Improving Vaccination Uptake using Cheap Experiments

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MINISTRY OF HEALTH
SINGAPORE

National
Quality Improvement
Conference
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ADVANCING QUALITY AND SAFETY TOGETHER:
A CELEBRATION OF LEARNING

Improving Vaccination Uptake using Cheap Experiments

Kenneth Sng, Senior Product Manager
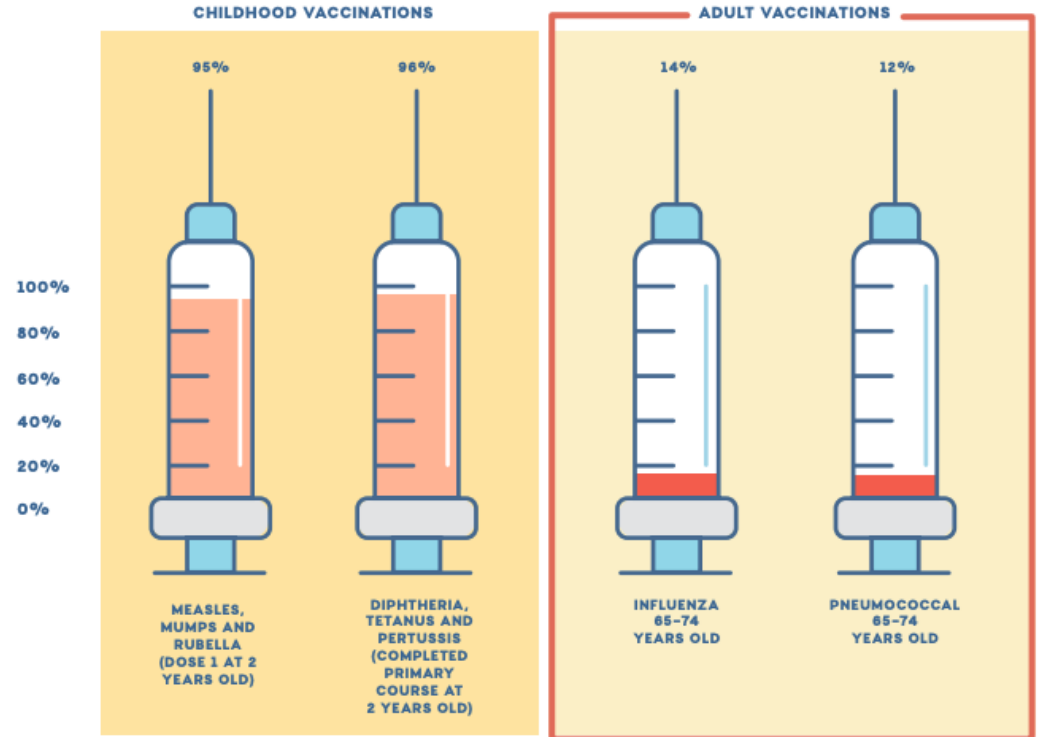
OPEN GOVERNMENT PRODUCTS

Problem Statement: Low Vaccine Uptake

Uptake of critical vaccines under NAIS were low, e.g.

- Flu and pneumococcal vaccines for elderly
- HPV2 vaccines for young women)

But the health benefits of these preventive care services are quite substantial

CHILDHOOD VACCINATIONS

ADULT VACCINATIONS

95% 96% 14% 12%

100%
80%
60%
40%
20%
0%

MEASLES, MUMPS AND RUBELLA (DOSE 1 AT 2 YEARS OLD)

DIPHTHERIA, TETANUS AND PERTUSSIS (COMPLETED PRIMARY COURSE AT 2 YEARS OLD)

INFLUENZA 65-74 YEARS OLD

PNEUMOCOCCAL 65-74 YEARS OLD

Source: Communicable Diseases Surveillance Singapore 2017

Source: National Population Health Survey 2016/17 Pilot

Statistics: Cervical Cancer and HPV Vaccines

172 women die from cervical cancer in Singapore each year

- 309 women diagnosed each year
- 2nd leading cause of death among women in 30s
- 99.7% of cervical cancer are caused by HPV viruses

Highly preventable via HPV vaccines, especially if taken before 26 years old (See table)

Age Group (years old)	% Reduction in Cervical Cancer Incidence
Before 17	↓ 88%
17 to 30	↓ 53%

Source: Study of 1.6 million girls and women in Sweden (New England Journal of Medicine)

4

How might we save more lives by increasing vaccination rates?

During Covid-19, MOH pioneered a new approach of nudging people **through SMSes**:

- Fast
- Targeted
- Allows you to book an appointment directly

Previously

New!

