Behavioral Insight Based Interventions to Increase Vaccine Uptake

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The University of Pennsylvania

BEHAVIOR CHANGE FOR GOOD

Interest in COVID-19 Vaccines Before T

USA TODAY

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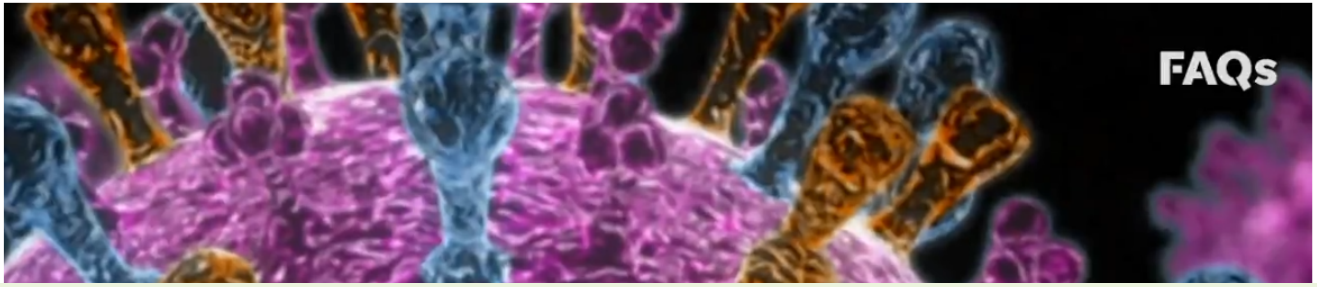
OPINION *This piece expresses the views of its author(s), separate from those of this publication.*

Developing a COVID-19 vaccine is just half the battle — you have to get Americans to take it

We've learned how to increase the chances adults will be vaccinated for the common flu. We need to put those methods into practice for coronavirus.

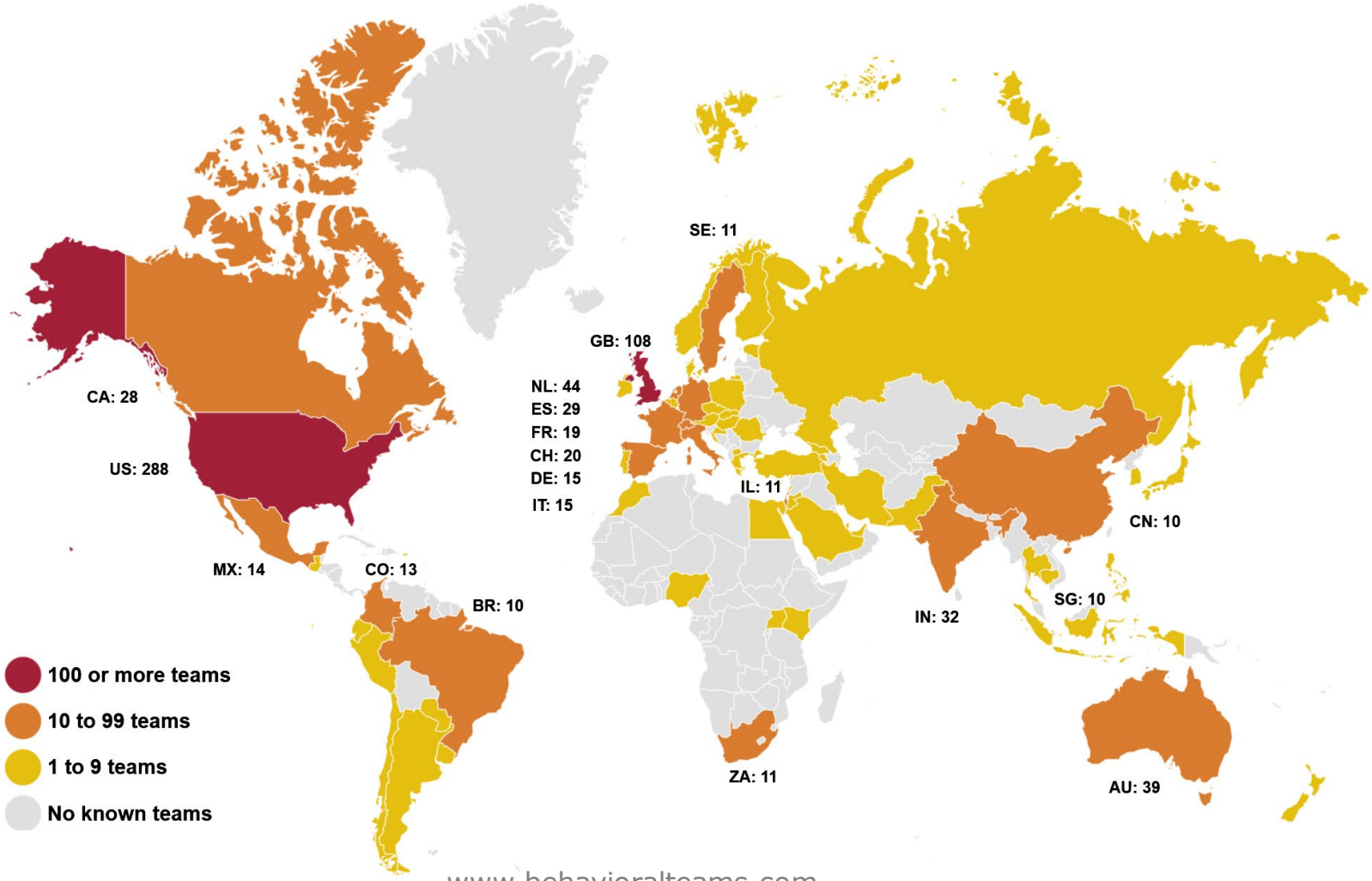
Katherine Milkman, Angela Duckworth, and Mitesh Patel Opinion contributors

Published 5:01 a.m. ET June 5, 2020 | **Updated 6:40 a.m. ET June 5, 2020**



Hundreds of Behavioral Insight Units Are Operating Globally, Many In Governments

(Thaler and Sunstein, 2008)



Talk Overview

1. **Brief Discussion of City-Wide Vaccine Lottery**
2. Pre-COVID Flu Vaccination Megastudy at Walmart Pharmacy
3. COVID Boosters Megastudy at the Pharmacy ****fresh****

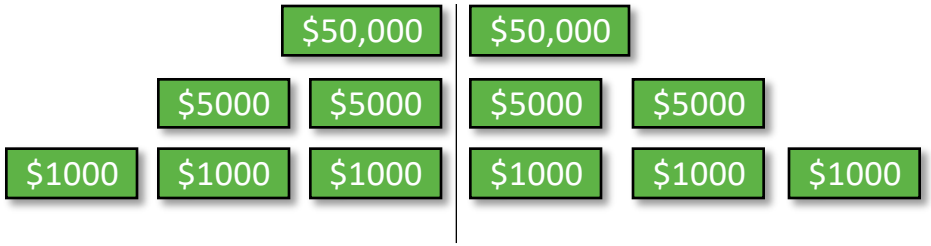
Can Lotteries Boost COVID-19 Vaccine Uptake?

