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National Diet and Nutrition Survey

Years 9-11 (2016/17-2018/19)

User Guide

NatCen Social Research

MRC Epidemiology Unit | UNIVERSITY OF CAMBRIDGE | NIHR | Cambridge Biomedical Research Centre

UKDA version

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The National Institute of Health Research Cambridge Biomedical Research Centre (NIHR BRC, Cambridge) consists of the NIHR BRC Diet, Anthropometry and Physical Activity Group and the NIHR BRC Nutritional Biomarker Laboratory hosted at the Medical Research Council Epidemiology Unit at the University of Cambridge.

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Contents

Glossary

5 a Day	5 portions of fruit and vegetables per day (5 x 80g portions)
AOAC fibre	Intake of fibre defined using the AOAC method of analysis
Ca	Calcium
CAPI	Computer Assisted Personal Interview
NDB	UK Nutrient Databank
DH	Department of Health
DLW	Doubly Labelled Water
Fe	Iron
FM	Fat Mass
FQ	food quotient
FSA	Food Standards Agency
GOR	Government Office Region
HbA1c	Glycosylated Haemoglobin or Haemoglobin A1c
HoloTC	Holotranscobalamin
HRP	Household Reference Person
IMS	Intrinsic Milk Sugars
kcal	Kilocalorie
kJ	Kilojoule
LC-MS/MS	Liquid Chromatography-Tandem Mass Spectrometry
LDL	Low Density Lipoprotein Cholesterol
LRNI	Lower Recommended Nutrient Intake
µg	Microgram
MG	Milligram
MFP	Main Food Provider
MRC	Medical Research Council

NatCen	NatCen Social Research
NDNS RP	National Diet and Nutrition Survey Rolling Programme
NISRA	Northern Ireland Statistics and Research Agency
NMES	Non-Milk Extrinsic Sugars
NSP	Non-Starch Polysaccharide
PAF	Postcode Address File
PHE	Public Health England
PSU	Primary Sampling Unit
RNI	Reference Nutrient Intake
RPAQ	Recent Physical Activity Questionnaire
Se	Selenium
sTfR	Soluble Transferrin Receptors
Sub	Subsidiary
Trig	Triglyceride or Triacylglycerol
Vit C	Vitamin C
Zn	Zinc

1. Introduction

1.1 The NDNS RP

The National Diet and Nutrition Survey Rolling Programme (NDNS RP) is a cross-sectional survey with a continuous programme of fieldwork, designed to assess the diet, nutrient intake and nutritional status of the general population aged 1.5 years and over living in private households in the UK. The core NDNS RP is jointly funded by Public Health England (PHE)[a] and the UK Food Standards Agency (FSA). The NDNS RP is currently carried out by a consortium comprising NatCen Social Research (NatCen) and the National Institute of Health Research Cambridge Biomedical Research Centre (NIHR BRC, Cambridge). The latter consists of the NIHR BRC Diet, Anthropometry and Physical Activity Group and the NIHR BRC Nutritional Biomarker Laboratory hosted at the Medical Research Council (MRC) Epidemiology Unit at the University of Cambridge.[b,c] Interviewer fieldwork in Northern Ireland is carried out by the Northern Ireland Statistics and Research Agency (NISRA).

The NDNS provides the only source of nationally representative UK data on the types and quantities of foods consumed by individuals, from which estimates of nutrient intake for the population are derived and on their nutritional status from analysis of blood and urinary biomarkers. Results are used by government to monitor progress toward diet and nutrition objectives of UK Health Departments and develop policy interventions, for example to monitor progress towards a healthy, balanced diet as visually depicted in the Eatwell Guide.[1] The NDNS is an important source of evidence underpinning work of the Scientific Advisory Committee on Nutrition (SACN) and their advice to UK governments on nutrition related matters. The food consumption data is also used by the FSA to assess exposure to chemicals in food, as part of the risk assessment and communication process in response to a food emergency or to inform negotiations on setting regulatory limits for contaminants.

The NDNS programme began in 1992 as a series of cross-sectional surveys designed to be representative of the UK population, each covering a different age

[a] From 1 April 2013, responsibility for the NDNS contract transferred from the Department of Health in England to the Department of Health's Executive Agency, Public Health England (PHE).
[b] Until December 2018, the consortium included the MRC Elsie Widdowson Laboratory, Cambridge.
[c] In Years 1 to 5 (2008/09 – 2012/13) the consortium also included the University College London Medical School (UCL).

group: pre-school children (aged 1.5 to 4.5 years);[2] young people (aged 4 to 18 years);[3] adults (aged 19 to 64 years)[4] and older adults (aged 65 years and over).[5] Since 2008, the NDNS has run continuously as a rolling programme (RP) covering adults and children aged 1.5 years and over. Methods used in the NDNS are kept under review to ensure they remain the best practical methods available.

1.2 NDNS RP reports

Further information about the NDNS collection and the published reports can be found on the gov.uk site: https://www.gov.uk/government/collections/national-diet-and-nutrition-survey or the NDNS website (natcen.ac.uk/taking-part/studies-in-field/national-diet-and-nutrition-survey). The latest report, published in December 2020 presents an overview of food consumption, nutrient intake and nutritional status for the UK in NDNS RP Years 9 to 11 (2016/17-2018/19) and trends in time for Years 1 to 11 (2008/09-2018/19).

2. Survey design

2.1 Sample design and response

The NDNS RP is a survey of the food consumption, nutrient intakes and nutritional status of people aged 1.5 years and older living in private households. The survey is carried out in all four countries of the UK and is designed to be representative of the UK population. The survey aimed to collect data from a UK representative sample of 1000 people per fieldwork year, 500 adults (aged 19+ years) and 500 children (aged 1.5-18 years). [d] [e] [f] Fieldwork for Years 9 to 11 of the NDNS RP was carried out between April 2016 and June 2019.

The sample was drawn from the 'small users' sub-file of the Postcode Address File (PAF), a computer list, prepared by the Post Office, of all the addresses (delivery points) which receive fewer than 25 articles of mail a day. In order to improve cost effectiveness, the addresses were clustered into Primary Sampling Units (PSUs), small geographical areas, based on postcode sectors, randomly selected from across the UK. A list of addresses was randomly selected from each PSU.

