Digital Public Health Interventions at Scale: The Impact of Social Media Advertising on Beliefs and Outcomes Related to COVID-19 Vaccines

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Core Research Question

- Public health organizations (CDC, WHO, etc.) are increasingly using social media to promote public health goals.
- This paper investigates whether social media campaigns are effective at encouraging COVID-19 vaccinations.
- To explore this question, we look at the near total universe of COVID-19 vaccine focused campaigns run through Meta.
- Main Takeaway: Across all campaigns, we find a cost per additional vaccination of $5.68.

Sample

$40M
Ad Spend

174
Organizations

2.1B
People Reached

819
Experiments

Key Features of Data

- Data came from ad campaigns that conducted experiments where exposure to the ads was randomized at the user level.
  - Allows us to assess the causal effect of each campaign.
  - Especially important in online advertising context, where selection bias is a common obstacle in non-experimental data.

- The ad experiment data can be combined with user-level survey data for a subset of users.
  - Willingness, Importance, Effectiveness, Safety, Trustworthiness of Advertiser, Knowledge, and Social Acceptance of Vaccines

Meta-Analysis Results

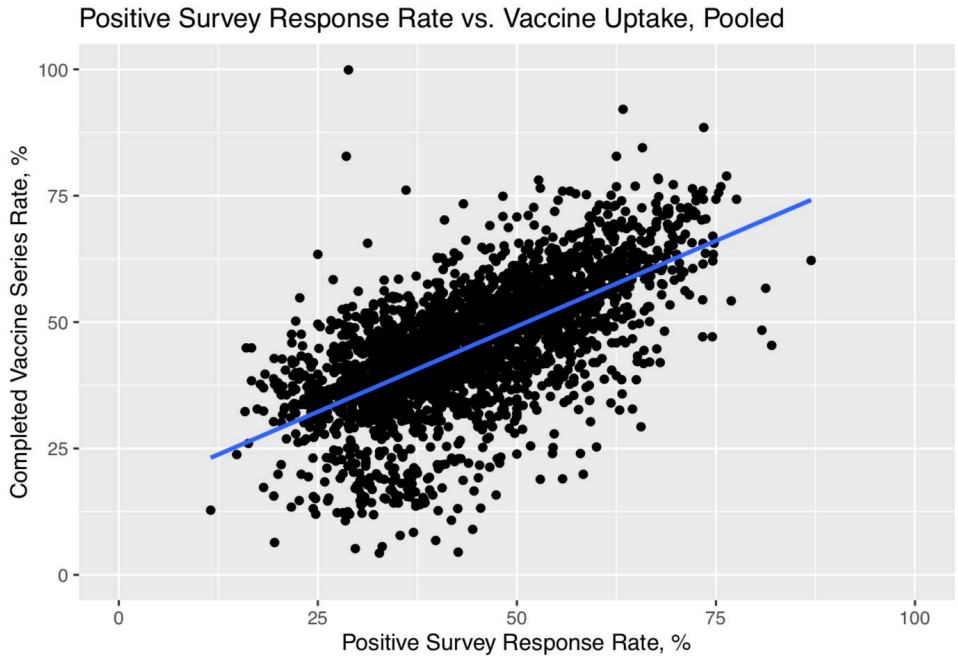
Treatment Coefficient	Standard Error	Cost per Influenced Person	Baseline Positive Response Rate	Cost per Additional Vaccine
0.0055***	0.0008	$3.41	55.7%	$5.68

Outcome-Specific Results

	Knowledge	Social norms	Safety	Importance	Effectiveness	Trustworthy Source	Willingness
Treatment Coefficient	0.0123***	0.0081***	0.0062***	0.0043***	0.0045	0.0012	0.0010
Standard Error	0.0025	0.0024	0.0016	0.0012	0.0029	0.0027	0.0042

Estimating Incremental Vaccine Cost

- Survey outcome is a surrogate for the outcome of interest: vaccine uptake.
- Used non-experimental data from CDC to estimate correlation between US county-level vaccination rates and county-level survey responses.
- Correlation of 0.6 (SE .0174) in a sample of 2,710 counties with more than 20 survey responses.
- Combining with the results of our meta-analysis, this implies that the cost of an incremental vaccine is $5.68.



Key Takeaways

- Digital campaigns may be an **easily scalable** and **cost-effective** intervention that can help organizations pursue a range of health policy goals (ranging from childhood vaccination to hand washing).
- Data suggests these campaigns were a cost-effective approach to increasing **vaccine uptake**.
  - We find a $5.68 estimated cost per additional vaccine
  - Compare to $49-$68 based on evaluations of the Vax-a-Million lottery in Ohio or $1 from a location-randomized YouTube ad experiment
- These insights highlight the potential for social media to be used for social good.