Philly Vax SWEEPSTAKES

Research Question: Do higher odds matter?

~$400k over 3 drawings

Each drawing:



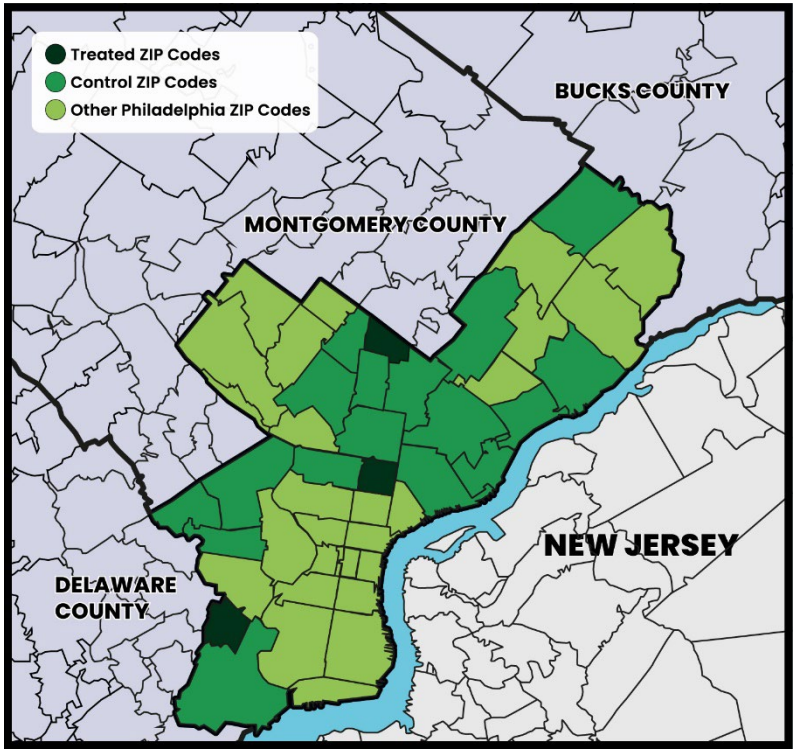
Winners drawn from 1 "priority" zip code

***Higher** odds (smaller population)*

Winners drawn from 45 remaining zip codes

***Lower** odds (larger population)*

Winners drawn from all 46 zip codes



Milkman, K.L, L. Ghandhi, S.F. Ellis, H.N. Graci, D.M Gromet, R.S. Mobarak, A.M. Buttenheim, A.L. Duckworth, D.G. Pope, A. Stanford, R.H. Thaler, and K.G. Volpp. 2022. "A City-Wide Experiment Testing the Impact of Geographically-Targeted, High-Payoff Vaccine Lotteries." *Nature Human Behaviour.* 6: 1515-1524.

Vaccine Lotteries Don't Seem To Boost COVID-19 Vaccination Rates

PLOS ONE

Association between statewide financial incentive programs and COVID-19 vaccination rates

Harsha Thirumurthy[1]*, Katherine L. Milkman[2], Kevin G. Volpp[1], Alison M. Buttenheim[3], Devin G. Pope[4]

1 Department of Medical Ethics and Health Policy, Perelman School of Medicine, University of Pennsylvania, Philadelphia, Pennsylvania, United States of America, **2** Department of Operations, Information and Decisions, The Wharton School, University of Pennsylvania, Philadelphia, Pennsylvania, United States of America, **3** Department of Family and Community Health, School of Nursing, University of Pennsylvania, Philadelphia, Pennsylvania, United States of America, **4** Booth School of Business, University of Chicago, Chicago, Illinois, United States of America

* hthirumu@upenn.edu

Abstract

To promote COVID-19 vaccination, many states in the US introduced financial incentives ranging from small, guaranteed rewards to lotteries that give vaccinated individuals a chance to win large prizes. There is limited evidence on the effectiveness of these programs and conflicting evidence from survey experiments and studies of individual states' lotteries. To assess the effectiveness of COVID-19 vaccination incentive programs, we combined information on statewide incentive programs in the US with data on daily vaccine doses administered in each state. Leveraging variation across states in the daily availability of incentives, our difference-in-differences analyses showed that statewide programs were not associated with a significant change in vaccination rates. Furthermore, there was no significant difference in vaccination trends between states with and without incentives in any of the 14 days before or after incentives were introduced. Heterogeneity analyses indicated that neither lotteries nor guaranteed rewards were associated with significant change in vaccination rates.

"neither lotteries nor guaranteed rewards were associated with significant change in vaccination rates"