Three-Step Process for Maximising Conversion

HAS's objective isn't just to facilitate appointments -- but to raise the take-up rates for preventative care services and save lives

We came up with a three-step framework for optimising vaccine take-up rates*.

Our goal is to optimise the conversion rates at each of the three steps.

* We are focusing on vaccines now, but will eventually expanding into screening and other preventative care services.

Focus for today!
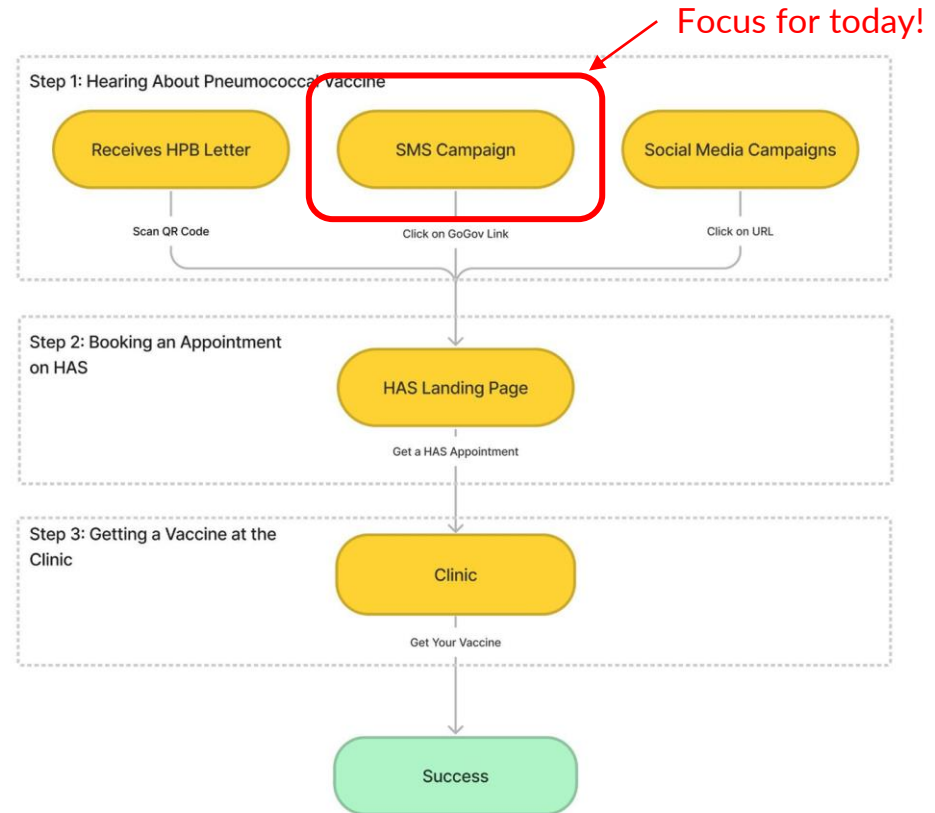
A/B Testing with Existing OGP Tools

VACCINATION SG $\rightarrow$ **GO**.gov.sg $\rightarrow$ **postman**

Retrieve Patient's contact info from Covid-19 appointment records

Mass generate unique URLs with GoGov

Send out SMSes via Postman

https://book.health.gov.sg/?source=gogov&key=12345

$\downarrow$

https://go.gov.sg/abcdef

Dear KENNETH SNG, you are invited to get the Pneumococcal vaccine to prevent serious infections from pneumococcal bacteria. Please book your appointment using this link: https://book.health.gov.sg.

If you have completed both Pneumococcal vaccine doses, please disregard this SMS. For enquiries, please visit ask.gov.sg/agency/has

First Experiment:
SMS Copy

(Side quest: Compare effectiveness with physical letters)

SMS Copy A: Psychological Safety

For the first copy, we tried to mirror the Covid-19 vaccine SMSes invite as much as possible to create:

- A sense of familiarity
- Psychological safety

Because of the scam climate, our hypothesis is that something familiar will lead to higher click-through rates for the book.health.gov.sg URL

Covid Booster Invite

Dear KENNETH SNG, you are invited to get the COVID-19 vaccine booster dose for an increased level of immunity and a higher level of protection from severe disease. Please book your booster appointment using this link https://vaccine.gov.sg/?code=2BMXNKK6DW and do not share the link with others as it is unique to you. Please book your booster vaccination at least five months after your second dose.

