ONLINE APPENDIX

The impact of large-scale social media advertising campaigns on COVID-19 vaccination: Evidence from two randomized controlled trials

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I. Supplementary Information on the Intervention

A. Treatments

The treatments were all initiated through Facebook platforms. In the US, the videos featured doctors and nurses from Massachusetts General Hospital (MGH), Harvard Kennedy School (HKS), Johns Hopkins School of Nursing, Harvard Medical School, Lynn Community Health Center, St. Anthony North Family Medicine, and McGovern Medical School. The US ads were sent from the Facebook group we created for our previous study, Doctors for Coronavirus Prevention (Breza et al. 2021). In France, the videos featured doctors and nurses from "Assistance Publique – Hôpitaux de Paris" (APHP). The France ads were associated with the project Facebook page titled "Vidéos Réalisées par des Médecins." All of the videos used in the campaigns can be found at https://www.doctorsforcovidprevention.org (US) and https://vaccin-action.org/ (France).

The ads were all targeted to Facebook users aged 18 and older. Like for any Facebook ad, individuals could choose whether or not to watch the video and could close the ad at any time. If individuals wished, they could also share any of the content with others. We provide additional details on each treatment group below:

Control group: Facebook users in these areas received no messages from the study.

Treatment Group 1 ("Direct" messaging): The videos about COVID-19 vaccination were directly served as ads to Facebook users. The scripts for the videos are below.

- ***Question: what are the mRNA vaccines made of?***

  The key ingredient in the Pfizer and Moderna vaccines is the mRNA that teaches our bodies to make a harmless piece of protein that is found in the virus that causes COVID-19. This is how our bodies learn to protect us. The other ingredients are commonly used in foods, medications and other vaccines. These include fats, acids, sugars, and salts to help stabilize the vaccine and balance the acidity. None of the approved COVID-19 vaccines contain eggs, latex or heavy metals.

- ***Question: Do the mRNA vaccines contain the virus that causes Covid-19?***

  The "m" in mRNA stands for messenger. The mRNA messages tell our bodies to make harmless pieces of protein, which our immune system reacts to and makes antibodies to get rid of. So, the vaccines do not contain the actual virus; they simply contain messenger mRNA.

- ***Question: Do the mRNA vaccines change my DNA?***

  The "m" in mRNA stands for messenger. The mRNA messages tell our bodies to make harmless pieces of protein, which our immune system reacts to and makes antibodies to get rid of. So, the mRNA vaccines never interact with our DNA. The vaccine never goes into the nucleus of our cells, where the DNA is kept. Our bodies break down and get rid of the mRNA from the vaccine as soon as it delivers its instructions.

- ***Question: Can the COVID vaccine cause COVID or debilitating side effects?***

  The vaccine cannot cause COVID. Some people get side effects that make it hard to go to work for a day or two, like a mild flu, but the disruption from actually getting COVID is much worse.

- ***Question: What kind of side effects should I expect?***

  Some people experience side effects in the few days following the shot. This can include a sore arm, headaches or flu-like symptoms, especially after the second dose. Others experience no side effects at all. As with any vaccination, serious side effects are extremely rare. Approximately 200 million people have been vaccinated in the US, and the CDC has

not detected any long-term side effects. In contrast, we know that Covid-19 can cause long-lasting symptoms.

- ***Question: I'm young and healthy, why do I need to get the vaccine?***
  We are seeing rising cases due to new variants. Even young and healthy people are coming into the hospital with severe symptoms. When you are vaccinated, you are much less likely to be hospitalized or die from Covid-19. You're also less likely to have long-term effects from COVID.
- ***Question: Why should I get vaccinated if it's still possible to get COVID-19?***
  Vaccines make the disease much less severe for you. Even if you get covid after being vaccinated, having the vaccine means that you are less likely to have a severe case. Your symptoms will be milder, and you will be much less likely to be hospitalized or die.
- ***Question: Have the vaccines been approved by the FDA?***
  The Pfizer vaccine received full FDA approval. All three vaccines approved for use in the US have undergone rigorous testing and have been shown to be safe and effective. Before being authorized for widespread use, each vaccine was tested in clinical trials with tens of thousands of participants. Now, over 350 million doses have been given in the US, and the vaccines continue to be closely monitored.
- ***Question: Does the vaccine reduce pregnancy rates?***
  The rates of pregnancy are the same for vaccinated and unvaccinated people, and there has been no difference in the rates of miscarriage among vaccinated and unvaccinated people
- ***Question: Should I get the vaccine if I'm pregnant or planning to get pregnant?***
  COVID-19 can cause severe complications if you are pregnant. Staying healthy is the best way to prevent these complications, so get vaccinated to keep you and your baby safe. Vaccinated people also pass antibodies to their babies.
- ***Question: Why does the vaccine protect me even if I was previously infected?***
  You can and should get the vaccine even if you already had COVID. The vaccine provides more protection than 'natural immunity' and especially with new variants, additional protection is needed. If you received monoclonal antibodies as treatment for COVID from your doctor, you should wait three months before getting vaccinated. Otherwise, you can get the vaccine as soon as you are out of isolation.

- ***Question: Was the vaccine rushed?***

  Scientists were working on the mRNA vaccine technology used in the Pfizer and Moderna shots for decades. When COVID hit, they were able to use what they had already learned to develop the Covid vaccine. The authorization was moved to the front of the line ahead of other drugs, and lots of people were freed up from other projects just to focus on Covid.

- ***Question: Does ivermectin prevent or treat Covid-19?***

  Ivermectin has not been proven to prevent or treat COVID-19, and taking Ivermectin can be harmful to you. If you take Ivermectin without a medical indication, you are at risk for potentially dangerous side effects, including vomiting, diarrhea, headache, low blood pressure, seizures, decreased alertness, and coma. The best way to protect yourself against COVID is to get vaccinated and continue precautions.

- ***Question: Will I have to miss school or work to get the vaccine?***

  There are plenty of vaccine doses all around the country, so you should not have to wait in long lines to get the vaccine, and they are available at many locations 7 days per week. If you do have to miss work to get the vaccine, many employers and states are providing paid time off.

- ***Question: Why should I get vaccinated? (3 possible responses)***

- *If enough of us get vaccinated, we can get back to normal. We know that the vaccines keep people out of the hospital and protect our communities.*
- *If you and your family and friends are vaccinated, it will be safer for you to gather anywhere, anytime you want. We know that the vaccines can help keep people out of the hospital and protect you and your family.*
- *If enough of us get vaccinated, our kids will be able to go to school safely. The vaccines protect children who are too young to get vaccinated.*

- ***Question: Why do my children need the vaccine?***

  We have been seeing more kids and teens getting sick with COVID as new variants have emerged. The good news is that everybody age 5 and over is eligible for a vaccine, and it has been shown to be safe and effective. Getting your older children vaccinated will also protect children who are too young to be vaccinated.

- ***Question: Why should I get a Covid-19 booster?***

  Everyone 18 and older should get a booster shot to renew their protection against Covid-19. If you were already vaccinated, you are still less likely to get severely ill from Covid-19 than someone who has never been vaccinated, but the booster will renew this protection and help stop the spread of Covid-19.

All videos concluded with "*My name is [NAME], and I am a [HEALTHCARE ROLE] at [INSTITUTION]. Each vaccination makes all of us safer. Get your vaccine today.*"

Treatment Group 2 ("Friends" messaging): The Facebook ad campaign included videos encouraging viewers to help spread the word about vaccination to their friends (see script below):

- *Help beat COVID-19. Encourage your friends to get vaccinated! Friends are the best way to convince friends that widespread COVID-19 vaccination is the key to protect ourselves and resume our normal lives. If you want to be part of this movement, click to visit our website. My name is [NAME], and I am a [HEALTHCARE ROLE] at [INSTITUTION]. Each vaccination makes all of us safer. Get your vaccine today.*

These ads were disseminated in a similar manner to the content in T1. Individuals were able to easily share the ad with others, and those interested in learning more could click through a link in the ad to the study website, where they could watch other videos about vaccination, share these videos with friends, and sign up to be a vaccine ambassador.

Treatment Group 3 (US only) ("Gossips" messaging): Facebook users received ads which encouraged them to ask their most influential friends to encourage their friends to get vaccinated (see script below):

- *Help beat COVID-19. Encourage your friends to get vaccinated! Do you know people who everyone listens to and want to help as well? Friends are the best way to convince friends that widespread COVID-19 vaccination is the key to protect ourselves and resume our normal lives. If you want to be part of this movement, click to visit our website. Most importantly, share this post with your friends who reach and motivate the most people. My name is [NAME], and I am a [HEALTHCARE ROLE] at [INSTITUTION]. Each vaccination makes all of us safer. Get your vaccine today.*

B. Sample population, Randomization & Stratification

In the US, the experimental sample includes all states where less than 60% of the total population had received a first dose of COVID-19 vaccine by October 21, 2021. There are 1402 counties in the 19 states satisfying those criteria (Alabama, Alaska, Arkansas, Georgia, Idaho, Iowa, Indiana, Louisiana, Michigan, Mississippi, Missouri, Montana, North Dakota, Ohio, Oklahoma, South Carolina, Tennessee, West Virginia, Wyoming). Excluding the five counties with missing data, 1,397 counties were randomized as part of the experiment.