Policy Advice Should Ideally Be Based On Field Experiments, But…

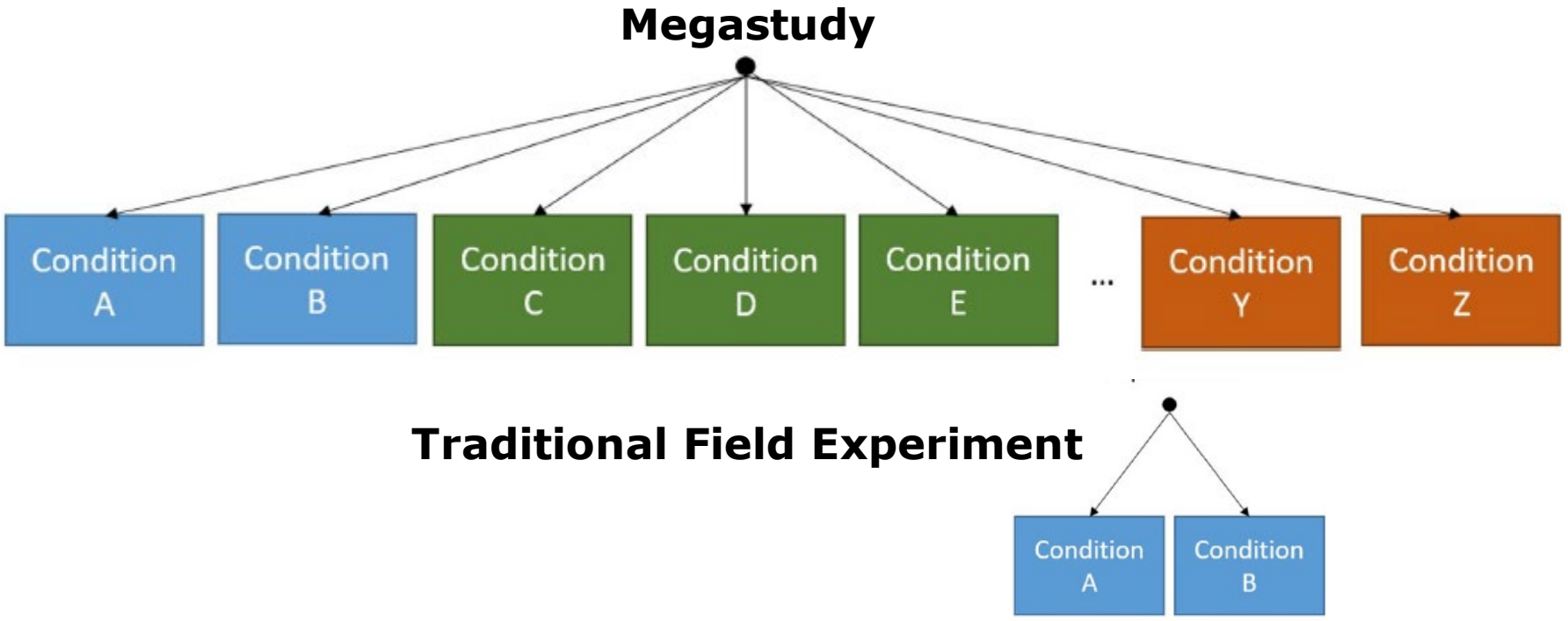
1. Running field experiments requires huge fixed costs and is **slow**
2. Even when we have field studies to look at, looking at effect sizes across studies requires apples to oranges comparisons
3. The replication crisis affects field work too:
   - It's not always clear which behavioral insights are robust
   - The file drawer means we may expend enormous resources to replicate others' failures without knowing it

   (Della Vigna and Linos, 2020)

So, what's the solution?

The "Megastudy"

A megastudy is a ***very large*** field experiment in which many smaller, sub-experiments are run synchronously with the same dependent variable



Milkman et al. (2021). Megastudies Improve the Impact of Applied Behavioural Science. *Nature*.
Duckworth and Milkman (2022). A Guide to Megastudies. *PNAS Nexus*.

Benefits of The Megastudy Approach

1. Allows for **comparability** of results across studies
2. **Fixed costs** of executing the study can be borne by a single central organizer (low marginal costs for scientists)
3. **Reduces risk** of learning nothing useful from field study (and eliminates the file drawer problem)
4. Can be run as a **tournament** with interdisciplinary teams
5. Behavioral **phenotyping** becomes feasible
6. Vastly **accelerates pace of scientific discovery** relative to the usual "one study at a time" process

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A MEGASTUDY WITH *Walmart Pharmacies*

Milkman, K. L., Gandhi, L., Patel, M. S., Graci, H. N., Gromet, D. M., Ho, H., Kay, J. S., Lee, T. W., Rothschild, J., Bogard, J. E., Brody, I., Chabris, C. F., Chang, E., Chapman, G. B., Dannals, J. E., Goldstein, N. J., Goren, A., Hershfield, H., Hirsch, A., … Duckworth, A. L. (2022). A 680,000-Person Megastudy of Nudges to Encourage Vaccination in Pharmacies. *Proceedings of the National Academy of Sciences*, *119*(6), e2115126119. https://doi.org/10.1073/pnas.2115126119

A MEGASTUDY WITH *Walmart Pharmacies*

Participants

- Customers who previously received a flu shot at Walmart during the 2019-2020 flu season

Sample Summary Statistics

- N = 689,693 (~30,000 per condition)
- 62% female
- Avg. age: 60.4 (SD=15.8)

Milkman, K. L., Gandhi, L., Patel, M. S., Graci, H. N., Gromet, D. M., Ho, H., Kay, J. S., Lee, T. W., Rothschild, J., Bogard, J. E., Brody, I., Chabris, C. F., Chang, E., Chapman, G. B., Dannals, J. E., Goldstein, N. J., Goren, A., Hershfield, H., Hirsch, A., … Duckworth, A. L. (2022). A 680,000-Person Megastudy of Nudges to Encourage Vaccination in Pharmacies. *Proceedings of the National Academy of Sciences*, *119*(6), e2115126119. https://doi.org/10.1073/pnas.2115126119

What Did We Test?

Experimental Design

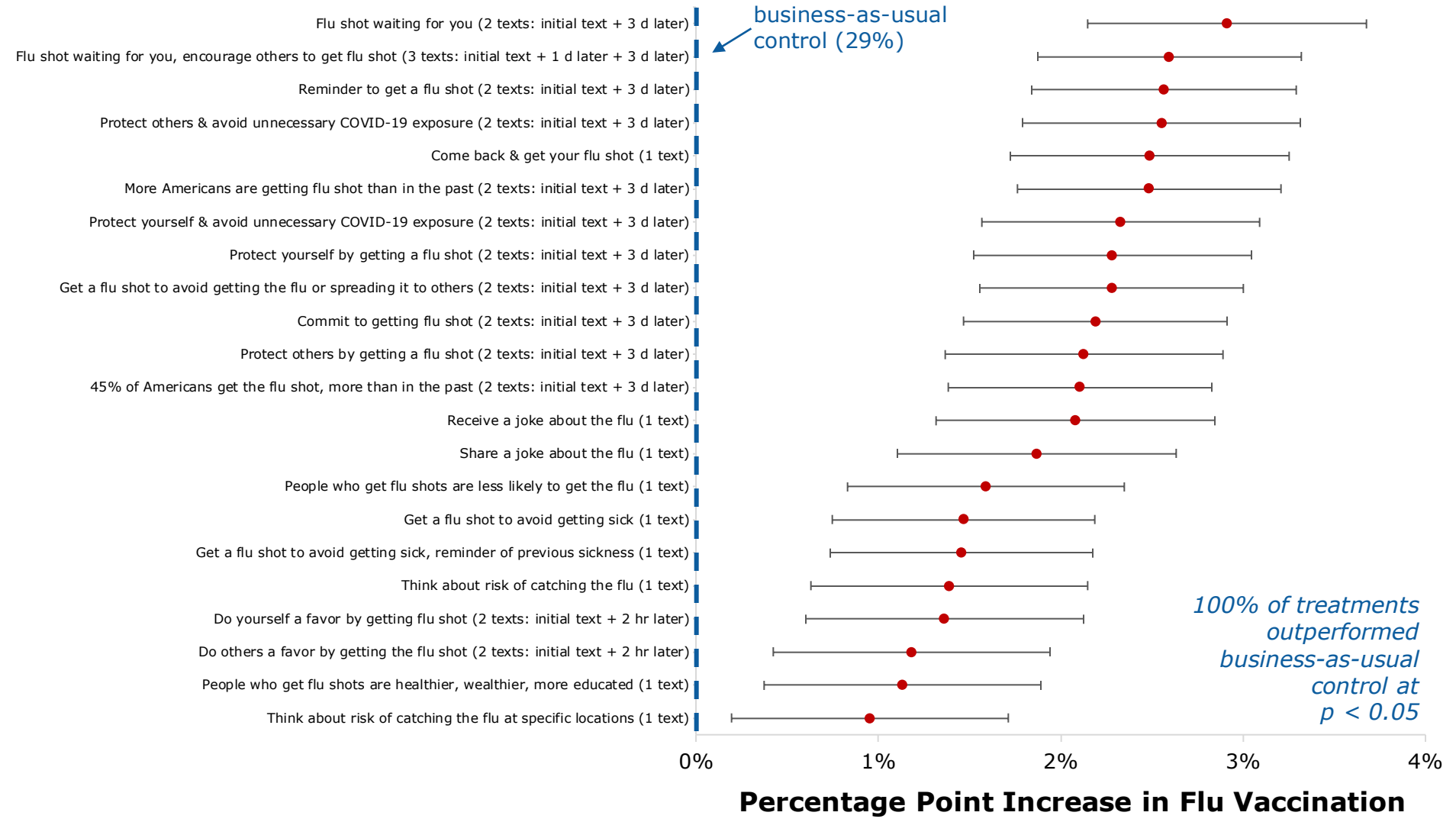
We tested 22 different text messaging strategies

