AIRA
AMERICAN IMMUNIZATION REGISTRY ASSOCIATION

Discovery Session: Centralized Reminders, Measurable Results!

February 23, 2026
4:00 p.m. ET

Today's Presenters

- **Francis Pacillo,** formerly of Alaska's Department of Health and Social Services
- **Marisa Langdon-Embry, MSc,** Data Governance and Quality Assurance Analyst, Bureau of Immunizations, New York City

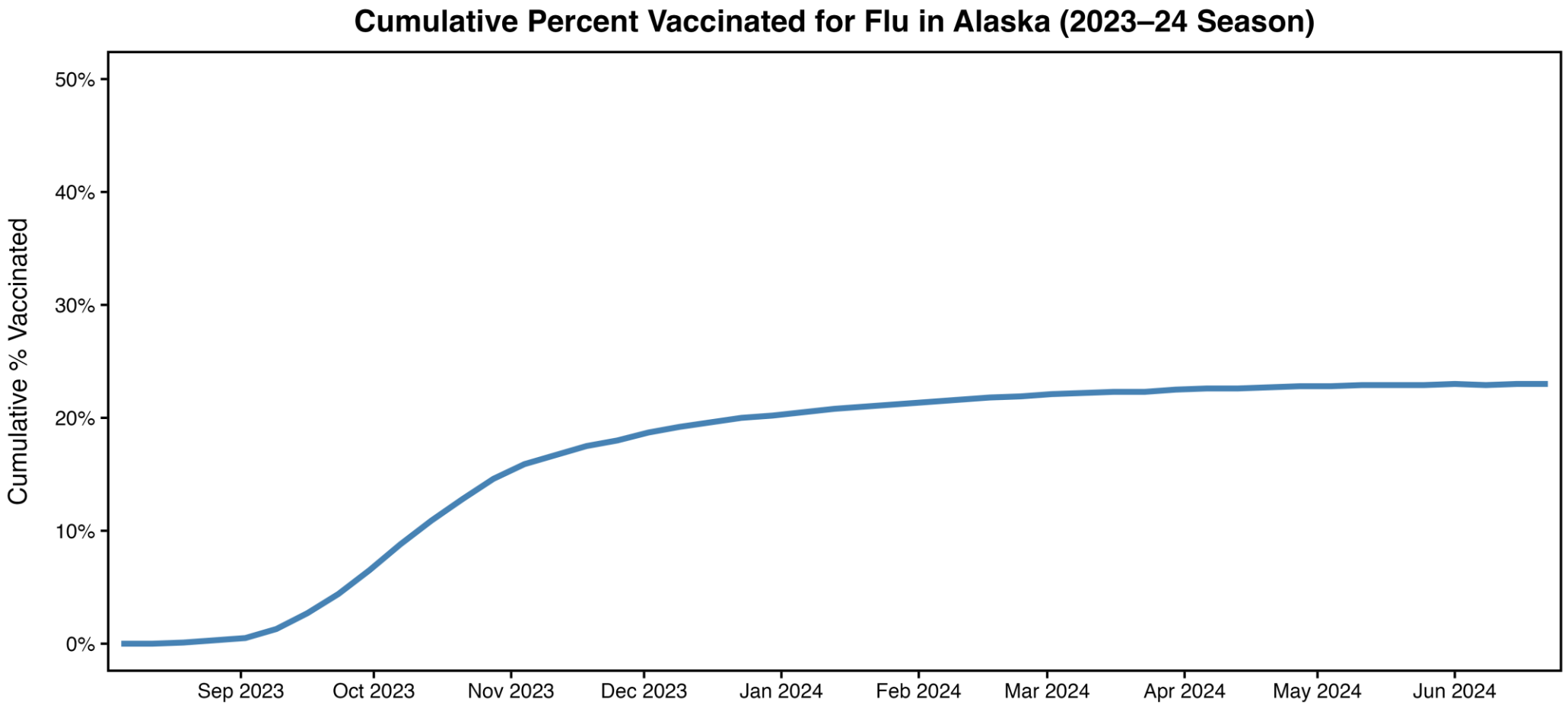
AIRA Discovery Session
February 23, 2026

Effect of Push Notification Reminders on Early Flu Vaccination in Alaska

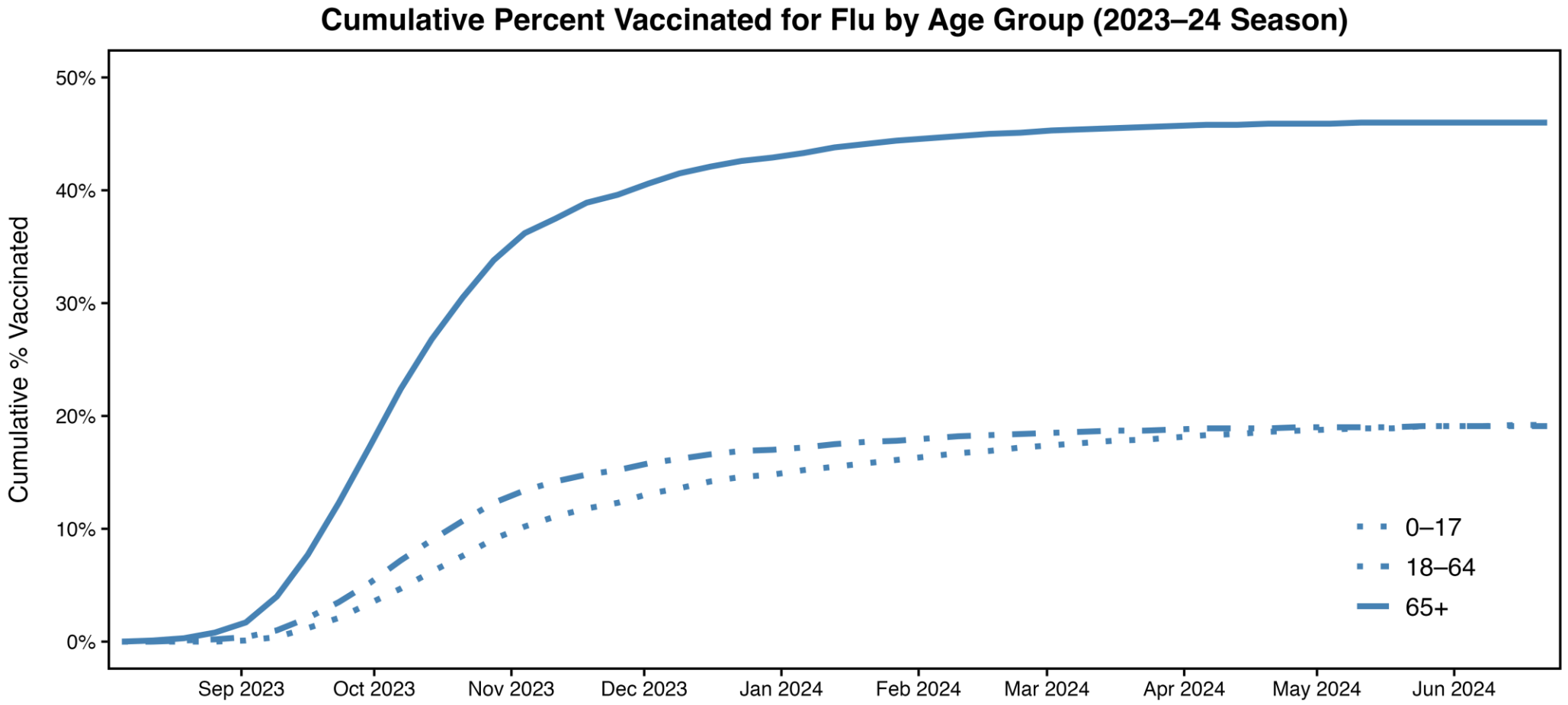
Francis Pacillo[1] Nathan Scott[2] Monette Schwoerer[1]

[1] Alaska Department of Health

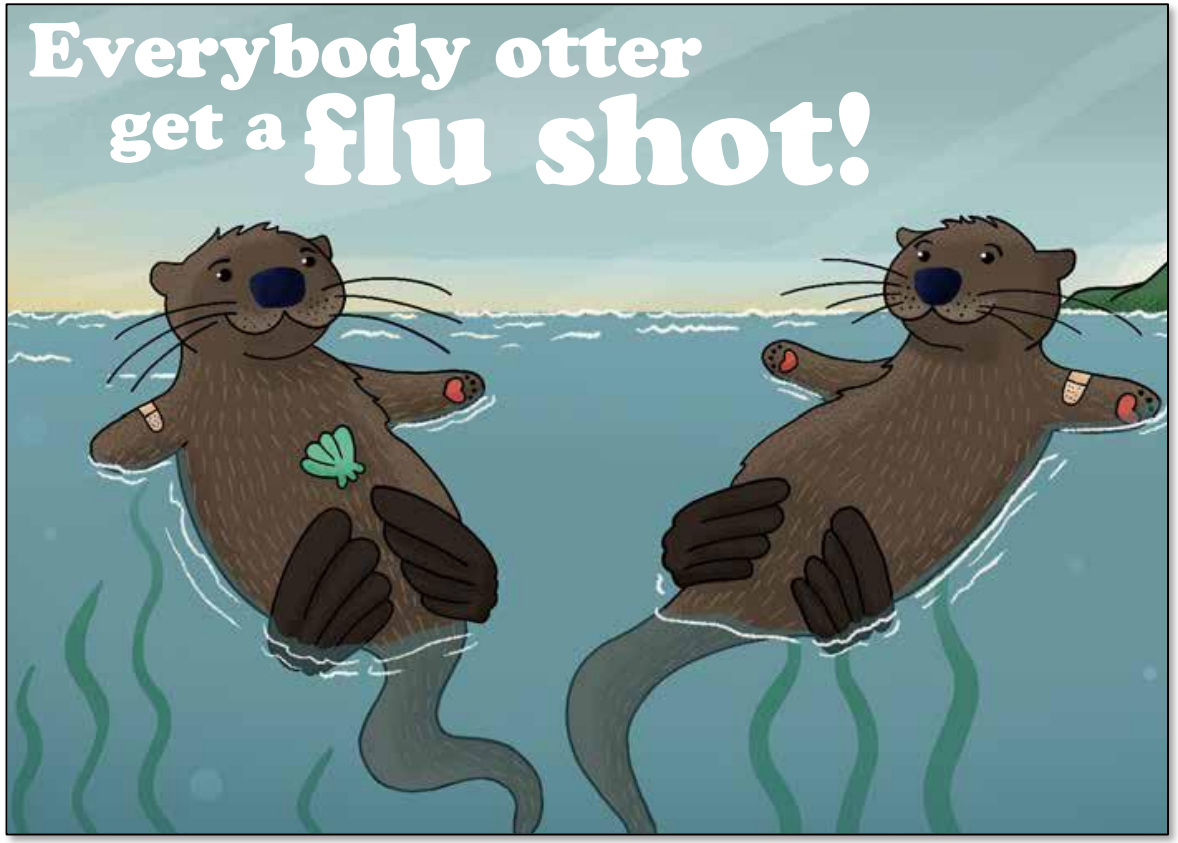
[2] Docket Health, Inc.



