Appendix A. Dietary data collection and editing

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A.1 Diary methodology

Previous National Diet and Nutrition Surveys (NDNS) assessed diet using weighed records of several days duration, seven days for adults aged 19 to 64 years[1] and young people aged four to 18 years[2] and four days for children aged 1.5 to 4.5 years[3] and people aged 65 years and over.[4] Since weighed records incur considerable burden for participants, the decision was made to change the method to one with lower participant burden for the new rolling programme.

A comparison study was carried out in 2007 to compare two potential methods: four repeat 24-hour recalls and a four-day estimated diary[5] for 1067 individuals aged four years and older. Half the sample participated in interviewer-administered 24-hour recalls (repeated on four non-consecutive days) and half kept a four-day estimated (unweighed) diary on consecutive days.

The NDNS Project Board considered the findings and decided that the four-day estimated diary would be the dietary assessment method used in the NDNS rolling programme because:

- response rates for the two methods were similar: 47% for the unweighed diary and 49% for the 24 hour recall
- there was no evidence in the scientific literature of major differences between the methods and
- the diary was considered on balance to be a more flexible and adaptable method to cover the wide population age range in the survey. In particular it was thought to be more suitable for young children who may have more than one carer

The diary method is widely used in the UK, in large studies such as the MRC National Survey of Health and Development (NSHD) (1946 British Birth

Cohort),[6] the EPIC Norfolk study,[7] the UK Women's Cohort Study in Leeds[8] and the Avon Longitudinal Study of Parents and Children (ALSPAC) cohort.[9]

A.2 Method

For the rolling programme, several versions of the diary were developed, for different age groups:

- An A5 diary for adults – also available in A4 size for those with vision or writing difficulties
- An A4 diary for children
- An A5 diary for toddlers to be completed by adults

Each version included example pages appropriate to the age group to show how to complete the diary and how much detail to include. For children aged 11 years or younger, a parent/carer was asked to complete the four-day diary with help from the child as appropriate. Children aged 12 years and over were asked to complete the diary themselves but details were confirmed with others, where necessary. Participants were asked to record food and drinks consumed both at home and away from home, and were therefore asked to take the diary with them when away from home. For young children, a teacher or friend's parent, for example, might then complete parts of the diary for the child.

Interviewers undertook three visits with each participant. At the first visit, the interviewer placed the diary. The second was a brief visit to check for compliance, answer questions or deal with problems and review the diary to identify and edit possible omissions and missing detail. In exceptional circumstances, a telephone call could be made in place of a home visit. The third visit was to collect the diary and again review and edit possible omissions. This final visit took place no later than three days after the last diary day.

Participants were asked to keep a record of everything eaten or drunk over four consecutive days. If a household contained two participants, both participants were assigned the same diary days. When placing the diary, interviewers followed a protocol to explain the method, taking participants through the different sections including the instruction page, how to describe details of food and drink and portion sizes and an example day. The adult diary provided photographs of 15 frequently consumed foods as small, medium and large portion sizes which participants could use for identical or similar foods. Otherwise they were asked to record portion sizes in household measures (e.g. one tablespoon of baked beans, one Kit Kat (two fingers)), or for packaged foods to note the weight indicated on the packet. Leftovers were not recorded separately; participants were asked to take into account leftovers when recording how much they consumed. As a prompt for this, a question at the end of each diary day asked participants whether they had finished all the food and drink they recorded for that day. Participants recorded brand names for foods wherever possible and were asked to collect the food label information/wrappers for any unusual foods and ready meals consumed to help coders identify or clarify items. For homemade dishes, participants were asked to record on a separate page in the diary the individual ingredients and quantities for the whole dish along with a brief description of the cooking method and how much of the dish they had consumed.

In addition to details of what and how much was eaten, participants recorded, for each eating occasion, where they were, who they were with and (if appropriate) whether they were watching TV and/or sitting at a table. After each day, participants recorded if their intake was typical for that day (and if not, the reason why) and details of any dietary supplements taken. The diary also contained a series of questions about usual eating habits (for example, type of milk or fat spread usually consumed) to facilitate coding in cases where details were omitted in the diet record.

A.3 Dietary data processing

Diaries were returned from the field to be coded by trained coders and editors. Food intakes were entered into a modified version of HNR's dietary assessment system DINO (Diet In Nutrients Out), an all-in-one dietary recording and analysis system written in Microsoft Access. The food composition data used was the Food Standards Agency (FSA)'s NDNS Nutrient Databank; this was incorporated into the DINO system.

