EVENS

EVIDENCE FOR EQUALITY NATIONAL SURVEY

DOCUMENTING THE LIVES OF ETHNIC AND RELIGIOUS MINORITIES IN A TIME OF CRISIS

Implementing and Adjusting a Non-probability Web Survey: Experiences of EVENs (Survey on the Impact of COVID19 on Ethnic Minorities in the United Kingdom)

Natalie Shlomo, Andrea Aparcio-Castro, Daniel Ellingworth, James Nazroo, Harry Taylor – University of Manchester

Nissa Finny – University of St. Andrews

Angelo Moretti – Utrecht University

MANCHESTER 1824 The University of Manchester

CODE CENTRE ON DYNAMICS OF ETHNICITY

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UKRI Economic and Social Research Council

Topics

- Designing and implementing a non-probability web survey: the 2021 Evidence for Equality National Survey (EVENS)
- Monitoring data collection
- Imputations
- Weighting adjustments
- Some Results

Designing and Implementing a Non-probability Web Survey

- Application: The Evidence for Equality National Survey (EVENS) - to investigate experiences of ethnic minority groups related to the coronavirus pandemic in the UK

- EVENS conducted from February to October 2021 (with a month break in April to make adjustments to the survey) - developed and coordinated by the Centre on the Dynamics of Ethnicity (CoDE) and implemented by Ipsos in the UK (funded by the Economic and Social Research Council of the UK)

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Requirements for a Non-probability Web Survey

Establish partnerships and recruitment strategies with Voluntary, Community and Social Enterprise (VCSE) organisations with focused traditional (mainstream and minority media), digital and social media campaigns

Design questionnaire a priori to allow for selection bias adjustments, ie. include common questions from probability-based samples that can be used as reference samples (both target variables and participation variables)

Ensure translations (EVENS had 14 languages) and allow for CATI via bespoke phone number

Supplement non-probability sample with other probability-based or quota samples from existing panels run by survey organizations (although there is a risk of a multiple frame scenario – the likelihood is low, check for duplication)

Use registration survey for screening prior to entry into survey via a personalized link

Eligible respondents to be given snowball links to invite friends and family, although these should be kept at a minimum (4) to avoid extreme clustering effects (clustering difficult to monitor and will change the method of calibration)

Requirements for a Non-probability Web Survey

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Use a parallel survey platform for snowball links to allow for quality assurances of legitimate responses, eg. digital fingerprinting allows use of one IP address

Use incentives to increase response rates and deliver them by email/post to allow for validation checks of the respondent

Calculate quotas (desired sample sizes) for data collection monitoring - here we used the SPREE method to adjust ethnic group population projections by ethnic group*sex*age group* region to current population estimates by region*sex*age group (note: used Census2011 proportions for some ethnic group calculations, eg. Jewish

Daily monitor responses to quotas and make use of a responsive survey design to enable targeted recruitment strategies for under-represented groups

Daily quality control checks of legitimate responses (IP checks, duration time, start time of survey, legitimate write-in responses) and weekly edit checks:

- Language of questionnaire inconsistent with ethnicity
- Heard about survey is inconsistent with ethnicity
- Inconsistencies in questionnaire responses, eg. type of household and age profile; education qualification and age, number of earners and persons in household
- Invalid write-in responses
- Inconsistencies of household characteristics within IP address

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Monitoring Data Collection

- Daily monitoring of responses for a nonprobability survey: all univariate and bivariate cross-tabs were examined from all sources of data
- Population-based R-indicators (Bianchi, et al. 2019)
- Target under-represented groups by boosting samples collected in panels

For the linear probability model, $\hat{\rho}_i^{OLS} = \boldsymbol{x}_i^T(\sum_s d_i\, \boldsymbol{x}_i \boldsymbol{x}_i^T)^{-1} \sum_s d_i\, \boldsymbol{x}_i\, \boldsymbol{r}_i, i \in s$

Replace $\sum_s d_i \boldsymbol{x}_i \approx \sum_U \boldsymbol{x}_i$ and $\sum_s d_i \boldsymbol{x}_i\, \boldsymbol{x}_i{}^T \approx \sum_U \boldsymbol{x}_i\, \boldsymbol{x}_i{}^T$:

$\hat{\rho}_i^P = \boldsymbol{x}_i^T(\sum_U \boldsymbol{x}_i \boldsymbol{x}_i^T)^{-1} \sum_r d_i \boldsymbol{x}_i,\ i \in r.$

R-indicator is $\hat{R}_{\hat{\rho}^P} = 1 - 2\hat{S}_{\hat{\rho}^P}$ where $\hat{S}^2_{\hat{\rho}^P} = \frac{N}{N-1}\{\frac{1}{N}\sum_r d_i \hat{\rho}_i^P - [\frac{1}{N}\sum_r d_i]^2\}$

