# Derived variables

# 40 year follow-up (Q40)

# 2018-2019

A number of key variables were derived by BRHS researchers working with the BRHS data collected in 2018-2019 (Q40). These variables were created by calculating or categorising existing variables in the BRHS dataset. They have been shared and are widely used by other researchers working with BRHS data.

The derived variables available are listed in the table below. A description of the method used to derive or adjust each variable is provided in the sections that follow.

| Derived variables: | Description | section |
|---|---|---|
| Height | Measured Height (for those who attended the 40-year follow-up physical examination) | 1a |
| | Measured + Estimated Height (includes estimated height for non-attenders for examination but who completed a the 40-year follow-up postal questionnaire) | 1b |
| Weight | Measured weight | 2 |
| BMI | Body Mass Index (BMI) | 3 |
| Diet | Elderly Dietary Index (EDI) | 4 |
| | Macronutrient and micronutrient estimates | 5 |
| Medications | Blood pressure medication<br>Lipid lowering medications (including statins)<br>Diabetes medication | 6 |
| Frailty | Frailty components<br>1) Fatigue, Exhaustion- no energy<br>2) Unintentional weight loss<br>3) Low physical activity<br>4) Slow walking pace<br>5) Weakness - Low grip<br><br>Frailty Score categories | 7 |

## DERIVED VARIABLES

### 1. Height

**a) Measured Height (q40height) -** for those who attended the 40-year follow-up examination ONLY.
Measured height data are available for participants who attended the 40-year follow-up physical examination. Of the 667 attendees, 664 had their height successfully measured; 3 participants could not be measured.
Corrections to the measured heights were necessary due to stadiometer recording issues that occurred over several weeks during fieldwork. The field team logged daily levels of under-recording, which were subsequently used to adjust the height data.

The variable q40height in this dataset reflects these corrections and is identical to q40height_corr found in the Physical Examination Measurements data file.

| Derived variables | units | BRHS Variable name | Data access |
|---|---|---|---|
| q40height | cm | q40height | yes |

**b) Measured and Estimated Height (q40heightestimate) -** Available for 1013 participants who either 1) attended the 40-year physical examination or 2) completed the postal questionnaire.

This variable combines height data from two sources:

1. Participants who attended the 40-year follow-up physical examination and had their height measured.
2. Participants who did not attend the physical examination but completed the 40-year follow-up questionnaire. For these individuals, height was estimated.

   For those without a measured height at the 40-year follow-up, an **estimated height** was calculated using their most recent available measured height from a prior physical examination (1978 [Q1], 1998 [Q20], or 2010 [Q30]). The estimation was based on applying the average change in height observed among BRHS participants between their last recorded measurement and the 2018 follow-up (Q40).

   Average changes in height over these intervals are provided in the table below.

| Period | Average change in height m) over the period |
|---|---|
| 2010 (Q30) to 2018 (Q40) | -0.02063 m |
| 1998 (Q20) to 2018 (Q40) | -0.0362249 m |
| 1978 Baseline (Q1) to 2018 (Q40) | -0.0473454 m |

| Derived variables | units | BRHS Variable name | Data access |
|---|---|---|---|
| Q40Heightestimate | | q40Heightestimate | yes |

### 2. Weight (q40weight)

During the physical examination, weight was measured in one of two ways:

1. using the Tanita Body Composition Analyser machine (q40bc_weight) or
2. if the participant was fitted with a pacemaker, using ordinary digital scales.

The data from each method was recorded separately on the data collection form and was later combined into a new single derived variable (q40weight) which is included in this dataset.

| Derived variables | Units | BRHS Variable name | Data access |
|---|---|---|---|
| Weight | kg | q40weight | yes |

### 3. Body Mass Index (BMI) (q40bmi)

Body mass Index was calculated/derived using the measured (corrected) height and measured weight from the 40 year follow-up physical examination(Q40). BMI = Weight (kg)/ Height $(m)^2$

| Derived variables | units | BRHS Variable name | Data access |
|---|---|---|---|
| Body Mass Index (BMI) | $kg/m^2$ | q40bmi | Yes |

