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# Harmonising physical health measures in five national cohort studies

12 June 2025

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# Harmonisation: physical health

Rebecca Hardy  
Martina Narayanan  
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# Agenda

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- Introduction
- Harmonisation process and asthma specifications
  - General harmonisation process
  - New harmonised asthma variables
  - Paper: childhood asthma and mental health/educational outcomes
- Diabetes
  - Diabetes specifications
  - New harmonised diabetes variables
  - Paper: diabetes ...

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# Introduction

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- Multiple longitudinal population studies in the UK
  - Including birth cohort studies
- Follow the same individuals across the life course
- Collect data at multiple time points

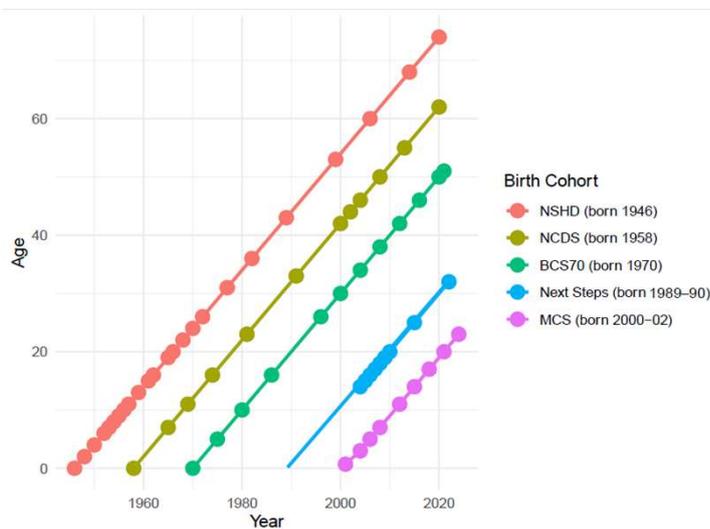


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## British Birth Cohort Studies

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## Cross-cohort comparisons

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- Compare by birth cohort:
  - Differences at a given age
  - Differences in change with age
  - Differences in associations
- Increase statistical power by pooling (e.g. genetics)
- Piecing together full life course
- Multiple challenges including harmonisation of variables
  - Some questions are harmonised prospectively
  - Retrospective harmonisation often needed
  - Use of variables from multiple sweeps

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## Physical health

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|                      |                   |                    |
|----------------------|-------------------|--------------------|
| General health       | Vision            | Cardiovascular     |
| Longterm illness     | Hearing           | Headaches          |
| Cancer               | Blood pressure    | Chronic fatigue    |
| Accidents            | Height            | Epilepsy           |
| Hospital admissions  | Weight            | Gallstones         |
| Diet                 | Diabetes          | Kidney problems    |
| Exercise             | Hip circumference | Cholesterol        |
| Skin conditions      | Lung function     | Prescription drugs |
| Respiratory problems | Back pain         | Allergies          |

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## Physical health

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|                             |                   |                       |
|-----------------------------|-------------------|-----------------------|
| General health              | Vision            | <b>Cardiovascular</b> |
| Longterm illness            | Hearing           | Headaches             |
| <b>Cancer</b>               | Blood pressure    | Chronic fatigue       |
| Accidents                   | Height            | Epilepsy              |
| Hospital admissions         | Weight            | Gallstones            |
| Diet                        | <b>Diabetes</b>   | Kidney problems       |
| Exercise                    | Hip circumference | Cholesterol           |
| Skin conditions             | Lung function     | Prescription drugs    |
| <b>Respiratory problems</b> | Back pain         | Allergies             |

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## Considerations

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- Type of physical health condition
  - Chronic versus episodic
- Type of measure
  - “Current” versus “ever had”
- Changes in historical diagnoses rates and definitions

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## Resources

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- Derived variables available via UKDS
  - asthma and diabetes
- General learning from our approach
  - Identified challenges with using and harmonising physical health variables
  - Similar approach can be used for other conditions

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## Harmonisation process and specifications for asthma

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## Types of data

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- Survey data
- Biomedical data
- Linked data

We focus on survey data, more specifically self reports or doctor reports from data files freely available on the UK Data Service with end user license agreement (or via Skylark for NSHD)

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## Harmonisation process

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- Step 1: Documentation of all available variables in all 5 cohorts for diabetes, respiratory problems, cancer and cardiovascular disease

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## Harmonisation process

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- Step 1: Documentation of all available variables in all 5 cohorts for diabetes, respiratory problems, cancer and cardiovascular disease
- Step 2: Choose specific conditions to start with (asthma and diabetes)

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## Harmonisation process

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- Step 1: Documentation of all available variables in all 5 cohorts for diabetes, respiratory problems, cancer and cardiovascular disease
- Step 2: Choose specific conditions to start with (asthma and diabetes)

<https://github.com/CLS-Data/Harmonised-asthma-across-cohorts>

<https://github.com/CLS-Data/harmonised-diabetes-across-cohorts>

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## Harmonisation process

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- Step 1: Documentation of all available variables in all 5 cohorts for diabetes, respiratory problems, cancer and cardiovascular disease
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github.com/CLS-Data/Harmonised-asthma-across-cohorts