A UK sample was selected as follows:

- In Year 9: 4,424 addresses from 158 PSUs
- In Year 10: 4,480 addresses from 160 PSUs
- In Year 11: 4,340 addresses from 155 PSUs

In each PSU, 28 addresses were randomly selected. At each address, the interviewer established the number of households and, in cases where there were two or more, selected one household at random.

In order to achieve (as far as possible) equal numbers of adults (aged 19+ years) and children (aged 1.5-18 years) in the sample, at some addresses only children were selected to take part. The addresses were randomly allocated to one of two

[d] Additional recruitment was undertaken in Wales (Years 2 to 9 (2009/10–2016/17)) and in Northern Ireland (Years 1 to 4 and Years 6 to 11 (2008/09-2012/13 and 2014/15-2018/19)) in order to achieve representative data for each country and to enable comparisons to be made with UK results. Data for both countries was weighted down so the core sample remained representative of the UK population. Country boosts were also funded in Scotland in Years 1 to 4 (2008/09-2012/13).

[e] The Wales boost was funded by the Food Standards Agency (FSA) in Wales which previously shared policy responsibility for diet and nutrition of the population in Wales. This policy area is now solely the responsibility of the Welsh Government.

[f] The Northern Ireland boost has been co-funded by 3 funding partners: the Department of Health; the Food Safety Promotion Board (safefood) and FSA in NI. FSA in NI has responsibility for monitoring the diet of the population in Northern Ireland.

groups to determine whether an adult and a child, or a child only, was selected for interview. At a number of addresses (10 in Years 9 and 10 and either 9 or 10 in Year 11[g]) the interviewer selected 1 adult and, where present, 1 child for inclusion in the survey ('basic' addresses). The remaining addresses (18 in Years 9 and 10 and either 18 or 19 in Year 11[g]) were for a 'child boost' where only a child was recruited, and therefore the interviewer only carried out interviews in households with children. In households containing more than 1 eligible person (adult and/or child), interviewers selected the participant(s) using a random selection procedure.

In total 3,558 individuals gave fully productive interviews (consisting of three or four diary days). Of these (i.e. those who had completed a diary), 53% of adults (406) and 28% of children (242) went on to give a blood sample.

2.2 Survey structure

There are two main parts to the survey: an interviewer stage and a nurse visit.

Stage 1: Interviewer visit:

- Four-day food diary[6]
- Face-to-face Computer Assisted Personal interview (CAPI)[7]
- Height and weight measurements
- Smoking and drinking self-completion questionnaires (aged 8-17 years)
- Physical activity self-completion questionnaire (aged 16+ years)
- Collection of spot urine sample (aged 4+ years)

On successful completion of the interviewer stage (including three or four completed days of the food diary), each participant was invited to take part in the next stage, a visit from a nurse.

[g] In Year 11, half of PSUs had a 9:19 split and half had a 10:18 split).

Stage 2: Nurse visit:

- Fasting blood sample (aged 4+ years)
- Non-fasting blood sample (aged 1.5-3 years)
- Physical measurements: waist and hip (aged 11+ years), demispan (all aged 65+ years and those aged 16-64 years from whom a reliable height measurement could not be taken) and infant length (under 2 years)
- Collection of information about prescribed medicines

3. Archive documentation

The NDNS RP documentation has been organised into the following sections:

- **Survey documents**
  This contains the CAPI documentation for the interviewer visit and nurse schedules, self-completion questionnaires, showcards and consent forms.
- **Data related documents**
  NDNS RP Yr9-11 Variable List - this contains a list of the variables on each dataset and the survey year to which it applies.

  NDNS RP Yr9-11 Derived Variables – this contains the SPSS syntax specification for each of the derived variables included in the data.
- **Supporting documents**
  This contains details of food coding and instructions for office editing of the diaries and coding of the CAPI data and self-completions. Also, documents related to the four-day food diary, interviewer and nurse project instructions and protocols.

4. Using the data

4.1 Years 9-11 datasets

Data collected during the survey are contained in different data files described below.

Name of Dataset	No. of records	Description of Dataset
NDNS_Yr9-11a_indiv		Contains data for all fully productive individuals i.e. completed three/four food diary days. It contains information from the household questionnaire, main individual schedule, self-completions, physical measurements and nurse visit (where one occurred). It also includes blood sample results, and spot iodine data.
NDNS_Yr9-11a_hhold		Contains data on household composition, sex, age and marital status for all individuals in co-operating households.
NDNS_Yr9-11a_FoodLevelDietaryData		Diary data. Includes nutrient data and disaggregation at food level. Also, shows who else was present at the eating occasion, where the participant was located, whether the television was on and whether or not the participant was sitting at a table.
NDNS_Yr9-11a_DayLevelDietaryData_Foods		Daily food consumption data calculated using recipe main food groups and recipe sub food groups data.
NDNS_Yr9-11a_DayLevelDietaryData_Nutrients		Daily intakes of macronutrients, micronutrients and disaggregated foods.
NDNS_Yr9-11a_PersonLevelDietaryData		Mean intakes of nutrients, food consumption data calculated using recipe main food groups and recipe sub food groups data plus disaggregated food at the participant level. Also includes derived variables such as LRNI and RNI indicators and percentages.

4.2 UK Nutrient Databank (NDB)

The UK Nutrient Databank (NDB) used in the NDNS RP is saved as a survey year specific file. Details about the NDB and its use can be found in Appendix A of this User Guide.

Name of Dataset	**Description of Dataset**
NDNS_Y9_NutrientDatabank	Contains nutrient data assigned to foods and supplements for Year 9
NDNS_Y10_NutrientDatabank	Contains nutrient data assigned to foods and supplements for Year 10
NDNS_Y11_NutrientDatabank	Contains nutrient data assigned to foods and supplements for Year 11

4.3 Variables in the datasets

The individual and household datasets contain questionnaire variables (excluding variables used for administrative purposes), demographic information including household composition, laboratory results and derived variables.

The dietary datasets contain variables coded from the diaries at food, day and person levels, plus dietary reference values and derived variables.

The variables included in all the datasets are detailed in the "**NDNS RP Yr9-11 UK Variable list**" document in the data section of the documentation. This document is the best place to look in order to plan your analysis. It includes:

- Major categories of variables (e.g. general health, blood sample, day-level dietary nutrients)
- Sub-categories of variables (e.g. longstanding illness (within general health), measurements from laboratory analysis (within the blood Sample and urine collection sections), nutrients including supplements (within day-level dietary nutrients)
- Source of each variable (e.g. Individual questionnaire, diary, nurse visit, self-completion booklet, laboratory, derived variable etc.)

