How Contact Can Promote Societal Change Amid Intergroup Conflict: An Intergroup Contact Field Experiment in Nigeria - Supplementary Information

Contents

Supplementary Information

Appendix A: Randomization Inference and Bootstrapping

Randomization inference and bootstrapping are nonparametric methods to generate p-values (randomization inference) and confidence intervals (bootstrapping). With *randomization inference*, we first shuffle the treatment variable to break the relationship between treatment and outcomes. Next we regress outcomes on treatment using our regression equation and store the resulting coefficient. Lastly, we repeat that process 10,000 times to create the distribution of coefficients we would observe if treatment had no effect on outcomes – the null hypothesis. Our p-value is the proportion of the null distribution that is greater than or equal to our observed coefficient.

Bootstrapping for standard errors is similar, but instead of shuffling the treatment indicator we resample units with replacement. By resampling with replacement, we create the empirical distribution of our data and the range of possible treatment effects we might observe if we repeated the experiment 10,000 times. The treatment effect at the 2.5th percentile and at the 97.5th percentile are equivalent to a 95% confidence interval .

In each of these procedures, we mimic our randomization process by randomizing/resampling the intervention to communities in site-level clusters and within state blocks. This means that both communities in an implementation site (farmers and pastoralists) will always be treated/sampled together and that assignment to the intervention and resampling are conducted separately in Nassarawa and Benue, just as the intervention was assigned in this study. This procedure ensures that our null distribution (for p-values) is created by randomizing the intervention between exchangeable units and that our empirical distribution (for confidence intervals) is created by resampling units as they were sampled.

Appendix B: Robustness checks for community analysis

Survey outcomes

These tables shows results with different ways of making indices (additive vs inverse-covariance weighted), different models for estimating effects (differencing vs controlling-for), and different ways of coding count variables (raw vs ranked). Each table is an outcome. Rows are results for different ways of creating the outcomes. Columns show the coefficient from OLS regression, true p-value from randomization inference, and a binary "base" indicator showing which method was used in the paper.

The base method is always inverse-covariance weighted indices; the estimation method is controlling-for unless the baseline difference between the treatment and control groups is 0.20 standard deviations or more; the base method of handling count variables is dense rank. Only contact outcomes use count variables, only survey outcomes have a baseline and an endline and are measured with indices.

Table 1: **Community Attitudes.** Effect of ECPN on attitudes using alternative methods of estimation and index construction. The first column shows coefficients from OLS regression, the second column shows p-values from randomization inference, and the third column shows which method was used in the paper.

	coefficient	p-value	base
Controlling-for & ICW	0.116	0.045	1
Controlling-for & Additive	0.093	0.038	0
Differencing & ICW	0.100	0.145	0
Differencing & Additive	0.073	0.116	0

Table 2: **Community Perceptions of Security** Effect of ECPN on perceptions of security using alternative methods of estimation and index construction. The first column shows coefficients from OLS regression, the second column shows p-values from randomization inference, and the third column shows which method was used in the paper.

	coefficient	p-value	base
Controlling-for & ICW	0.098	0.032	0
Controlling-for & Additive	-0.010	0.593	0
Differencing & ICW	0.159	0.020	1
Differencing & Additive	0.054	0.213	0

Table 3: **Community Contact** Effect of ECPN on contact using alternative methods of estimation, index construction, and measuring count variables. The first column shows coefficients from OLS regression, the second column shows p-values from randomization inference, and the third column shows which method was used in the paper.

	coefficient	p-value	base
Controlling-for & ICW & Ranks	0.013	0.424	0
Controlling-for & Additive & Ranks	0.003	0.422	0
Differencing & ICW & Ranks	0.138	0.060	1
Differencing & Additive & Ranks	0.015	0.182	0
Controlling-for & ICW & Categories	0.017	0.377	0
Controlling-for & ICW & Raw	-0.020	0.602	0
Differencing & ICW & Categories	0.120	0.064	0
Differencing & ICW & Raw	0.071	0.207	0

Table 4: **Community Contact Willingness (Percent Experiment)** Effect of ECPN on willingness to have contact with the outgroup using alternative methods of estimation. The first column shows coefficients from OLS regression, the second column shows p-values from randomization inference, and the third column shows which method was used in the paper.

	coefficient	p-value	base
Controlling-for	0.093	0.051	0
Differencing	0.062	0.239	1

Table 5: **Community Endorsement Experiment** Effect of ECPN on endorsement experiment using alternative methods of estimation. The first column shows coefficients from OLS regression, the second column shows p-values from randomization inference, and the third column shows which method was used in the paper.

	coefficient	p-value	base
Controlling-for	0.103	0.158	0
Differencing	0.123	0.212	1

Table 6: **Community Public Goods Game** Effect of ECPN on probability of donating and on donation amount. The first column shows coefficients from OLS regression and the second column shows p-values from randomization inference.

	coefficient	p-value
Donation (binary)	0.022	0.294
Donation amount	-35.124	0.852

Behvioral outcomes

Enumerators (for surveys and for behavioral observation) were not informed of a community's treatment status, but two of the enumerators for behavioral observations interacted with the research team frequently and may have intuited the study's hypotheses. They also only made observations at treatment sites. If their

intuition of program aims affected their observations (or if their observations became more positive over time for other reasons), our estimates of the treatment effect could be inflated.

We first checked the change over time in outcomes they reported. Descriptively, the two senior enumerators observed *less* interaction in treatment sites over time, suggesting that they were not influenced by knowledge of the study's hypotheses. As a robustness check, we then repeated the main analysis but removed observations from these two enumerators. Coefficients with their data removed are very similar to coefficients with their data included; p-values are higher mainly as a result of fewer observations (and therefore degrees of freedom).

Table 7: **Robustness check for behavioral observations** This table shows the baseline-endline change in outcomes for the two senior enumerators who may have intuited the study's hypotheses. The first column shows coefficients from OLS regression, the second column shows p-values. The row names show outcomes (pastoralists in the market, farmers in the market, and outgroup attending events). The two enumerators reported decreases in market outcomes in treatment sites and no change to event outcomes in treatment sites, suggesting that they were not influenced by knowledge of the study's hypotheses.

	coefficient	p-value
market-pastoralists_enum	-4.4079254	0.1744306
market-farmers_enum	-10.8863636	0.0161117
events-outgroup_enum	0.1363636	0.9929502

Table 8: **Robustness check for behavioral observations** This table shows behavioral observation outcomes with two senior enumerators removed. The first column shows coefficients from OLS regression, the second column shows p-values. The row names show outcomes (pastoralists in the market, farmers in the market, and outgroup attending events) and subsets of the data (all data, data without two enumerators, and data from only those two enumerators).

	coefficient	p-value
market-pastoralists_all	12.532	0.001
market-pastoralists_without	10.285	0.103
market-farmers_all	3.339	0.242
market-farmers_without	1.286	0.456
events-outgroup_all	9.228	0.186
events-outgroup_without	6.333	0.136

Appendix C: Robustness checks for individual analysis

These tables shows results with different ways of making indices (additive vs inverse-covariance weighted), different models for estimating effects (differencing vs controlling-for), and different ways of coding count variables (raw vs ranked). Each table is an outcome. Rows are results for different ways of creating the outcomes. Columns show the coefficient from OLS regression, true p-value from randomization inference, and a binary "base" indicator showing which method was used in the paper.

The base method is always inverse-covariance weighted indices; the estimation method is controlling-for unless the baseline difference between the participants and control groups is 0.20 standard deviations or more; the base method of handling count variables is dense rank. Only contact outcomes use count variables, only survey outcomes have a baseline and an endline and are measured with indices.

Table 9: **Individual Attitudes.** Effect of ECPN on attitudes using alternative methods of estimation and index construction. The first column shows coefficients from OLS regression, the second column shows p-values from randomization inference, and the third column shows which method was used in the paper.

	coefficient	p-value	base
Non: Controlling-for & ICW	0.031	0.264	0
Part: Controlling-for & ICW	0.058	0.129	0
Non: Controlling-for & Additive	0.154	0.202	0
Part: Controlling-for & Additive	0.269	0.081	0
Non: Differencing & ICW	0.054	0.130	1
Part: Differencing & ICW	0.060	0.130	1
Non: Differencing & Additive	0.183	0.144	0
Part: Differencing & Additive	0.296	0.049	0

Table 10: **Individual Perceptions of Security** Effect of ECPN on perceptions of security using alternative methods of estimation and index construction. The first column shows coefficients from OLS regression, the second column shows p-values from randomization inference, and the third column shows which method was used in the paper.

	coefficient	p-value	base
Non: Controlling-for & ICW	-0.022	0.681	0
Part: Controlling-for & ICW	-0.024	0.675	0
Non: Controlling-for & Additive	0.015	0.467	0
Part: Controlling-for & Additive	-0.007	0.540	0
Non: Differencing & ICW	0.045	0.178	1
Part: Differencing & ICW	0.050	0.186	1
Non: Differencing & Additive	0.083	0.244	0
Part: Differencing & Additive	0.146	0.123	0

Table 11: **Individual Contact** Effect of ECPN on contact using alternative methods of estimation, index construction, and measuring count variables. The first column shows coefficients from OLS regression, the second column shows p-values from randomization inference, and the third column shows which method was used in the paper.

	coefficient	p-value	base
Non: Controlling-for & ICW & Ranks	-0.029	0.735	0
Part: Controlling-for & ICW & Ranks	0.062	0.094	0
Non: Controlling-for & Additive & Ranks	-0.024	0.771	0
Part: Controlling-for & Additive & Ranks	0.041	0.094	0
Non: Differencing & ICW & Ranks	0.002	0.492	1
Part: Differencing & ICW & Ranks	0.098	0.018	1
Non: Differencing & Additive & Ranks	-0.005	0.580	0
Part: Differencing & Additive & Ranks	0.063	0.017	0
Non: Controlling-for & ICW & Categories	-0.045	0.764	0
Part: Controlling-for & ICW & Categories	0.063	0.203	0
Non: Controlling-for & ICW & Raw	-0.023	0.737	0
Part: Controlling-for & ICW & Raw	0.044	0.126	0
Non: Differencing & ICW & Categories	0.017	0.407	0
Part: Differencing & ICW & Categories	0.130	0.029	0
Non: Differencing & ICW & Raw	-0.002	0.531	0
Part: Differencing & ICW & Raw	0.066	0.025	0

Table 12: **Individual Publid Goods Game** Effect of ECPN on probability of donating and on donation amount. The first column shows coefficients from OLS regression and the second column shows p-values from randomization inference.

	coefficient	p-value
Non: Donation (binary)	0.050	0.081
Part: Donation (binary)	0.020	0.295
Non: Donation amount	-27.023	0.743
Part: Donation amount	-53.740	0.875

Appendix D: Balance Tests

Table 13: **Balance: Observational Data All Outcomes**

	Control.strat	Treatment.strat	adj.diff.strat	adj.diff.null.sd.strat	std.diff.strat
Pastoralists_index_rank_events	35.415	25.141	-10.275	12.377	-0.585
Farmers_index_rank_events	32.978	36.182	3.204	7.104	0.303
Pastoralists_index_rank_markets	25.458	14.151	-11.308	6.576	-1.375
Farmers_index_rank_markets	24.417	25.250	0.834	5.699	0.101

Table 14: **Balance: Observational Data Omnibus P-value**

	chisquare	df	p.value
strat	6.494	4	0.165

Table 15: **Balance: Survey Data All Outcomes**

	Control.strat	Treatment.strat	adj.diff.strat	adj.diff.null.sd.strat	std.diff.strat
Baseline_Attitudes	0.542	0.566	0.023	0.065	0.098
Baseline_Perceptions_of_Security	-0.459	-0.537	-0.079	0.071	-0.246
Baseline_Contact	0.496	0.336	-0.159	0.104	-0.585
Baseline_Percent_Experiment	0.443	0.474	0.031	0.056	0.206
Baseline_Endorsement_Experiment	-0.212	-0.250	-0.038	0.169	-0.067

Table 16: **Balance: Survey Data Omnibus P-value**

	chisquare	df	p.value
strat	6.302	5	0.278

Appendix E: Placebo tests

Several of our outcomes are survey self-reports, and self-reports could be affected by factors other than the intervntion. For example, our survey results are suspect if respondents in treatment communities learned the "correct'' answers better than respondents in control communities (social desirability bias). If social desirability accounts for the effect in survey self-reports, we would also expect differences between treatment and control for other normatively desirable attitudes.