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|                                    |                                   |                |
|------------------------------------|-----------------------------------|----------------|
| Asthma Derivation BCS.do           | Add files via upload              | 11 minutes ago |
| Asthma Derivation MCS.do           | Add files via upload              | 11 minutes ago |
| Asthma Derivation NCDS.do          | Add files via upload              | 11 minutes ago |
| Asthma Derivation NextSteps.do     | Add files via upload              | 11 minutes ago |
| Asthma variable documentation.xlsx | Documentation of asthma variables | 7 minutes ago  |
| README.md                          | Update README.md                  | last month     |

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github.com/CLS-Data/Harmonised-asthma-across-cohorts

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| README.md                          | Update README.md                  | last month     |

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| Study | Year    | Age | Informant | Person of Interest | Variable | Scale | Question   | Response   |
|-------|---------|-----|-----------|--------------------|----------|-------|--|--|
| MCS   | 2015/16 | 14  | Parent    | Cohort Member      | ASMA     |       | Does [cohort member] have asthma?  | Yes/No   |
| MCS   | 2012/13 | 11  | Parent    | Cohort Member      | WHEE     |       | Has [cohort member] ever had wheezing or whistling in the chest at any time in the past?   | Yes/No   |
| MCS   | 2012/13 | 11  | Parent    | Cohort Member      | WHLY     |       | Has [cohort member] had wheezing or whistling in the chest in the last 12 months?  | Yes/No   |
| MCS   | 2012/13 | 11  | Parent    | Cohort Member      | WHAN     |       | How many attacks of wheezing has [cohort member] had in the last 12 months?  | 1 to 3/ 4 to 12/ More than 12  |
| MCS   | 2012/13 | 11  | Parent    | Cohort Member      | WHSD     |       | In the last 12 months, how often on average has [cohort member]'s sleep been disturbed due to wheezing?                                      | Never woken with wheezing/ Less than one night per week/ One or more nights per week |
| MCS   | 2012/13 | 11  | Parent    | Cohort Member      | WHSL     |       | In the past 12 months, has wheezing ever been severe enough to limit [cohort member]'s speech to one or two words at a time between breaths? | Yes/No   |
| MCS   | 2012/13 | 11  | Parent    | Cohort Member      | ASMA     |       | Has [cohort member] ever had asthma?   | Yes/No   |
| MCS   | 2012/13 | 11  | Parent    | Cohort Member      | WHEE     |       | In the last 12 months, has [cohort member] had wheezing or whistling in the chest at any time in the past?                                   | Yes/No   |

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| Study | Year    | Age | Informant | Person of Interest | Variable | Scale | Question   | Response   |
|-------|---------|-----|-----------|--------------------|----------|-------|--|--|
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| MCS   | 2012/13 | 11  | Parent    | Cohort Member      | WHEE     |       | In the last 12 months, has [cohort member] had wheezing or whistling in the chest at any time in the past?                                   | Yes/No   |

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## Harmonisation process

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- Step 3: Identify questions and items that are most commonly included across time and across cohorts

*Have you ever had [...]?*

*Since the last interview, have you had [...]?*

*Do you currently have [...]?*

*Do you have a longstanding illness? If yes, which one?*

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## Data on asthma in the cohorts

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- Does cohort member have asthma?
  - Lifetime prevalence ("ever" and "ever since x" questions)
  - Point prevalence ("currently" questions)
  - Exploration of longstanding illness questions
- Other related variables
  - Age at "diagnosis"
  - Doctor visits in last 12 months
  - Medication/treatment (e.g. inhaler)

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## Data on asthma in the cohorts

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- Does cohort member have asthma?
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### Step 4: Code indicator variables asthma and diabetes

- Within each sweep
- Across sweeps
- Across cohort studies

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## Data on asthma in the cohorts

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- Does cohort member have asthma?
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### Step 4: Code indicator variables asthma and diabetes

- Within each sweep ←
- Across sweeps
- Across cohort studies

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## Sweep-specific indicators

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Original variables with yes/no and missing data coded consistently across sweeps and cohorts.

### Ever had asthma reported at age xx

*asthma\_xx\_ever*. Self-report or parental report.

### Currently have diabetes reported at age xx

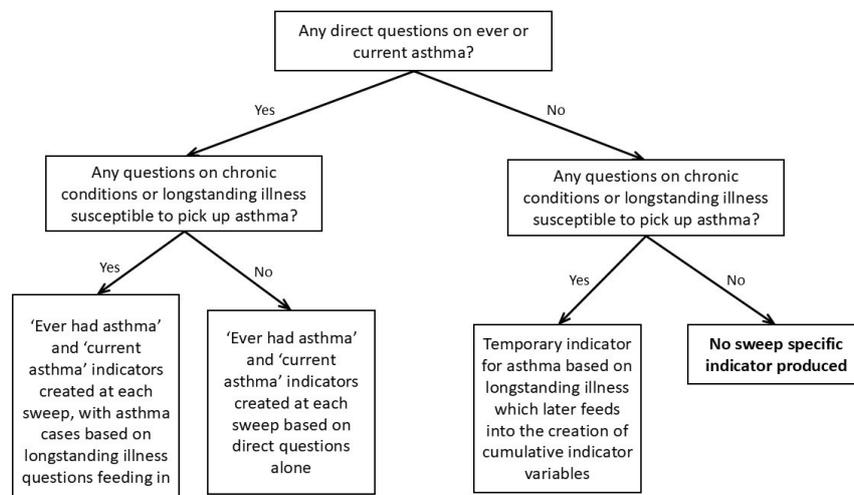
*asthma\_xx\_current*. Self-report or parental report.