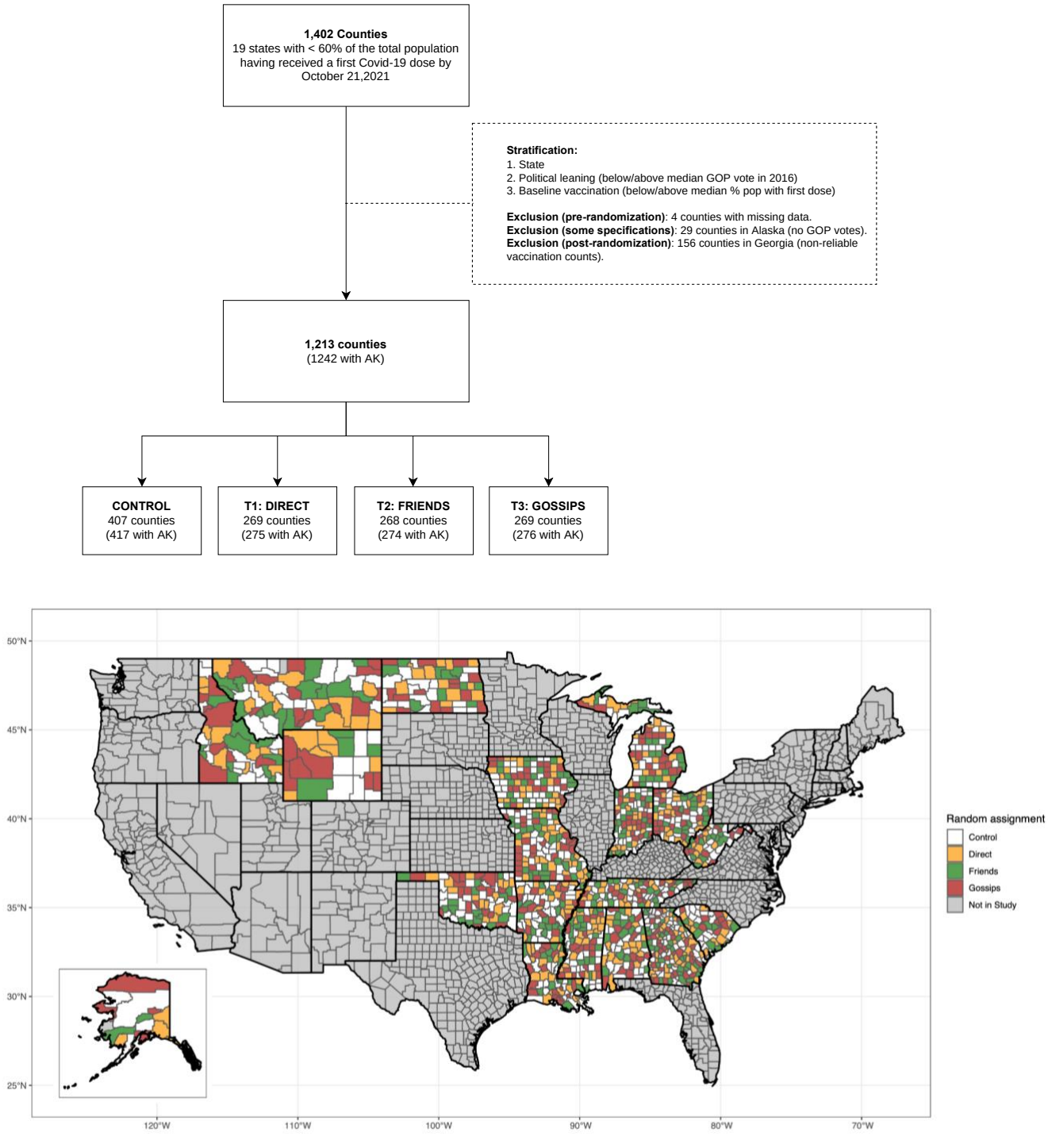
Randomization was conducted at the county level (see Supplementary Figure 1a). County-level randomization was stratified by three characteristics: 1) state, 2) political leaning (according to 2020 election results), and 3) baseline vaccination rates. For political leaning, counties were divided into below and above median GOP vote in the 2020 presidential election. For baseline vaccination rates, counties were divided into above and below median percentage of the population that had received the 1st dose of Covid-19 vaccine. After stratifying on these three variables, strata were adjusted so that no stratum was smaller than 9 counties. Strata with fewer than nine counties were dissolved by baseline percentage of population having a first dose of vaccine. For the three states (South Carolina, Michigan, and Wyoming) where this does not result in strata that have at least nine counties, we dissolve instead by baseline GOP vote share. In total, this left us with 47 strata. However, county-level GOP votes were not available for Alaska, and so this stratification variable was used for the other 18 states in the sample only.

Out of the 1,397 counties which fit the eligibility criteria for the experiment, we assigned 468 counties to the control group, 310 counties to T1 ("Direct" messaging) treatment, 309 counties to T2 ("Friends" messaging), and 310 counties to T3 ("Gossips" messaging). However, after examining the reported vaccination counts in January 2022, we found that the vaccination counts in Georgia were not reliable, as vaccination rates as large as 25-30% of the counties' populations were reported in a single week, and so Georgia is excluded from the results presented in the paper. This results in 1,213 total counties in the experiment, of which 407 are in the control group, 269 in the Direct group, 268 in the Friends group, and 269 in the Gossips group.

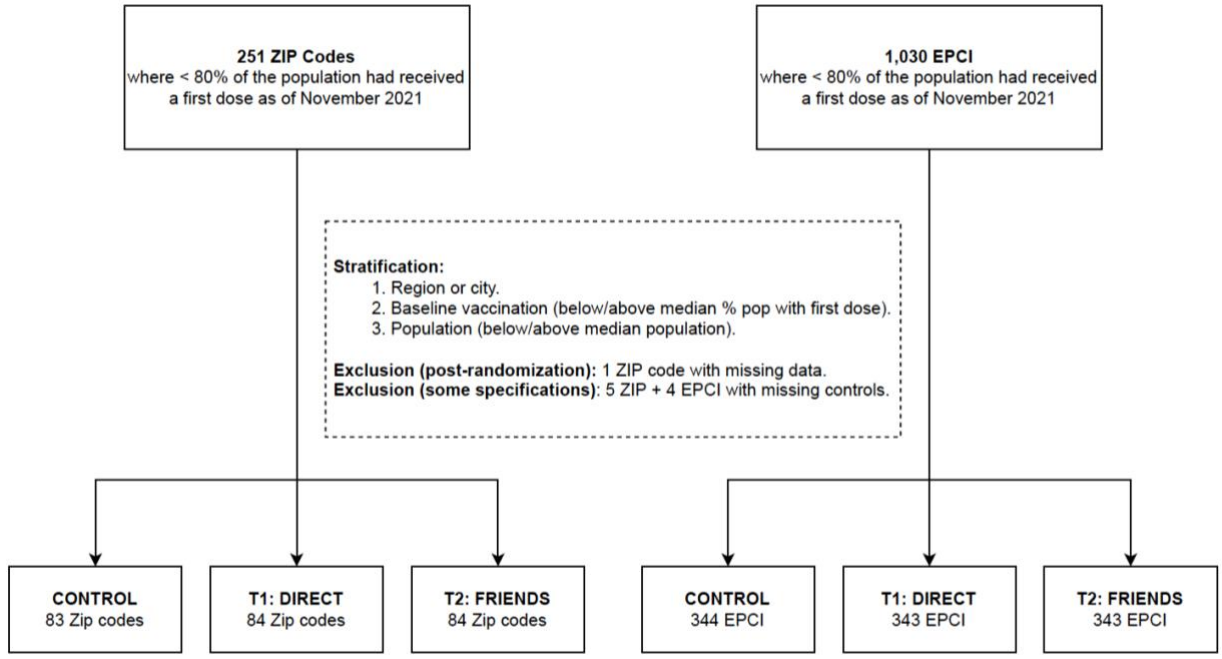
In France, the unit of randomization is postal codes in Lyon/Paris/Marseille, and “Etablissement public de cooperation intercommunale” (EPCI - a federation of municipalities) in the rest of mainland France (Supplementary Figure 1b). The inclusion criteria for the study was: areas where below 80% of people were without the first dose of vaccine as of November 2021, and where the data were available on first vaccination doses. Under these criteria, the experimental sample includes 1,030 EPCI and 251 postal codes in France.

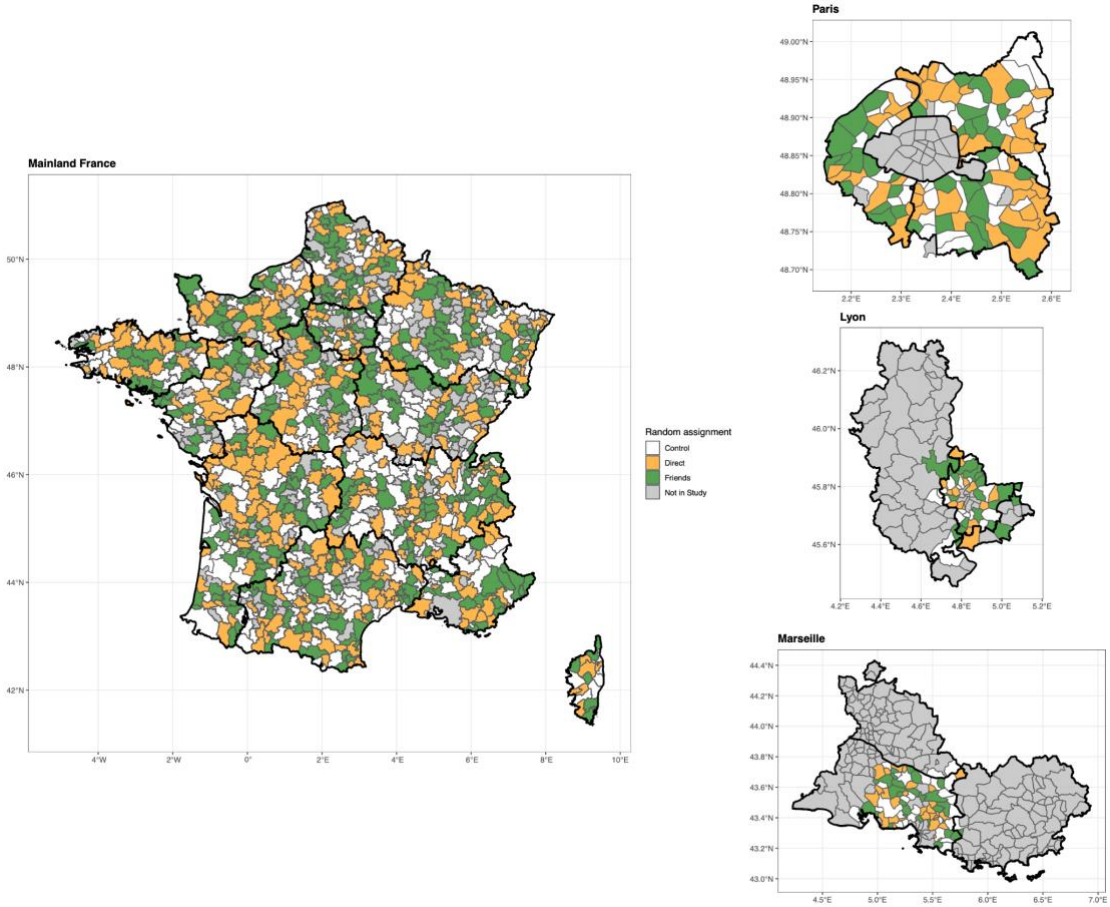
Randomization was stratified by three characteristics: 1) region or city, 2) above/below median baseline 1st dose, and 3) above/below median population. For baseline vaccination rates, areas were divided into above and below median percentage of the population that had received the first dose of COVID-19 vaccine. In total, this left us with 44 strata for the EPCI and 12 strata for the postal codes in Lyon/Marseille/Paris. Out of the 1,030 EPCI which fit the eligibility criteria for the experiment, we assigned 344 EPCIs to the control group, 343 EPCIs to T1 ("Direct" messaging treatment), and 343 EPCIs to T2 ("Friends" messaging treatment). Out of the 251 postal codes in Lyon/Marseille/Paris which fit the eligibility criteria for the experiment, we assigned 83 postal codes to the control group and 84 postal codes each to the Direct and Friends groups.