Problem: CDC recommends that people get a flu vaccine by the end of October. In 2023, only **14.6%** of Alaska residents had received a flu vaccine by that point.

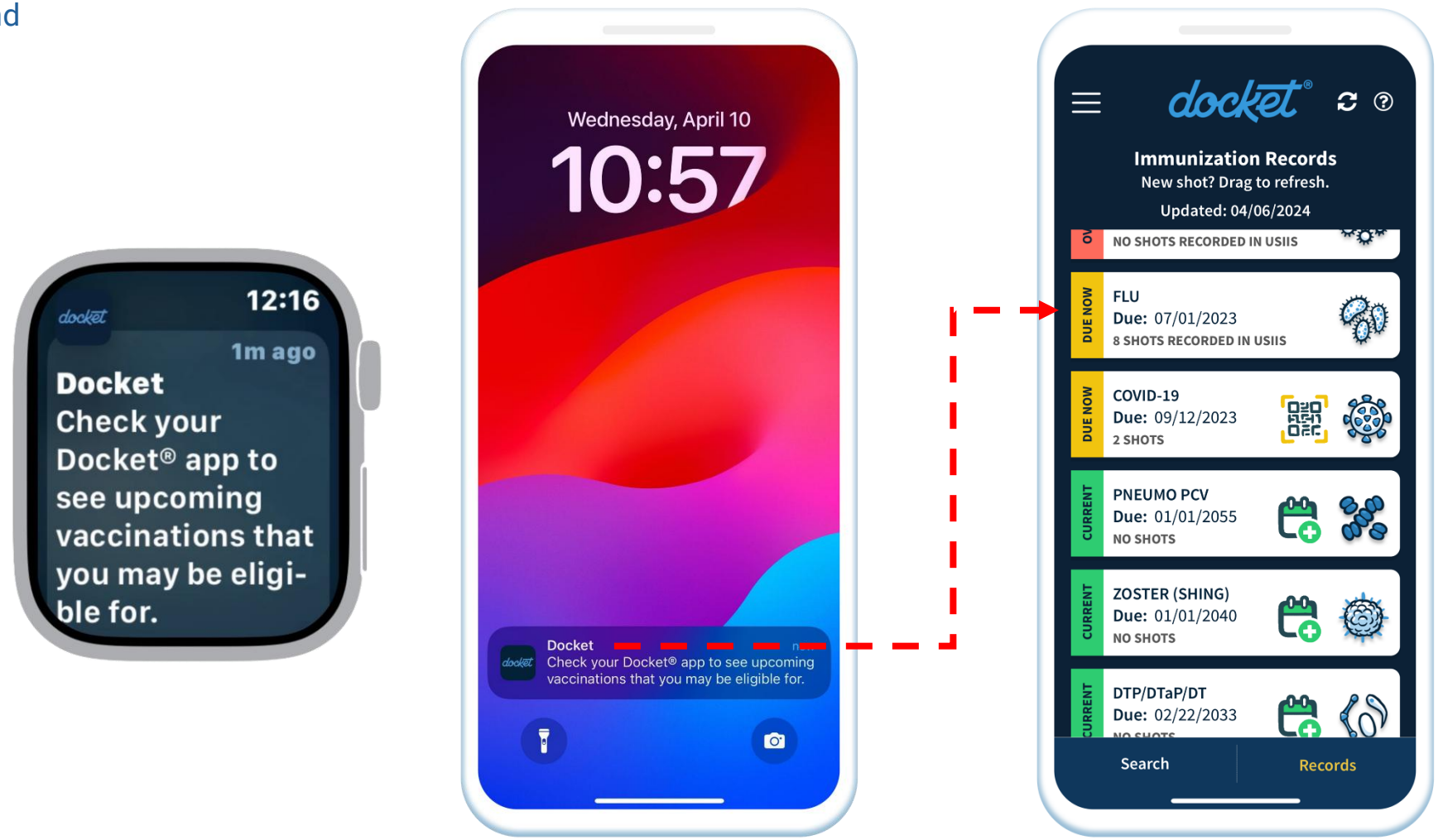


Vaccination Gap: By the end of October 2023, only **9.1%** of children (0-17), **12.3%** of adults (18-64), and **33.8%** of older adults (65+) in Alaska had received a flu vaccine.



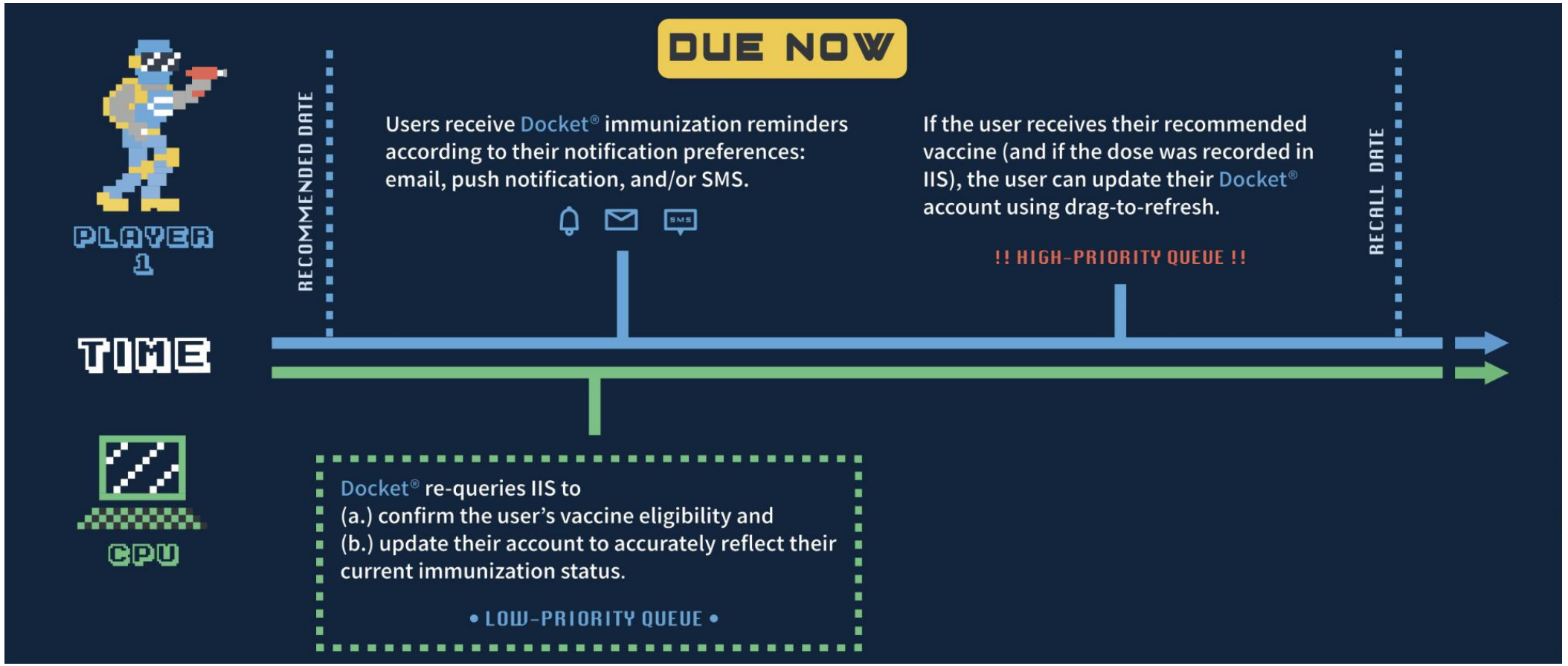
Context: Alaska's Immunization Program sends **costly** reminder/recall postcards statewide to promote vaccination.

I Background



Potential Solution: Push notification reminders may offer a **zero-cost** way to boost early flu vaccination.

I Background



Note: From *Guardians of Immunization Adherence: Cosmic Reminder/Recall*, presented at AIRA 2024 National Meeting.

Workflow: Docket checks vaccine eligibility, sends reminders, and re-queries the IIS to update records and send recalls when needed.

Study Rationale

- Research suggests that mail and phone reminders increase vaccination uptake, but the impact of mobile push notifications remains unknown.
- Given their **scalability** and **zero-cost**, push notifications may be a promising tool to promote vaccination.

Research Questions

1. **Effectiveness:** Does the intervention improve vaccination uptake?
2. **Timing:** Does the intervention initiate earlier vaccination?
3. **Subgroups:** Is the intervention more effective in younger adults?

Pilot Study Methodology

Study Design

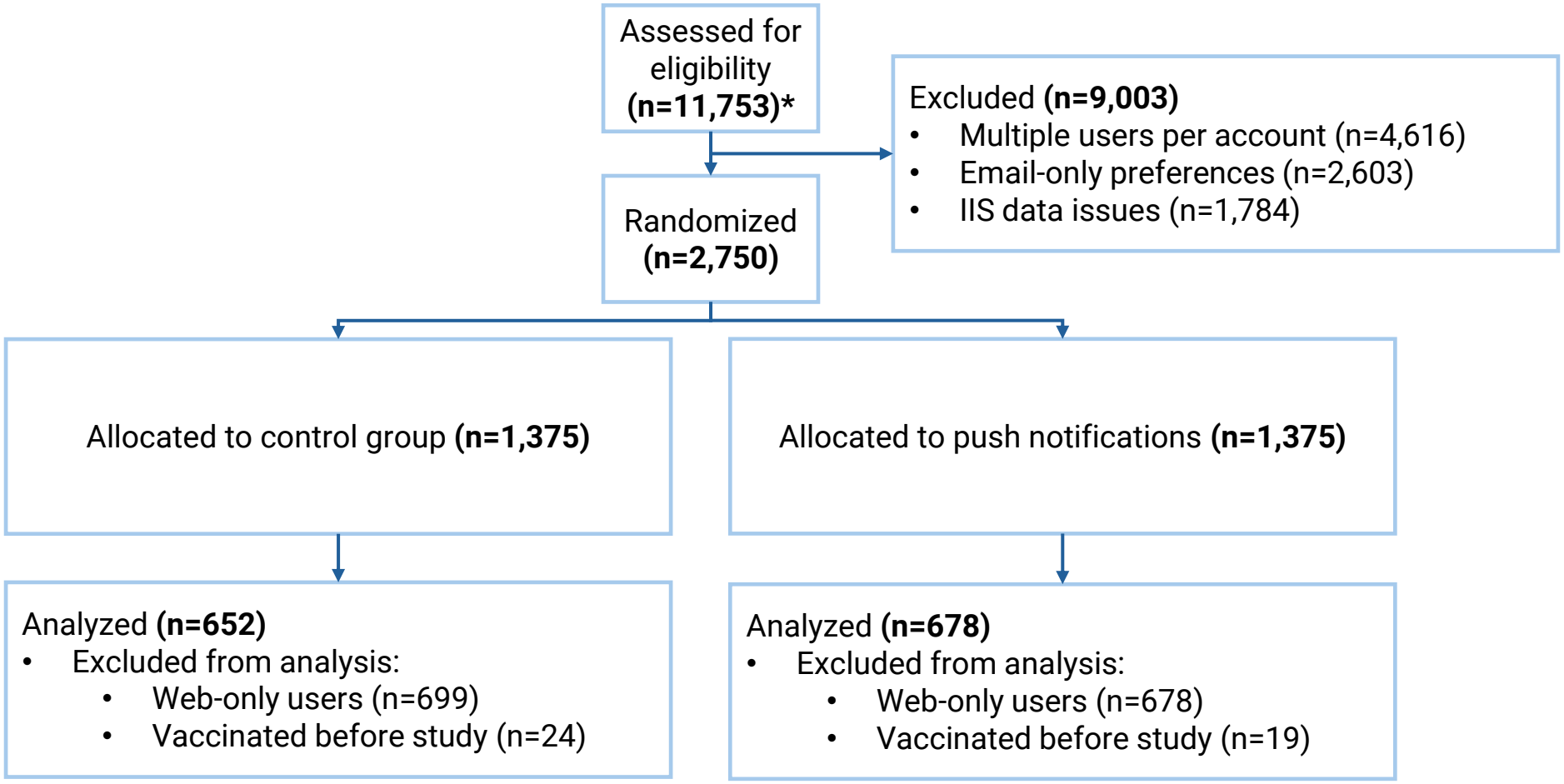
- **Study design:** Randomized controlled trial (Sep-Oct 2024)
- **Intervention:** Mobile app push notifications
- **Outcome:** Influenza vaccination
- **Cadence:** 1 reminder + 1 recall after 30 days

Population

- **Population**: Alaskan adults with Docket accounts and push notifications enabled.
- **Eligibility Criteria**: Adults (18+) with Docket accounts, enabled notifications, and complete IIS records.

