Supplementary Table 1. Summary of UK LLC Longitudinal Population Studies included in this paper.

LPS listed in alphabetical order

ALSPAC: Avon Longitudinal Study of Parents and Children	
Description of Study Population (including citations and references if required)	Pregnant women resident in a defined area of the former county of Avon, UK with expected dates of delivery 1st April 1991 to 31st December 1992 were invited to take part in the study [1,2]. The initial number of pregnancies enrolled is 14,541 (14,676 foetuses), resulting in 14,062 live births and 13,988 children who were alive at 1 year of age. Further recruitment took place after the age of 7 years, the total sample size for analyses using any data collected after the age of 7 is therefore 15,454 pregnancies, resulting in 15,589 foetuses. Of these 14,901 were alive at 1 year of age. [1]Boyd A, Golding J, Macleod J, Lawlor DA, Fraser A, Henderson J, Molloy L, Ness A, Ring S, Davey Smith G. Cohort Profile: The 'Children of the 90s'; the index offspring of The Avon Longitudinal Study of Parents and Children (ALSPAC). International Journal of Epidemiology 2013; 42: 111-127. [2]Fraser A, Macdonald-Wallis C, Tilling K, Boyd A, Golding J, Davey Smith G, Henderson J, Macleod J, Molloy L, Ness A, Ring S, Nelson SM, Lawlor DA. Cohort Profile: The Avon Longitudinal Study of Parents and Children: ALSPAC mothers cohort. International Journal of Epidemiology 2013; 42:97-110.
Acknowledgements	We are extremely grateful to all the families who took part in this study, the midwives for their help in recruiting them, and the whole ALSPAC team, which includes interviewers, computer and laboratory technicians, clerical workers, research scientists, volunteers, managers, receptionists and nurses.
Ethics	Ethical approval for the study was obtained from the ALSPAC Law and Ethics committee and local research ethics committees (NHS Haydock REC: 10/H1010/70).
Further information	http://www.bristol.ac.uk/alspac/researchers/access/

BIB: Born in Bradford	
Description of Study Population (including citations and references if required)	Born in Bradford (BiB) is a prospective pregnancy and birth cohort study of the children, mothers and fathers from 13,776 pregnancies from between 2007 and 2011, based in Bradford, UK. The study was established to examine how genetic, nutritional, environmental, behavioural and social factors affect health and development during childhood, and subsequently, adult life in a deprived multi-ethnic population[1]. From 2017 to 2021 a full follow-up of the cohort was conducted[2] to investigate the determinants of children's pre-pubertal health and development,

	including through understanding parents' health and wellbeing, and to obtain data on exposures in childhood that might influence future health. In 2022, the Age of Wonder study was launched to complete another full follow-up through adolescence into adulthood, focusing on priority areas of physical and mental health, growth, identity, cognition, socioeconomic status and environmental exposures[3]. [1]John Wright, Neil Small, Pauline Raynor, Derek Tuffnell, Raj Bhopal, Noel Cameron, Lesley Fairley, Debbie A Lawlor, Roger Parslow, Emily S Petherick, Kate E Pickett, Dagmar Waiblinger, Jane West, on behalf of the Born in Bradford Scientific Collaborators Group, Cohort Profile: The Born in Bradford multi-ethnic family cohort study, International Journal of Epidemiology, Volume 42, Issue 4, August 2013, Pages 978–991, https://doi.org/10.1093/ije/dys112 [2]Rosemary R C McEachan, Gillian Santorelli, Aidan Watmuff, Dan Mason, Sally E Barber, Daniel D Bingham, Philippa K Bird, Laura Lennon, Dan Lewer, Mark Mon-Williams, Katy A Shire, Dagmar Waiblinger, Jane West, Tiffany C Yang, Deborah A Lawlor, Kate E Pickett, John Wright, Cohort Profile Update: Born in Bradford, International Journal of Epidemiology, Volume 53, Issue 2, April 2024, dyae037, https://doi.org/10.1093/ije/dyae037 [3]Shire KA, Newsham A, Rahman A et al. Born in Bradford's Age of Wonder cohort: protocol for adolescent data collection [version 1; peer review: 2 approved]. Wellcome Open Res 2024, 9:32 (https://doi.org/10.12688/wellcomeopenres.20785.1)
Acknowledgements	Born in Bradford has received funding from the Wellcome Trust [101597/Z/13/Z and 223601/Z/21/Z]; a joint grant from the UK Medical Research Council (MRC) and UK Economic and Social Science Research Council (ESRC) [MR/N024391/1; a British Heart Foundation Clinical Study grant [CS/16/4/32482]; the National Institute for Health Research under its Applied Research Collaboration Yorkshire and Humber [NIHR200166]; and a Health Foundation COVID-19 Award [2301201]. Born in Bradford is only possible because of the enthusiasm and commitment of the Children and Parents in BiB. We are grateful to all the participants, health professionals, schools and researchers who have made Born in Bradford happen. **NMR metabolomics data – additional acknowledgement** Researchers who use the NMR metabolomics data should cite the following data note: https://wellcomeopenresearch.org/articles/5-264 The funding acknowledgement should be:

BIB: Born in Bradford	
	Funding for the metabolomics analyses in BiB has been provided by the US National Institutes of Health [R01 DK10324]; the European Research Council (ERC) under the European Union's Seventh Framework Programme [FP7/2007-2013] / ERC grant agreement no 669545; and the UK Medical Research Council [MC_UU_00011/6].
Ethics	Study: Born in Bradford Age of Wonder: a co-produced mixed methods longitudinal exploration of health and wellbeing trajectories through adolescence and young adulthood in the multi-cultural city of Bradford, UK. REC: 21/YH/0261 Study: Born in Bradford's Growing up Family Study REC: 16/YH/0320 Study: Born in Bradford: A longitudinal cohort study of babies born in Bradford and their mothers and fathers REC: 07/H1302/112
Further information	https://www.borninbradford.nhs.uk

EXCEED: Extended Cohort for E-Health, Environment and DNA	
Description of Study Population (including citations and references if required)	EXCEED is a longitudinal population-based cohort which facilitates investigation of genetic, environmental and lifestyle-related determinants of a broad range of diseases and of multiple morbidity through data collected at baseline and via electronic healthcare record linkage. Recruitment has taken place in Leicester, Leicestershire and Rutland since 2013 and is ongoing, with 11,000 participants. Participants provided a DNA sample, have consented to follow-up for up to 25 years through electronic health records and additional bespoke data collection is planned. Data available includes baseline demographics, anthropometry, spirometry, lifestyle factors (smoking and alcohol use), multi-omics data, and longitudinal health information from primary and secondary care records. Patients have consented to be contacted for recall-by-genotype and recall-by-phenotype sub-studies. Further details about the study can be accessed in the Cohort Profile Paper[1], with additional information about our COVID-19 Focus available as a Data Note Paper[2].

EXCEED: Extended Cohort for E-Health, Environment and DNA	
	[1]Catherine John, Nicola F Reeve, Robert C Free, […] Edward J Hollox, Louise V Wain, Martin D Tobin. Cohort Profile: Extended Cohort for E-health, Environment and DNA (EXCEED). International Journal of Epidemiology, Volume 48, Issue 3, June 2019, Pages 678–679j, https://doi.org/10.1093/ije/dyz073 [2]Lee PH, Guyatt AL, John C et al. Extended Cohort for E-health, Environment and DNA (EXCEED) COVID-19 focus [version 1; peer review: awaiting peer review]. Wellcome Open Res 2021, 6:349, https://doi.org/10.12688/wellcomeopenres.17437.1
Acknowledgements	EXCEED is funded by the University of Leicester, the NIHR Leicester Respiratory Biomedical Research Centre, the NIHR Clinical Research Network East Midlands, the Medical Research Council (grant G0902313) the Wellcome Trust (grant 202849) and HDR UK BREATHE- Health Data Research Hub for Respiratory Health (grant MC-PC_19004). EXCEED gratefully acknowledges the support of all participants and staff who have contributed to the study.
Ethics	The study is led by the University of Leicester, in partnership with University Hospitals of Leicester NHS Trust and in collaboration with Leicestershire Partnership NHS Trust, local general practices and smoking cessation services. Ethical approval for the study was obtained from the Leicester Central Research Ethics Committee (13/EM/0226).
Further information	www.exceed.org.uk/research