A Sample of What We Tested

- *"Commit to getting a flu shot"*
- *"Get a shot to protect family & friends"*
- *"A shot is waiting for you"*
- *"More Americans are getting a flu shot than in the past"*
- *"People who get the flu shot are healthier, wealthier, and better educated"*

Milkman, K. L., Gandhi, L., Patel, M. S., Graci, H. N., Gromet, D. M., Ho, H., Kay, J. S., Lee, T. W., Rothschild, J., Bogard, J. E., Brody, I., Chabris, C. F., Chang, E., Chapman, G. B., Dannals, J. E., Goldstein, N. J., Goren, A., Hershfield, H., Hirsch, A., … Duckworth, A. L. (2022). A 680,000-Person Megastudy of Nudges to Encourage Vaccination in Pharmacies. *Proceedings of the National Academy of Sciences*, *119*(6), e2115126119. https://doi.org/10.1073/pnas.2115126119

Did We Increase Vaccinations?



whiskers depict +/-95% CIs

Top Performing Intervention: Flu Shot Waiting For You (2 Texts)

Initial Text

WalmartRx - Hi Katherine! It's flu season & you can get a flu shot at Walmart. To help you remember, you'll receive another text in a few days. INFO = info, STOP = opt out. Flu vaccines prevent getting or spreading the flu.

3 Days Later

WalmartRx - Remember a flu shot is waiting for you at Walmart.

(PIs: Noah Goldstein, Jon Bogard)

Key Takeaways

- ✓ **Owership language** reliably improved the performance of vaccine reminders
- ✓ Multiple reminders outperformed single reminders **so nagging works**
- ✓ Informal, interactive texts were less effective

This Extends to COVID-19 Vax Take-Up

nature

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Article | Open Access | Published: 02 August 2021

Behavioural nudges increase COVID-19 vaccinations

Hengchen Dai, Silvia Saccardo, Maria A. Han, Lily Roh, Naveen Raja, Sitaram Vangala, Hardikkumar Modi, Shital Pandya, Michael Sloyan & Daniel M. Croymans

Nature **597**, 404–409 (2021) | Cite this article

27k Accesses | **2** Citations | **604** Altmetric | Metrics

Abstract

Enhancing vaccine uptake is a critical public health challenge[1]. Overcoming vaccine hesitancy[2,3] and failure to follow through on vaccination intentions[3] requires effective communication strategies[3,4]. Here we present two sequential randomized controlled trials to test the effect of behavioural interventions on the uptake of COVID-19 vaccines. We designed text-based reminders that make vaccination salient and easy, and delivered them to participants drawn from a healthcare system one day (first randomized controlled trial) (n = 93,354 participants; clinicaltrials number NCT04800965) and eight days (second randomized controlled trial) (n = 67,092 individuals; clinicaltrials number NCT04801524) after they received a notification of vaccine eligibility. The first reminder boosted appointment and vaccination rates within the healthcare system by 6.07 (84%) and 3.57 (26%) percentage points, respectively; the second reminder increased those outcomes by 1.65 and 1.06 percentage points, respectively. The first reminder had a greater effect when it was designed to make participants feel ownership of the vaccine dose. However, we found no evidence that combining the first reminder with a video-based information intervention designed to address vaccine hesitancy heightened its effect. We performed online studies (n = 3,181 participants) to examine vaccination intentions, which revealed patterns that diverged from those of the first randomized controlled trial; this underscores the importance of pilot-testing interventions in the field. Our findings inform the design of behavioural nudges for promoting health decisions[5], and highlight the value of making vaccination easy and inducing feelings of ownership over vaccines.

The…[text] reminder had a greater effect when it was designed to **make participants feel ownership of the vaccine dose.**

Dai, Saccardo et al. (2021). *Nature*.

This Extends to COVID-19 Vax Take-Up

JAMA Network | Open

Original Investigation | Public Health

Effect of Text Message Reminders and Vaccine Reser to a Health System COVID-19 Vaccination Policy
A Randomized Clinical Trial

Mitesh S. Patel, MD, MBA; Richard Fogel, MD; Angela L. Winegar, PhD; Charles Horseman, MS; Allison Otten Jonathan L. Dukes, PhD, MPH; Teresa C. Brinson, DSL; Shanda C. Price, MSN, RN; Frederick A. Masoudi, MD

Abstract

IMPORTANCE Many organizations implemented COVID-19 vaccination requirements during the pandemic, but the best way to increase adherence to these policies is unknown.

OBJECTIVE To evaluate if behavioral nudges delivered through text messages could accelerate adherence to a health system's COVID-19 vaccination policy.

DESIGN, SETTING, AND PARTICIPANTS This randomized clinical trial was conducted Ascension health system from October 11 to November 8, 2021. Participants include system employees in the Midwest or South US who were not adherent with the vaccin icy 1 month before its deadline. Data were analyzed from November 17, 2021, to Februa 2022.