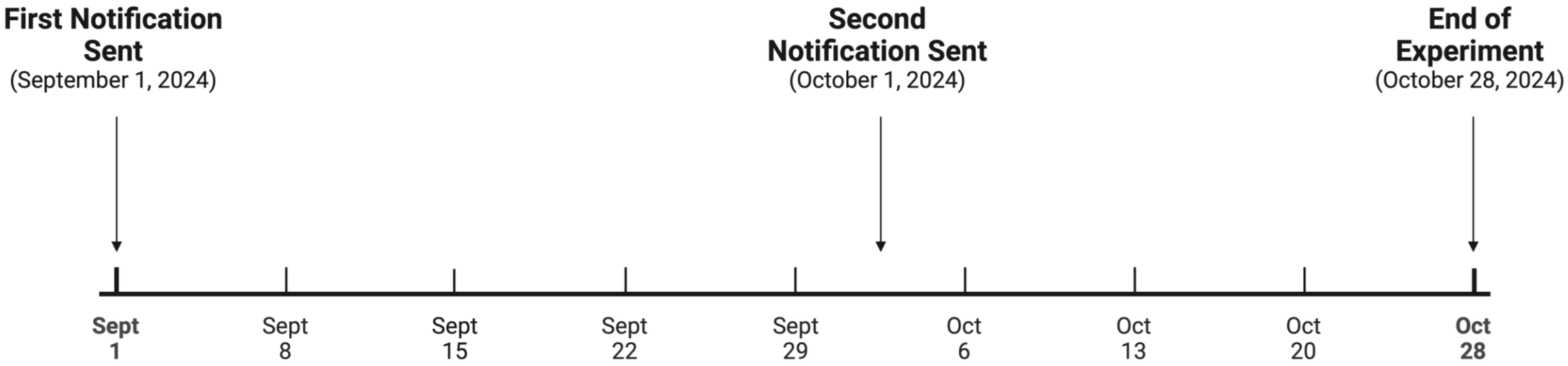
Data Analysis

- **Measures of Association**: Hazard ratios (HRs) and 95% confidence intervals (CIs) were estimated using Cox proportional-hazards models. Analyses conducted in R (v4.4.1).



* Subset of 17,730 total Docket users.

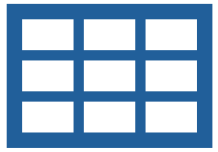
Participant Selection: Issues in study execution impacted the final analysis, as many were excluded post-randomization.



Experiment Timeline: This pilot study tracked documented influenza vaccinations in Alaska's IIS from September 1 through October 28, 2024.

1

Transforming data elements



Created a time-to-event variable (days from study start to vaccination)

2

Estimating intervention effect on vaccination

Fit Cox proportional hazards models to estimate hazard ratios

3

Testing proportional hazard assumption

Evaluated model assumptions using Schoenfeld residuals

Statistical Analysis: We used R to conduct statistical analyses, applying Cox proportional-hazard models to estimate the intervention effect.

Table 1. Baseline statistics according to study arm

Characteristic	Category	Control (%)	Intervention (%)
Sex	Male	35.4	34.5
	Female	64.1	64.9
	Unknown	0.5	0.6
Race	White	53.1	56.6
	Black	3.2	1.9
	Asian	6.0	4.7
	Alaska Native/American Indian	13.0	12.2
	Native Hawaiian/Pacific Islander	1.4	0.6
	Other Race	23.3	23.9
Age	18-34	25.9	24.8
	35-64	43.9	40.4
	65+	30.2	34.8

Note: Based on the analyzed sample (n = 652 control, n = 678 intervention).

Figure 1. Median time to vaccination was 48 days in the intervention arm and 55 days in the control group

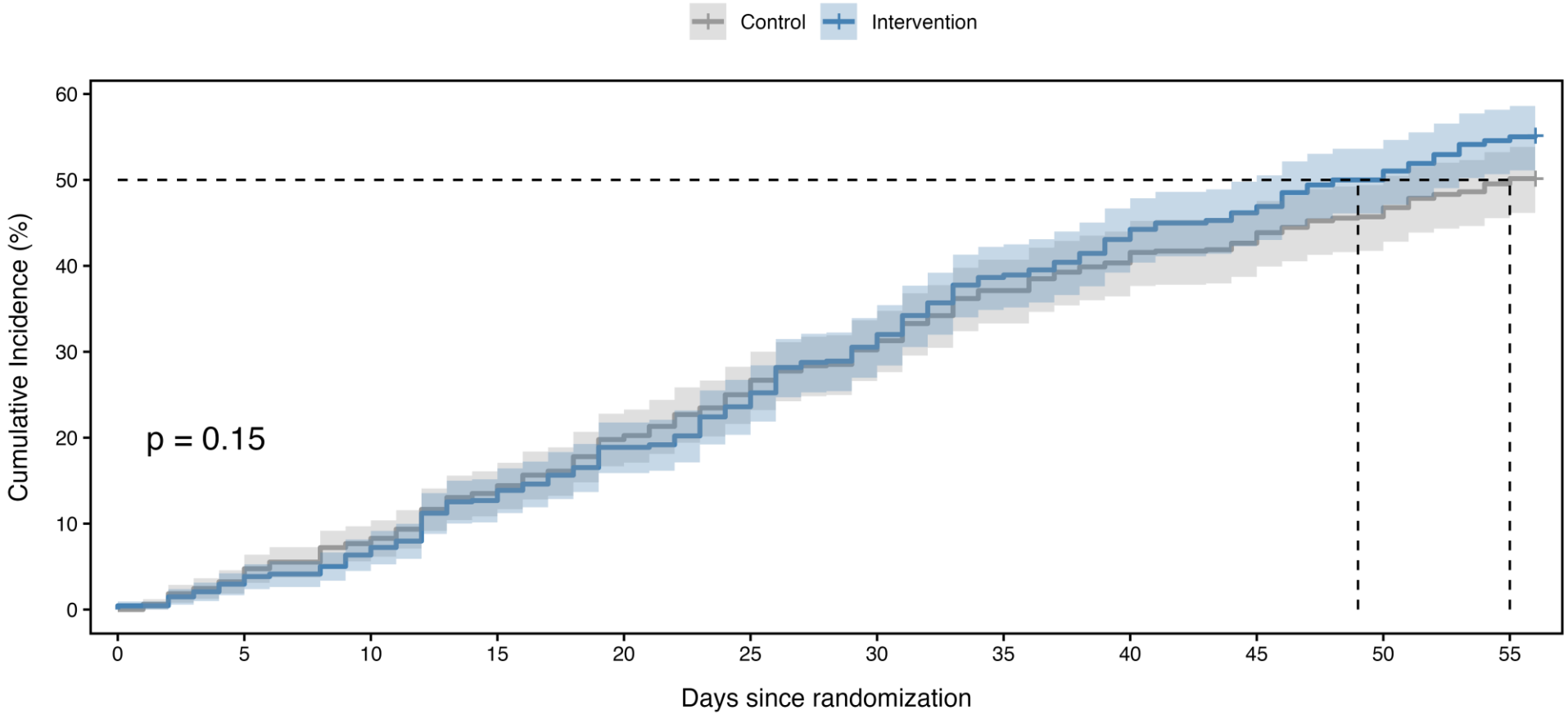


Table 2. Cox proportional-hazards model with age-interaction: push notification effect decreased with age

Model Term	HR	95% CI	P-value
Push Notification group (at age 0)	1.84	1.12 - 3.03	0.02
Age (continuous)	1.03	1.02 - 1.04	<0.001
Push Notification x Age (interaction)	0.99	0.98 - 1.00	0.02

Note: Intervention effect decreased with age: HR = 1.50 at age 20 and 1.23 at age 40.

Table 3. Push notifications effect varied by age group, with largest effect observed among 18 to 34 year-olds

Age Group	HR	95% CI	P-value
18-34	**1.33**	**0.92 - 1.92**	**0.13**
35-64	1.25	0.99 - 1.58	0.06
65+	0.82	0.65 - 1.03	0.08
All ages (crude)	1.12	0.96 - 1.29	0.15

Note: Wide CIs and non-significant p-values may reflect small sample sizes within subgroups.

Discussion

Key Findings and Future Directions

- **Findings**: Results varied by age, with stronger associations observed among **younger adults**.
- **Next Steps**: Future research will address challenges with participant selection *and* test other R/R modalities.

Limitations

- **Sample size**: Due to small sample size and issues with participant selection, interpret findings with caution.
- **Generalizability**: The sample was skewed towards regular vaccinators, limiting broader applicability.

Conclusion

- **Research Needed**: Pilot design was feasibility-focused, not conclusive. Larger studies are needed to assess effectiveness and explore how age and other factors (e.g., geography) modify intervention effectiveness.

