

# Force-fed

Does the food system constrict healthy choices for typical British families?

## Methods

### Introduction: Our typical family

Our 'typical' family is a middle-income household with children living in England. Middle-income households are defined as those with an equivalised household income that falls within the 3<sup>rd</sup> quintile for equivalised household income in the Family Resources Survey for the relevant year (Department for Work and Pensions, 2013). Equivalisation takes into account variations in the size and composition of households, reflecting the fact that a family of several people needs a higher income than a single individual so they can enjoy a comparable standard of living<sup>1</sup>. In 2013, households in the third quintile had an equivalised gross household income of between £24,388 and £34,268. For a family composed of two adults and two children, one child under 14 years of age and one child aged 14 years or over, this equates to a gross household income of between £37,000 and £52,000.

Although we mostly report results for middle-income households, estimates for the total population have been used where income data has not been available. Where possible, any demographic differences (e.g. by income or region) have also been noted.

## Chapter 1: dietary intakes

### Data source and population

UK National Diet and Nutrition Survey Rolling Programme (2008–2012)

Data from the UK National Diet and Nutrition Survey (NDNS) Rolling Programme (Waves 1–4 (2008/2009 to 2011/2012) was used to examine dietary intakes for each of our family members (NatCen Social Research, et al., 2015a). The NDNS is a rolling programme that aims to provide comprehensive, cross-sectional information on the dietary habits and nutritional status of individuals aged one-and-a-half years and older living in private households in the UK. A multistage probability sampling design is used to collect a random sample of primary sampling units (PSUs). Within these PSUs, private addresses are randomly selected for inclusion. Up to one adult and one child per household are randomly selected to take part in the survey.

Interviewers collect information on socio-demographics, and shopping, cooking and eating habits, and participants also complete a four-day food diary. For children aged 11 years and younger, parents or carers complete the four-day food diary. As part of the survey, a nurse takes anthropometric and blood pressure measurements, and collects blood samples for laboratory analyses. Blood sample analyses test for nutritional, routine metabolic and cardiovascular outcomes. More information on the NDNS methodology can be found elsewhere (Bates, et al., 2014).

The NDNS also includes results from a series of 24-hour urinary sodium surveys conducted on representative samples of the UK. Salt intake can be measured using urinary sodium excretion,

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<sup>1</sup> [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/432843/hbai-low-income-how-is-it-measured-infographic.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/432843/hbai-low-income-how-is-it-measured-infographic.pdf)

which reflects an individual’s sodium intake. More information on the urinary sodium surveys can be found elsewhere (Sadler, et al., 2011).

## Nutritional outcomes

### 1. Proportion of family members meeting UK diet and nutrition recommendations

The proportion of family members with mean daily intakes meeting UK dietary reference values (DRVs) for specific macronutrients and food groups outlined in Tables 1–2 were obtained.

Adequacy of micronutrient intakes was determined by calculating the proportion of family members with intakes below lower reference nutrient intakes (LRNIs) for key micronutrients (see tables 5.14 and 5.32 in National Diet and Nutrition Survey: Results from Years 1–4 (combined) of the Rolling Programme (2008/2009–2011/2012) for micronutrient LRNIs and RNIs (Bates, et al., 2014). The data are not shown but are referred to in the narrative report.

**Table 1:** Dietary reference values for key macronutrients

Macronutrient	Recommendation
<b>Total fat</b>	Population average no more than 35% of food energy for individuals aged 5 years and above.
<b>Saturated fatty acids</b>	Population average no more than 11% of food energy for individuals aged 5 years and above.
<b>Trans fatty acids</b>	Population average no more than 2% of food energy.
<b>Free sugars<sup>2</sup></b>	Population average no more than 5% of daily energy from food and drink for all ages.
<b>AOAC fibre<sup>3</sup></b>	Population average of at least 30g/day for adults; 15g/day for children aged 2–5 years; 20g/day for children aged 5–11 years; 25g/day for children aged 11–16 years; and 30g/day for adolescents aged 16–18 years.
<b>Salt</b>	Maximum intake of 6g/day for individuals aged 11 years and above; 5g/day for children aged 7–10 years; 3g/day for children aged 4–6 years.