## 4. Elderly Dietary Index (EDI)

The EDI was developed by Kourlaba et al, specifically to address adherence to nutritional recommendations for older adults, based on the frequency of consumption of specific foods/food groups in the Modified MyPyramid for Older Adults.3, 4 The EDI consisted of nine components (meat; fish and seafood; vegetables; cereals; fruit; legumes; olive oil; dairy; bread), each assigned a four-point scoring system based on frequency of consumption, resulting in a total score range from 9-36. The frequency of olive oil consumption was not available, so the scoring of this component was modified from the original score used (1 = <1 day/week; 2 = 1-2 days/week; 3 = 3-6 days/week; 4 = daily) to the quantity of weekly consumption (never/rarely consumed and tertiles of weekly consumption). The derived EDI components and total score are based on responses to the dietary questions, PART II of the 40 year follow up survey questionnaire[5].

References:


1. Atkins JL, Whincup PH, Morris RW, Lennon LT, Papacosta O, Wannamethee SG. High diet quality is associated with a lower risk of cardiovascular disease and all-cause mortality in older men. J Nutr. 2014 May;144(5):673-80. doi: 10.3945/jn.113.186486. Epub 2014 Feb 26.
2. Parsons TJ, Papachristou E, Atkins JL, Papacosta O, Ash S, Lennon L, Whincup PH, Ramsay SE, Wannamethee SG. Healthier diet quality and dietary patterns are associated with lower risk of mobility limitation in older men. European Journal of Nutrition 2018; Epub Jul 23
3. Kourlaba G, Polychronopoulos E, Zampelas A, Lionis C, Panagiotakos DB. Development of a diet index for older adults and its relation to cardiovascular disease risk factors: the Elderly Dietary Index. Journal of the American Dietetic Association. 2009; 109:1022-30.
4. Lichtenstein AH, Rasmussen H, Yu WW, Epstein SR, Russell RM. Modified MyPyramid for Older Adults. The Journal of nutrition. 2008; 138:5-11.
5. **BRHS 2018 questionnaire Q2018 (Q40) V1.pdf**


**Elderly Dietary Index (EDI) components and scoring criteria:**

| Elderly Dietary Index Scoring (EDI) | | | | |
|---|---|---|---|---|
| **Component** | **Score = 1** | **Score = 2** | **Score = 3** | **Score = 4** |
| Meat | ≥3 days/week | Never/rarely | <1 day/week | 1-2 days/week |
| Fish/Seafood | Never/rarely | <1 day/week | ≥3 days/week | 1-2 days/week |
| Legumes | Never/rarely | <1 day/week | ≥3 days/week | 1-2 days/week |
| Fruit | <1 day/week | 1-2 days/week | 3-6 days/week | Daily |
| Vegetables | <1 day/week | 1-2 days/week | 3-6 days/week | Daily |
| Cereals | <1 day/week | 1-2 days/week | 3-6 days/week | Daily |
| Bread | None | White | White & whole grain | Whole grain |
| Olive oil | Never/Rarely | Tertile 1 of intake | Tertile 2 of intake | Tertile 3 of intake |
| Dairy | Full-fat milk and full-fat cheese | Semi-skimmed milk and full-fat cheese / full-fat milk and low-fat cheese | Skimmed milk and full-fat cheese | Skimmed/Semi-skimmed milk and low-fat cheese |

| **Derived variables**<br>**EDI components and score** | **Value labels/categories** | **BRHS Variable name** | **Data access** |
|---|---|---|---|
| 1. Bread | 1-4 as above | q40EDI_bread | yes |
| 2. Vegetables | 1-4 as above | q40EDI_veg | Yes |
| 3. Fruit | 1-4 as above | q40EDI_fruit | Yes |
| 4. Legumes | 1-4 as above | q40EDI_legume | Yes |
| 5. Meat | 1-4 as above | q40EDI_meat | Yes |
| 6. Cereals | 1-4 as above | q40EDI_cereal | Yes |
| 7. Olive oil | 1-4 as above | q40EDI_oliveoil | Yes |
| 8. Fish/Seafood | 1-4 as above | q40EDI_fish | Yes |
| 9. Dairy | 1-4 as above | q40EDI_dairy | Yes |
| | | | |
| EDI Total score (sum of all 9 components listed above) | 14-34 | Q40EDI_total9 | Yes |
| | | | |

## 5. Macronutrient and micronutrient estimates

A validated computer programme was used to calculate the total macronutrient and micronutrient intakes of all foods reported as consumed by the BRHS participants in the FFQ of PART II of the 40 year follow up survey questionnaire[3]. and hence the total energy intake (Ref 1). This computer programme multiplied food frequency by standard portion sizes for each food and by the nutrient composition of the food obtained from the UK food composition tables (Ref 2). The distribution of total energy intakes was checked for any extreme values. A list of the macronutrient and micronutrient with estimated intakes are shown in the table below.