To test social desirability effects, we conduct a placebo analysis using attitudes about violence as a placebo. Attitudes about violence are a good candidate for this placebo because intergroup contact should not affect general attitudes about violence, but respondents may feel social pressure to answer violence questions in a desirable way. We measure attitudes about violence with a six question index asking respondents if it is always, sometimes, rarely, or never justified to use violence in certain situations, such as retaliating against violence or bringing criminals to justice.

Respondents in treatment communities might also express more positive attitudes towards the outgroup if attitudes were becoming more tolerant in treatment villages in a way that was unrelated to the intervention. If attitudes towards any outgroup were becoming more tolerant in treatment communities compared to control communities, we would expect attitudes towards religious outgroups to improve more in treatment communities than control communities. The contact intervention should not affect attitudes towards people from other religions because the farmers and pastoralists are often the same religion.

Respondents in treatment communities also might have had better access to information, and that information changed their attitudes/perceptions. To measure access to information, we use frequency of radio listening. If the treatment communities increased their amount of radio listening significantly more than control communities, it is possible their attitudes/perceptions changed due to information and not the contact intervention.

Coefficients come from OLS regression equation specified in the paper (using state-level blocked fixed effects). P-values come from the randomization inference described in the paper and in Appendix A; they are one-sided "greater-than" p-values. The base method used in the paper always constructs indices using inverse-covariance weighting; it uses the controlling-for method of difference-in-differences estimation when an outcome's baseline difference between treatment and control is less than 0.20 standard deviations; it uses the differencing method when the baseline difference is 0.20 standard deviations or larger.

Community.

Table 17: **Community Placebo: Attitudes towards violence index.** Effect of ECPN on placebo outcome using alternative methods of estimation and index construction. The first column shows coefficients from OLS regression, the second column shows p-values from randomization inference, and the third column shows which method was used in the paper.

	coefficient	p-value	base
Controlling-for & ICW	0.010	0.466	0
Controlling-for & Additive	0.004	0.441	0
Differencing & ICW	-0.067	0.687	1
Differencing & Additive	-0.027	0.679	0

Table 18: **Community Placebo: Components of violence index.** Effect of ECPN on components of placebo index (attitudes towards violence) using alternative methods of estimation and index construction. The first column shows coefficients from OLS regression, the second column shows p-values from randomization inference, and the third column shows which method was used in the paper.

	coefficient	p-value	base
Bring criminals to justice: Controlling-for	0.034	0.252	0
Bring criminals to justice: Differencing	-0.092	0.792	1
Defend ones group: Controlling-for	-0.026	0.659	1
Defend ones group: Differencing	-0.026	0.663	0
Defend ones religion: Controlling-for	-0.031	0.662	1
Defend ones religion: Differencing	-0.031	0.671	0
Force the government to change their policies: Controlling-for	0.004	0.436	1
Force the government to change their policies: Differencing	-0.012	0.640	0
Maintain culture and traditions: Controlling-for	-0.004	0.558	1
Maintain culture and traditions: Differencing	-0.011	0.585	0
Retaliate against violence: Controlling-for	-0.007	0.658	1
Retaliate against violence: Differencing	0.011	0.387	0

Table 19: **Community Placebo: Trust towards religious outgroups.** Effect of ECPN on placebo outcome using alternative methods of estimation and index construction. The first column shows coefficients from OLS regression, the second column shows p-values from randomization inference, and the third column shows which method was used in the paper.

	coefficient	p-value	base
Controlling-for	0.017	0.349	1
Differencing	-0.002	0.519	0

Table 20: **Community Placebo: Radio listening frequency.** Effect of ECPN on placebo outcome using alternative methods of estimation and index construction. The first column shows coefficients from OLS regression, the second column shows p-values from randomization inference, and the third column shows which method was used in the paper.

	coefficient	p-value	base
Controlling-for	0.021	0.430	1
Differencing	0.021	0.441	0

Individual

Table 21: **Individual Placebo: Attitudes towards violence index.** Effect of ECPN on placebo outcome using alternative methods of estimation and index construction. The first column shows coefficients from OLS regression, the second column shows p-values from randomization inference, and the third column shows which method was used in the paper.

	coefficient	p-value	base
Non: Controlling-for & ICW	-0.057	0.801	0
Part: Controlling-for & ICW	0.013	0.413	0
Non: Controlling-for & Additive	-0.163	0.770	0
Part: Controlling-for & Additive	0.022	0.441	0
Non: Differencing & ICW	-0.033	0.642	1
Part: Differencing & ICW	-0.016	0.549	1
Non: Differencing & Additive	-0.058	0.580	0
Part: Differencing & Additive	-0.023	0.508	0

Table 22: **Individual Placebo: Components of violence index.** Effect of ECPN on components of placebo index (attitudes towards violence) using alternative methods of estimation and index construction. The first column shows coefficients from OLS regression, the second column shows p-values from randomization inference, and the third column shows which method was used in the paper.

	coefficient	p-value	base
Non: Bring criminals to justice: Controlling-for	-0.154	0.680	0
Part: Bring criminals to justice: Controlling-for	-0.031	0.535	0
Non: Bring criminals to justice: Differencing	-0.292	0.813	1
Part: Bring criminals to justice: Differencing	-0.494	0.933	1
Non: Defend ones group: Controlling-for	-0.078	0.616	1
Part: Defend ones group: Controlling-for	0.039	0.440	1
Non: Defend ones group: Differencing	0.034	0.447	0
Part: Defend ones group: Differencing	-0.021	0.525	0
Non: Defend ones religion: Controlling-for	-0.250	0.892	1
Part: Defend ones religion: Controlling-for	0.141	0.276	1
Non: Defend ones religion: Differencing	-0.143	0.726	0
Part: Defend ones religion: Differencing	0.067	0.378	0
Non: Force the government to change their policies: Controlling-for	-0.227	0.781	1
Part: Force the government to change their policies: Controlling-for	0.031	0.457	1
Non: Force the government to change their policies: Differencing	-0.142	0.684	0
Part: Force the government to change their policies: Differencing	0.013	0.496	0
Non: Maintain culture and traditions: Controlling-for	-0.190	0.797	1
Part: Maintain culture and traditions: Controlling-for	0.024	0.443	1
Non: Maintain culture and traditions: Differencing	0.022	0.453	0
Part: Maintain culture and traditions: Differencing	0.161	0.261	0
Non: Retaliate against violence: Controlling-for	-0.091	0.639	1
Part: Retaliate against violence: Controlling-for	-0.080	0.601	1
Non: Retaliate against violence: Differencing	0.176	0.254	0
Part: Retaliate against violence: Differencing	0.156	0.286	0

Table 23: **Individual Placebo: Trust towards religious outgroups.** Effect of ECPN on placebo outcome using alternative methods of estimation and index construction. The first column shows coefficients from OLS regression, the second column shows p-values from randomization inference, and the third column shows which method was used in the paper.

	coefficient	p-value	base
Non: Controlling-for	0.178	0.208	1
Part: Controlling-for	-0.060	0.586	1
Non: Differencing	0.140	0.283	0
Part: Differencing	-0.079	0.616	0

Table 24: **Individual Placebo: Radio listening frequency.** Effect of ECPN on placebo outcome using alternative methods of estimation and index construction. The first column shows coefficients from OLS regression, the second column shows p-values from randomization inference, and the third column shows which method was used in the paper.

	coefficient	p-value	base
Non: Controlling-for	0.178	0.208	1
Part: Controlling-for	-0.060	0.586	1
Non: Differencing	0.140	0.283	0
Part: Differencing	-0.079	0.616	0

Appendix F: State-level heterogeneous effects

This looks at heterogeneous effects by state. This is a low-power analysis. There are no significant differences in treatment effect by state.

Coefficients and p-values estimating state-level heterogeneous effects were calculated with robust OLS regression using site-level clusters. The regression interacted the treatment indicator with the state indicator. Benue was the reference category so this table shows differences for Nasarawa.

Table 25: **State-level differences in community-level analysis.** There are not significant differences between the effect of the contact intervention by state. The first column shows coefficients from OLS regression, the second column shows p-values from OLS regression.

	coefficient	p-value
Attitudes	-0.176	0.315
Perceptions of security	0.133	0.383
Contact	-0.104	0.469
Percent Experiment	-0.251	0.158
Endorsement Experiment	0.191	0.488
PGG donation	-0.093	0.257
PGG amount	-84.807	0.442

Appendix G: Farmer-pastoralist differences

We show demographic differences between farmers and pastoralists. We also shows regressions using demographic characteristics as control variables to confirm that accounting for these variables does not change the study's results.

Table 26: **Farmer and Pastoralist Demographics** This table shows demographic characteristics for farming groups and pastoralist groups

farm_pastor	age	female	income	fulani	christian	muslim	farming	pastoral	trading	radio
farmers	36.31	0.43	42235.09	0	0.64	0.35	0.80	0.00	0.12	2.32
pastoralists	34.66	0.46	30407.69	1	0.00	1.00	0.13	0.85	0.09	1.46

Table 27: **Farmer and Pastoralist Demographics by State** This table shows demographic characteristics for farming groups and pastoralist groups, separating respondents from Nasarawa and Benue

farm_pastor	state	age	female	income	fulani	christian	muslim	farming	pastoral	trading	radio
farmers	ben	36.32	0.41	32521.10	0	0.98	0.00	0.97	0.00	0.02	2.50
farmers	nas	36.30	0.44	48373.50	0	0.42	0.57	0.70	0.00	0.19	2.20
pastoralists	ben	35.04	0.39	24947.04	1	0.00	1.00	0.04	0.88	0.10	1.55
pastoralists	nas	34.40	0.51	34050.07	1	0.00	1.00	0.18	0.83	0.08	1.40

Table 28: **Regressions with community-average demographic variables** This table shows coefficients from each survey regression either (1) the version in the paper that does not control for demographic characteristics, or (2) a regression that aggregated demographic characteristics to the community-level and included them as control variables. The coefficients are similar – the sum of the coefficients when controlling for demographic characteristics is slightly larger.

	paper	check	difference
attitude	0.1160135	0.0770404	0.0389731
in	0.1590911	0.1681601	-0.0090690
contactOnly	0.1377790	0.1066938	0.0310852
rMean	0.0621330	-0.0080656	0.0701985
end_exp	0.1225162	0.2701144	-0.1475982
pgp_donate_end	0.0224200	0.0218400	0.0005800
pgp_amount_end	-35.1235007	-32.4998039	-2.6236968
total (excludes pgp_amount)	0.6199528	0.6357832	-0.0158305

Table 29: **Regressions with individual demographic variables** This table shows coefficients from each survey regression either (1) the version in the paper that does not control for demographic characteristics, or (2) a regression that includes individual-level demographic characteristics as control variables. The coefficients are similar – the sum of the coefficients when controlling for demographic characteristics is slightly smaller.

	paper	check	difference
attitude	0.0602411	0.0515518	0.0086894
in	0.0495368	0.0461179	0.0034189
contactOnly	0.0975058	0.0451252	0.0523806
pgp_donate_end	0.0203803	0.0405599	-0.0201796
pgp_amount_end	-53.7397532	-38.3723911	-15.3673621
total (excludes pgp_amount)	0.2276640	0.1833548	0.0443092

This looks at heterogeneous effects by group (farmers and pastoralists). This is a low-power analysis. There are no significant differences in treatment effect by farmer/pastoralist.

Coefficients and p-values estimating farmer/pastoralist heterogeneous effects were calculated with robust OLS regression using site-level clusters and fixed effects for state. The regression interacted the treatment indicator with the state indicator. Farmers were the reference category so this table shows differences for pastoralists.