<sup>2</sup> Free sugars’ includes all monosaccharides and disaccharides added to foods by the manufacturer, cook or consumer, plus sugars naturally present in honey, syrups and unsweetened fruit juices. The NDNS does not contain a derived variable for free sugars, only non-milk extrinsic sugars (NMES). NMES includes stewed, canned and dried fruit whereas the free sugars classification does not. Therefore, NMES are used but may result in a slight overestimate of free sugar intake.

<sup>3</sup> Latest recommendations for fibre are for AOAC fibre. The NDNS only contains estimates for Non-Starch Polysaccharides (Englyst method) so these values were adjusted by 1.33 as per [https://www.gov.uk/government/uploads/system/uploads/attachment\\_data/file/404094/ERG\\_eatwell\\_modeling\\_update\\_paper\\_final.pdf](https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/404094/ERG_eatwell_modeling_update_paper_final.pdf)

**Table 2:** UK recommendations for consumption of fruit and vegetables, red and processed meat, and oily fish

Food group	Recommendation
<b>Fruit and vegetables</b>	At least five portions per day for children aged 11 years and above. One portion is approximately equivalent to a serving of 80g.
<b>Red and processed meat</b> (Includes beef, lamb, pork, sausages, burgers and kebabs, offal, processed red meat and red meat)	No more than 70g/day for adults.
<b>Oily fish</b> (Includes anchovies, carp, trout, mackerel, herring, jack fish, pilchards, fresh and canned salmon, sardines, sprats, swordfish, fresh tuna and whitebait)	At least one portion per week for adults and children (140g).

## 2. Dietary salt intakes

Estimates for daily dietary consumption of salt for each family member and the proportion of individuals consuming more than the UK recommendations for dietary salt intake (Table 3) were calculated from the 24-hour urinary sodium excretion data using the equation: 17.1mmol of sodium excreted = 1 g of salt consumed. This assumes that the dietary intake of sodium is equal to the urinary output, and that all sodium in the diet comes from salt. Results for estimated daily salt intakes are based on 24-hour urine collections that were classified as complete.

**Table 3:** UK recommendations for dietary salt intake

Age group	Recommended maximum salt intake
4–6 years	3g/day
7–10 years	5g/day
11–18 years	6g/day
19–64 years	6g/day

Urine collections for adults aged 19 to 64 years were classified as ‘complete’ or ‘incomplete/unreliable’ by either of two criteria: ‘complete by PABA’, where the participant has reported taking three PABA tablets and the amount of PABA recovered in the urine collection is consistent with completeness; or ‘complete by claim’, where participants report taking fewer than three PABA tablets and reported collection of all urine passed during 23 to 25 hours, jointly referred to as ‘standard criteria’. For participants aged 11 to 65 years and over, only results of urine collections classified as complete by these criteria are included in the narrative report. Children aged four to 10 years are more likely to have difficulty swallowing tablets than older participants, so compliance with the PABA protocol is likely to be poorer in this age group, particularly at the

younger end of the age range. Therefore, for children aged four to 10 years, we also used an alternative child criterion where collections were regarded as 'complete' when they were claimed to include all urine passed for 23 to 25 hours from the start time irrespective of PABA excretion.

### **3. Proportion of energy intake from 'less healthy' and 'more healthy' foods.**

Nutrient Profiling (NP) Guidance from the Department of Health was used to investigate the proportion of energy obtained from 'healthy' foods based on a nutrient profile model developed by the Food Standards Agency in 2004/2005 (Department of Health, 2011). The model uses a scoring system whereby points are allocated based on the nutrient content per 100g of a food or drink. 'A' points are awarded for specific nutrients (energy, saturated fat, total sugar and sodium); and 'C' points are awarded depending on the content of fruit, vegetables and nuts in the food or drink. The final nutrient score is derived by subtracting the score for 'C' nutrients from the score for 'A' nutrients.