Details of the question wording relating to a variable in the household and individual datasets is provided in the interview section documentation. The "**NDNS RP Yr9-11 UK Derived Variables**" document provides information on how the variables were derived.

4.4 Missing values conventions

Missing value conventions are applied to most of the derived variables as well as the original questionnaire variables. The "**NDNS RP Yr9-11 UK Derived Variables**" specification should be consulted for details.

-1 Not applicable. This code is used to signify that a particular variable did not apply to a given participant because of internal routing (e.g. questions for children only) or because the participant did not participate in a particular element of the survey (e.g. refused a nurse visit).

-4 Question not applicable to survey year. This code indicates that that particular question was not asked/or element was not in a survey year.

-8 Don't know/Can't say

-9 No answer/Refusal

The above conventions apply to the majority of the variables on the data, however some variables have been attributed specific missing value codes, for example blood and urine results on the individual dataset, and "5 A Day" variables on the dietary data files. The description for each of the missing value codes are specified in the variable value label.

For a full list of variables on the dataset and to which survey they apply see the "**NDNS RP Yr9-11 UK Variable list**".

4.5 Merging datasets

As various data are contained in different datasets, users may need to merge several datasets together for the purposes of their analysis. Individual serial number, survey year, age, sex and country variables are included in all the datasets for consistency.

4.6 Serial number composition

Serial numbers on the data consist of the following:

Variable name	Definition	Composition	File/files included
SERIALH	Household serial number	8 digits. The same number is allocated to each member of the same household. The first number corresponds to the survey year	Household and individual files
SERIALP	Individual identifier for each household member in a productive household	10 digits. SERIALH + PGRID	Household file only
SERIALI	Individual serial number for each productive individual (i.e. completed 3 or 4 diary days	9 digits SERIALH + ADCHILD ADCHILD is coded 1 for adult and 2 for child	Household, Individual and all Dietary files

The individual file also contains the person number of the Household Reference Person (HRP) and the Main Food Provider (MFP) (variables HRPNO and MFPNUM respectively). To create individual serial numbers for either the HRP or MFP, add HRPNO or MFPNUM to SERIALH.

Note that the HRP or MFP numbers correspond to the person number within each household. Therefore, due to the recoding of each productive individual to a 1 for the adult and 2 for the child, the HRP or MFP may not be the same individual although they may have the same serial number and vice versa. An example is shown in the following table for a household consisting of 2 adults and 2 children.

	SERIALH	PGRID	SERIALP	Productive Y/N	SERIALI	Is HRP? Y/N	Is MFP? Y/N	HRP serial	MFP serial
Adult 1	90010101	1	9001010101	No	N/A	No	Yes	N/A	900101011
Adult 2	90010101	2	9001010102	Yes	900101011	Yes	No	900101012	N/A

Child 1	90010101	3	9001010103	No	N/A	N/A	N/A	N/A	N/A
Child 2	90010101	4	9001010104	Yes	900101012	N/A	N/A	N/A	N/A

In this example, the MFP and the individual are not the same person even though they have the same MFP and individual serial numbers. For clarification and cross checking, the age and sex of the HRP and MFP have been provided.

5. Dietary, spot urine and blood data

5.1 Using the dietary data

It is important to note the following when using the dietary data from Years 9-11 of the NDNS RP:

Days of the week

- The survey is designed so that all days of the week were evenly represented.[8]

Dietary coding

- In the RP all individual ingredients of a homemade recipe as reported in the food diary, or components of the purchased product as described on the food packaging, have been coded as their separate food codes and linked together under the appropriate Recipe Food Group, which highlights that those food codes were consumed together in one composite dish. The following variables should be used when calculating food consumption data:
    - RECIPEMAINFOODGROUPCODE
    - RECIPEMAINFOODGROUPDESC
    - RECIPESUBFOODGROUPCODE
    - RECIPESUBFOODGROUPDESC
- An example is provided here: A homemade dish of Thai chicken curry containing chicken, Thai curry sauce, and onion would appear in the RP Food Level dietary dataset as three entries with the food names; CHICKEN BOILED LIGHT MEAT ONLY, THAI CURRY SAUCE PURCHASED, and ONIONS BOILED, linked to the MAINFOODGROUPDESC of "*chicken and turkey dishes", "miscellaneous"* and *"vegetables not raw"*, respectively. As these three foods were consumed together in one composite dish they are assigned to the RECIPESUBFOODGROUPDESC of *Other chicken/turkey including homemade recipe dishes*. In previous NDNS datasets this homemade dish would have shown as one entry, assigned as one food name, and the proportions of the composite dish consumed would not have been known.
- Recipes names are included in the Years 9-11 dataset.

- To estimate absolute food consumption of one specific food type examine the FOODNAME and MAINFOODGROUPDESC variables, whilst examining disaggregation variables of any foods that are composites (NB disaggregation data is only provided for certain categories of meat, fish, fruit and vegetables). For example, to estimate absolute intakes of sausages from all sources you would need to include all the specific discrete portions of sausages, as well as calculate the percentage of sausages within all composite foods such as meat pies.

- All foods consumed have a base unit of grams that is, the amount consumed is described in grams. The exceptions are dietary supplements and artificial sweeteners. These have a base unit based on their form i.e. tablet, teaspoon. To avoid errors when calculating consumption, these have only been included in the food level dietary data file. When using this file, it should be noted that, for dietary supplements and artificial sweeteners, the value in the Total_Grams column is not a value in grams but a value in terms of the base unit, i.e. 0.5 for a granulated artificial sweetener would refer to 0.5 of a teaspoon not 0.5 grams.