The estimator of the R-indicator makes the estimator $\hat{S}^2_\rho$ linear in $\hat{\rho}_i^P$ which provides an advantage for bias adjustment computations and propensity weighting by $\hat{\rho}_i^{P^{-1}}$ to adjust for nonresponse bias

Partial R-indicators: $R_U(x_k) = \sqrt{\frac{1}{N}\sum_{h=1}^H n_{hr}\,(\hat{\bar{\rho}}_h - \hat{\bar{\rho}})^2}$ and $R_U(x_k^h) = \sqrt{\frac{n_{hr}}{N}}\,(\hat{\bar{\rho}}_h - \hat{\bar{\rho}})$

R-Indicators on Final Sample and Final Sample Size

Component	Sample Size		
	Ethnic minority (with Jewish)	White British	Total*
Main Survey	**3292**	**114**	**3406**
Panels	**3554**	**4114**	**7668**
Prolific	**2862**	**285**	**3147**
Total	**9708**	**4513**	**14221**

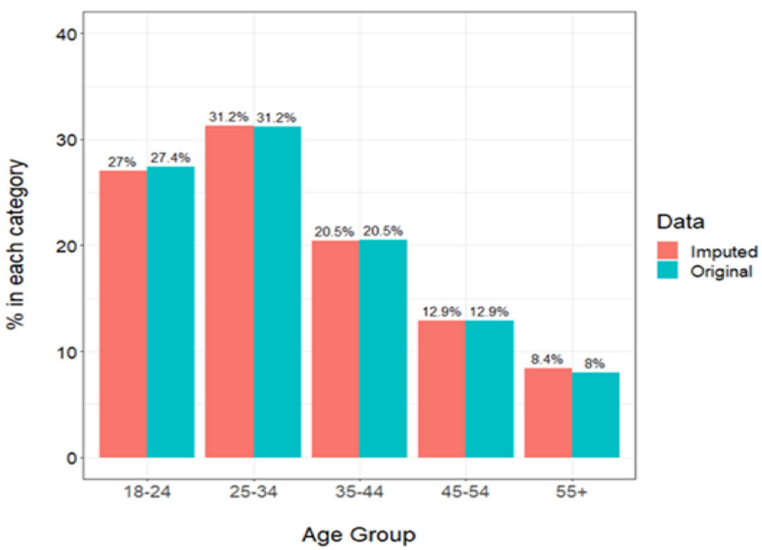
*Note: An additional 6 records were deleted in the final weighting stage due to missing values, so final sample size of 14215

R-indicator	**0.434**							
Variables and Categorical Level R-indicator:							Population Counts	Quotas
Region	**0.060**	Sex	**0.058**	Age group	**0.080**	Ethnic group	**0.128**	**0.132**
East Midlands	**0.004**	Males	**-0.044**	18-24	**0.048**	Bangladeshi	**0.015**	**-0.045**
East of England	**0.021**	Females	**0.038**	25-34	**0.021**	Black African	**0.025**	**0.021**
London	**-0.026**			35-44	**-0.013**	Black Caribbean	**0.019**	**-0.012**
North East	**-0.004**			45-54	**-0.044**	Chinese	**0.004**	**0.012**
North West	**0.019**			55 over	**-0.039**	Indian	**-0.027**	**0.033**
Scotland	**0.023**					White and Black Caribbean	**0.008**	**0.015**
South East	**-0.004**					White and Black African	**0.015**	**-0.031**
South West	**0.002**					White and Asian	**0.039**	**0.038**
Wales	**0.028**					Other Asian	**-0.023**	**0.026**
West Midlands	**-0.004**					Other Black	**-0.009**	**-0.026**
Yorkshire and Humber	**-0.026**					Arab	**-0.017**	**-0.024**
						Pakistani	**-0.026**	**0.018**
						White Roma	**0.014**	**-0.042**
						White Eastern Europe	**-0.063**	**-0.043**
						White Irish	**-0.066**	**-0.067**
						White Gypsy/traveller	**0.027**	**-0.022**
						Jewish	**0.044**	**-0.001**