INTERVENTIONS Participants were randomly assigned to control o receive a text message intervention that stated a vaccine had been reserved for the participant, with a scheduled date for vaccination within a 2-week period. Participants could reschedule to a different date within the period or upload a copy of their vaccination card. Follow-up text message reminders were sent the day before and the day of the appointment.

xt messages with a or vaccination over a eriod accelerate employee erence with a health system COVID-19 vaccination policy?

Findings In this randomized clinical trial of 2000 participants, the behavioral nudge delivered through text messages significantly increased adherence to the health system COVID-19 vaccination policy by 4.9 percentage points compared with the control group during the 2-week intervention period. At the 4-week time point near the vaccination policy deadline, there was no longer a

"a text message intervention that stated a vaccine had been reserved for the participant"

Patel et al. (2022). *JAMA Network Open*.

BUT COULD WE SWING A HEAVIER BAT AT THIS IMPORTANT PROBLEM?

Talk Overview

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2. Pre-COVID Flu Vaccination Megastudy at Walmart Pharmacy
3. **COVID Boosters Megastudy at the Pharmacy **fresh****

A MEGASTUDY TESTING HOW FREE RIDES & TEXT REMINDERS AFFECT COVID-19 *Vaccination Decisions*

Milkman, K.L., Ellis, S.F., Gromet, D.M., Luscher, A.S., Mobarak, R.S., Paxson, M.K., Silvera Zumaran, R.A., Kuan, R., Berman, R., Lewis, N.A., List, J.A., Patel, M.S., Van den Bulte, C., Volpp, K.G., Beauvais, M.V., Bellows, J.K., Marandola, C.A., and Duckworth, A.L. (2023). How do free rides and text reminders affect COVID-19 vaccinations? A 3.5-million person megastudy. *Revise & Resubmit at Nature.*

A MEGASTUDY TESTING HOW FREE RIDES & TEXT REMINDERS AFFECT COVID-19 *Vaccination Decisions*

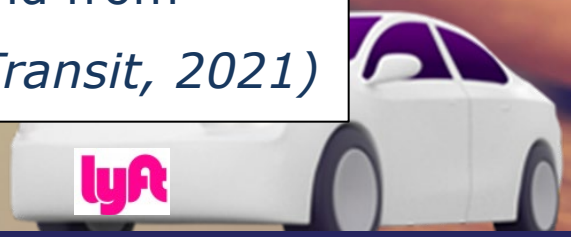
Key Research Question

Do free rides to and from the pharmacy for a vaccination appointment add value?

Why might this work?

- Small transaction costs matter a lot *(Thaler & Sunstein, 2008)*
- Vaccine accessibility has been a widely-discussed challenge *(Feldman, 2021; Mueller, 2021)*
- Those who live further from vaccination sites are less likely to get vaxxed *(Mazar et al., 2022)*

P.S. Large investments were made in free rides to and from vaccination sites in mid-to-late 2021 *(U.S. Dept of Transit, 2021)*



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A MEGASTUDY TESTING HOW FREE RIDES & TEXT REMINDERS AFFECT COVID-19 *Vaccination Decisions*

Patients (N = 3,662,548) randomly assigned to one of **9 experimental conditions** (8 treatments, 1 control)

- Free Rides N = 47,873
- Avg. N in Other Conditions = 492,573
- 40% male, Avg. age 47.3 (SD=17.2), Residents of 65 largest MSAs

Outcome: Receipt of a bivalent COVID booster shot within 30 days of the start of the study period

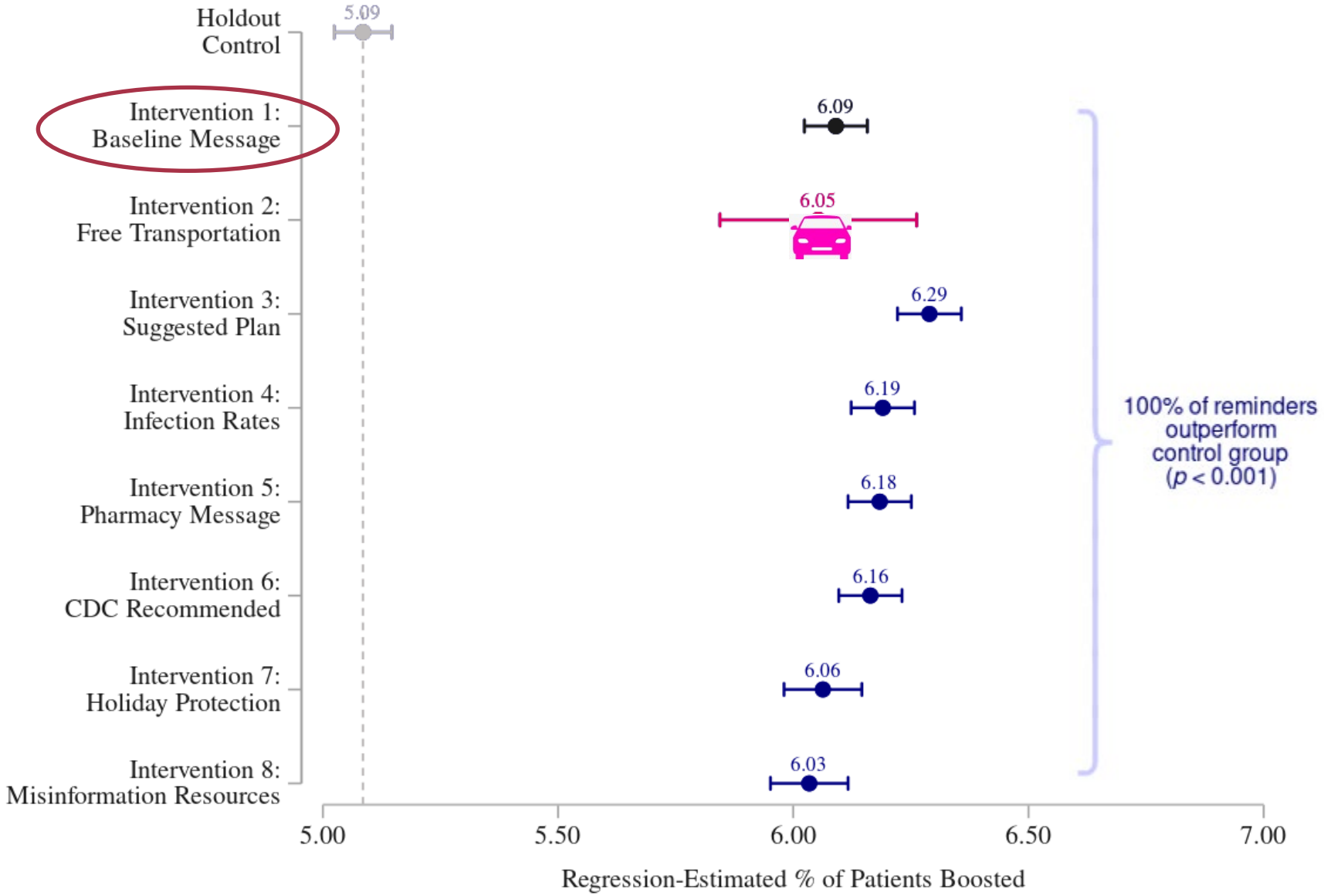
Condition determined which (if any) **text messages** and **free rides** patients received from the pharmacy starting on November 3, 2022

