Using linked Hospital Episode Statistics data to aid the handling of missing cohort data

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Outline

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1. Background
2. Data sources: NCDS, HES & linkage
3. HES predictors of NCDS non-response
4. Restoring NCDS sample representativeness (preliminary results)
5. Conclusions

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Background

Missing data

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- Non-response is common in longitudinal surveys.
- Missing values due to non-response mean less efficient estimates because of the reduced size of the of the analysis sample.
- Also introduce the potential for bias since respondents are often systematically different from non-respondents.

Analytical Strategy

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- Growing interest in whether linked administrative data have the potential to aid analyses subject to missing data in cohort studies.
- Identify predictors of cohort non-response in linked administrative data.
- Explore whether added value in including identified variables as auxiliary variables with respect to restoring sample representativeness.
- Today: NCDS and HES.

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Data sources: NCDS & HES

1958 National Child Development Study (NCDS)

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- Longitudinal birth cohort study of all babies born in a single week in Great Britain in 1958.
- Initial N = 17,415, later augmented by immigrants born in target week.
- Multidisciplinary content spanning physical and educational development, economic circumstances, employment, family life, health behaviour, wellbeing, social participation and attitudes.

Hospital Episode Statistics (HES)

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- A collection of databases containing details of interactions with NHS hospitals in England:
  - Admitted Patient Care (APC)
  - Critical Care (CC) admissions
  - Accident and Emergency (A&E) attendances
  - Outpatient (OP) appointments
- Datasets include dates, diagnoses, procedures, patient demographics, and hospital characteristics for each hospital episode.
- Often multiple episodes per admission (APC).
- Period of data availability differs by dataset: APC (1997-), OP (2003-), A&E (2007-), CC (2009-).
- Linkage between NCDS and all four HES datasets undertaken on the basis of consent at sweep 8 (age 50).

NCDS-HES linkage

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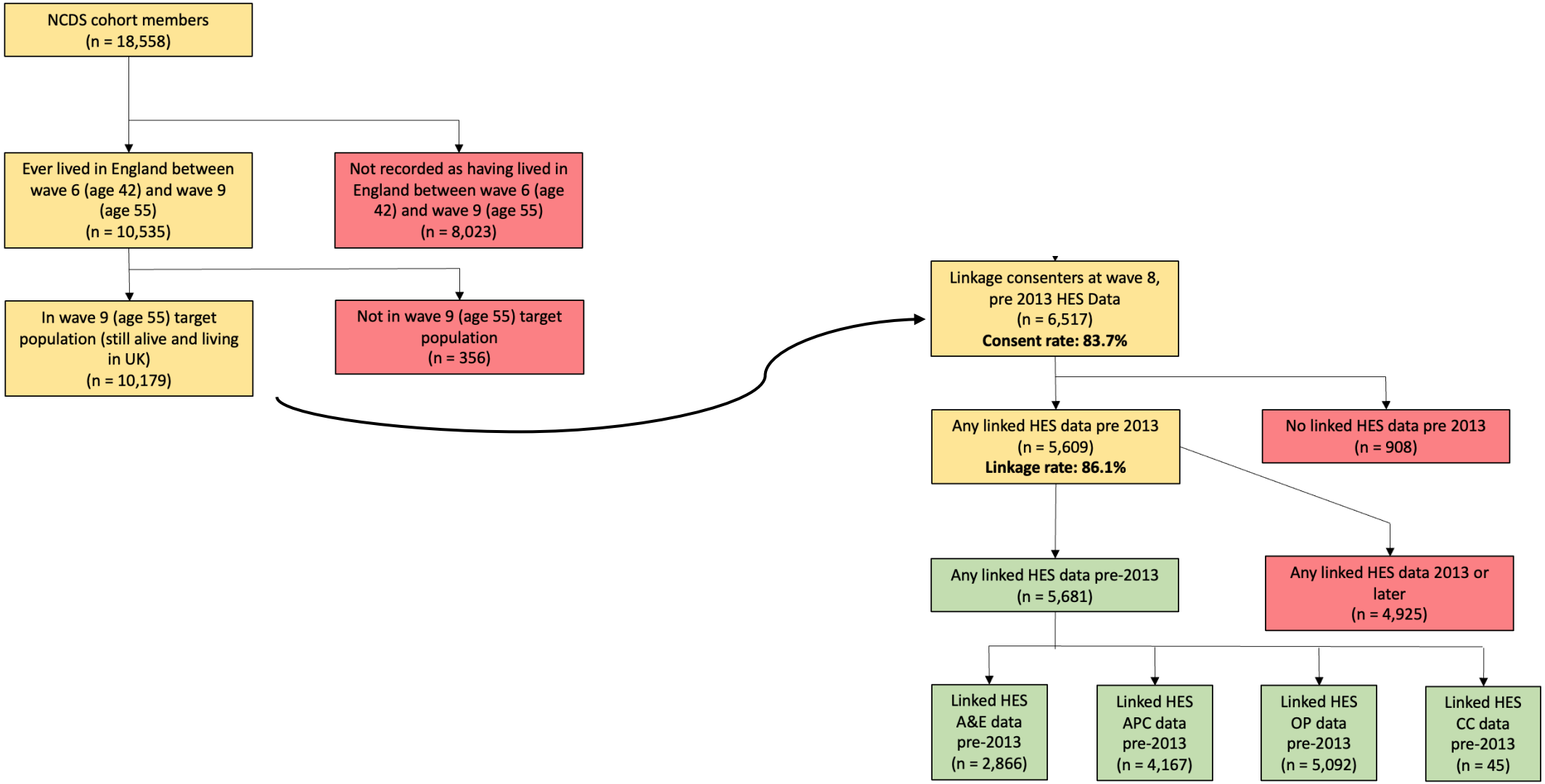