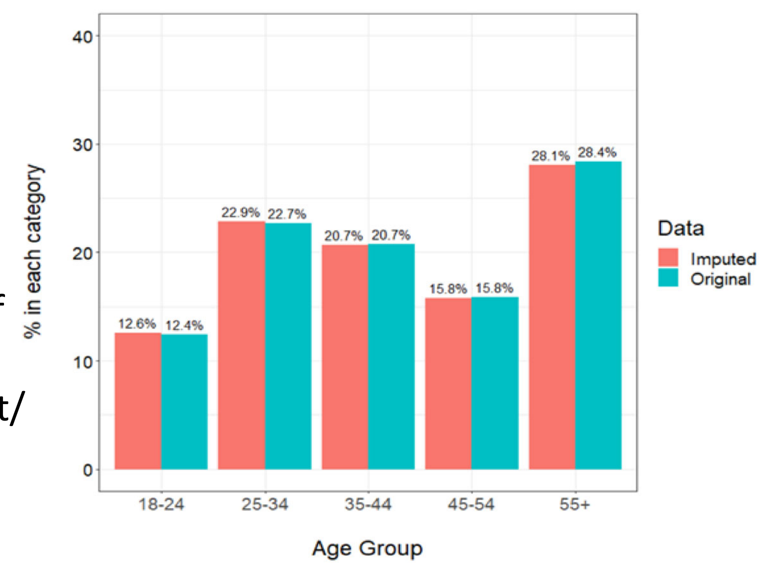
Imputing Abandoned Cases and Other Data Cleaning

- 121 abandons completed more than 2/3 of the questionnaire: 6 completed all questions, imputations for 115 abandons using nearest neighbour hot-deck imputations on all variables
- 'Prefer not to say' option on weighting variables: age, sex, region and ethnic group
- Available information taken from registration survey and other sources from panels
- Imputation of weighting variables: Age group: 254, Sex: 43, Ethnic group: 32. Region: 8
- Further data cleaning and corrections for failed edit rules will be implemented
- Confidentiality protection to upload data to the UK Data Service in April 2023 (coincide with release of book)

RAC01: Has anyone insulted you for reasons to do with your ethnicity, race, colour, or religion?



GOV01: How much do you trust the UK Parliament in relation to its management of the coronavirus outbreak? (A lot/ a fair amount)



Calculation of Benchmarks and Calibration

2 sets of weights:

- Preliminary benchmarks calculated from ethnic group population projections and adjusting to mid-year 2020 population estimates (information on Gypsy/traveller and Roma from external sources): population estimate N_k for each weighting class k (2310 classes) defined by: age-group (5 - combining 55-64 with 65 and over), sex (2), region (8) and ethnicity (21)

- Final benchmarks were calculated from Census 2021 for England and Wales with adjustments to original Scottish estimated counts (largely impacted on estimates for Gypsy/traveller and Roma populations)

Comparison to sample counts n_k from EVENs and collapsing of weighting classes k where necessary (collapsing carried out on region) for a total of 1705 weighting classes

Calibration using raking-ratio procedure (fits all-2 way margins of weighting class variables via IPF where the starting values are the pseudo-design weights)

Calibration alone does not compensate for selection bias but it does provide some robustness with respect to coverage errors

Compensating for Selection Bias

- Quasi randomization approach using a probability reference sample to estimate probability of participation
- Use a logistic function with covariates in the model that explain both participation and outcome variables
- Implement the method proposed in Chen, Li and Wu (2019)

- Stack the two files and define $T_i = 1$ if $i \in A$ (EVENS) and $T_i = 0$ if $i \in B$ (reference sample
- Probability of participation for nonprobability sample A is $\tilde{p}_i \equiv \tilde{p}_i(x_i, \boldsymbol{\xi}) = P(T_i = 1 | x_i, \boldsymbol{\xi})$ where x_i is the design vector denoting main effects and interactions
- The maximum likelihood estimator of $\tilde{p}_i$ is $\widehat{\tilde{p}}_i\left(x_i, \hat{\boldsymbol{\xi}}\right)$ where $\hat{\boldsymbol{\xi}}$ maximizes the log-likelihood function

$$l(\boldsymbol{\xi}) = \sum_{i=1}^{N} (T_i \log(\tilde{p}_i) + (1 - T_i) \log(1 - \tilde{p}_i))$$
$$= \sum_{i \in A} \log \left(\frac{\tilde{p}_i(x_i, \xi)}{1 - \tilde{p}_i(x_i, \xi)}\right) + \sum_{i=1}^{N} \log\left(1 - \tilde{p}_i(x_i, \boldsymbol{\xi})\right)$$

Replace second term with the Horvitz- Thompson estimator obtained from the random reference sample having survey weights w_i and with information on x_i, to maximize the pseudo log-likelihood function

$$l^*(\boldsymbol{\xi}) = \sum_{i \in A} \log \left(\frac{\tilde{p}_i(x_i, \xi)}{1 - \tilde{p}_i(x_i, \xi)}\right) + \sum_{j \in B} w_j \log\left(1 - \tilde{p}_j\left(x_j, \boldsymbol{\xi}\right)\right)$$

- Under a logistic regression model where $\tilde{p}_i \equiv \tilde{p}_i(x_i, \xi) = \frac{exp(x_i' \xi)}{1 + xp(x_i' \xi)}$ we set the score function equal to 0 and obtain the MLE using a Newton-Raphson procedure