A sample of what we tested:

- Simple "waiting for you" messaging without additions
- Offering a **free Lyft ride** to and from the pharmacy
- Informing patients of high COVID infection rates
- Providing resources to combat misinformation

Milkman, K.L., Ellis, S.F., Gromet, D.M., Luscher, A.S., Mobarak, R.S., Paxson, M.K., Silvera Zumaran, R.A., Kuan, R., Berman, R., Lewis, N.A., List, J.A., Patel, M.S., Van den Bulte, C., Volpp, K.G., Beauvais, M.V., Bellows, J.K., Marandola, C.A., and Duckworth, A.L. (2023). How do free rides and text reminders affect COVID-19 vaccinations? A 3.5-million person megastudy. *Revise & Resubmit at Nature.*

Did We Increase Booster Rates?



whiskers depict +/-95% CIs

Top Performing Intervention: Suggested a Personalized Plan

Initial Text

Pharmacy: Hi Sean! Updated COVID boosters are recommended to help prevent infection & severe illness. Your booster is waiting for you.

Many find it helps to make a plan. Would Tuesday at 2:00 PM at 123 Main Street work?

To try to book that time, or another that works better for you, schedule here: [scheduler link]

7 Days Later

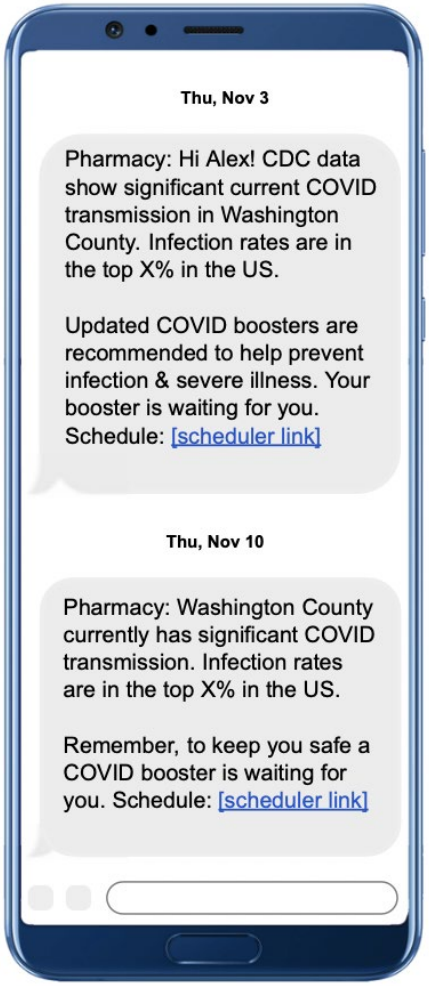
Pharmacy: Remember, a COVID booster is waiting for you. Many find it helps to plan ahead. If you haven't yet, consider planning when you'll get yours.

How would Tuesday at 2:00 PM at 123 Main Street work?

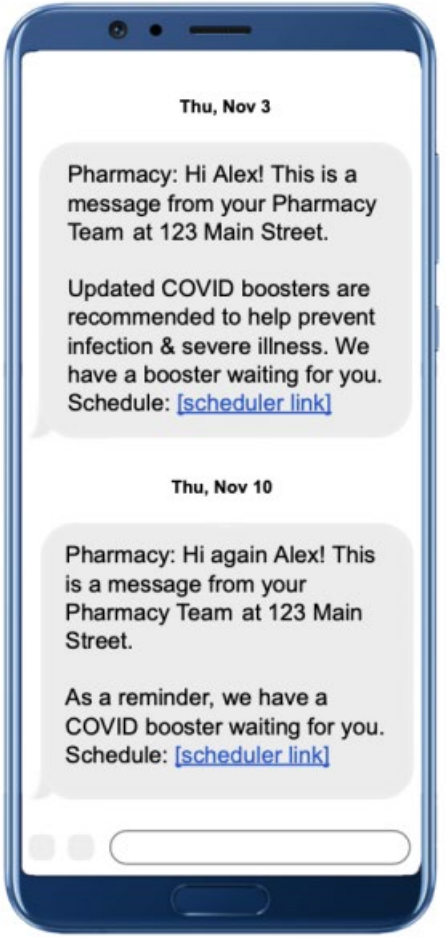
To try to book that time, or another that works better for you, schedule here: [scheduler

Other Top Performers

Infection rates are currently high



From your local pharmacy team



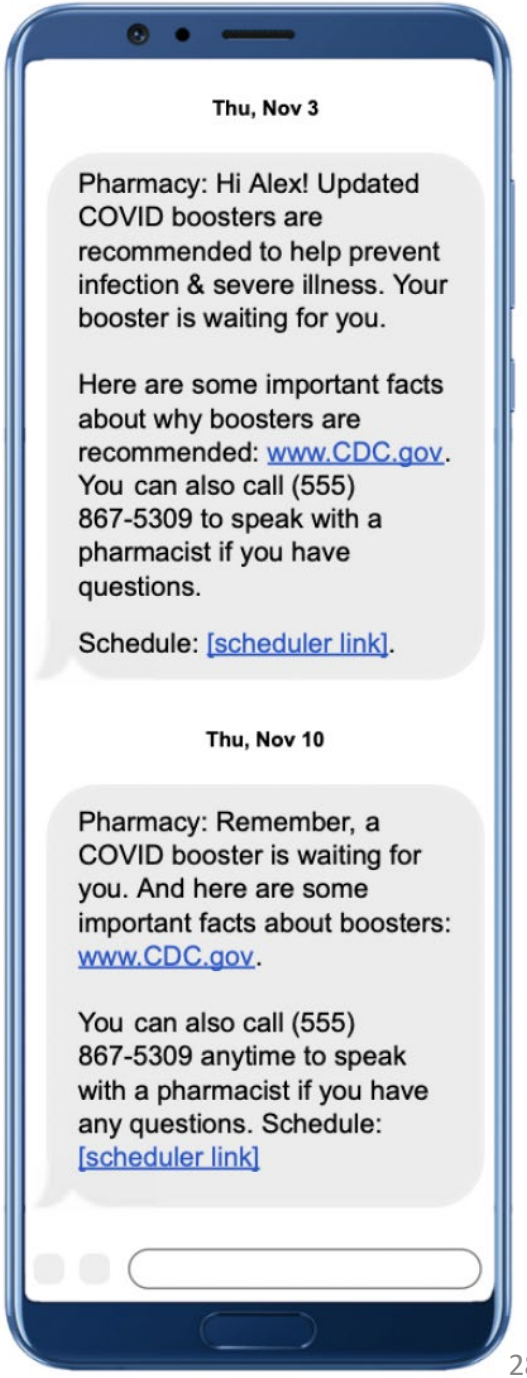
What Else Did We Test?