NSHD: Medical Research Council National Survey of Health and Development	
Description of Study Population (including citations and references if required)	The MRC National Survey of Health and Development (NSHD) is a socially stratified birth cohort of 2,547 women and 2,815 men. It is a sample of all births in England, Scotland, and Wales that occurred in one week in 1946, and consists of all singleton births to married women with a husband in non-manual and agricultural employment and 1 in 4 of all comparable births to women with a husband in manual employment.[1] The study members have been followed up in over 25 data collections. Regular interviews with the mothers were conducted by health visitors, with additional assessments by school doctors and teachers. In adult life, research nurses conducted home visits at ages 26, 36, 43, 53 and 69, a detailed clinic visit took place between ages 60-64, as well as clinical sub studies focusing on the heart (Myofit46) and brain (Insight46). [1]Kuh et al. Cohort profile: updating the cohort profile for the MRC National Survey of Health and Development: a new clinic-based data collection for ageing research. Int J Epidemiol. 2011 Feb;40(1):e1-9. doi: 10.1093/ije/dyq231.

NSHD: Medical Research Council National Survey of Health and Development	
Acknowledgements	The UK Medical Research Council provides core funding for the MRC National Survey of Health and Development (MC_UU_00019/1; MR/Y014022/1). We are extremely grateful to the NSHD study members for their lifelong participation and continuing support; and to past and present members of the study teams, who helped to collect and process the data.
Ethics	Ethical approval for the study was obtained from the UK Research Ethics Committee (REC).
Further information	https://skylark.ucl.ac.uk/

NIHR BioResource: National Institute of Health Research BioResource COVID-19 Psychiatry and Neurological Genetics (COPING) Study	
Description of Study Population (including citations and references if required)	The NIHR BioResource is a recallable resource of over 200,000 volunteers from the general population, and patients with rare and common diseases. Participants provide information about their health and lifestyle, together with biological samples, including DNA, and consent for access to their health records and for re-contact. The BioResource is one of four key infrastructures supporting population level genomic projects in the UK Life Science Industrial Strategy. Key unique features of the NIHR BioResource are its focus on recall of participants for experimental medicine studies by genotype and/or phenotype, and the inclusion of both healthy volunteers and patients with common and rare diseases. Participants represented in UK LLC are respondents to an online recall study, the Covid-19 Psychiatry and Neurological Genetics (COPING) study[1]. [1]https://www.maudsleybrc.nihr.ac.uk/posts/2020/may/covid-19-psychiatry-and-neurological-genetics-coping-study/
Acknowledgements	We thank NIHR BioResource volunteers for their participation, and gratefully acknowledge NIHR BioResource centres, NHS Trusts and staff for their contribution. We thank the National Institute for Health and Care Research, NHS Blood and Transplant, and Health Data Research UK as part of the Digital Innovation Hub Programme. The views expressed are those of the author(s) and not necessarily those of the NHS, the NIHR or the Department of Health and Social Care.
Ethics	Research Tissue Bank (REC REF: 17/EE/0025).
Further information	https://bioresource.nihr.ac.uk/using-our-bioresource/academic-and-clinical-researchers/apply-for-bioresource-data/

TwinsUK	
Description of Study Population (including citations and references if required)	TwinsUK is the largest adult twin registry in the UK and the most clinically detailed in the world. The national, population-based study was founded in 1992 and aims to investigate the