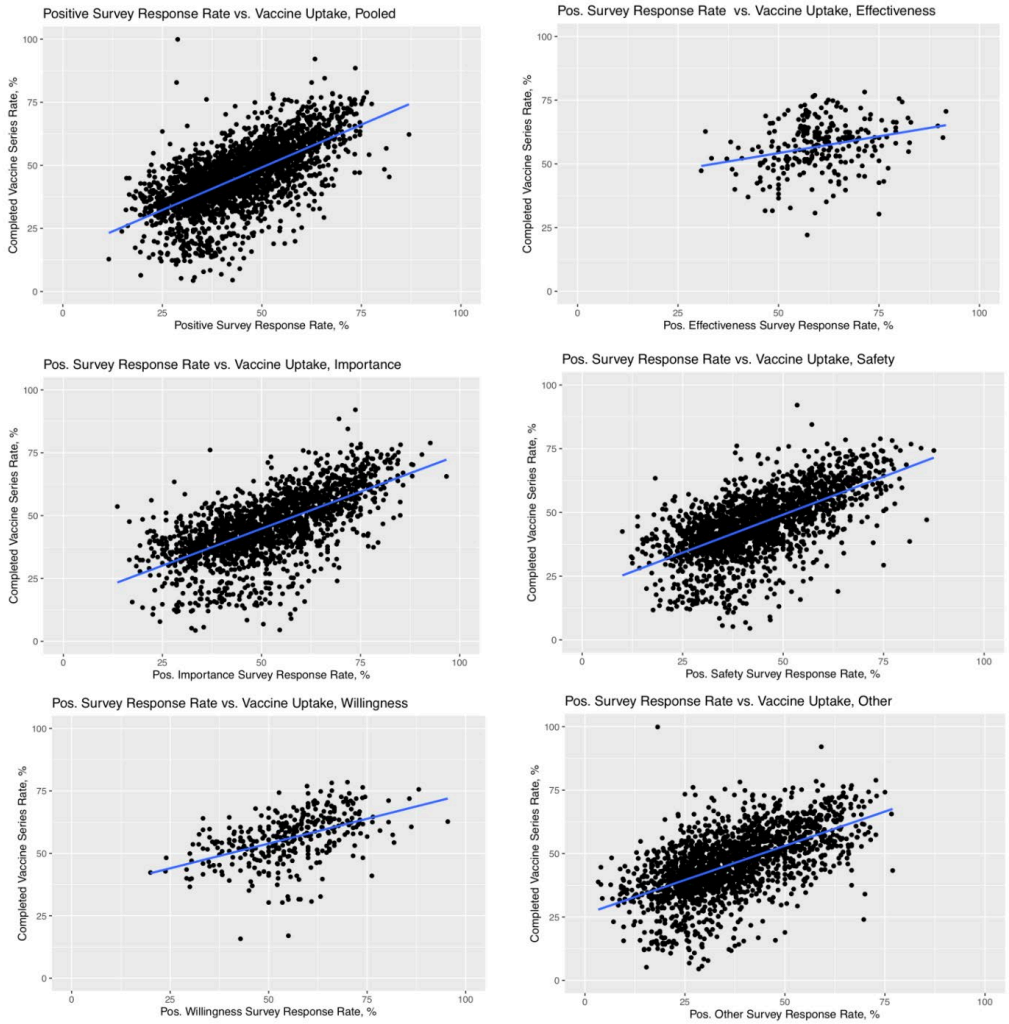
Broader Lessons

- Many of the experiments run by organizations in our sample were underpowered (common in advertising world).
- Companies can learn a lot by conducting meta-analyses.
  - Helps build internal frameworks
  - Can help overcome power limitations from individual experiments
- Companies often work with surrogates (e.g., survey outcomes). Cross-validation of surrogates can be helpful in interpreting results.

Thank you!

Appendix

Comparison to CDC Vaccination Data



Full Results

Table 3. Meta-analysis of experiments by outcome.

Category	Effectiveness	Importance	Knowledge	Safety	Social Norms	Trustworthy Source	Willingness	Overall
Treatment Coefficient	0.0045 (0.0029)	0.0043*** (0.0012)	0.0123*** (0.0025)	0.0062*** (0.0016)	0.0081*** (0.0024)	0.0012 (0.0027)	0.0010 (0.0042)	0.0055*** (0.0008)
p-value	0.114	0.0004	5e-7	8e-5	0.0006	0.639	0.807	2e-13
Cost per Influenced Person	$2.43	$2.41	$0.77	$3.20	$1.00	$11.79	$17.14	$3.41
Baseline Positive Response Rate	0.505	0.672	0.575	0.501	0.556	0.365	0.517	0.557
Treatment Effect as % of Baseline	0.89%	0.64%	2.14%	1.24%	1.46%	0.33%	0.19%	0.99%
Power Calculations (Approximate)								
Minimum Detectable Effect	0.0071	0.0030	0.0061	0.0039	0.0059	0.0066	0.0104	0.0019
Power to Detect Given Effect Size	0.474	0.973	1.000	0.989	0.962	0.120	0.081	1.00
# Experiments Needed for 80% Power	159	115	23	87	57	1,660	4,133	94
# Survey Resp. per Exp for 80% Power	4,349	1,036	426	770	801	49,567	147,635	214