*asthma\_xx\_currentdoc*. Reported by study doctor based on parental report and review of medical records.

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## Longstanding illness type questions and how we use them

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## Example for BCS at age 10

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*Has the child ever had one or more attacks or bouts in which there was wheezing or whistling in the chest?*

*What are these thought to be due to? (Asthma)*

>> asthma\_10\_ever

*Have there been any other illnesses or relevant conditions concerning the child's past or present health which have not been described already? If yes, please specify.*

>> one additional case identified and fed back into asthma\_10\_ever

*Did wheezing occur at any of the following ages?*

>> asthma\_10\_current

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## Example for BCS at age 10

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*Has the child ever had any of the following conditions? (Asthma) [doctor report]*

>> asthma\_10\_everdoc and asthma\_10\_currentdoc

*Is there any evidence that this child has now or has had in the past any significant illness, developmental problem, defect or handicap? Diagnosis [doctor report]*

>> additional cases of asthma identified and fed back into asthma\_10\_everdoc

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## Harmonisation process

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### Step 4: Code indicator variables asthma and diabetes

- Within each sweep
- Across sweeps ←
- Across cohort studies

### Ever had asthma reported up to age xx

*asthma\_xx\_cumul*

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## Asthma indicator variables in NCDS

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| Age | NCDS                                     |                 |
|-----|--|-----------------|
| 7   | asthma_7_ever<br>asthma_7_everdoc        | asthma_7_cumul  |
| 11  | asthma_11_ever                           | asthma_11_cumul |
| 33  | asthma_33_ever                           | asthma_33_cumul |
| 42  | asthma_42_ever<br>asthma_42_current      | asthma_42_cumul |
| 62  | asthma_62_current1<br>asthma_62_current2 |                 |
| 63  | asthma_63_current3                       |                 |

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## Asthma and wheezy bronchitis

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For NCDS and BCS asthma was grouped with wheezy bronchitis at certain time points.

‘Have you ever had asthma or wheezy bronchitis?’

‘Do you currently have asthma or wheezy bronchitis’

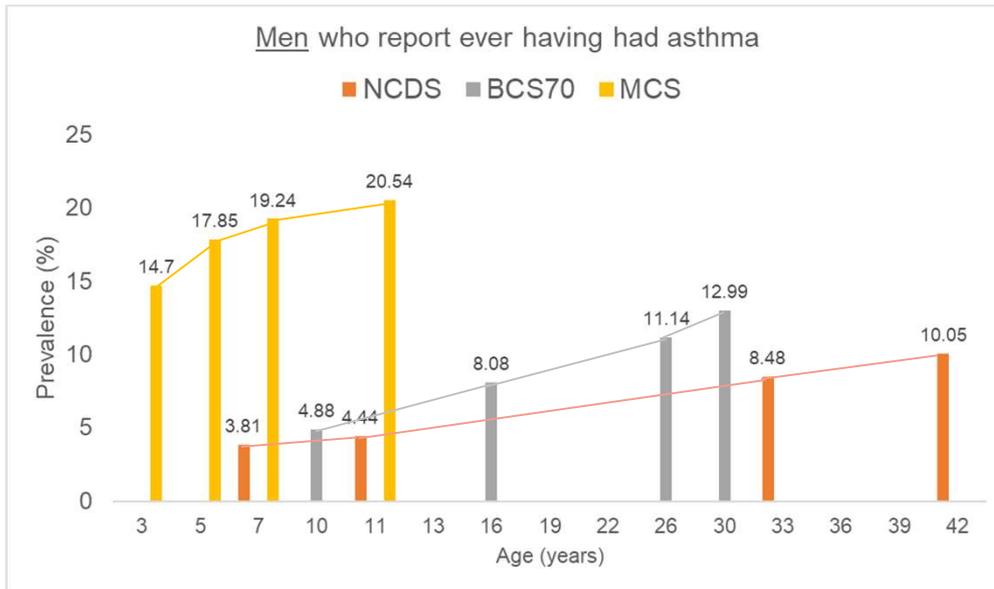
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## Asthma indicator variables in NCDS

