Social Media-Based Field Experiments: Cluster-random assignment

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Outline for this session

1. luster-random assignment
2. Clustering at the level of assignment
3. The penalty to clustering
4. Analyse as you randomize
5. Complications
6. Power calculations

Clustering

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- Cluster-random assignment means that all subjects in the same cluster are assigned *together* to the same experimental condition, e.g. every subject in the same Zoom room will either be treated or untreated.
- Cluster-random assignment is sometimes necessary due to platform constraints (e.g. Facebook only allows targeting of users by geographic area or interest) or because we expect that the non-interference assumption is violated in meaningful ways (within clusters, potential outcomes are a function of the treatment assignment of other subjects).

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The true standard error under cluster random assignment

$$SE(\widehat{ATE}) = \sqrt{\frac{1}{k-1}\{\frac{mVar(\overline{Y}_j(0))}{N-m} + \frac{(N-m)Var(\overline{Y}_j(1))}{m} + 2Cov(\overline{Y}_j(0), \overline{Y}_j(1))\}}$$

where

$\overline{Y}_j(0)$ is the average untreated potential outcome in the jth cluster,

$\overline{Y}_j(1)$ is the average treated potential outcome in the jth cluster

and k is the number of clusters.

Cluster versus complete random assignment, following Gerber and Green (2012)

TABLE 3.6

Hypothetical schedule of potential outcomes for 12 classrooms in four schools—high sampling variability

		Classroom-level potential outcomes		Cluster-level mean potential outcomes	
School	Classroom	$Y_i(0)$	$Y_i(1)$	$Y_j(0)$	$Y_j(1)$
A	A-1	0	4		
A	A-2	1	5	1	5
A	A-3	2	6		
B	B-1	2	6		
B	B-2	3	7	3	7
B	B-3	4	8		
C	C-1	3	7		
C	C-2	4	8	4	8
C	C-3	5	9		
D	D-1	7	11		
D	D-2	8	12	8	12
D	D-3	9	13		

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Hypothetical schedule of potential outcomes for 12 classrooms in four schools—low sampling variability

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A	A-2	3	7	4	8
A	A-3	9	13		
B	B-1	2	6		
B	B-2	3	7	4	8
B	B-3	7	11		
C	C-1	1	5		
C	C-2	4	8	3.3	7.3
C	C-3	5	9		
D	D-1	4	8		
D	D-2	8	12	4.7	8.7
D	D-3	2	6		

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- (Almost) always cluster your standard errors at the level at which the treatment is assigned.
- If you assign subjects within Zoom rooms to treatment and control, then you need to cluster your standard errors at the Zoom room level.
- The penalty you occur for cluster random assignment depends on the variability of the cluster-level means.
- This is often summed up in the Intra-Cluster-Correlation (ICC). The ICC compares the variance within clusters to the variance between clusters. The ICC varies between 0 and 1. If the ICC is 1, then subjects within clusters do not vary from each other and N = k.

The penalty to clustering: Power simulation

https://egap.shinyapps.io/power-app/

Potential bias

- If clusters are of (vastly) unequal size and cluster size varies with potential outcomes, then the difference-in-means estimater can be biased.
- This bias disappears if the number of clusters increases.
- If you suspect bias, you can use the difference-in-totals estimater instead of the difference-in-means estimator.

Clustering above the level of assignment

- "Analyze as you randomize" usually works as a yardstick.
- If your clusters are sampled from a larger population and you are interested in population average estimands, then you might want to cluster at the level at which the sampling was done (Abadie, Athey, Imbens and Wooldridge 2019)
- More info: Blair, Cooper, Coppock and Humphreys `https://declaredesign.org/blog/sometimes-you-need-to-cluster-standard-errors-above-the.html`

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- Level of outcome measurement should be perfectly nested within the cluster used for assignment, e.g. postcode sector $\rightarrow$ postcode.
- Important that outcomes can be matched unambiguously to assignment and that boundaries do not overlap.