Any food item is considered 'less healthy' if the overall NP score is 4 or more and a drink item is considered 'less healthy' if the overall NP score is 5 or more. Using this model, a NP score was calculated for each food/drink entry in the NDNS dataset in order to classify it as 'more healthy' or 'less healthy'. The mean proportion of daily energy consumption from more healthy/less healthy foods was then calculated for each family member.

### **4. Proportion of energy intake 'ultra-processed' foods**

We used the NOVA classification for processed and ultra-processed foods to classify food entries in the NDNS dataset based on the degree of processing (Monteiro, et al., 2015). The classification can be used to group food entries into three main groups and sub-groups (Table 4). Group 1 contains unprocessed foods that are consumed without further processing and preparation, with the exception of washing, cutting and squeezing. The second group contains processed culinary ingredients, including plant oils, animal fats, and sugars or syrups. Group 3 contains processed foods, further divided into processed food products and ultra-processed foods. After each food entry in the NDNS was classified into one of the NOVA groups, we determined the proportion of each of our family member's daily energy intake that came from foods that were in Group 3 (processed and ultra-processed foods). We report the findings for ultra-processed foods only.

**Table 4: NOVA Classification**

Food groups and definition	Examples
<p><b>1. Unprocessed and minimally processed foods</b>            Unprocessed foods are of plant origin (leaves, stems, roots, tubers, fruits, nuts, seeds) or animal origin (meat, other flesh, tissue and organs, eggs, milk), shortly after harvesting, gathering, slaughter or husbanding. Minimally processed foods are unprocessed foods altered in ways that do not add or introduce any substance, but may involve subtracting parts of the food in ways that do not significantly affect its use. Minimal processes include cleaning, scrubbing and washing; winnowing, hulling, peeling, grinding, grating, squeezing and flaking; skinning, boning, carving, portioning, scaling and filleting; drying, skimming and fat reduction; pasteurisation and sterilising; chilling, refrigerating and freezing; sealing and bottling (as such); simple wrapping, and vacuum and gas packing. Malting, which adds water, is a minimal process, as is fermenting, which adds living organisms, when it does not generate alcohol.</p>	<p>Fresh, chilled, frozen and vacuum-packed vegetables and fruits; grains (cereals), including all types of rice; fresh, frozen and dried beans and other legumes (pulses), roots and tubers; fungi; dried fruits and freshly prepared or pasteurised non-reconstituted fruit juices; unsalted nuts and seeds; fresh, dried, chilled and frozen meat, poultry, fish and seafood; dried, fresh, pasteurised full-fat, low-fat and skimmed milk, and fermented milk such as plain yoghurt; eggs; teas, coffee and herbal infusions; tap, filtered, spring and mineral water.</p>
<p><b>2. Processed culinary ingredients</b>            Processed culinary ingredients are food products extracted and purified by industry from constituents of foods, or else obtained from nature, such as salt. Specific processes include pressing, milling and pulverising. Stabilising or purifying agents and other additives may also be used.</p>	<p>Plant oils; animal fats; sugars and syrups; starches and flours; uncooked 'raw' pastas made from flour and water, salt.</p>
<p><b>3. Ready-to-consume products</b></p> <p><b>3.1. Processed food products</b>            These are manufactured by adding substances such as oil, sugar or salt to whole foods, to make them durable and more palatable and attractive. They are directly derived from foods and recognisable as versions of the original foods. They are generally produced to be consumed as part of meals or dishes, or may be used, together with ultra-processed products, to replace food-based freshly prepared dishes and meals. Processes include canning and bottling using oils, sugars or syrups, or salt; and methods of preservation such as salting, salt-pickling, smoking and curing.</p> <p><b>3.2. Ultra-processed products</b>            These are formulated mostly or entirely from substances derived from foods, and typically contain little or no whole foods. They are durable, convenient, accessible, highly or ultra-palatable, often habit-forming. They are typically not recognisable as versions of foods, although they may imitate the appearance, shape and sensory qualities of foods. Many ingredients are not available in retail outlets. Some ingredients are directly derived from foods, such as oils, fats, flours, starches and sugar. Others are obtained by further processing of food constituents. Numerically, the majority of the ingredients are preservatives; stabilisers, emulsifiers, solvents, binders and bulkers; sweeteners, sensory enhancers, colours and flavours; and processing aids and other additives. Bulk may come from added air or water. Micronutrients may fortify the products. Most ultra-processed products are designed to be consumed by themselves or in combination as snacks. They displace food-based, freshly prepared dishes and meals. Processes include hydrogenation, hydrolysis; extruding, moulding and reshaping; and pre-processing by frying or baking.</p>	<p><b>3.1. Processed food products</b>            Canned or bottled vegetables and legumes (pulses) preserved in brine; peeled or sliced fruits preserved in syrup; tinned whole or pieces of fish preserved in oil; salted nuts; un-reconstituted processed meat and fish such as ham, bacon and smoked fish; cheese.</p> <p><b>3.2. Ultra-processed products</b>            Chips (crisps), many types of sweet, fatty or salty snack products; ice-cream, chocolates, candies (confectionery); French fries (chips), burgers and hot dogs; poultry and fish 'nuggets' or 'sticks' ('fingers'); breads, buns and cookies (biscuits); breakfast cereals; pastries, cakes and cake mixes; 'energy' bars; preserves (jams), margarines; desserts; canned, bottled, dehydrated, packaged soups and noodles; sauces; meat; yeast extracts; soft, carbonated, cola and 'energy' drinks; sugared, sweetened milk drinks, condensed milk and sweetened including 'fruit' yoghurts; fruit and fruit 'nectar' drinks; instant coffee, cocoa drinks; no-alcohol wine and beer; pre-prepared meat, fish, vegetable, cheese, pizza and pasta dishes; infant formulas, follow-on milks and other baby products; 'health' and 'slimming' products such as powdered or fortified meal and dish substitutes.</p>