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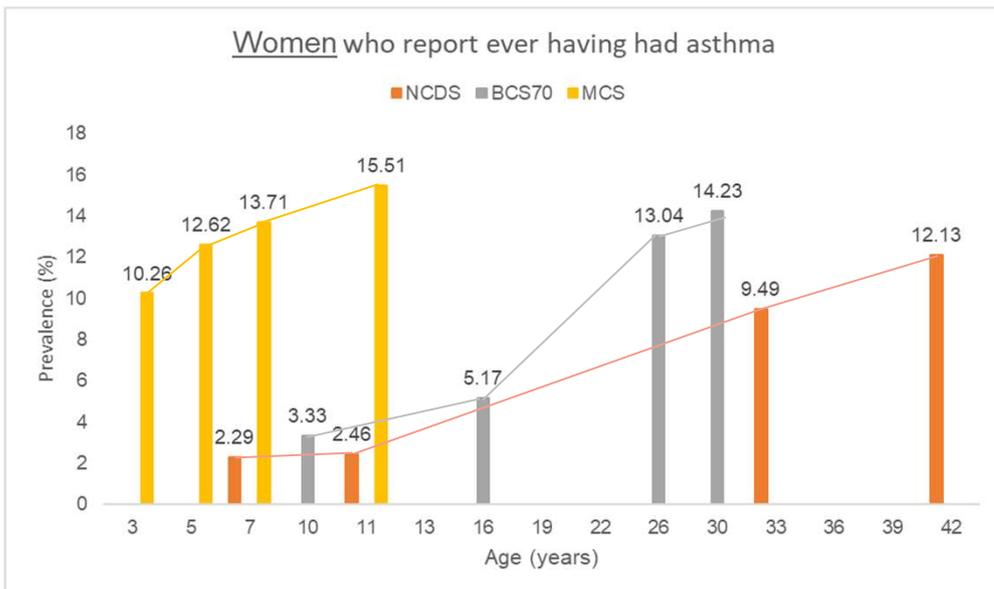
| Age | NCDS   |   |
|-----|--|---|
| 7   | asthma_7_ever / asthma_7_everdoc<br>asthmabronc_7_ever                                       | asthma_7_cumul<br>asthmabronc_7_cumul   |
| 11  | asthma_11_ever<br>asthmabronc_11_ever / asthmabronc_11_everdoc<br>asthmabronc_11_currentdoc  | asthma_11_cumul<br>asthmabronc_11_cumul |
| 16  | asthmabronc_16_ever / asthmabronc_16_current   | asthmabronc_16_cumul                    |
| 23  | asthmabronc_23_ever / asthmabronc_23_current   | asthmabronc_23_cumul                    |
| 33  | asthma_33_ever   | asthma_33_cumul                         |
| 42  | asthma_42_ever<br>asthma_42_current  | asthma_42_cumul                         |
| 50  | asthmabronc_50_current   |   |
| 55  | asthmabronc_55_ever_ltd  | asthmabronc_55_cumul_ltd                |
| 62  | asthma_62_current1 / asthma_62_current2<br>asthmabronc_62_current1 / asthmabronc_62_current2 |   |
| 63  | asthma_63_current3<br>asthmabronc_63_current3  |   |

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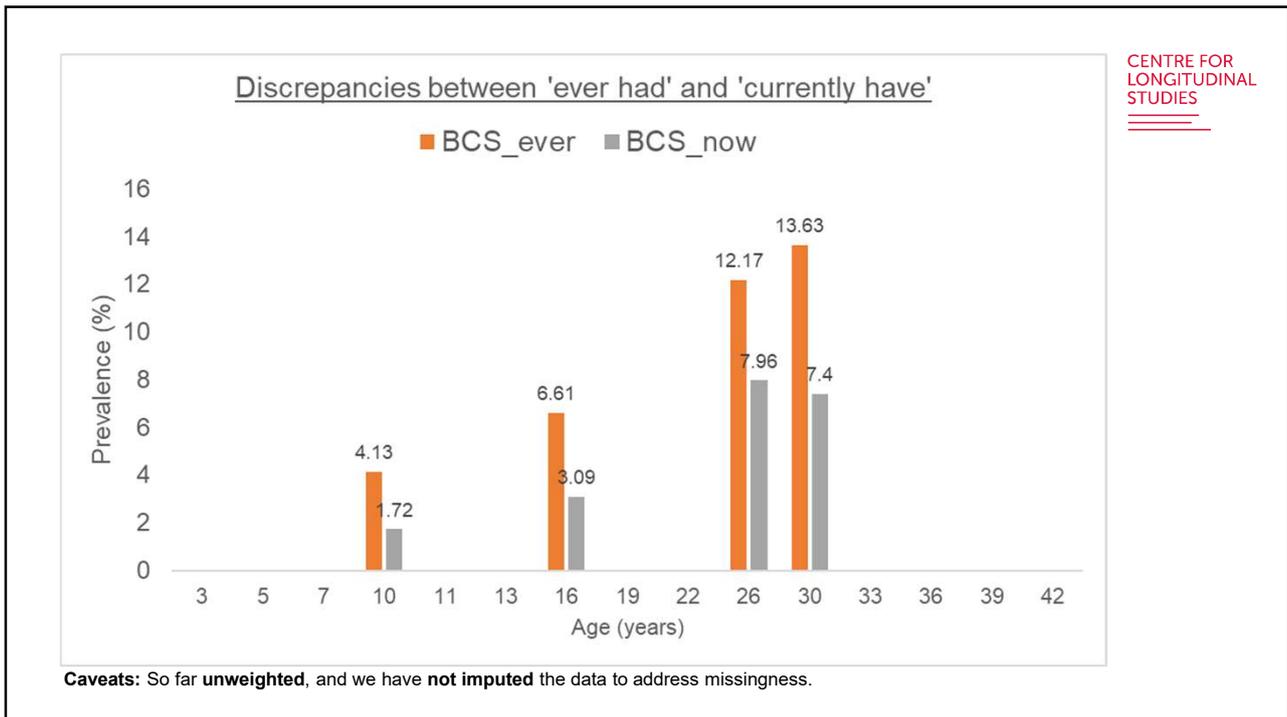
**Caveats:** So far **unweighted**, and we have **not imputed** the data to address missingness.

