Enhancing Patient Engagement in Preventative Care

A Field Experiment on the Effectiveness of Personalized and Generic Digital Outreach Strategies

Lynne Wang, Jesse Cox, Mridul Jain, and Tejasvi Kalakota

Berkeley
UNIVERSITY OF CALIFORNIA

Research Question

Main Research Question

How can digital outreach strategies (especially personalized messaging) increase patient engagement in preventative healthcare?

Why Experiment?

- Observational data can't isolate causal effects.
- Randomized experimentation needed to test effective outreach types.

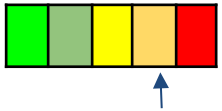
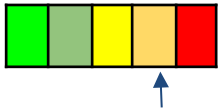
Sub-Questions

- Does **personalization** lead to higher engagement than generic messaging?
- Does a **personalized email** drive more engagement than no outreach?
- Does a **non-personalized email** increase preventative care behavior?

Definitions

- **Personalization:** Messaging that includes basic information about the recipient, in order to connect with them and gain their trust.
- **Personalized Email:** An email that contains some personalized messaging.
- **Patient Engagement:** Creating a new healthcare appointment (primary), or opening email communications from their healthcare provider (secondary).

Hypothesis / Expected Outcome

			Appointment Signup rate	Expected Outcome
Control		*No Messaging*		 – *Maintains current baseline*
Placebo Treatment		*Unrelated Messaging or Advertisement*		 – *No increase in signups compared to control*
Treatment 1		*Generic Messaging*		 – *Some increase in signups compared to control*
Treatment 2		*Personalized Messaging*		 – *Larger increase in signups compared to Treatment 1*

Our Treatment

Control: No Messaging

Bringing Primary Care to You – Learn More About Fia Care. External Inbox ×

Fia Care
to me

Hello,

At Fia Care, we believe healthcare should come to you.

We are a full-service virtual primary care clinic offering on-demand chat, video consultations, and home visits when needed.

Our services include physicals, chronic disease management, some labs, prescription renewals, and referrals to specialists.

We aim to make healthcare more accessible and cost-effective for individuals and companies alike.

To learn more about how we are redefining primary care, visit our About Us page.

Best regards,
The Fia Care Team
About Fia Care

fia CARE

unsubscribe

Placebo: Advertisement

Your Fia Benefits Await – Book Your Wellness Visit Today! External Inbox ×

Fia Care
to me

Hello!

We are thrilled to have you as part of the Fia family! Are you ready to book your wellness visit?

As a valued member of Fia, you have exclusive access to comprehensive benefits including health screenings, expert consultations, and much more.

Don't wait any longer to make the most of your Fia benefits. Schedule your visit online today and ensure that you are keeping on top of your health. Your well-being is our priority, and we're here to support you every step of the way.

Kind regards,
The Fia Team
Connect with Fia Care

fia CARE

unsubscribe

Treatment1: Generic Messaging

Stay on Track! Schedule Your Next Health Screening. External Inbox ×

Fia Care
to me

Hi Mridul!

It's been a while since your last check-up - 4/12/2025. Let's get you back on track with your health goals by scheduling your next health screening.

Staying current with regular screenings is the key to maintaining good health.

Contact us online today, and let's keep moving forward on your health journey. We are here to help you every step of the way.

Best regards,
The Fia Team
Connect with Fia Care

fia CARE

unsubscribe

Treatment2: Personalized Messaging

Measurement Units

People (Patients)

- **Who:** ~469 Patients of fia.care healthcare provider
- **Where:** Drawn from an existing fia.care patient database (e.g., patients who have visited in the last year)
- **How Identified:** fia.care has an email address on file and are eligible to receive digital communications