If you had already received an earlier SMS to book or have completed your booster vaccination, please disregard this SMS. For enquiries, please visit www.vaccine.gov.sg or call the COVID-19 hotline 1800-333-9999.

中文,Melayu, தமிழ் - go.gov.sg/c19-booster

HAS SMS Copy A

Dear KENNETH SNG, you are invited to get the Pneumococcal vaccine to prevent serious infections from pneumococcal bacteria. Please book your appointment using this link: https://book.health.gov.sg.

If you have completed both Pneumococcal vaccine doses, please disregard this SMS. For enquiries, please visit ask.gov.sg/agency/has

SMS Copy B: Loss Aversion

For the second copy, we wanted to convey the impact of not taking a vaccine:

- "Estimated 1,000 lives lost each year"
- "Get protected from serious complications"

The hypothesis is that loss aversion/fear is a strong motivator for non-mandatory vaccines, such as pneumococcal.

Dear KENNETH SNG,

Pneumonia resulting from the pneumococcal bacteria claims an estimated 1,000 lives a year in Singapore. Get protected from serious complications by taking a Pneumococcal vaccine now. You can book your appointment using this link: https://book.health.gov.sg.

If you have completed both Pneumococcal vaccine doses, please disregard this SMS. For enquiries, please visit ask.gov.sg/agency/has

SMS Copy C: Low Cognitive Load

For the third copy, we wanted to keep the SMS short and succinct with minimal information by reducing the number of words and sentences (i.e. 43 words in 4 short sentences).

The hypothesis is that people don't like to read long SMSes and would prefer SMSes to be short and succinct.

HAS SMS Copy C

Dear KENNETH SNG,

Protect yourself against Pneumococcal pneumonia. Book an appointment to take the Pneumococcal vaccine now: https://book.health.gov.sg

If you have completed both Pneumococcal vaccine doses, please disregard this SMS. For enquiries, please visit ask.gov.sg/agency/has

Guess which SMS copies have the highest unique click-through rates?

Copy A: Psychological Safety

Dear KENNETH SNG, you are invited to get the Pneumococcal vaccine to prevent serious infections from pneumococcal bacteria. Please book your appointment using this link: https://book.health.gov.sg.

If you have completed both Pneumococcal vaccine doses, please disregard this SMS. For enquiries, please visit ask.gov.sg/agency/has

2000 SMSes sent

Copy B: Loss Aversion

Dear KENNETH SNG,

Pneumonia resulting from the pneumococcal bacteria claims an estimated 1,000 lives a year in Singapore. Get protected from serious complications by taking a Pneumococcal vaccine now. You can book your appointment using this link: https://book.health.gov.sg.

If you have completed both Pneumococcal vaccine doses, please disregard this SMS. For enquiries, please visit ask.gov.sg/agency/has

2000 SMSes sent

Copy C: Low Cognitive Load

Dear KENNETH SNG,

Protect yourself against Pneumococcal pneumonia. Book an appointment to take the Pneumococcal vaccine now: https://book.health.gov.sg

If you have completed both Pneumococcal vaccine doses, please disregard this SMS. For enquiries, please visit ask.gov.sg/agency/has

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Kenneth's bet

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Dear KENNETH SNG,

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Copy A: Psychological Safety   Copy B: Loss Aversion   Copy C: Low Cognitive Load