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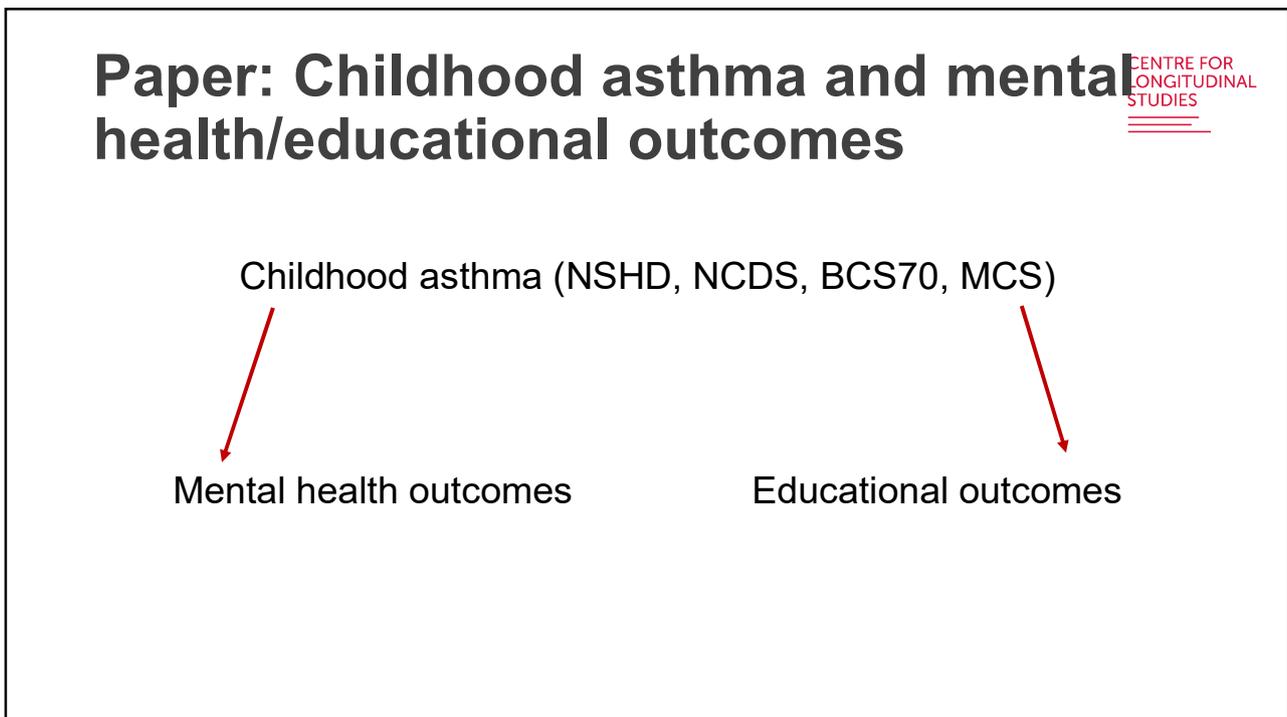


**Caveats:** So far **unweighted**, and we have **not imputed** the data to address missingness.

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## Paper: Childhood asthma and mental health/educational outcomes

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Childhood asthma (NSHD, NCDS, BCS70, MCS)

Cumulative 'ever had' indicator variable for asthma  
up to age 11 (NSHD, NCDS, MCS) or age 10 (BCS)

Mental health outcomes

- Emotional / behavioural problems at age 10/11 (NCDS, BCS, MCS)
- Psychological distress at age 42/43 (NSHD, NCDS, BCS)

Educational outcomes

- educational attainment early adulthood (NCDS, BCS, MCS)
- highest level of qualification late adulthood (NSHD, NCDS, BCS)

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## Harmonised self-reported diabetes in five British birth cohort studies

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## Harmonisation process

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1. Documentation of all diabetes questions
2. Creation of indicators at each sweep
3. Creation of cross-sweep indicators
- 4. Creation of a harmonised indicator of diabetes type**

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## Harmonised indicators of having self-reported diabetes at age xx

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## Sweep-specific indicators

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Original variables with yes/no and missing data coded consistently across sweeps and cohorts.

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### Currently have diabetes reported at age xx

*diab\_xx\_current*. Self-report or parental report.

*diab\_xx\_currentdoc*. Reported by study doctor based on parental report and review of medical records.

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## Sweep-specific indicators

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We also cleaned and derived variables feeding into the derivation of cross-sweep indicators and diabetes type.

These are not included in the deposited data but can be re-derived using our code.

### Examples:

- Diabetes indicated in response to a longstanding illness question.
- Medication use (e.g., whether injecting insulin and age began using insulin).
- Self-reported age at diagnosis.

**More information in the User Guide.**

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## Cross-sweep indicators

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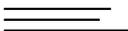

### Ever had diabetes up to and including age xx

*diab\_xx\_cumul*. Based on all available self-reported data.

**Note:** These indicators are derived for the 1946c, 1958c and 1970c only.

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## Harmonised self-reported diabetes type

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## Why a harmonised indicator of diabetes type?

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1. Diabetes type not asked consistently and only first reported at older ages in the oldest cohorts (53 in 1946c, 42 in 1958c, 30 in the 1970c).
2. There are differences in how diabetes type is asked about (e.g., 1958c asks about gestational diabetes, but no other study does).