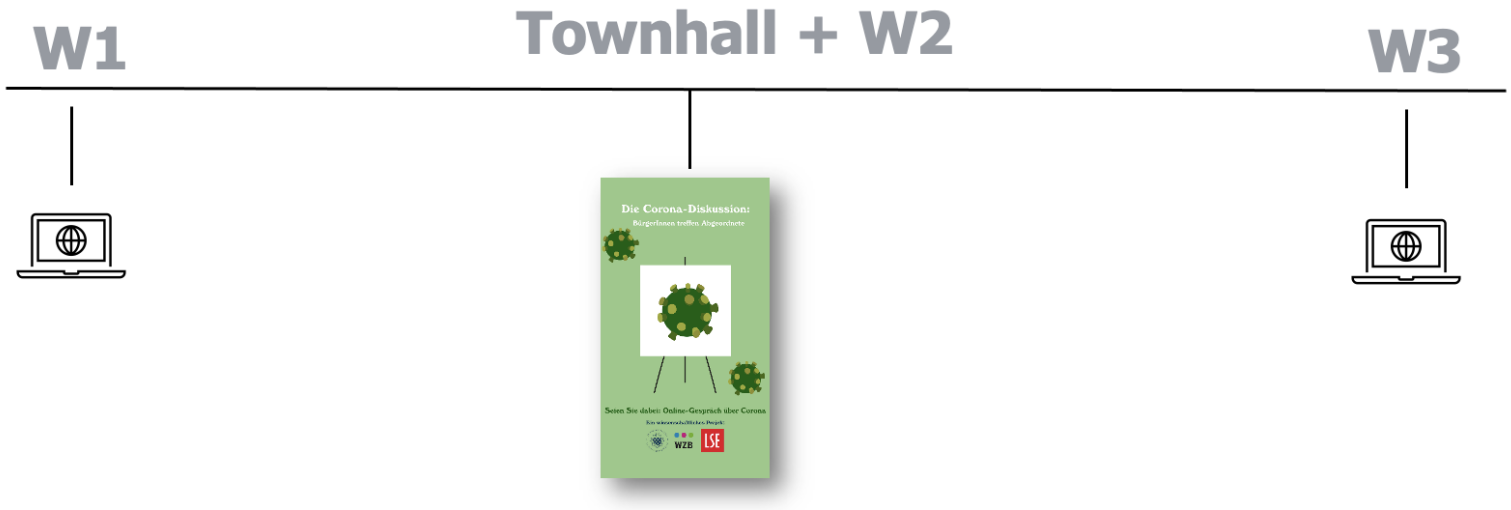
Example 1: Democratic persuasion

- Can legislators persuade citizens about the merits of liberal democracy?
- Basic idea: What if elected representatives make an explicit case for the democratic system of government, while acknolwedging that democracy is not perfect?

Sampling

- Recruited a politically heterogeneous sample of German citizens via quota sampling on Facebook to participate in one of 16 Zoom townhalls with elected state and federal representatives.
- Townhalls were advertised as opportunities for citizens to meet representatives and discuss with them about COVID-19.

Study Set-Up



Townhalls

Townhalls

Encounters of citizens and politicians

Cluster random assignment

- Pair-random assignment to determine whether during the townhall, the representative engages in "democratic persuasion", or not.
- Corresponds to block (legislator) and cluster (townhall) random assignment of subjects to the "democratic persuasion" or the standard townhall.