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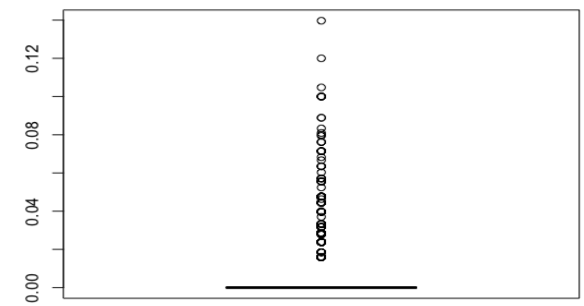
Preparing Reference Sample

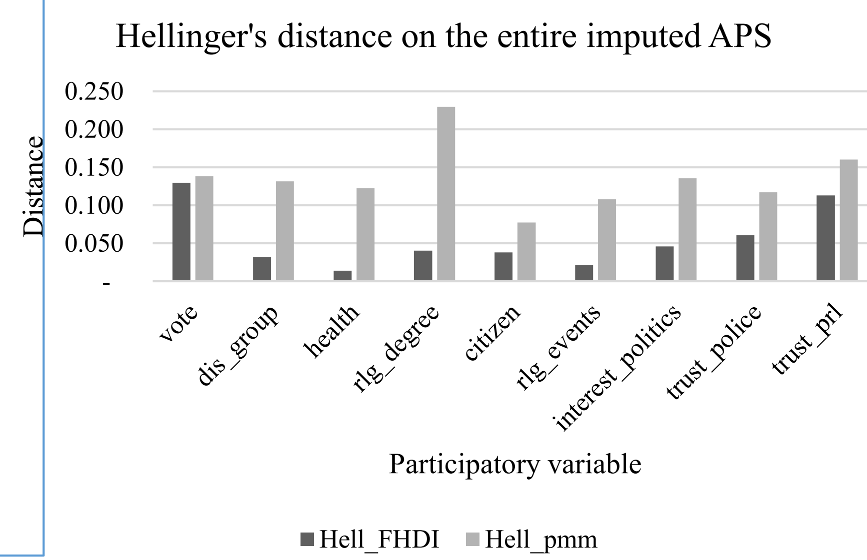
- Reference sample: (1) 2019, 2020 Annual Population Survey (APS) for demographic, socio-economic variables; (2) 2016, 2018 Social Survey (ESS) for participation variables, eg. trust in government, neighbourhood engagement, member of discrimination group, voted in last election (note internet usage assumed universal based on evidence from 2021 UK census)
- Data Integration of two sources:

- Statistical matching of ESS to APS based on Gower's Distance: age, sex, ethnicity, region, education, employment, occupation (1 digit), marital status

Distances between pairs of final matched records



- Mass imputation on remaining APS records: (1) Multiple Imputation Predictive Mean Matching (PMM) (10 replicates) (2) Fractional Hot-Deck Imputation FHDI (R-package Im et al., 2015)
- FHDI provides a single imputation based on the conditional probabilities of obtaining the value given the observed data (Kim and Fuller, 2004)



Comparison of Distributions: EVENS vs Reference Sample

Weighted frequency distributions of Economic Status

Economic Status	APS/ESS	EVENS
Employed	61.69	58.63
Unemployed	2.61	5.07
Retired	22.14	22.09
Other	13.56	13.61
Unknown	-	0.6

Weighted frequency distributions of interest in politics variable

Interest in politics	APS/ESS	EVENS
Very Interested	19.09	20.36
Fairly Interested	46.26	43.87
Not Very Interested	22.92	21.80
Not at all Interested	11.74	11.92
Unknown	-	2.04

Weighted frequency distributions of trust in parliament variable

Trust in parliament	APS/ESS	EVENS
A lot	7.84	8.50
A Fair Amount	31.96	35.65
Not Very Much	45.10	36.11
Not At All	14.51	19.61
Unknown	0.59	0.13

Weighted frequency distributions of trust in the police variable

Trust in the police	APS/ESS	EVENS
Strongly Agree	16.77	17.69
Agree	50.54	41.72
Neutral	14.80	22.89
Disagree	15.39	9.78
Strongly Disagree	2.40	4.69
Unknown	0.10	0.23

Weighted frequency distributions of subjective general health variable

Subjective General Health	APS/ESS	EVENS
Very Good	30.52	18.50
Good	41.40	45.01
Fair	19.94	28.09
Bad	6.04	6.50
Very Bad	2.09	1.35
Unknown	-	0.55

Weighted frequency distributions of ethnicity variable

Ethnicity	APS/ESS	EVENs
White British	80.99	78.53
White Irish, White Other	6.65	6.79
Black/African/Caribbean/Black British	2.98	3.24
Other Asian	1.18	1.73
Pakistani, Bangladeshi, Indian	4.94	5.40
Chinese	0.54	1.06
Other	2.72	2.79
Jewish	-	0.44