Supplementary Figure 1a: United States Randomization



Supplementary Figure 1b: France Randomization





II. Supplementary Results & Robustness Checks

The analysis was pre-registered in the AEA RCT Registry, with unique identification numbers AEARCTR-0008711 (United States) and AEARCTR-0008902 (France).

A. Randomization Check

Baseline characteristics by treatment group are presented in Supplementary Table 1 for the United States and Supplementary Tables 2a-2b for France and generally demonstrate the effectiveness of our randomization. Just before the intervention began on December 21st 2021, the average rates of first dose vaccination were approximately 50% across counties in the experiment (and 45% for complete vaccination rates). The counties in the experiment were mostly non-metro areas; approximately 1 in 3 counties in the experiment was classified as urban. Overall, the counties in the experiment voted for Donald Trump by a wide margin in 2020. The percentage of voters favoring Trump was approximately 68% in the study counties. On average, the counties in the Gossips groups have a larger population (74,617 people on average), as compared to between 55,000-60,000 people on average in Control, Direct, and Friends group counties. We control for population in all of our regressions.

In France, the average rates of first dose vaccination were higher before the experiment began. Just before the campaigns, the average first dose vaccination rate at the end of January 2022 was approximately 76% in EPCIs (75% for completed vaccination or reported recovery from COVID-19)[1]. In the postal code sample, vaccination rates were slightly lower, with an average first dose vaccination rate of 71% (70% for completed vaccination or first dose with reported recovery). EPCI units had populations ranging from 43,797 people on average (Control group) to 55,264 people on average (Direct group), with the Friends group in between (48,378). The difference between Control and Direct group average populations is significant at the 10% level. Postal code units in the control and treatment groups have populations between 25,000 - 30,000 people and are not significantly different between groups. Again, we control for population in our regressions.

[1] At the time, the French administration considered people with a first dose of vaccine who were recently infected by COVID-19 to be "fully vaccinated".

Supplementary Table 1: Baseline Characteristics by Treatment Group (US, Counties)

	(1) Control		(2) Direct		(3) Friends		(4) Gossips		(1)-(2)		(1)-(3)		(1)-(4)		(2)-(3)		(2)-(4)		(3)-(4)	
									Pairwise t-test											
Variable	N	Mean/(SE)	N	Mean/(SE)	N	Mean/(SE)	N	Mean/(SE)	N	P-value	N	P-value	N	P-value	N	P-value	N	P-value	N	P-value
GOP Win Margin (2020)	407	0.388 (0.014)	269	0.372 (0.018)	268	0.384 (0.016)	269	0.375 (0.016)	676	0.471	675	0.869	676	0.555	537	0.607	538	0.882	537	0.695
GOP Vote 2020 (%)	407	0.685 (0.007)	269	0.677 (0.009)	268	0.683 (0.008)	269	0.678 (0.008)	676	0.476	675	0.866	676	0.532	537	0.615	538	0.911	537	0.674
Urban Counties (%)	417	0.312 (0.023)	275	0.302 (0.028)	274	0.299 (0.028)	276	0.377 (0.029)	692	0.782	691	0.728	693	0.076	549	0.948	551	0.063	550	0.055
Baseline Complete Vacc (%)	417	45.797 (0.503)	275	45.404 (0.612)	274	44.800 (0.608)	276	45.479 (0.588)	692	0.621	691	0.209	693	0.684	549	0.485	551	0.929	550	0.423
Baseline Dose 1 Vacc (%)	417	52.100 (0.567)	275	51.757 (0.712)	274	50.870 (0.684)	276	51.699 (0.636)	692	0.706	691	0.169	693	0.645	549	0.369	551	0.951	550	0.375
Population	417	55104.763 (5109.717)	275	59720.731 (7280.587)	274	58041.000 (8236.215)	276	74617.257 (9521.786)	692	0.593	691	0.749	693	0.051	549	0.879	551	0.215	550	0.189

Note: In this table, columns (1), (2), (3), and (4) show the means and standard errors of county-level characteristics of the treatment groups for the US.

Suppl. Table 2a: Baseline Characteristics by Treatment Group (France, Postal Codes)

	(1) Control		(2) Direct		(3) Friends		(1)-(2)		(1)-(3)		(2)-(3)	
									Pairwise t-test			
Variable	N	Mean/(SE)	N	Mean/(SE)	N	Mean/(SE)	N	P-value	N	P-value	N	P-value
Population: 00-19	83	6449.759 (629.485)	84	6079.167 (678.098)	84	7044.286 (755.233)	167	0.689	167	0.547	168	0.343
Population: 20-64	83	15942.892 (1517.716)	84	14978.095 (1685.071)	84	17617.024 (2007.027)	167	0.671	167	0.507	168	0.315
Population: 65+	83	4416.386 (389.870)	84	4099.167 (389.593)	84	4774.405 (541.271)	167	0.566	167	0.593	168	0.313
Population: All Ages	83	26806.747 (2498.868)	84	25152.024 (2729.761)	84	29432.619 (3268.272)	167	0.656	167	0.525	168	0.316
Baseline Dose 1 (%)	83	0.706 (0.007)	84	0.710 (0.006)	84	0.709 (0.006)	167	0.692	167	0.764	168	0.926
Baseline Complete Vacc (%)	83	0.695 (0.007)	84	0.698 (0.006)	84	0.698 (0.007)	167	0.712	167	0.752	168	0.961

Note: In this table, columns (1), (2) and (3) show the means and standard errors of postal-code-level characteristics of the treatment groups for France.

Supplementary Table 2b: Baseline Characteristics by Treatment Group (France, EPCI)

	(1) Control		(2) Direct		(3) Friends		(1)-(2)		(1)-(3) Pairwise t-test		(2)-(3)	
Variable	N	Mean/(SE)	N	Mean/(SE)	N	Mean/(SE)	N	P-value	N	P-value	N	P-value
Population: 00-19	344	9551.744 (988.230)	343	12055.364 (1070.309)	343	10517.843 (995.168)	687	0.086	687	0.491	686	0.293
Population: 20-64	344	24431.831 (2425.680)	343	31113.615 (2783.969)	343	27149.417 (2670.180)	687	0.071	687	0.451	686	0.304
Population: 65+	344	9814.884 (748.555)	343	12098.426 (905.604)	343	10712.566 (914.482)	687	0.052	687	0.448	686	0.282
Population: All Ages	344	43797.035 (4136.446)	343	55263.965 (4729.148)	343	48378.309 (4546.412)	687	0.068	687	0.456	686	0.294
Baseline Dose 1 (%)	344	0.765 (0.002)	343	0.762 (0.002)	343	0.761 (0.002)	687	0.291	687	0.177	686	0.759
Baseline Complete Vacc (%)	344	0.753 (0.002)	343	0.750 (0.002)	343	0.749 (0.002)	687	0.294	687	0.174	686	0.746

Note: In this table, columns (1), (2) and (3) show the means and standard errors of EPCI-level characteristics of the treatment groups for France.

B. Supplementary Results on the Effects of the Interventions

Aggregated weeks - In addition to the week-by-week regressions presented in Section III, we also estimate specifications which aggregate weeks which occurred before, during, and after the campaigns. The estimates from these aggregated time period regressions are presented in Table 1 (United States) and Supplementary Table 3 (France) where we report the coefficients from the following regression:

$$\text{(2)}\quad \text{asinh}\,(y_{it}) = \beta_{0,D}\,Direct_i + \beta_{1,during}\,Direct_i \times During_t + \beta_{1,post}\,Direct_i \times Post_t + \beta_{0,F}\,Friends_i + \beta_{2,during}\,Friends_i \times During_t + \beta_{2,post}\,Friends_i \times Post_t + \beta_{0,G}\,Gossips_i + \beta_{3,during}\,Gossips_i \times During_t + \beta_{3,post}\,Gossips_i \times Post_t + Controls_i + W_t + Strata_i + \varepsilon_{it}$$

France results– In Supplementary Figures 2a and 2b and Supplementary Table 3 we show week-by-week and pooled results from estimating equation (1) and equation (2) for France. Here again, we see no impacts either of the Direct campaign (Supplementary Figure 2a) or the Friends campaign (Supplementary Figure 2b). Most coefficients are relatively small and close to zero.

