Supplementary Materials for "Bottom-Up Accountability and Public Service Provision: Evidence from a Field Experiment in Brazil"

Danilo Freire* Manoel Galdino† Umberto Mignozzetti‡

3 January 2020

Abstract

Does local oversight improve public service delivery? We study the effect of a mobile phone application that allows citizens to monitor school construction projects in Brazilian municipalities. The app prompts users to submit data about construction sites, sends such crowdsourced information to independent engineers, and contacts the mayors' offices about project delays. Our results show that the app has a null impact on school construction indicators. Additionally, we find that politicians are unresponsive to individual requests. The results question the impact of bottom-up monitoring on public service performance and suggest that interventions targeted at other groups, or focused on different issues, may produce better policy outcomes.

Keywords: accountability, Brazil, impact evaluation, state capacity, technology

*Postdoctoral Research Associate, The Political Theory Project, Brown University, Providence, RI 02912, USA, danilofreire@brown.edu, http://danilofreire.github.io, +1 (401) 584-2494. Corresponding author.

†Executive Director, Transparência Brasil, São Paulo, SP, Brazil, mgaldino@transparencia.org.br, https://www.transparencia.org.br.

‡School of International Relations, Fundação Getulio Vargas, São Paulo, SP, Brazil and Wilf Family Department of Politics, NYU, NY, USA, umberto.mig@nyu.edu, http://umbertomig.com.

Contents

A Balance Tests **3**

B Manipulation Checks **7**

C Treatment Definition and Mechanism **10**

D Outcome Data Collection **12**

E Facebook Tá de Pé Campaign **13**

F Main Results **15**

I Intervention 1 15

II Intervention 2 17

G Randomisation Inference **19**

H APSA Experimental Section Standard Report for Experimental Research **20**

I Hypotheses 20

II Subjects and Context 21

III Allocation Methods 21

IV Treatments 31

V Results 32

I Other Information **34**

J Session Information **35**

A Balance Tests

The tables below show the results of the balance tests we conducted for interventions 1 and 2. Our covariates are:

1. Log of municipal population in 2015;
2. Log of number of poor families in each city;
3. Log of total federal transfers to the municipality in 2016;
4. Federal government indicator for primary school quality;
5. Federal government indicator for secondary school quality.

The data come from the Brazilian Ministry of Education and the National Census.

In intervention 1, we randomised the treatment at the municipality level. We selected 150 municipalities for the control group while the rest were placed in the treatment group. We created the control group by deleting all the construction sites in the selected cities. No difference between control and treatment variables is statistically significant.

```
# R options
r <- getOption("repos")
r["CRAN"] <- "http://cran.cnr.berkeley.edu/"
options(repos = r)


# Install required packages
pkgs <- c("tidyverse", "dummies", "kableExtra", "haven", "compareGroups",
    "grid", "gridExtra", "devtools", "lubridate", "brazilmaps",
    "abjutils", "lfe", "cobalt", "MatchIt", "ri2", "DeclareDesign",
    "knitr", "DiagrammeR", "DiagrammeRsvg", "rsvg", "flextable",
    "officer", "ggthemes", "stargazer", "formatR")


# Install required packages
install_if_not <- function(x) {
    if (x %in% rownames(installed.packages()) == FALSE)
        install.packages(x, dependencies = T)
```

```
}
lapply(pkgs, install_if_not)


# Load scripts
lapply(pkgs, require, character.only = T)
rm(pkgs, install_if_not)


# Load Data
load("../article/tdp.RData")


# Disable scientific notation
options(scipen = 999)
```

```
# Covariate Balance -- Intervention 1
aux <- select(impact_evaluation_phase1, treat, logPop2015, ideb_ai_2015,
    ideb_af_2015, log_poorFam2010, log_totTransf2016) %>% unique()


resu1 <- compareGroups(treat ~ logPop2015 + log_poorFam2010 +
    log_totTransf2016 + ideb_ai_2015 + ideb_af_2015, data = aux)


tab_IE1_balance <- createTable(resu1, digits = 2)
row.names(tab_IE1_balance$descr) <- c("Log Population (2015)",
    "Log Poor Families (2010)", "Log Total Transfers (2016)",
    "IDEB Initial Years (2015)", "IDEB Final Years (2015)")


print(tab_IE1_balance)
```

```
##
## --------Summary descriptives table by 'treat'---------
##
## _____________________________________________________________
```

```
##                               Control     Treatment   p.overall
##                                N=150        N=1034
##
## Log Population (2015)      10.19 (1.08) 10.17 (1.10)   0.835
## Log Poor Families (2010)   7.77 (1.02)  7.78 (1.04)    0.952
## Log Total Transfers (2016) 15.85 (0.83) 15.84 (0.84)   0.877
## IDEB Initial Years (2015)  4.97 (0.96)  4.97 (0.98)    0.976
## IDEB Final Years (2015)    4.01 (0.84)  3.99 (0.80)    0.746
##
```

In intervention 2, we randomised the treatment at the school level. We placed 15% of schools that could potentially appear in the app in the control group. We used block randomisation, blocking by three characteristics:

1. Brazilian State
2. Construction Status (under construction, stopped, unfinished)
3. School construction completion rates above the national median

```
## Covariate balance
aux <- select(impact_evaluation_phase2, treat, logPop2015, ideb_ai_2015,
              ideb_af_2015, log_poorFam2010, log_totTransf2016)


resu1 <- compareGroups(treat ~ logPop2015 + log_poorFam2010 +
                         log_totTransf2016 + ideb_ai_2015 + ideb_af_2015,
                       data = aux)


tab_IE2_balance <- createTable(resu1, digits = 2)
row.names(tab_IE2_balance$descr) <-  c("Log Population (2015)",
                                       "Log Poor Families (2010)",
                                       "Log Total Transfers (2016)",
                                       "IDEB Inicial Years (2015)",
```

```
                                    "IDEB Final Years (2015)")
print(tab_IE2_balance)
```

```
##
## --------Summary descriptives table by 'treat'---------
##
## _____________________________________________________________
##                               Control     Treatment   p.overall
##                                 N=659        N=3717
##
## Log Population (2015)      10.49 (1.49) 10.48 (1.46)   0.898
## Log Poor Families (2010)   8.08 (1.37)  8.07 (1.33)    0.825
## Log Total Transfers (2016) 16.09 (1.17) 16.07 (1.15)   0.783
## IDEB Inicial Years (2015)  4.89 (0.99)  4.91 (0.98)    0.551
## IDEB Final Years (2015)    3.95 (0.71)  3.88 (0.72)    0.068
##
```

B Manipulation Checks

In randomised experiments, manipulation is defined as the extent through which the treatment is successfully delivered to the control and treated units. In the case of the *Tá de Pé* app intervention, the manipulation indicates whether the app improves school construction completion rates. We present two manipulation indicators. First, we look into municipalities which did or did not download the app. Next, we see the number of app downloads during intervention 1 (February 2017–July 2018) and intervention 2 (August 2018–July 2019). The code replicates figures 2 and 3 in the article.

```
# Map manipulation test -- Intervention 1
mapbr <- get_brmap("City")
gaaux <- filter(ga, phase1 == 1)
gaaux <- select(gaaux, ibge_code7, downl)
gaaux <- rename(gaaux, City = ibge_code7)
gaaux <- unique(gaaux)
gaaux$City <- as.numeric(gaaux$City)
gaaux2 <- impact_evaluation_phase1 %>%
  select(ibge_code7) %>%
  transmute(City = as.numeric(ibge_code7)) %>%
  unique()
gaaux <- merge(gaaux2, gaaux, all.x = TRUE); rm(gaaux2)
gaaux$downl[is.na(gaaux$downl)] <- 0
gaaux2 <- data.frame(City = mapbr$City)
gaaux <- merge(gaaux2, gaaux, all.x = TRUE); rm(gaaux2)
gaaux$downl[is.na(gaaux$downl)] <- 2
gaaux$Downloads <- factor(gaaux$downl, labels = c("No Downloads", "Downloads",
                                                  "Not in App"))
mapbr <- join_data(mapbr, gaaux, by = "City")
map_downloads_int1 <- ggplot() +
  geom_sf(data = mapbr, aes(fill = Downloads), lwd = 0.001) +
  scale_fill_manual(values = c("#E69F00", "#0072B2", "#F0E442")) +
```

```
  theme_map()

map_downloads_int1


# App downloads over time -- Intervention 1

tab <- filter(ga, phase1 == 1) %>%

  group_by(data) %>%

  summarize(NewUsers = sum(novos_usuarios))

names(tab) <- c("Date", "Frequency")

freq_downloads_int1 <- ggplot(tab, aes(x = Date, y = Frequency, group = 1)) +

  geom_line() + geom_point()

freq_downloads_int1
```