TwinsUK	
	genetic and environmental basis of a range of complex diseases and conditions. TwinsUK currently consists of over 15,700 volunteer adult twins (both monozygotic and dizygotic) who are between 18 to 104 years of age from around the UK (mean age 59)[1]. The cohort is predominantly female, and disease prevalence is broadly reflective of the UK population. Over 750,000 biological samples and extensive phenotypes have been collected longitudinally over 30 years. [1]Verdi S, Abbasian G, Bowyer RCE, et al.: TwinsUK: The UK Adult Twin Registry Update. Twin Res Hum Genet. 2019; 22(6): 523–529.
Acknowledgements	We thank TwinsUK members for their participation and the TwinsUK operations team for coordinating and undertaking twin clinic visits and data and sample collections. TwinsUK is funded by the Medical Research Council (MRC), Wellcome LEAP, Wellcome Trust, EPSRC, BBSRC, Versus Arthritis, European Commission, Chronic Disease Research Foundation (CDRF), Zoe Ltd, the National Institute for Health and Care Research (NIHR) Clinical Research Network (CRN) and Biomedical Research Centre based at Guy's and St Thomas' NHS Foundation Trust in partnership with King's College London.
Ethics	All collections of TwinsUK data have received ethical approval associated with TwinsUK Biobank (19/NW/0187), TwinsUK (EC04/015) or Healthy Ageing Twin Study (H.A.T.S) (07/H0802/84) from NHS Research Ethics Committees. Linkage to health and environmental records is also covered by approval from the Health Research Authority (19/CAG/0223).
Further information	https://twinsuk.ac.uk/resources-for-researchers/access-our-data/

Supplementary Table 2.

NHS_E COHORT	>1 LSOA	1 LSOA	All
>1 LSOA	14396 (36.7%)	9311 (23.7%)	23707
1 LSOA	9424 (24.0%)	6085 (15.5%)	15509
All	23820	15396	39216

Supplementary Table 2. Agreement of whether the individual reported only a single LSOA in Cohort and NHS_E.

Supplementary Table 3

n = 39,216	<-10 years	-5 to -10 years	-2 to -5 years	-2 to 2 years	2 to 5 years	5 to 10 years	> 10 years
age							
19-30 years	278 (19.6%)	236 (16.7%)	218 (15.4%)	645 (45.5%)	26 (1.8%)	<1%	<1%
31-59 years	3088 (18.2%)	2873 (16.9%)	2536 (15.0%)	8030 (47.4%)	281 (1.7%)	<1%	<1%
60-74 years	1711 (18.1%)	1673 (17.7%)	1403 (14.9%)	4425 (46.9%)	138 (1.5%)	<1%	<1%
75+ years	894 (17.4%)	859 (16.7%)	777 (15.1%)	2498 (48.6%)	76 (1.5%)	<1%	<1%
≤18 years	890 (17.7%)	836 (16.6%)	774 (15.4%)	2410 (47.9%)	83 (1.7%)	<1%	<1%
Missing	224 (18.0%)	214 (17.2%)	190 (15.3%)	578 (46.6%)	24 (1.9%)	<1%	<1%
Total	7085 (18.1%)	6691 (17.1%)	5898 (15.0%)	18586 (47.4%)	628 (1.6%)	<1%	<1%