(Adapted from: Food Classification Systems Based on Food Processing: Significance and Implications for Policies and Actions: A Systematic Literature Review and Assessment. Curr Obes Rep. 2014, 3: 256)

## Analyses

The NDNS dataset was obtained from the UK data service (UK Data Service, 2015). Statistical analysis was conducted in Stata (version SE 14.0; Stata Corporation). Weights and the 'svy' survey command were used when conducting analyses to allow for the complex sample design. Nutrition intake estimates arising from NDNS data are reported for male and female adults (aged 19 to 64 years) and children (aged one-and-a-half to three four to 10 years and 11 to 18 years) living in middle-income households in England (n=511). All analyses using NDNS data were conducted using data from all four survey years (2008–2012)<sup>4</sup>.

## Chapter 1: health consequences

### Data sources and population

#### Health Survey for England 2013

Data on health outcomes for each family member were obtained from the 2013 cross-section of the Health Survey for England (HSE), an annual survey of a nationally representative sample of the general population living in households in England (NatCen Social Research, et al., 2015b). The HSE utilises a multistage stratified probability sampling design with postcode sectors as the primary sampling unit and the Postcode Address File as the sampling frame for households. Interviewers visit participants to collect data on demographic and socioeconomic indicators, information on health and health-related behaviours, and take height and weight measurements. With consent, nurses visit to take additional measurements, collect biological samples and record information on medication use. Detailed information on the HSE methods and results can be found elsewhere

#### Children's Dental Health Survey 2013

The 2013 Children's Dental Health (CDH) Survey is a series of national children's dental health surveys that have been carried out every 10 years since 1973 (Health & Social Care Information Centre, 2013). The CDH survey 2013 used a clustered, stratified, multistage design to randomly select a representative sample of children aged five, eight, 12 and 15 years attending state and independent schools across England, Wales and Northern Ireland. The sample included academies and free schools in England, but excluded special schools.