5 A Day calculations

- Appendix A of the NDNS RP Years 9-11 report provides full details of:
    - the methods used for the disaggregation of meat, fish, fruit and vegetables
    - the variables/methodology used for 5 A Day calculations
    - all other dietary data methodologies used in the RP

Vitamin D

Following the publication of the SACN vitamin D report in 2016,[9] a RNI of 10µg vitamin D has been added to the Years 9-11 dataset for those aged 2 years and over and a safe intake of 10µg vitamin D has been added for those aged 1.5 to 2 years.[10]

Comparing NDNS RP data to previous NDNS data

In comparing the NDNS RP data to past published reports of the NDNS, the differences in duration of assessment must be taken into account. Dietary assessment over a four-day period will provide similar mean intakes from assessment over a seven-day period, but the variation in intakes will be different as will the percentage of participants consuming any given food over the recording period (percentage consumers), especially for foods that are consumed infrequently. Moreover, estimates of proportions of individuals above or below certain cut-off values, such as Lower Reference Nutrient Intakes (LRNIs) will be affected by assessments of different duration. For this reason, for the previous NDNS of young

people aged 4 to 18 years and NDNS of adults aged 19 to 64 years reports, the seven-day information from previous NDNS surveys was converted to four days using bootstrapping techniques. Details of the bootstrapping methodology used and descriptive statistics of bootstrapped data for NDNS food groups are provided in Appendix K of the NDNS RP Years 7-8 report (see section 1.2 of this User Guide for links to published reports).

5.2 Using spot urine iodine data

Spot urinary iodine data have been supplied for fully continent participants over the age of four years. For those who provided a spot urine sample, but a urinary iodine result could not be obtained, the interview data have been included in the dataset but these individuals have been attributed a specific missing value code for each result variable and given a urine weighting of '0'.

5.3 Using the blood data

The complete blood results dataset has been supplied for those aged 1.5 years and over including both data for blood analytes published in the report tables as well as data for additional blood analytes measured but not reported. For those who provided a blood sample but results could not be obtained, the interview data has been included in the dataset but these respondents have been attributed a specific missing value code for each blood result variable and given a blood weight of 0.

Low Density Lipoproteins (LDL), Triglycerides (Trig) and Glucose (Glucose) result data are only provided for fasted blood samples. Glucose (Glucose), Selenium (Se) and Zinc (Zn) result data has been supplied for those aged 7 years and over. Glucose, creatinine and HbA1C were measured in Years 9 and 10 but not in Year 11.

6. Weighting variables

6.1 Description of weights

The NDNS RP requires weights to correct for differences in sample selection and response. The weights adjust for differential selection probabilities of households and individuals, non-response to the individual and RPAQ questionnaires, non-response to the nurse visit and non-response to the blood sample. Non-response weights were generated using a mixture of non-response modelling and calibration weighting methods. Five weights were generated for the NDNS RP Years 9-11 datasets these are described in Table 6.1.

Table 6.1 Description of the NDNS RP Years 9-11 weights

Weight name	Description of weight	Use for
wti_Y911	Weight for non-response by individuals to the individual questionnaire and diary	Any analysis of individuals using data from the individual questionnaire or diary. Including analysis of Smoking & Drinking data (collected in self-completions & CAPI)
wtn_Y911	Weight for non-response by individuals to the nurse visit	Any analysis of individuals using data collected at the nurse visit
wtb_Y911	Weight for non-response by individuals to the blood sample	Any analysis of individuals using blood sample data
wtr_Y911	Weight for analysis of RPAQ (all individuals aged 16+)	Any analysis of RPAQ info for individuals aged 16+
wtsu_Y911	Weight for analysis of spot urinary iodine data (aged 4+)	Any analysis of individuals with spot urinary iodine data

6.2 Strata

There are 5 strata altogether (called astrata1[h] to astrata5 in the archived dataset) and the idea is to use the one that's most appropriate for the analysis that you're doing. The way to find this out is to try them in sequence (starting from astrata1) i.e. if astrata1 is "not working" (see below for explanation of what this means), then you can try using astrata2, then astrata3 etc. (up to astrata5).

[h] In previous versions of the archived dataset (before the 20th edition) the strata variables are called cluster1 to cluster5, but this has been updated to more accurately reflect the variable type.

In SPSS or STATA you will get a warning message if there are strata with single PSUs. If this occurs one way to deal with it is to recode these strata so that they are grouped with adjacent strata (making sure you do this within region). (In SPSS if you don't do this then cases in the single PSU strata will be removed from the analysis.) However, if you're analysing very small subgroups there may be many of these recodes to perform, too many to be practical. In that case you can try the next strata down. In other words "not working" means that there are more than a handful of single PSU strata to deal with.

For example, if you are analysing the whole sample then astrata1 will be fine. But let's say you're analysing a subgroup e.g. aged 65+ then using astrata 1 will probably result in a number of single PSU strata. If there are a handful you can recode them appropriately (group them with adjacent strata within region) but if there are more than a few then you can try using astrata 2 instead. If there are still too many single PSU strata to recode then you would try astrata 3 and so on.

6.3 Single weights for all individuals

There is a single weight for all individuals, rather than separate weights for adults and children. This means the sample needs to be filtered by age to ensure the correct ages are included. However, this means different age breaks to those presented in the published tables can be used, i.e. those aged 16 to 18 years can be combined with adults (19 years and over), which allows more flexibility in reporting.

Alongside the Years 9-11 combined weights, outlined above, the archived dataset contains five weights for analysis of Year 9 data on its own. These weights, called wti_Y9 and so on, were created to enable single year analysis prior to the Year 10 and 11 data being made available. For analysis of the entire dataset the Y9-11 weights should be used as described above; for analysis of Year 9 data only then the Y9 weights should be used in the same way.

6.3 Individual non-response weight

The individual non-response weight was generated for the analysis of fully responding individuals; individuals who responded to the individual interview and completed at least three food diary days. The individual non-response weight was generated using calibration weighting methods. An iterative procedure is used to adjust a starting weight until the distribution of the (weighted) sample matches that of the population for a set of key variables. The adjustment keeps the values of the final weights as close as possible to those of the initial weights, which ensures the properties of the initial weights are retained in the final calibrated weights. The initial weights were a set of selection weights. These

selection weights corrected for the unequal selection probabilities that were built into the sample design; for the random selection of individuals in households where more than one person was eligible and for the random selection of catering units and dwelling units at multi-unit addresses.

The key variables used to create the individual weight were: age (grouped) by sex and Government Office Region (GOR). The population figures used were taken from the mid-year population estimates from 2017.[11]

The aim of the calibration weighting was to reduce non-response bias resulting from differential non-response at the household and individual interview. The calibration weights generated were re-scaled so that the sum of the weights equaled the number of participating individuals; these are the final individual weights (wti_Y911). Thus the final individual weights adjust for dwelling unit, catering unit and individual selection, and for the age/sex and regional profiles of participating individuals. This weight should be used for any analyses of interview and food data in the data.