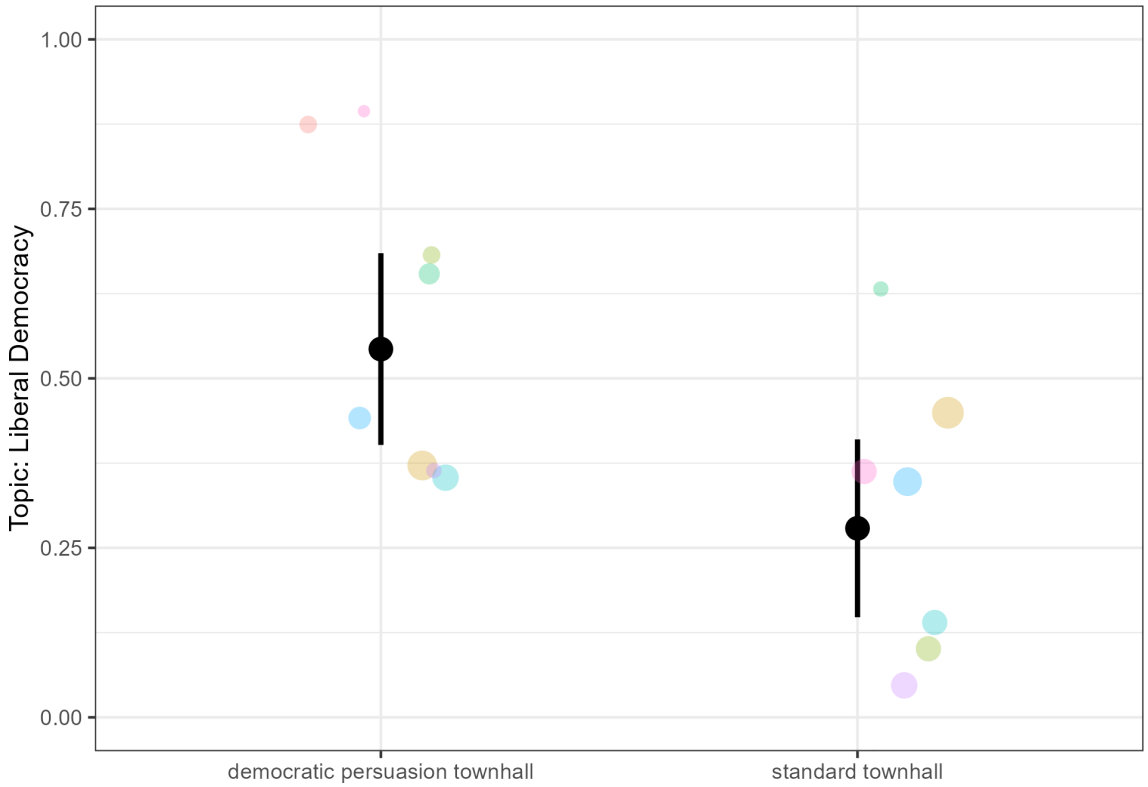
Democratic persuasion townhall

1. Welcome and brief introductory remarks (5 minutes)
2. Short presentation on "Democracy during COVID-19" discussing some of the challenges with democratic processes during the pandemic (5 minutes)
3. Short introductory remarks by the representative taking up the batton and making the case for democracy in challenging times (5 minutes minutes)
4. Followed by around 45 minutes of open Q&A.