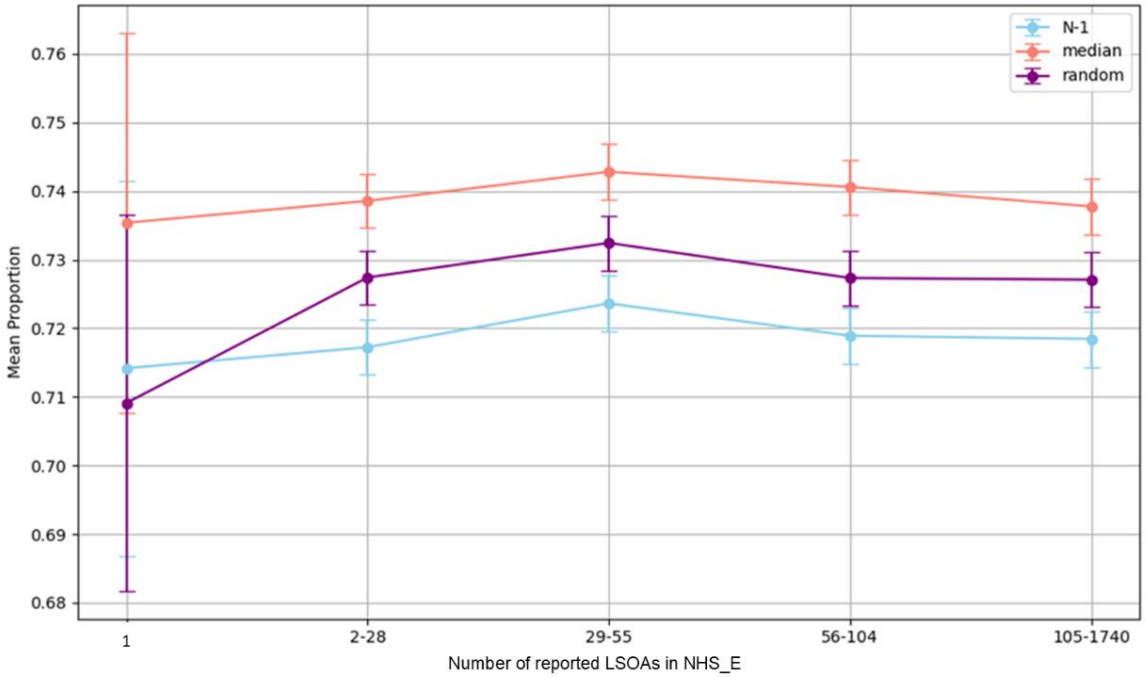
Supplementary Table 3. Cross-sectional comparison, minimum start date difference by age groups. *<1% may include 0. Precise numbers for those cells are suppressed due to risk of disclosure, therefore only percentages were given.

Supplementary Table 4.

Full sample; Number of reported LSOA in NHS_E (*n* = 39,216)	**N-1**	**Median**	**Random (Beta)**
1	77%	78%	77%
2-28	78%	79%	79%
29-55	79%	80%	79%
56-104	78%	79%	78%
105-1740	79%	79%	79%
Reported at least 1 LSOA change in Cohort; Number of reported LSOA in NHS_E (*n* = 23,707)	**N-1**	**Median**	**Random (Beta)**
1	71%	74%	71%
