Appendix D. Dietary data collection and editing

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D.1 Diary methodology

Accurate dietary reporting of infants and young children can be complex with many factors to consider, including the minimising of participant burden whilst still enabling sufficient detail to be recorded. Various methods have been used in surveys of this age group; most commonly in large surveys in the UK, an estimated diary has been used, such as in the Food and Nutrient Intakes of British Infants age 6-12 months[1], conducted in 1986, in the Avon Longitudinal Survey of Parents and Children (ALSPAC)[2] and in a number of European longitudinal studies[3,4]. Elsewhere, 24 hour recall has been used, such an the Feeding Infants and Toddlers Surveys in the United States[5,6], and a food frequency questionnaire has been used in large prospective birth cohorts such as the Southampton Womens Study[7]. Nationally representative data is available from the Infant Feeding Surveys, commissioned by the Department of Health every five years[8]. These provide valuable information about infant feeding, particularly about breastfeeding, through questionnaires, but do not assess intake quantitatively. In order to obtain detailed information about all foods consumed by infants in quantitative terms, it was decided to use an estimated diary of four days duration for the Diet and Nutrition Survey of Infants and Young Children (DNSIYC), based on those designed for use in the NDNS rolling programme[9] and the Cambridge Baby Growth Study (CBGS)[10], for which HNR carries out the diet assessment. A series of pilot phases and a dress rehearsal were undertaken to determine the most appropriate methods to use in DNSIYC, the overall outcomes of which are outlined below.

The pilot phases were conducted at Newcastle University, and were divided into three phases. The Pre-Pilot phase used focus groups to ascertain parental views on the best and most convenient way of measuring what infants eat. It was agreed to investigate the use of graduated measuring implements (lidded pots, drinking cup and measuring spoons) to assist with the reporting of portion sizes. Diaries were designed to test whether foods should be recorded as consumed or served and left over, whether solid food and drink should be recorded together or separately and to test graduated measurement equipment for ease of use and accuracy. Outcomes of this work confirmed food and drink should be reported together in the same food diary but there was non-conclusive outcomes regarding the use of the graduated measuring implements. A second pilot study examined the impact of using the graduated measuring implements on portion sizes by comparing diaries completed with estimated intakes using these implements to weighed intakes. Extensive analysis was carried out to examine the results of this pilot study to take forward recommendations for the full dress rehearsal.

The dress rehearsal ran from February to June 2010 and utilised a revised A4 sized food diary to allow for more writing space, with parents advised to record portion sizes as consumed using household measures or volumes from the graduated implements.

The findings from the pilot phases and dress rehearsal were fully considered by the DNSIYC Project Board. During the pilot studies, parents reported favouring the recording of 'served and leftover' quantities instead of 'as consumed' quantities as they found it easier to record both amounts without the need to calculate the difference themselves. This approach was incorporated into the final food diary. Following the dress rehearsal it was concluded that while the implements assisted in recording accurate information they did not appear to impact on the dietary results obtained and the coding and editing of diaries was considerably more onerous as a result of their use. Therefore, it was decided not to use the graduated measuring implements in DNSIYC.

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D.2 Method

Two A4 versions of the food diary were developed, one for age 4 to 8 months and one for 9 to 18 months (see Appendix E). Parents were asked to keep a record of everything the infant ate or drank over four consecutive days. Brief instructions were provided in the food diary but parents were also provided with an A5 Food and Drink Instructions Booklet to assist them in completing the food diary. Parents were asked to record food and drinks consumed both at home and away from home and were therefore expected to take the food diary with them when they were away from home, and to give it to anyone else who might be caring for and feeding the child. Portion sizes were advised to be recorded in household measures (e.g. one table spoon of baked beans, five grapes), or using the weight indicated on packaged foods. The amount served to the infant was recorded (e.g. one medium banana and 60g pot of fromage frais served), together with the amount leftover (e.g. half banana and no fromage frais left). It was reinforced to parents that the leftover column must be completed with 'none' for occasions where all the food and drink served had been consumed. Parents were also asked to record brand names in the food diary and collect food packaging for any unusual foods consumed to help coders accurately determine items consumed. For homemade dishes, parents were asked to record on a separate page in the diary the individual ingredients and quantities for the whole dish, a brief description of preparation and the number and size of servings from the dish consumed by the infant.

After each diary day parents were asked if the infant's intake was typical for that day and if anyone else had looked after the child, prompting the parent to think about whether any addition food and drink should be recorded. There was a separate section for parents to record any dietary supplements that the infant had taken on each diary day. The diary also contained a series of general questions about the infant's food and drink to facilitate coding on occasions when details were omitted in the diet record, for example, types of milk usually consumed and type of spoon usually used for feeding.

In addition to details of what and how much was eaten, parents were also asked to provide basic information on the circumstances of each eating occasion: who else was eating at the same time, where the eating took place, whether or not the infant fed at a table, and whether or not the television was on.