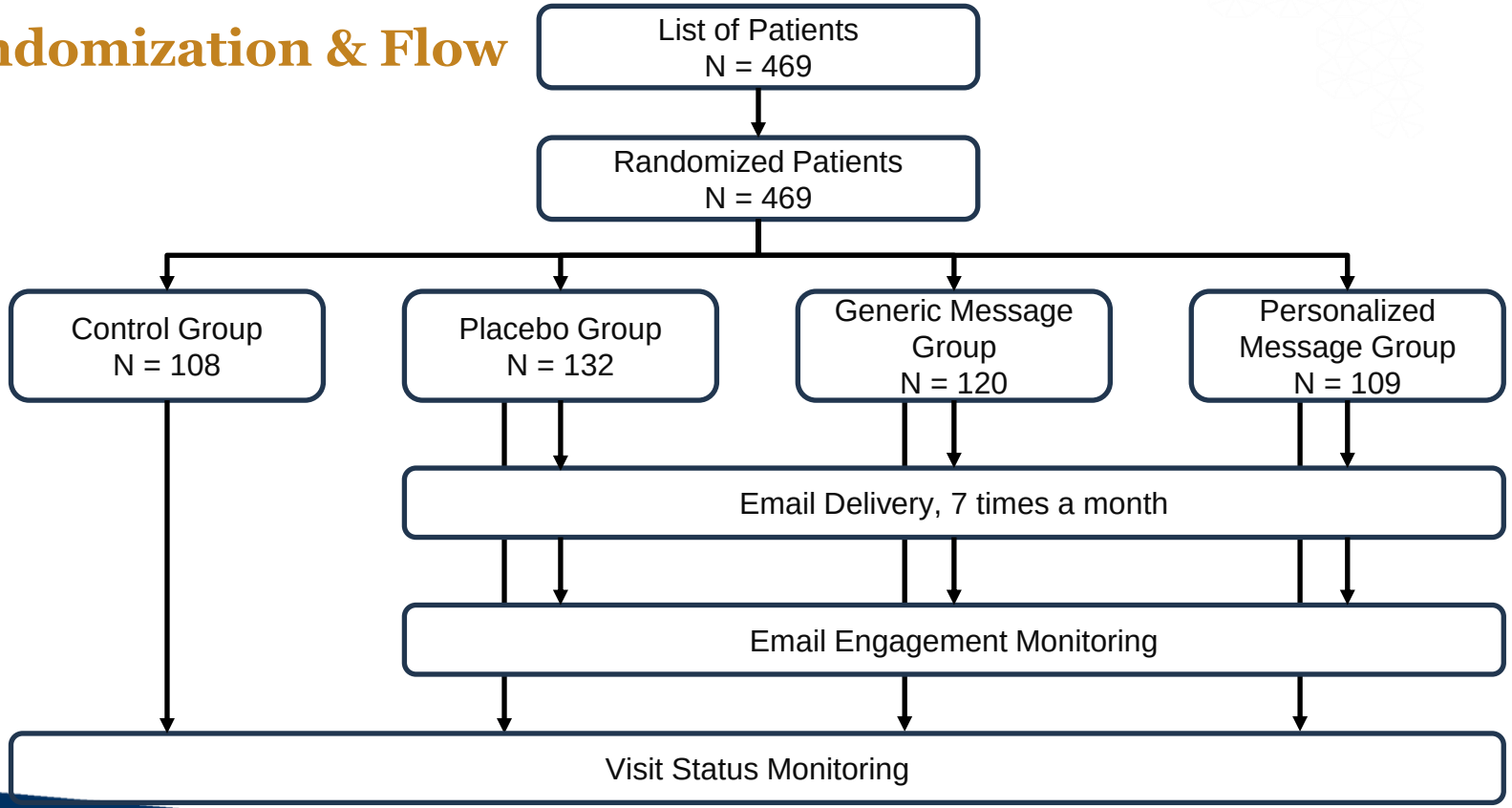
Target Population Characteristics

- Individuals/Adults i.e human subjects eligible for preventative care services (e.g., check-ups, screenings)
- Each participant is uniquely identifiable (by email or patient ID) and can be tracked individually for outcomes