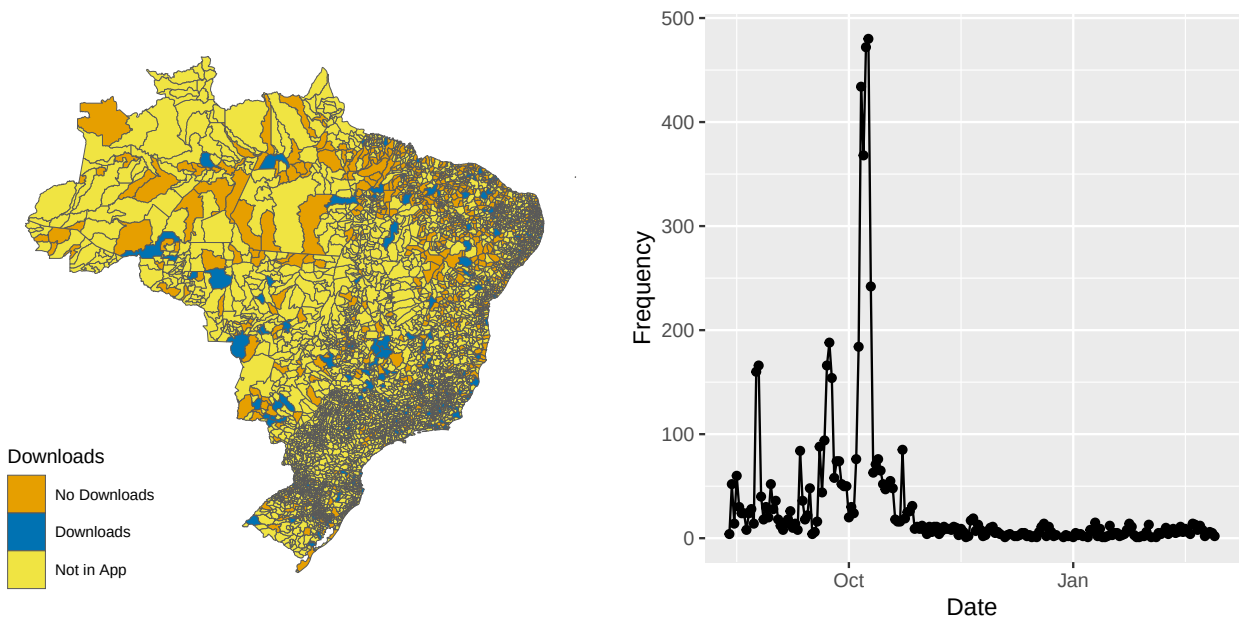


Figure 1: Manipulation checks for intervention 1. The first plot shows the geographical distribution of the treatment condition and the second graph displays the number of TDP app downloads from August 2017 to February 2018.

```
## Map manipulation test -- Intervention 2

mapbr <- get_brmap("City")

gaaux <- filter(ga, phase2 == 1)

gaaux <- select(gaaux, ibge_code7, downl)

gaaux <- rename(gaaux, City = ibge_code7)
```

```r
gaaux <- unique(gaaux)

gaaux$City <- as.numeric(gaaux$City)

gaaux2 <- impact_evaluation_phase2 %>%

  select(ibge_code7) %>%

  transmute(City = as.numeric(ibge_code7)) %>%

  unique()

gaaux <- merge(gaaux2, gaaux, all.x = TRUE); rm(gaaux2)

gaaux$downl[is.na(gaaux$downl)] = 0

gaaux2 <- data.frame(City = mapbr$City)

gaaux <- merge(gaaux2, gaaux, all.x = TRUE); rm(gaaux2)

gaaux$downl[is.na(gaaux$downl)] = 2

gaaux$Downloads <- factor(gaaux$downl, labels = c("No Downloads", "Downloads",

                                                  "Not in App"))

mapbr <- join_data(mapbr, gaaux, by = "City")

p1 <- ggplot() +

  geom_sf(data = mapbr, aes(fill = Downloads), lwd = 0.01) +

  scale_fill_manual(values = c("#E69F00", "#0072B2", "#F0E442")) +

  theme_map()

p1


# App downloads over time -- Intervention 2

tab <- filter(ga, phase2 == 1) %>%

  group_by(data) %>%

  summarize(NewUsers = sum(novos_usuarios))

names(tab) <- c("Date", "Frequency")

p2 <- ggplot(tab, aes(x = Date, y = Frequency, group = 1)) +

  geom_line() + geom_point()

p2
```

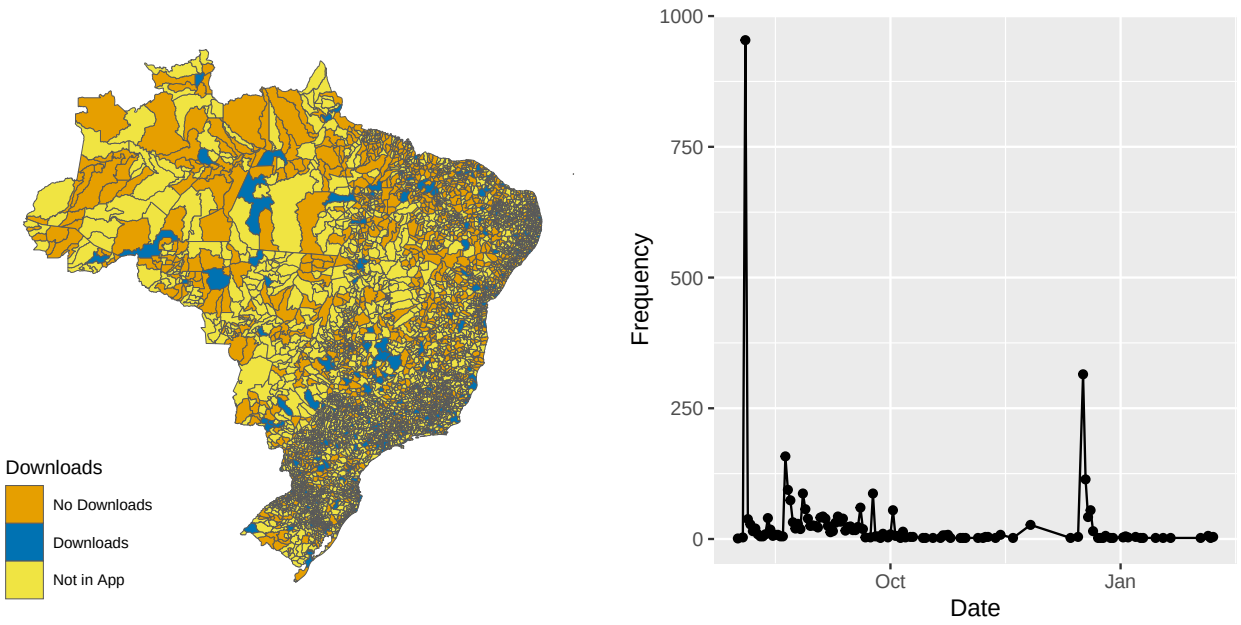


Figure 2: Manipulation checks for intervention 2. The graphs display the geographical and temporal variation of TDP app downloads from August 2018 to February 2019.

C Treatment Definition and Mechanism

In this section, we explain in detail how the *Tá de Pé* app works. The treatment involves the following procedures:

1. Users download the app.

2. Users access the app and add new information about school constructions near to their location.

3. The app sends a message to the mayor's office requesting details about the project. If necessary, the message is also forwarded to other government oversight institutions such as the city council and the Brazilian Federal Comptroller (CGU). Below, we discuss the cases in which we forwarded the denounce to the authorities.

4. If the pressure over the mayors has an effect, we expect to witness improvements on governmental data regarding the school construction progress.

The treatment is a compounded treatment comprised of steps (2) to (4). To make sure that the only source of the effect comes from step (2), we took the following precautions:

In step (1), we have implemented Facebook campaigns in municipalities that have school construction agreements with the Federal government. We did not discriminate any municipality in

this step, and citizens living in municipalities in the treatment and in the control could equally have received the banners about the *Tá de Pé* app. The Facebook campaign was not randomised.

For step (3), we put a team of two data scientists to ensure that upon receiving a denounce, the mayor's office, the city council, and the Brazilian Federal Comptroller (CGU) would be notified. The decision making funnel was:

3.1. We notified the *Engineers without Borders* (EWB) about the denounce and sent them the user-provided pictures and auxiliary information. They issued a report on how much the construction was likely to be delayed.

3.2. After we had the EWB report, we notified the mayor's office in compliance with Brazil's Freedom of Information Act (FOI). We communicated that a citizen had anonymously made a denounce about a school (fully identifying the school construction that we were referring to), and that the Engineers without Borders found the construction delayed. We submitted a request for the mayor's office to provide an explanation on why the construction was delayed and asked for updated statistics on when the construction will be finished. According to the FOI law, the mayor had twenty days to respond.

3.3. If the response was deemed insufficient, we forwarded the denounce to the city council and to the Brazilian Federal Comptroller (CGU). As the denounce goes to these institutions, they can harm mayors by restricting access to Federal funds.

3.4. At each stage, a Twitter bot constructed by Transparência Brasil (https://twitter.com/tadepeapp) reported the reception of a denounce and tracked the responses of the mayor, the city council, and the CGU.

In step (4), we relied on administrative data by the Brazilian Ministry of Education. The Ministry of Education provides monthly data on school constructions build with Federal Government resources and shows how many of them are delayed across the country. We use the finishing dates reported by the municipality at the time they sign the agreement with the Federal Government as our measure of construction delays. This data helped us to keep the app updated. We selected outcomes six months before and after the treatment. The data were constantly updated by the Ministry of Education, and we found no red flags in the overall quality of their information.

Therefore, steps (1), (3), and (4) were standardised and do not vary across the country. The only source of variation in our intervention should come from step (2).

In step (2), we applied the treatment by removing schools within municipalities out of the app. In the first intervention, which happened at the municipal level, we excluded all schools within a given randomly selected municipality. In the second intervention, we randomly excluded selected schools out of the app. Removing a school means that the school was in the dataset provided by the Brazilian Ministry of Education, but it did not show up in the app. Therefore, our treatment effect represents the school being present (treatment) or absent (control) in the app.

We argue that the app promotes two crucial features of bottom-up accountability. First, it helps people to access information that would otherwise be available only in an obscure spreadsheet on the Ministry of Education website. Second, whenever people find this information troublesome, we are providing an easy way for them to act upon the information. As the *Tá de Pé* design was intuitive and straightforward, we believe that most Brazilians would find it easy to use the app.

Moreover, the success of treatment does not require that everyone in the municipality uses it. The more usage means more pictures and denounces, and this represents more pressure over the mayors' office, which could revert into a higher effect. However, just one denounce would be enough for the project to be successful, as the denounce can be directed to the Brazilian General Comptroller (CGU), and this could potentially deny future funding to the municipality.

D Outcome Data Collection

We collect the main outcomes using the data reported by the municipality to the Brazilian Ministry of Education. Note that this is the same data as the pre-treatment data that we use to feed in the app with delayed schools.

The outcomes used in the paper are:

1. Percentage of the project completed before the impact evaluation started: This is a column in the Ministry of Education dataset. The data in this column were sampled at the beginning of the intervention.

2. Percentage of the project reported as completed by the end of the intervention period: Another column in the Ministry of Education dataset. The data were sampled six months after the intervention.

3. Difference between the percentage reported as completed before and after the intervention: The difference between (1) and (2) above. Note that according to Gerber and Green (2012), this way to look into outcomes is positive, as having a pre-treatment covariate that highly predicts the outcome reduces the variance in the estimator considerably.

4. Dummy indicator for finished constructions: The Ministry of Education dataset has a column with the construction status. We created a dummy to be one when the construction was reported as finished and zero otherwise. The data here were sampled six months after the intervention.

5. Dummy indicator for cancelled constructions: Similarly, we created a dummy variable from the Ministry of Education dataset indicating when the construction was reported as cancelled. The data here were sampled six months after the intervention.