Interviewers undertook three visits with each participant. At the initial visit the interviewer placed the food diary with the parent, following

written instructions in the form of a script, which gave clear instructions and prompts on how to explain the food diary. The interviewer went through each section of the diary, and completed a practice day with the parent to optimise their understanding of the level of detail required. A pre-arranged follow-up visit by the interviewer was carried out, usually on day two of the recording period, to check for compliance, answer questions and review the diary for omissions. The interviewer was provided with a checklist to assist in identifying missing details. In exceptional circumstances the follow-up visit was made by telephone call instead of a home visit. The final interviewer visit was to collect the food diary and took place no later than three days after the last diary day. At this visit, the interviewer went through each day of the diary with the parent, checking for completeness of the information recorded and filling in any missing details, in green pen to be able to distinguish interviewer entries from those of others. The interviewer was asked to complete feedback on each food diary, as soon as possible after collecting it, to give an indication of how comprehensively the food diary had been completed.

D.3 Dietary data processing

Diaries were returned to NatCen from the field and forwarded in batches to HNR, where they were logged to confirm receipt, before being coded by trained coders and editors. Diet diaries were coded 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, also used in NDNS. The food composition data used was the Department of Health's Nutrient Databank[1], which was incorporated into the DINO system. Food composition data used in DNSIYC was comparable to that of Year 3 of the NDNS rolling programme 2010-11.

Coders attempted to match each food or drink item recorded in the diary with a food code and a portion code from DINO, having subtracted the leftover portion from the served quantity. If an item had been recorded and there was no suitable food code or portion in DINO, or if there was insufficient detail in the food diary to code the food, the entry was flagged as a query for action by an editor who had greater nutrition knowledge and experience. The editors assigned appropriate codes for all flagged queries and checked any additional queries raised by the coders to ensure a consistent approach. In general, where details for the coding of foods were missing, formally agreed default codes were used, based on the most commonly consumed foods in that type, such as no added sugar squash or white bread. Where portion sizes were missing, an estimate was made using the same weight if the food was consumed on another dietary day, a portion size consistent with the infant's usual consumption (e.g. small, medium or large), or an average portion size collated from diet studies of similar aged infants that have been coded by HNR.

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. Most portion sizes were provided in DNSIYC in household measures or units of items. Standardised weights of commonly consumed infant foods were measured specifically for use in DNSIYC, including teaspoon, dessertspoon and tablespoon, as well as weaning spoon which replicated common feeding practice. Conversion factors were also determined for foods recorded in volume opposed to gram weights, for example yoghurts and ice cream. For beverages, the portion codes were described as volumes with the conversion to grams carried out automatically within DINO based on representative specific gravity[2].

For new food and drink items 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 of the new food compared to that of existing codes and the frequency of its consumption, and was made in conjunction with the DH. If a new food code was required, the nutrient content was entered into the nutrient databank and transferred into DINO. If a portion was recorded that was not available in DINO a new portion code was created.

For homemade dishes where a recipe had been recorded in the food diary, 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[3]) and the weight of the portion consumed. This function is carried out within DINO. Where the food was stated as homemade but there was no recipe given, a standard homemade recipe food code was chosen. Some commercially produced infant foods were coded as individual components based on label ingredient details, in order for a more accurate estimate of nutritional content to be made. These individually coded items were also linked together into a recipe food group to demonstrate that the food items had been consumed as part of the same dish. Uncooked composite food items, such as sandwiches, were coded as their individual constituent parts but are not linked by a recipe group.

DINO has the capability to report foods both at the recipe level and food level, providing a clearer picture of consumption of components like meat, fish, fruit and vegetables (see D.4.2 for Disaggregation of composite dishes). This approach also means the number of new foods added to the nutrient databank was reduced, as there was no need to hold numerous variations of the same dish. Having fewer food codes improved coding efficiency and consistency.

D.3.1 Assessing breast milk intake and maximum daily intakes

Breast milk intake was assessed in DNSIYC using the method of duration of each feed as adopted in the earlier survey of "Food and Nutrient Intakes of British Infants age 6 to 12 months", conducted in 1986 by Mills and Tyler[4], which in turn was based on the detailed studies of Paul et al describing breast milk intake in infants 2 to 10 months of age[5]. On the basis of these studies, breast milk intake was calculated based on the time for each feed, at 13.5g/min with a maximum of 135g per feed for

those aged 4 to 7 months 10g/min with a maximum of 100g per feed for those aged 8 to 18 months. A maximum was applied to each feed to more accurately reflect occasions when the infant is put to the breast for longer periods more for comfort than for active feeding. Other investigators have also used this approach[6,7].