1: Wannamethee, SG, Lowe, GD, Rumley, A, et al. (2006) Associations of vitamin C status, fruit and vegetable intakes, and markers of inflammation and hemostasis. *Am J Clin Nutr* 83, 567–574.

2: Holland, B, Welch, AA, Unwin, ID, et al. (1991) McCance and Widdowson's the Composition of Foods, 5th ed. London: Royal Society of Chemistry and Ministry of Agriculture, Fisheries and Food.

3. **BRHS 2018 questionnaire Q2018 (Q40) V1.pdf**

| **Derived variables**<br>**Macronutrients and micronutrients** | **Units** | **BRHS Variable name** | **Data Access** |
|---|---|---|---|
| Fat | mg/d | q40_FAT | yes |
| Saturated fat | mg/d | q40_SAT | yes |
| Polyunsaturated fat | mg/d | q40_POLY | yes |
| Protein | mg/d | q40_PROT | yes |
| Carbohydrate | mg/d | q40_CHO | yes |
| Starch | mg/d | q40_STCH | yes |
| Sugar | mg/d | q40_SUG | yes |
| Alcohol | mg/d | q40_ALC | yes |
| Cereal fibre | mg/d | q40_CF | yes |
| Vegetable fibre | mg/d | q40_VF | yes |
| Vitamin C | mg/d | q40_VITC | yes |
| Total daily k calories | kcal | q40_KCAL | yes |
| Cholesterol | mg/d | q40_CHOLEST | yes |
| Retinol (i.e. dietary vitamin A) | mg/d | q40_RETINEL | yes |
| Beta carotene | mg/d | q40_B_CAROT | yes |
| Alpha tocopherol (i.e. dietary vitamin E) | mg/d | q40_A_TOCOP | yes |
| Dietary intake linoleic acid | mg/d | q40_LINOLEIC | yes |
| Iron | mg/d | q40_IRON | yes |

## 6. Medications – derived medication variables

Respondents to the 40 year follow-up survey questionnaire[1] were asked to list the names of regular medications taken, the reason they were taken, the year started and whether the listed medication was prescribed. Using this information, (question 81.0) the medications were coded according to the British National Formulary (BNF) classification codes. Variables indicating whether BRHS participants were taking certain types of medications were derived based on defined BNF codes as shown in the table below.

1. **BRHS 2018 questionnaire Q2018 (Q40) V1.pdf**

The derived medication variables are listed below.

| **Derived variables**<br>**Medications** | **Value, labels/categories** | **BRHS Variable name** | Data access |
|---|---|---|---|
| Blood Pressure (BP) lowering medication | | | |
| Based on:<br>BNF codes:<br>2.2.1, 2.2.3, 2.2.4, 2.2.8, 2.4,<br>2.5.1 to 2.5.5, 2.6.2 | 0= not on BP lowering medication<br>1= taking BP lowering drugs<br>(reason: ICD codes 401 429 459)<br>2= taking BP lowering drugs<br>(Reason: not for hypertension<br>(ICD other than those above))<br>9= taking BP lowering drugs<br>(reason: not specified) [usually grouped with code 1 – assume taken for BP]<br>. = missing data on drug taking | q40bpmed_icd | Yes |
| **Lipid lowering medication** | | | |
| On BP lowering drugs:<br>BNF codes: 2.12 | 0= not on BP lowering medication<br>1= taking BP lowering drugs<br>. =missing data | q40bnf212_lipidlowering | Yes |
| Diabetes medication: | | | |
| Diabetic med Insulin BNF code 6.1.1 | 0=not on insulin (BNF6.1.1)<br>1=on insulin (BNF6.1.1) | q40bnf611_insulin | Yes |
| Diabetic medication BNF code 6.1.2 | 0=not on diabetic medication<br>1=on diabetic medication | q40bnf612_diabMed | Yes |