Coders attempted to match each food or drink item recorded in the diary with a food code and a portion code from DINO. For composite items, which could be split into their component parts, for example sandwiches, each individual component was assigned. If an item had been recorded and there was no suitable code in DINO or there was insufficient detail to code the food, the entry was flagged as a query.

Within DINO, each food code is linked to appropriate portion size descriptors, mainly household measures, which are then linked to the correct weight for that portion or, where the portion size is described as a weight, the weight can be entered directly in grams. For adults, coding of portions described as small, medium or large was based on FSA's reference book on Food Portion Sizes.[10] For children, age-appropriate portions were used based on the analysis of portion sizes consumed in previous NDNS based on weighed records.[11] For foods consumed at primary and secondary school, portion sizes were taken from data collected from school meal surveys.[12] FSA also provided weights for common branded foods from supermarkets and manufacturers and for foods from fast food outlets. If necessary, a food would be purchased and weighed.

Where the coder could not resolve the food or portion consumed, the entry was flagged as a query for action by an editor who had greater nutrition background and experience. The editors assigned appropriate codes for all flagged food and portion codes and checked any other queries raised by the coders. In general, where details for the coding of foods were missing,

formally agreed default codes were used, such as for the type of milk in tea or coffee in a café, or lasagne eaten at a restaurant. Where portion sizes were missing, an estimate was made using the same weight if the food was consumed on another dietary day, or a portion size consistent with the participant's usual consumption (e.g. small, medium or large) or an age-appropriate average portion.

For new products not in DINO, editors visited supermarkets or contacted the manufacturer to obtain information on nutrient content in order to decide whether a new food code was needed. This decision was based on nutritional composition compared to that of existing codes and the frequency of consumption and was made in conjunction with FSA. If a new food code was required, the nutrient content was entered into the databank. If a portion was used but there was no corresponding portion code on DINO, a new portion code was created using either a weight from an equivalent food, or the food item was weighed and the weight entered into DINO for future use. In the case of school meals school caterers were contacted for information about nutrient content and portion size of dishes.

Where a participant consumed a homemade recipe each individual food item was linked with the food group of the recipe. DINO has the capability to report on these foods both at the recipe level and food level, providing a clearer picture of consumption of components like meat, fish, fruit and vegetables. This approach meant that it was possible to reduce the number of foods in the nutrient databank by more than 4000, as there was no longer a need to hold numerous variations of the same dish. Having fewer food codes has improved coding efficiency and consistency.

For homemade dishes where a recipe had been recorded, the ingredients were entered individually using the appropriate cooked food codes, and all the codes for the dish were allocated to a recipe food group according to the type of dish. The weight of each cooked ingredient was calculated using the raw weights recorded by the participant, a weight loss factor for the whole dish (from a comparable recipe in McCance and Widdowson's The Composition of

Foods series[13]) and the weight of the portion consumed. Where the food was stated as homemade but there was no recipe given, a standard homemade recipe food code was chosen.

A.4 Quality control

At the start of the coding process, editors checked ten complete diaries for each coder and gave them individual feedback on their work. For a random 10% of all diaries the editors undertook a further 100% check of all food and portion code entries. This ensured that error rates were monitored for all the coders working on the project and helped identify any coding issues. All of the entries flagged as a query by the coders were categorised into eight query types, such as food code or portion code not available in DINO, recipes, missing or insufficient detail to code food or portion.

At the end of coding and editing, each participant's mean energy and nutrient intake over the diary days was calculated. Intakes as a percentage of the dietary reference value for each nutrient were also calculated. For selected nutrients, if a participant's intake fell outside the 2.5 and 97.5 percentile ranges for their age and sex group, as based on previous NDNS data, they were flagged and checked against the diaries.[14] If results outside the reference range were due to data entry errors then these were corrected.

A.4.1 NDNS databank modifications and additions

Intakes of nutrients were calculated from the food consumption records using a specially adapted Nutrient Databank, which was originally developed by the Ministry of Agriculture, Fisheries and Food (MAFF) for the Dietary and Nutritional Survey of British Adults[15] and subsequently updated for the NDNS surveys of children aged 1.5 to 4.5 years,[3] people aged 65 years and over,[4] and young people aged four to 18 years.[2] Ownership of the Nutrient Databank transferred to FSA where it was updated for the NDNS of adults aged 19 to 64

years,[1] the Low Income Diet and Nutrition Survey (LIDNS)[16] and prior to commencing the NDNS rolling programme.[a]

Each food on the Nutrient Databank has values assigned for 54 nutrients and energy. The nutrient values assigned to the food codes are based on data from FSA's rolling programme of nutrient analysis of foods. Data obtained from food manufacturers were also used in the Nutrient Databank, as was nutritional information provided on food labels. All data were carefully evaluated before being incorporated into the Nutrient Databank.