6. Number of schools where construction companies updated the conclusion dates: Lastly, the Ministry of Education dataset has a column with the construction estimated completion date. We took the completion dated reported before and six months after the intervention. If the dates differed, we coded as one, and zero otherwise.

All these variables come from our manipulation of the Ministry of Education data. Collecting the outcomes in this way is superior to the alternative of gathering the data ourselves. First, we would not be able to manipulate the results and cherry-pick favourable results. Even if they have the best intentions, researchers may bias the results just by the choices they make in the data collection process. For instance, if we send an RA to collect the data, as she knows the app, she could unconsciously over-report positive results. This would bias our findings and undermine the credibility of our experiment. Second, using external data makes the results easily reproducible by other researchers. As the Ministry of Education has standardised data collection procedures, they greatly simplify and facilitate the reproduction of our findings.

E Facebook Tá de Pé Campaign

The app by itself would probably not have had an effect on the responsiveness of mayors. To boost usage and publicize the app, Transparência Brasil ran 64 Facebook campaigns throughout the country.

The Facebook campaign concentrates the bulk of the investments at the beginning of the intervention. The app download data is in the second panel of Figures 2 and 3. For the Facebook interaction, we have the following statistics:

1. Impressions
    - Total for all campaigns: 5,155,535
2. App Download link clicks:
    - Mean: 24,398.65

- Total for all campaigns: 1,951,892

As we see from the actual download activity, the people who indeed downloaded the app were much fewer than these numbers would suggest.

We have chosen Facebook because the platform offers an easy and cheap method to spread information. Moreover, according to the Statista website, Facebook is used by 70 million Brazilians (60% of the entire adult population), and the demographics largely match the demographics publicised by the Brazilian Institute of Geography and Statistics. For instance, see the following websites:

1. Statista Total Facebook Users
2. Statista Total Facebook Users by Age

F Main Results

I Intervention 1

The code below replicates table 1 in the manuscript.

Table 1: Impact Evaluation – Intervention 1

	Dependent variable:					
	Investment Before	Investment After	Delta Investment	Finished Construction	Cancelled Construction	Updated Date
	(1)	(2)	(3)	(4)	(5)	(6)
ATE	−0.99	−1.12	−0.13	0.002	0.02**	0.05
	(2.59)	(2.96)	(1.03)	(0.01)	(0.01)	(0.05)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,986	2,986	2,986	2,986	2,986	2,926
R^2	0.16	0.14	0.05	0.02	0.07	0.13

Note: *p<0.1; **p<0.05; ***p<0.01
Cluster-robust SEs at the municipality level.

The models without control variables or fixed effects follow below.

Table 2: Impact Evaluation – Intervention 1
No Controls and No Fixed Effects

	Dependent variable:					
	Investment Before	Investment After	Delta Investment	Finished Construction	Cancelled Construction	Updated Date
	(1)	(2)	(3)	(4)	(5)	(6)
ATE	−0.21	−0.56	−0.36	0.01	0.02**	0.04
	(4.10)	(4.86)	(1.21)	(0.01)	(0.01)	(0.07)
Controls	No	No	No	No	No	No
State fixed effects	No	No	No	No	No	No
Observations	2,986	2,986	2,986	2,986	2,986	2,926
R^2	0.0000	0.0000	0.0001	0.0001	0.001	0.001

Note: *p<0.1; **p<0.05; ***p<0.01
Cluster-robust SEs at the municipality level.

Table 3: Impact Evaluation – Intervention 1
No Controls

	Dependent variable:					
	Investment Before	Investment After	Delta Investment	Finished Construction	Cancelled Construction	Updated Date
	(1)	(2)	(3)	(4)	(5)	(6)
ATE	−2.20	−2.08	0.12	0.003	0.03**	0.03
	(2.87)	(3.33)	(1.06)	(0.01)	(0.01)	(0.05)
Controls	No	No	No	No	No	No
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,986	2,986	2,986	2,986	2,986	2,926
R^2	0.07	0.06	0.04	0.01	0.05	0.06

Note: *p<0.1; **p<0.05; ***p<0.01
Cluster-robust SEs at the municipality level.

Table 4: Impact Evaluation – Intervention 1
No Fixed Effects

	Dependent variable:					
	Investment Before	Investment After	Delta Investment	Finished Construction	Cancelled Construction	Updated Date
	(1)	(2)	(3)	(4)	(5)	(6)
ATE	1.23	0.82	−0.41	0.01	0.02**	0.06
	(3.59)	(4.14)	(1.06)	(0.01)	(0.01)	(0.06)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	No	No	No	No	No	No
Observations	2,986	2,986	2,986	2,986	2,986	2,926
R^2	0.11	0.10	0.02	0.01	0.02	0.08

Note: *p<0.1; **p<0.05; ***p<0.01
Cluster-robust SEs at the municipality level.

II Intervention 2

Below, the code required to replicate the main findings of intervention 2.

Table 5: Impact Evaluation – Intervention 2

	Dependent variable:					
	Investment Before	Investment After	Delta Investment	Finished Construction	Cancelled Construction	Updated Date
	(1)	(2)	(3)	(4)	(5)	(6)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
State Fixed Effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,226	3,226	3,226	3,226	3,226	3,109
R^2	0.12	0.11	0.04	0.02	0.17	0.09

Note: *p<0.1; **p<0.05; ***p<0.01
Cluster-robust SEs at the municipality level.
IPW computed using the randomizr package

And the models without controls or fixed effects follow below.

Table 6: Impact Evaluation – Intervention 2
No Controls and No Fixed Effects

	Dependent variable:					
	Investment Before	Investment After	Delta Investment	Finished Construction	Cancelled Construction	Updated Date
	(1)	(2)	(3)	(4)	(5)	(6)
ATE	−1.02	−1.90	−0.88	−0.001	0.01	−0.002
	(1.52)	(1.66)	(0.61)	(0.01)	(0.02)	(0.02)
Controls	No	No	No	No	No	No
State fixed effects	No	No	No	No	No	No
Observations	3,226	3,226	3,226	3,226	3,226	3,109
R^2	0.0003	0.001	0.001	0.0000	0.0004	0.0000

Note: *p<0.1; **p<0.05; ***p<0.01
Cluster-robust SEs at the municipality level.
IPW computed using the randomizr package

Table 7: Impact Evaluation – Intervention 2
No Controls

	Dependent variable:					
	Investment Before	Investment After	Delta Investment	Finished Construction	Cancelled Construction	Updated Date
	(1)	(2)	(3)	(4)	(5)	(6)
ATE	−1.46	−2.30	−0.84	−0.002	0.02	−0.003
	(1.49)	(1.62)	(0.61)	(0.01)	(0.02)	(0.02)
Controls	No	No	No	No	No	No
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3,226	3,226	3,226	3,226	3,226	3,109
R^2	0.05	0.06	0.03	0.01	0.09	0.05

Note: *p<0.1; **p<0.05; ***p<0.01
Cluster-robust SEs at the municipality level.
IPW computed using the randomizr package

Table 8: Impact Evaluation – Intervention 2
No Fixed Effects

	Dependent variable:					
	Investment Before	Investment After	Delta Investment	Finished Construction	Cancelled Construction	Updated Date
	(1)	(2)	(3)	(4)	(5)	(6)
ATE	−0.94	−1.90	−0.96	−0.0005	0.01	−0.002
	(1.47)	(1.59)	(0.61)	(0.01)	(0.01)	(0.02)
Controls	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	No	No	No	No	No	No
Observations	3,226	3,226	3,226	3,226	3,226	3,109
R^2	0.08	0.08	0.01	0.005	0.12	0.05

Note: *p<0.1; **p<0.05; ***p<0.01
Cluster-robust SEs at the municipality level.
IPW computed using the randomizr package

G Randomisation Inference

We employ randomised inference to estimate the probability of the sharp null hypothesis over all possible randomisations that could have occurred under our research design. We fail to reject the null in all but the finished school indicator in experiment 1.

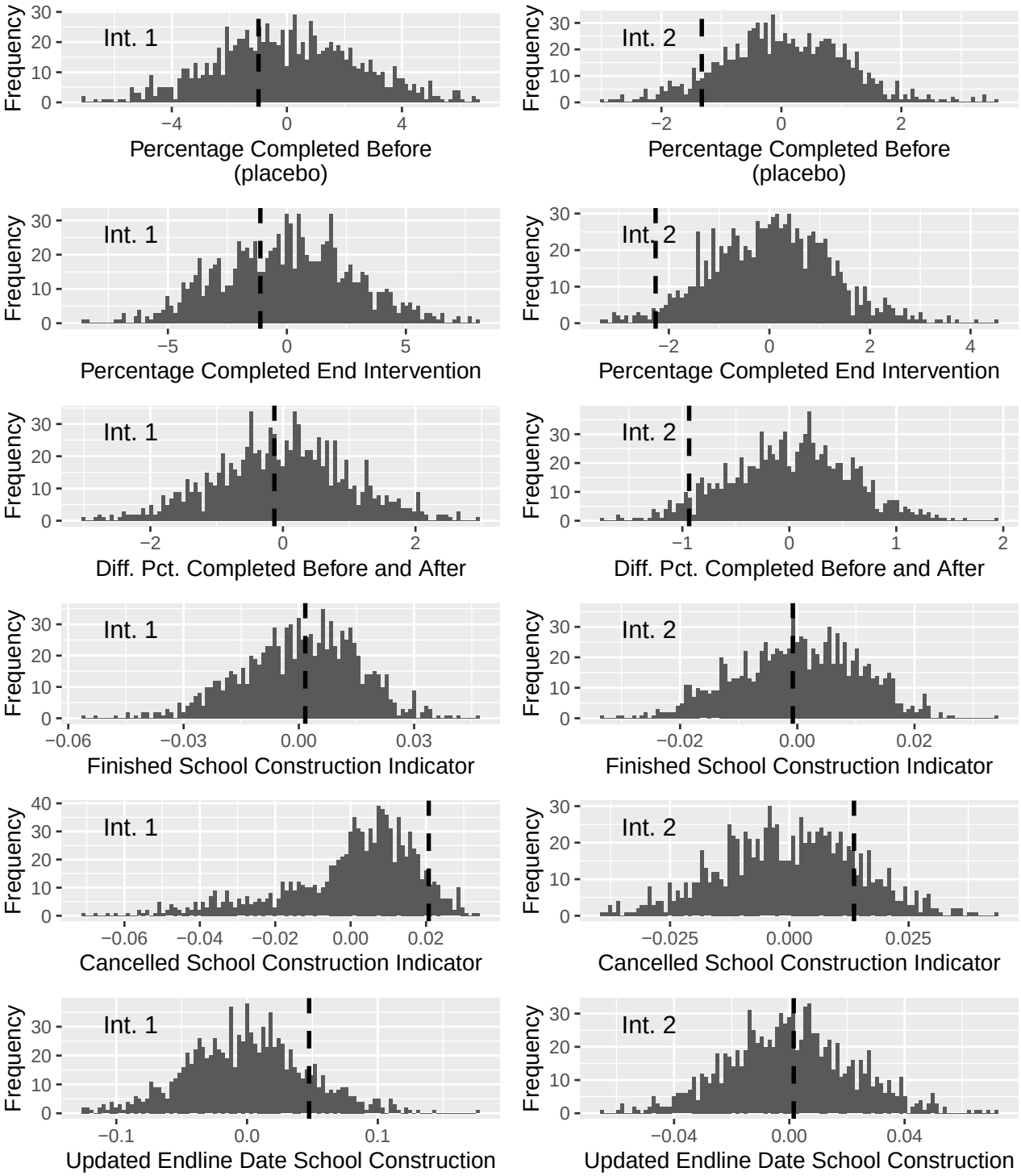


Figure 3: Sampling distribution of the estimated coefficient for our six outcomes in two interventions. Graphs on the left correspond to randomisation inference estimates for intervention 1 and those on the right describe the results for intervention 2.