Data was collected through a dental examination carried out by NHS qualified dentists and nurses, a self-completion questionnaire completed by 12- and 15-year-olds, and a parental self-completion questionnaire. The survey provides information on clinical indicators of oral health, reported perceptions of oral health, and behaviours and dental service usage patterns captured from the parental and pupil questionnaires. A total of 13,628 children were sampled. Dental examinations were carried out on 9,866 children. Response rates varied by age cohort: 70% in five-year-olds; 65% in eight-year-olds, 83% in 12-year-olds and 74% in 15-year-olds. The response rate for the self-completion questionnaire children aged 12 and 15 years who agreed to a dental examination was 99.6%. The overall response rate for the parental questionnaire was 43%. Further information on the

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<sup>4</sup> All years of the NDNS rolling programme were used to increase sample size.

CDH survey design and results can be found elsewhere (Health & Social Care Information Centre, Child Dental Health Survey 2013, England, Wales and Northern Ireland, 2013).

## Health outcomes

### Overweight/obesity

The Health Survey for England (2013) contains information on anthropometric measurements: the interviewer took height and weight, and the nurse took waist measurements. This data was used to determine rates for overweight and obesity for adults and children living in middle-income households in England<sup>5</sup>.

### Diabetes

The HSE 2013 collected information on self-reported doctor-diagnosed diabetes. Objective blood measurements of high blood sugar levels for adults aged 16 years and over are also taken. The HSE interview makes no distinction between Type 1 and Type 2 diabetes because of changing patterns of the disease. In previous years, it was assumed that participants who reported having doctor-diagnosed diabetes before the age of 35 and who were having insulin therapy at the time of the survey had Type 1 diabetes, and all other participants with doctor-diagnosed diabetes were classified as having Type 2 diabetes. As increasing numbers of people are now being diagnosed with Type 2 diabetes below the age of 35, and some adults with Type 2 diabetes are now prescribed insulin therapy, these distinctions are no longer reliable. The estimates presented in the report therefore do not distinguish between Type 1 and Type 2 diabetes.

### Dental health

The Children's Dental Health Survey 2013 was used to identify dental caries in children aged five, eight, 12 and 15 years living in England. Obvious decay experience is the traditional measure used in dental epidemiology surveys seeking to establish the number of 'cavities' to be 'filled'.

### Analyses

The HSE dataset was obtained from the UK Data Service (UK Data Service, 2015). Statistical analysis was conducted in Stata (version SE 14.0; Stata Corporation). Weights and the 'svy' survey command were used when conducting analyses to allow for the complex sample. Estimates for adult overweight/obesity and diabetes outcomes were age-standardised to allow comparisons between groups after adjusting for the effects of any differences in their age distributions. All age standardisation has been undertaken separately within each sex, expressing male data to the overall male population and female data to the overall female population. The HSE dataset contains a variable for net household equivalised income. This was used to identify households with an equivalised household income within the 3<sup>rd</sup> quintile in the Family Resources Survey for 2013. Health outcome estimates using HSE data are reported for male and female adults (aged 19 to 64 years) and children (aged four to 10 and 11 to 18 years) living in middle-income households in England (n=1455).

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<sup>5</sup> Data for adults was age-standardised to allow comparisons between groups after adjusting for the effects of any differences in their age distributions. All age standardisation was undertaken separately within each sex, expressing male data to the overall male population and female data to the overall female population.

Estimates for dental caries in children were taken directly from the Children's Dental Health Survey 2013 report tables for England. It was not possible to obtain data from the Children's Dental Health Survey 2013 stratified by income level. Therefore, estimates provided in the report are for all children living in England.