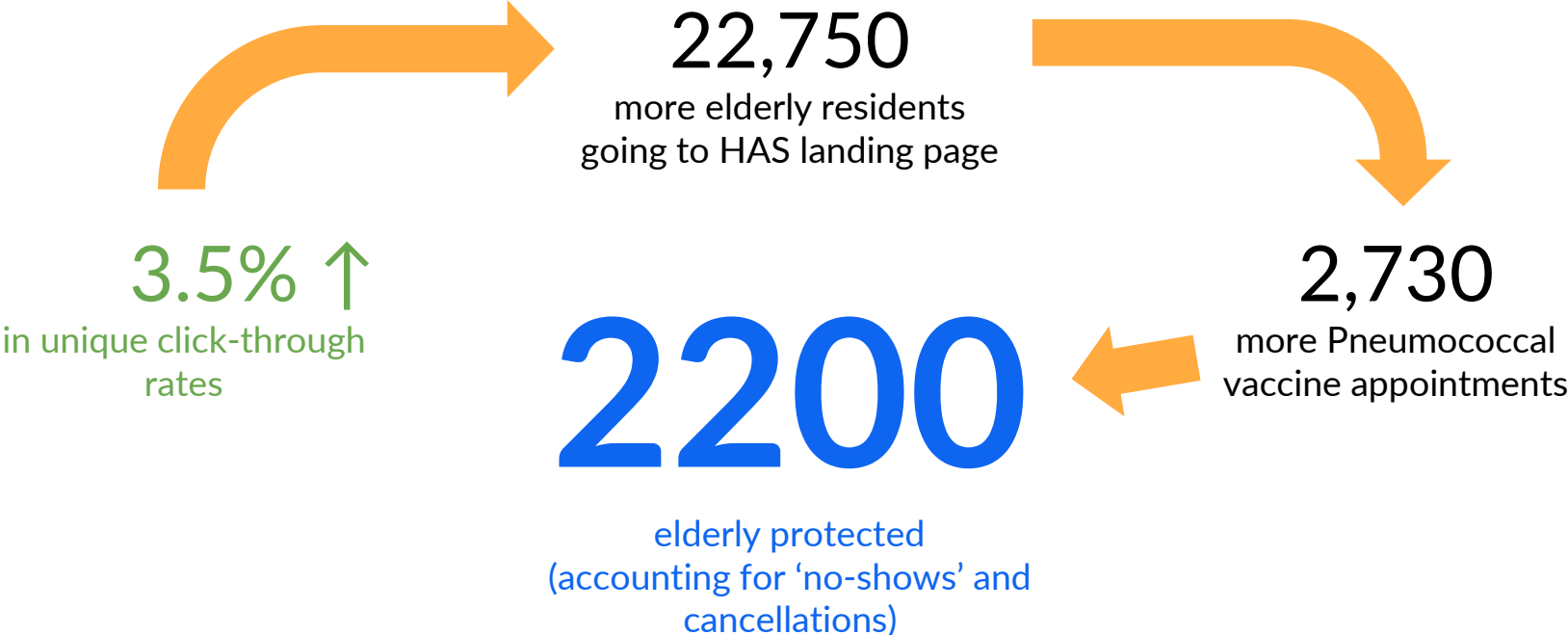27.1%   23.6%   25.5%

Copy A and C looks formal, impersonal and official => Less sketchy

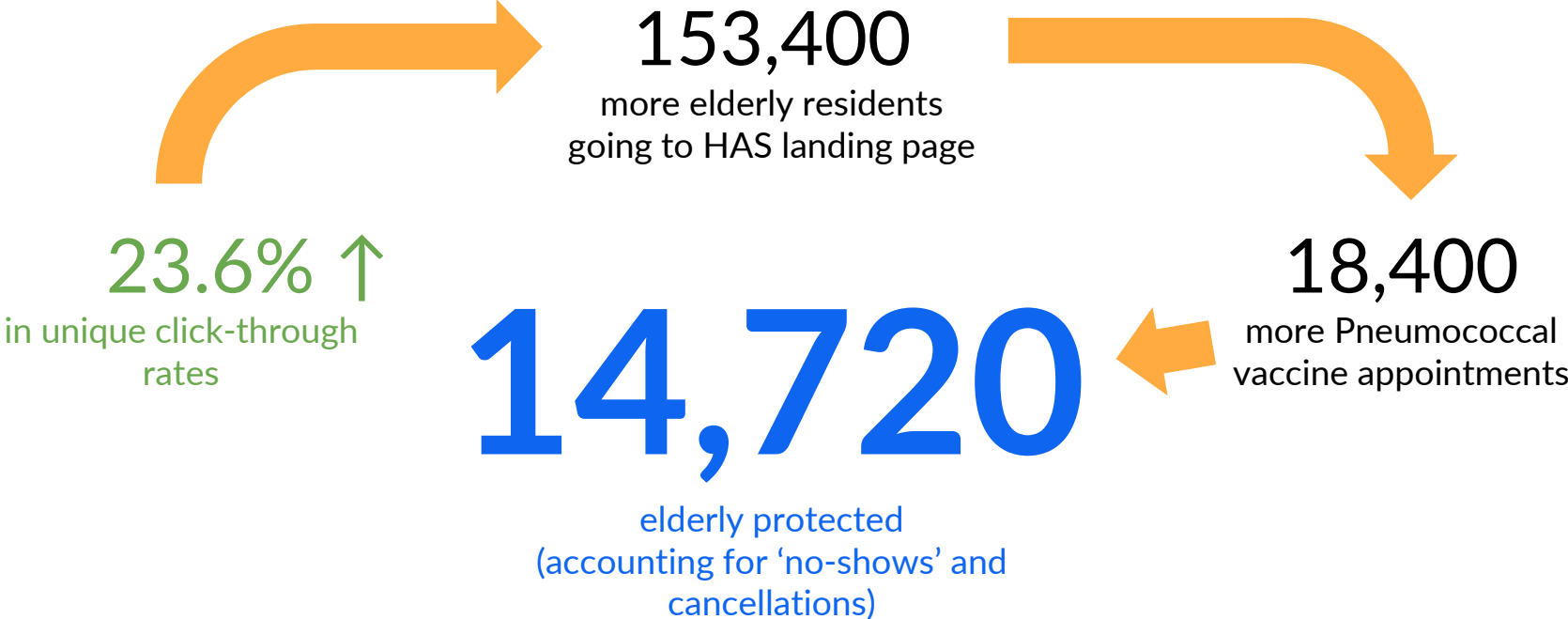# Copy A that mirrored MOH's Covid-19 SMS invitations performed the best!