2-28	72%	74%	73%
29-55	72%	74%	73%
56-104	72%	74%	73%
105-1740	72%	74%	73%
Reported no LSOA change in Cohort; Number of reported LSOA in NHS_E (*n* = 15,509)	N-1	Median	Random (Beta)
1	85%	84%	85%
2-28	89%	87%	88%
29-55	89%	88%	88%
56-104	88%	87%	87%
105-1740	89%	87%	88%

Supplementary Table 4. Mean coverage by three date ascertainment methods, using full analytical sample (*n* = 39,216), those reported at least one LSOA change (*n* = 23,797), and those reported only one LSOA (*n* = 15,509), over number of reported LSOAs in NHS_E in bins.

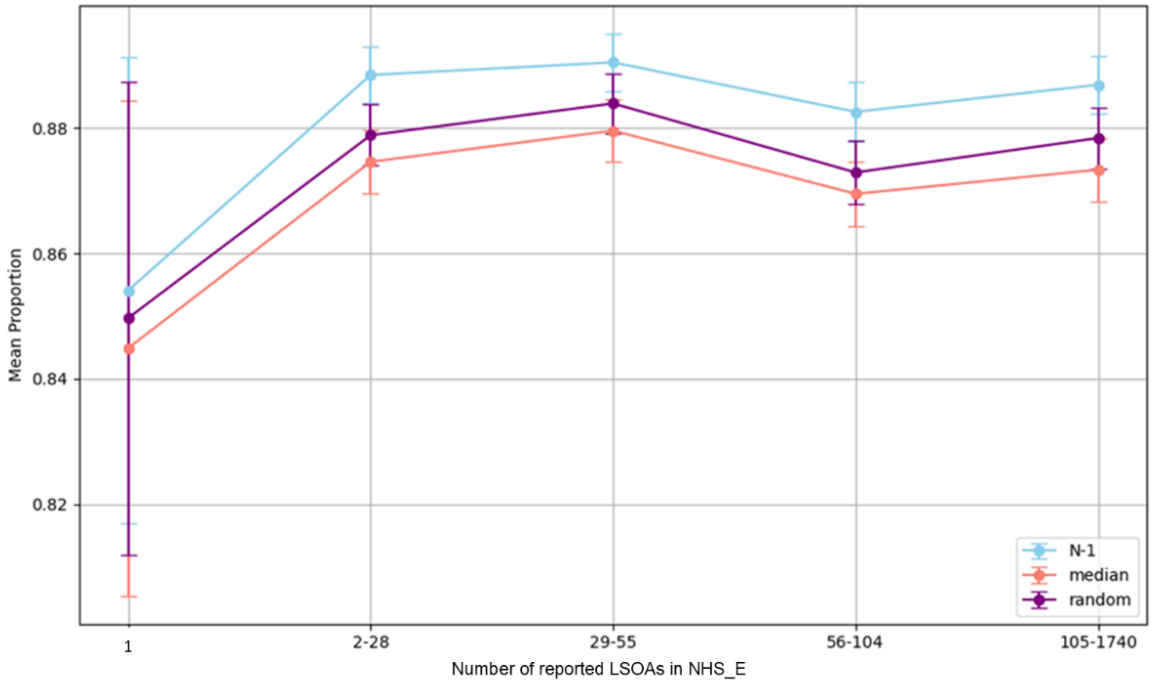
Supplementary Figure 1.