## **Chapter 2: Food eaten and thrown away**

### **Data sources and population**

#### Living Costs and Food Survey (2013)

The Living Costs and Food Survey (LCF), previously known as the Expenditure and Food Survey, is a national cross-sectional survey of private households conducted in the United Kingdom (ONS, et al., 2015)

The LCF employs a multi-stage stratified random sample with clustering. Addresses are drawn from the Postcode Address File (PAF). The LCF collects information on purchasing at the household and individual level. Each individual aged 16 and over in the household visited is asked to keep a diary record of daily expenditure for two weeks. Information about regular expenditure, such as rent and mortgage payments, is obtained from a household interview along with retrospective information on certain large, infrequent expenditures, such as those on vehicles. More information about the LCF can be found elsewhere (Bulman, et al., 2013).

#### Horizons data (2013/2015)

Horizons is a source of foodservice insights, data and trends for the UK, European and global foodservice markets (Horizons, 2015). Horizons produce a report, 'Eating Out-Look', from survey research conducted in the eating-out market. Eating Out-Look is a panel survey run quarterly, twice with consumers and twice with operators (Horizons, 2015). The survey collects information on eating-out behaviour from representative samples of 2,000 consumers and 300 operators, including frequency of eating out, where people eat out and who eats out the most, among others. Both the consumer and operator survey are conducted online.

#### Kantar Worldpanel (2013)

Data on household retail food and drink purchasing for 52 weeks ending 26 May 2013 was obtained from Kantar Worldpanel (Kantar, 2015). Kantar Worldpanel conducts consumer panel research in the UK. Purchasing data is collected by a continuously reporting panel of 30,000 demographically representative British households. Panellists are asked to record details of all food and drink purchased for household consumption, including volumes bought and prices paid. The sampling frame for Kantar's survey was Great Britain (n=32,545). More information about the data can be viewed elsewhere (Kantar, 2015).

#### School Lunch Take-up Survey (2013/2014)

The School Lunch Take-up Survey, commissioned by the Department for Education, was conducted in the 2013/2014 financial year (Department for Education, 2015). The survey is a source of

independent data on school lunch take-up, school lunch prices, types of catering provision and school's perceptions of school lunch take-up. Although the sample frame was all primary, special and secondary schools in England, the report contains findings from only primary and special schools due to secondary schools' low response rate. Schools were stratified by school phase, type of school, size and the proportion of pupils eligible for school meals. Schools completed the survey either via an online Excel spreadsheet or by telephone. The overall response rate for the survey was 19% of the sample. The response rate varied by school type, i.e. primary, special or secondary.

### Household Food and Drink Waste in the UK (2012)

WRAP (Waste & Resources Action Programme) is a registered charity that works to help businesses, individuals and communities in the UK to reduce waste, increase sustainability and use resources more efficiently (WRAP, 2016). WRAP conducted research into the quantity and types of food and drink waste generated by UK households in 2012 (WRAP, 2013). The estimates were derived from a combination of three main data sources:

1. Data from waste audits commissioned by local authorities and data submitted to WasteDataFlow, a web-based system for municipal waste data reporting by UK local authorities (WasteDataFlow, 2016).
2. Data collected from 1800 consenting households in 2013 on the weight and types of food and drink wasted.
3. Diary records of waste from all disposal routes from the home in 2012.

More information about the Household Food and Drink Waste in the UK report can be found elsewhere (WRAP, 2013).

## **Expenditure and waste outcomes**

### **Where do we buy our food and how much do we spend?**

The Living Costs and Food Survey (LCF) 2013 was used to look at household-level expenditure on food and drink purchased for household consumption, as well as food consumed outside of the home. Data on total spending on retail food and drink, household shopping frequency, spend per household and spend per trip was obtained from Kantar. Kantar also provided data on the grocery market share of major retailers and provided a list of the top 80 product categories in terms of annual spending. The top 20 items in this list accounted for 50% of total annual consumer spending on retail food and drink purchased for household consumption. As Kantar data was for all UK households, expenditure data used in the main narrative was obtained from the LCF data rather than Kantar data to allow a focus on middle-income households with children.