6.4 Nurse interview non-response weight

Participants who completed three or four food diary days (i.e. those deemed fully productive) were asked to consent to a nurse visit. Almost 70% of these participants went on to do a nurse interview. Non-response weights were generated to adjust for differences between participants and non-participants to the nurse visit.

To produce nurse interview non-response weights a logistic regression was used to model the relationship between response to the nurse interview (coded into a binary outcome variable) and a set of predictor variables (socio-demographic, participant and household/catering unit characteristics collected during the interview). Adults and children were modelled separately as response behaviour can vary between the two groups. The weights from the two models were then combined into a single weight.

The model generated a predicted probability for each participant. This is the probability the participant would take part in the nurse interview, given the characteristics of the individual and the household/catering unit. Participants with characteristics associated with non-response were under-represented in the nurse sample and therefore receive a low predicted probability. The inverse of these predicted probabilities were then used to generate a set of non-response weights; participants with a low predicted probability got a larger weight, increasing their representation in the sample.

As before, the nurse weights were re-scaled so that the sum of the combined adult and child weights equalled the number of participants who had a nurse visit. These are the final nurse weights for the sample (wtn_Y911) and adjust for unequal selection, non-response to the household/MFP and individual interviews and non-response to the nurse visit. The nurse weights should be used for all analyses of nurse level data.

6.5 Recent Physical Activity Questionnaire (RPAQ) non-response weight

All individuals aged 16 years and over were asked to record their physical activity over the previous seven days in a self-completion booklet (the RPAQ).

Response behaviour was modelled using a logistic regression. The same set of predictor variables used to model non-response to the nurse visit was used to model non-response to RPAQ, namely, socio-demographic, participant and household/catering unit characteristics collected during the individual interview. Those aged 16 to 18 years were modelled with the adult (19+) respondents as children under the age of 16 were not asked to fill in the self-completion booklet.

The RPAQ weights were re-scaled so that the sum of the combined adult and child weights equalled the number of participants who had completed RPAQ. These are the final RPAQ weights for the sample (wtr_Y911) and adjust for unequal selection, non-response to the household/MFP and individual interviews and non-response to the RPAQ.

Note that response to RPAQ and the nurse visit was not hierarchical; it was possible for a respondent to complete the RPAQ section but not the nurse visit, and vice versa.

6.6 Blood sample non-response weights

An additional set of weights was generated to correct for differential non-response to giving a blood sample. Non-response, whether due to refusal or inability to give a blood sample, will cause the blood data to be biased if there are systematic differences between individuals that provide a blood sample and individuals that do not. Blood samples were taken during the nurse visit. Only participants who fulfilled certain eligibility criteria were

asked whether they would be prepared to give a blood sample. Participants were ineligible if they:

- had a clotting or bleeding disorder (e.g. conditions such as haemophilia and low platelets (thrombocytopenia))
- had **ever** had a fit
- were **currently** on anticoagulant drugs, e.g. Warfarin therapy
- had volunteered information that they are HIV or Hepatitis B or C positive

The blood weights were generated using a logistic regression model. Adults and children were modeled separately. The non-response weights from the model were combined with the final nurse weights to give the final blood weights for adults and children (wtb_Y911). These weights adjust for non-response to the blood sample, non-response to the nurse visit, non-response to the individual questionnaire and unequal selection probabilities. The weights were scaled, so the mean weight equaled one and the weighted sample size matched the unweighted sample size. These weights should be used for any analysis of blood sample data.

6.7 Selecting the appropriate weight variable

Any analyses that incorporate information from more than one stage should use the weight from the 'last' stage. For example, a cross tabulation using a variable from the nurse visit and a variable from the individual questionnaire should use the nurse weights (i.e. the weights from the latter stage of the survey), similarly, a cross tabulation of blood sample data and data collected at the nurse visit should use the blood weight.

6.8 Selecting the appropriate stratification variable

Any analyses that incorporate information from more than one stage should use the weight from

6.9 Combining data from previous NDNS RP years (Years 1-8)

The NDNS datasets for Years 1-4, Years 5&6, Years 7&8 and Years 9-11 can be combined for analysis of Years 1-11 but, to produce valid results, the four sets of weights should be re-scaled. This will ensure that the four sets of data are in their correct proportions i.e. 4:2:2:3. A different calculation is required for each weight (individual, nurse, blood etc.).

Re-scaling is necessary because there were different numbers of participants in each dataset/year. The number of participants per dataset/year is as follows:

Year	**Number of participants**
1-4	6,828
5&6	2,546
7&8	2,723
9-11	3,558
Total	*15,655*

If the weights were combined into one variable without any further adjustment, Years 1-4 and Years 7&8 would have more weight *per year* than other years, while Years 9-11 would have less weight *per year*.

To re-scale the weights correctly, it is necessary to perform the following calculations:
i) Divide each weight variable by its sum (i.e. the sum of the weights);
ii) Multiply each by the combined sum of the four weights (15,655);
iii) Multiply the Years 1-4 weight by 4/11, Years 5&6 weight by 2/11, Years 7&8 weight by 2/11 and Years 9-11 weight by 3/11.
The resulting weights can then be combined into one variable.

Example: individual weights
For example, to create new individual weights for analysis of the combined dataset, the steps would be as follows:
i) Divide Years 1-4 weight by 6,828, the Years 5&6 weight by 2,546, the Years 7&8 weight by 2,723 and the Years 9-11 weight by 3,558;
ii) Multiply each weight by 15,655;
iii) Multiply the Years 1-4 weight by 4/11, the Years 5&6 weight by 2/11, the Years 7&8 weight by 2/11 and the Years 9-11 weight by 3/11;
iv) Combine the resulting weights into one variable.