Supplementary Figure 1. Coverage of NHS_E-reported LSOA relative to Cohort-reported LSOA, using three methods, restricted to those with >1 reported LSOA in Cohort, according to categorised number of reported LSOAs in NHS_E (1, quartile).

For individuals with more than one recorded LSOA change in Cohorts (*n* = 23,707), coverage was slightly lower, with a mean of 72% for N-1, 74% for Median, and 73% for Random (Supplementary Figure 1).

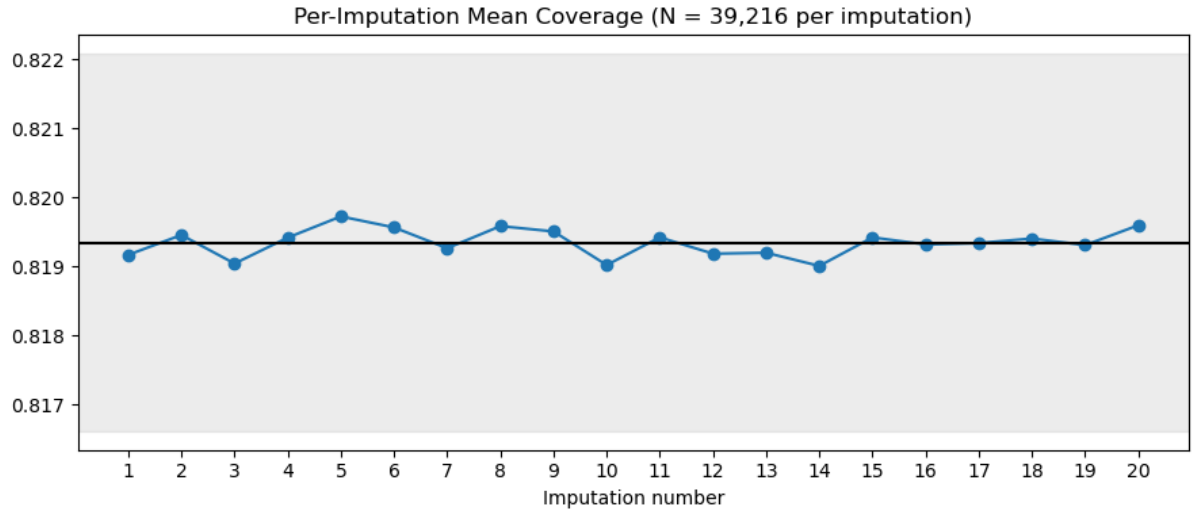
Supplementary Figure 2



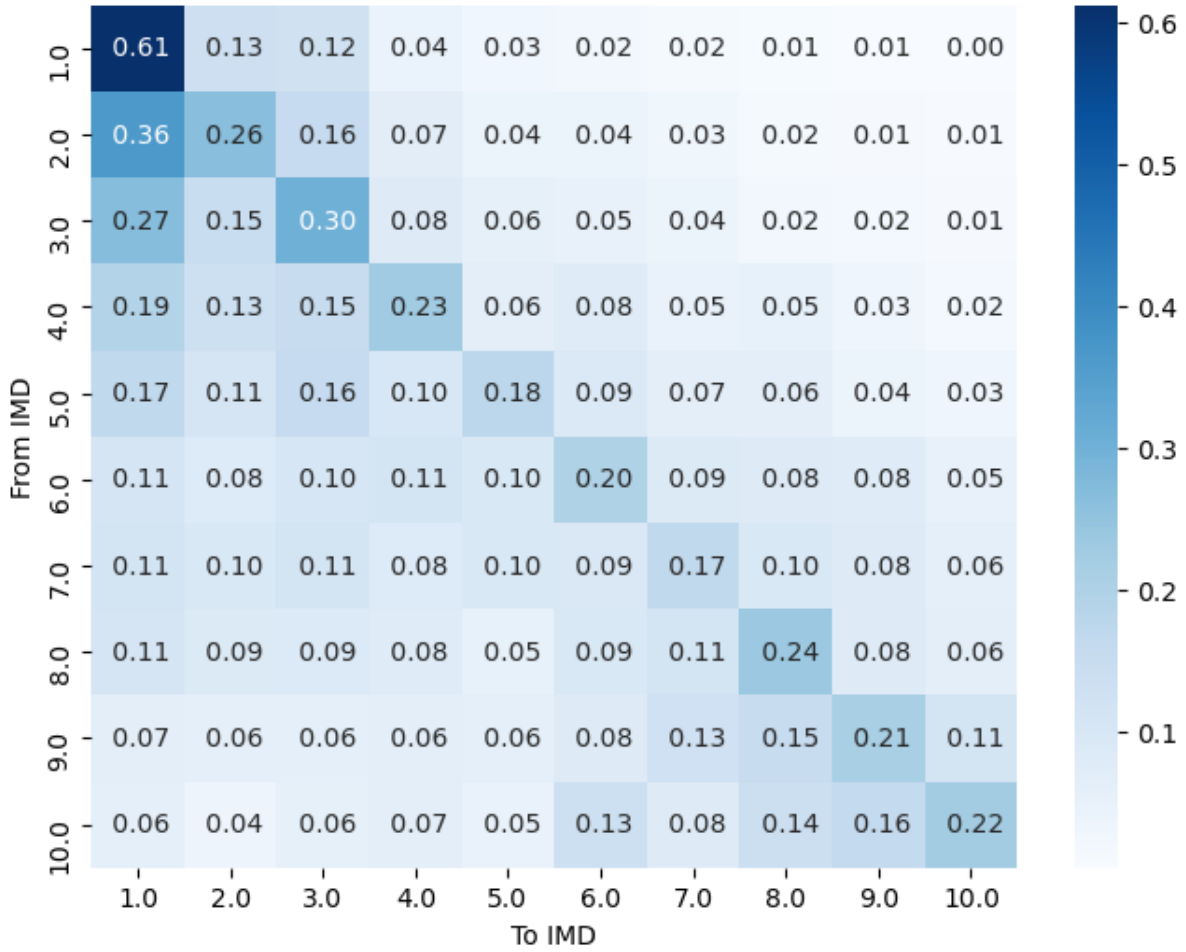
Supplementary Figure 2. Coverage of NHS_E LSOA relative to Cohort LSOA, using three methods, only including those with a one reported LSOA in Cohort, over categorised number of reported LSOA in NHS_E (1, quartile).

For individuals with only one recorded LSOA in the Cohorts (*n* = 15,509), mean coverage was 88% for N-1,87% for Median, and 87% for Random method (Supplementary Figure 2).