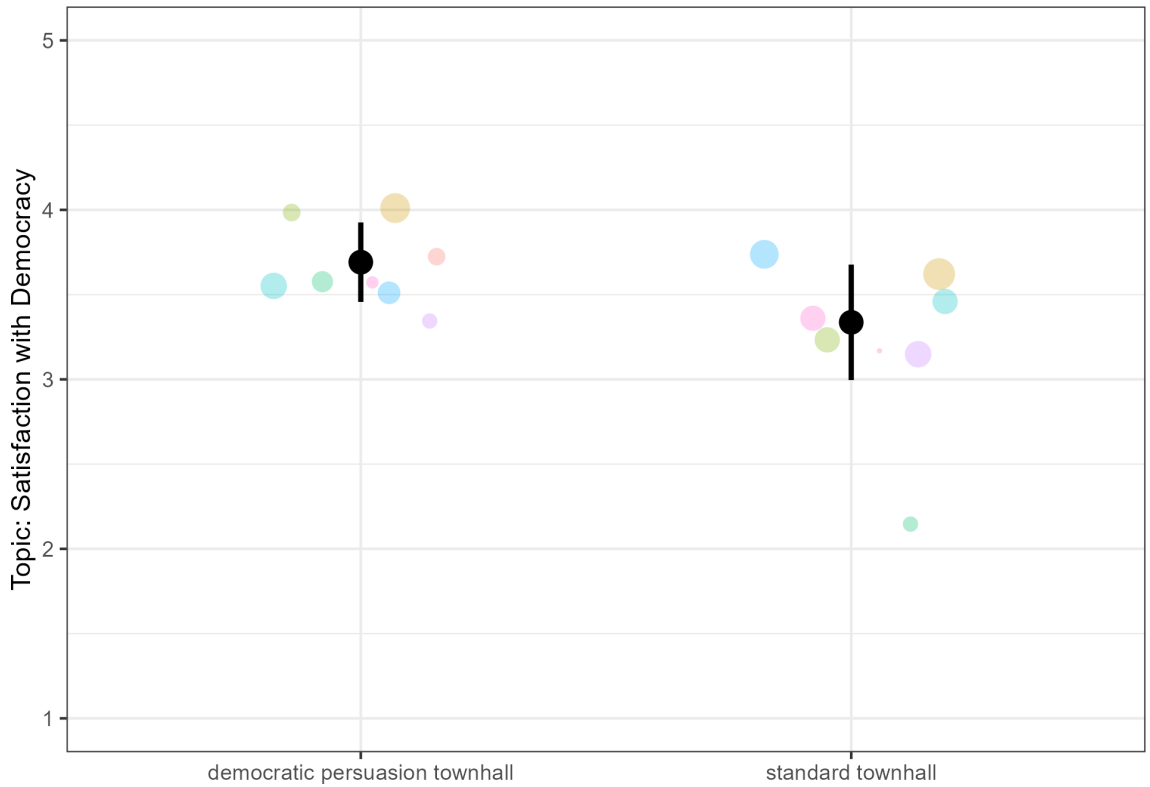
Pre-Analysis Plan

https://osf.io/wjk9c/

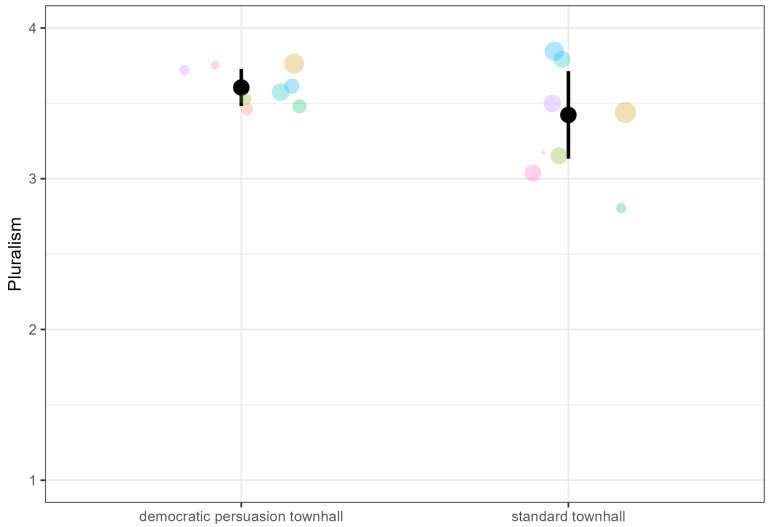
Manipulation Check

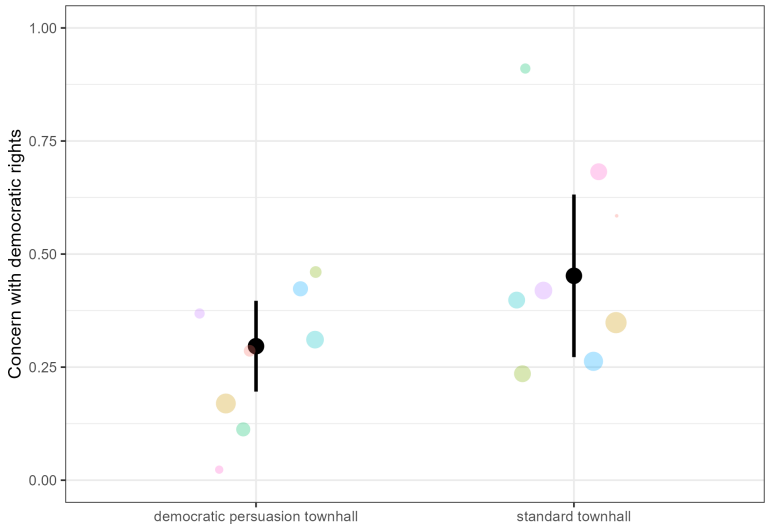


Effects on Satisfaction with Democracy

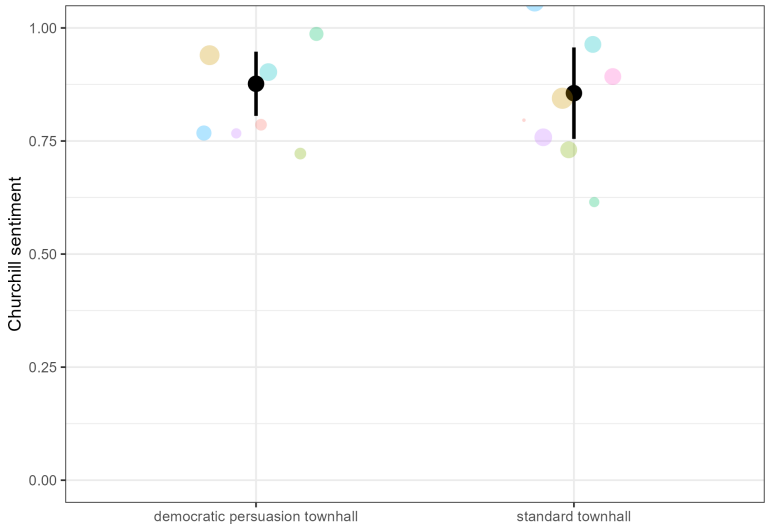


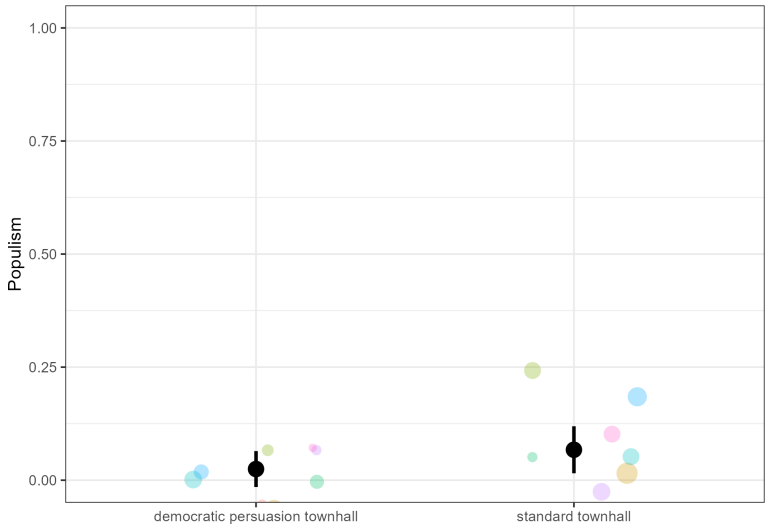
Support for pluralism and concern about democratic rights





Secondary outcomes: Churchill indicator and populism





Example 2: Voter registration ads

- "Voters randomly exposed to the ads were in some cases more likely to recall them but no more likely to recognize or positively evaluate the candidates they depicted." (Broockman and Green 2013)
- Facebook and Google ads have a small positive effect on turnout (Bond et al. 2012; Hager 2019)
- Facebook and Google ads have a small positive (0.5%p) effect on vote shares (Hager 2018, 2019)
- Facebook ads can inform voters (Enriquez, Larreguy and Marshall 2019)

Cluster random assignment at the postcode sector level

- Treatments: Voter registration videos on Instagram and Snapchat, followed by GOTV videos (after the registration deadline) on the same channel; targeted at young voters (18-35).
- Young people nested within postcodes, nested within N=879 postcode sectors.
- Cluster random assignment at the postcode sector level: Postcode sectors are assigned with a probability of .5 to treatment, stratified by parliamentary constituency.

