available evidence as contained in the following major reports; and a quick Pubmed search.

- (i) The Foresight Report on Tackling Obesities - Future choices (2nd edition) [16]
- (ii) British Medical Association 2005 report on prevention of childhood obesity [17]
- (iii) U.K Chief Medical Officer's Report entitled "At least five a week" (Evidence on the Impact of Physical Activity and its Relationship to Health). [18]
- (iv) Cochrane review on interventions for preventing childhood obesity [14]
- (v) Scottish Evidence-Based Child Health Unit (SEBCHU) Systematic Review on Prevention of Childhood Obesity [19]
- (vi) Scottish Public Health Observatory (ScotPHO) 2007 Report on Obesity in Scotland [6]
- (vii) Scottish Intercollegiate Guidelines Network (SIGN) Report on Obesity in Scotland: integrating Prevention with Weight Management. [20]

The key literature sources and a summary of the evidence/strength of associations identified for each chain are shown in table 2. For the purpose of this report, chains that are associated with increase in weight/BMI are designated as 'a', and those that show no association with weight/BMI increase as 'b'.

Table 2: Key sources of evidence for each chain

Chain	Drivers, pressures and effect	Source of evidence (a= associated with increase in weight/ b=no association with weight/BMI increa
A1. Demand for easy to prepare food and individual meals	Availability of palatable processed foods; time pressure on working parents; Over-consumption of calories, excess weight gain	a [21-25] b [26]
A2. Food promotion	Heavy marketing and advertising of unhealthy foods; low price of unhealthy foods; Over-consumption of calories, excess weight gain	a [27] b [28]
A3. Food availability	Supermarket dominance; readily available energy dense foods; Over-consumption of calories, excess weight gain	a [21-25] b [26]
A4. Large portions	Profit-led food industry, increasing portion size; Over-consumption of calories, excess weight gain	a [29-31] b [26]
A5. Restaurants, fast food outlets and coffee bars	Food as a treat; availability of high fat, high sugar foods and drinks; Over-consumption of calories, excess weight gain	a [32, 33] b [26]
A6. Snacking in children	Availability of snack foods; advertising of snack foods to children, free access to snacks; Over-consumption of calories, excess weight gain	a [34, 35] b [26]
A7. School and nursery catering	Low budget and the need to produce foods which children will eat; Over-consumption of calories, excess weight gain	a [36]
A8. Changing design of homes	Lack of food preparation and dining areas; TVs available during mealtimes; Over-consumption of calories, excess weight gain	No evidence
A9. Sugar-sweetened soft drinks	Availability of sugar-sweetened drinks; giving sweet drinks to children; Over-consumption of calories, excess weight gain	a [26, 37-42] b [43]
A10. Infant feeding practices	Promotion of formula milk; Lack of post-natal support for breast feeding; Over-consumption of calories, excess weight gain	a [26, 44] b [45]
A11. Desire for highly palatable foods	Appetite for fat and sugar; tendency for fat, sugar and salt to be added during food processing; Over-consumption of calories	a [32, 33]
B1. Unsafe and unsightly environment	Unsafe neighbourhoods for children; low levels of lighting, dog ownership; Low levels of physical activity; excess weight gain	No evidence
B2. Traffic levels	Increasing car ownership, lack of public transport alternatives; Children remain indoors or transported by car, Low levels of activity, excess weight gain	a [46-49] b [50, 51]
B3. Provision of high quality greenspace and paths	Lack of play areas and opportunities for cycling and walking for children; Children remain indoors or transported by car, Low levels of activity, excess weight gain	a [52-55] b [50, 51]

Table 2 contd.

Chain	Drivers, pressures and effect	Source of evidence (a= associated with increase in weight/BMI b=no association with weight/BMI increase)
B4. Access to amenities within a neighbourhood	New housing developments away from amenities, Loss of services (shops, libraries) within neighbourhoods; Children remain indoors or transported by car, Low levels of activity, excess weight gain	No evidence
B5. Safe routes to schools and nurseries	Increased car use for school transport; lack of walking and cycling routes; concerns about safety; low levels of activity and excess weight gain	a [52-54]
B6. School and nursery outdoor play and sports facilities	Low priority for physical activity in schools; financial constraints; Less activity during and after school hours; excess weight gain	No evidence
B7. School and nursery indoor play and sports facilities	Low priority for physical activity in schools; financial constraints; Less activity during school hours; excess weight gain	b [56]
B8. School and nursery physical education	Low priority for physical activity in schools; trend to reduce time for PE; PE generally physically inactive; Low levels of activity; excess weight gain	No evidence
B9. Lack of affordable out-of-school active leisure activities	Financial constraints; lack of transport to leisure facilities ; Out-of-school activities only available for children of more affluent parents; Low levels of physical activity, reduced motor skills; excess weight gain	a [35, 57]
C1. Health awareness of parents & carers	Lack of awareness of overweight, fat and sugar content of foods, healthy foods and physical activity; Low levels of activity and high calorie intake	a [58-62]
C2. Health awareness of children	Lack of awareness of overweight, fat and sugar content of foods, healthy foods and physical activity; Low levels of activity and high calorie intake	a [63-65] b [66, 67]
C3. Changing family structure and work patterns	Extended family support less common; parental separation; parental stress; Low levels of activity; high calorie intake, excess weight gain	a [64-66, 46]
C4. Sedentary leisure activities	More time spent watching TV, DVDs and playing computer games; increased time spent indoors; Low levels of activity and high snack food intake; excess weight gain	a [26, 35, 42, 47, 67-71]