In Supplementary Table 3, we present results from the pooled time period regression in France. We can rule out effect sizes smaller than a 1pp increase in vaccination rates relative to the control

group. We find that during the campaign, the estimated coefficient of the Direct campaign is 0.013 (SE 0.032 95% CI -0.050 +0.076) and -0.038 (SE 0.048, 95% CI -0.132 +0.056) after the campaign. These are very small, and we can reject an increase in the number of immunizations given of 7.6% during and 5.6% after. For example, if the campaign had increased the number of vaccinations given during the intervention period by 7.6% in every area, then that would have increased the *change* in EPCI and postal code vaccination rates during the treatment period by 0.021pp on average (on a base of 0.27pp increase for the control group over the treatment period). In other words, a positive effect of 7.6% in each area would have resulted in an EPCI and postal code vaccination rates of 75.62% on average at the end of the intervention, as compared to the control group mean of 75.60% at the end of the intervention period. The coefficients for the Friends campaign are 0.005 during the campaign (SE 0.033, 95% CI -0.060 +0.070) and 0.047 (SE 0.048, 95% CI -0.047 +0.14) after the campaign. As in the Direct campaign, the point estimates are small and insignificant. We can reject an increase in the number of immunizations given by 7.0% during the campaign and 14% after the campaign. Using similar logic, this bounds the positive impact at an average increase of the change in EPCI and postal code vaccination rates during the treatment period by 0.019 pp on a base of 0.27 pp. This change would have resulted in a vaccination rate of 75.62% at the end of the intervention, again compared to 75.60% in the absence of treatment.

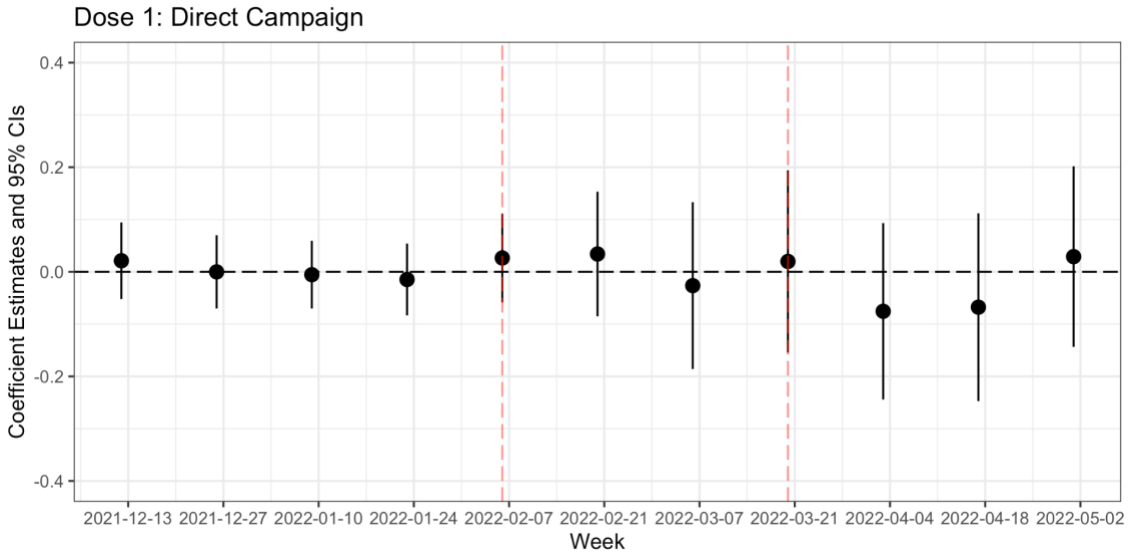
Supplementary Table 3: Effects of Facebook campaigns on new COVID-19 dose 1 vaccinations, France

	(1)	(2)
	Asinh(New Dose 1)	Log(New Dose 1 + 1)
Direct Campaign		
Direct x during	0.013	0.011
	(0.032)	(0.025)
	p = 0.676, RI p = 0.289	*p = 0.665, RI p = 0.293*
Direct x post	-0.038	-0.034
	(0.048)	(0.038)
	p = 0.426, RI p = 0.827	*p = 0.382, RI p = 0.843*
Friends Campaign		
Friends x during	0.005	0.006
	(0.033)	(0.026)
	p = 0.879, RI p = 0.424	*p = 0.820, RI p = 0.386*
Friends x post	0.047	0.037
	(0.048)	(0.039)
	p = 0.330, RI p = 0.119	*p = 0.338, RI p = 0.127*
Observations	13981	13981
Avg % with Dose 1 at Baseline	75.2	75.2
Week Fixed Effects	Yes	Yes
Strata Fixed Effects	Yes	Yes

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

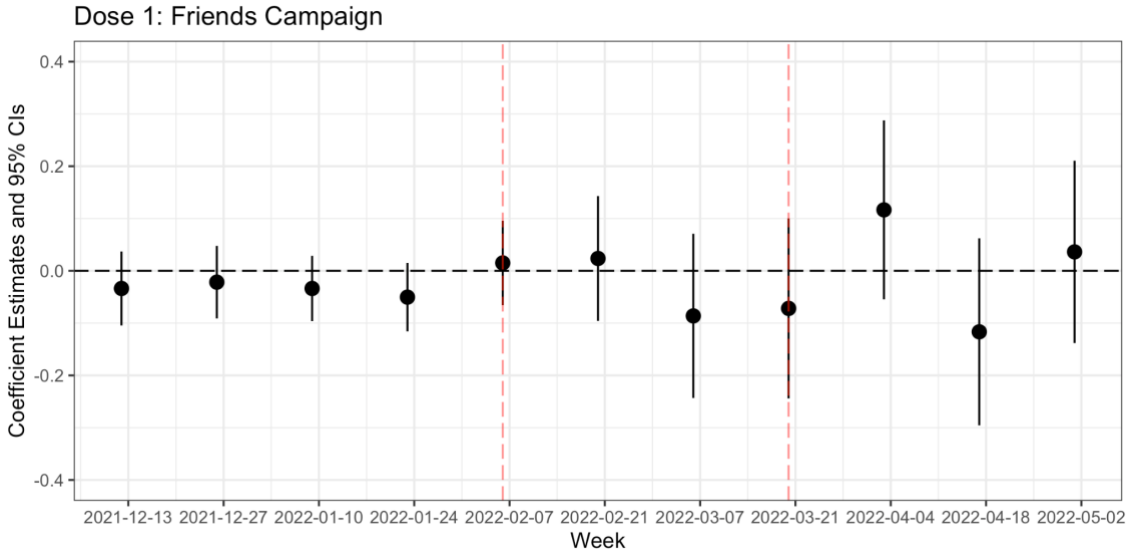
Note: This table presents the result of estimating Equation (2) for France. Only the β_1 and β_2 coefficients are reported and show the effect of the campaigns on the inverse hyperbolic sine (Column 1) or logarithm (Column 2) of new first doses within two weeks. Standard errors are reported in parentheses and we provide standard p-values and p-values from randomization inference of the estimated coefficients below. Regressions include week and region fixed effects, as well as LASSO-selected controls including population and baseline vaccination rates. Standard errors have been clustered at the EPCI or postal code level.

Supplementary Figure 2a: Two-week-by-two-week impact of the Direct campaign on first vaccination, France



Notes: This figure presents the estimated coefficients $\beta_{1,t}$ in Equation (1) for France along with 95% confidence intervals, using the number of first dose vaccinations within two weeks as the outcome variable. The red dotted vertical lines indicate the beginning and the end of the campaign. The regression includes week and strata fixed effects, as well as LASSO-selected controls including population and baseline vaccination rates. Standard errors have been clustered at the EPCI or postal code level.

Supplementary Figure 2b: Two-week-by-two-week impact of the Friends campaign on first vaccination, France



Notes: This figure presents the estimated coefficients $\beta_{2,t}$ in Equation (1) for France along with 95% confidence intervals, using the number of first dose vaccinations within two weeks as the outcome variable. The red dotted vertical lines indicate the beginning and the end of the campaign. The regression includes week and strata fixed effects, as well as LASSO-selected controls including population and baseline vaccination rates. Standard errors have been clustered at the EPCI or postal code level.

US results on completed vaccinations, boosters, and any doses– In Supplementary Tables 4 and 5, we demonstrate that the treatments still have a null effect when using new completed vaccinations or new booster shots as the outcome variables. In the US, no intervention was successful at boosting any of these vaccination measures. Note that for France, booster shots are not available at our level of granularity for the considered time period and *completed vaccinations* would give us flawed information: at the time, the French administration considered people with a first dose of vaccine who were recently infected by COVID-19 to be fully vaccinated.

Supplementary Table 4: Effects of Facebook campaigns on new COVID-19 completed vaccinations, USA

	Asinh(New Completed)	Log(New Completed + 1)
Direct x during	−0.017	−0.012
	(0.037)	(0.034)
Direct x post	−0.028	−0.018
	(0.052)	(0.045)
Friends x during	0.021	0.019
	(0.039)	(0.035)
Friends x post	0.018	0.024
	(0.051)	(0.045)
Gossips x during	0.034	0.033
	(0.039)	(0.035)
Gossips x post	−0.019	−0.012
	(0.053)	(0.047)
% Complete at Baseline	−0.068***	−0.064***
	(0.014)	(0.013)
Observations	21 834	21 834
Avg % with Completed vacc. at Baseline	45.08	45.08
Week Fixed Effects	Yes	Yes
Strata Fixed Effects	Yes	Yes

* p < 0.1, ** p < 0.05, *** p < 0.01

Note: This table presents the result of the estimation of Equation (2) for the US. The β_1, β_2 and β_3 are reported and show the effects of the campaigns on the inverse hyperbolic sine (Column 1) or the logarithm (Column 2) of the number of new completed vaccinations within a week. Standard errors of the estimated coefficients are reported in parentheses. Regressions include week and strata fixed effects, as well as LASSO-selected controls, from a pool of county-level characteristics. Standard errors have been clustered at the county level.