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HES predictors of NCDS non-response

Potential predictors of non-response

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- Variables derived using HES APC, OP and A&E Prior to NCDS9 (2013).
- A total of 58 variables derived relating to:
  - Numbers of admissions and appointments
  - Missed appointments
  - Investigations undertaken
  - Diagnoses
  - Treatments received
- Assume cohort members who were eligible for and consented to linkage but did not have linked data truly did not have a relevant interaction with an NHS hospital.
- E.g. No linked HES APC data → truly no hospital admissions → all APC-based diagnoses and treatments = "No".

Identifying predictors of non-response

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- Least absolute shrinkage and selection operator (LASSO) on identified HES variables (58)
- LASSO removes variables that are not influential in predicting non-response at age 55.
- Uses a penalty (lambda) that is determined by cross-validation
- Select lambda value that gives the minimum mean cross validated error (minimum misclassification error)
- Variables selected after LASSO include:
  - Number of A&E Appointments (continuous)
  - Treatment for adult mental illness in APC (binary)
  - Proportion of appointments missed in outpatient (continuous)
  - 5 ICD Chapter Diagnoses in APC (e.g., ICD Chapter IV: Endocrine, nutritional and metabolic diseases) (binary)
  - 2 Operation Codes in APC (e.g., Operation Code T – Soft Tissue) (binary)

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Restoring NCDS sample representativeness

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We include the ten HES variables identified as being predictive of non-response as auxiliary variables in MI analyses.

We explore the performance of this approach in two separate samples

A. Amongst HES Linkage Consenters

B. Amongst the Whole Cohort

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Analysis A – HES Consenters

1. See whether distributions of variables from earlier sweeps can be replicated using only data from respondents at a later sweep