H APSA Experimental Section Standard Report for Experimental Research

I Hypotheses

Hypotheses: The experiment studies how technology facilitates bottom-up and top-down pressure to improve service provision. More precisely, we test whether the *Tá de Pé* mobile phone app is able to successfully mobilise citizens to exert pressure on local representatives and civil servants. We also test whether bottom-up monitoring of public works improves school construction rates and spending.

Background: Recent studies show that community monitoring improves public service outcomes in developing economies. Some of the papers find that bottom-up accountability has a significant impact on public service delivery:

- Bjorkman, Martina and Jakob Svensson. 2009. "Power to the People: Evidence from a Randomized Field Experiment of a Community-Based Monitoring Project in Uganda." Quarterly Journal of Economics 124(2):735–769.
- Bjorkman, Martina and Jakob Svensson. 2010. "When Is Community-Based Monitoring Effective? Evidence from a Randomized Experiment in Primary Health in Uganda." Journal of the European Economic Association 8(2–3):571–581. Bjorkman Nyqvist, Martina, Damien de Walque and Jakob Svensson. 2017. "Experimental Evidence on the Long-Run Impact of Community-Based Monitoring." American Economic Journal: Applied Economics 9(1):33–69.

However, other authors fail to find positive resuls for the same type of intervention, e.g.:

- Banerjee, A. V., Banerji, R., Duflo, E., Glennerster, R., and Khemani, S. 2010. "Pitfalls of Participatory Programs: Evidence from a Randomized Evaluation in Education in India." American Economic Journal: Economic Policy, 2(1):1–30.
- Lieberman, E. S., Posner, D. N., and Tsai, L. L. 2014. "Does Information Lead to More Active Citizenship? Evidence from an Education Intervention in Rural Kenya." World Development, 60:69–83.

- Raffler, Pia, Dan Posner, and Doug Parkerson. 2019. "The Weakness of Bottom-up Accountability: Experimental Evidence from the Ugandan Health Sector." URL: https://bit.ly/2L36vzI

This project re-evaluates this theoretical controversy and proposes a new field experiment to test whether bottom-up accountability is effective to promote better policy outcomes. The results are substantively important as well. First, we conduct this experiment in a middle-income country, Brazil, which has municipalities whose social indicators match both those of developed and developing nations. Brazil is notably unequal in several characteristics, thus allowing us to infer results for different subgroups if required. Second, we are evaluating school constructions, and the presence of schools have essential consequences in terms of long-run economic development, the household income composition, and women empowerment.

II Subjects and Context

Eligibility and Exclusion Criteria: We selected all school projects that received Federal fundings from the Brazilian Ministry of Education. By an agreement with the Brazilian Ministry of Education, they allowed us to have the data of all school constructions receiving funds from them.

All schools constructions funded by the Brazilian Ministry of Education participated in this study. We had no schools excluded from the program.

Interventions' dates: We ran two interventions:

- App impact evaluation 1: From August 2017 to February 2018. We call this Intervention 1 throughout the text.
- App impact evaluation 2: From August 2018 to February 2019. We call this Intervention 2 throughout the text.

III Allocation Methods

Assignment Procedure: The treatment here was assigned by the municipality in the first intervention, and at the school level in the second and third interventions.

For intervention one, we selected 150 municipalities that were placed in the control group. The randomization code was:

```
vectreat <- c(rep(0,150), rep(1, nrow(dat)-150))


AIC_info = numeric()
for (i in 1:5000) {
  vectreat <- sample(vectreat, length(vectreat))
  mod <- glm(formula(paste('vectreat', vars, sep = '~')),
             family = binomial, data = dat)
  if(sum(summary(mod)$coefficients[-1,4]<.2)==0) {
    dat = data.frame(dat, vtreat = vectreat)
    AIC_info = c(AIC_info, AIC(mod))
  }
}
```

Then, we checked whether the one of the selected covariates is a significant predictor of the random assignment. We presented a vector of acceptable random assignment in these grounds, and Transparência Brasil selected the one we use in the first intervention.

For intervention 2, we selected 15% of the schools in the dataset that could either be placed in the treatment or in control in each of the interventions. The `randomizr` code for intervention 2 follows below. `OnApp` means treatment and `OffApp` means the control for this intervention:

```
# Install and load required package
install.packages("randomizr")
library(randomizr)
decl_intheapp <- declare_ra(blocks = dat_intheapp$var_blocking,
                            prob_each = c(.85,.15),
                            conditions = c('OnApp', 'OffApp'))


dat_intheapp$Z_intheapp <- block_ra(blocks = dat_intheapp$var_blocking,
                        conditions = c('OnApp', 'OffApp'),
                        prob_each = c(.85,.15))
```

```
dat_intheapp$IPW_intheapp <- 1/obtain_condition_probabilities(decl_intheapp,
                                                              dat_intheapp$Z_intheapp)
```

Block randomization: We used simple randomisation in the first assignment. In the second intervention, we blocked by the Brazilian State, the construction status, and above the median execution. The summary of the blocks, with the IPWs assigned follow below.

```
aux <- rand2018 %>%
  select(state, status, above_median_executed,
         var_blocking, Z_campaign, IPW_campaign) %>%
  unique() %>%
  na.omit()
kable(aux, "latex", caption = "Block randomization -- Intervention 2",
      booktabs = TRUE, longtable = TRUE) %>%
  kable_styling(font_size = 8) %>%
  kable_styling(latex_options = c("hold_position", "repeat_header"))
```

Table 9: Block randomization – Intervention 2

	state	status	above_median_executed	var_blocking	Z_campaign	IPW_campaign
1	CE	Unfinished	AboveMedianExecuted	CE_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
2	PI	Unfinished	AboveMedianExecuted	PI_Unfinished_AboveMedianExecuted	Campaign	1.176471
3	PI	Unfinished	AboveMedianExecuted	PI_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
4	MA	Unfinished	AboveMedianExecuted	MA_Unfinished_AboveMedianExecuted	Campaign	1.176471
5	RN	Unfinished	AboveMedianExecuted	RN_Unfinished_AboveMedianExecuted	Campaign	1.176471
6	TO	Unfinished	AboveMedianExecuted	TO_Unfinished_AboveMedianExecuted	Campaign	1.176471
7	TO	Unfinished	Below_Median_Executed	TO_Unfinished_Below_Median_Executed	Campaign	1.176471
8	SP	Ongoing	AboveMedianExecuted	SP_Ongoing_AboveMedianExecuted	Campaign	1.176471
9	PB	Unfinished	Below_Median_Executed	PB_Unfinished_Below_Median_Executed	ControlCampaign	6.666667
10	PB	Ongoing	AboveMedianExecuted	PB_Ongoing_AboveMedianExecuted	Campaign	1.176471
13	MG	Unfinished	AboveMedianExecuted	MG_Unfinished_AboveMedianExecuted	Campaign	1.176471
14	GO	Unfinished	AboveMedianExecuted	GO_Unfinished_AboveMedianExecuted	Campaign	1.176471
15	RJ	Unfinished	AboveMedianExecuted	RJ_Unfinished_AboveMedianExecuted	Campaign	1.176471
17	ES	Ongoing	AboveMedianExecuted	ES_Ongoing_AboveMedianExecuted	Campaign	1.176471
18	PI	Ongoing	AboveMedianExecuted	PI_Ongoing_AboveMedianExecuted	Campaign	1.176471
19	CE	Unfinished	AboveMedianExecuted	CE_Unfinished_AboveMedianExecuted	Campaign	1.176471