Table 30: **Farmer-pastoralist differences in community-level analysis.** There are not significant differences between the effect of the contact intervention by farmer/pastoralist. The first column shows coefficients from OLS regression, the second column shows p-values from OLS regression.

	coefficient	p-value
Attitudes	-0.090	0.278
Perceptions of security	0.021	0.905
Contact	0.031	0.911
Percent Experiment	-0.014	0.913
Endorsement Experiment	-0.194	0.626
PGG donation	-0.064	0.386
PGG amount	23.284	0.784

Appendix H: Survey Questions

Attitudes

- With regards to someone from [X GROUP], would you feel comfortable:
  - if they worked in your field?
  - paying them to watch your animals?
  - trading goods with them?
  - sharing a meal with them?
  - with a close relative marrying a person from [X GROUP]?
- From 1-5, how much do you trust people from [X GROUP] in your area?
- Now I'm going to ask you questions about your community here in Benue/Nassarawa, including [X GROUP]. Please tell me how strongly you agree/disagree with each of the following statements: People in this area can be trusted.

Contact

- Now I'm going to ask you questions about your contact with [X GROUP] in your area.
  - Think of the market you go to most frequently. During the past month, have members of X GROUP gone to that market too? In the past month, how many times did you interact with X group in the market?
- In the past month, have you:
  - Joined a member of X group for a social event outside the home? How often?
  - Hosted a member of X group for a ceremony in your home? How often?
  - Gone to the home of a member of X group for a ceremony? How often?
  - Have you interacted with members of X group in any other way in the past month?

Insecurity

- In the last year were there any areas that you avoided going to or through because of insecurity during the night?
- In the last year were there any areas that you avoided going to or through because of insecurity, during the day?

- In the last year, did insecurity ever prevent you from:
  - Working when you wanted to work? About how many days were you unable to work?
  - Going to the market?
  - Getting water for the household?
  - Going to your field/farm?
  - Moving your animals to grazing areas?
  - Moving your animals to water?
  - Earning money or going to work?
  - Going to school?

Endorsement Experiment

- Imagine that there is a proposal by [**the Farmer's Cooperative Society/MACBAN**] for action to enhance access to clean water in rural areas. Though expensive, the proposal aims to bring fresh, clean water to hundreds of areas without access to it, including this one. If this were proposed, how would you feel about it?

Percent Experiemnt

- Think about groups that you might join in your leisure time. Would you join a group that had **5/25/50/75**% X Group members?
- Think about the community you live in. Would you live in a community that had **5/25/50/75**% X Group members?

Violence Placebo

- Now I am going to ask you some questions about the use of violence. Is it always, sometimes, rarely, or never justified to use violence to do each of the following:
  - Retaliate against violence
  - Defend one's group
  - Maintain culture and traditions
  - Defend one's religion
  - Bring criminals to justice
  - Force the government to change their policies

Public Goods Game

"Thank you very much for participating in our survey. Before I go, there is one last thing. As you may have heard, we have development funds to use in this community. We have randomly selected you as one of the 50 people to receive these funds. These funds are not for a Mercy Corps project, but rather for you to keep personally or to donate to a community fund.

We have 1,000 Naira to give to you. It is yours, and you can use it either way–for yourself or for a community good.

Your community and [joint farmer/pastoralist community] have created a project committee to whom you can donate this money so that it may be used to help both communities. The project committee has 4 people from each community. We have found a donor that will match the funds that you all contribute to the project committee, so that if you donate 100 Naira the project committee receives 300 Naira, and if you donate all 1,000 Naira the project committee receives 3,000 Naira. You are welcome to donate none, some, or all of the money to the project committee.

These are your individual donation envelopes. All the donations will be private – only you will know how much money you donated. It essential that you keep how much you give private – please do not tell anyone.

I have with me a donation envelope to collect donations. Please go into your home, put however much of the 1,000 Naira you wish to donate to the project committee in the envelope, take whatever amount you want to keep for yourself, and come back to place your envelope in the donation envelope. Remember, you are welcome to donate none, some, or all of the money to the project committee. After that we are finished and you may continue your day. We will come back and publicly announce how much money your community's project committee will receive."

Appendix I: Alternative explanations

It is possible that the effects of our intervention are due to impact of the development project around which the contact was organized, rather than intergroup contact itself. The effect could also be due to mediation provided to some community leaders. We ran three analyses to disentangle the effects of contact from the effects of the development projects and mediation.

Effect of contact vs. effect of development projects

The first was to determine if treatment effects were significantly larger for communities where larger proportions of people were aware of, used, and perceived benefit from the projects. In treatment communities, we predicted outcome change with (1) awareness of boreholes, (2) use of boreholes, (3) awareness of quick-impact projects, and (4) perceived benefit from quick-impact projects. If treatment effects are due to development projects and not contact, we would expect larger effects where a greater proportion of respondents were aware of, used, and benefited from the development projects.

Our analysis shows that awareness, use, and benefit from the projects is not significantly related to any outcome (the mean p-value is ~0.32). It's also not the case that any of those variables separately (awareness, use, and benefit) are related to improvements on any outcome. Though the p-values are insignificant, the mean t-statistic for the awareness/use/benefit variables is positive, possibly suggesting that the development projects, while not explaining the bulk of the treatment effect, may have increased the effect. The tables show the mean coefficient, p-value, and t-statistic for each outcome being predicted by each "benefit" variable.

Table 31: **Benefit variables affect on outcomes.** Mean coefficient, p-value, and t-statistic for each outcome, across benefit variables. Benefit variables are not significantly related to any outcome.

	coefs	pvals	tstat
Attitudes	0.1936077	0.1836764	0.9056779
Security	0.2448961	0.2794338	1.2928731
Contact	0.3207580	0.2643255	1.3698100
Contact Willingness	0.3714763	0.0915421	1.9362679
Endorsement Exp	0.1398422	0.6779022	0.3172168
PGG Donation	-0.0306856	0.2763725	-1.3456686
PGG Amount	-35.9157762	0.4960119	-0.7851551
All	NA	0.3241806	0.5272889

Table 32: **Benefit variables affect on outcomes.** Mean coefficient, p-value, and t-statistic for each benefit variables, across outcomes. This tables removes Public Goods Game outcomes because (1) their coefficients are on a different scale than the survey outcomes and (2) the coefficients and t-statistics are negative, which could hide the effect of benefit variables on the other outcomes. However, this table shows that benefit variables are not significantly related to any survey outcome.

	coefs	pvals	tstat
Borehole use	0.3355362	0.2547888	1.5838113
Borehole aware	0.2377543	0.3878788	0.9939178
QIP benefit	0.0657282	0.3007221	-0.0346520
QIP aware	0.3774457	0.2541144	2.1143994
all	NA	0.2993760	1.1643691

Second, we looked at whether pastoralists in Benue differed from the rest of the sample. Pastoralists in Benue benefited least from the development projects (especially the main project that built boreholes) because they became displaced from where the boreholes were constructed prior to the endline survey. Here we (1) confirm that pastoralists in Benue were less likely to be aware of, use, or benefit from the development projects and (2) see no significant outcome differences between pastoralists in Benue and the rest of the sample (mean p-value ~0.58).

Table 33: **Benefit pastoralists awareness and benefit from development projects.** Coefficients, t-statistics, and p-values comparing Benue pastoralists in the treatment group to the rest of the treatment group. Benue pastoralists were significantly less likely to be aware of the boreholes or use the boreholes; they were marginally less likely to be aware of the quick-impact projects.

	estimate	statistic	p.value
Borehole Awareness	-0.4309759	-4.3361033	0.0111897
Borehole Use	-0.3406948	-5.1907843	0.0058327
QIP Awareness	-0.2907236	-2.4706291	0.0662889
QIP Benefit	-0.0644359	-0.6369732	0.5574075

Table 34: **Benefit outcomes for pastoralists in the treatment group.** Coefficients, p-values, and t-statistics comparing Benue pastoralists in the treatment group to the rest of the treatment group. Treatment effects are not smaller among Benue pastoralists than the rest of the treatment group. Note: the mean coefficient excludes the Public Goods Game, which is on a different scale than the other variables; it is included in the p-value and t-statistic.

	coef	pvalue	tstat
Attitudes	-0.0317303	0.8260431	-0.2398319
Security	-0.1668610	0.6400484	-0.5187857
Contact	0.2343247	0.3188031	1.1945197
Contact Willingness	0.0301262	0.8672572	0.1820363
Endorsement Exp	-0.5074066	0.1968861	-1.6571511
PGG Donation	-0.0342750	0.5305509	-0.7077525
PGG Amount	49.9043759	0.6549041	0.4949424
All	-0.0883094	0.5763561	-0.1788604

Effect of contact vs. effect of mediation

The third analysis concerned mediation. While we cannot rule out that the effect was due to the meditation training, only 52 of the over 1000 endline respondents in treatment sites were aware of the mediation intervention.

Table 35: **Mediation Exposure.** Exposure to mediation in treatment and control sites in endline survey. Only 52 randomly selected respondents in treatment had any exposure to mediation. No control respondents had exposure to mediation.

	Control	Treatment
None	504	996
Exposure	0	52

Appendix J: Family-Wise Error Rate (FWER)

To control the FWER, we conducted within-family hypothesis corrections using the Holm correction. For two of our outcomes (pastoralists in market and perceptions of insecurity), the findings remain statistically significant. For the two other outcomes (self-reported contact and attitudes), significance levels shift from statistically significant to marginally significant (.04 to .08). This means we have a significant p-value for our hypothesis families about intergroup contact and about insecurity; we have a marginally significant p-value for our hypothesis family about attitudes; we have no signifcant p-value for our hypothesis family about cooperation.

Note: the outcome measuring pastoralists in the market remains statistically significant even if using the bonferonni correction to correct for all (vs. within family) hypothesis tests in the analysis.

The exploratory individual-level data has only one outcome per family (except for the Cooperation family, for which no p-values were significant without correction). We therefore do not show "corrected" individual-level p-values. If we put all individual-level hypotheses into a single family and use the Holm correction, the *Self-reported contact* outcome changes from significant (p=0.018) to marginally significant(p=0.088). None of the other outcomes were significant or marginally significant before correction.

Table 36: **P-values controlling the family-wise error rate.**

Outcome	None	Holm	Family
Pastoralists in Market	0.0014	0.0070	Contact
Self-reported contact	0.0595	0.2380	Contact
Contact willingness	0.2389	0.5568	Contact
Farmers in Market	0.2416	0.5568	Contact
Outgroup event attendance	0.1856	0.5568	Contact
Perceptions of security	0.0205	0.0205	Insecurity
Self-reported attitudes	0.0448	0.0896	Attitudes
Endorsement Experiment	0.2117	0.2117	Attitudes
Public Goods Donation	0.2938	0.5876	Cooperation
Public Goods Amount	0.8522	0.8522	Cooperation

Appendix K: Power Analysis

At community level, we could detect effects of ~0.60 SDs with 0.80 power. We expected better power for our actual analysis because our power analysis does not use randomization inference to generate true p-values. We simulated our community-level power analysis with the following code.

```
# using insecurity as the default outcome, as it is our strongest survey outcome at the community level
bigPow.fn <-function(nsims, var=outcome_list_qip[2], tau)
{
  newPow.fn <- function(var, tau)
{
    # 6 TR sites from Nas, 4 from Ben
    newtr_nas <- sample(unique(ag.df$psu[ag.df$state %in% "nas"]), size=6)
    newtr_ben <- sample(unique(ag.df$psu[ag.df$state %in% "ben"]), size=4)
    newtr <- c(as.character(newtr_nas), as.character(newtr_ben))
    df <- ag.df
    df[,"newtr"] <- ifelse(df$psu %in% newtr, 1, 0)

  # make endline outcome with TR effect tau
  df[, paste0(var,"_end")] <- (df[,paste0(var,"_end")]-mean(df[,paste0(var,"_end")]))/sd(df[,paste0(var
  #scale(df[,paste0(var,"_end")])
  df[df$newtr %in% 1, paste0(var,"_end")] <- df[df$newtr %in% 1, paste0(var,"_end")]+tau

  # for baseline control, also scale
  df[, paste0(var,"_base")] <- (df[,paste0(var,"_base")]-mean(df[,paste0(var,"_base")]))/sd(df[,paste0(

  # lm
  lm1 <- lm_robust(df[,paste0(var,"_end")]~df[,'newtr']+df[,paste0(var,"_base")]+state,
                   clusters = psu, data=df)

  want <- tidy(lm1)[2,5]
  return(want)
  }

  check <- do(nsims)*newPow.fn(var=var, tau=tau)
  pval <- mean(check<0.05)
  return(pval)
}

# run power analysis for tau 0-1
possibleTaus <- seq(0,1,0.1)
possibleTaus <- as.data.frame(possibleTaus)
system.time(
for(i in 1:nrow(possibleTaus))
{
  possibleTaus[i, "pow"] <- bigPow.fn(nsims=3000, tau=possibleTaus[i,1])
}
)
possibleTaus
```