**Note:** These indicators are derived for the 1946c, 1958c and 1970c only.

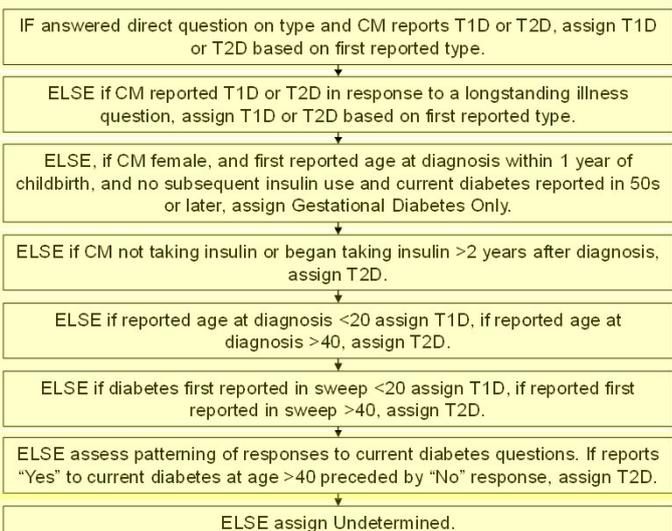
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## Assigning self-reported diabetes type

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Start with what  
a CM says  
about their  
diabetes type

Follow a  
process of  
deduction for  
those who do  
not self-report  
diabetes type



*diab\_type*  
type 1, type 2,  
gestational diabetes  
only, undetermined

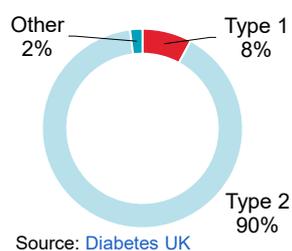
*diab\_type\_rsn* contains  
information about how  
the assignment of  
diabetes type was made  
(e.g., from self-reported  
type, from first report in  
sweep age <20 or >40)

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## Breakdown of diabetes by type

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|                     | 1946c<br>n (%)   | 1958c<br>n (%)    | 1970c<br>n (%)   |
|---------------------|------------------|-------------------|------------------|
| <b>Any diabetes</b> | <b>463 (100)</b> | <b>1140 (100)</b> | <b>807 (100)</b> |
| Type 1              | 40 (8.6)         | 90 (7.9)          | 72 (8.9)         |
| Type 2              | 419 (90.5)       | 1008 (88.4)       | 678 (84.0)       |
| Gestational only    | <5 (<1.0)        | 12 (1.0)          | 25 (3.1)         |
| Undetermined        | <5 (<1.0)        | 30 (2.6)          | 32 (4.0)         |



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## Caution flags

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Our hierarchy uses self-reported diabetes type as the first method of assignment.

For some individuals, there are discrepancies between the type of diabetes they are assigned (driven by their self-reported type), and other indicators (e.g., self-reported insulin use and age at diagnosis).

**Example:** Self-reports type 1 diabetes but reports age at diagnosis at age 46 and no insulin use at age 50.

*diab\_type\_caution* flag

*diab\_type\_caution\_rsn* contains information about why observation is flagged (self-report type 1 but no insulin use, self-report type 1 but age at diagnosis >30, self-report type 2 but age at diagnosis <20)

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## Breakdown of diabetes caution flags

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|  | 1946c<br>% of cases    | 1958c<br>% of cases  | 1970c<br>n (% of cases) |
|--|------------------------|----------------------|-------------------------|
| Any caution flag                               | 30 (6.5% of all cases) | 68 (6% of all cases) | 29 (4% of all cases)    |
| Type 1 but no insulin                          | 0                      | 0                    | 7 (10% of all T1D)      |
| Type 1 but diagnosis age >30                   | 6 (15% of all T1D)     | 21 (23% of all T1D)  | 0                       |
| Type 1 but no insulin AND<br>diagnosis age >30 | 23 (58% of all T1D)    | 1 (1% of all T1D)    | 0                       |
| Type 2 but diagnosis age <20                   | 1 (<1% of all T2D)     | 46 (5% of all T2D)   | 5 (<1% of all T2D)      |

Likely misclassifications of diabetes type are **more common for Type 1 diabetes and in older cohorts.**

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## Agreement with cohort-specific derived variables in 1946c

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Derived diabetes variables for 1946c at age 53 used survey responses *and* medical notes (*diabec* and *diabty*).

- Cumulative prevalence by age 53 very similar (2.9% in harmonized data versus 2.7%)
- For cases up to age 53, similar assignments of type using harmonization approach and cohort-specific derived variable.
  - Differences mostly driven by self-reported type (in harmonization approach) or because of use of medical notes for more information
  - Cases of gestational diabetes mostly assigned Type 2 using harmonization approach.

**More information can be found in the User Guide.**

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# A note on self-reported diabetes

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## The issue of undiagnosed and diagnosed diabetes

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Screening and diagnostic practices have changed across time. Knowledge about diabetes and diabetes type has likely increased across cohorts.

**To self-report diabetes, cohort members must be diagnosed.**

Among those who *do* report diabetes, agreement with GP records (Pastorino *et al.*, 2015) and biomarker data (HbA1c; Gondek, 2020) is often good.

Less is known about the numbers who *do not* report diabetes (whether due to being undiagnosed or not reporting a diagnosed condition).