Table 9: Block randomization – Intervention 2 *(continued)*

	state	status	above_median_executed	var_blocking	Z_campaign	IPW_campaign
21	CE	Unfinished	Below_Median_Executed	CE_Unfinished_Below_Median_Executed	Campaign	1.176471
24	MG	Unfinished	AboveMedianExecuted	MG_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
26	BA	Unfinished	AboveMedianExecuted	BA_Unfinished_AboveMedianExecuted	Campaign	1.176471
30	RJ	Unfinished	Below_Median_Executed	RJ_Unfinished_Below_Median_Executed	Campaign	1.176471
33	GO	Ongoing	AboveMedianExecuted	GO_Ongoing_AboveMedianExecuted	Campaign	1.176471
36	PB	Unfinished	Below_Median_Executed	PB_Unfinished_Below_Median_Executed	Campaign	1.176471
37	RS	Unfinished	Below_Median_Executed	RS_Unfinished_Below_Median_Executed	Campaign	1.176471
39	RS	Unfinished	AboveMedianExecuted	RS_Unfinished_AboveMedianExecuted	Campaign	1.176471
41	SP	Unfinished	AboveMedianExecuted	SP_Unfinished_AboveMedianExecuted	Campaign	1.176471
48	MS	Unfinished	AboveMedianExecuted	MS_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
50	MT	Unfinished	AboveMedianExecuted	MT_Unfinished_AboveMedianExecuted	Campaign	1.176471
51	ES	Ongoing	Below_Median_Executed	ES_Ongoing_Below_Median_Executed	Campaign	1.176471
52	MG	Unfinished	Below_Median_Executed	MG_Unfinished_Below_Median_Executed	ControlCampaign	6.666667
53	MG	Stopped	AboveMedianExecuted	MG_Stopped_AboveMedianExecuted	Campaign	1.176471
55	RS	Ongoing	AboveMedianExecuted	RS_Ongoing_AboveMedianExecuted	Campaign	1.176471
58	TO	Unfinished	AboveMedianExecuted	TO_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
59	PR	Unfinished	Below_Median_Executed	PR_Unfinished_Below_Median_Executed	Campaign	1.176471
61	PB	Unfinished	AboveMedianExecuted	PB_Unfinished_AboveMedianExecuted	Campaign	1.176471
64	RN	Unfinished	AboveMedianExecuted	RN_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
68	GO	Unfinished	AboveMedianExecuted	GO_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
73	PI	Unfinished	Below_Median_Executed	PI_Unfinished_Below_Median_Executed	Campaign	1.176471
74	MG	Unfinished	Below_Median_Executed	MG_Unfinished_Below_Median_Executed	Campaign	1.176471
84	MT	Unfinished	AboveMedianExecuted	MT_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
85	BA	Ongoing	AboveMedianExecuted	BA_Ongoing_AboveMedianExecuted	Campaign	1.176471
88	BA	Ongoing	AboveMedianExecuted	BA_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
89	BA	Stopped	AboveMedianExecuted	BA_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
90	PR	Stopped	AboveMedianExecuted	PR_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
94	PA	Ongoing	AboveMedianExecuted	PA_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
95	PA	Stopped	AboveMedianExecuted	PA_Stopped_AboveMedianExecuted	Campaign	1.176471
97	PR	Stopped	AboveMedianExecuted	PR_Stopped_AboveMedianExecuted	Campaign	1.176471
100	PA	Ongoing	Below_Median_Executed	PA_Ongoing_Below_Median_Executed	Campaign	1.176471
105	RR	Ongoing	AboveMedianExecuted	RR_Ongoing_AboveMedianExecuted	Campaign	1.176471
106	AM	Unfinished	AboveMedianExecuted	AM_Unfinished_AboveMedianExecuted	Campaign	1.176471
108	AM	Unfinished	Below_Median_Executed	AM_Unfinished_Below_Median_Executed	Campaign	1.176471
112	AM	Unfinished	Below_Median_Executed	AM_Unfinished_Below_Median_Executed	ControlCampaign	6.666667
116	PA	Ongoing	AboveMedianExecuted	PA_Ongoing_AboveMedianExecuted	Campaign	1.176471
118	PA	Ongoing	Below_Median_Executed	PA_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
119	PA	Stopped	AboveMedianExecuted	PA_Stopped_AboveMedianExecuted	ControlCampaign	6.666667

Table 9: Block randomization – Intervention 2 *(continued)*

	state	status	above_median_executed	var_blocking	Z_campaign	IPW_campaign
122	PA	Stopped	Below_Median_Executed	PA_Stopped_Below_Median_Executed	Campaign	1.176471
129	CE	Ongoing	AboveMedianExecuted	CE_Ongoing_AboveMedianExecuted	Campaign	1.176471
132	TO	Ongoing	AboveMedianExecuted	TO_Ongoing_AboveMedianExecuted	Campaign	1.176471
136	TO	Stopped	AboveMedianExecuted	TO_Stopped_AboveMedianExecuted	Campaign	1.176471
137	RR	Stopped	AboveMedianExecuted	RR_Stopped_AboveMedianExecuted	Campaign	1.176471
139	RR	Stopped	Below_Median_Executed	RR_Stopped_Below_Median_Executed	ControlCampaign	6.666667
140	RR	Stopped	Below_Median_Executed	RR_Stopped_Below_Median_Executed	Campaign	1.176471
141	RR	Ongoing	Below_Median_Executed	RR_Ongoing_Below_Median_Executed	Campaign	1.176471
145	AP	Unfinished	AboveMedianExecuted	AP_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
146	AP	Unfinished	AboveMedianExecuted	AP_Unfinished_AboveMedianExecuted	Campaign	1.176471
149	AP	Unfinished	Below_Median_Executed	AP_Unfinished_Below_Median_Executed	Campaign	1.176471
153	AP	Unfinished	Below_Median_Executed	AP_Unfinished_Below_Median_Executed	ControlCampaign	6.666667
157	GO	Ongoing	Below_Median_Executed	GO_Ongoing_Below_Median_Executed	Campaign	1.176471
158	GO	Stopped	AboveMedianExecuted	GO_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
163	GO	Ongoing	Below_Median_Executed	GO_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
166	GO	Stopped	AboveMedianExecuted	GO_Stopped_AboveMedianExecuted	Campaign	1.176471
169	GO	Stopped	Below_Median_Executed	GO_Stopped_Below_Median_Executed	Campaign	1.176471
174	MA	Ongoing	AboveMedianExecuted	MA_Ongoing_AboveMedianExecuted	Campaign	1.176471
175	MA	Ongoing	Below_Median_Executed	MA_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
176	MA	Ongoing	Below_Median_Executed	MA_Ongoing_Below_Median_Executed	Campaign	1.176471
186	MA	Unfinished	Below_Median_Executed	MA_Unfinished_Below_Median_Executed	Campaign	1.176471
198	SE	Unfinished	Below_Median_Executed	SE_Unfinished_Below_Median_Executed	Campaign	1.176471
202	RR	Unfinished	AboveMedianExecuted	RR_Unfinished_AboveMedianExecuted	Campaign	1.176471
203	RR	Unfinished	Below_Median_Executed	RR_Unfinished_Below_Median_Executed	Campaign	1.176471
204	MA	Unfinished	AboveMedianExecuted	MA_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
208	MT	Ongoing	AboveMedianExecuted	MT_Ongoing_AboveMedianExecuted	Campaign	1.176471
210	AP	Ongoing	Below_Median_Executed	AP_Ongoing_Below_Median_Executed	Campaign	1.176471
228	MS	Unfinished	Below_Median_Executed	MS_Unfinished_Below_Median_Executed	ControlCampaign	6.666667
231	PA	Unfinished	AboveMedianExecuted	PA_Unfinished_AboveMedianExecuted	Campaign	1.176471
233	MG	Ongoing	AboveMedianExecuted	MG_Ongoing_AboveMedianExecuted	Campaign	1.176471
241	MS	Unfinished	AboveMedianExecuted	MS_Unfinished_AboveMedianExecuted	Campaign	1.176471
242	MT	Stopped	AboveMedianExecuted	MT_Stopped_AboveMedianExecuted	Campaign	1.176471
247	AM	Unfinished	AboveMedianExecuted	AM_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
252	RO	Unfinished	AboveMedianExecuted	RO_Unfinished_AboveMedianExecuted	Campaign	1.176471
253	RO	Ongoing	Below_Median_Executed	RO_Ongoing_Below_Median_Executed	Campaign	1.176471
256	PI	Ongoing	AboveMedianExecuted	PI_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
265	RN	Ongoing	AboveMedianExecuted	RN_Ongoing_AboveMedianExecuted	Campaign	1.176471

Table 9: Block randomization – Intervention 2 *(continued)*

	state	status	above_median_executed	var_blocking	Z_campaign	IPW_campaign
270	RN	Ongoing	AboveMedianExecuted	RN_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
272	RN	Stopped	Below_Median_Executed	RN_Stopped_Below_Median_Executed	Campaign	1.176471
280	PE	Unfinished	AboveMedianExecuted	PE_Unfinished_AboveMedianExecuted	Campaign	1.176471
285	AL	Ongoing	AboveMedianExecuted	AL_Ongoing_AboveMedianExecuted	Campaign	1.176471
287	SE	Unfinished	AboveMedianExecuted	SE_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
288	SE	Ongoing	AboveMedianExecuted	SE_Ongoing_AboveMedianExecuted	Campaign	1.176471
300	MG	Ongoing	Below_Median_Executed	MG_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
313	SP	Unfinished	AboveMedianExecuted	SP_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
316	RO	Stopped	AboveMedianExecuted	RO_Stopped_AboveMedianExecuted	Campaign	1.176471
319	PR	Unfinished	AboveMedianExecuted	PR_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
320	PR	Ongoing	AboveMedianExecuted	PR_Ongoing_AboveMedianExecuted	Campaign	1.176471
321	PR	Unfinished	AboveMedianExecuted	PR_Unfinished_AboveMedianExecuted	Campaign	1.176471
327	RS	Stopped	AboveMedianExecuted	RS_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
328	MT	Ongoing	Below_Median_Executed	MT_Ongoing_Below_Median_Executed	Campaign	1.176471
329	MT	Stopped	Below_Median_Executed	MT_Stopped_Below_Median_Executed	Campaign	1.176471
333	BA	Ongoing	Below_Median_Executed	BA_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
340	BA	Unfinished	Below_Median_Executed	BA_Unfinished_Below_Median_Executed	ControlCampaign	6.666667
341	BA	Unfinished	AboveMedianExecuted	BA_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
357	PR	Stopped	Below_Median_Executed	PR_Stopped_Below_Median_Executed	ControlCampaign	6.666667
359	PR	Stopped	Below_Median_Executed	PR_Stopped_Below_Median_Executed	Campaign	1.176471
371	RS	Ongoing	Below_Median_Executed	RS_Ongoing_Below_Median_Executed	Campaign	1.176471
384	SP	Ongoing	Below_Median_Executed	SP_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
391	MG	Ongoing	AboveMedianExecuted	MG_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
410	SE	Unfinished	AboveMedianExecuted	SE_Unfinished_AboveMedianExecuted	Campaign	1.176471
411	SE	Ongoing	Below_Median_Executed	SE_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
415	AM	Ongoing	AboveMedianExecuted	AM_Ongoing_AboveMedianExecuted	Campaign	1.176471
418	BA	Stopped	AboveMedianExecuted	BA_Stopped_AboveMedianExecuted	Campaign	1.176471
420	SP	Unfinished	Below_Median_Executed	SP_Unfinished_Below_Median_Executed	Campaign	1.176471
422	SC	Ongoing	Below_Median_Executed	SC_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
424	PE	Ongoing	AboveMedianExecuted	PE_Ongoing_AboveMedianExecuted	Campaign	1.176471
439	GO	Unfinished	Below_Median_Executed	GO_Unfinished_Below_Median_Executed	Campaign	1.176471
445	MS	Ongoing	Below_Median_Executed	MS_Ongoing_Below_Median_Executed	Campaign	1.176471
446	MS	Ongoing	AboveMedianExecuted	MS_Ongoing_AboveMedianExecuted	Campaign	1.176471
449	PB	Ongoing	Below_Median_Executed	PB_Ongoing_Below_Median_Executed	Campaign	1.176471
450	PE	Unfinished	Below_Median_Executed	PE_Unfinished_Below_Median_Executed	Campaign	1.176471
456	CE	Stopped	AboveMedianExecuted	CE_Stopped_AboveMedianExecuted	Campaign	1.176471
467	BA	Unfinished	Below_Median_Executed	BA_Unfinished_Below_Median_Executed	Campaign	1.176471
487	AL	Unfinished	Below_Median_Executed	AL_Unfinished_Below_Median_Executed	ControlCampaign	6.666667