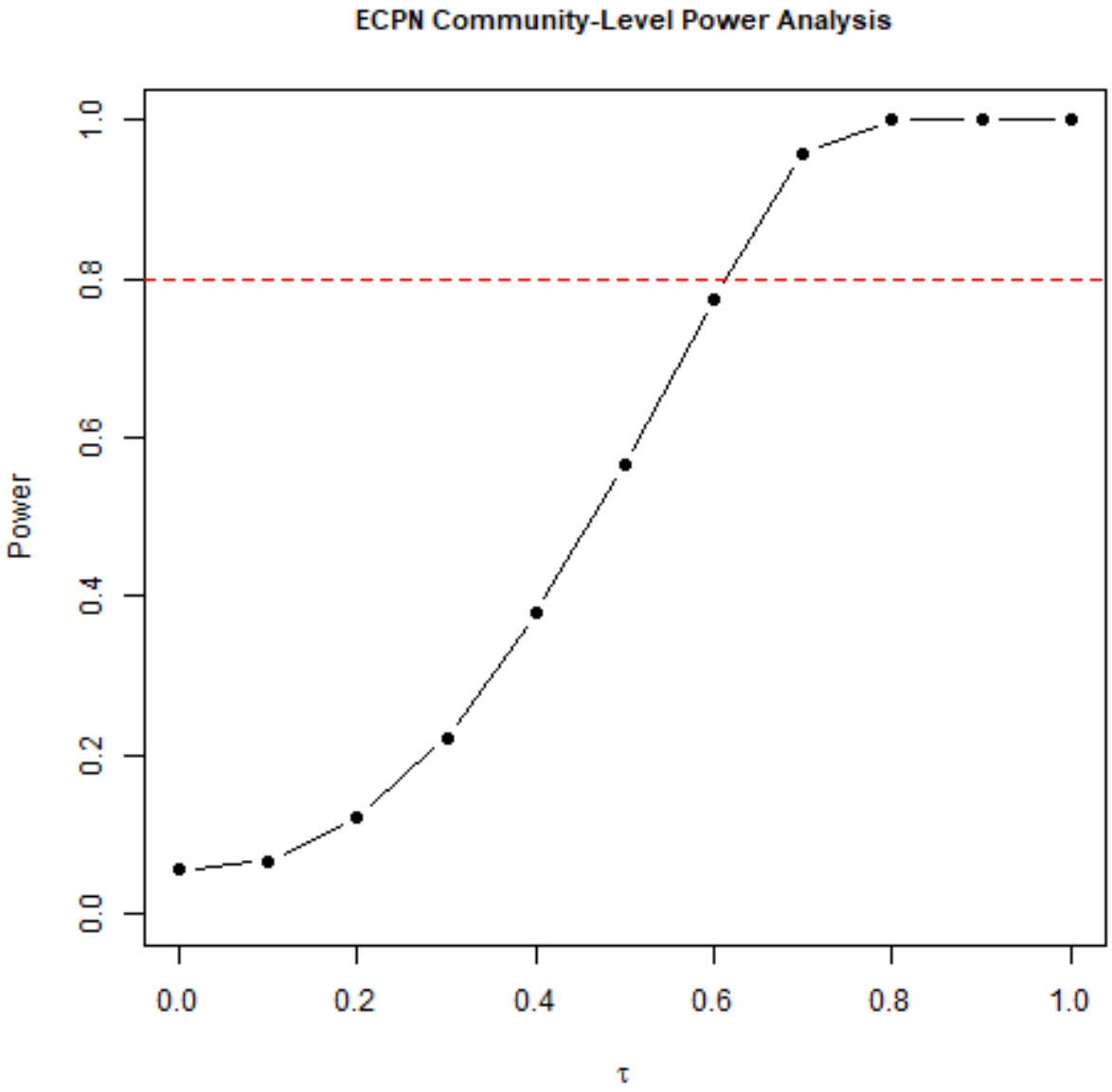

Figure 1: Community-level power analysis.

At individual level, we could detect effects of ~0.40 SDs with 0.80 power. We expected better power for our actual analysis because our power analysis does not use randomization inference to generate true p-values. We used the EGAP power calculator for the individual-level power analysis. The parameters were: Alpha = 0.05, Tau = 0.40 SD, ICC=0.05, 15 clusters per arm, up to 300 respondents per cluster.

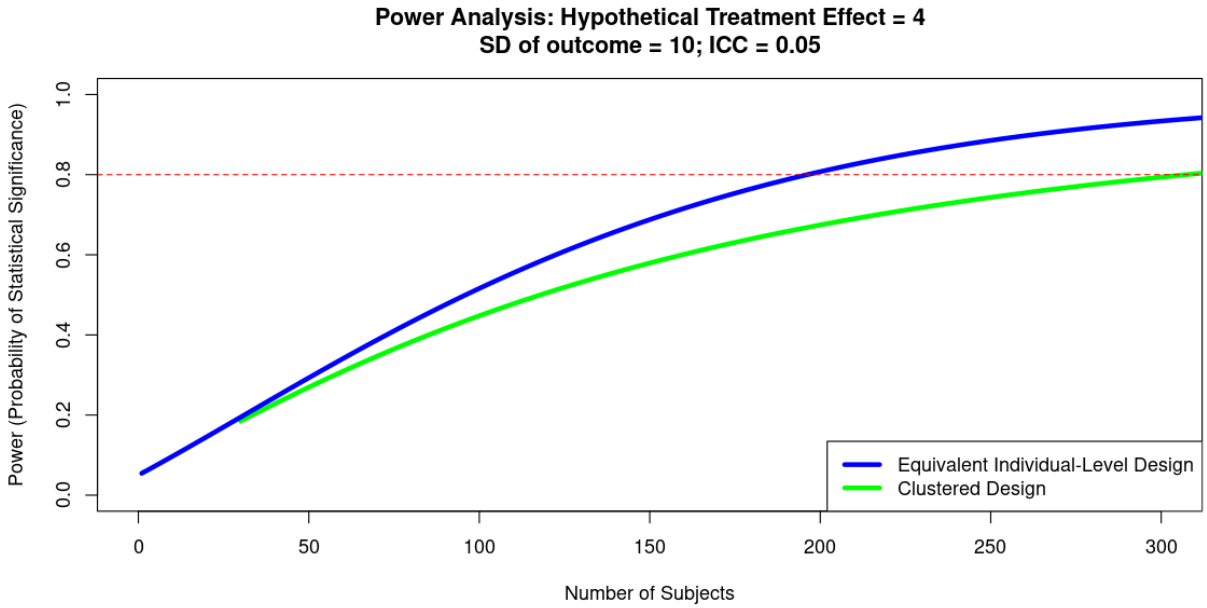

Figure 2: Individual-level power analysis.

Appendix L: Difference-in-differences plots

Many effects are driven by worsening conditions in control communities. Given the small number of control communities, it's possible that the effects could be driven by a particularly bad period in a single control community. It's also possible that there could be ceiling or floor effects. These plots show that (1) the effects are not driven by a large drop in a single control community/site and (2) the overall effect is not demonstrating a floor below which no community-site falls.

Survey outcomes

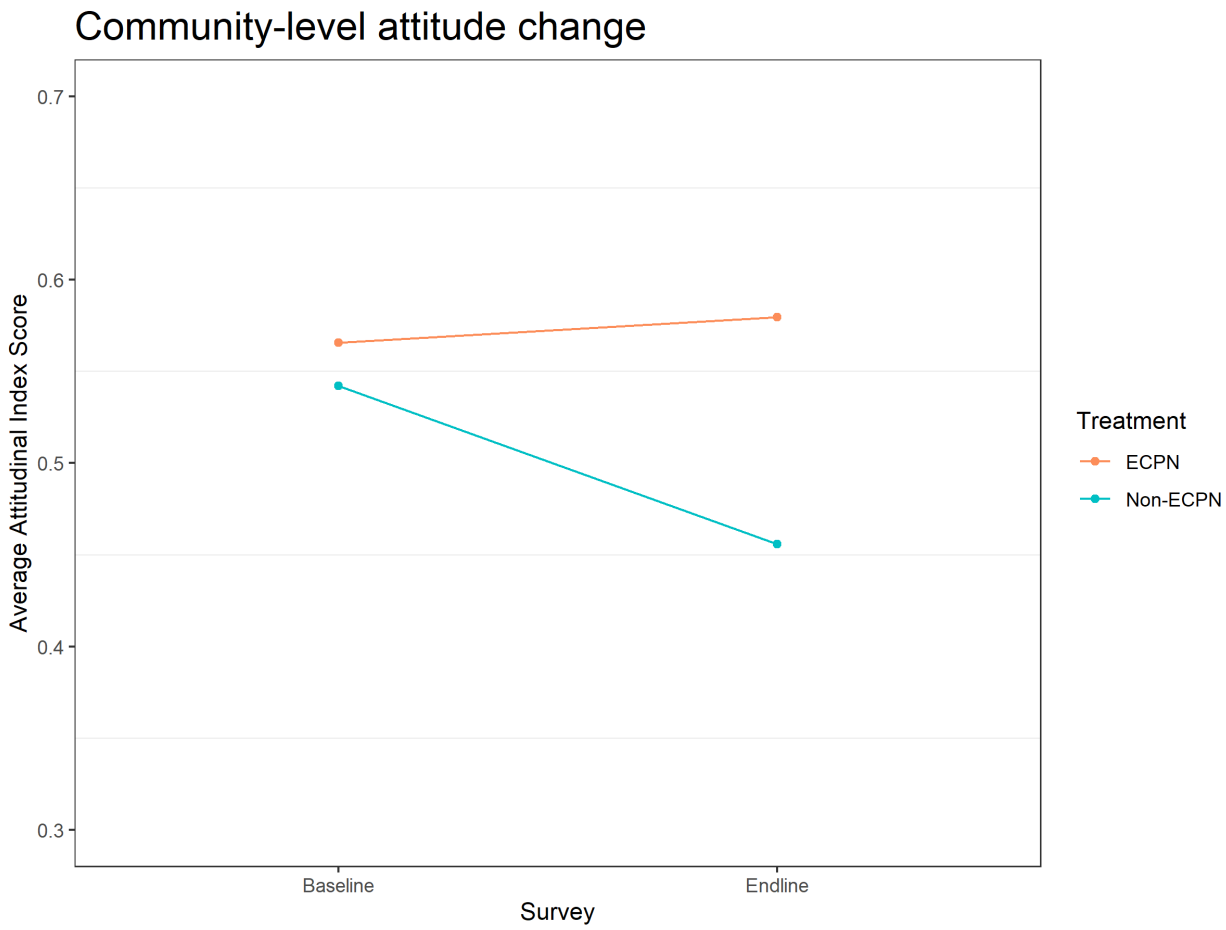

Figure 3: Difference-in-differences plot comparing change in treatment to change in control.