Supplementary Table 5: Effects of Facebook campaigns on new COVID-19 booster vaccinations, USA

	Asinh(New Boosters)	Log(New Boosters + 1)
Direct	−0.031	−0.031
	(0.047)	(0.045)
Friends	−0.019	−0.018
	(0.049)	(0.047)
Gossips	−0.002	−0.002
	(0.048)	(0.046)
Direct x post	0.016	0.016
	(0.043)	(0.038)
Friends x post	0.006	0.015
	(0.044)	(0.039)
Gossips x post	0.012	0.011
	(0.044)	(0.040)
Observations	9704	9704
Week Fixed Effects	Yes	Yes
Strata Fixed Effects	Yes	Yes

* p < 0.1, ** p < 0.05, *** p < 0.01

Note: This table presents the result of the estimation of Equation (2) for the US with booster shots as the outcome variable. Because booster shot data only became available during the campaign, we drop the interactions with "Pre" and "During" from the equation. Only the β_1, β_2 and β_3 coefficients are reported and show the effects of the campaigns on the inverse hyperbolic sine (Column 1) or the logarithm (Column 2) of the number of new booster vaccinations within a week. Standard errors of the estimated coefficients are reported in parentheses. Regressions include week and strata fixed effects, as well as LASSO-selected controls from a pool of county-level demographics. Standard errors have been clustered at the county level.

US heterogeneity analysis– In the US, we pre-registered studying heterogeneity by political leaning, urban/rural status, and prior immunization status. These results are presented in Supplementary Tables 6 & 7. We do not find any important differences by these characteristics[2], although it is worth noting that nearly all of our sample was Republican-leaning, rural, and low immunization, so given how it was selected, these are gradations within this group.

[2] Some interactions with the "Gossip" campaign have significant coefficients and would suggest a positive impact on any vaccines with a negative interaction on GOP win margin and urban status. Note however that the Gossip x post interaction vanishes in two of the three specifications and that, in light of all other results and the fact that we expect 5% of coefficients to be significant by chance at the 5% level, we do not think these results are likely to be real causal effects

Supplementary Table 6: Heterogeneity Analysis (Booster shots), USA

	Asinh(New boosters)	Asinh(New boosters)	Asinh(New boosters)
Direct	−0.058	−0.018	−0.020
	(0.081)	(0.052)	(0.242)
Friends	−0.030	0.005	−0.014
	(0.085)	(0.052)	(0.221)
Gossips	0.011	−0.029	−0.010
	(0.081)	(0.053)	(0.235)
Direct x GOP Win Margin	0.088		
	(0.178)		
Friends x GOP Win Margin	0.035		
	(0.190)		
Gossips x GOP Win Margin	−0.026		
	(0.187)		
Direct x Metro		−0.022	
		(0.091)	
Friends x Metro		−0.070	
		(0.096)	
Gossips x Metro		0.083	
		(0.091)	
Direct x % Complete at Baseline			0.000
			(0.005)
Friends x % Complete at Baseline			0.000
			(0.005)
Gossips x % Complete at Baseline			0.000
			(0.005)
GOP Win Margin	0.806	0.907	0.760
	(6.865)	(6.798)	(6.820)
% Complete at Baseline	−0.003	−0.002	−0.003
	(0.014)	(0.014)	(0.014)
Observations	9704	9704	9704
Week Fixed Effects	Yes	Yes	Yes
Strata Fixed Effects	Yes	Yes	Yes

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: This table presents the result of estimating three different regressions for the US to explore heterogeneous treatment effects by adding interactions with specific county-level characteristics. The number of new boosters in a week is used as outcome variable and only the "during" (26 Dec 2021 - 30 Jan 2022) and "post" (30 Jan 2022 - 20 Feb 2022) periods are used because no boosters were administered prior to the intervention. Column (1) presents a regression where treatment status is interacted with GOP Win margin in the 2020 elections. Column (2) includes the interaction with the status of the county of residence (urban or rural area). Finally, Column (3) includes the interaction with the initial rate of completed vaccination schemes. All regressions include week and strata fixed effects, as well as LASSO-selected controls from a pool of county-level demographics. Standard errors have been clustered at the county level.

Supplementary Table 7: Heterogeneity Analysis (Any new vaccine), USA

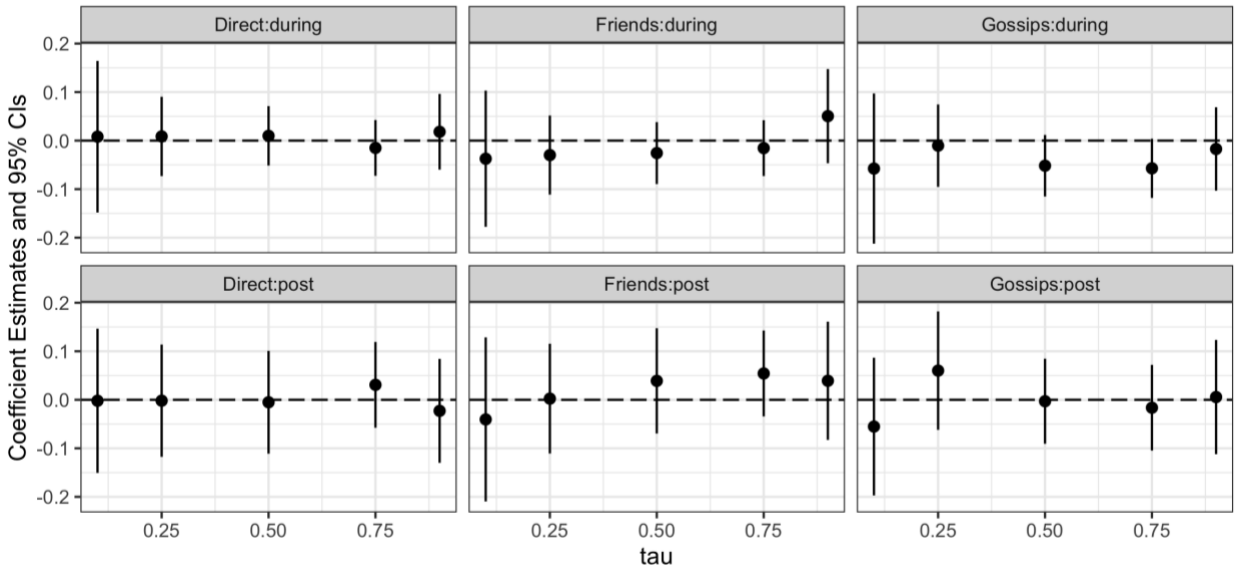
	Asinh(Any new vaccine)	Asinh(Any new vaccine)	Asinh(Any new vaccine)
Direct x during	−0.015	−0.037	−0.070
	(0.063)	(0.041)	(0.205)
Direct x post	0.079	−0.038	−0.019
	(0.079)	(0.061)	(0.224)
Friends x during	0.011	0.003	0.038
	(0.068)	(0.043)	(0.187)
Friends x post	0.107	−0.012	0.191
	(0.079)	(0.061)	(0.181)
Gossips x during	0.081	−0.063	−0.167
	(0.062)	(0.046)	(0.195)
Gossips x post	0.155*	−0.066	−0.154
	(0.086)	(0.064)	(0.223)
GOP Win Margin x Direct x during	0.008		
	(0.141)		
GOP Win Margin x Direct x post	−0.234		
	(0.151)		
GOP Win Margin x Friends x during	0.008		
	(0.156)		
GOP Win Margin x Friends x post	−0.230		
	(0.145)		
GOP Win Margin x Gossips x during	−0.232		
	(0.144)		
GOP Win Margin x Gossips x post	−0.439**		
	(0.174)		
is_urban x Direct x during		0.081	
		(0.075)	
is_urban x Direct x post		0.096	
		(0.095)	
is_urban x Friends x during		0.036	
		(0.077)	
is_urban x Friends x post		0.101	
		(0.097)	
is_urban x Gossips x during		0.151**	
		(0.071)	
is_urban x Gossips x post		0.147	
		(0.092)	
% Complete at Baseline x Direct x during			0.001
			(0.005)
% Complete at Baseline x Direct x post			0.000
			(0.005)
% Complete at Baseline x Friends x during			−0.001
			(0.004)
% Complete at Baseline x Friends x post			−0.004
			(0.004)
% Complete at Baseline x Gossips x during			0.004
			(0.004)
% Complete at Baseline x Gossips x post			0.003
			(0.005)
GOP Win Margin	3.143	3.050	2.925
	(6.412)	(6.388)	(6.394)
% Complete at Baseline	−0.077***	−0.076***	−0.077***
	(0.014)	(0.014)	(0.014)
Observations	21 834	21 834	21 834
Week Fixed Effects	Yes	Yes	Yes
Strata Fixed Effects	Yes	Yes	Yes

* p < 0.1, ** p < 0.05, *** p < 0.01

Note: This table presents the result of the estimation of three different regressions for the US to explore heterogeneity patterns, by adding interactions with selected county-level characteristics. The number of any new vaccine dose is used as outcome variable. Column (1) presents a regression where the interaction with the 2020 election GOP Win-margin has been added. Column (2) includes the interaction with the status of the county of residence (urban or rural area). Finally, Column (3) includes the interaction with the initial rate of completed vaccination schemes. All regressions include week and strata fixed effects, as well as LASSO-selected controls from a pool of county-level demographics. Standard errors have been clustered at the county level.