To do all of this in in SPSS you could use the following syntax:

```
weight off.
compute wti_UKY1234r = wti_UKY1234 * 15655 / 6828 * (4/11).
compute wti_Y56r     = wti_Y56     * 15655 / 2546 * (2/11).
```

```
compute wti_Y78r     = wti_Y78     * 15655 / 2723 * (2/11).
compute wti_Y911r    = wti_Y911    * 15655 / 3558 * (3/11).
compute wti_UKY1to11 = sum (wti_UKY1234r, wti_Y56r, wti_Y78r, wti_Y911r).
```

Running these commands will result in a new set of weights (wti_UKY1to11) which can be used for analysing Years 1-11. The new weight should have a mean of 1 and be non-missing for all 15,655 cases in the combined dataset. You can check this by running descriptives on the weights: desc wti_UKY1to11.

Notes:

1. The intermediate weights (wti_UKY1234r, wti_Y56r, wti_Y78r, wti_Y911r) can be discarded/deleted.
2. In this example the sum of the weights is equal to the total sample size in each case. This will not hold for subgroups (see below).

Combining other weights

Analogous calculations can be performed for:

Nurse weights: wtn_UKY1234, wtn_UKY56, wtn_Y78, wtn_Y911
Blood weights: wtb_UKY1234, wtb_UKY56, wtb_Y78, wtb_Y911
RPAQ weights: wtr_UKY1234, wtr_UKY56, wtr_Y78, wtr_Y911
Spot- urine weights: wtsu_Y6, wtsu_Y78, wtsu_Y911 {* see below}

* Note that spot-hour urine samples were only collected in Years 6-11 so when combining these weights, the correct proportions to use are 1/6; 2/6; 3/6.

Weights for combined sub-group analysis

The above explanation assumes that analysis will be performed for all cases i.e. all adults and children. If analysis of subgroups is required, analogous calculations should be performed on the combined dataset filtered to include only the subgroup of interest. This will produce bespoke weights for analysis of that particular subgroup (adults only for example).

One additional step is required but otherwise the procedure is the same:

i) Divide each weight variable by its sum (i.e. the sum of the weights);
ii) Multiply each by the total (combined) sum of the four weights;
iii) Multiply the Years 1-4 weight by 4/11, the Years 5&6 weight by 2/11, the Year 7&8 weight by 2/11 and the Years 9-11 weight by 3/11;
iv) Combine the resulting weights into one variable;
v) Re-scale this weight to have a mean of 1.

The additional step (v) ensures that the resulting weights have a mean of 1.

Example: individual weights (adults only)

To create new individual weights for analysis of adults (only) in the combined dataset, you can use the following syntax in SPSS.

```
select if age>=19.
weight off.
compute x=1.
aggregate outfile = * mode=addvar /break x /n1 = sum(wti_UKY1234)
/n2 = sum(wti_Y56) /n3 = sum(wti_Y78) /n4 = sum(wti_Y911).
compute N = sum (n1, n2, n3, n4).
compute wti_UKY1234r = wti_UKY1234 * N / n1 * (4/11).
compute wti_Y56r     = wti_Y56     * N / n2 * (2/11).
compute wti_78r      = wti_Y78     * N / n3 * (2/11).
compute wti_91011r       = wti_Y91011      * N / n4 * (3/11).
compute wti_UKY1to11Ad = sum (wti_UKY1234r, wti_Y56r, wti_78r, wti_911r).
aggregate outfile = * mode=addvar /break x /mn=mean(wti_UKY1to11Ad).
compute WTI_UKY1to11Ad = WTI_UKY1to11Ad / mn.
exec.
```

The above syntax is generic i.e. it can be used to create bespoke weights for any subgroup; just change the criteria in the first line to select the relevant subgroup. (This includes the full combined dataset i.e. if the first line is excluded then the syntax will create appropriate weights for the full dataset.)

The resulting weights (wti_UKY1to11Ad) should have a mean of 1 and be non-missing for all cases in the combined dataset of adults. As above, you can check this by running descriptives on the weights: desc wti_UKY1to11Ad.

Notes:

1. As above, the intermediate weights (wti_UKY1234r, wti_Y56r, wti_Y78r, wti_Y911r) can be discarded/deleted.
2. If subgroup analysis is performed using weights produced for the whole dataset, Years 1-4, Years 5&6, Years 7&8 and Years 9-11 may not be in the correct proportion.

Appendix A UK Nutrient Databank (NDB)

A.1 Introduction to the NDB

The food level dataset provides nutrients for the foods in amounts as consumed whilst the NDB dataset provides nutrient information per 100g.

The NDB contains extensive information on the nutrient content of foods commonly consumed in the UK and enables nutrient intakes to be calculated from consumption data. Details on the history of the NDB can be found in Appendix A of the Years 1 to 9 report.

Data in the NDB (currently managed by PHE and NIHR BRC, Cambridge) is largely the same as that in the published UK food composition tables[12] but includes a larger range of processed foods and composite dishes and no missing values. The nutrient data assigned to foods originate from three main sources:

- Nutrient analysis of foods
- Food manufacturers and information from food labels
- Recipe calculations for homemade dishes, and some manufactured products

In order to estimate nutrient intakes, values are assigned for all nutrients in all foods. Where reliable information is not available for some nutrients, data is obtained by extrapolating estimates from similar foods. All data is carefully evaluated before being incorporated into the databank.

In the NDNS RP it is essential that the NDB 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 RP, with a yearly update carried out by PHE in conjunction with the NIHR BRC, Cambridge.[13] Each year of the RP is coded separately using a contemporaneous version of the NDB. 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 extrapolating estimates by taking in to account the reformulations of manufacturers and changes in fortification practices. As changes in the NDB are partly driven by the availability of new analytical data, new data are produced only occasionally so a gradual change in the nutrient content of the food supply may appear as a step change in the NDB with the same foods having a different composition for some nutrients in one year of the RP compared to

the next. It is important to utilise contemporaneous food composition data to produce accurate assessments of dietary intake.

A.2 Description of the NDB fields and variables

A.2.1 Food name and food code

All foods are assigned a food code and a clear name is given to describe the code. The name may include specific qualities of the food, informing the user it is a fortified food, or from a specific brand. The food codes in the NDB cannot be linked directly to foods in McCance and Widdowson's Composition of Foods.[14]

A.2.2 Food code markers

Each food code is assigned as an 'F' or 'R' code. 'F' indicates that the code exists as an atomic food and 'R' denotes a recipe code usually comprising 2 or more food codes. Details of the recipes held in the 'R' codes are not provided in this dataset.