Worse performing Copy B felt like a scam message (fear-inducing, urgent, click on link right away)

Impact from Optimising SMS Copy

22,750
more elderly residents
going to HAS landing page

2,730
more Pneumococcal
vaccine appointments

3.5% ↑
in unique click-through
rates

2200
elderly protected
(accounting for 'no-shows' and
cancellations)

Impact from Shifting from Letters to SMS

153,400
more elderly residents
going to HAS landing page

23.6% ↑
in unique click-through
rates

14,720
elderly protected
(accounting for 'no-shows' and
cancellations)

18,400
more Pneumococcal
vaccine appointments

Second Experiment:
URL Legitimacy
(most exciting one)

Which URL is the most trusted by Singaporean public?

GoGov?

ForSG?

Book.Health.Gov.Sg?

Guess which URL has the highest click-through rates?

GoGov

Dear KENNETH SNG, you are invited to get the Pneumococcal vaccine to prevent serious infections from pneumococcal bacteria. Please book your appointment using this link: https://go.gov.sg/abcdef.

If you have completed both Pneumococcal vaccine doses, please disregard this SMS. For enquiries, please visit ask.gov.sg/agency/has

https://go.gov.sg/abcdef

ForSG

Dear KENNETH SNG, you are invited to get the Pneumococcal vaccine to prevent serious infections from pneumococcal bacteria. Please book your appointment using this link: https://for.sg/abcdef.

If you have completed both Pneumococcal vaccine doses, please disregard this SMS. For enquiries, please visit ask.gov.sg/agency/has

https://for.sg/abcdef

HAS

Dear KENNETH SNG, you are invited to get the Pneumococcal vaccine to prevent serious infections from pneumococcal bacteria. Please book your appointment using this link: https://book.health.gov.sg/?key=abcdef.

If you have completed both Pneumococcal vaccine doses, please disregard this SMS. For enquiries, please visit ask.gov.sg/agency/has

https://book.health.gov.sg/?key=abcdef

Round 1: GoGov versus ForSG?

GoGov

https://go.gov.sg/abcdef

> Dear KENNETH SNG, you are invited to get the Pneumococcal vaccine to prevent serious infections from pneumococcal bacteria. Please book your appointment using this link: https://go.gov.sg/abcdef.
>
> If you have completed both Pneumococcal vaccine doses, please disregard this SMS. For enquiries, please visit ask.gov.sg/agency/has

2000 SMSes sent

ForSG

https://for.sg/abcdef

> Dear KENNETH SNG, you are invited to get the Pneumococcal vaccine to prevent serious infections from pneumococcal bacteria. Please book your appointment using this link: https://for.sg/abcdef.
>
> If you have completed both Pneumococcal vaccine doses, please disregard this SMS. For enquiries, please visit ask.gov.sg/agency/has

2000 SMSes sent

Round 1: GoGov versus ForSG?

GoGov	ForSG
https://go.gov.sg/abcdef	https://for.sg/abcdef

27.1%

26.4%

But the difference is **not** statistically significant

2000 SMSes sent

2000 SMSes sent

We <u>cannot</u> say with 90% confidence that GoGov will perform better than ForSG

P-value = 0.6916

Round 2: GoGov versus HAS

GoGov

https://go.gov.sg/abcdef

Dear KENNETH SNG, you are invited to get the Pneumococcal vaccine to prevent serious infections from pneumococcal bacteria. Please book your appointment using this link: https://go.gov.sg/abcdef.

If you have completed both Pneumococcal vaccine doses, please disregard this SMS. For enquiries, please visit ask.gov.sg/agency/has

4000 SMSes sent

HAS

https://book.health.gov.sg/?key=abcdef

Dear KENNETH SNG, you are invited to get the Pneumococcal vaccine to prevent serious infections from pneumococcal bacteria. Please book your appointment using this link: https://book.health.gov.sg/?key=abcdef.