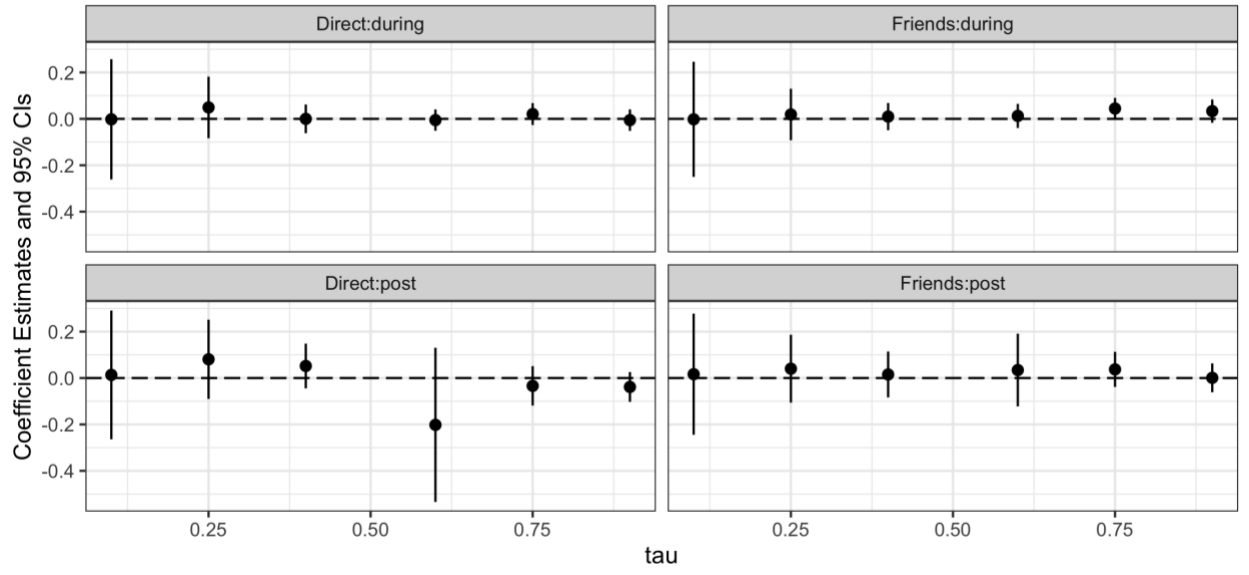
Quantile regression analysis– Finally, following our pre-analysis plan, we present below the results from running a quantile regression on new first doses in the US and in France. This is to alleviate the concern that the treatment effects might have been cancelling out each other if, say, the least vaccinated areas were positively affected by the campaign while the most vaccinated were negatively affected ("backfiring" effect). These are presented in Supplementary Figures 3a (US) and 3b (France) and demonstrate a null treatment effect along the entire distribution.

Supplementary Figure 3a: Quantile Regression on 1st dose vaccinations, USA



Notes: These figures present the results of the quantile regressions based on Equation (1) for the US, using the number of new first doses in a week as the outcome variable. The 95% confidence intervals are plotted. The standard quantiles are used (tau): 5%, 25%, 50%, 75%, and 95%. Regressions include week and strata fixed effects, as well as LASSO-selected controls, from a pool of county-level demographics. Standard errors have been clustered at the county level.

Supplementary Figure 3b: Quantile Regression on 1st dose vaccinations, France



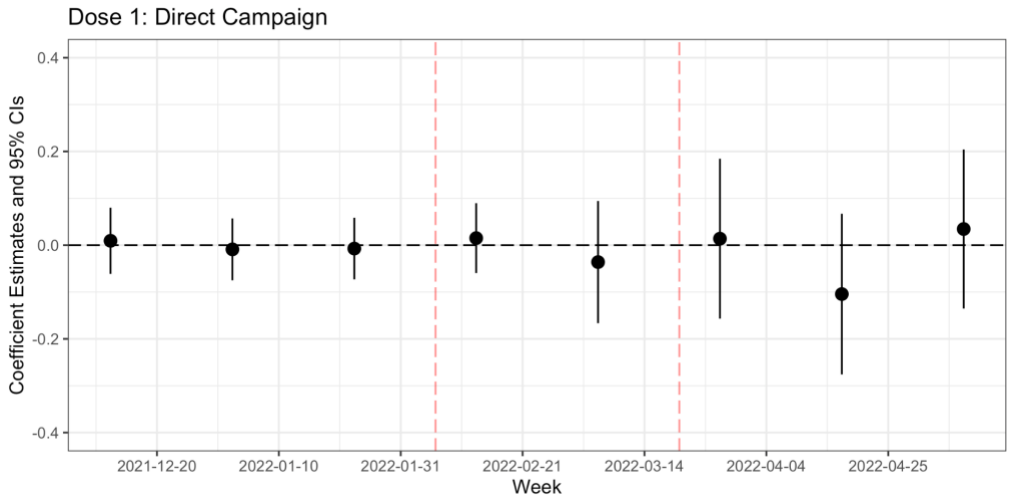
Notes: These figures present the results of the quantile regressions based on Equation (1) for France, using the number of new first doses within a two-week period as the outcome variable. The 95% confidence intervals are plotted. For France, we use the following quantiles: 10%, 25%, 40%, 60%, 75% and 95%. We use the 40th and 60th quantile instead of the median because of discontinuities in the outcome variable in the post period around the median, leading to highly imprecise estimates. Regressions include week and strata fixed effects, as well as population and baseline vaccination rates controls. Standard errors have been clustered at the EPCI or postal code level.

C. Robustness checks

Robustness to three-week aggregation– For France, vaccination counts are aggregated at the two-weeks level in Equation (1). This two-week aggregation is done to reduce the number of zeros in the outcome distribution: given the granularity and timeline of our intervention, a substantial fraction of units had zero new vaccinations reported in a given week, some of which resulted from the 10-cases reporting threshold the French administrative data imposes. Thus, moving from a week-level aggregation to a two-weeks-level aggregation reduces the share of zeros from 30.6% to 20.6%, and it is further reduced to 15.2% when using a 3-weeks-level aggregation. In Supplementary Figures 4a and 4b (below) we show that our results are robust to using a three-week aggregation.

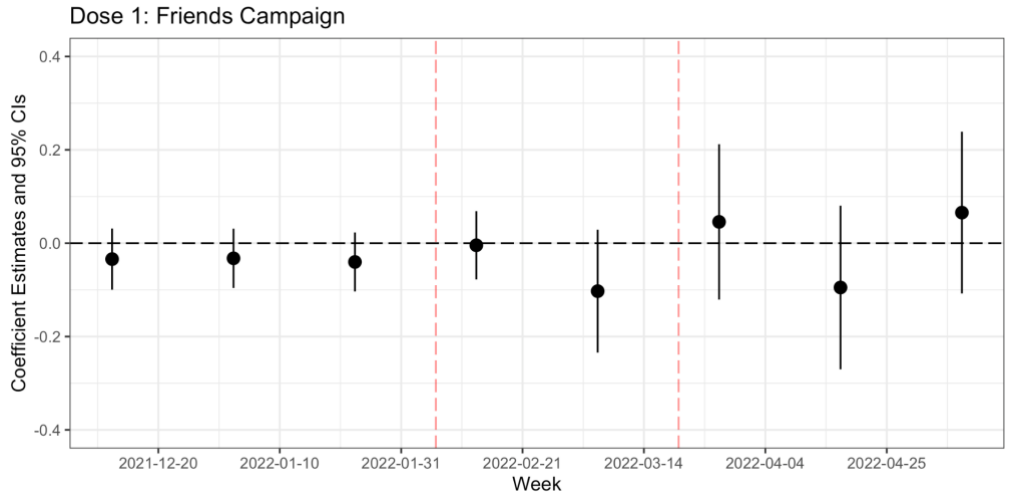
Robustness to negative binomial specification– Because the new vaccination distribution in France is skewed towards 0, we also carry out a negative binomial specification, presented in Supplementary Figures 5a-5b, which again gives us similar results. We estimate the negative binomial regression using the R MASS package and include population, percentage of population with a first dose at baseline as well as week and strata fixed effects as control variables.

Supplementary Figure 4a: Three-week-by-three-week impact of the Direct campaign on first vaccination, France



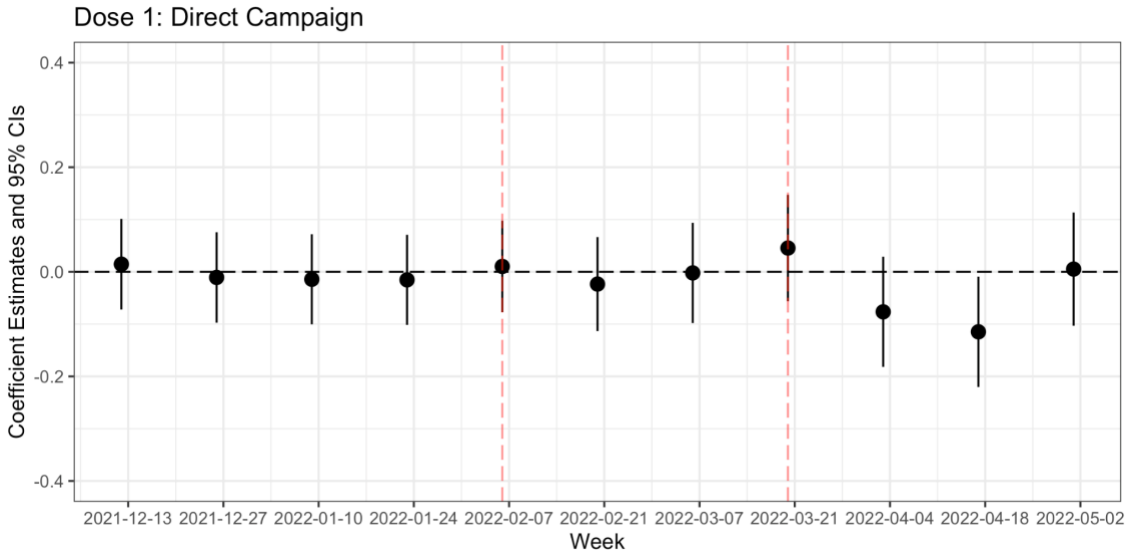
Notes: This figure presents the estimated coefficients $\beta_{1,t}$ from Equation (1) for France along with 95% confidence intervals, using the number of first dose vaccinations within three weeks as the outcome variable. The red dotted vertical lines indicate the beginning and the end of the campaign. The regression includes week and strata fixed effects, as well as LASSO-selected controls including population and baseline vaccination rates. Standard errors have been clustered at the EPCI or postal code level.