A.2.3 Sub food group name and code

A full breakdown of the NDNS food groups is provided in appendix R of the NDNS RP Years 9-11 report. Each food code is assigned to a subsidiary (sub) food group, expressed as an integer with an alphabetical suffix, which is a food group level of greater detail than the main food groups. The NDB displays the sub food group name as well as the code.

A.2.4 Water and vitamin loss

Recipe 'R' food codes may have water and vitamin loss assigned, which provides a correction to the nutrient data for associated cooking losses.

A.2.5 Maximum weight

This is an edit check field to assist users of the nutrient data to pick up any coding errors in portion sizes. Amending the maximum weight will not impact the nutrient values in the NDB. Maximum weights are set at sub food group level and do not usually have to be adjusted for each code. Food codes that would not appear in dietary assessment records, such as raw meat, have a maximum weight set at 1.

A.2.6 Base and unit (F codes only)

These fields describe how the nutrient data are expressed. For most foods the nutrients are entered per 100 grams (base = 100, unit = grams). For vitamin and mineral supplements, nutrients are entered per tablet, capsule, teaspoon or drop (base = 1, unit = tablet, capsule, teaspoon or drop). The base and unit of a food code must match the form in which items are recorded in the dietary assessment method.

A.2.7 Dilution

The majority of food codes have a dilution of 1. Concentrated soft drinks and dried products that are made up have a dilution factor greater than 1. For example, if a concentrated drink is usually made up 1 part concentrate to 4 parts water the dilution factor would be 5. This provides the user with additional detail regarding the food in its unconcentrated form; however, this is not used in calculating nutrient intakes.

A.2.8 Edible portion

The majority of food codes have an edible portion of 1; however, this will be less than 1 for foods that include waste, such as meat weighed with bones.

A.2.9 Comments and descriptions

The comments box provides details on when the food code was created, including any updates and the data source. The description box provides details on the number and brand names of products included in calculating the nutrient information, or the food codes used in collating the recipe. Some food codes (particularly dietary supplements) contain nutritional compounds not measured in the NDB (e.g. vitamin K or lutein).

A.2.10 Nutrition data

Each food code in the NDB has a value assigned for 56 nutrients, including energy, provided in specific units of measurement (see table A.1). Additionally, to ensure accurate reporting of specific food types in NDNS, each food code present in the NDB has been disaggregated into 28 specific food components (see table A.2).[15] Disaggregation values (g amount in per base unit, e.g. 75g ‘fruit’ in 100g ‘fruit pie’) are assigned into the NDB. Nutrient values reported as ‘trace’ are assumed as zero in the NDB. Some data will have been rounded into the appropriate number of decimal places.

A.3 Quality assurance

The NDB is designed to perform automated quality assurance checks to nutrient data,[16] when food codes are added or updated:

kcal	(protein x 4) + (fat x 9) + (carbohydrate x 3.75) + (alcohol x 7)
kJ	(protein x 17) + (fat x 37) + (carbohydrate x 16) + (alcohol x 29)
Carbohydrate	total sugars + starch
Total sugars	sum of all individual sugars
Total sugars	intrinsic + non milk extrinsic sugars
Total iron	haem iron + non haem iron
Total carotene	β-carotene + (α-carotene x 0.5) + (β-cryptoxanthin x 0.5)
Vitamin A	Retinol + (total carotene/6)
Total N	Protein/Nitrogen Conversion Factor (NCF)
Total fat	should be ≥ the sum of fatty acids
Fatty acids	0.6 X total fat is ≤ the sum of the fatty acids.

A.4 Nutrient fields and disaggregation categories in the Years 9-11 NDBs

Table A.1 Nutrient fields available in the NDB

Nutrient (unit of measure)		
Water (g)	Lactose (g) ^	Vitamin B6 (mg)
Total Nitrogen (g)	Other sugars^ (g)	Vitamin B12 (µg)
Nitrogen conversion factor	Saturated fatty acids (g)	Folate (µg)
Protein (g)	Cis-monounsaturated fatty acids (g)	Pantothenic acid (mg)
Fat (g)	Cis-n3 fatty acids (g)	Biotin (µg)
Carbohydrate (g)^	Cis-n6 fatty acids (g)	Sodium (mg)
Energy (kcal)	Total trans fatty acids (g)	Potassium (mg)
Energy (kJ)	Cholesterol (mg)	Calcium (mg)
Alcohol (g)	Retinol (µg)+	Magnesium (mg)
Englyst Fibre (NSP) (g)*	Total carotene (µg)+	Phosphorus (mg)
AOAC fibre (g)**	Alpha-carotene (µg)+	Iron (mg)
Starch (g)^	Beta-carotene (µg)+	Haem iron^ (mg)
Total sugars (g)^	Beta cryptoxanthin (µg)+	Non-haem iron (mg)

Non-milk extrinsic sugars*** (NMES) (g)^	Vitamin A (retinol equivalents) (µg)+	Copper (mg)
Free sugars (g) ^ ****	Vitamin D (µg)	Zinc (mg)
Intrinsic and milk sugars***** (IMS) (g) ^	Thiamin (mg)	Chloride (mg)
Glucose (g) ^	Riboflavin (mg)	Iodine (µg)
Fructose (g) ^	Niacin equivalent (mg)	Manganese (mg)
Sucrose (g) ^	Vitamin C (mg)	Selenium (µg)
Maltose (g) ^	Vitamin E (mg)	

^ Carbohydrate is expressed as monosaccharide equivalents. Other sugars include oligosaccharides, where data is available on their levels. Haem iron is calculated as 40% of the iron in fish and meat.