Adjusted Weights with Calibration

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- On APS/ESS (FHDI procedure) and using survey weights w_i of the APS (divided by 2), estimate probabilities of participation for EVENS
- Models separately for White British and All Other Ethnic Groups where health variable interacted with ethnic groups (5 categories). Other variables in model: trust in parliament, trust in police, interest in politics, age group, gender, region, economic status, education marital status, occupation, ethnicity (Note: discrimination variable was used in preliminary weights and dropped in the final weights due to the inconsistent definition and lack of coherence)
- Approaches for producing pseudo-design weight prior to calibration
  - Inverse probability of participation $dw = 1/\tilde{p}_i$
  - Stratify EVENS (approx.) 20 groupings of $\tilde{p}_i$ and estimate dw within each strata *h* (produces smoother weights): $dw = \frac{\sum_{i \in h} w_i}{n_h}$ where w_i is the weight in APS/ESS and n_h is the EVENS count in strata *h*
- Calibration of EVENS sample on pseudo-design weight dw
- Next step: variance estimation using a bootstrap approach

Adjusted Weights with Calibration

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- Approaches for producing pseudo-design weight prior to calibration
  - Inverse probability of participation $dw = 1/\tilde{p}_i$
  - Stratify EVENS (approx.) 20 groupings of $\tilde{p}_i$ and estimate dw within each strata *h* (produces smoother weights): $dw = \frac{\sum_{i \in h} w_i}{n_h}$ where w_i is the weight in APS/ESS and n_h is the EVENS count in strata *h*
- Calibration of EVENS sample on pseudo-design weight dw

Variance Estimation

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- Preliminary analyses calculated variance estimates using standard packages for complex survey designs with adjustment weights and strata defined by ethnic groups
- Initial work based on a bootstrap procedure:
  - From the adjusted EVENS sample, produce a pseudo- population by replicating each record according to the (randomly rounded) adjustment weight
  - Draw B probability samples and nonprobability samples under same designs and same sample sizes
  - Implement same weighting procedure and produce bootstrap weights (for those units not selected they receive a bootstrap weight of 0)
  - Repeat M times
- Users can undertake statistical analysis on B×M replicates to obtain bootstrap variance estimate as follows: $\frac{1}{BM}\sum_{i=1}^{BM}\left(\hat{\theta}^*_{(bm)} - \hat{\theta}^*_{(.)}\right)$ where $\hat{\theta}^*_{(.)} = \frac{1}{BM}\sum_{i=1}^{BM}\hat{\theta}^*_{(bm)}$
- To reduce number of bootstrap weights, can average over C iterations and change $\frac{1}{BM}$ with $\frac{C}{BM}$
- We obtained similar bootstrap variances to variances obtained from complex survey design
- Future work: Reassess bootstrap variance based on the final set of weights which are more stable than preliminary set of weights