Supplementary Figure 4b: Three-week-by-three-week impact of the Friends campaign on first vaccination, France



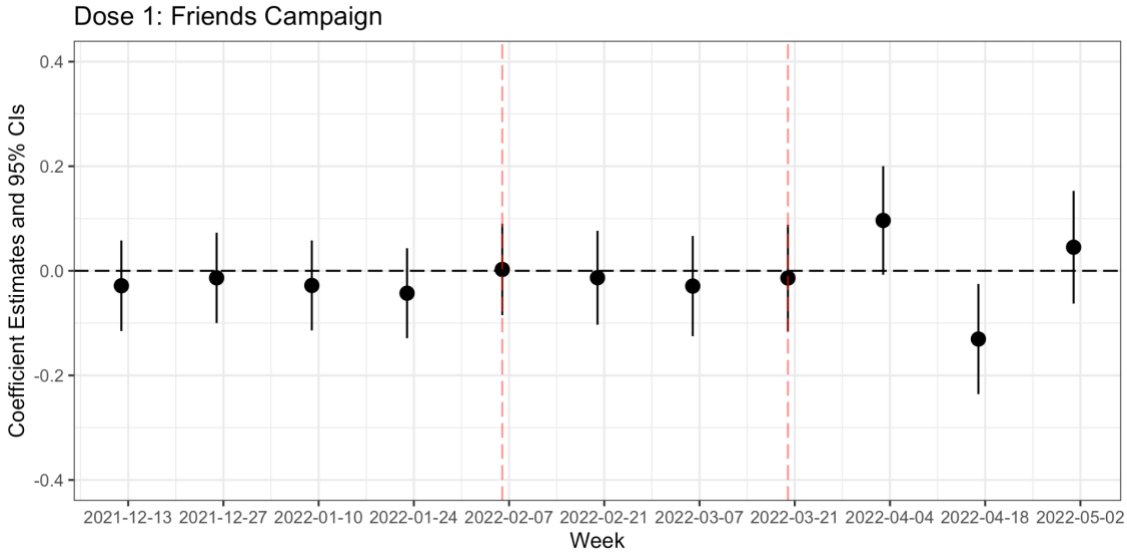
Notes: This figure presents the estimated coefficients $\beta_{2,t}$ from Equation (1) for France along with 95% confidence intervals using the number of first dose vaccinations within three weeks as the outcome variable. The red dotted vertical lines indicate the beginning and the end of the campaign. The regression includes week and strata fixed effects, as well as LASSO-selected controls including population and baseline vaccination rates. Standard errors have been clustered at the EPCI or postal code level.

Supplementary Figure 5a: Two-week-by-two-week impact of the Direct campaign on first vaccination, France (negative binomial regression)



Notes: This figure presents the estimated coefficients $\beta_{1,t}$ from Equation (1) with a negative binomial regression for France along with 95% confidence intervals using the number of first dose vaccinations within two weeks as the outcome variable. The red dotted vertical lines indicate the beginning and the end of the campaign. The regression includes week and strata fixed effects, as well as LASSO-selected controls including population and baseline vaccination rates. Standard errors have been clustered at the EPCI or postal code level.

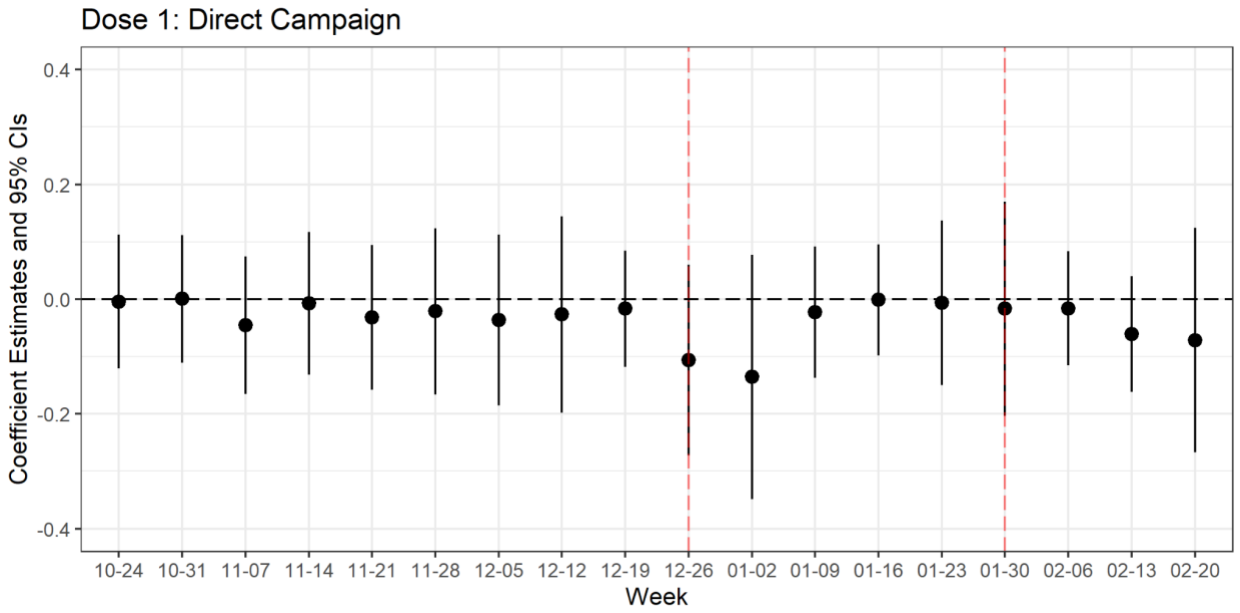
Supplementary Figure 5b: Two-week-by-two-week impact of the Friends campaign on first vaccination, France (negative binomial regression)



Notes: This figure presents the estimated coefficients $\beta_{2,t}$ from Equation (1) with a negative binomial regression for France along with 95% confidence intervals using the number of first dose vaccinations within two weeks as the outcome variable. The red dotted vertical lines indicate the beginning and the end of the campaign. The regression includes week and strata fixed effects, as well as LASSO-selected controls including population and baseline vaccination rates. Standard errors have been clustered at the EPCI or postal code level.

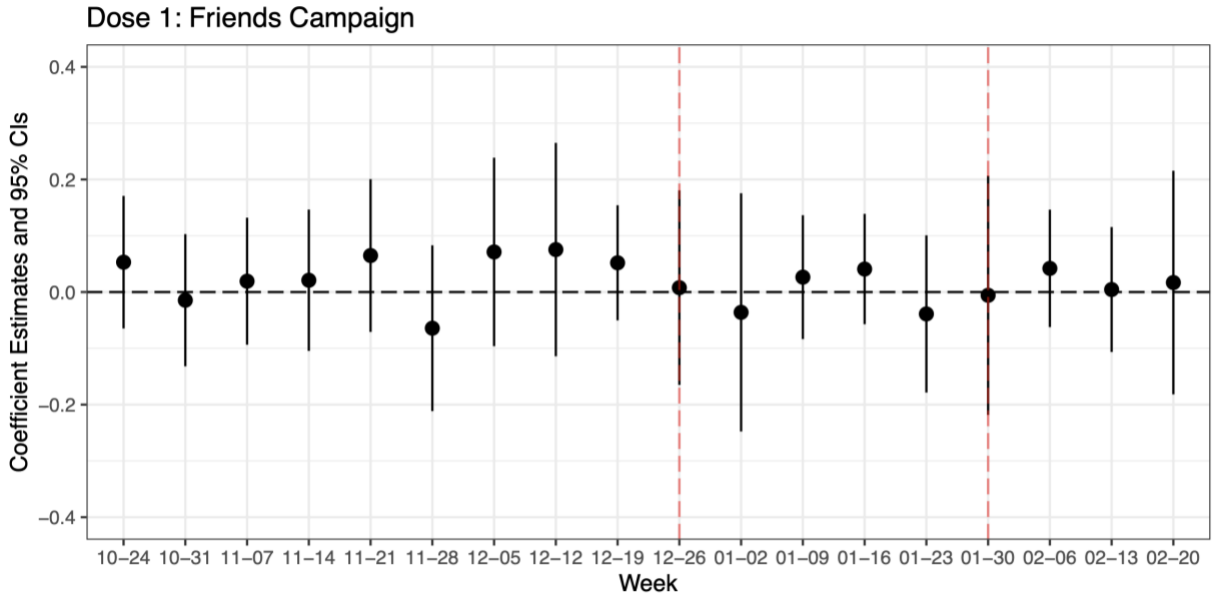
Robustness to pre-trend reweighting– In Figure 1 from the main paper, estimated coefficients from before the intervention are mostly negative, and one could be worried that this pre-trend imbalance is causing the null result that otherwise would have been positive. To alleviate this concern, we present in Supplementary Figure 6a-c the weekly treatment effect of the campaigns again, where we reweight pre-trend imbalances using entropy weighting (Hainmuller 2012). Weights are calibrated to match pre-intervention periods across groups and then entered in a weighted regression to estimate week-by-week treatment effects as in Equation (1). Results are robust to this reweighting.