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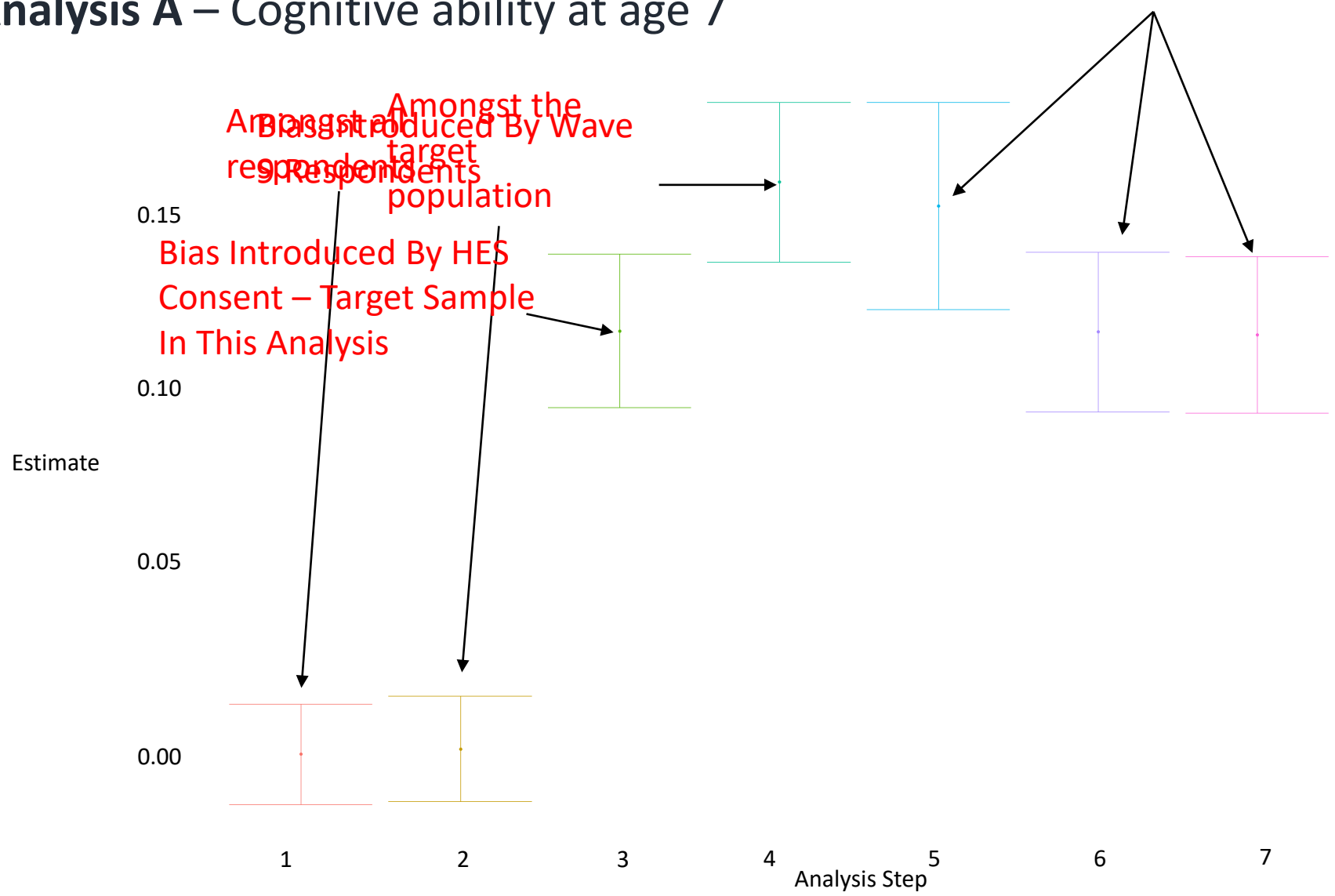
Analysis A – Cognitive ability at age 7



1 – All Respondents
n = 14,407

2 – Target Population
n = 12,938

3 – Consenters
n = 5,546

4 – Wave 9 Respondents
n = 4,928

5 – MI HES
n = 5,546

6 – MI Survey
n = 5,546

7 – MI Survey & HES
n = 5,546

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Analysis B – Amongst the Whole Cohort

1. See whether distributions of variables from earlier sweeps can be replicated using only data from respondents at a later sweep.