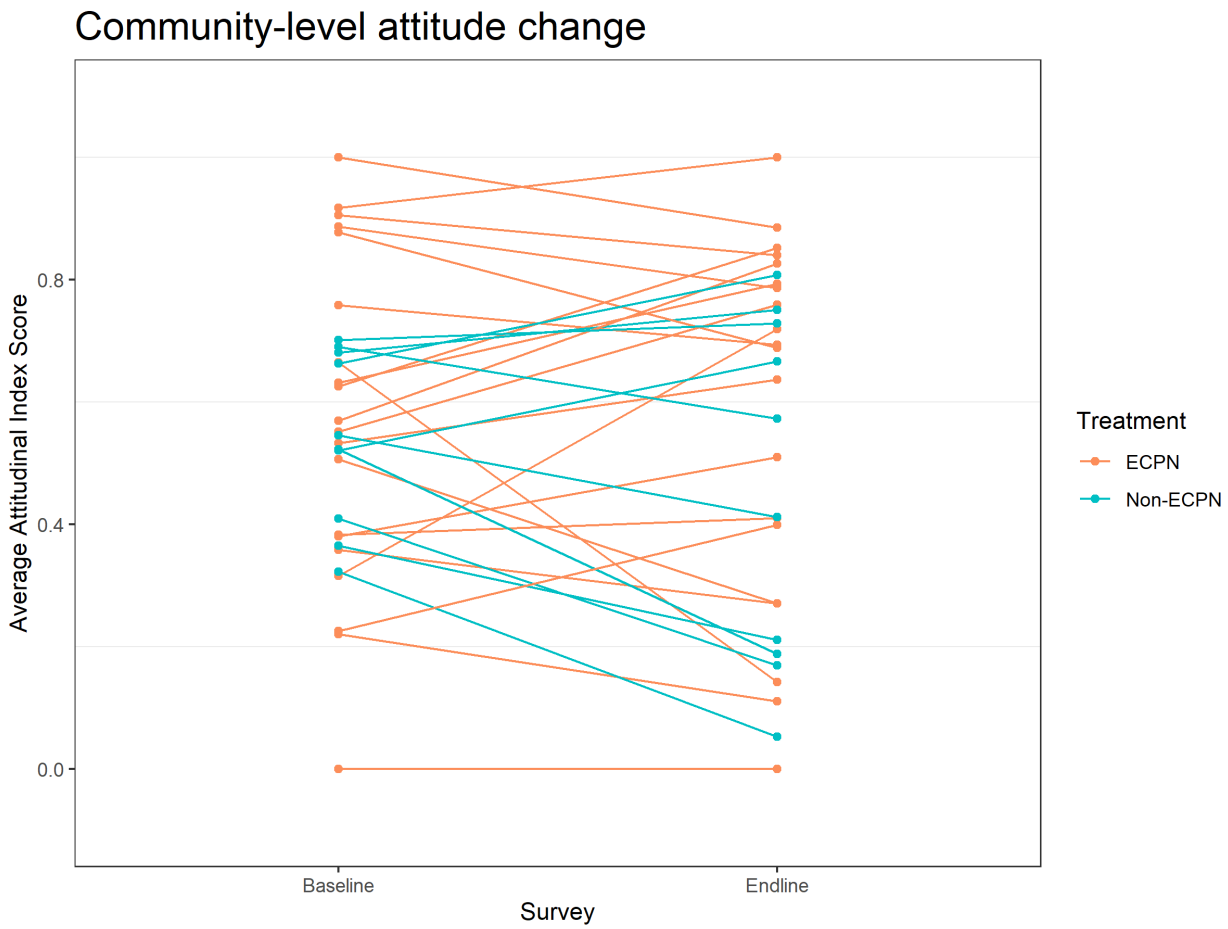

Figure 4: Each point represents a community. This graph shows (1) that overall changes are not driven by a large change in a single community and (2) that the overall change does not reflect a ceiling or floor effect.

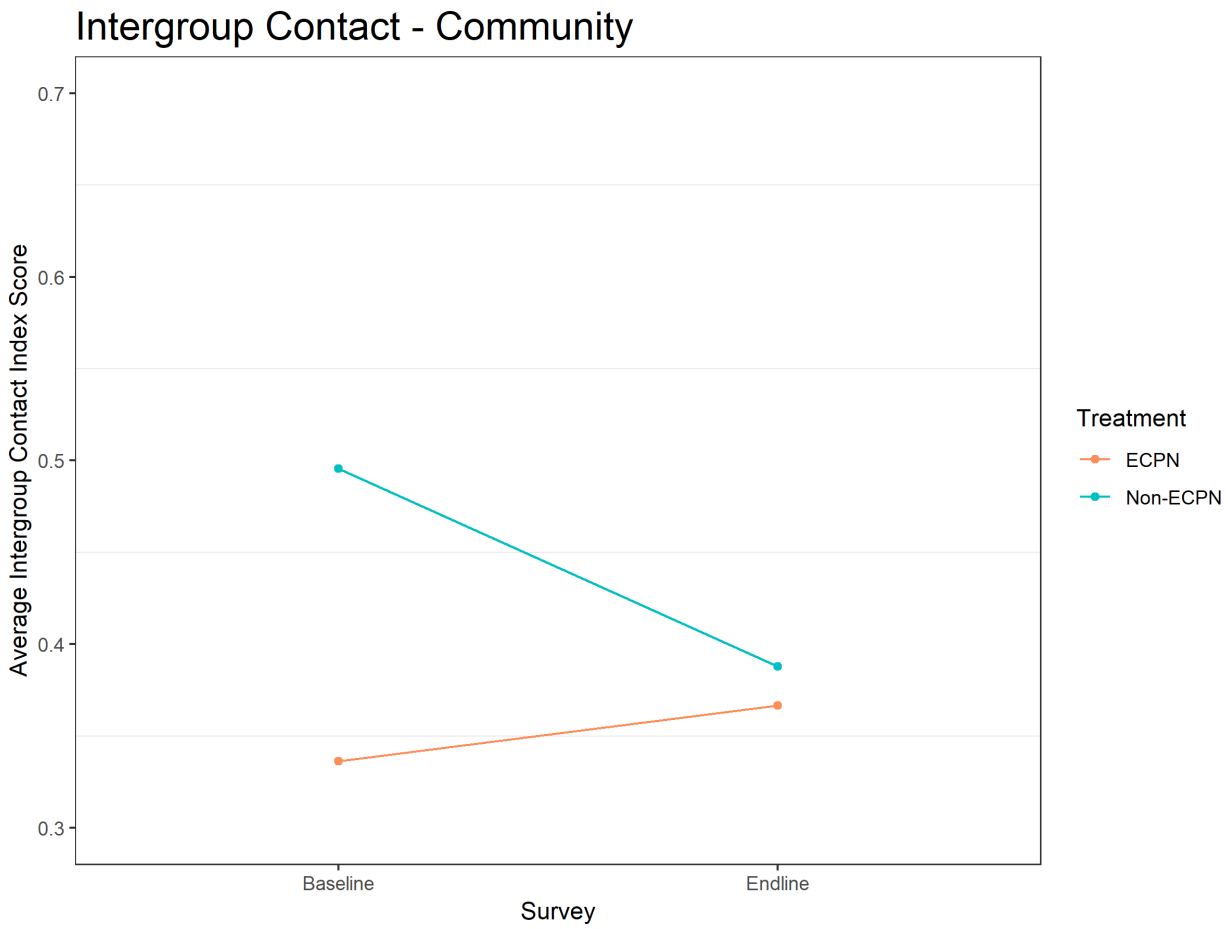

Figure 5: Difference-in-differences plot comparing change in treatment to change in control.

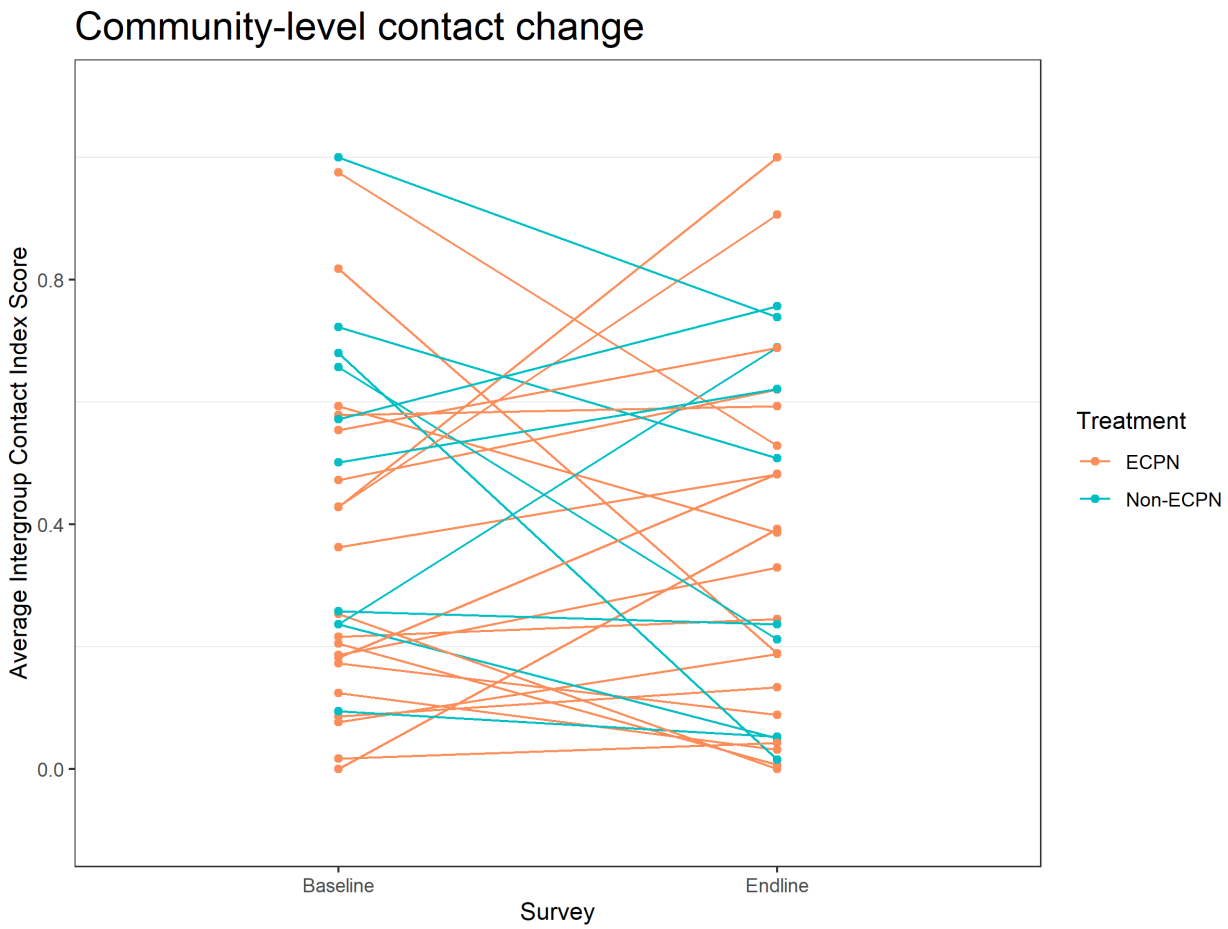

Figure 6: Each point represents a community. This graph shows (1) that overall changes are not driven by a large change in a single community and (2) that the overall change does not reflect a ceiling or floor effect.