Unit for Causal Inference

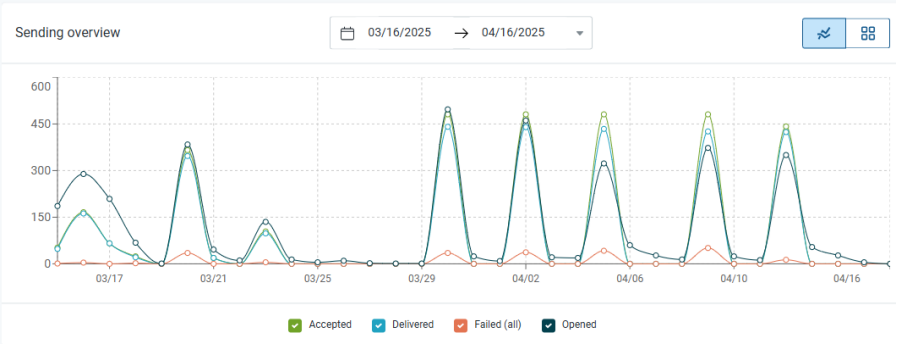
- The **treatment** (email message) is **administered at the person-level**
- The **outcomes** (open rate, click, appointment) are **measured at the person-level**

Randomization & Flow



ROXO Design

```
R_X1_O_X1_O_X1_O_X1_O_X1_O_X1_O_X1_O
R_X2_O_X2_O_X2_O_X2_O_X2_O_X2_O_X2_O
R_X0_O_X0_O_X0_O_X0_O_X0_O_X0_O_X0_O
R_____________________________________O
```



- **R**: Random assignment of patients to each group
- **X1**: Generic outreach message (non-personalized)
- **X2**: Personalized outreach message (name + last visit)
- **X0**: Placebo message (e.g., general health system update)
- **O**: Outcome observed (e.g., appointment booking, open rate, CTR)

Each group has **~120 patients**, making for well-balanced **between-subjects** comparisons

Outcome

- ✅ Appointment bookings (primary behavior) – Bernoulli Distribution – sparse bookings
- ✅ Email open rate (intermediate engagement) – Bernoulli Distribution – high open rates
- ✅ Click-through rate (secondary engagement) – Bernoulli Distribution – Low click rates
- ✅ Unsubscribe rate (negative treatment effect) – Bernoulli Distribution – Low unsubscribe rates