Restoring NCDS sample representativeness

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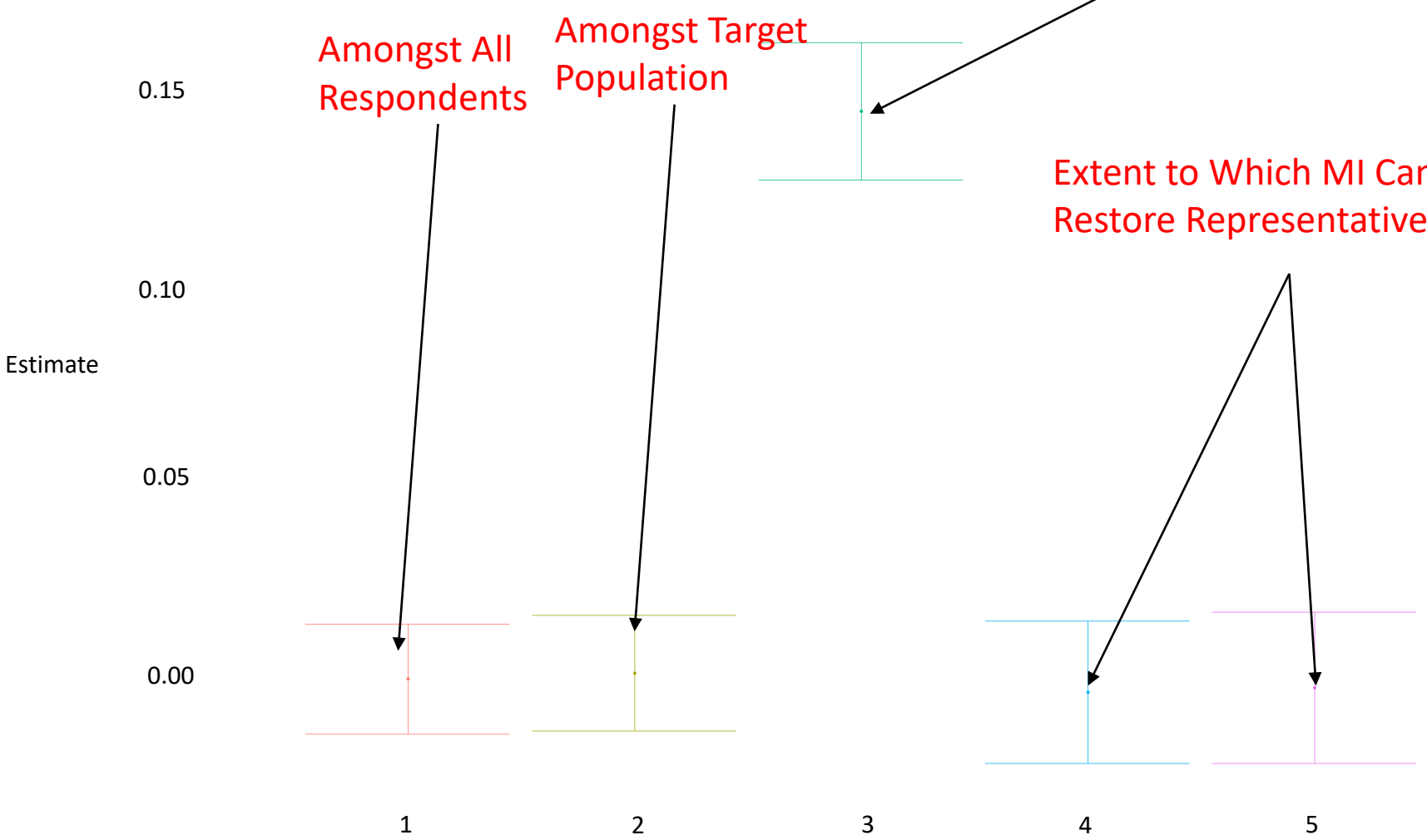
Analysis B – Cognitive ability at age 7



1 – All Respondents
n = 14,407

2 – Target Population
n = 12,938

3 – Wave 9 Respondents
n = 7,839

4 – MI Survey
n = 12,938

5 – MI Survey & HES
n = 12,938

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Conclusions

Conclusions

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- We have identified HES variables which are predictive of non-response at NCDS wave 9 (age 55).
- Incorporating these variables as auxiliary variables in MI analyses of NCDS had relatively limited impact on restoring sample representativeness.
- We found no additional gain relative to using only previously identified survey predictors of non-response.
- Whilst this finding may not extend to other analyses or NCDS sweeps, it highlights the utility of survey variables in handling non-response.
- This provides a straightforward approach for missing data handling, which is easily implemented in standard software.

References

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Thank you.

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