Social Media Ads

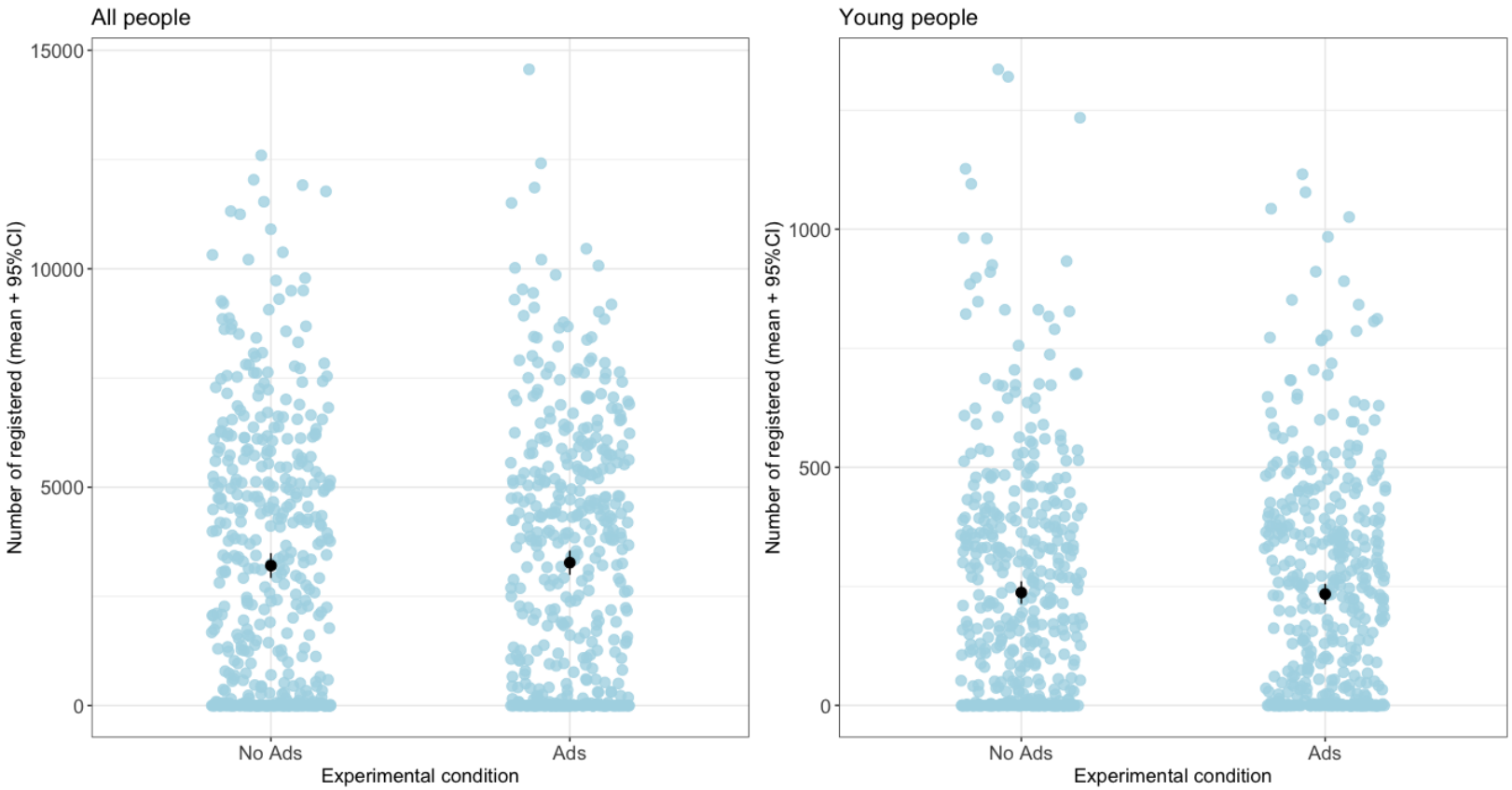
Outcome measurement

- Registration outcome variable is obtained post-election from de-identified registers.
- We use two different levels of aggregation:
  1. Absolute number of registered voters for 879 postcode sector (e.g. SE11 4)
  2. Absolute number of registered voters for 149'240 postcodes (e.g. SE11 4BE)

Pre-Analysis Plan

https://osf.io/fyxsd

Mean plots with 95% CIs



Time for questions.