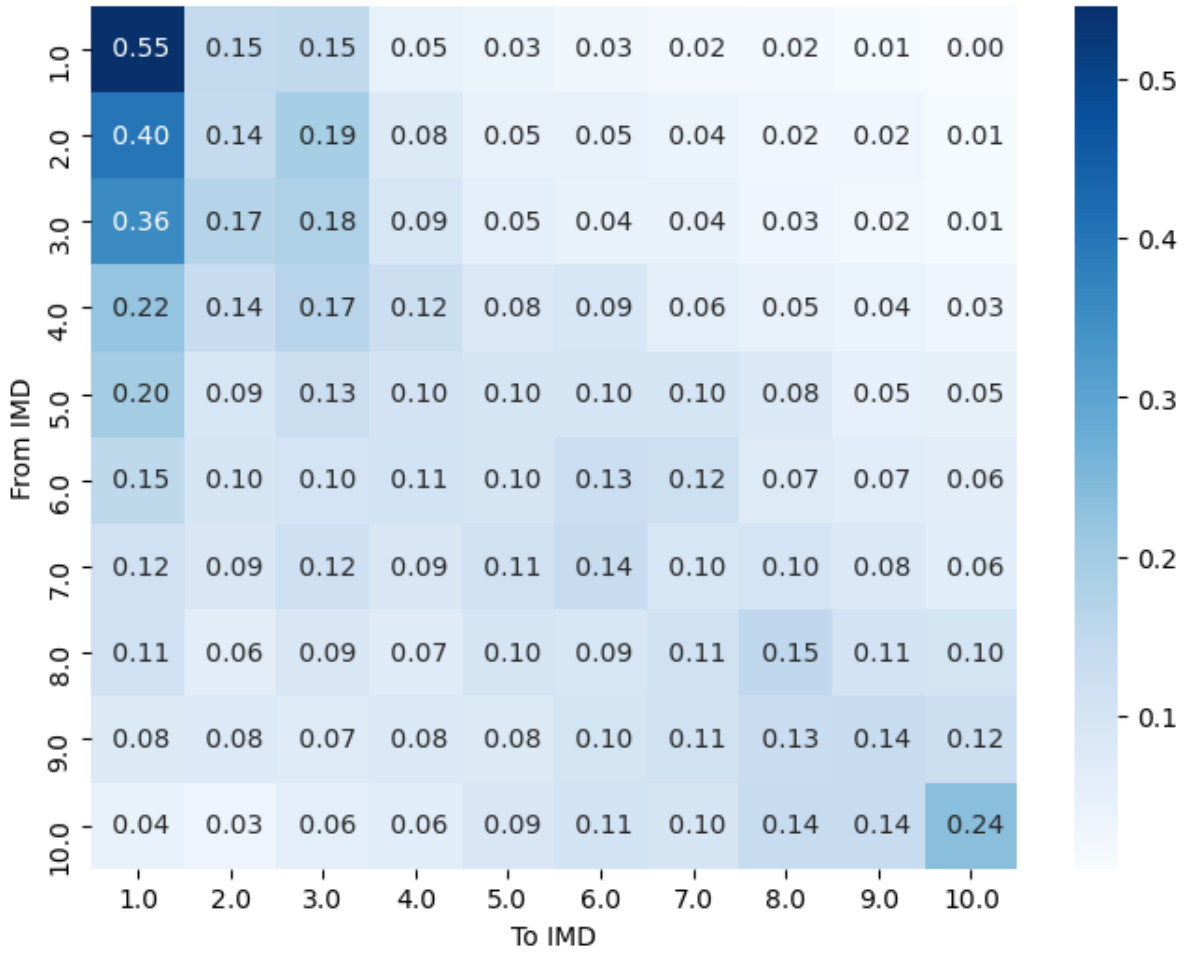
Supplementary Figure 3



Mean Coverage of NHS_E LSOA relative to Cohort LSOA in the 20 imputations using fitted Beta distribution (α, β = 4.26, 2.96). Grey box represented pooled mean 95% confidence interval (81.7% - 82.2%).



Supplementary Figure 4. Transition matrix describing changes in Index of Multiple Deprivations (IMD) from LSOA in Cohort data, 1 = most deprived, 10 = least deprived. This transition matrix characterises all LSOA changes by IMD in Cohort data.



Supplementary Figure 5. Transition matrix describing changes in Index of Multiple Deprivations (IMD) from NHS_E, 1 = most deprived, 10 = least deprived. This transition matrix characterises all LSOA changes by IMD in NHS_E data.