6. Priorities for further literature review.

Although a large amount of literature exists for many chains, the majority of the evidence is derived from cross sectional studies, some of which only provided weak evidence or no evidence of a relationship with obesity but in some cases this was due to the quality of study design. Longitudinal studies are the preferred method for analysing the relationship between dietary and physical activity factors and obesity development [26, 72], and intervention studies for analysing the effectiveness of interventions. Most of the evidence contained in this report was obtained from observational and cross-sectional data, and hence they either fail to establish causal relationships or do not provide a high level of causal inference. Secondly since this evidence was obtained from major reports and reviews, it is hoped that a detailed literature search may identify more studies that establish strong causal relationships. The focus of the future literature search strategy will be for high quality evidence, particularly longitudinal studies and intervention studies. No chains were excluded on the basis of the initial literature search as it was felt important not to exclude any possibility at this scoping stage.

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Appendix: EDPHiS chains for obesity – correspondence with the Scottish Government Policy Team.

The Scottish Government policy team chains are based on the UK Government Foresight report systems map. This map identifies the relationship between all factors contributing to obesity; the strength of the evidence and direction of associations and key enablers and barriers to change in different sectors such as food production, media, healthcare, education and the built environment. The chains cover all age groups in the population. 14 chains have been selected: 9 for diet, 4 for physical activity and 1 for both diet and physical activity.

The chains for the EDPHiS project have been developed using the DPSEEA approach and were based on the basis of ‘brain-storming’ workshops held with a range of stakeholders, including practitioners. Although originally designed for all ages these chains have been revised to be relevant to the EDPHiS project target group of the Early Years, i.e. pre-birth to age 8. After consultation among the 7 academic members of the obesity case study team the chains have been refined to add some additional topics on which it was known that there was evidence in the literature, to avoid duplication and to select chains relevant to younger children. It was decided not to eliminate any chains at this stage, even if the case study team were not aware of evidence or could not envisage a related policy intervention. It was also agreed to keep a larger number of chains so that specific areas could be sought in the subsequent literature review. 24 chains have been agreed: 11 relating to diet, 10 to physical activity and 3 to both diet and physical activity.

Although the two sets of chains were developed for different age-groups using different approaches, it is useful to consider the common components of the two initiatives so that each may inform the other as far as possible. The table overleaf shows the Scottish Government chains and the closest match in the EDPHiS chains.

Four EDPHiS chains have no correspondence with SG chains: these are:

- School and nursery catering (child specific; also has recently been improved by legislation in Scotland)
- Changing design of homes (thought unlikely to have much evidence or to be amenable to policy intervention)
- Infant feeding (infant specific; is mentioned in SG chain 9)
- Changing family structure and work patterns (may be more relevant for child than adult obesity)

SG chain	Corresponding EDPHiS chain(s)	Comments
1. Tendency to graze	6 (High energy snack consumption in children)	Good correspondence
2. Portion size	4 (Large portions)	Good correspondence
3. Palatability of food offerings	5 (Restaurants, fast food outlets and coffee bars) 9 (Sugar-sweetened soft drinks)	Good correspondence; EDPHiS more specific
4. Force of dietary habits	11 (Desire for highly palatable foods)	Good correspondence
5. Food exposure	2 (Promotion of high fat and sugar foods and drinks) 5 (Restaurants, fast food outlets and coffee bars)	Good correspondence; EDPHiS more detailed
6. Food abundance	3 (Food availability and access)	Good correspondence
7. Energy density of food offerings	2 (Promotion of high energy density foods)	Good correspondence
8. Convenience of food offerings	1 (Demand for easy-to-prepare food and meals)	Good correspondence
9. Degree of primary appetite control	11 (Desire for highly palatable foods)	Good correspondence
10. Psychological ambivalence	2 (Promotion of high fat and sugar foods and drinks), 12 (Health awareness of parents) 13 (Health awareness of children), 22 (Sedentary leisure activities)	EDPHiS more detailed
11. Level of recreational activity	15 (Unsafe and unsightly environment), 17 (Provision of high quality greenspace and paths), 20 (School and nursery outdoor play facilities), 24 (Lack of affordable out-of-school leisure activities)	EDPHiS more detailed, relate to outdoor leisure (but see SG chain 14 below)
12. Transport activity	16 (Traffic levels), 17 (Provision of high quality greenspace and paths), 18 (Access to amenities within neighbourhood), 19 (Safe routes to schools and nurseries)	EDPHiS more detailed
13. Occupational activity	21 (School and nursery indoor play facilities), 23 (School and nursery physical education)	EDPHiS more child-specific, relates to schools and nurseries not workplace
14. Domestic activity	22 (Sedentary leisure activities)	EDPHiS more child-specific, relates to indoor leisure not housework