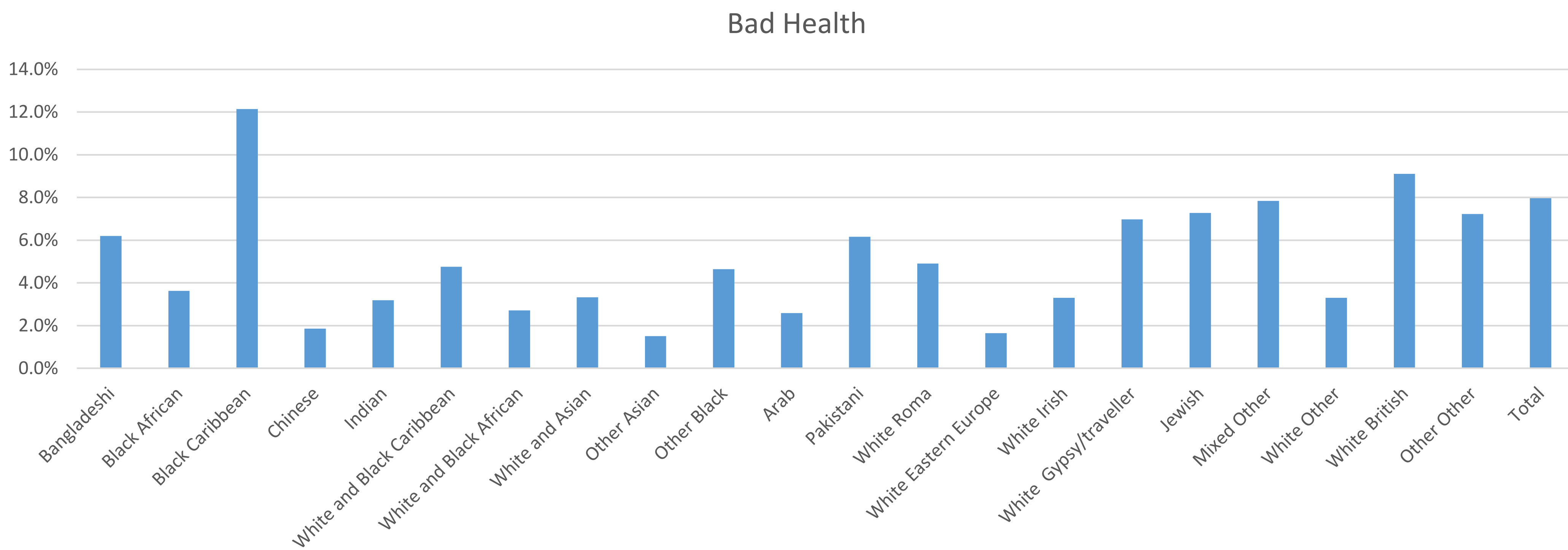
Weighting Diagnostics

Diagnostics of the Initial Set of Survey Adjustment Weights (EVENS sample size 14221) (final weights trimmed to 1 (69 weights) and several very large weights reduced by combining with other strata

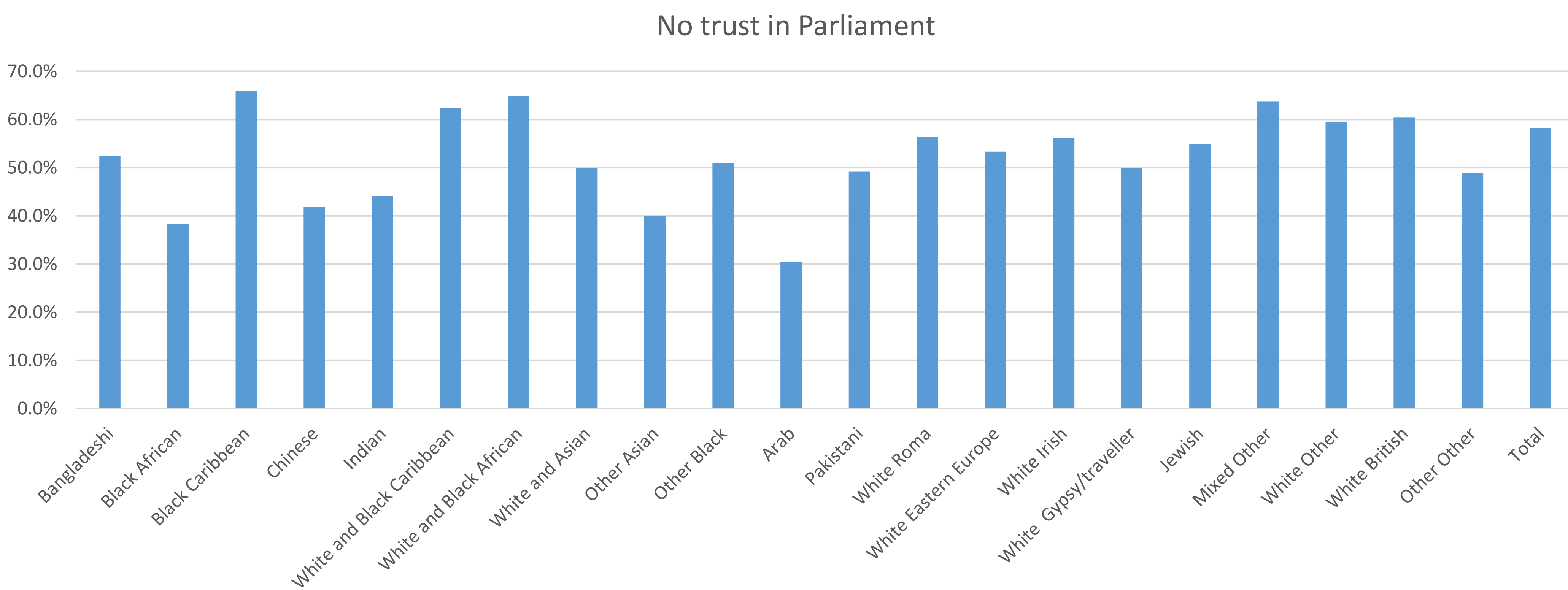
	Benchmark Weights only	Inverse Propensity Benchmarked Weights	Propensity Stratification Benchmarked Weights (original)	Propensity Stratification Benchmarked Weights (trimmed)
Mean	3632.94	3632.94	3632.94	3632.94
Median	1230.2	382.1	1072.3	1072.3
Minimum value	36.395	0.00198	0.0748	1.0069
Maximum value	24549.1	112677.0	88889.8	66852.1
Standard Deviation	4187.16	6887.18	6080.81	6067.33
Coefficient of Variation	1.153	1.896	1.674	1.670
Increase in Standard Errors	1.526	2.143	1.950	1.946