** Includes total non-starch polysaccharides. From Year 8, AOAC fibre has been reported in NDNS replacing Englyst fibre. Subsequent updates to Englyst fibre values in the databank are less reliable and so have not been included in the Y10 and Y11 NDB*

*** Includes resistant starch, lignin and non-starch polysaccharides captured by AOAC method.*

****Includes all sugars in fruit juices, table sugar, honey, sucrose, glucose and glucose syrups added to foods + 50% of the sugars in canned, stewed, dried or preserved fruits. Non-milk extrinsic sugars cannot be determined by chemical analysis so values are estimated based on available information on the types and sources of sugar in the food. From Year 8, free sugars have been reported in NDNS replacing NMES. Subsequent updates to NMES values in the databank are less reliable and so have not been included in the Y10 and Y11 NDB*

***** Includes all monosaccharides and disaccharides added to foods by the manufacturer, cook or consumer, plus sugars naturally present in honey, syrups, unsweetened fruit juices, unsweetened vegetables juices, fruit purees and vegetable purees..*

******Includes all sugars in fresh fruit and vegetables + 50% of the sugars in canned, stewed, dried or preserved fruits + lactose in milk and milk products.+ Vitamin A retinol equivalent is calculated as Retinol + (total carotene/6). Where, Total carotene is β-carotene + (½ α-carotene) + (½ β-cryptoxanthin). Fortified sources of vitamin A are entered as retinol in the NDB. From Year 8 updates to IMS values in the databank are less reliable and so have not been included in the Y10 and Y11 NDB.*

Table A.2 Disaggregation categories used in the NDNS RP

Disaggregation category (g)	
Fruit (Fresh and canned fruit)	Other Red Meat
Dried Fruit	Burgers (Burgers and grill steaks)
Fruit Juice	Sausages
Smoothie Fruit	Offal
Tomatoes	Poultry (white meat)
Tomato puree	Processed Poultry
Brassicaceae	Game Birds
Yellow red Green (Yellow, Red & Dark Green Leafy Vegetables)	White Fish
Other Vegetables	Oily Fish
Beans (Beans and pulses)	Canned Tuna

Nuts	Shellfish
Beef (red meat)	Cottage cheese
Lamb (red meat)	Cheddar Cheese
Pork (red meat)	Other Cheese
Processed Red Meat	

[1] The Eatwell Guide (2016) [Internet]. Available from: www.gov.uk/government/publications/the-eatwell-guide

[2] Gregory JR, Collins DL, Davies PSW, Hughes JM, Clarke PC. National Diet and Nutrition Survey: children aged 1 ½ to 4 ½ years. Volume 1: Report of the diet and nutrition survey London: HMSO, 1995.
Hinds K, Gregory JR. National Diet and Nutrition Survey: children aged 1½ to 4½ years. Volume 2: Report of dental survey. London: HMSO, 1995.

[3] Gregory JR, Lowe S, Bates CJ, Prentice A, Jackson LV, Smithers G, Wenlock R, Farron M. National Diet and Nutrition Survey: young people aged 4 to 18 years. Volume 1: Report of the diet and nutrition survey. London: TSO, 2000.
Walker A, Gregory J, Bradnock G, Nunn J, & White D. National Diet and Nutrition Survey: young people aged 4 to 18 years. Volume 2: Report of the oral health survey. London: TSO, 2000.

[4] Henderson L, Gregory J, Swan G. National Diet and Nutrition Survey: adults aged 19 to 64 years. Volume 1: Types and quantities of food consumed. London: TSO, 2002.
Henderson L, Gregory J, Irving K, Swan G. National Diet and Nutrition Survey: adults aged 19 to 64 years. Volume 2: Energy, protein, carbohydrate, fat and alcohol intake. London: TSO, 2002.
Henderson L, Irving K, Gregory J, Bates CJ, Prentice A, Perks J, Swan G, Farron M. National Diet and Nutrition Survey: adults aged 19 to 64 years. Volume 3: Vitamin and mineral intake and urinary analytes. London: TSO, 2003.
Rustin D, Hoare J, Henderson L, Gregory J, Bates CJ, Prentice A, Birch M. National Diet and Nutrition Survey: adults aged 19 to 64 years. Volume 4: Nutritional status (anthropometry and blood analytes), blood pressure and physical activity. London: TSO, 2004.
Hoare J, Henderson L, Bates CJ, Prentice A, Birch M, Swan G, Farron M. National Diet and Nutrition Survey: adults aged 19 to 64 years. Volume 5: Summary report. London: TSO, 2004.

[5] Finch S, Doyle W, Lowe C, Bates CJ, Prentice A, Smithers G, Clarke PC. National Diet and Nutrition Survey: people aged 65 years and over. Volume 1: Report of the diet and nutrition survey. London: TSO, 1998.
Steele JG, Sheiham A, Marcenes W, Walls AWG. National Diet and Nutrition Survey: people aged 65 years and over. Volume 2: Report of the oral health survey. London: TSO, 1998.

[6] See the UK Years 7-8 report (https://www.gov.uk/government/statistics/ndns-results-from-years-7-and-8-combined) and section 5.1 of this user guide for more details.

[7] Collecting information on shopping and food preparation practices, cooking facilities in the household, eating habits and food avoidance. Also included a section for the Main Food Provider (MFP).

[8] This is also the case with the Years 5-6 and Years 7-8 data. However, in the Years 1-4 combined data, there remains a slightly higher proportion of weekend days than weekdays.

[9] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/537616/SACN_Vitamin_D_and_Health_report.pdf

[10] It should be noted that the RNI has not been added retrospectively to the Years 1-4 and Years 5-6 datasets for those aged 4 to 64 years. However intakes as a % of the RNI can be calculated for Years 1-6 using the syntax provided in the Years 7-8 derived variables document.

[11] Produced for England and Wales by ONS, for Scotland by GROS and for Northern Ireland by NISRA.

[12] The summary edition and related supplements are referenced and located as follows: Composition of Foods Series, Sixth Edition and Supplements as cited in Bates B, Lennox A, Bates C & Swan G. National Diet and Nutrition Survey: Headline results from Years 1 and 2 (combined) of the Rolling Programme (2008/9 – 2009/10) http://www.dh.gov.uk/en/Publicationsandstatistics/Publications/PublicationsStatistics/DH_128166 (accessed 20/04/12).

[13] Previously FSA or DH when ownership of the NDB lay with them and the MRC Elsie Widdowson

Laboratory.

[14] McCance and Widdowson's The Composition of Foods integrated dataset [online] http://tna.europarchive.org/20110116113217/http://www.food.gov.uk/science/dietarysurveys/dietsurveys/

[15] Fitt E, Mak TN, Stephen AM, Prynne C, Roberts C, Swan G & Farron-Wilson M. (2010) Disaggregating composite food codes in the UK National Diet and Nutrition Survey food composition databank. Eur J Clin Nutr 64: S32-S36.

[16] Results from these calculations may not match the final values exactly (especially when comparing against analytical data) as a small margin of difference is acceptable in food composition.