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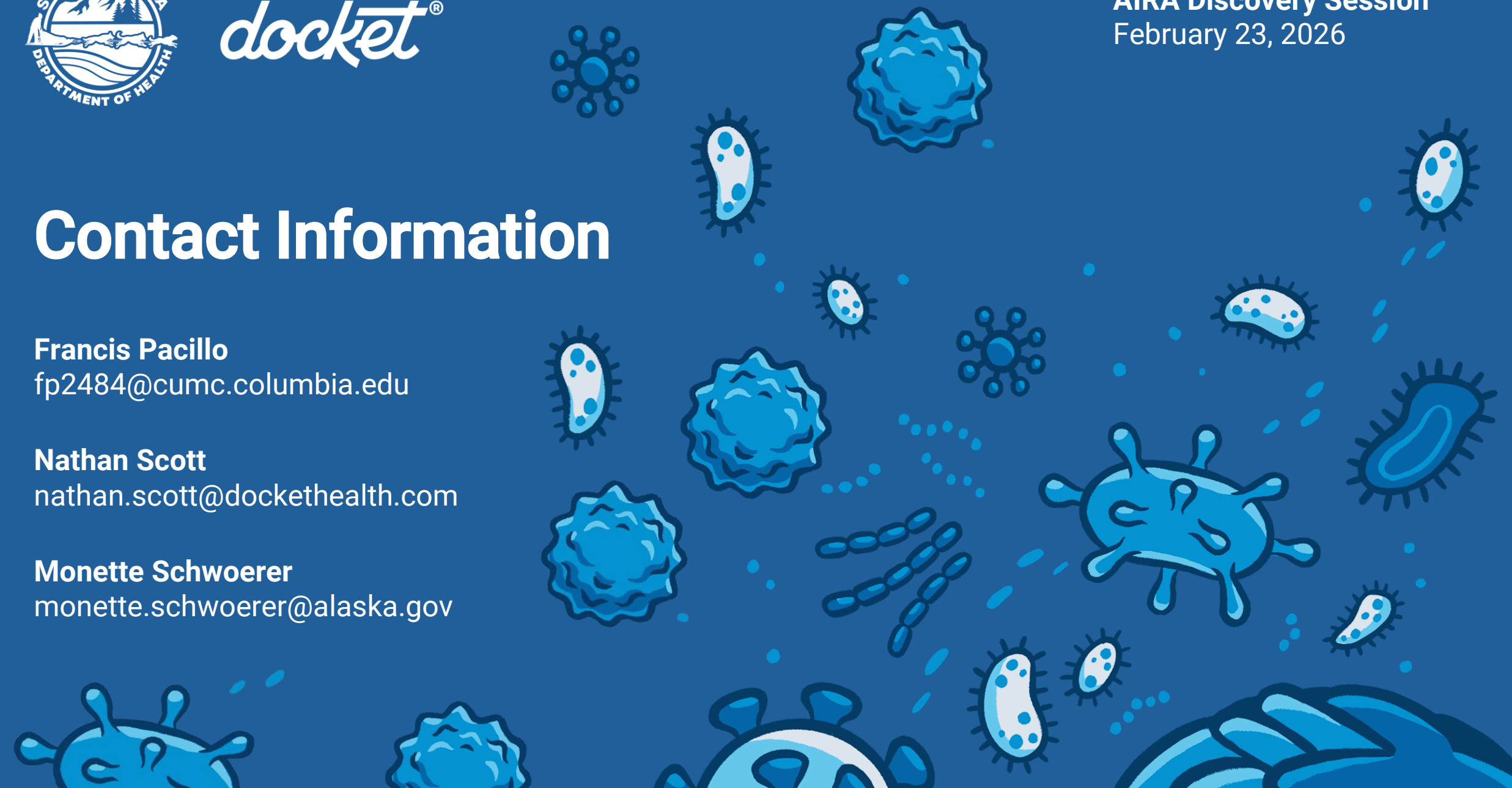
Contact Information

Francis Pacillo
fp2484@cumc.columbia.edu

Nathan Scott
nathan.scott@dockethealth.com

Monette Schwoerer
monette.schwoerer@alaska.gov



Impact of a Centralized Text Message Recall to Increase HPV Vaccine Series Completion Rates

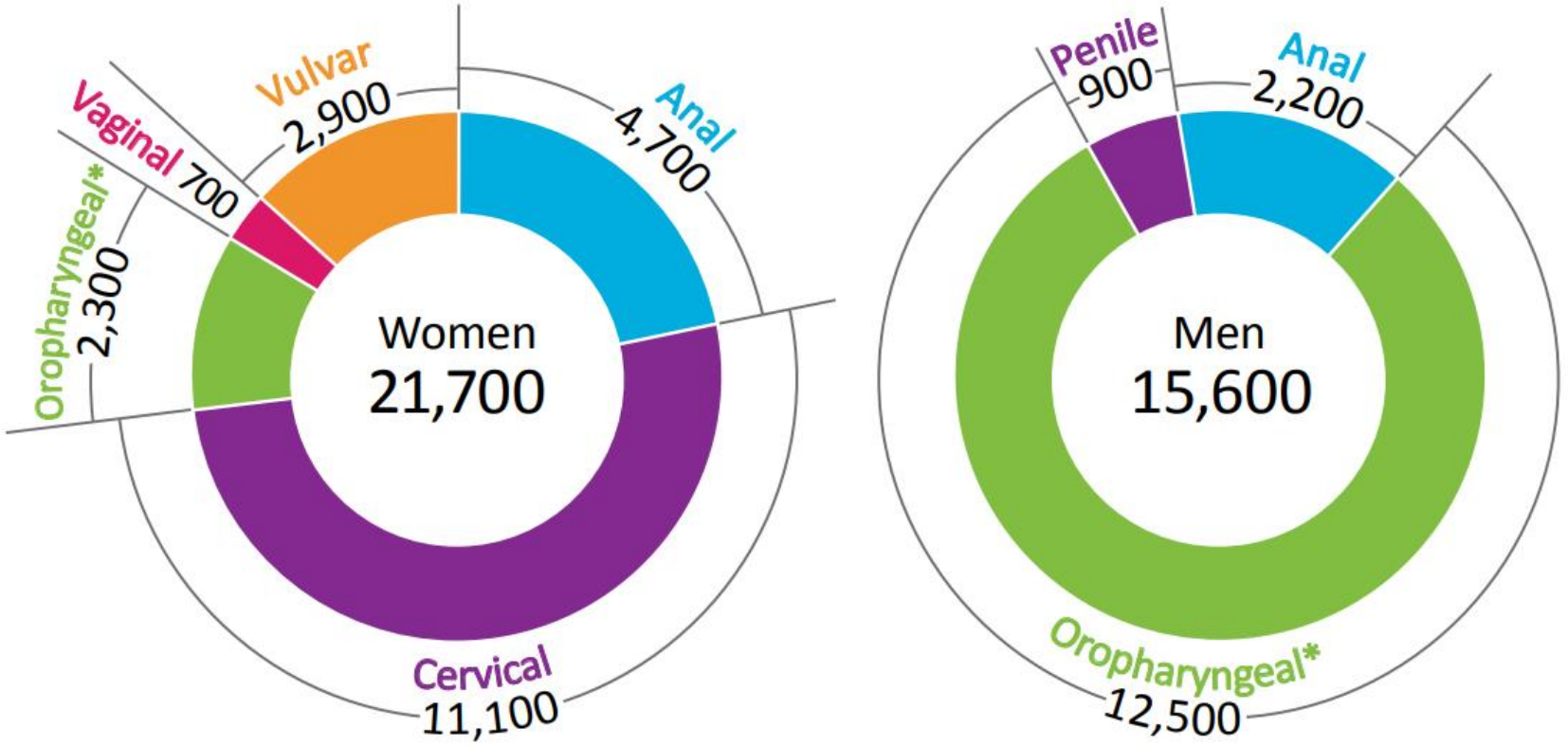
Marisa Langdon-Embry, MSc
CIR Data Governance and Quality Assurance Analyst
Bureau of Immunization
New York City Department of Health and Mental Hygiene

American Immunization Registry Association Discovery Session
February 23, 2026

NYC Health

37,300 Cancers Are Caused by HPV Each Year

That equates to one person every 15 minutes, every day, all year long.



*Cancer in the back of the throat, including the base of the tongue and tonsils

Source: NYC Health Department HPV Vaccine Fact Sheet: https://www.nyc.gov/assets/doh/downloads/pdf/csi/csi-hpv-tearoffsheet.pdf

Human papillomavirus (HPV) is very common.

- 13 million Americans are diagnosed with HPV each year. **More than half are between the ages of 15 and 24.**

Source: NYC Health Department HPV Vaccine Fact Sheet: https://www.nyc.gov/assets/doh/downloads/pdf/csi/csi-hpv-tearoffsheet.pdf

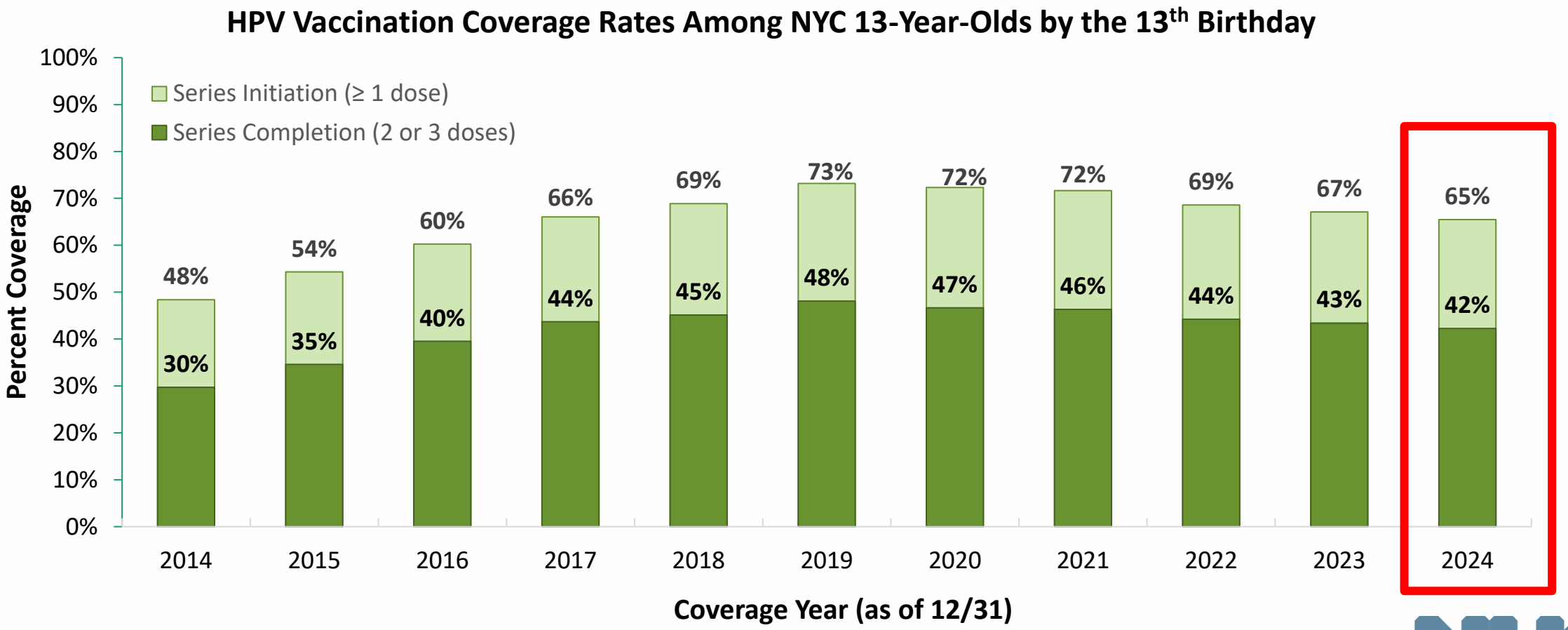
HPV Vaccine

- Gardasil® (Merck); licensed in 2006
- Prevents more than 90% of HPV-related cancers
- Routinely recommended for 11-12-year-olds, prior to exposure to HPV
  - In July 2025, NYS and NYC started recommending HPV vaccination at age 9
  - 2-3 doses required
- HPV vaccination is not required for school in New York State