**Prevalence estimates using self-reports is an underestimate of true diabetes prevalence**, and the extent of the underestimate likely varies by cohort.

Gondek (2020) *We are living longer but not healthier [...]* UCL Doctoral Thesis.  
Pastorino *et al.* (2015) Validation of self-reported diagnosis of diabetes in the 1946 British birth cohort. *Primary Care Diabetes*, 9(5): 397-41

52

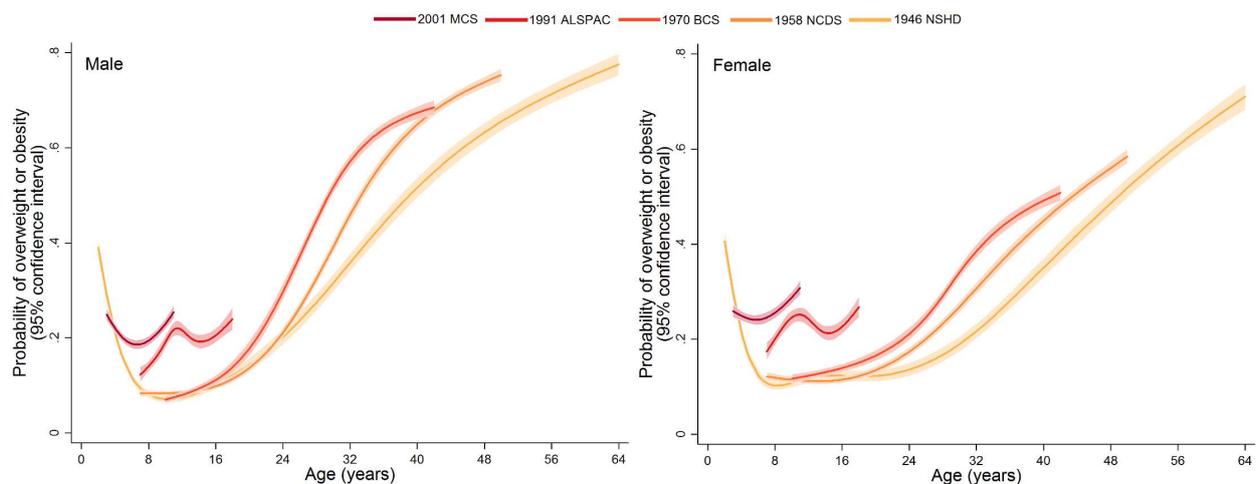
# Harmonised variables in action: Self-reported type 2 diabetes and childhood socioeconomic position across cohorts

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## More recently born cohorts have experienced higher prevalence of overweight and obesity across the lifecourse

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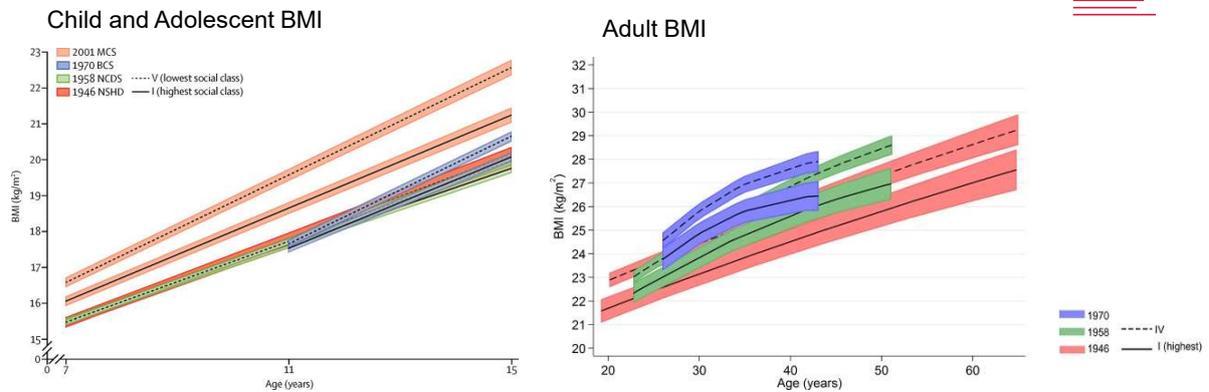


Johnson *et al.* (2015) How has the age-related process of overweight or obesity development changed over time? [...] *PLOS Med*, 12(5): e1001828.

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## Social inequalities in body mass index (BMI)

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- Social inequalities in BMI in childhood/adolescents emerge after 1970c.
- Magnitude of difference in adult BMI by parental social class and adult BMI was similar across 1946c, 1958c and 1970c.