If you have completed both Pneumococcal vaccine doses, please disregard this SMS. For enquiries, please visit ask.gov.sg/agency/has

4000 SMSes sent

* The values are lower, because I used RUM logs to track the unique click-through, which doesn't capture every single session (e.g. ad blocker). The experiment duration was also shorter (i.e. 1 week)

Round 2: GoGov versus HAS

GoGov

https://go.gov.sg/abcdef

HAS

https://book.health.gov.sg/?key=abcdef

13.13%

13.70%

But the difference is **not** statistically significant

4000 SMSes sent

4000 SMSes sent

* The values are lower, because I used RUM logs to track the unique click-through, which doesn't capture every single session (e.g. ad blocker). The experiment duration was also shorter (i.e. 1 week)

We **cannot** say with 90% confidence that HAS will perform better than GoGov

P-value = 0.7748

Differences in click-through rates between URLs are not statistically significant

Possible explanations:

- GoGov and HAS performed slightly better than ForSG
  - This might suggest that the **.gov.sg** confers some legitimacy, but not to a statistically significant degree
  - MOH and HPB call centres received some calls reporting the for.sg urls as potential scams

- HAS performed slightly better than GoGov
  - Perhaps in the context of healthcare services, the health.gov.sg URL looks more credible than generic go.gov.sg links (which seems contextless)

Health Appointment System

https://book.health.gov.sg/?key=abcdef

GO.gov.sg

https://go.gov.sg/abcdef

for.sg

https://for.sg/abcdef

Third Experiment: Date/Time

(most rabak one)

SMS Experiment Schedule

	Mon	Tue	Wed	Thu	Fri	Sat	Sun

SMS Experiment Schedule

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
8am							
10am							
12pm							
2pm							
4pm							
6pm							
8pm							

SMS Experiment Schedule

	Mon	Tue	Wed	Thu	Fri	Sat	Sun
8am	Batch 1	Batch 8	Batch 15	Batch 22	Batch 29	Batch 36	Batch 43
10am	Batch 2				Batch 30	Batch 37	Batch 44
12pm	Batch 3				Batch 31	Batch 38	Batch 45
2pm	Batch 4				Batch 32	Batch 39	Batch 46
4pm	Batch 5				Batch 33	Batch 40	Batch 47
6pm	Batch 6	Batch 13	Batch 20	Batch 27	Batch 34	Batch 41	Batch 48
8pm	Batch 7	Batch 14	Batch 21	Batch 28	Batch 35	Batch 42	Batch 49

Best Day of the Week?

It is *marginally* better to send out SMSes at the start of the week (Mon-Wed)!
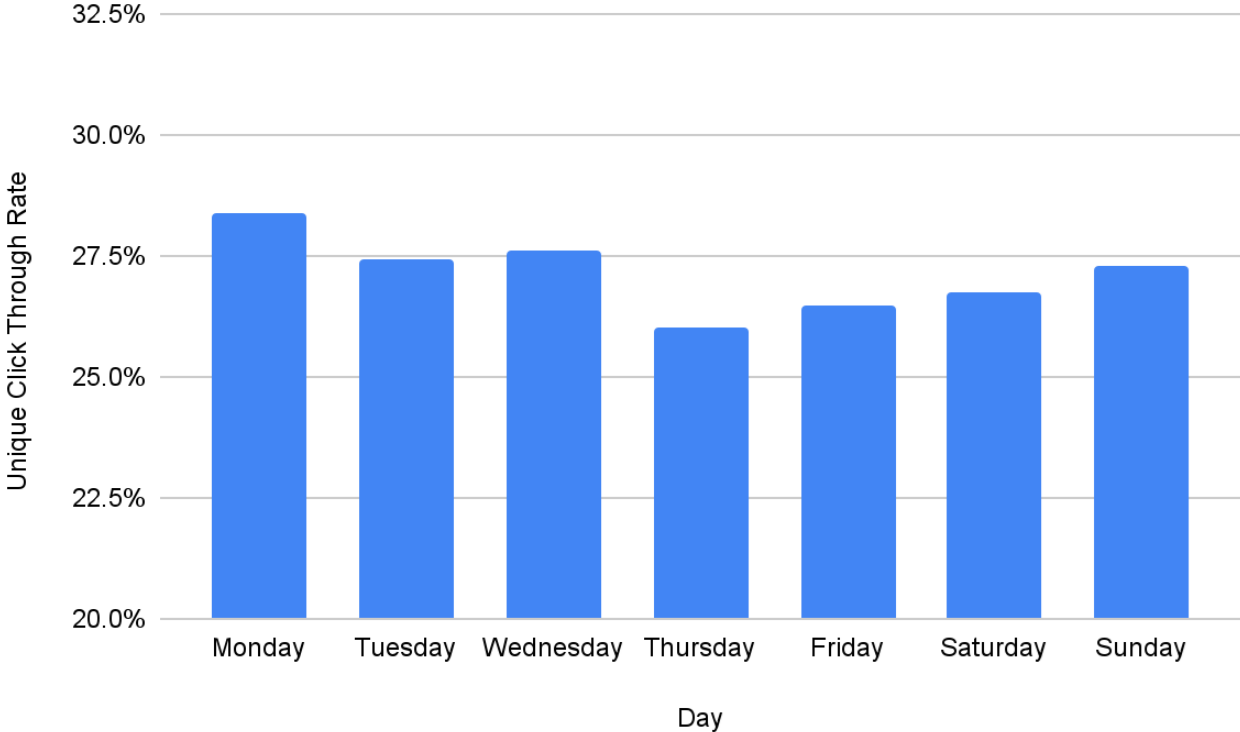
Best Time of the Day?