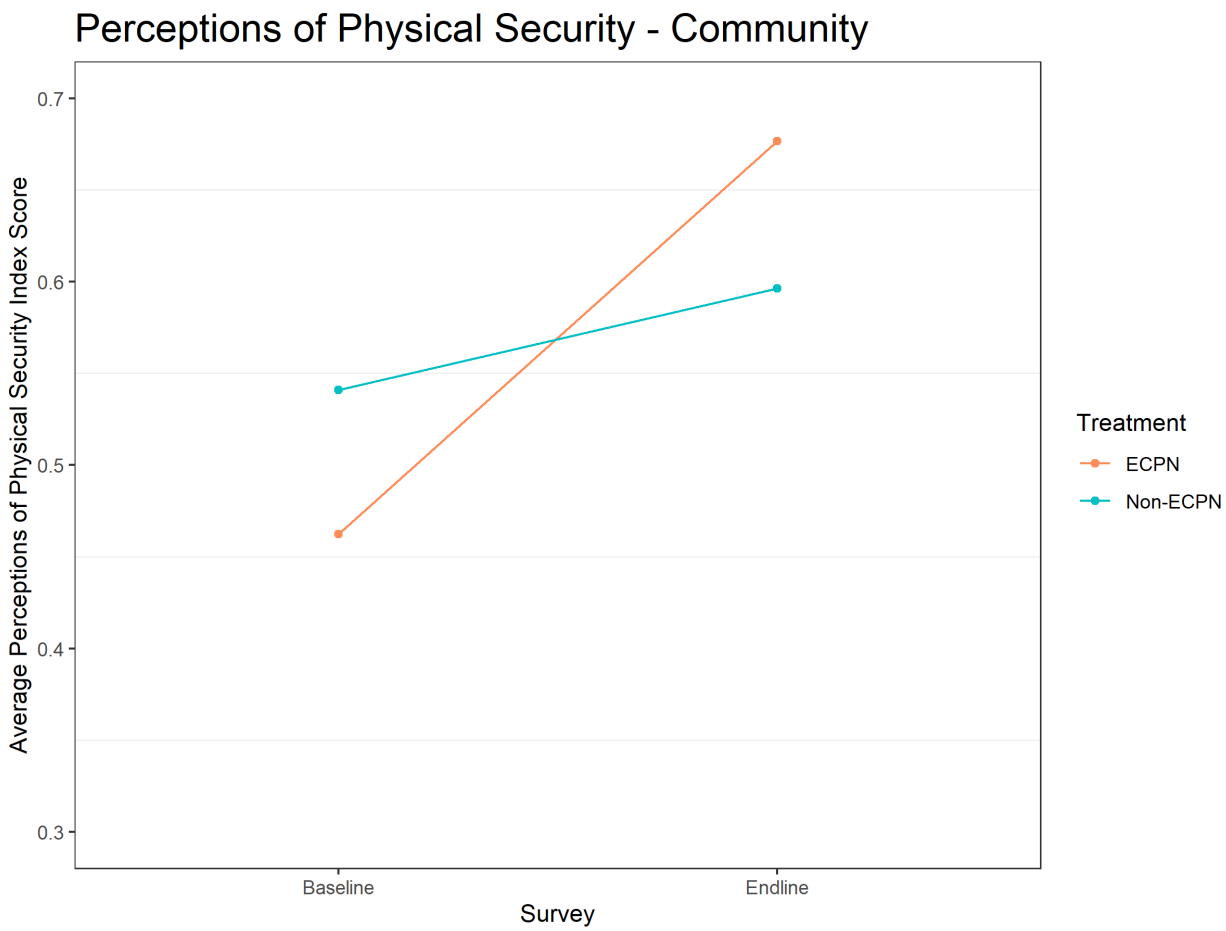

Figure 7: Difference-in-differences plot comparing change in treatment to change in control.

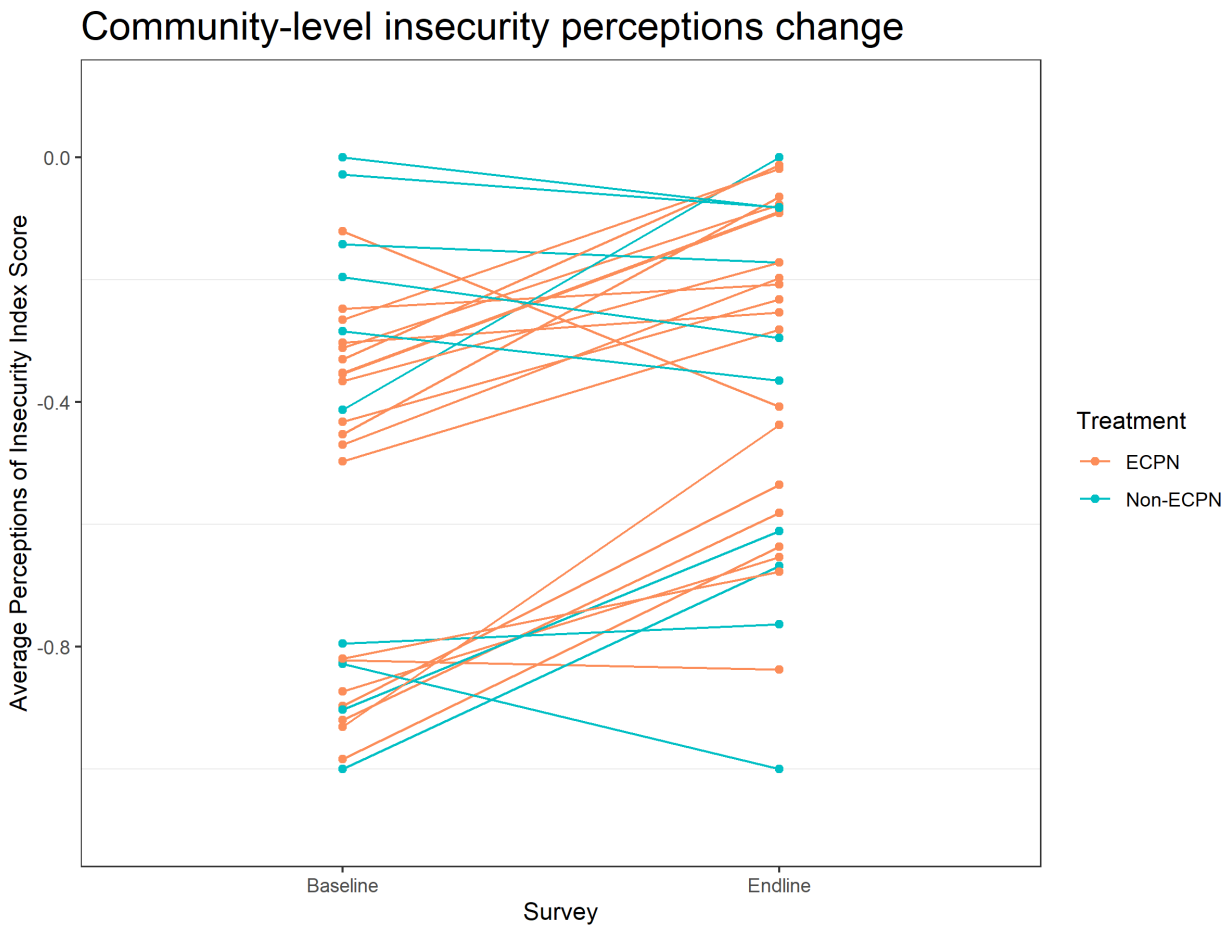

Figure 8: Each point represents a community. This graph shows (1) that overall changes are not driven by a large change in a single community and (2) that the overall change does not reflect a ceiling or floor effect.

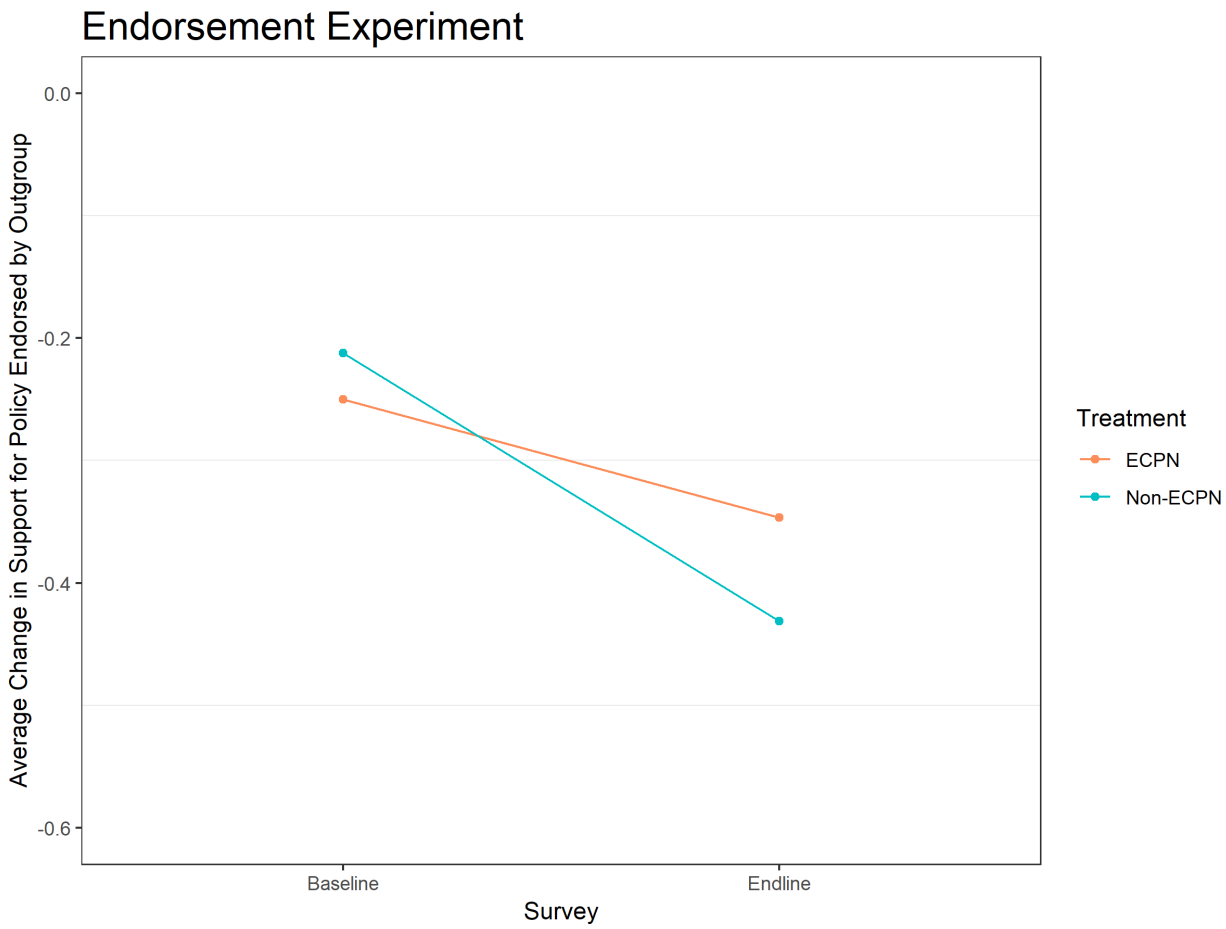

Figure 9: Difference-in-differences plot comparing change in treatment to change in control.

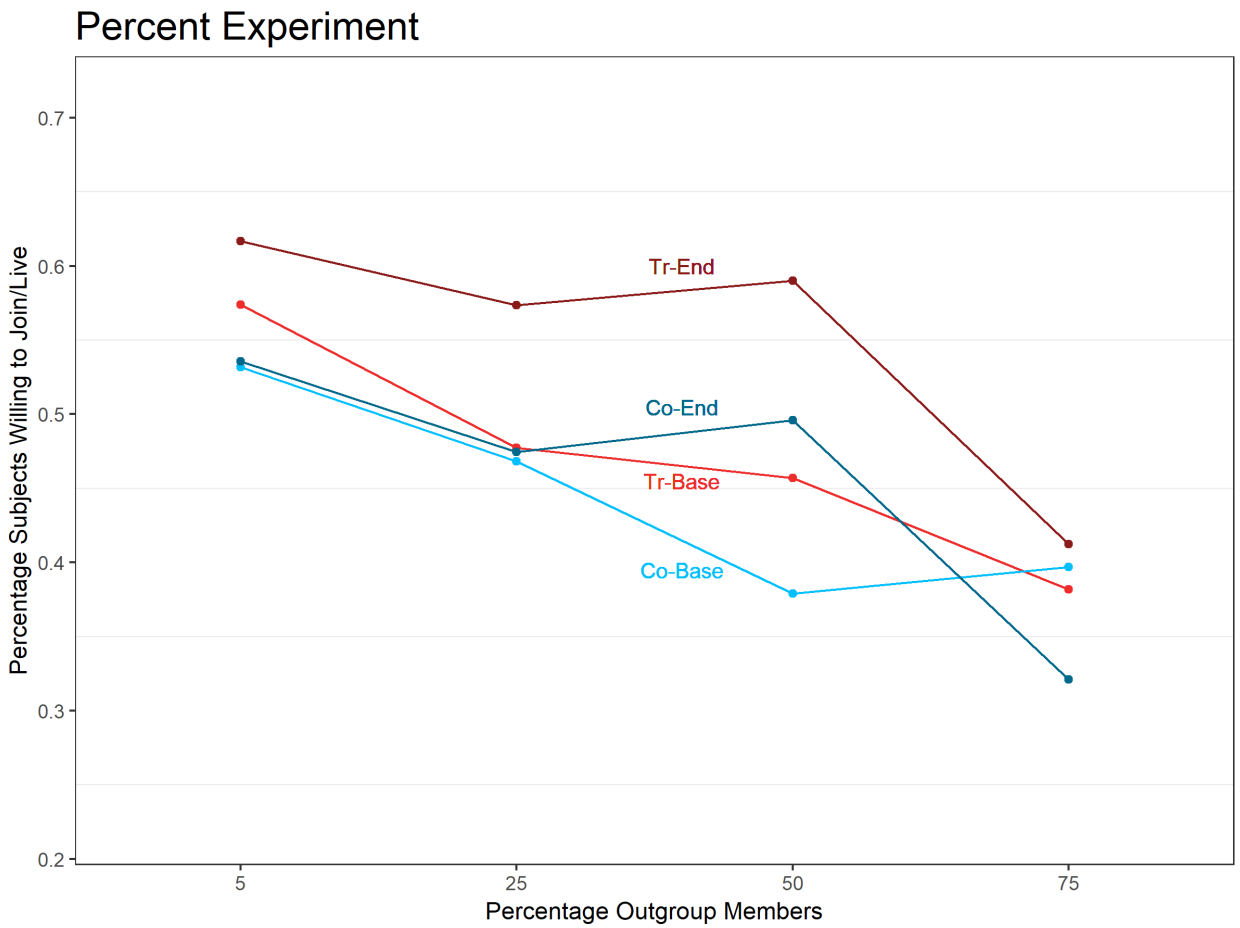

Figure 10: Difference-in-differences plot comparing change in treatment to change in control.