### **Eating at school**

Estimates for school lunch uptake in primary and special schools and differences in uptake between free and paid lunches were obtained from the School Lunch Take-up Survey 2013/2014.

### **Eating out**

Horizon's Eating-Outlook survey provided information on how often consumers in the UK eat outside of the home. Eating out expenditure estimates provided in the narrative report were obtained from the LCF 2013 survey. The LCF survey recorded expenditure on different items defined as either 'household' or 'eating out' expenditure, whereby household expenditure covers all food

and drink bought for consumption at home and eating out covers food that never enters the household. Eating out expenditure includes expenditure on items such as restaurant meals, school meals and snacks, and meals bought and eaten at work.

According to Horizon's data, McDonalds UK was the Quick Service Restaurant with the biggest market share in 2013 so we looked in more detail at their menu and the prices for different foods. Information on the nutritional composition of menu items, including the amount of fat, saturated fat, salt, sugar and energy per 100g of the product, was obtained from the McDonalds website (McDonalds, 2015).

The World Health Organization Regional Office for Europe Nutrient Profiling Model was used to identify whether each food and drink item on the menu would be restricted from marketing to children (WHO Regional Office for Europe, 2015). Food and drink items were classified into one of the categories listed in the model. Once the appropriate category was identified, the nutritional content of the food product was crosschecked against the thresholds of the model. If one or more of the nutrients were above the set threshold, the item was not permitted to be marketed to children. For some items, added sugars and non-sugar sweeteners were not permitted in any amounts. Nutritional information on these was not available on the nutrition information section of the website, however the ingredients list for each product was checked to look for items that would contain or be classified as added sugars or non-sugar sweeteners. Prices for McDonald's menu items were obtained from a high street store.

The WRAP Household Food and Drink Waste in the UK report lists estimates for avoidable household food and drink waste from UK households for a number of food items. Estimates are presented as weight of total avoidable waste (tonnes) and in terms of the cost of avoidable waste (£million per year). Avoidable waste is a classification used in the report relating to food and drink thrown away that was, at some point prior to disposal, edible, e.g. milk, lettuce, fruit juice, meat (e.g. Unavoidable waste would include meat bones, egg shells etc.).

The WRAP estimates for cost of avoidable waste for particular food items were matched as best possible with the top 20 products in the Kantar list of product categories ranked in terms of consumer spending on retail food and drink. For each product in this list, we calculated the cost of avoidable waste as a proportion of total annual spending using the Kantar figures for annual spending on each product.

## Analyses

The LCF dataset was obtained from the UK Data Service (UK Data Service, 2015). Statistical analysis was conducted in Stata (version SE 14.0; Stata Corporation). The unit of analyses for expenditure data using the LCF survey was the household. The LCF assigns weights to cases to correct for unit non-response in the survey sample. Expenditure estimates using data from the LCF survey are presented for middle-income households in England (n=192).

The LCF dataset contains a variable for net household equivalised income. This was used to identify middle-income households with an equivalised household income within the 3<sup>rd</sup> quintile for the Family Resources Survey for 2013. The sample was also limited to these households with one or more children (n= ~192 households).

## Chapter 3: Drivers of food choice: labelling and formulations data

Kantar provided a list of the top 80 product categories in terms of consumer spending, the market share of each item, and the brand leader and brand detail (e.g. Warbutons crumpets) for each of the 80 products.

The Kantar data was used to determine 4 four commonly consumed processed products (bread, breakfast cereals, ready meals and yoghurts) in which healthy products should be readily available. Each product in the list of top 80 items was randomly assigned a retailer based on the retailer market share. For each processed product category, a sample of all available unique products available in the retailer's online grocery store was taken (one day only in 2015). For each sample, information was collected on: the number of available products; the types of front-of-pack labelling used and the levels of nutrients reported (e.g. green, orange, red labels); the proportion of products on promotion; and the proportion of products with health or nutrient claims.