SMSes sent before 10am perform much better than SMSes sent after hours
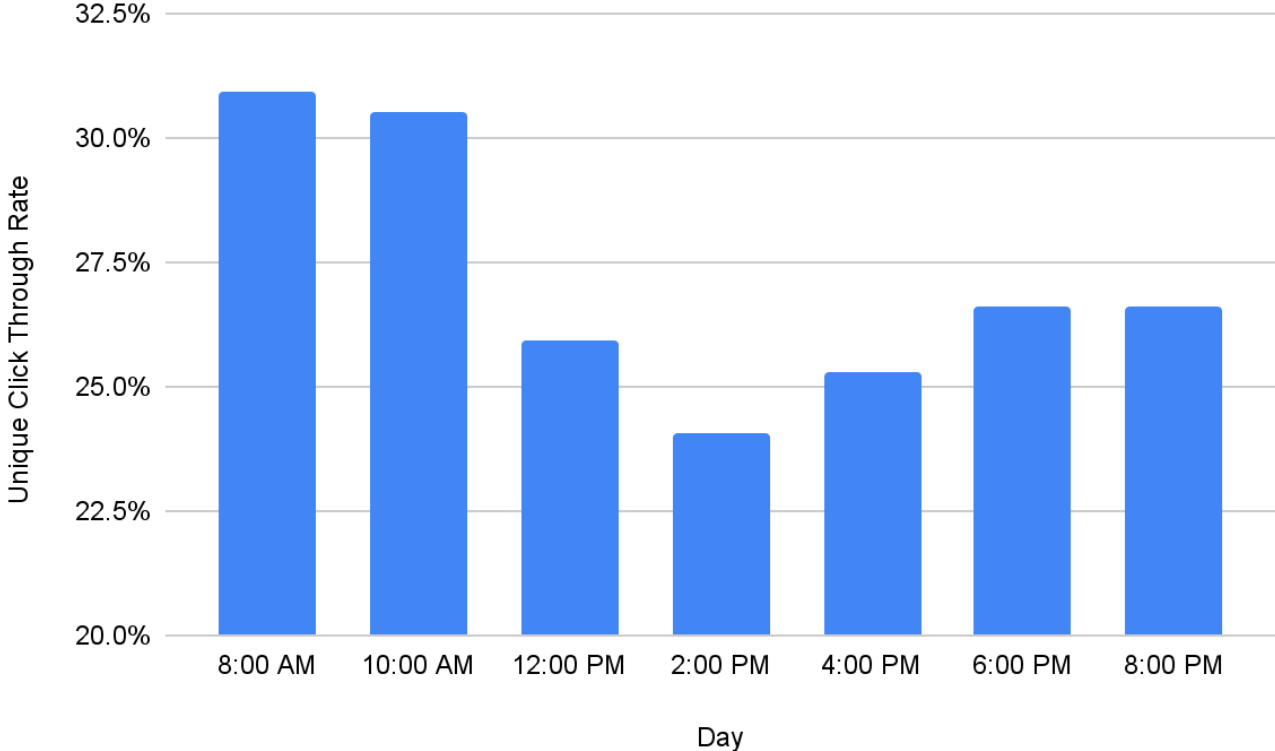
Conclusion

Summary of Results

1. SMS campaigns are cheap, fast and effective in driving vaccine uptake

2. SMS copy that mirrors MOH's Covid-19 SMSes perform the best
    a. Conversely, SMSes that try to play on risk-aversion or fear-mongering might backfire, because it looks like a scam SMS

3. There is **no** statistical significance in click-through rates for GoGov, ForSG and HAS URLs (with 'MOH' Sender ID)
    a. Might suggest that Sender ID is a more effective tool in fighting scams?