[Pharmacy Name]: Hi [Patient First Name]! Updated COVID boosters are recommended to help prevent infection & severe illness. Your booster is waiting for you.

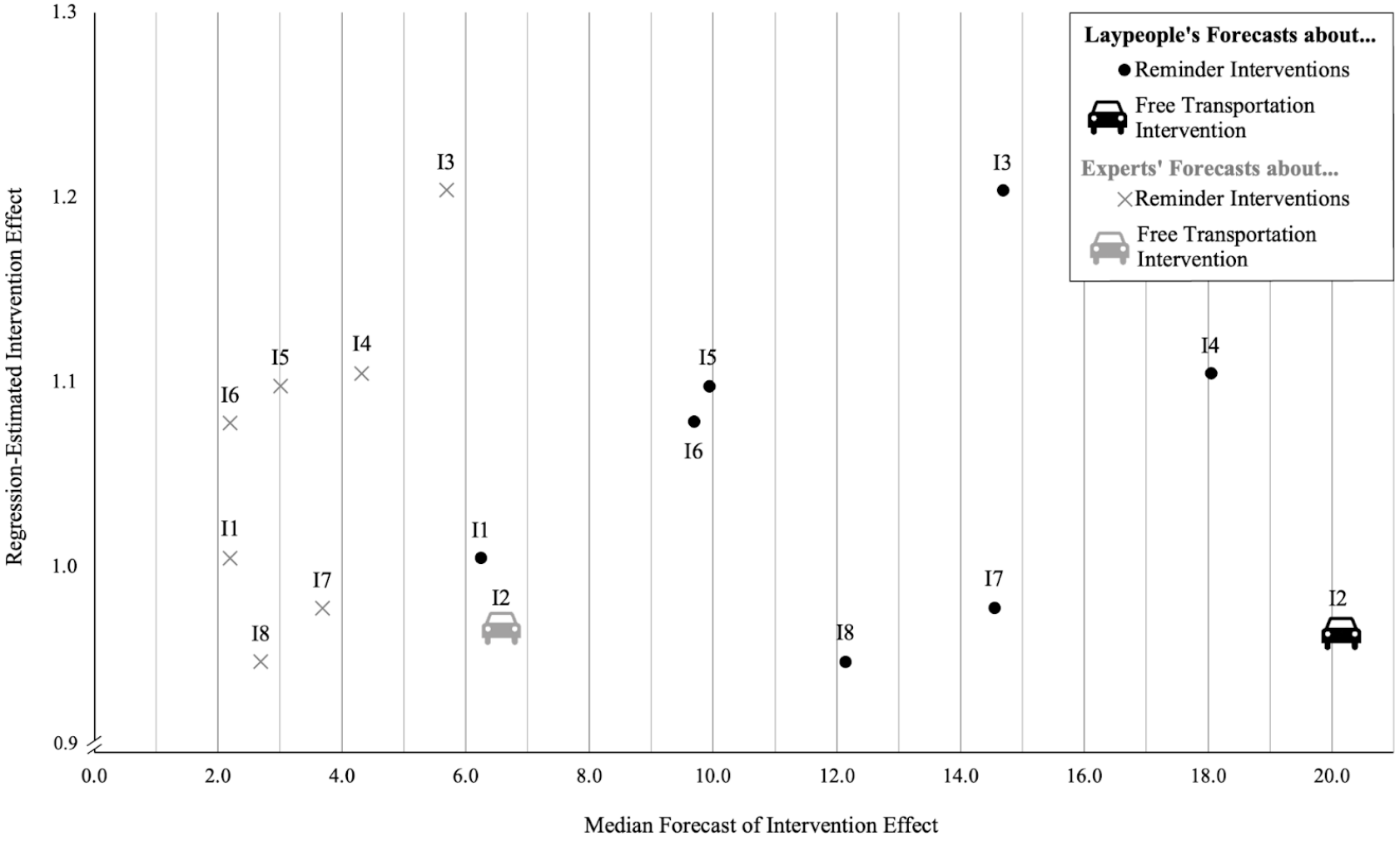
Here are some important facts about why boosters are recommended: www.CDC.gov. You can also call (555) 867-5309 to speak with a pharmacist if you have questions.