Diagnostics of the Final Set of Survey Adjustments (EVENS sample size 14215) (final weights were trimmed to 2 (27 weights) and no large weights reduced

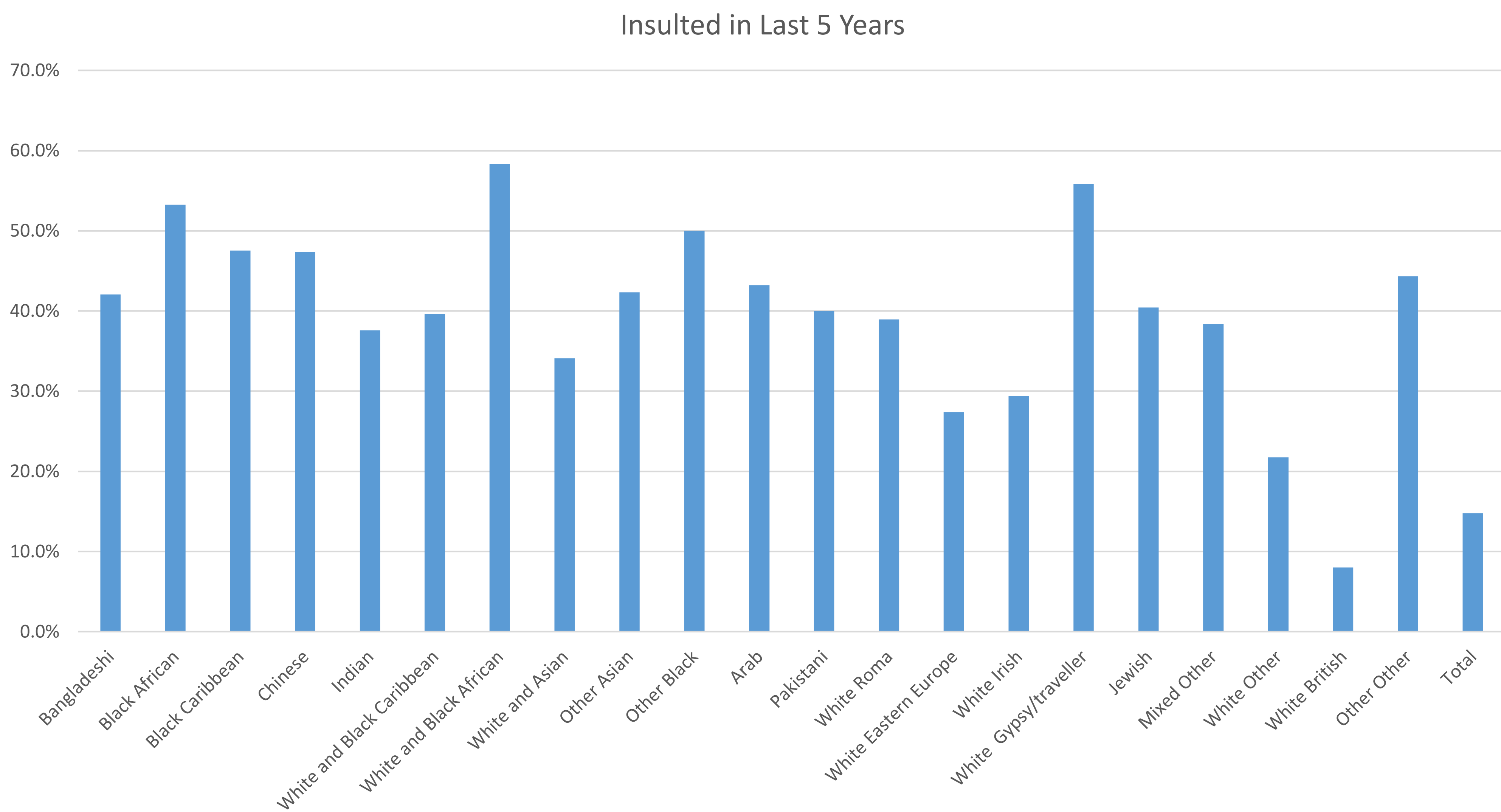
	Benchmark Weights only	Inverse Propensity Benchmarked Weights	Propensity Stratification Benchmarked Weights (original)	Propensity Stratification Benchmarked Weights (trimmed)
Mean	3633.21	3033.21	3633.21	3633.21
Median	1261.7	1010.5	1275.3	1275.3
Minimum value	29.871	0.42089	0.09285	1.9280
Maximum value	27102.1	89461.6	74649.8	74649.8
Standard Deviation	4131.06	6035.18	5869.56	5869.56
Coefficient of Variation	1.137	1.661	1.616	1.616
Increase in Standard Errors	1.514	1.939	1.900	1.900