Source: HPV Vaccination Recommendations | CDC

NYC Health

In New York City (NYC), on-time HPV vaccination rates are low



Source: NYC Citywide Immunization Registry (numerators); 2022 Vintage Population Estimates (denominators)

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Citywide Immunization Registry (CIR)

- NYC's Immunization Information System (IIS)
  - Implemented citywide in 1997
- Population-based
  - Birth certificates loaded into CIR twice per week
- Mandatory reporting of immunizations for children 0-18 years
- Contains
  - >15 million patient records
  - >180 million immunizations

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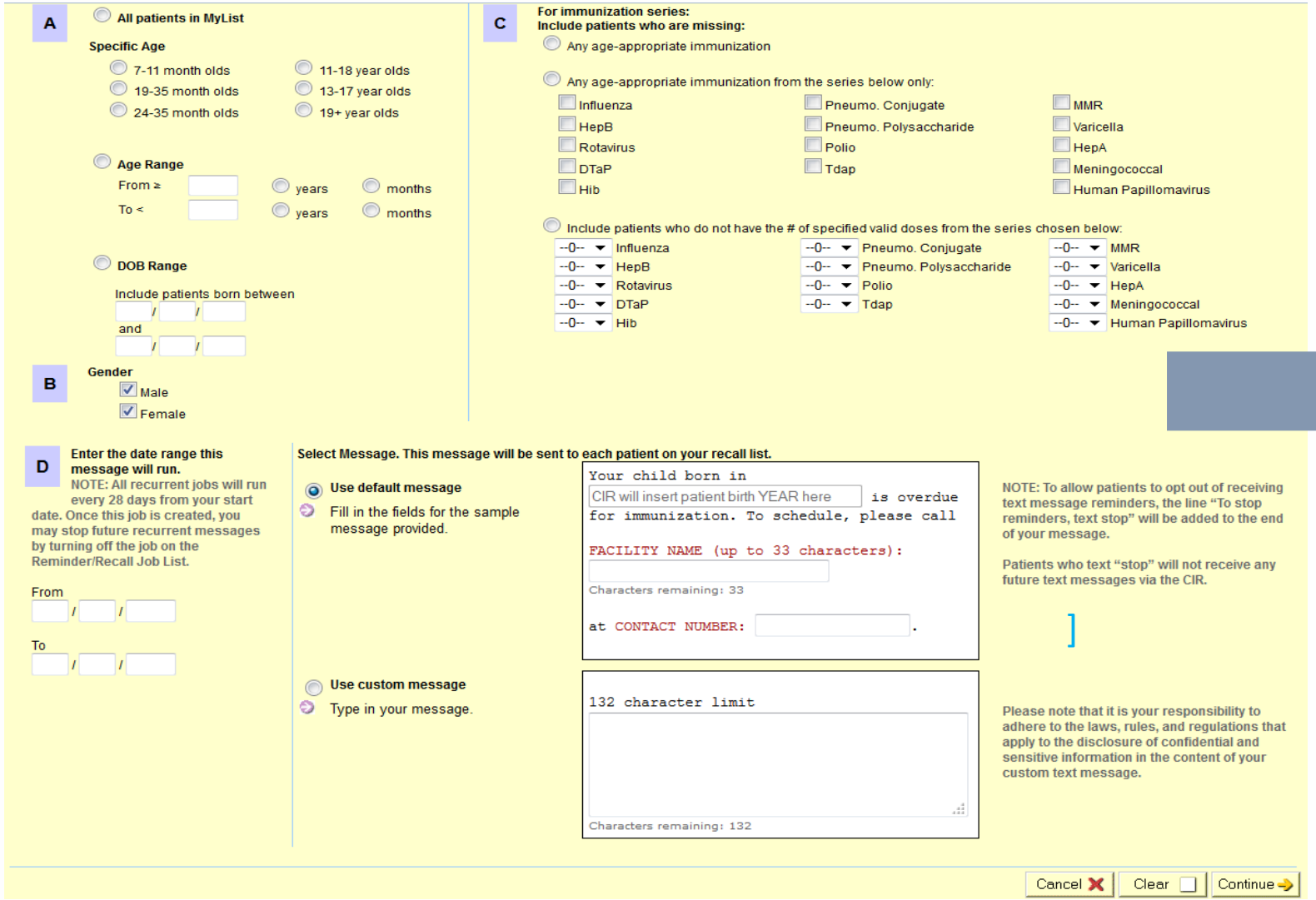
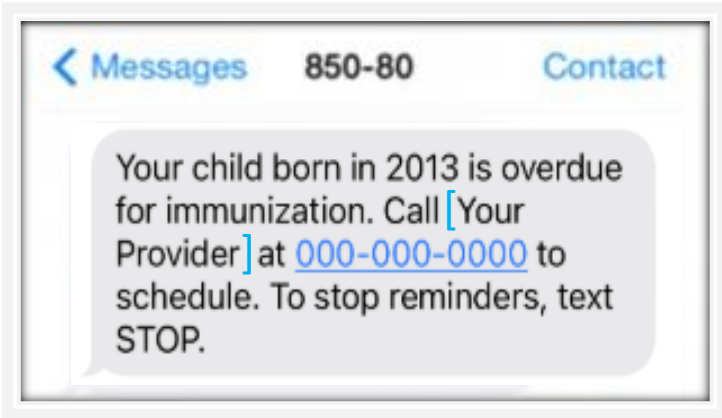
Text messaging functionality was deployed in CIR in 2015.





Effectiveness of Text Message Reminder/Recall in the Literature

- Previous studies have found text messaging by healthcare providers or schools to be a successful method of recalling patients for HPV vaccination[1-6]
- Few studies on text message recall by health departments

Study Aim & Objectives

- Aim: To evaluate the impact of centralized recall text message on HPV vaccine series completion rates among NYC adolescents who initiated the HPV series and were overdue for the second dose
- Objectives:
  1. To compare HPV vaccine series completion rates between adolescents whose parents/guardians were sent an HPV recall text message or a general health text message within 8 weeks
  2. To evaluate intervention effects among demographic subgroups

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Methods

Study Design

- **Study Design:** Randomized Controlled Trial

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- **Data Source:** NYC Citywide Immunization Registry

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- **Data Source:** NYC Citywide Immunization Registry
- **Study Population:** NYC adolescents ages 11-14 years who received HPV dose 1 and were overdue for HPV dose 2
  - ***Intervention Group:*** Sent HPV vaccination recall text message
  - ***Control Group:*** Sent general health text message

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Study Design

- **Study Design:** Randomized Controlled Trial
- **Data Source:** NYC Citywide Immunization Registry
- **Study Population:** NYC adolescents ages 11-14 years who received HPV dose 1 and were overdue for HPV dose 2
  - ***Intervention Group:*** Sent HPV vaccination recall text message
  - ***Control Group:*** Sent general health text message
- **Primary Outcome:** Proportion of adolescents completing the HPV vaccine series (dose 2 uptake) within 8 weeks of the text messages

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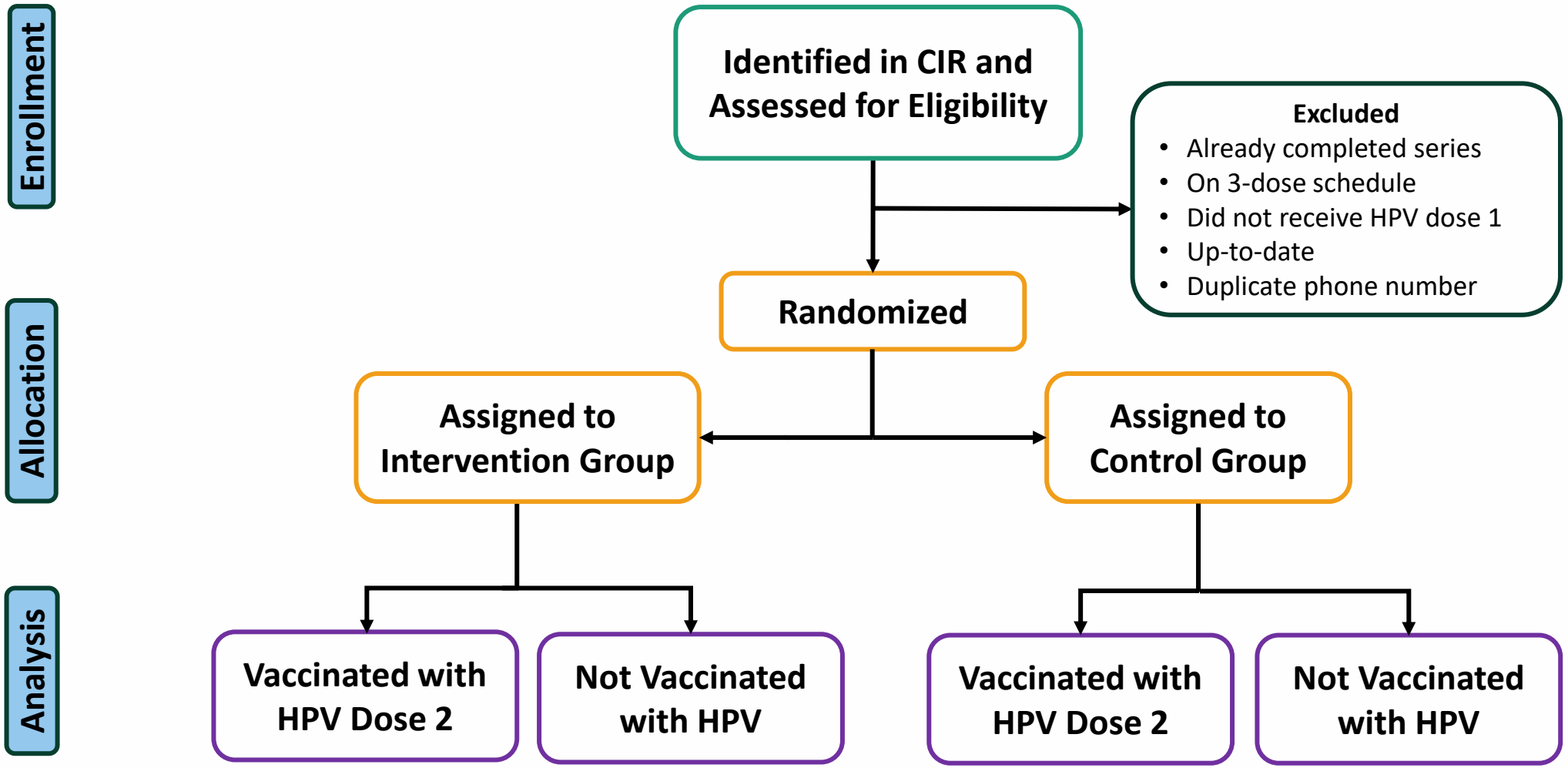
Enrollment
Allocation
Analysis
Identified in CIR and Assessed for Eligibility
Excluded
• Already completed series
• On 3-dose schedule
• Did not receive HPV dose 1
• Up-to-date
• Duplicate phone number
Randomized
Assigned to Intervention Group
Assigned to Control Group
Vaccinated with HPV Dose 2
Not Vaccinated with HPV
Vaccinated with HPV Dose 2
Not Vaccinated with HPV