4. Monday to Wednesday mornings work best for patients above the age of 65 #earlybirdgetstheworm

Impact from Optimising SMS Copy
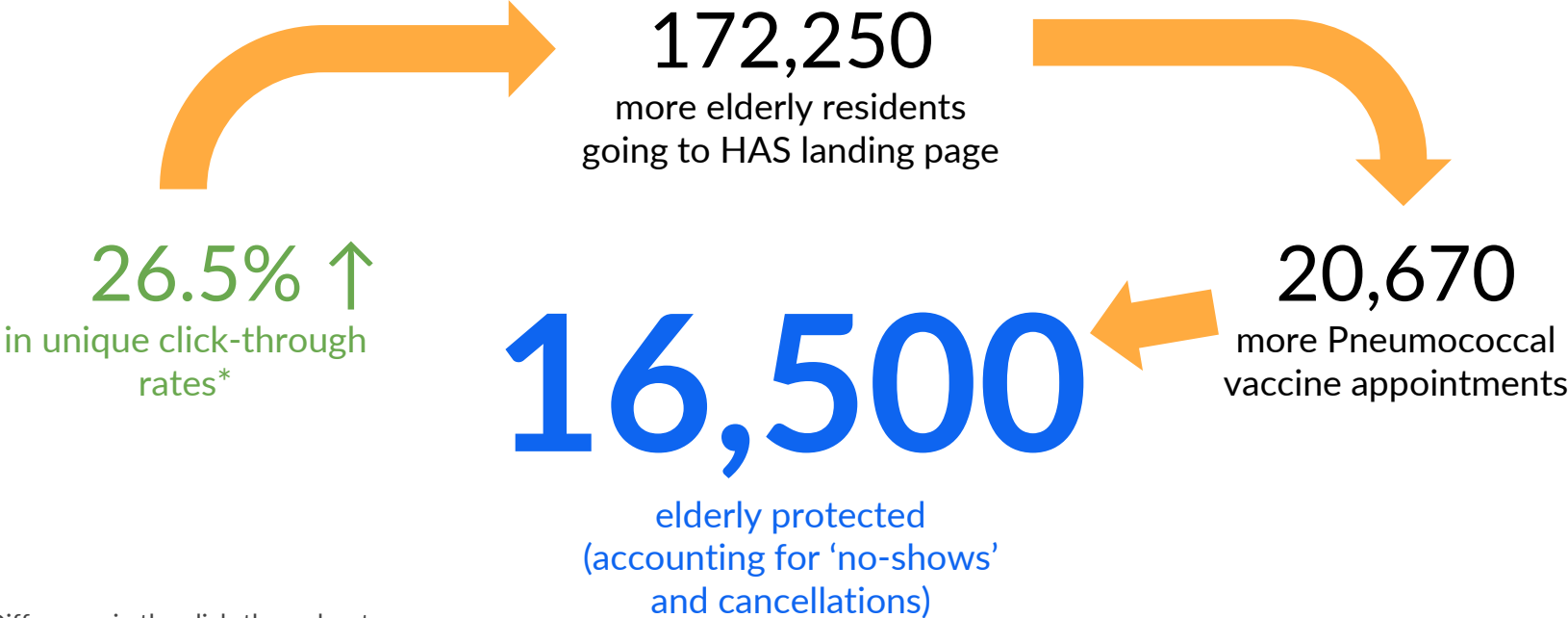
172,250
more elderly residents
going to HAS landing page

26.5% ↑
in unique click-through
rates*

16,500
elderly protected
(accounting for 'no-shows'
and cancellations)

20,670
more Pneumococcal
vaccine appointments

* Difference in the click-through rate
between HPB letter and SMS
campaign

The launch of HAS <u>correlated</u> with a 100% increase in vaccination rates for Pneumococcal vaccines

Future? Possibilities are limitless!

1. **SMS as a Core Tool for Nudging Health Care Behaviours**

2. **Dedicated SMSes for Every Patient**

3. **Expansion to Early Cancer Screening**

4. **Experimenting with Cost Transparency**

5. **Experimenting with Different Age Groups**