Supplementary Figure 6a: Week-by-week impact of the Direct campaigns on first vaccination with entropy weighting, USA



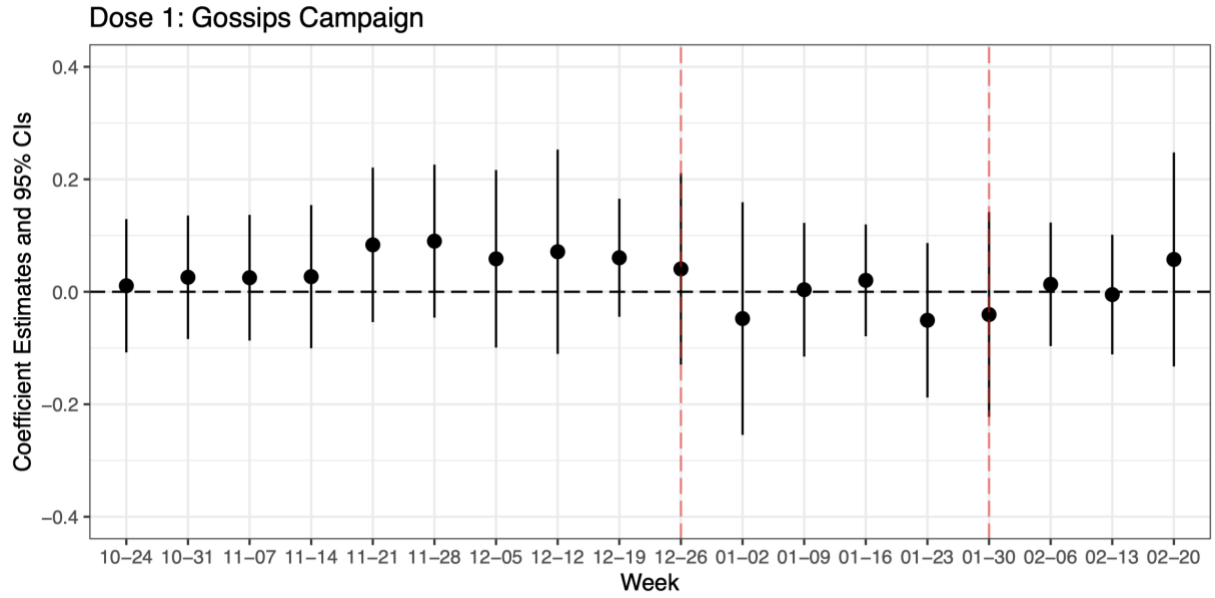
Notes: This figure presents the estimated coefficients $\beta_{1,t}$ from Equation (1) for the US along with 95% confidence intervals using the number of new first doses in a week as the outcome variable. The regression includes entropy weights calibrated to match the Direct and Control groups on county-level characteristics (population, urban/rural status, political leaning, baseline vaccination rates) and pre-intervention vaccination counts. The red dotted vertical lines indicate the beginning and the end of the campaign. The regression includes week and strata fixed effects, as well as LASSO-selected controls from a pool of county-level demographics. Standard errors are clustered at the county level.

Supplementary Figure 6b: Week-by-week impact of the Friends campaigns on first vaccination with entropy weighting, USA



Notes: This figure presents the estimated coefficients $\beta_{2,t}$ in Equation (1) for the US along with 95% confidence intervals using the number first doses in a week as the outcome variable. The regression includes entropy weights calibrated to match the Friends and Control groups on county-level characteristics (population, urban/rural status, political leaning, baseline vaccination rates) and pre-intervention vaccination counts. The red dotted vertical lines indicate the beginning and the end of the campaign. The regression includes week and strata fixed effects, as well as LASSO-selected controls from a pool of county-level demographics. Standard errors have been clustered at the county level.

Supplementary Figure 6c: Week-by-week impact of the Gossips campaigns on first vaccination with entropy weighting, USA



Notes: This figure presents the estimated coefficients $\beta_{3,t}$ in Equation (1) for the US along with 95% confidence intervals using the number of first doses in a week as the outcome variable. The regression includes entropy weights calibrated to match the Gossips and Control groups on county-level characteristics (population, urban/rural status, political leaning, baseline vaccination rates) and pre-intervention vaccination counts. The red dotted vertical lines indicate the beginning and the end of the campaign. The regression includes week and strata fixed effects, as well as LASSO-selected controls from a pool of county-level demographics. Standard errors have been clustered at the county level.

Robustness to inclusion of Alaska– In the US, county-level GOP votes were not available for Alaska. In Supplementary Table 8a, we exclude GOP vote shares in our control variables and demonstrate that results are robust to this inclusion of Alaska.

Supplementary Table 8a: Effects of Facebook campaigns on new COVID-19 dose 1 vaccinations, USA (with Alaska)

	Asinh(New Dose 1)	Log(New Dose 1 + 1)
Direct x during	−0.014	−0.009
	(0.039)	(0.036)
Direct x post	−0.006	0.000
	(0.043)	(0.038)
Friends x during	−0.015	−0.014
	(0.039)	(0.036)
Friends x post	0.018	0.028
	(0.046)	(0.041)
Gossips x during	−0.039	−0.037
	(0.036)	(0.033)
Gossips x post	−0.018	−0.018
	(0.044)	(0.039)
% Dose 1 at Baseline	0.101***	0.097***
	(0.014)	(0.013)
Observations	22 356	22 356
Avg % with Dose 1 at Baseline	51.7	51.7
Week Fixed Effects	Yes	Yes
Strata Fixed Effects	Yes	Yes

* p < 0.1, ** p < 0.05, *** p < 0.01

Note: This table presents the effects of the campaigns on the inverse hyperbolic sine (Column 1) or the logarithm (Column 2) of the number of new first doses in a week. Standard errors are reported in parentheses. Regressions include week and strata fixed effects, as well as LASSO-selected controls, from a pool of county-level demographics, but exclude GOP win margin in order to include Alaska. Standard errors have been clustered at the county level.

Robustness to inclusion of geographic units without socioeconomic control variables– In France, socioeconomic control variables were not available for 4 EPCIs and 5 postal codes. In Supplementary Table 8b, we exclude these socioeconomic controls and demonstrate that results are robust to the inclusion of these EPCIs/postal codes.

Supplementary Table 8b: Effects of Facebook campaigns on new COVID-19 dose 1 vaccinations, France (with EPCIs/postal codes missing socioeconomic data)

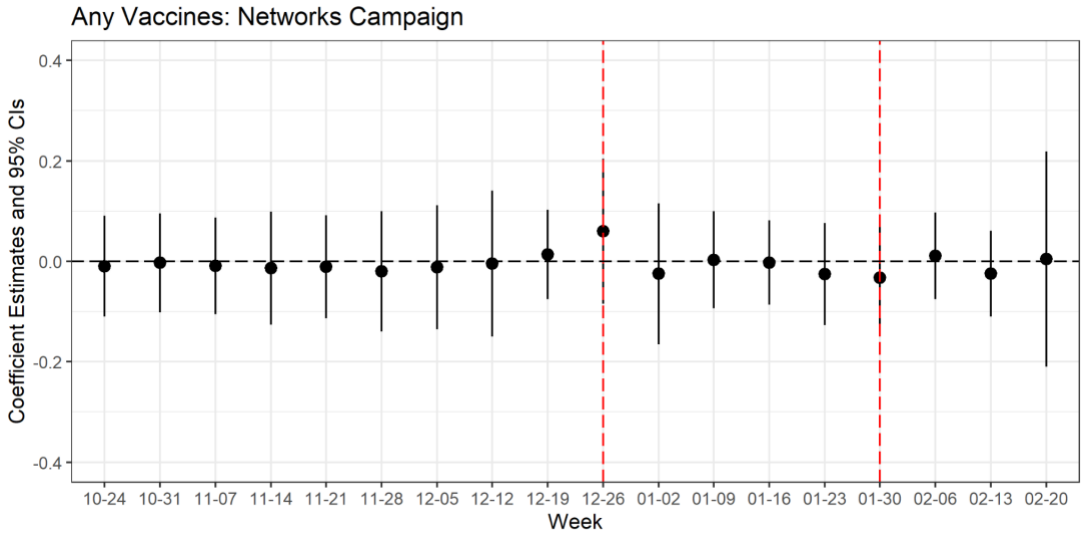
	(1)	(2)
	Asinh(New Dose 1)	Log(New Dose 1 + 1)
Direct Campaign		
Direct x during	0.019	0.015
	(0.032)	(0.025)
	p = 0.558	*p = 0.552*
Direct x post	-0.037	-0.033
	(0.049)	(0.040)
	p = 0.447	*p = 0.408*
Friends Campaign		
Friends x during	0.009	0.008
	(0.033)	(0.026)
	p = 0.792	*p = 0.750*
Friends x post	0.043	0.033
	(0.049)	(0.040)
	p = 0.385	*p = 0.407*
Observations	14080	14080
Avg % with Dose 1 at Baseline	75.2	75.2
Week Fixed Effects	Yes	Yes
Strata Fixed Effects	Yes	Yes

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Note: This table presents the effects of the campaigns on the inverse hyperbolic sine (Column 1) or the logarithm (Column 2) of the number of new first doses in a two-week period. Standard errors are reported in parentheses. Regressions include week and strata fixed effects, as well as LASSO-selected controls (excluding socioeconomic variables to include the EPCIs/postal codes with missing data in the regressions). Standard errors have been clustered at the EPCI or postal code level.

Robustness to pooling Friends and Gossips– Both "Friends" and "Gossips" campaigns aimed to leverage social networks in order to boost vaccination. To increase power to detect potentially small treatment effects, we present in Supplementary Figure 7 the results when pooling together the two campaigns (on any vaccine - US only). The findings still suggest a null effect.

Supplementary Figure 7: Week-by-week impact of the Friends and Gossips campaigns (pooled) on any vaccination, USA



Notes: This Figure presents the estimated Networks coefficients of a regression similar to Equation (1) for the US, where Friends and Gossips have been pooled in one treatment group (called "Networks"). The number of any new vaccine dose - either first, second or booster dose - in a week is used as the outcome variable. The 95% confidence intervals are plotted. The red dotted vertical lines indicate the beginning and the end of the campaign. The regression includes week and strata fixed effects, as well as LASSO-selected controls, from a pool of county-level demographics. Standard errors have been clustered at the county level.

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[1] Breza, E., Stanford, F. C., Alsan, M., Alsan, B., Banerjee, A., Chandrasekhar, A. G., ... & Duflo, E. (2021). Effects of a large-scale social media advertising campaign on holiday travel and COVID-19 infections: a cluster randomized controlled trial. Nature medicine, 27(9), 1622-1628.

[2] Hainmueller, J. (2012). Entropy balancing for causal effects: A multivariate reweighting method to produce balanced samples in observational studies. Political analysis, 20(1), 25-46.