In order to calculate nutrient intakes from food consumption data it is important that there are no missing values in the databank. Where reliable information was not available for some nutrients, values for such foods were obtained by extrapolating from data for similar foods. For homemade dishes and manufactured products, nutrients were calculated from their constituents using a computer recipe program that allows adjustments to be made for weight and vitamin losses on cooking.

In the NDNS rolling programme, it is essential that the databank is up-to-date and, as far as possible, reflects the nutrient composition of the food supply for each year reported. Hence a programme of updates and revisions is a continuing aspect of the rolling programme, with a yearly update carried out by FSA.[a] Each year of the rolling programme is coded separately using a contemporaneous version of the databank. At the end of each survey year the databank is returned to FSA[a] for updating and then returned to HNR within two months, so that the next survey year of diet diaries can be coded. Updating of the databank includes the addition of new foods as well as revision of nutrient composition of existing foods, either at food group level following a programme of reanalysis or to take account of reformulation by manufacturers and changes in fortification practices. Therefore the same foods may have a different composition for some nutrients in one year of the rolling programme compared to the next. Currently, the databank contains

[a] Responsibility for updating the food composition databank transferred from FSA to DH in October 2010 as part of the transfer of responsibility for nutrition policy in England.

over 5000 foods and drinks, including manufactured products, homemade recipe dishes and dietary supplements.

A.4.2 Disaggregation of composite dishes

At the beginning of the rolling programme the NDNS nutrient databank contained many composite food codes, which comprised two or more ingredient components and related either to purchased or homemade dishes. For some food groups it is important to quantify those foods eaten as part of composite dishes, as well as their discrete portions, to provide more accurate estimates of total amounts consumed at an individual food level. For example, carrots may be eaten as an accompaniment to a main meal, but they may also be consumed as an ingredient within a stew, together with additional vegetables such as onions and celery. In order to determine the total intakes of fruit and vegetables, meats, and fish, a project was undertaken during Year 1 of the rolling programme to retrospectively disaggregate all pre-existing food codes in the databank.[17] A number of categories for these food types were determined and all foods containing any of these food types (n= 3030) were systematically disaggregated into their components. Following this initial project new food codes are disaggregated prospectively as they are added to the Nutrient Databank.

The proportion of the composite dish which comprised fruit, vegetable, meat or fish subgroups was determined using a number of sources of information, such as:

- Manufactured product information
- Standard recipes from McCance and Widdowson's "The Composition of Foods"[13]
- Homemade recipes from participants' food diaries
- Haem iron data to estimate meat content when other recipe details were not available
- Vitamin A content to estimate tomato puree content in condiments and sauces

- Fructose content to calculate proportions of fresh and dried fruit in some food codes
- Dishes containing dried vegetables, such as dehydrated soups, were scaled up in relation to water content

Disaggregation data allows the estimation of total intakes of fruit, vegetables, meat and fish in NDNS, including the contribution from composite dishes. These intakes are provided in Table 5.3 (chapter 5).

A.4.3 Calculation of "five-a-day" using disaggregated data

One of the estimates required for reporting is the intake of fruit and vegetables, specifically how participants compare to the DH recommendations to eat "five-a-day".[18] The information on the fruit and vegetable content of each disaggregated food code was used to calculate estimates of the number of portions of fruit and vegetables consumed for each participant aged 11 years and over, using a portion weight of 80 grams (150 grams for fruit juice). In line with the "five-a-day" criteria[18] fruit juice (including fruit smoothies) and pulses (including baked beans) were included in the calculation up to a maximum of one portion per day each, at 150g for fruit juice and 80g for pulses. The calculations included the fruit and vegetable content of foods such as meat, fish, pasta, rice and egg dishes, pizza, breakfast cereals, yogurts and dairy desserts and soups. Puddings and fruit pies were also included as these can contain significant amounts of fruit. However, it was decided to exclude other foods that fell into the 'high fat/ high sugars' segment of the EatWell Plate[19] from the "five-a-day" calculations on the grounds that healthy eating advice is to reduce consumption of foods in this group, so it would not be appropriate to include their fruit and vegetable content in the "five-a-day" estimates. Therefore the fruit and vegetable content of the following food groups was excluded from the estimates:

- Soft drinks (57A, B and C, 58A, B, and C)
- Confectionery (43R and 44R)
- Cakes and biscuits (7A, 7B, 8D and 8E)

- Sugar, preserves and sweet spreads (41A, 41B, 41R) *This means that jam is excluded*
- Savoury snacks (42R)
- Ice cream (53R)

The calculation of "five-a-day" portions was performed as follows:

- Daily consumption of fruit juice was limited to 150g – one portion
- Daily consumption of baked beans and other pulses was limited to 80g – one portion
- Daily consumption of dried fruit was multiplied by three
- Daily consumption of tomato puree was multiplied by five to account for effects of concentration
- Total weight of fruit and vegetables was divided by 80 to arrive at the number of fruit and vegetable portions
- Fruit juice was divided by 150 to arrive at the number of portions of fruit juice
- The number of fruit and vegetable portions and the number of portions of fruit juice were added to give total "five-a-day" portions

"Five-a-day" portions were not calculated for children aged ten years and younger. The 80g portion weight used in the calculation for adults and children aged 11 years and over is likely to be too large for younger children but there are little data on which to base the choice of a lower portion weight for this age group.

A.4.4 Calculation of "five-a-day" using non-disaggregated data

In the previous NDNS of adults aged 19 to 64 years,[1] "five-a-day" portions were calculated using non-disaggregated data. In order to compare these data with current data, "five-a-day" portions in this report were additionally calculated using the non-disaggregation method, which is briefly described here and has been published previously.[1]

To calculate "five-a-day" portions using non-disaggregated data:

- total fruit consumption (mean g/day) was calculated by combining fresh and canned fruit consumed as discrete items (not in composite dishes)
- fruit from fruit pies was calculated as 45% of consumed weight of fruit pies
- total vegetable consumption was calculated by combining all vegetables consumed as discrete items (not in composite dishes) including baked beans but excluding potatoes, plantains, yams, and soya based foods used as meat substitutes
- vegetables from vegetable dishes, for example, cauliflower cheese, vegetable curry, were calculated as 40% of consumed weight of dishes
- the weight of baked beans and other pulses was limited to a daily average of 80g (one portion) regardless of whether more was consumed (less than 80g did not count at all as part-portions were not included in the calculation)
- fruit juice was limited to a daily average of 80g (one portion) regardless of whether more was consumed (less than 80g did not count at all as part-portions were not included in the calculation)
- total portions of fruit and vegetables were calculated by combining weights of fruit, vegetables, baked beans and other pulses and fruit juice (limited as above) and dividing the total by 80

Table A1 shows the results of using the two different methods of calculation of "five-a-day".

Table A1

Comparison of disaggregation and non-disaggregation methods of calculating "five-a-day" fruit and vegetable portions for NDNS Years 1 and 2 combined data (2008/09-2009/10) and comparison with non-disaggregated results from NDNS of adults 19 to 64 years (2000/01)

"Five-a-day" fruit and vegetable portions		**Age group (years) and sex**						**Total**		
		Boys	Men		Girls	Women				
		11-18	19-64	65+	11-18	19-64	65+	11-18	19-64	65+
NDNS Years 1 and 2 combined data (2008/09-2009/10)	Disaggregated	3.1	4.2	4.7	2.7	4.1	4.2	2.9	4.2	4.4
	Non-disaggregated	2.0	3.0	3.5	1.9	3.1	3.3	2.0	3.1	3.4
NDNS of adults aged 19-64 years	Non- disaggregated	-	2.7	-	-	2.9	-	-	2.8	-

A.5 Dietary feedback to participants

Participants who completed three or four diary recording days were asked whether they would like to be sent feedback on the analysis of their diary and how this compared with dietary recommendations. The feedback consisted of the participant's average daily energy intake and graphs of intake for eight different nutrients (total fat; saturated fat; non-milk extrinsic sugars (NMES); dietary fibre (as non-starch polysaccharide (NSP)); vitamin C; folate (including folic acid); calcium; and iron), each of which showed the average daily intake, based on the participant's diet over the diary recording period. The graphs also highlighted the UK guideline intake for the nutrient and the range of observed intakes for the participant's age group from previous NDNS results so that participants could compare their intake with other people of the same age and sex. The feedback also included general information on sources of healthy eating advice. (See Appendix J for an example of the feedback).

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