These distributions are **skewed**, since most people may not click or book

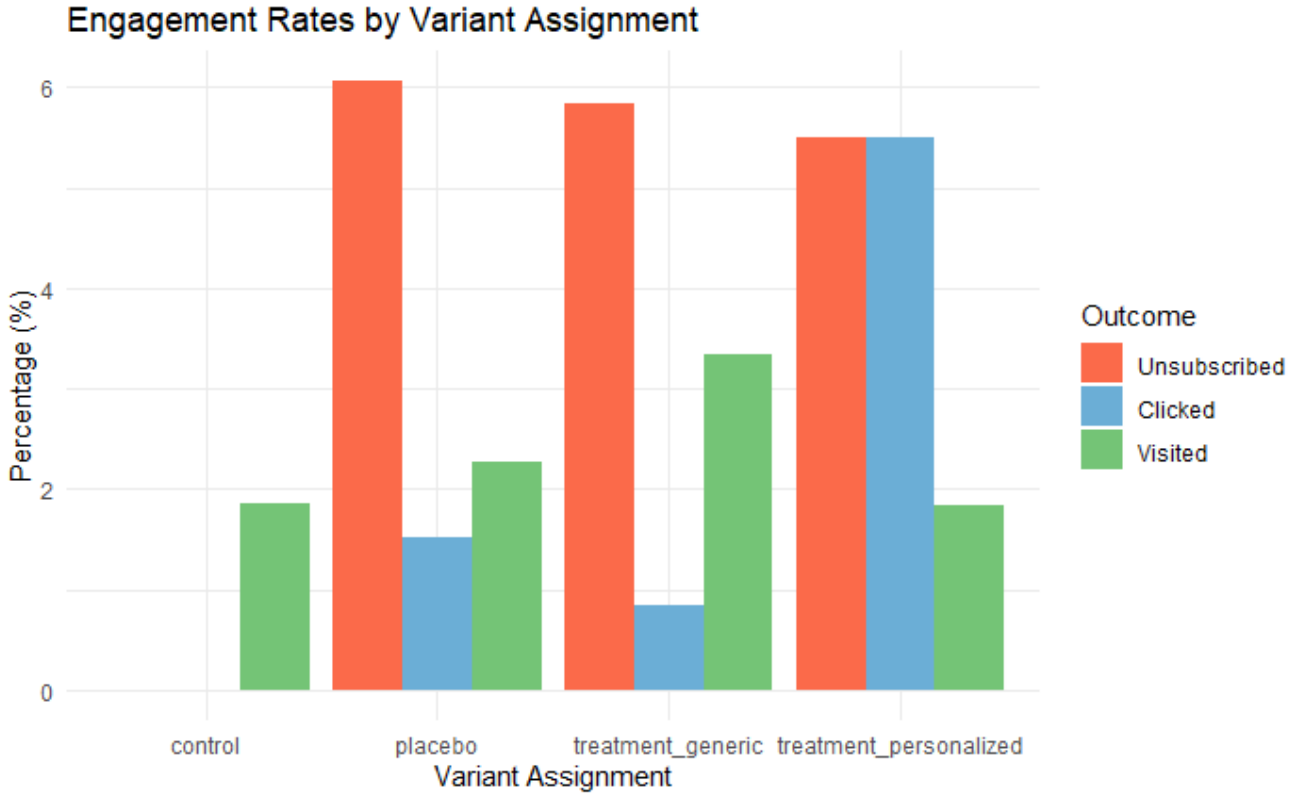
Data - Unsubscribed, Clicked, Visited

id	variant_assignment	unsubscribed	opened	click	visit
21	placebo	1	1	0	0
41	treatment_generic	1	1	0	0
44	placebo	1	1	0	0
78	treatment_generic	1	1	0	0
105	treatment_generic	1	1	0	0
190	placebo	1	1	0	0
201	treatment_personalized	1	1	0	0
221	treatment_personalized	1	1	0	0
232	treatment_generic	1	1	0	0
278	placebo	1	1	0	0
296	treatment_generic	1	1	0	0
363	placebo	1	1	0	0
381	treatment_generic	1	1	0	0
404	treatment_personalized	1	1	0	0
410	treatment_personalized	1	1	1	0
415	treatment_generic	1	1	0	0
418	treatment_personalized	1	1	0	0
425	placebo	1	1	0	0
438	treatment_personalized	1	1	0	0
442	control	1	1	0	0
448	placebo	1	1	0	0

id	variant_assignment	unsubscribed	opened	click	visit
410	treatment_personalized	1	1	1	0
17	treatment_personalized	0	1	1	0
95	treatment_personalized	0	1	1	0
107	placebo	0	1	1	0
183	treatment_personalized	0	1	1	0
342	treatment_personalized	0	1	1	0
383	treatment_generic	0	1	1	1
422	treatment_personalized	0	1	1	0
455	placebo	0	1	1	0

id	variant_assignment	unsubscribed	opened	click	visit
383	treatment_generic	0	1	1	1
25	control	0	0	0	1
28	placebo	0	1	0	1
31	treatment_generic	0	1	0	1
97	treatment_generic	0	1	0	1
112	treatment_personalized	0	1	0	1
164	placebo	0	1	0	1
171	control	0	0	0	1
203	treatment_generic	0	1	0	1
248	treatment_personalized	0	1	0	1
400	placebo	0	1	0	1