Bann *et al.* (2017) Socioeconomic inequalities in Body Mass Index across adulthood [...] *PLOS One*, 14(1): e1002214.  
Bann *et al.* (2018) Socioeconomic inequalities in child and adolescent body-mass index [...] *Lancet Public Health*, 3(4): E194-E203

55

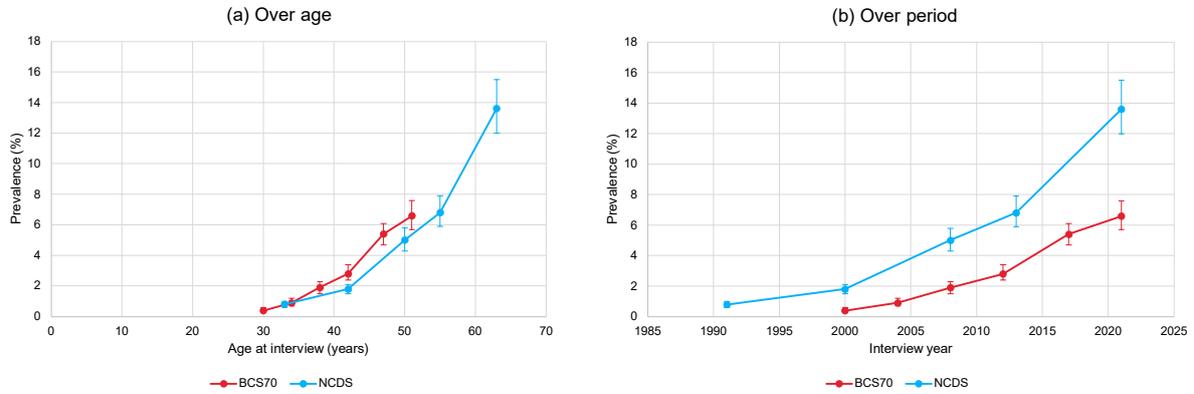
## Diabetes Paper

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1. Describe prevalence of self-reported type 2 diabetes across the lifecourse.
2. Describe social inequalities in type 2 diabetes risk across cohorts. Do we see the same thing as for obesity?

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## Type 2 diabetes prevalence



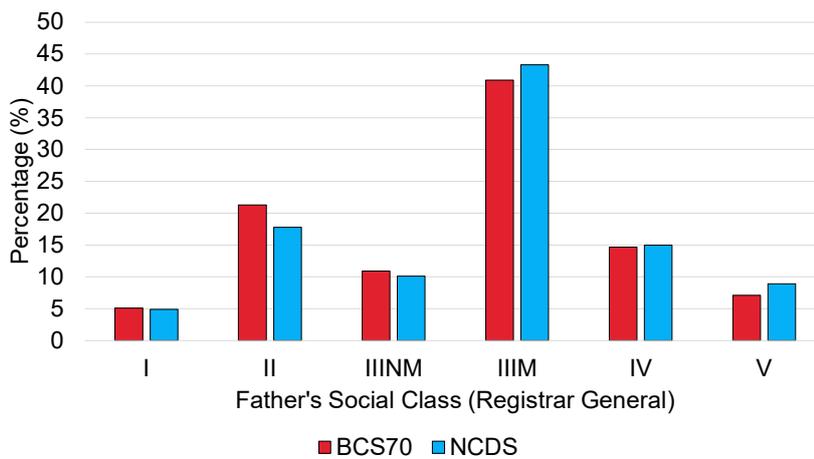
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**Preliminary findings.** Prevalences are given among respondents at each sweep. We use inverse probability weights for nonresponse derived for each sweep to mitigate the impact of loss to follow-up. We plan to add the 1946c.

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## Father's occupational social class when cohort member was 10/11

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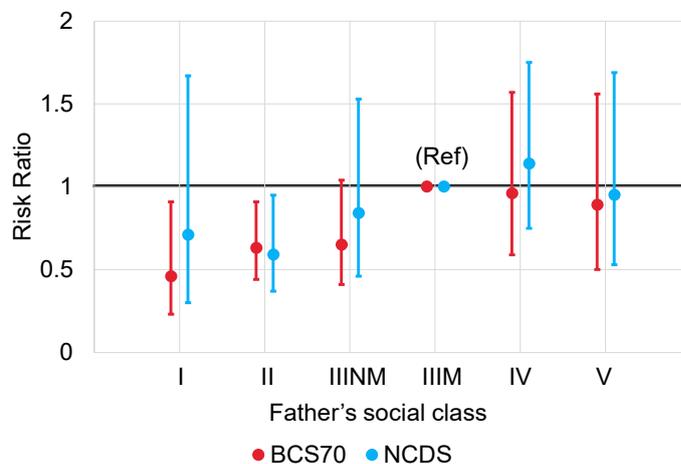


**Preliminary findings.** To minimise missingness in childhood SEP, social class at age 10/11 was supplemented with values at age 5/7 and at birth. We plan to add the 1946c.

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## Father's social class and risk of type 2 diabetes at age 42

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**Preliminary findings.** Models adjust for sex at birth and use inverse probability weights for nonresponse. Using modified Poisson regression with robust standard errors to model binary outcome. We plan to add the 1946c and expand the range of ages when the outcome is observed.

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## Slope index of inequality of self-reported type 2 diabetes risk at age 42

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|                           | 1958c<br>RR (95% CI) | 1970c<br>RR (95% CI) |
|---------------------------|----------------------|----------------------|
| Slope index of inequality | 1.86 (1.09-3.18)     | 1.89 (1.17-3.06)     |

The slope index of inequality quantifies the risk of the most disadvantaged in each cohort compared to the most advantaged (i.e., a change in Ridit score from 0 to 1).

**Preliminary findings.** Models adjust for sex at birth and use inverse probability weights for non-response. Using modified Poisson regression with robust standard errors to model binary outcome. We plan to add the 1946c and expand the range of ages when the outcome is observed.

Plan to include data from 1946c, and to expand modelling to a wider range of ages (here only focus on outcome at age 42).

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