Enrollment

Identified in CIR and Assessed for Eligibility

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Enrollment

Identified in CIR and Assessed for Eligibility

Query Restrictions:

- Between ages 11-14 years
- Current NYC resident
- Valid mobile phone number in CIR record
- Did not opt out of text messaging

Enrollment

Identified in CIR and Assessed for Eligibility

NYC Health

Enrollment

Identified in CIR and Assessed for Eligibility

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Enrollment

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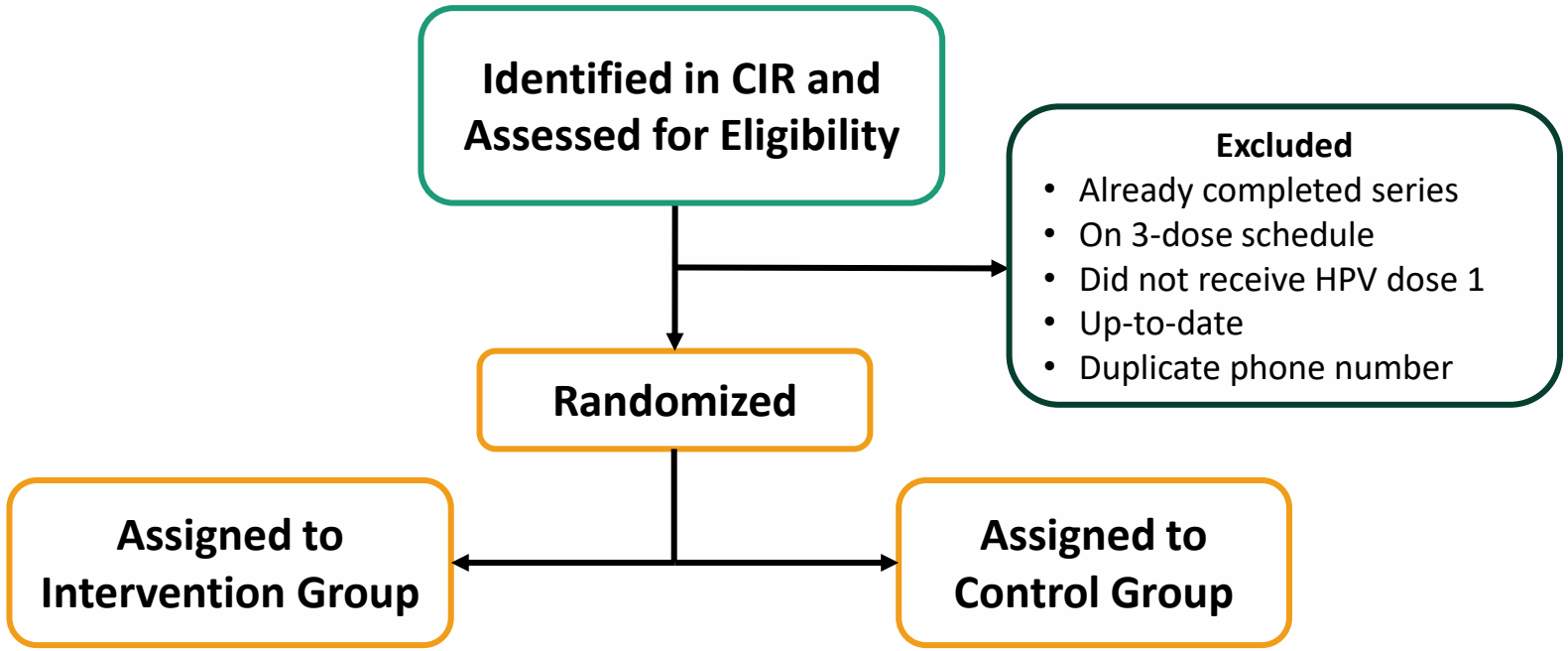

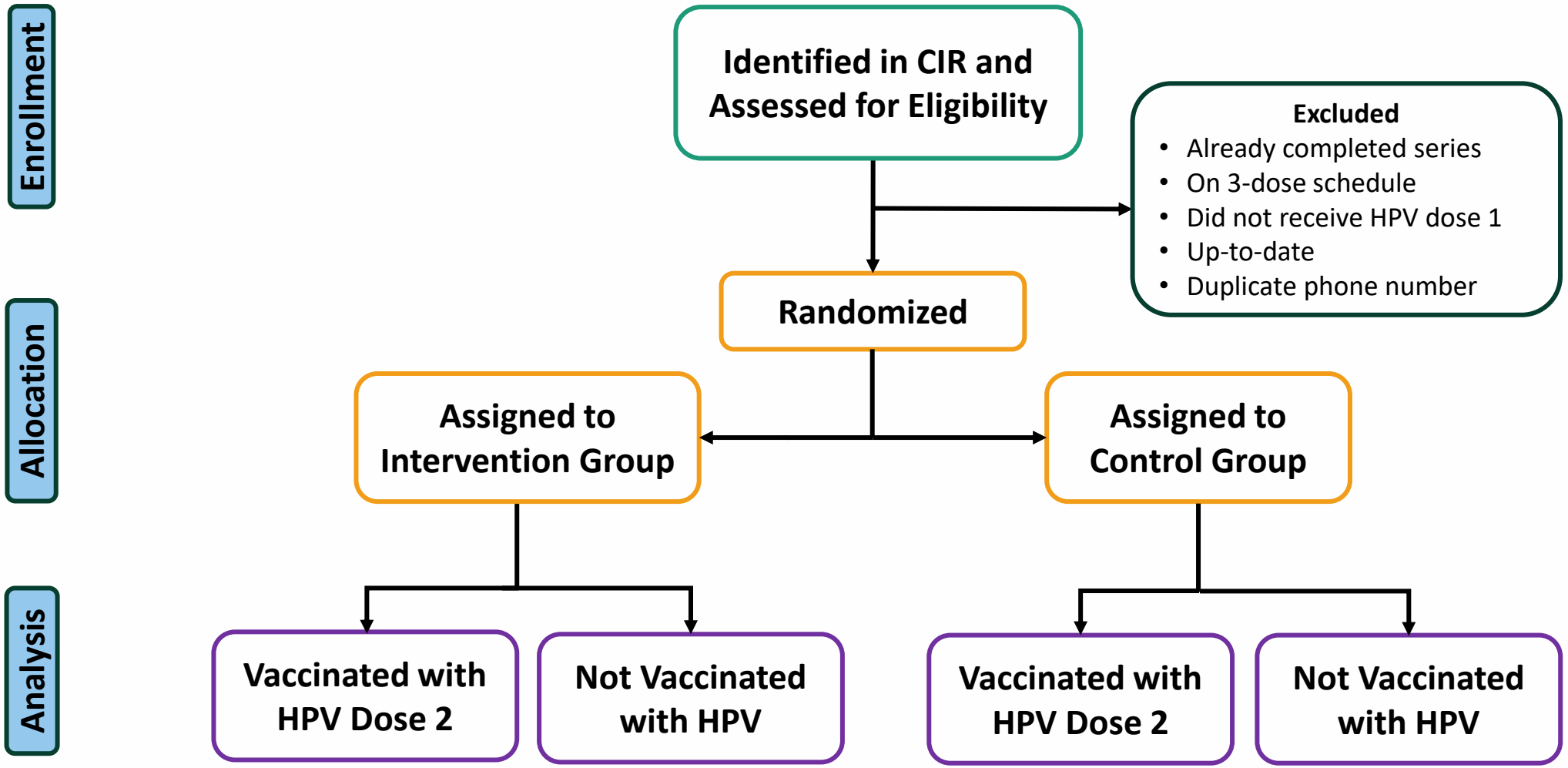
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Assigned to Intervention Group
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Vaccinated with HPV Dose 2
Not Vaccinated with HPV
Vaccinated with HPV Dose 2
Not Vaccinated with HPV

Text Message Intervention

- On May 14, 2024, the NYC Health Department sent a one-time text message to parents of adolescents in both groups

Intervention Group

NYC Health, 311: Your child born in 2012 is due for their next HPV vaccine. Call your doctor today. To stop reminders, text STOP.

Control Group

NYC Health, 311: Beat the heat. Visit on.nyc.gov/nycheat or call 311 for tips to stay healthy, safe and keep cool this summer. To stop reminders, text STOP.

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Statistical Analysis Plan

- Primary analysis:
  - Compared HPV vaccine series completion rates at 8 weeks using a multivariable logistic regression model to adjust for confounders
    - A-priori covariates included age, sex, race/ethnicity, borough of residence and Vaccines For Children (VFC) eligibility status
- Secondary analysis:
  - Fit interaction models to evaluate the impact of the intervention on HPV vaccine series completion rates among demographic subgroups

Results

Enrollment

Identified in CIR and Assessed for Eligibility
(n=355,412)

Enrollment

Identified in CIR and Assessed for Eligibility
(n=355,412)

Excluded (n=333,182)
- Already completed series (n=149,028, 45%)
- Did not receive HPV dose 1 (n=133,855, 40%)
- Up-to-date (n=49,033, 15%)
- On 3-dose schedule (n=571, 0.2%)
- Duplicate phone number (n=695, 0.2%)