Berkeley
UNIVERSITY OF CALIFORNIA



Berkeley
UNIVERSITY OF CALIFORNIA

Analysis & Results

Linear Regression Models to Compare Outcomes of Different Groups

- **Open Rate:** X0 vs. X1 vs. X2
- **Click Rate:** X1 vs. X2
- **Opted Out Rate:** X1 vs. X 2
- **Visit Rate:** R vs. X1 vs. X2

Analysis & Results

Open Rate: O vs. X1 vs. X2 (No Statistical Significance)

```
t test of coefficients:

                                          Estimate Std. Error  t value Pr(>|t|)
(Intercept)                              0.9924242  0.0075786 130.9515   <2e-16 ***
variant_assignmenttreatment_generic      0.0075758  0.0075786   0.9996   0.3182
variant_assignmenttreatment_personalized 0.0075758  0.0075786   0.9996   0.3182
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

- There is no statistically significant difference in email open rates across the placebo, generic treatment, and personalized treatment groups.
- All p-values > 0.05.
- Effect sizes are tiny.
- Open rate (= compliance rate) nearly 100% in all groups.

Analysis & Results

Open Rate: O vs. X1 vs. X2: ITT, Complier Rate, Attrition

variant_assignment <chr>	open_rate <dbl>	count <int>
placebo	0.9924242	132
treatment_generic	1.0000000	120
treatment_personalized	1.0000000	109

- ITT=1 → Complier Rate = 1
- No Known Attrition

Analysis & Results

Click Rate: X1 vs. X2 (Statistical Significance)

```
t test of coefficients:

                                          Estimate Std. Error t value Pr(>|t|)
(Intercept)                              0.0083333  0.0083350  0.9998  0.31847
variant_assignmenttreatment_personalized 0.0467125  0.0234710  1.9902  0.04777 *
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

- Personalized reminders significantly increased click rates compared to generic reminders.
- The result is statistically significant: p = 0.04777
- Suggests personalization makes patients more likely to engage with links in the message

Analysis & Results

Unsubscribed Rate: X1 vs. X2 (No Statistical Significance)

```
t test of coefficients:

                                                Estimate Std. Error t value Pr(>|t|)
(Intercept)                                    0.0583333  0.0214892  2.7145 0.007147
**
variant_assignmenttreatment_personalized -0.0032875  0.0307116 -0.1070 0.914849
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

- There is no statistically significant difference in opt-out rates between patients who received personalized vs. generic reminders.
- Personalization didn’t increase unsubscribes.
- Both types of messages appear similarly acceptable to recipients in terms of not provoking opt-out behavior.

Analysis & Results

Visit Rate: R vs. X1 vs. X2 (No Statistical Significance)

```
t test of coefficients:

                                    Estimate  Std. Error t value Pr(>|t|)
(Intercept)                       0.01851852  0.01303089  1.4211   0.1562
variant_assignmenttreatment_generic  0.01481481  0.02099368  0.7057   0.4809
variant_assignmenttreatment_personalized -0.00016989  0.01834491 -0.0093   0.9926
```

- Neither the generic nor the personalized outreach led to a statistically significant increase in appointment bookings.
- The visit rates were low across all groups.
- Estimated effects are small and not meaningful.
- Personalized message did not improve real-world healthcare engagement beyond open or click behavior.

Analysis & Results

HTE Visit Rate: R vs. X1 vs. X2) (No Statistical Significance)

```
t test of coefficients:

                                                    Estimate Std. Error t value Pr(>|t|)
(Intercept)                                         0.083333   0.056926  1.4639   0.1442
variant_assignmenttreatment_generic                -0.018817   0.072269 -0.2604   0.7947
variant_assignmenttreatment_personalized           -0.011905   0.075182 -0.1583   0.8743
not_seen_recently                                  -0.083333   0.056926 -1.4639   0.1442
variant_assignmenttreatment_generic:not_seen_recently  0.041289   0.073987  0.5581   0.5772
variant_assignmenttreatment_personalized:not_seen_recently  0.011905   0.075182  0.1583   0.8743
```

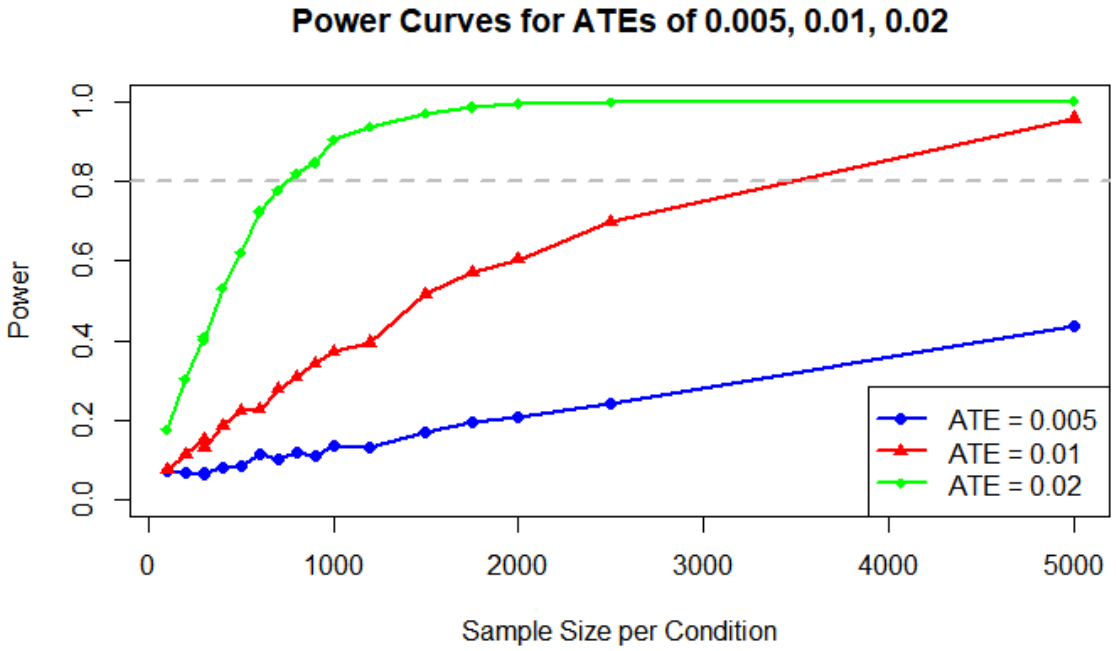
- THE: Not seen within a year.
- No statistically significant effects were found—none of the coefficients have p-values below 0.05.
- The baseline visit rate in the control group for recently seen patients is modest (~8.3%).
- Generic and personalized outreach had no statistically meaningful effect, either on recently seen or not recently seen patients.
- The interaction terms (HTEs) suggest that outreach doesn't significantly help patients who hadn't been seen recently—this subgroup didn't show stronger treatment responsiveness.

Experiment Limitations

- **Low Statistical Power / Sample Size**
- **Short Intervention Duration**
- **How do we interpret patients who clicked and then unsubscribed?**
- **How do we interpret patients in treatment groups who did not click but scheduled a visit?**

Questions?

Appendix I – Power Analysis



Appendix II - Image References

- https://marcabees.com/nurture-long-term-patient-relationships-with-email-marketing/ (Source image modified)
- https://images.app.goo.gl/kvDUgLmi9SQABmaF8
- https://images.app.goo.gl/7oRrzirri7A2PH3q7
- https://images.app.goo.gl/x54HZd2F1wJrZY827
- https://images.app.goo.gl/vcLwySCZgxSBikLx8
- https://docs.google.com/presentation/d/1KiiMd4GFSalEmVp7pd-u8LuTWbhD_sG5FL1bWmtqsQo/edit?usp=sharing