Table 9: Block randomization – Intervention 2 *(continued)*

	state	status	above_median_executed	var_blocking	Z_campaign	IPW_campaign
488	BA	Ongoing	Below_Median_Executed	BA_Ongoing_Below_Median_Executed	Campaign	1.176471
496	GO	Ongoing	AboveMedianExecuted	GO_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
505	MG	Ongoing	Below_Median_Executed	MG_Ongoing_Below_Median_Executed	Campaign	1.176471
507	MG	Stopped	AboveMedianExecuted	MG_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
512	MT	Ongoing	AboveMedianExecuted	MT_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
515	PB	Unfinished	AboveMedianExecuted	PB_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
517	PE	Ongoing	AboveMedianExecuted	PE_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
526	RN	Stopped	AboveMedianExecuted	RN_Stopped_AboveMedianExecuted	Campaign	1.176471
527	RS	Ongoing	Below_Median_Executed	RS_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
530	RS	Ongoing	AboveMedianExecuted	RS_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
531	SC	Unfinished	AboveMedianExecuted	SC_Unfinished_AboveMedianExecuted	Campaign	1.176471
537	AL	Unfinished	AboveMedianExecuted	AL_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
559	SC	Ongoing	Below_Median_Executed	SC_Ongoing_Below_Median_Executed	Campaign	1.176471
560	SC	Ongoing	AboveMedianExecuted	SC_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
561	SC	Ongoing	AboveMedianExecuted	SC_Ongoing_AboveMedianExecuted	Campaign	1.176471
562	SC	Stopped	AboveMedianExecuted	SC_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
571	SP	Ongoing	Below_Median_Executed	SP_Ongoing_Below_Median_Executed	Campaign	1.176471
576	CE	Ongoing	Below_Median_Executed	CE_Ongoing_Below_Median_Executed	Campaign	1.176471
581	CE	Ongoing	AboveMedianExecuted	CE_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
589	CE	Unfinished	Below_Median_Executed	CE_Unfinished_Below_Median_Executed	ControlCampaign	6.666667
604	PR	Ongoing	AboveMedianExecuted	PR_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
625	MS	Stopped	AboveMedianExecuted	MS_Stopped_AboveMedianExecuted	Campaign	1.176471
627	MS	Unfinished	Below_Median_Executed	MS_Unfinished_Below_Median_Executed	Campaign	1.176471
637	PR	Ongoing	Below_Median_Executed	PR_Ongoing_Below_Median_Executed	Campaign	1.176471
658	PR	Ongoing	Below_Median_Executed	PR_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
664	PI	Unfinished	Below_Median_Executed	PI_Unfinished_Below_Median_Executed	ControlCampaign	6.666667
668	RN	Unfinished	Below_Median_Executed	RN_Unfinished_Below_Median_Executed	Campaign	1.176471
671	MA	Stopped	AboveMedianExecuted	MA_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
673	RO	Unfinished	Below_Median_Executed	RO_Unfinished_Below_Median_Executed	Campaign	1.176471
674	SE	Ongoing	Below_Median_Executed	SE_Ongoing_Below_Median_Executed	Campaign	1.176471
702	ES	Unfinished	AboveMedianExecuted	ES_Unfinished_AboveMedianExecuted	Campaign	1.176471
711	MT	Unfinished	Below_Median_Executed	MT_Unfinished_Below_Median_Executed	Campaign	1.176471
730	MT	Stopped	AboveMedianExecuted	MT_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
734	PE	Ongoing	Below_Median_Executed	PE_Ongoing_Below_Median_Executed	Campaign	1.176471
735	PA	Unfinished	Below_Median_Executed	PA_Unfinished_Below_Median_Executed	ControlCampaign	6.666667
736	AL	Ongoing	Below_Median_Executed	AL_Ongoing_Below_Median_Executed	Campaign	1.176471
752	AM	Stopped	AboveMedianExecuted	AM_Stopped_AboveMedianExecuted	Campaign	1.176471

Table 9: Block randomization – Intervention 2 *(continued)*

	state	status	above_median_executed	var_blocking	Z_campaign	IPW_campaign
771	CE	Stopped	AboveMedianExecuted	CE_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
782	ES	Stopped	AboveMedianExecuted	ES_Stopped_AboveMedianExecuted	Campaign	1.176471
783	RS	Stopped	AboveMedianExecuted	RS_Stopped_AboveMedianExecuted	Campaign	1.176471
786	AM	Ongoing	Below_Median_Executed	AM_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
787	RS	Stopped	Below_Median_Executed	RS_Stopped_Below_Median_Executed	ControlCampaign	6.666667
791	PE	Stopped	AboveMedianExecuted	PE_Stopped_AboveMedianExecuted	Campaign	1.176471
801	RO	Unfinished	AboveMedianExecuted	RO_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
803	AL	Stopped	AboveMedianExecuted	AL_Stopped_AboveMedianExecuted	Campaign	1.176471
804	SP	Stopped	AboveMedianExecuted	SP_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
818	TO	Stopped	AboveMedianExecuted	TO_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
820	SP	Stopped	AboveMedianExecuted	SP_Stopped_AboveMedianExecuted	Campaign	1.176471
830	AL	Unfinished	AboveMedianExecuted	AL_Unfinished_AboveMedianExecuted	Campaign	1.176471
834	RJ	Ongoing	Below_Median_Executed	RJ_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
835	RJ	Ongoing	Below_Median_Executed	RJ_Ongoing_Below_Median_Executed	Campaign	1.176471
846	MA	Ongoing	AboveMedianExecuted	MA_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
884	PB	Stopped	AboveMedianExecuted	PB_Stopped_AboveMedianExecuted	Campaign	1.176471
932	RO	Ongoing	AboveMedianExecuted	RO_Ongoing_AboveMedianExecuted	Campaign	1.176471
935	RJ	Stopped	AboveMedianExecuted	RJ_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
936	RJ	Stopped	AboveMedianExecuted	RJ_Stopped_AboveMedianExecuted	Campaign	1.176471
949	PA	Unfinished	AboveMedianExecuted	PA_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
952	RS	Stopped	Below_Median_Executed	RS_Stopped_Below_Median_Executed	Campaign	1.176471
989	RN	Stopped	AboveMedianExecuted	RN_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
1006	TO	Ongoing	Below_Median_Executed	TO_Ongoing_Below_Median_Executed	Campaign	1.176471
1013	RJ	Ongoing	AboveMedianExecuted	RJ_Ongoing_AboveMedianExecuted	Campaign	1.176471
1033	PI	Stopped	AboveMedianExecuted	PI_Stopped_AboveMedianExecuted	Campaign	1.176471
1054	AL	Stopped	AboveMedianExecuted	AL_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
1086	MA	Stopped	AboveMedianExecuted	MA_Stopped_AboveMedianExecuted	Campaign	1.176471
1102	BA	Stopped	Below_Median_Executed	BA_Stopped_Below_Median_Executed	ControlCampaign	6.666667
1118	BA	Stopped	Below_Median_Executed	BA_Stopped_Below_Median_Executed	Campaign	1.176471
1136	MS	Stopped	AboveMedianExecuted	MS_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
1147	PE	Stopped	AboveMedianExecuted	PE_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
1155	AC	Ongoing	AboveMedianExecuted	AC_Ongoing_AboveMedianExecuted	Campaign	1.176471
1158	AC	Stopped	AboveMedianExecuted	AC_Stopped_AboveMedianExecuted	Campaign	1.176471
1161	AL	Unfinished	Below_Median_Executed	AL_Unfinished_Below_Median_Executed	Campaign	1.176471
1163	AL	Ongoing	AboveMedianExecuted	AL_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
1187	RN	Ongoing	Below_Median_Executed	RN_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
1225	SP	Stopped	Below_Median_Executed	SP_Stopped_Below_Median_Executed	Campaign	1.176471
1231	SP	Ongoing	AboveMedianExecuted	SP_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667