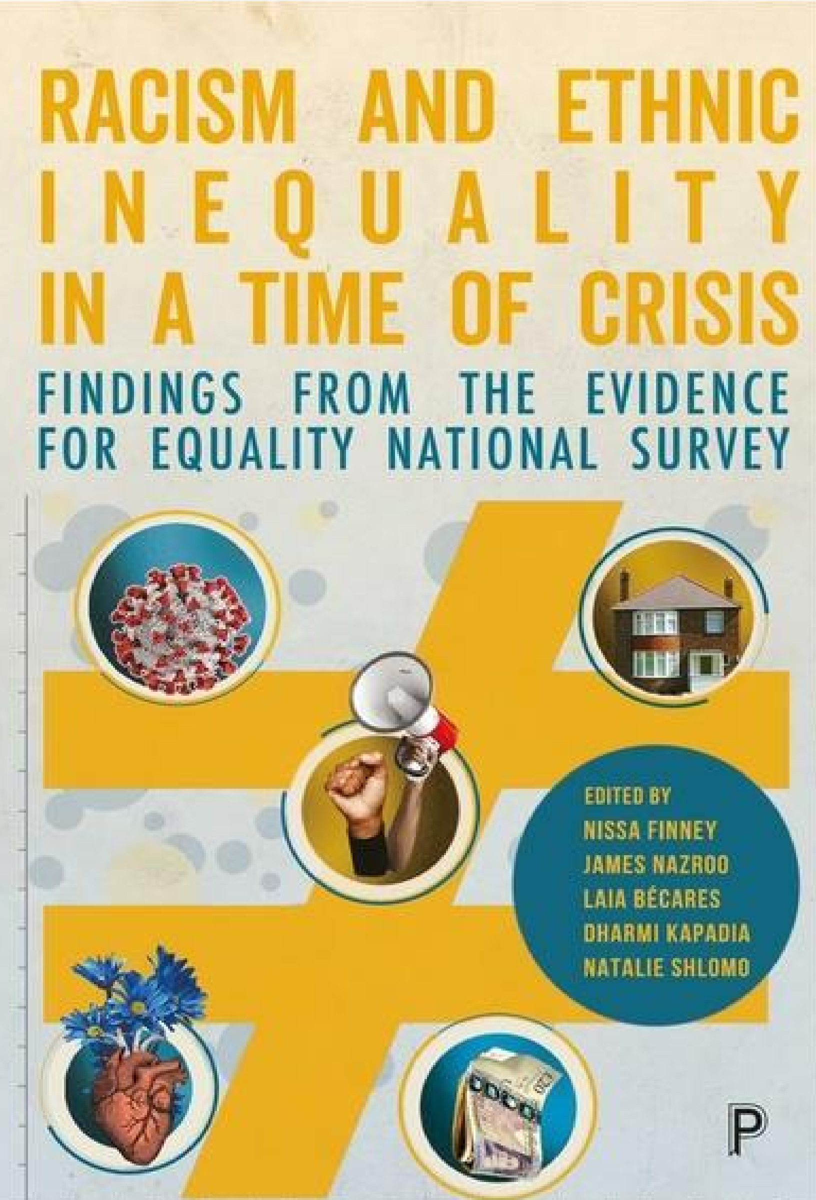


Bad Health
14.0%
12.0%
10.0%
8.0%
6.0%
4.0%
2.0%
0.0%
Bangladeshi
Black African
Black Caribbean
Chinese
Indian
White and Black Caribbean
White and Black African
White and Asian
Other Asian
Other Black
Arab
Pakistani
White Roma
White Eastern Europe
White Irish
White Gypsy/traveller
Jewish
Mixed Other
White Other
White British
Other Other
Total



No trust in Parliament
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
Bangladeshi
Black African
Black Caribbean
Chinese
Indian
White and Black Caribbean
White and Black African
White and Asian
Other Asian
Other Black
Arab
Pakistani
White Roma
White Eastern Europe
White Irish
White Gypsy/traveller
Jewish
Mixed Other
White Other
White British
Other Other
Total


Insulted in Last 5 Years
70.0%
60.0%
50.0%
40.0%
30.0%
20.0%
10.0%
0.0%
Bangladeshi
Black African
Black Caribbean
Chinese
Indian
White and Black Caribbean
White and Black African
White and Asian
Other Asian
Other Black
Arab
Pakistani
White Roma
White Eastern Europe
White Irish
White Gypsy/traveller
Jewish
Mixed Other
White Other
White British
Other Other
Total



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Thank you for your Attention

Questions:

Natalie.Shlomo@manchester.ac.uk

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The University of Manchester

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