## 7. FRAILTY

Assessment of frailty was based on the 'Fried frailty phenotype'[2] using both questionnaire and objective data. This included unintentional weight loss (assessed as ≥5% decrease in self-reported weight that was reported to be unintentional); exhaustion (if response to the question 'Do you feel full of energy?' was 'no'); weakness (assessed as lowest fifth of grip strength distribution – grip strength was assessed during the physical examination. See section 5.39 of the 40 year follow-up physical examination protocol[3] for method; and slow walking speed (lowest fifth of walking speed – assessed during the physical examination see 5.32 for method[3]. If walking speed was unavailable, self-report of slow walking pace (being unable to walk more than a few steps or <200 yards or difficulty walking across a room) or low physical activity (self-report of being less/much less active than an average man). Presence of three or more of these components was defined as frailty, and presence of one or two as pre-frailty.


1. Ramsay SE, Arianayagam DS, Whincup PH, et al. Cardiovascular risk profile and frailty in a population-based study of older British men. Heart 2015;101:616–22.

2. Fried LP, Tangen CM, Walston J, et al. Frailty in older adults: evidence for a phenotype. J Gerontol A Biol Sci Med Sci 2001;56:M146–57.

3. **BRHS 2018-19 (Q40) 40yr follow-up Physical examination protocol.pdf**


| **Frailty components** | **Value, labels/categories** | **BRHS Variable name** | **Data access** |
|---|---|---|---|
| 1) Fatigue- Exhaustion- no energy | 0=no, 1=yes | q40exh | yes |
| 2) Unintentional weight loss | 0=no, 1=yes | q40frailtyUWL | Yes |
| 3) Low physical activity | 0=no, 1=yes | q40lowact | Yes |
| 4) Slow walking speed | 0=no, 1=yes | q40slow_walk | Yes |
| 5) Weakness - Low grip strength | 0=no, 1=yes | q40low_grip1 | Yes |
| | | | |
| **Frailty Score (categories)**<br>Note<br>(Total score=sum of 5 components listed above) | 0= Not frail<br>1=pre-frail (total score 1 or 2)<br>2=frail (total score 3,4 or 5) | q40fscore | yes |

## Operationalization of Frailty according to the Frailty Phenotype of Fried et al

| Criterion (Yes/No) | Response Item/Functional Measure | Notes* | Data source |
|---|---|---|---|
| Unintentional weight loss | ≥5% self-reported weight loss from previous questionnaire (2017). | Specified not trying to lose weight or no change/unknown change in weight but a substantial measured weight loss (i.e., ≥5%) since the previous assessment. If missing and self-reported weight loss of more than 7 pounds (3 kg) in past 3 months, then coded as unintentional weight loss. | Questionnaire + Physical examination |
| Fatigue | "Do you feel full of energy?" (Response to a question 71.0g on the 2018 (Q40) questionnaire). | Answering "no" coded as fatigue | Questionnaire |
| Low physical activity | "Compared with a man who spends 2 hours on most days on activities such as: walking, gardening, household chores, DIY projects, how physically active would you consider yourself?" (Response to a question 26.5 on the 2018(Q40) questionnaire). | Answering "much less active" coded as low physical activity. If missing information on self-reported walking, cycling and sporting physical exercise used to determine activity level | Questionnaire |
| Weakness | Grip strength (Lamar Hydraulic Hand Dynamometer Model J00105) highest of 3 readings in both hands. (Tested at the Q40 physical examination). | Lowest quintile coded as weak. Where measured grip strength was unavailable self-reported weak grip strength or inability to grip with hands (e.g., opening a jam jar) was coded as weakness. | Questionnaire + Physical examination |
| Slow walking speed | Gait speed (m/s) based on the time required to walk 3 m at normal pace. (Tested at the Q40 physical examination). | Lowest quintile coded as slow walking speed. Where measured gait speed was unavailable, self-report of low walking pace (or being unable to walk more than a few steps, or <200 yards (approximately 180 m), or difficulty walking across a room) was used to determine slowness. | Questionnaire + Physical examination |

*Those with 3 or more criteria missing excluded.