Behavioral outcomes

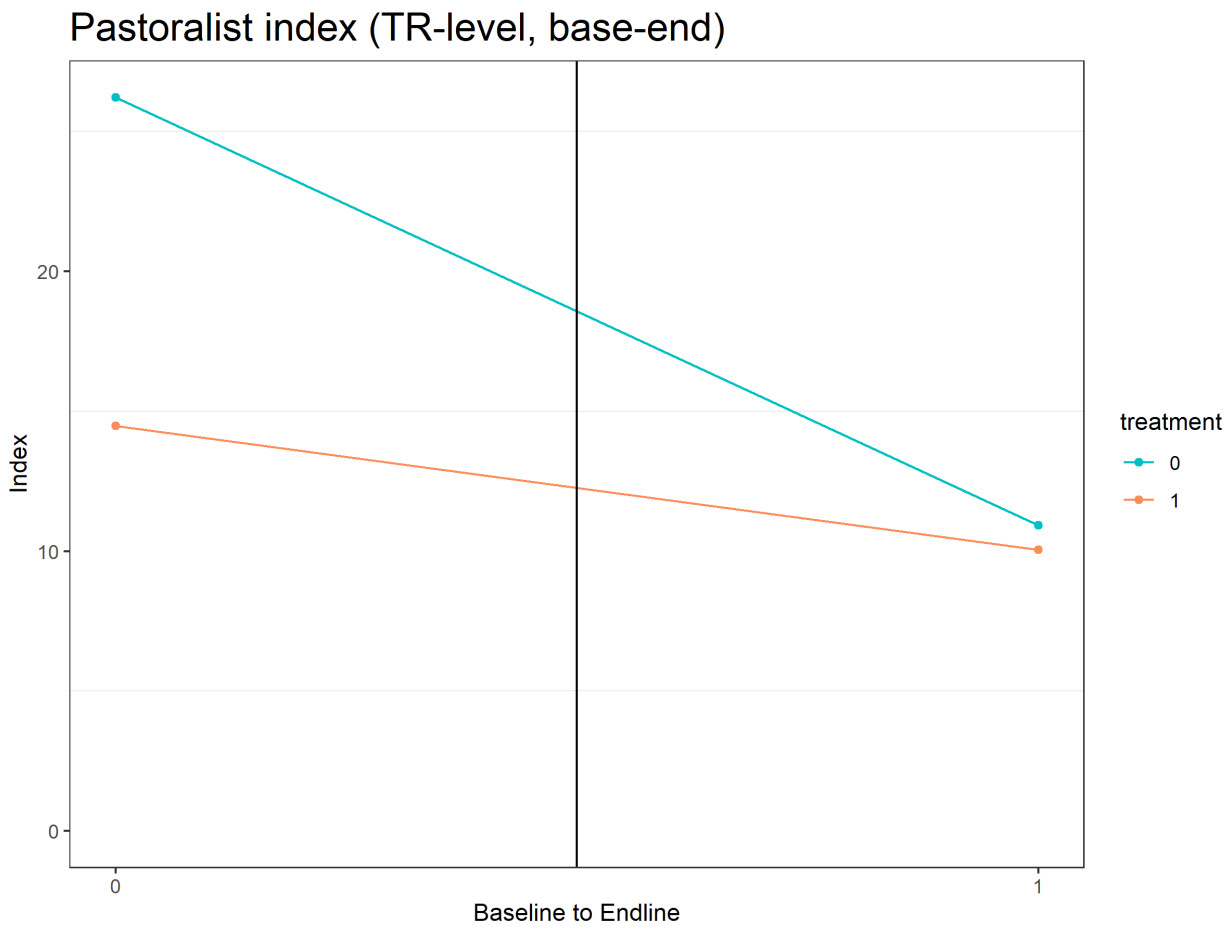

Figure 11: Difference-in-differences plot comparing change in treatment to change in control.

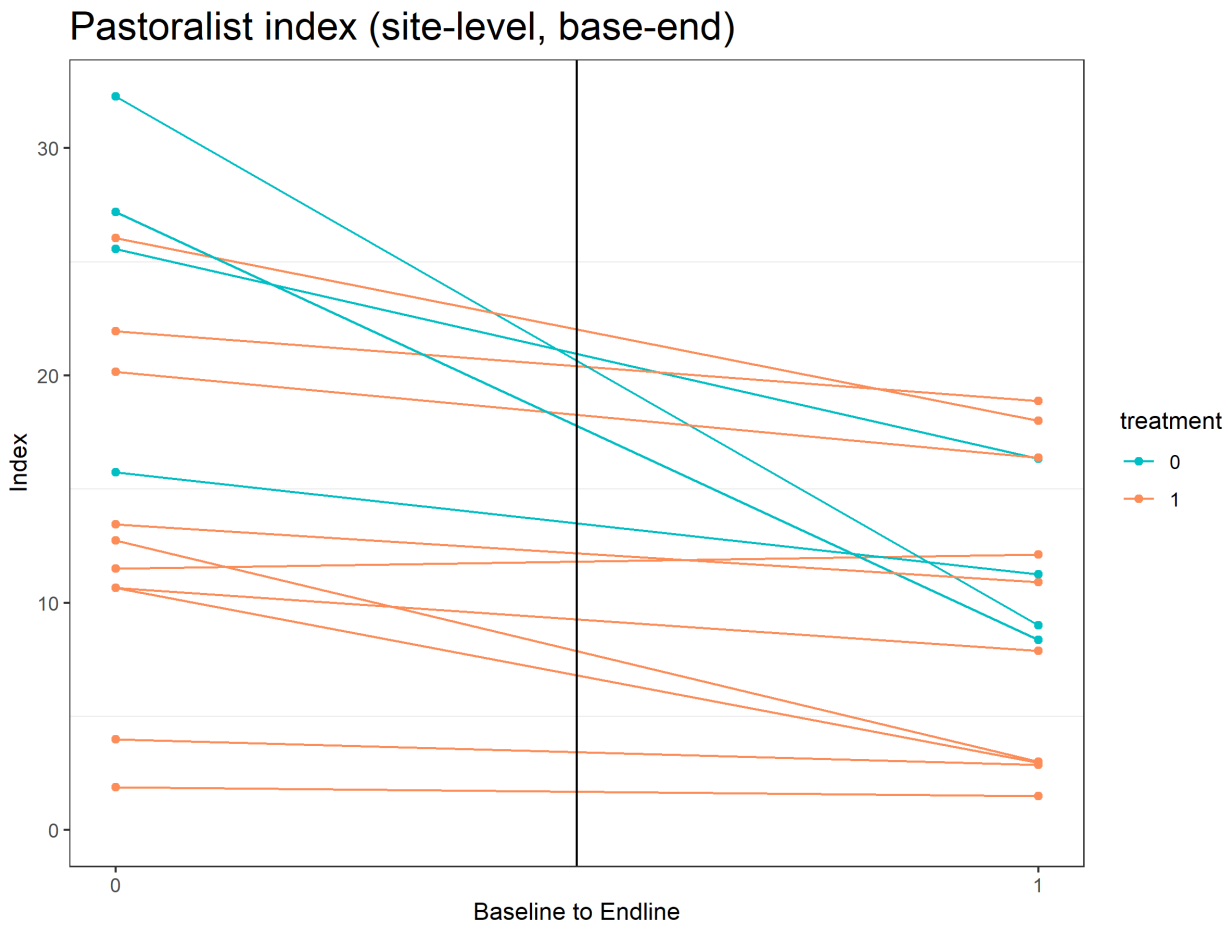

Figure 12: Each point represents a site. This graph shows (1) that overall changes are not driven by a large change in a single community and (2) that the overall change does not reflect a ceiling or floor effect.

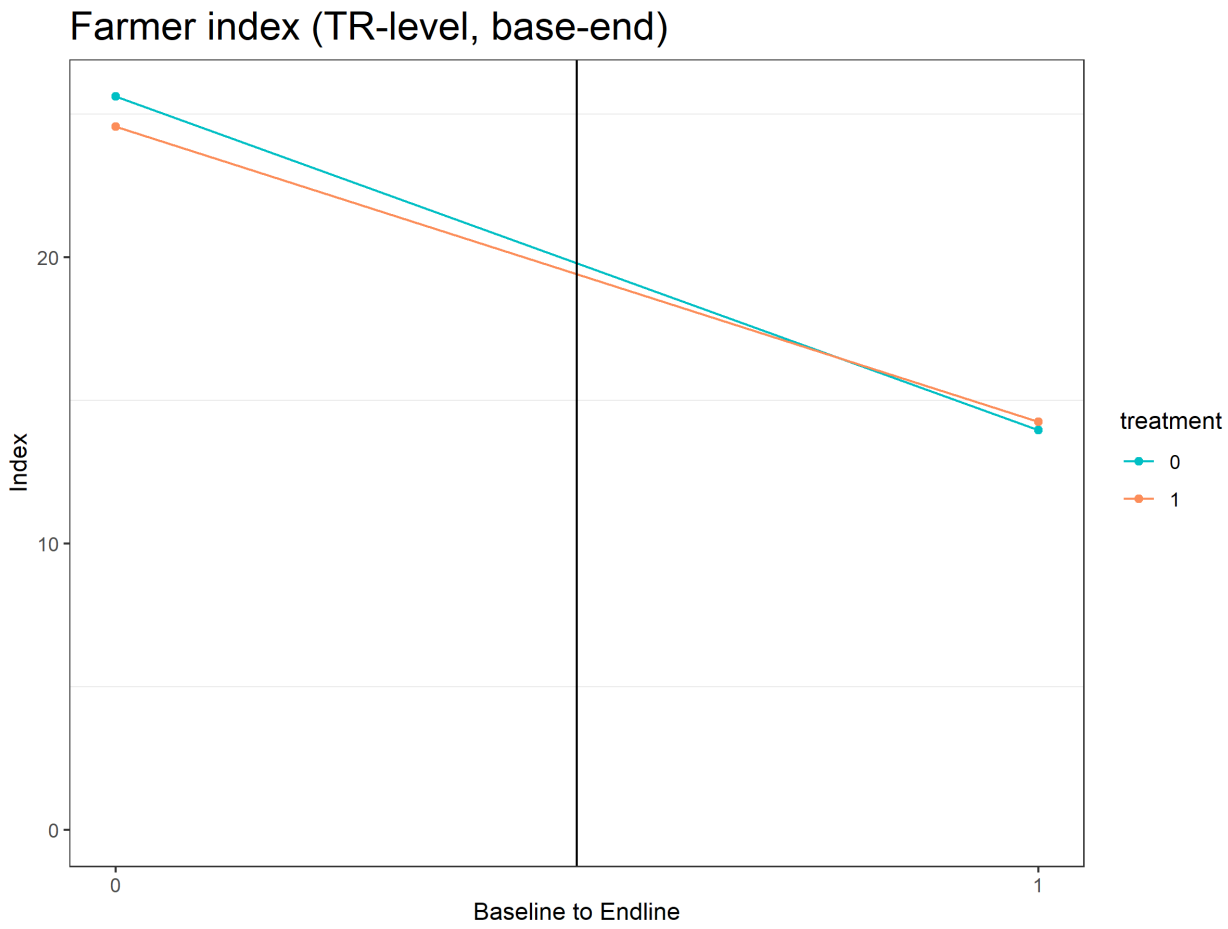

Figure 13: Difference-in-differences plot comparing change in treatment to change in control.