Table 9: Block randomization – Intervention 2 *(continued)*

	state	status	above_median_executed	var_blocking	Z_campaign	IPW_campaign
1246	RJ	Stopped	Below_Median_Executed	RJ_Stopped_Below_Median_Executed	Campaign	1.176471
1264	ES	Ongoing	Below_Median_Executed	ES_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
1279	SE	Stopped	AboveMedianExecuted	SE_Stopped_AboveMedianExecuted	Campaign	1.176471
1287	SE	Stopped	AboveMedianExecuted	SE_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
1313	PI	Ongoing	Below_Median_Executed	PI_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
1316	PI	Ongoing	Below_Median_Executed	PI_Ongoing_Below_Median_Executed	Campaign	1.176471
1318	PI	Stopped	AboveMedianExecuted	PI_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
1338	RS	Unfinished	AboveMedianExecuted	RS_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
1371	PE	Unfinished	Below_Median_Executed	PE_Unfinished_Below_Median_Executed	ControlCampaign	6.666667
1381	PE	Ongoing	Below_Median_Executed	PE_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
1385	PA	Unfinished	Below_Median_Executed	PA_Unfinished_Below_Median_Executed	Campaign	1.176471
1402	PE	Unfinished	AboveMedianExecuted	PE_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
1527	PB	Ongoing	AboveMedianExecuted	PB_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
1560	AL	Ongoing	Below_Median_Executed	AL_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
1639	SC	Stopped	AboveMedianExecuted	SC_Stopped_AboveMedianExecuted	Campaign	1.176471
1652	MA	Stopped	Below_Median_Executed	MA_Stopped_Below_Median_Executed	Campaign	1.176471
1670	MA	Unfinished	Below_Median_Executed	MA_Unfinished_Below_Median_Executed	ControlCampaign	6.666667
1771	AM	Ongoing	Below_Median_Executed	AM_Ongoing_Below_Median_Executed	Campaign	1.176471
1852	MS	Ongoing	AboveMedianExecuted	MS_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
1948	TO	Stopped	Below_Median_Executed	TO_Stopped_Below_Median_Executed	ControlCampaign	6.666667
1952	SP	Stopped	Below_Median_Executed	SP_Stopped_Below_Median_Executed	ControlCampaign	6.666667
1963	RO	Stopped	AboveMedianExecuted	RO_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
1971	RO	Ongoing	AboveMedianExecuted	RO_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
1990	DF	Ongoing	Below_Median_Executed	DF_Ongoing_Below_Median_Executed	Campaign	1.176471
1995	AP	Stopped	AboveMedianExecuted	AP_Stopped_AboveMedianExecuted	Campaign	1.176471
2022	AC	Ongoing	AboveMedianExecuted	AC_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
2026	AC	Ongoing	Below_Median_Executed	AC_Ongoing_Below_Median_Executed	Campaign	1.176471
2093	CE	Stopped	Below_Median_Executed	CE_Stopped_Below_Median_Executed	Campaign	1.176471
2108	DF	Ongoing	Below_Median_Executed	DF_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
2206	RO	Stopped	Below_Median_Executed	RO_Stopped_Below_Median_Executed	Campaign	1.176471
2207	GO	Stopped	Below_Median_Executed	GO_Stopped_Below_Median_Executed	ControlCampaign	6.666667
2231	ES	Ongoing	AboveMedianExecuted	ES_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
2271	TO	Unfinished	Below_Median_Executed	TO_Unfinished_Below_Median_Executed	ControlCampaign	6.666667
2274	AM	Ongoing	AboveMedianExecuted	AM_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
2333	PA	Stopped	Below_Median_Executed	PA_Stopped_Below_Median_Executed	ControlCampaign	6.666667
2451	RS	Unfinished	Below_Median_Executed	RS_Unfinished_Below_Median_Executed	ControlCampaign	6.666667
2463	DF	Ongoing	AboveMedianExecuted	DF_Ongoing_AboveMedianExecuted	Campaign	1.176471

Table 9: Block randomization – Intervention 2 *(continued)*

	state	status	above_median_executed	var_blocking	Z_campaign	IPW_campaign
2467	RJ	Unfinished	AboveMedianExecuted	RJ_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
2532	CE	Ongoing	Below_Median_Executed	CE_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
2545	TO	Ongoing	Below_Median_Executed	TO_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
2561	RN	Ongoing	Below_Median_Executed	RN_Ongoing_Below_Median_Executed	Campaign	1.176471
2570	PB	Stopped	Below_Median_Executed	PB_Stopped_Below_Median_Executed	ControlCampaign	6.666667
2571	PB	Stopped	Below_Median_Executed	PB_Stopped_Below_Median_Executed	Campaign	1.176471
2607	PB	Ongoing	Below_Median_Executed	PB_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
2663	PE	Stopped	Below_Median_Executed	PE_Stopped_Below_Median_Executed	Campaign	1.176471
2695	MS	Stopped	Below_Median_Executed	MS_Stopped_Below_Median_Executed	Campaign	1.176471
2736	PI	Stopped	Below_Median_Executed	PI_Stopped_Below_Median_Executed	Campaign	1.176471
2791	RO	Ongoing	Below_Median_Executed	RO_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
2847	MT	Ongoing	Below_Median_Executed	MT_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
2862	RJ	Ongoing	AboveMedianExecuted	RJ_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
2874	AC	Stopped	Below_Median_Executed	AC_Stopped_Below_Median_Executed	Campaign	1.176471
2995	SP	Unfinished	Below_Median_Executed	SP_Unfinished_Below_Median_Executed	ControlCampaign	6.666667
3117	TO	Stopped	Below_Median_Executed	TO_Stopped_Below_Median_Executed	Campaign	1.176471
3262	SC	Unfinished	Below_Median_Executed	SC_Unfinished_Below_Median_Executed	Campaign	1.176471
3301	MT	Unfinished	Below_Median_Executed	MT_Unfinished_Below_Median_Executed	ControlCampaign	6.666667
3362	PR	Unfinished	Below_Median_Executed	PR_Unfinished_Below_Median_Executed	ControlCampaign	6.666667
3485	RR	Ongoing	Below_Median_Executed	RR_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
3488	RR	Stopped	AboveMedianExecuted	RR_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
3511	ES	Stopped	Below_Median_Executed	ES_Stopped_Below_Median_Executed	Campaign	1.176471
3533	AP	Ongoing	AboveMedianExecuted	AP_Ongoing_AboveMedianExecuted	Campaign	1.176471
3574	MA	Stopped	Below_Median_Executed	MA_Stopped_Below_Median_Executed	ControlCampaign	6.666667
3846	SC	Stopped	Below_Median_Executed	SC_Stopped_Below_Median_Executed	Campaign	1.176471
3866	TO	Ongoing	AboveMedianExecuted	TO_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
3909	ES	Unfinished	Below_Median_Executed	ES_Unfinished_Below_Median_Executed	ControlCampaign	6.666667
3971	AP	Ongoing	Below_Median_Executed	AP_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
4167	MG	Stopped	Below_Median_Executed	MG_Stopped_Below_Median_Executed	Campaign	1.176471
4527	PE	Stopped	Below_Median_Executed	PE_Stopped_Below_Median_Executed	ControlCampaign	6.666667
4571	MT	Stopped	Below_Median_Executed	MT_Stopped_Below_Median_Executed	ControlCampaign	6.666667
4656	ES	Unfinished	Below_Median_Executed	ES_Unfinished_Below_Median_Executed	Campaign	1.176471
4738	PB	Stopped	AboveMedianExecuted	PB_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
4807	CE	Stopped	Below_Median_Executed	CE_Stopped_Below_Median_Executed	ControlCampaign	6.666667
4844	AP	Stopped	Below_Median_Executed	AP_Stopped_Below_Median_Executed	Campaign	1.176471
4989	AC	Ongoing	Below_Median_Executed	AC_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
5159	AL	Stopped	Below_Median_Executed	AL_Stopped_Below_Median_Executed	Campaign	1.176471
5471	AC	Stopped	AboveMedianExecuted	AC_Stopped_AboveMedianExecuted	ControlCampaign	6.666667

Table 9: Block randomization – Intervention 2 *(continued)*

	state	status	above_median_executed	var_blocking	Z_campaign	IPW_campaign
6030	RR	Unfinished	Below_Median_Executed	RR_Unfinished_Below_Median_Executed	ControlCampaign	6.666667
6087	RO	Unfinished	Below_Median_Executed	RO_Unfinished_Below_Median_Executed	ControlCampaign	6.666667
6095	SE	Ongoing	AboveMedianExecuted	SE_Ongoing_AboveMedianExecuted	ControlCampaign	6.666667
6118	PI	Stopped	Below_Median_Executed	PI_Stopped_Below_Median_Executed	ControlCampaign	6.666667
6346	MS	Ongoing	Below_Median_Executed	MS_Ongoing_Below_Median_Executed	ControlCampaign	6.666667
6400	AP	Stopped	AboveMedianExecuted	AP_Stopped_AboveMedianExecuted	ControlCampaign	6.666667
6458	RR	Unfinished	AboveMedianExecuted	RR_Unfinished_AboveMedianExecuted	ControlCampaign	6.666667
6631	AL	Stopped	Below_Median_Executed	AL_Stopped_Below_Median_Executed	ControlCampaign	6.666667
6992	RJ	Stopped	Below_Median_Executed	RJ_Stopped_Below_Median_Executed	ControlCampaign	6.666667

As pre-treatment variables, we used the following municipality-level characteristics:

1. Log of Municipal Population in 2015
2. Log of Number of Poor Families (2010 IBGE Census)
3. Log of Total Federal Transfers to the Municipality in 2016
4. IDEB Indicator for Primary School Quality (2015 Ministry of Education)
5. IDEB Indicator for Secondary School Quality (2015 Ministry of Education)

None of the pre-treatment variables were significant, as shown in Section A.

IV Treatments

- **Treatment Groups**:
  - *Intervention 1*: Municipality with all schools funded by the Ministry of Education showing up in the app.
  - *Intervention 2*: School construction showing up in the app.
- **Control Groups**:
  - *Intervention 1*: Municipality with all schools funded by the Ministry of Education **not** showing up in the app.
  - *Intervention 2*: Selected school constructions **not** showing up in the app.
- **Method of Manipulation Delivery**:

  - *Intervention 1*: The municipalities in the treatment had all their school constructions showing up in the app.
  - *Intervention 2*: The schools in the treatment group were showing up in the app.

- **Software**: The TDP app is an Android and iOS application developed to facilitate bottom-up pressure on school constructions in Brazil.