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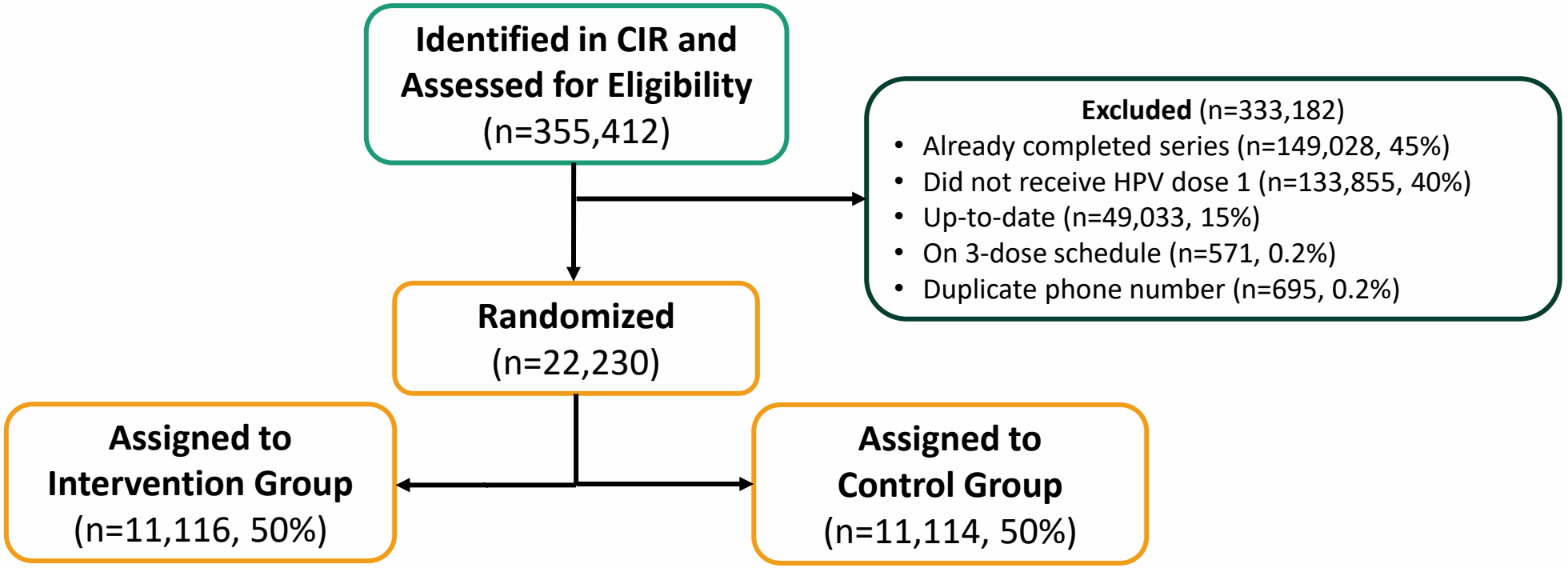
Enrollment

Allocation



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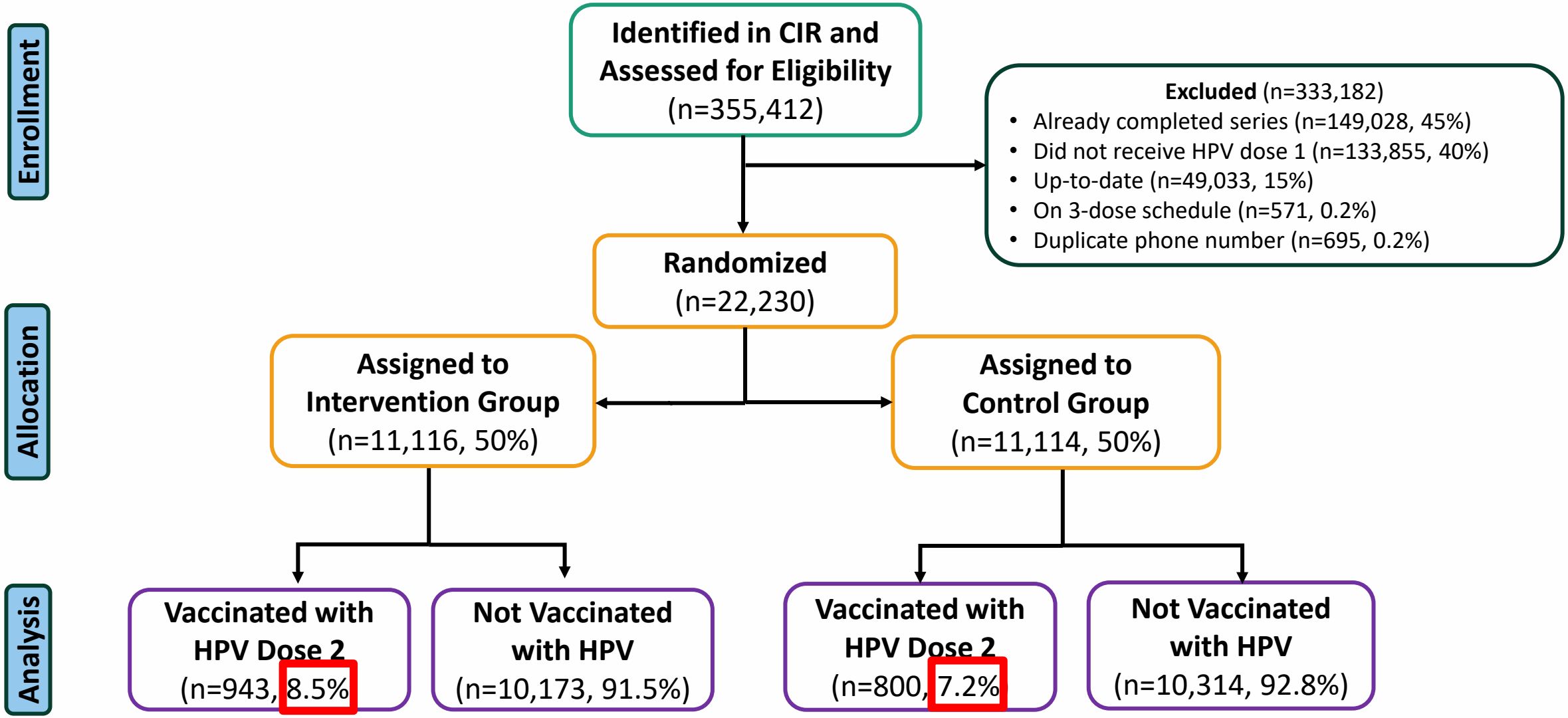
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Duplicate phone number (n=695, 0.2%)
Randomized (n=22,230)
Assigned to Intervention Group (n=11,116, 50%)
Assigned to Control Group (n=11,114, 50%)
Vaccinated with HPV Dose 2 (n=943, 8.5%
Not Vaccinated with HPV (n=10,173, 91.5%)
Vaccinated with HPV Dose 2 (n=800, 7.2%
Not Vaccinated with HPV (n=10,314, 92.8%)

Text message opt-out and failure rates were similar in both study arms

Text Job Summary	Intervention Group		Control Group	
	N	Percent (%)	N	Percent (%)
No. of Text Messages Sent	11,116	100%	11,114	100%
No. Successfully Delivered	9,378	84%	9,428	85%
No. Failed	1,507	16%	1,437	15%
Opt-outs	95	1%	66	0.70%

Source: NYC Citywide Immunization Registry
OR: Odds Ratio; 95% CI: 95% Confidence Interval

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Demographic characteristics were similar in both arms at baseline, indicating successful randomization

Table 1: Baseline characteristics of study participants (n=22,230)

	Intervention Group n (%)	Control Group n (%)
Total	**11,116 (100%)**	**11,114 (100%)**
Age		
11-12 Years	3,893 (35.0%)	3,729 (33.6%)
13-14 Years	7,223 (65.0%)	7,385 (66.5%)
Sex		
Male	5,657 (50.9%)	5,769 (51.9%)
Female	5,448 (49.0%)	5,336 (48.1%)
Other	11 (0.1%)	9 (0%)
Race/Ethnicity		
Asian/Pacific Islander	1,105 (9.9%)	1,048 (9.4%)
Black, Non-Hispanic	2,779 (25.0%)	2,722 (24.5%)
Hispanic	4,505 (40.5%)	4,563 (41.1%)
Other	1,793 (16.1%)	1,812 (16.3%)
White, Non-Hispanic	934 (8.4%)	969 (8.7%)
Borough of Residence		
Manhattan	1,363 (12.3%)	1,433 (12.9%)
Bronx	3,162 (28.5%)	3,238 (29.1%)
Brooklyn	3,228 (29.0%)	3,166 (28.5%)
Queens	2,879 (25.9%)	2,832 (25.5%)
Staten Island	475 (4.3%)	442 (4.0%)
Missing	9 (0.1%)	3 (0%)
VFC Eligibility Status		
Yes	6,853 (61.7%)	6,994 (62.9%)
No	1,644 (14.8%)	1,564 (14.1%)
Unknown	2,619 (23.6%)	2,556 (23.0%)

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Adolescents whose parents were sent the HPV recall text had 20% higher odds of completing the HPV vaccine series within 8 weeks compared to adolescents whose parents were sent the general health text

Study Arm	Total Participants	Vaccinated n (%)	Not Vaccinated n (%)	Unadjusted OR (95% CI)	Adjusted OR* (95% CI)
HPV recall text (Intervention group)	11,116	943 (8.5%)	10,173 (91.5%)	1.20 (1.08-1.32)	1.19 (1.07-1.31)
General health text (Control group)	11,114	800 (7.2%)	10,314 (92.8%)	--------	--------

*Adjusted for age, sex, race/ethnicity, borough of residence and VFC eligibility status

Source: NYC Citywide Immunization Registry
OR: Odds Ratio; 95% CI: 95% Confidence Interval