Examination of the final dietary data for breast milk intakes in DNSIYC revealed some total daily weights of milk higher than would be expected, even with the feeding maximums applied. This appeared to be largely due to frequent feeding occasions. An examination of the previous literature was therefore conducted to determine the maximum breast milk intake seen in earlier studies. Studies using fixed volumes methods similar to those used in DNSIYC, studies of infant weighing,[8,9,10], and studies using the dose-to-mother method using stable isotopes[11,12] were all examined. In no studies in western countries was a volume over 1200 ml per day seen for the age groups studied in DNSIYC, and only on rare occasions in those studies from developing countries, although higher daily volumes were seen in younger infants.

It was therefore decided that a daily maximum of 1200g/d of breast milk intake should be applied to more accurately reflect the intake of breastfed infants in DNSIYC.

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D.4 Quality control

At the start of the coding process, editors checked ten coded 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, a series of data quality checks were performed to identify data entry and food composition errors in a two-phase process. Phase one data checking involved examining the diary days coded for each participant to ensure a minimum of three days had been recorded. At this stage the data was also reviewed for un-flagged queries that were still outstanding and were corrected accordingly. During phase two data checks, the portion sizes recorded and subsequent nutrient intakes are reviewed. Daily consumption in grams was examined for each food group, which highlighted any incorrect portion size entries. Daily nutrient intakes for all the reported nutrients were plotted and outliers scrutinised for potential errors in coding or within the food composition data. At each phase the hand written diet diaries were referred to and entries only corrected if they were due to data entry error. Specific checks are carried out on entries of breast milk consumption to ensure the correct individual feed maximum for age had been used and to review the daily total consumption. Infants who were reported to have consumed over 1200g breast milk in any day were documented and nutrient intakes were calculated based on this upper daily limit (see D.3.1 for additional details).

D.4.1 Nutrient databank modifications and additions

Intakes of nutrients were calculated from the food diary 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[1] and subsequently updated for the NDNS surveys of children aged 1.5 to 4.5 years[2], people aged 65 years and over[3], and young people aged four to 18 years[4]. Ownership of the nutrient databank transferred to the FSA where it was updated for the NDNS of adults aged 19 to 64 years[5], the Low Income Diet and Nutrition Survey (LIDNS)[6] and yearly since the NDNS rolling programme commenced in 2008[7].

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 the DH 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 for a specific food, values for this food were obtained by extrapolating from data for similar foods. For homemade dishes and manufactured products, nutrients were calculated from their constituent food components using a computer recipe program that allows adjustments to be made for weight and vitamin losses on cooking.

The nutrient databank contains over 5000 foods and drinks, including manufactured products, homemade recipe dishes and dietary supplements. However, it is essential that the databank reflects the nutrient composition of the food supply for the period of the survey. Therefore it was decided to utilise the same version of the databank in DNSIYC that was used for year 3 of the NDNS rolling programme in 2010-11. As the nutrient databank had not previously been used for a specific infant survey a total of 97 new food codes were added during the survey year, incorporating new commercial toddler food and drink items (n=30 food codes) and infant formula (n=22 food codes)[8]. There were also substantial updates to the food composition of existing food codes to reflect current nutritional contents, particularly within infant formulas.

Alterations were made to the food group structure of the nutrient databank to enable accurate reporting of new formulations of dietary supplements containing multivitamins and/or minerals with omega 3 from fish or plant oil sources. Also, additional sub-categories were assigned to Infant Formula and Commercial Toddler Foods, to review the specific types of foods reported within these widely consumed groups. A full list of food groups used in DNSIYC is shown in Appendix M.

D.4.2 Disaggregation of composite dishes

The nutrient databank contains many composite food codes, which comprise two or more ingredient components and relate 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 other vegetables such as onions and celery. A project to disaggregate all composite food codes in the nutrient databank was undertaken at the commencement of the NDNS rolling programme, to determine their proportion of fruit and vegetables, meat, and fish to allow for more accurate reporting of these food types[9]. 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 series[8], and homemade recipes from participants' food diaries. Disaggregation data allows the estimation of total intakes of fruit, vegetables, meat and fish, including the contribution from composite dishes. These intakes are provided in Table 6.3 (Chapter 6).

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D.5 Dietary feedback to participants

Parents of infants who completed three or four diary recording days were asked whether they would like to be sent feedback on the analysis of the infant's food diary, which was tailored depending on whether the infant was consuming an exclusive milk diet, or if they were currently breastfeeding or not. Parents of infants who were receiving exclusive milk diets were not provided with a detailed breakdown of their dietary intake as they were receiving all the nutrients they need for the first six months of their life from the breast or formula milk. The feedback for parents of infants with complementary foods in addition to breast milk or formula consisted of the infant's average daily energy intake and graphs of intake for four nutrients based on the diet over the recording period; protein, vitamin C, iron and calcium. These nutrient intakes were from food sources only and did not include supplement intakes if there were any. The intake graphs highlighted the range of observed intakes for the infant's age group from the DNSIYC dress rehearsal so that parents could review the intake with other infants of similar ages. All versions of the feedback included general information on sources of healthy eating advice. (see Appendix K for an example of the feedback).