V Results

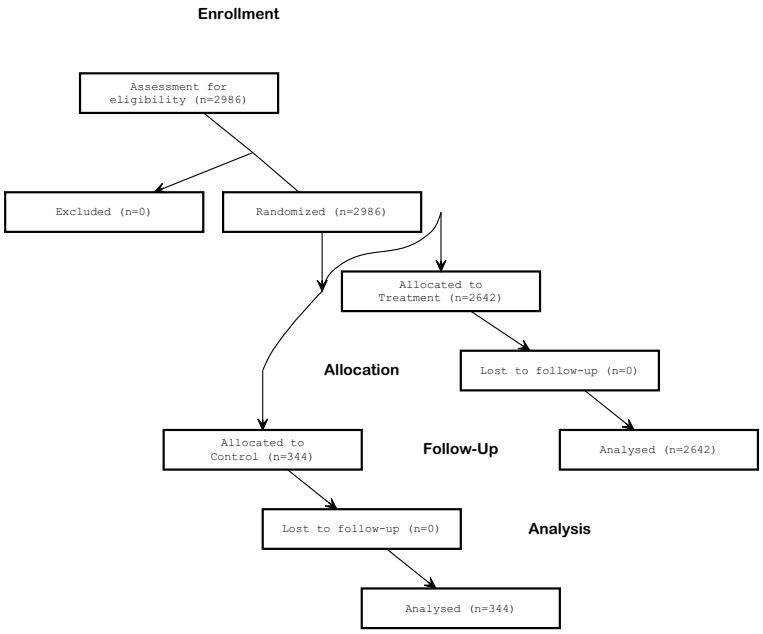
- **Outcome measures**: We use six outcome measures, all taken from the Ministry of Education biannual report:

1. Percentage of the investment executed before the impact evaluation started (placebo)
2. Percentage of the investment executed by the end of the impact evaluation period
3. The difference of the percentage invested in the end and in the beginning of the impact evaluation period
4. Indicator for a construction finished during the impact evaluation period
5. Indicator for a construction cancelled during the impact evaluation period
6. Indicator for an updated conclusion date for the construction during the impact evaluation period

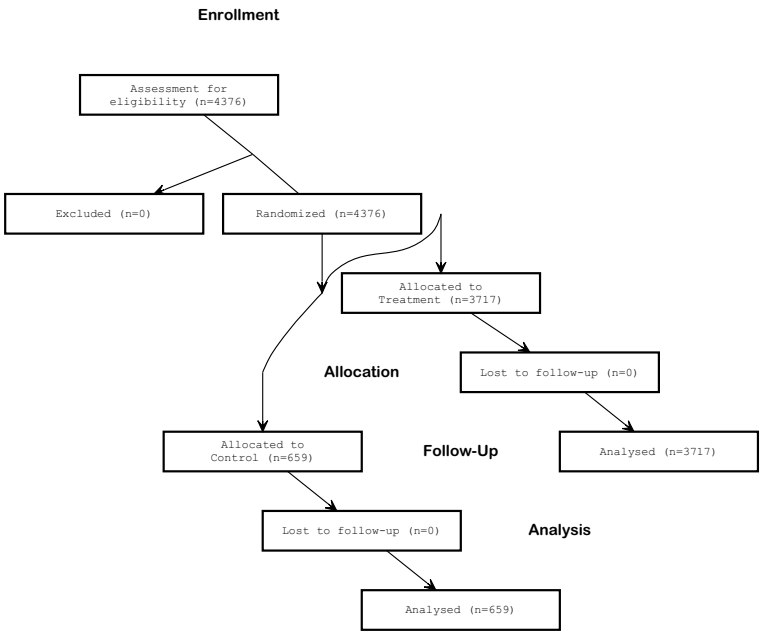
- **CONSORT**

Below follows the CONSORT chart flow:

- *Intervention 1*:



- *Intervention 2*:



- **Reasons for exclusion in the CONSORT:**

  - *Intervention 1*: Constructions that were not in the app when the intervention started.
  - *Intervention 2*: Constructions that were not in the app when the intervention started.

- **Statistical analysis**:

For all interventions, we run the following regression model:

$$Y_i = \alpha + \beta T_i + \gamma X_i + \theta F_i + \varepsilon_i$$

Where i indexes a given school observed in the intervention. Y_i represents an outcome variable. T_i represents a treatment indicator. β represents the estimated Average Treatment Effect. γ is a vector of pre-treatment coefficient effects and X_i a vector of pre-treatment covariates. θ represents a vector of fixed effects estimands and F_i the Brazilian state level fixed effects indicator vector. ε_i is the common error term.

We run three types of analysis:

1. Full regressions with all data available
2. Full regressions using inverse probability weights
3. Regression where we match the control group with a same-size treatment group on the proximity of covariates using genetic matching.

All models use municipal-level cluster robust standard errors and state-level fixed effects. For all models, we also run regressions without clusters or fixed effects.

I Other Information

- **IRB**: FGV exempted the investigators from getting IRB approval because this research used online data and was approved by the Brazilian Ministry of Education.
- **Pre-Registration**: this research has been pre-registered on the EGAP pre-registry tool: https://egap.org/registration/4505.
- **Replication Materials**: The replication materials for this project are available here: https://github.com/umbertomig/tdp-accountability.
- **Funding**: This research received funding from the 2016 Google Social Impact Challenge. Google did not interfere in any aspect of the research design and analysis.
- **Conflict of Interests**: The authors of this analysis declare that there are no conflict of interest.

J Session Information

We used R version 3.6.2 (2019-12-12) to write the manuscript and this appendix. For the regression models estimation, we used the `lfe` package. We employed the `MatchIt` package to improve covariate matching. Everything in this report is fully automated and can be reproduced using RMarkdown.

```
sessionInfo()
```

```
## R version 3.6.2 (2019-12-12)
## Platform: x86_64-apple-darwin15.6.0 (64-bit)
## Running under: macOS Mojave 10.14.6
##
## Matrix products: default
## BLAS:   /Library/Frameworks/R.framework/Versions/3.6/Resources/lib/libRblas.0.dylib
## LAPACK: /Library/Frameworks/R.framework/Versions/3.6/Resources/lib/libRlapack.dylib
##
## locale:
## [1] en_US.UTF-8/en_US.UTF-8/en_US.UTF-8/C/en_US.UTF-8/en_US.UTF-8
##
## attached base packages:
## [1] grid      parallel  stats     graphics  grDevices
## [6] utils     datasets  methods   base
##
## other attached packages:
##  [1] formatR_1.7          stargazer_5.2.2
##  [3] ggthemes_4.2.0       officer_0.3.6
##  [5] flextable_0.5.6      rsvg_1.3
##  [7] DiagrammeRsvg_0.1    DiagrammeR_1.0.1
##  [9] knitr_1.26           DeclareDesign_0.20.0
## [11] fabricatr_0.10.0     ri2_0.1.2
## [13] estimatr_0.20.0      randomizr_0.20.0
## [15] MatchIt_3.0.2        cobalt_3.9.0
```

```
## [17] lfe_2.8-3            Matrix_1.2-18
## [19] abjutils_0.2.3       brazilmaps_0.1.0
## [21] lubridate_1.7.4      devtools_2.2.1
## [23] usethis_1.5.1        gridExtra_2.3
## [25] compareGroups_4.2.0  SNPassoc_1.9-2
## [27] mvtnorm_1.0-11       survival_3.1-8
## [29] haplo.stats_1.7.9    haven_2.2.0
## [31] kableExtra_1.1.0     dummies_1.5.6
## [33] forcats_0.4.0        stringr_1.4.0
## [35] dplyr_0.8.3          purrr_0.3.3
## [37] readr_1.3.1          tidyr_1.0.0
## [39] tibble_2.1.3         ggplot2_3.2.1
## [41] tidyverse_1.3.0      rmarkdown_1.18
## [43] nvimcom_0.9-83
##
## loaded via a namespace (and not attached):
##   [1] readxl_1.3.1        uuid_0.1-2
##   [3] backports_1.1.5     Hmisc_4.3-0
##   [5] systemfonts_0.1.1   igraph_1.2.4.2
##   [7] lazyeval_0.2.2      splines_3.6.2
##   [9] TH.data_1.0-10      digest_0.6.23
##  [11] htmltools_0.4.0     viridis_0.5.1
##  [13] magrittr_1.5        Rsolnp_1.16
##  [15] checkmate_1.9.4     memoise_1.1.0
##  [17] cluster_2.1.0       remotes_2.1.0
##  [19] modelr_0.1.5        sandwich_2.5-1
##  [21] prettyunits_1.0.2   colorspace_1.4-1
##  [23] rvest_0.3.5         pan_1.6
##  [25] xfun_0.11           callr_3.3.2
##  [27] crayon_1.3.4        jsonlite_1.6
```

```
##  [29] lme4_1.1-21         zeallot_0.1.0
##  [31] brew_1.0-6          zoo_1.8-6
##  [33] glue_1.3.1          gtable_0.3.0
##  [35] webshot_0.5.2       MatrixModels_0.4-1
##  [37] V8_2.3              pkgbuild_1.0.6
##  [39] Rook_1.1-1          rms_5.1-4
##  [41] jomo_2.6-10         SparseM_1.77
##  [43] scales_1.1.0        DBI_1.0.0
##  [45] Rcpp_1.0.3          viridisLite_0.3.0
##  [47] xtable_1.8-4        htmlTable_1.13.2
##  [49] ggstance_0.3.3      foreign_0.8-72
##  [51] Formula_1.2-3       truncnorm_1.0-8
##  [53] htmlwidgets_1.5.1   httr_1.4.1
##  [55] RColorBrewer_1.1-2  acepack_1.4.1
##  [57] ellipsis_0.3.0      mice_3.6.0
##  [59] XML_3.98-1.20       pkgconfig_2.0.3
##  [61] nnet_7.3-12         dbplyr_1.4.2
##  [63] tidyselect_0.2.5    rlang_0.4.2
##  [65] visNetwork_2.0.8    munsell_0.5.0
##  [67] cellranger_1.1.0    tools_3.6.2
##  [69] downloader_0.4      cli_1.1.0
##  [71] generics_0.0.2      broom_0.5.2
##  [73] evaluate_0.14       yaml_2.2.0
##  [75] processx_3.4.1      fs_1.3.1
##  [77] zip_2.0.4           mitml_0.3-7
##  [79] nlme_3.1-142        quantreg_5.52
##  [81] xml2_1.2.2          compiler_3.6.2
##  [83] rstudioapi_0.10     curl_4.2
##  [85] rgexf_0.15.3        testthat_2.3.0
##  [87] reprex_0.3.0        stringi_1.4.3
```

```
##  [89] HardyWeinberg_1.6.3 ps_1.3.0
##  [91] desc_1.2.0          gdtools_0.2.1
##  [93] lattice_0.20-38     nloptr_1.2.1
##  [95] vctrs_0.2.0         pillar_1.4.2
##  [97] lifecycle_0.1.0     data.table_1.12.6
##  [99] R6_2.4.1            latticeExtra_0.6-28
## [101] writexl_1.2         sessioninfo_1.1.1
## [103] codetools_0.2-16    polspline_1.1.17
## [105] boot_1.3-23         MASS_7.3-51.4
## [107] assertthat_0.2.1    pkgload_1.0.2
## [109] chron_2.3-54        rprojroot_1.3-2
## [111] withr_2.1.2         multcomp_1.4-10
## [113] hms_0.5.2           influenceR_0.1.0
## [115] rpart_4.1-15        minqa_1.2.4
## [117] base64enc_0.1-3     epitools_0.5-10
```

References

Gerber, A. S. and Green, D. P. (2012). *Field Experiments: Design, Analysis, and Interpretation.* New York City, NY: WW Norton. Cited on page 13.