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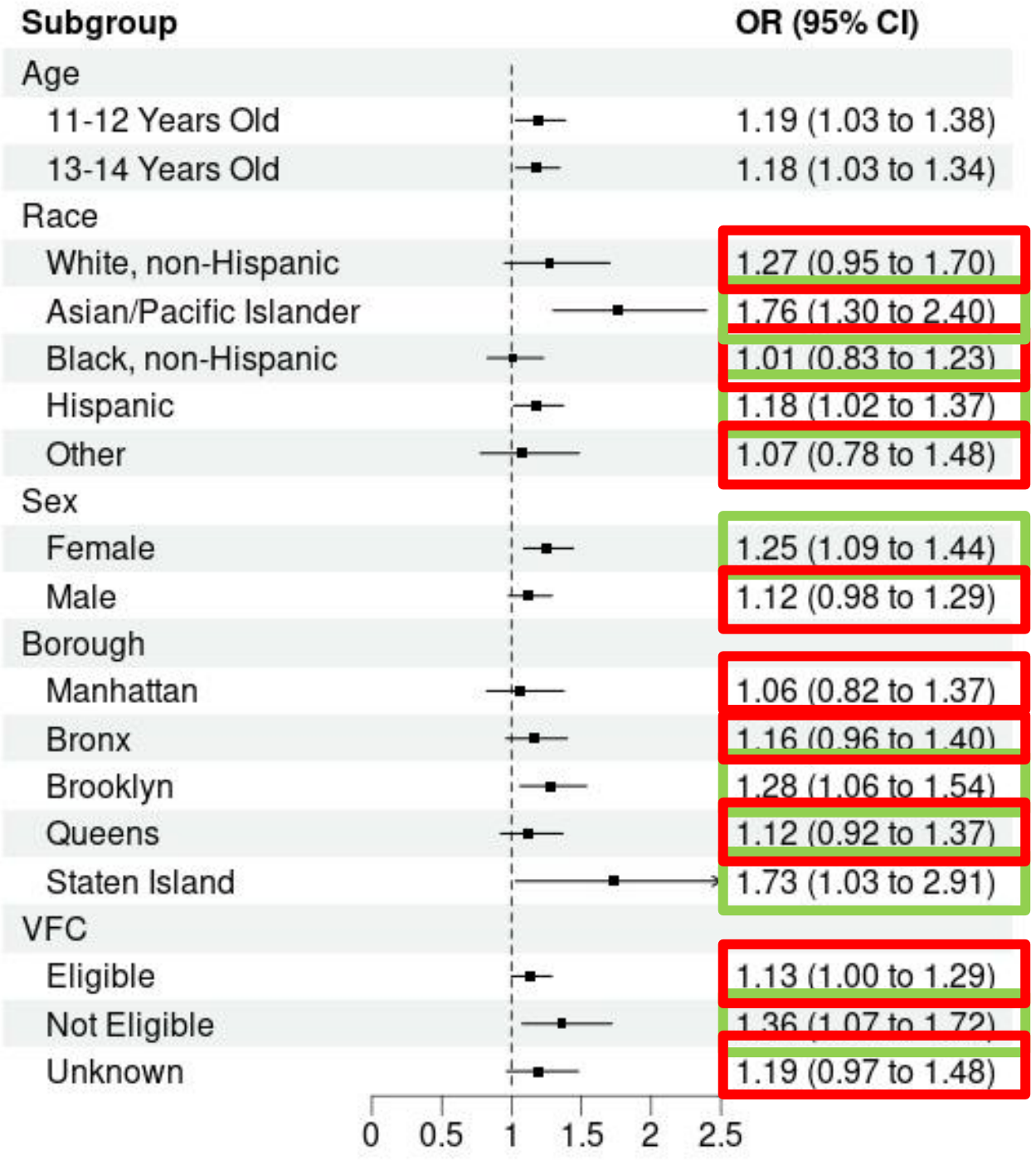
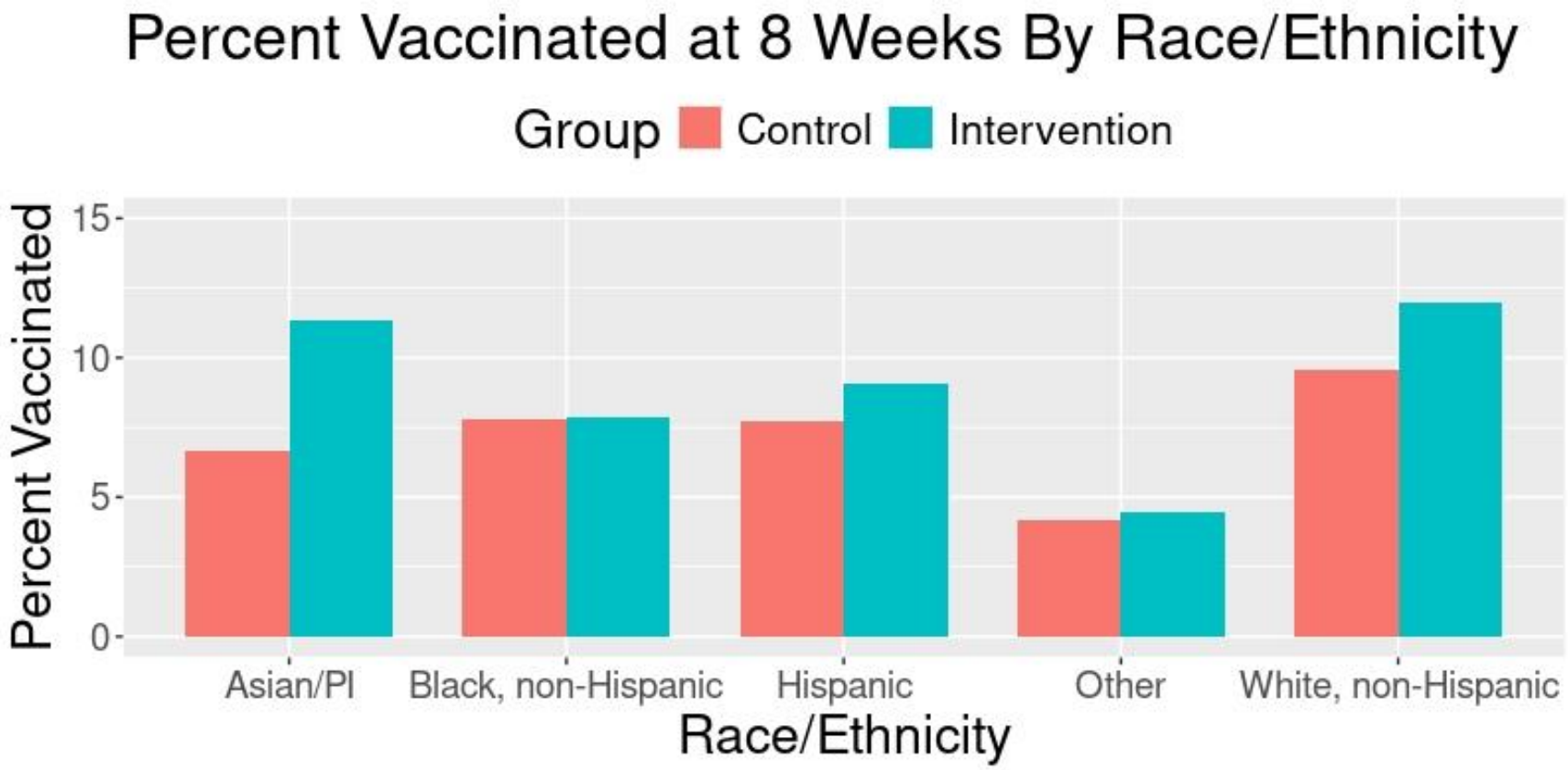
Who benefited the most from the HPV recall text message?

- Greatest impact among Asian/Pacific Islander, Hispanic, female, non-VFC eligible and residents in Staten Island and Brooklyn
- Less impact observed among Black, non-Hispanic, males, VFC eligible and residents in Manhattan, Bronx and Queens



Source: NYC Citywide Immunization Registry
OR: Odds Ratio; 95% CI: 95% Confidence Interval

A greater percentage of Asian/Pacific Islander, Hispanic, and White, non-Hispanic adolescents in the intervention group received HPV dose 2 compared to adolescents in the control group



Source: NYC Citywide Immunization Registry

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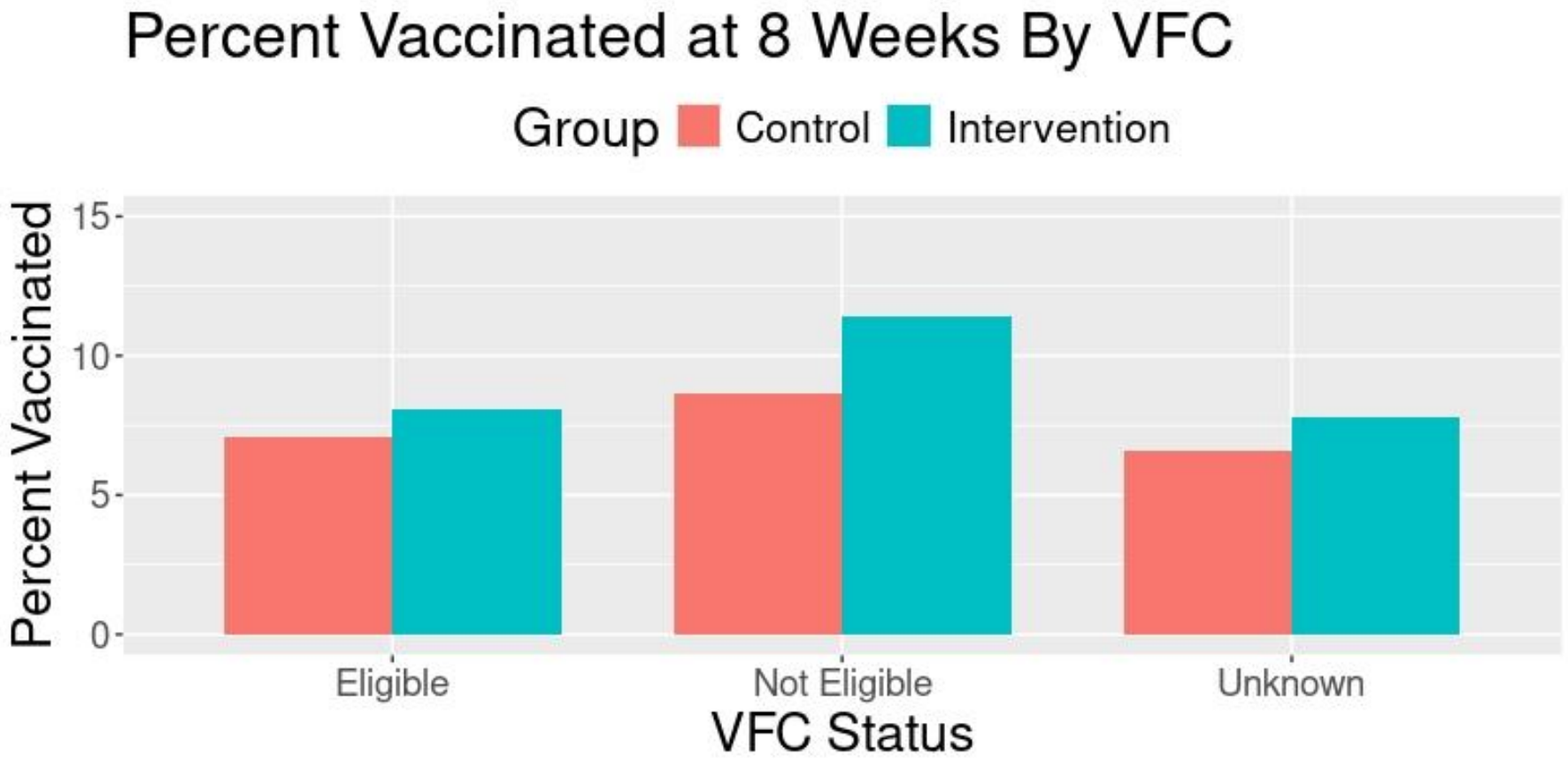
A greater percentage of non-VFC eligible adolescents in the intervention group were vaccinated compared to adolescents in the control group



Source: NYC Citywide Immunization Registry

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Key Findings

- The HPV vaccination recall text message increased HPV vaccine series completion rates among adolescents who were overdue for HPV vaccine
- There were notable disparities in series completion based on race/ethnicity, sex, borough of residence, and VFC eligibility status
  - Certain demographic groups may be more likely to benefit from a centralized text intervention
  - Additional outreach methods (i.e., phone calls, provider engagement) may be needed for less responsive groups

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Limitations

- Text message available only in English language
- One-time text message
- Follow-up period coincided with summer break
- Looked only at HPV dose 2 uptake – results may not be generalizable to HPV series initiation or other vaccines

Strengths

- Large registry-based population
- Multivariable model
- Opt-out rates were low, indicating that intervention was well-tolerated
- Easy, low-cost intervention

Conclusions

- A centralized text message recall by a health department is a simple, low cost and well-tolerated strategy to increase vaccination rates
- Recommend using as a supplement to increase vaccine uptake among populations with low vaccination coverage

Thank you!

- Acknowledgements:
  - Nilram Halat, Alexandra Ternier, Iris Cheng, Conner Jackson, Denise Benkel, Noora Majid, Kristin Oliver, Melissa Mickle-Hope, Alexa Riggs, Beth Rubenstein, Allison Lemkin, Michelle Macaraig, Bindy Crouch

- Contact info:
  - mlangdonembry@health.nyc.gov

Health

References

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Thank you to our presenters, and thanks to all of you for joining us!

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The next Discovery Session will be on **March 23, 2026**