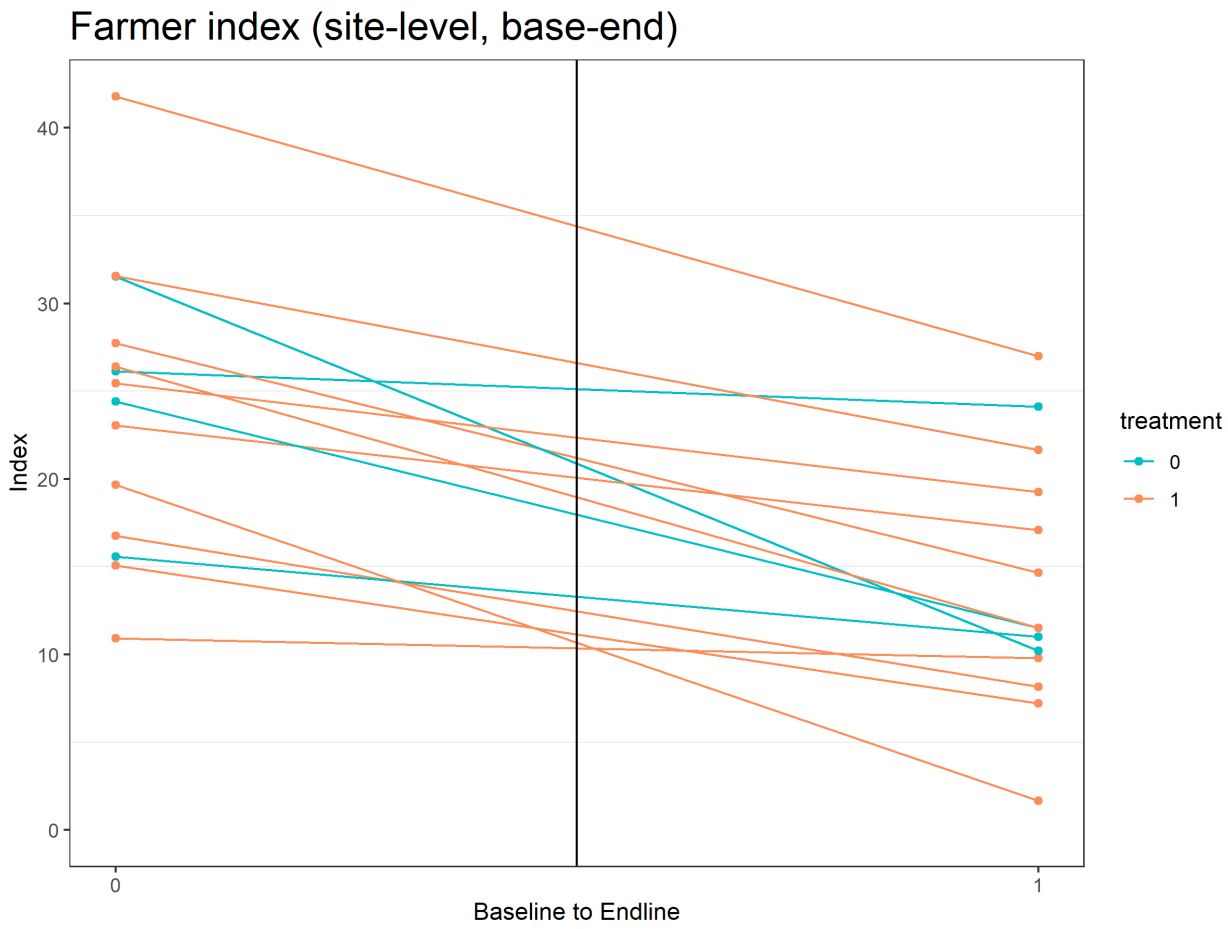

Figure 14: Each point represents a site. This graph shows (1) that overall changes are not driven by a large change in a single community and (2) that the overall change does not reflect a ceiling or floor effect.

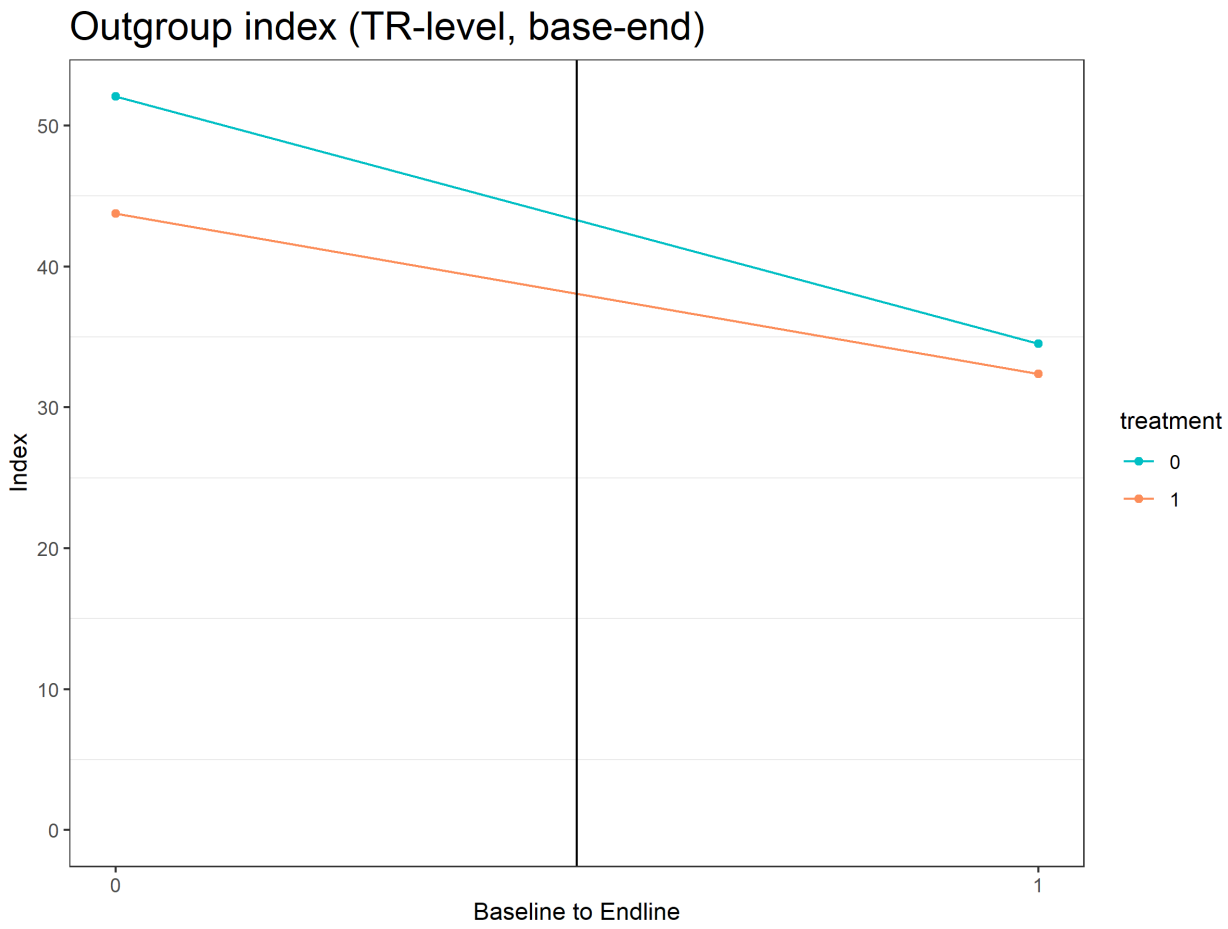

Figure 15: Difference-in-differences plot comparing change in treatment to change in control.

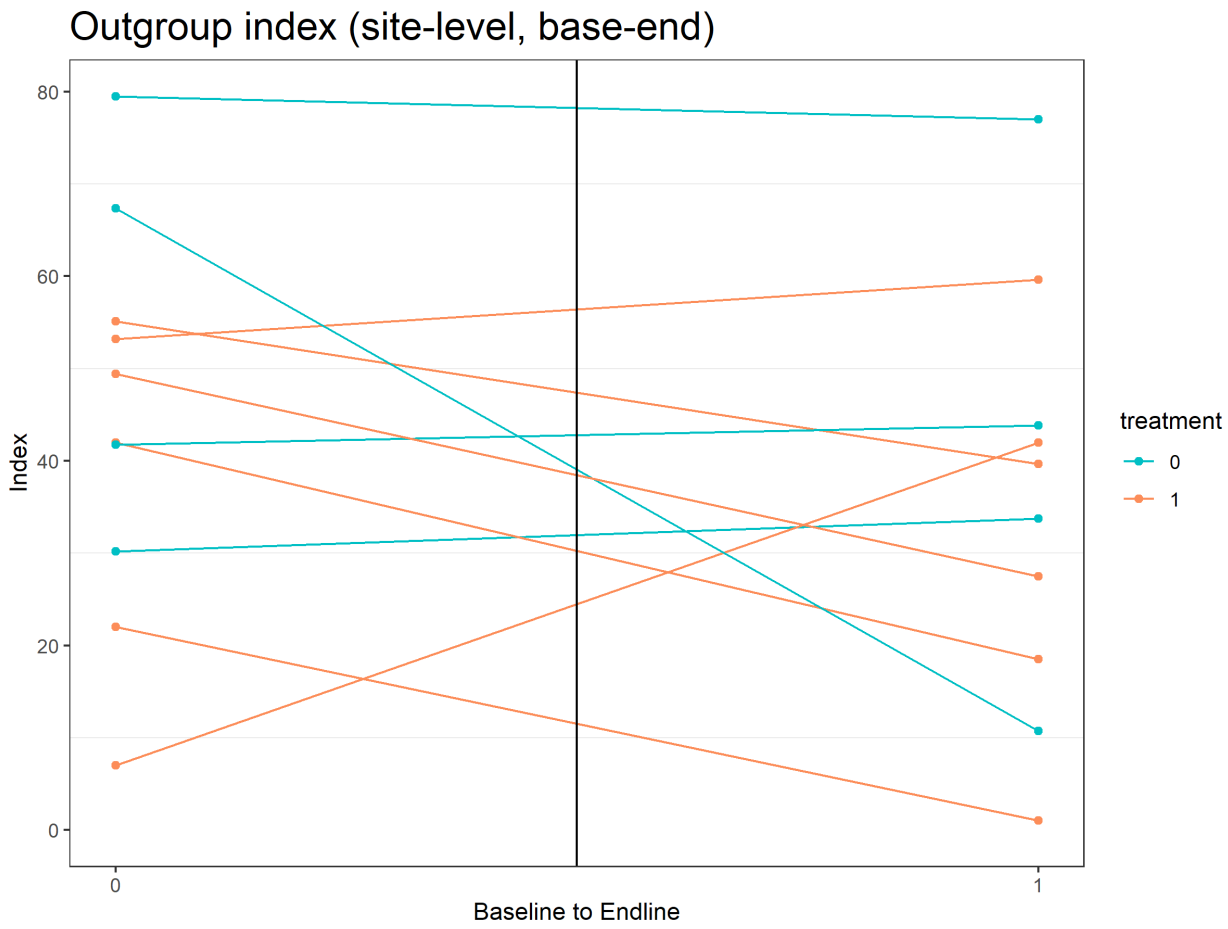

Figure 16: Each point represents a site. This graph shows (1) that overall changes are not driven by a large change in a single community and (2) that the overall change does not reflect a ceiling or floor effect.