The remaining data in chapter 3 is drawn from secondary sources, referring where possible to systematic reviews.

## Chapter 4: The food system drivers of food price

Chapter 4 of the report is intended to illustrate the ways in which the policy environment impacts on the price of items in our typical family's diet. We randomly assigned supermarkets to all items in the shopping basket based weighted by supermarket market share (see above). We then chose the brand leader of four food categories which appeared in the top 20 items of the shopping basket to illustrate different problem areas of the diet: vegetables (white potatoes, own label, randomly assigned to Tesco), fresh beef (lean mince, own label, randomly assigned to Asda), fresh poultry (whole chicken, own label, randomly assigned to Asda) and yoghurt (Müller corner). Vegetables were chosen because our typical family eats too little fruit and vegetables and fibre. Meat was chosen because members of our typical family eat too much red and processed meat, and because meat has a significant environmental-footprint. Yoghurts were chosen because they illustrate a product for which healthy options are available as well as processed, high sugar options. We then used key informant interviews to trace the food back to the farm. This was possible for the meat and potatoes but not for the yoghurt for which Müller was not willing to provide the information needed. We used key informant interviews, policy analysis (below) and government data to examine the policies affecting price.

For the analysis of the yoghurt, in the absence of information from Müller we had to deduce the amount of sugar and milk in the yoghurt from the calories and calcium levels in the product, using where relevant McCance and Widdowson as a reference. Average price data on Müller crunch yoghurts and Natural yoghurt came from a snapshot analysis of prices in all four major supermarkets on the last week day in June and November 2015. Promotions were captured in this price data which was sourced from Mysupermarket.com. Natural yoghurt price analysis included all types of natural yoghurt but the price per kcal data was based on whole natural yoghurt.

## Policy analysis

The policies that have an influence on the food system are summarised throughout the document. They were extracted from an Evidence Summary prepared by the Food Foundation in the initial stages of preparing a Food Environment Policy Index (Food-EPI) for the United Kingdom (UK). The methods for Food EPI have been developed by the International Network for Food and Obesity/ NCDs Research, Monitoring and Action Support (INFORMAS) and piloted in New Zealand. The goal of the Food-EPI is to identify and prioritise actions needed to address critical gaps in government policies and infrastructure support. The first step in the process is to review evidence and policy documents that relate to the food environment, and to compile an Evidence Summary. The Food-EPI has been fully completed in New Zealand and is being undertaken in several other countries, including Thailand, Mexico and South Africa.

Food-EPI methods are described in detail by Swinburn et al. in *The Lancet* (2015), Vandevijvere, S and Swinburn, B. in the *British Medical Journal* (2014) and Swinburn et al. *Obesity Reviews* (2013).

The Evidence Summary for the UK Food-EPI was based on a review of government legislation, plans and policies, parliamentary committee reports, expert advisory group reports and major authoritative evidence-based reports pertaining to food environments.<sup>6</sup> These were derived from an internet search of organisation databases and grey literature. A total of 211 resources were cited in the draft Evidence Summary document by 5 November 2015.

The policies set out in this document cover the UK, which is made up of four countries: England, Wales, Scotland and Northern Ireland. Devolution took place in 1999 when powers were transferred from the UK Parliament in Westminster to the [Scottish Parliament](#), the [National Assembly for Wales](#), and the [Northern Ireland Assembly](#). England is the only country of the UK that does not have a devolved Parliament or Assembly, and the Westminster Parliament decides on English affairs. As a result of devolution, policies in certain areas – including health, agriculture, education, the environment, and local government – is determined by the devolved powers. The UK is a member of the European Union (EU), so all four nations are subject to EU legislation. Specific legislation and policies that apply differently in England, Scotland, Wales or Northern Ireland are noted.

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<sup>6</sup> **Food environment** is defined as the collective physical, economic, policy and sociocultural surroundings, opportunities and conditions that influence people's food and beverage choices, and nutritional status.

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