Schedule: pharmacy.co/6846120

Facts to dispel misinformation



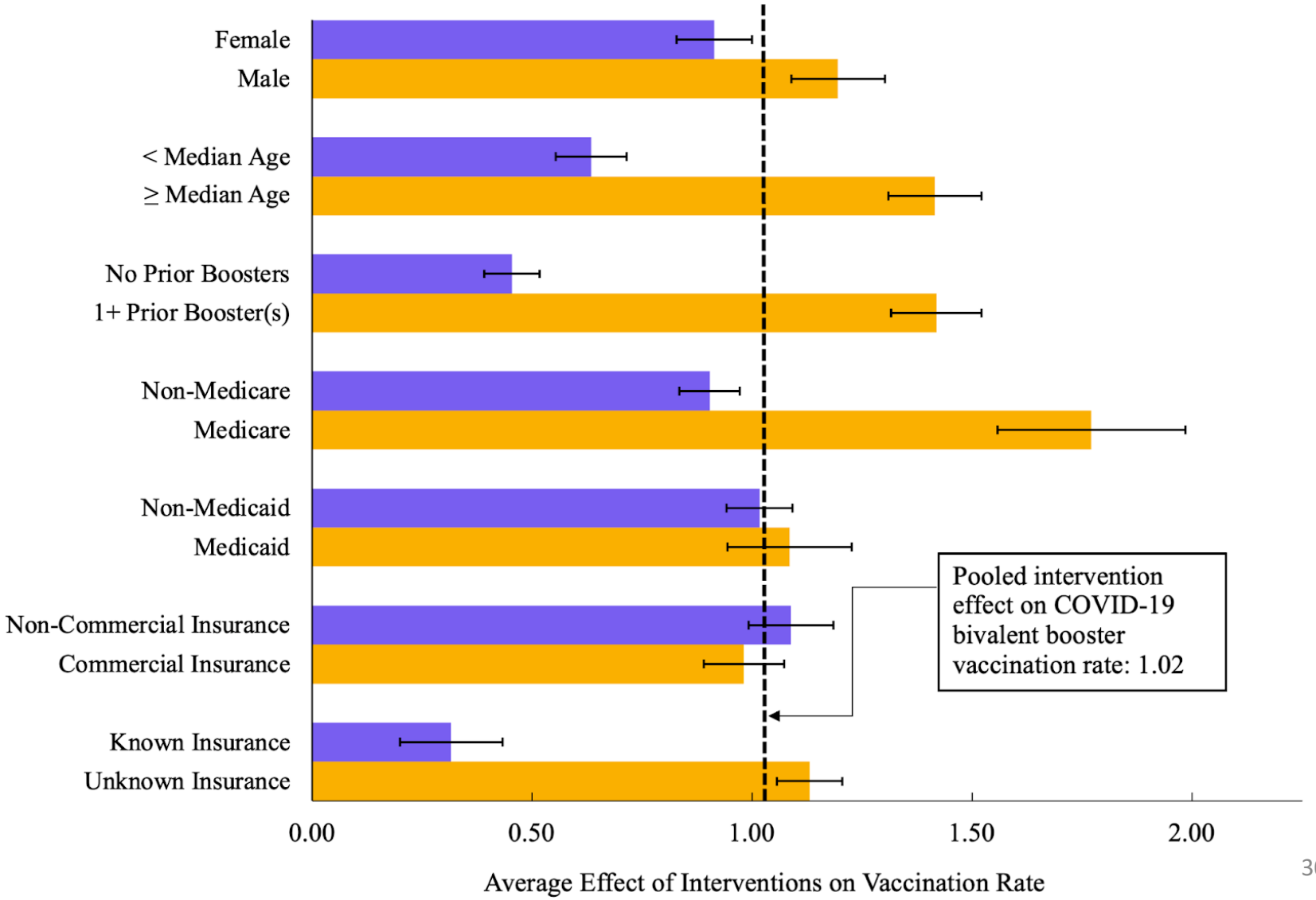
Could Laypeople or Experts Predict Our Results?



Note: I1: Baseline Message; I2: Free Transportation; I3: Suggested Plan; I4: Infection Rates; I5: Pharmacy Message; I6: CDC Recommended; I7: Holiday Protection; I8: Misinformation Resources.

Was There Any Heterogeneity?

Avg. correlation of 8 intervention effects across all sub-populations = 1.02



Key Takeaways

- ✓ Text reminders increased COVID booster vaccinations by **20%** on average
  - ✓ The top-performing reminder increased vaccinations by **23%**
- ✓ Offering patients **free rides** to pharmacies for vaccines **did not add value** over and above simple reminders to get boosted
- ✓ Forecasters anticipated that providing **free rides** would outperform simple reminder messages, but **forecaster were wrong**
  - ✓ They were also wildly **over-optimistic** about the performance of all interventions we tested

Key Takeaways

- ✓ Reminders **spilled over** to boost **flu vaccinations**
- ✓ Reminders had larger effects for **men**, **Medicare beneficiaries**, **older adults**, those with **prior boosters**, and those with **unknown insurance**
- ✓ The top-performing reminders (…were personalized):
  - ✓ Suggested a **date/time/location** matching people's **last vax**
  - ✓ Communicated that **infection rates** were currently high in a patient's county
  - ✓ Were sent on behalf of a patient's **local pharmacy team**

Thank You!

BCFG FUNDERS

Alfred P. Sloan Foundation

Abby and Jeremy Schiffman

AKO Foundation

Bill and Melinda Gates Foundation

Center for Health Incentives & Behavioral Economics

Chan Zuckerberg Initiative

Character Lab

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Flu Lab

John Alexander, Alexander Production Company

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THANK YOU!

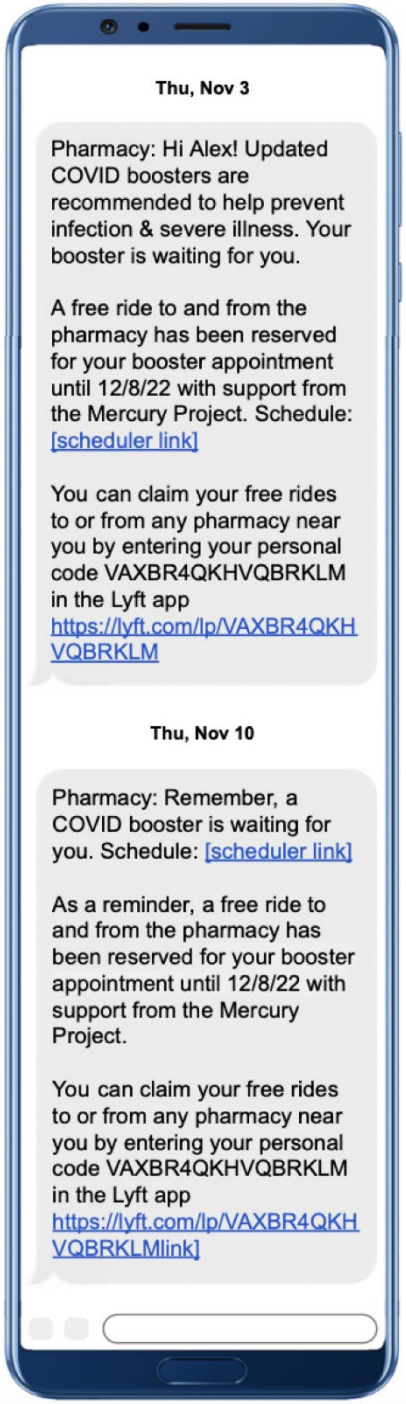
Sean F. Ellis, PhD

sfellis@wharton.upenn.edu

BEHAVIOR CHANGE FOR GOOD

Free Rides Text Messages

[Pharmacy Name]: Hi [Patient First Name]! Updated COVID boosters are recommended to help prevent infection & severe illness. Your booster is waiting for you.

A free ride to and from the pharmacy has been reserved for your booster appointment until 12/8/22 with support from the Mercury Project. Schedule: pharmacy.co/6846120

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