Social Media and the Evolution of Vaccine Preferences During the Covid-19 Pandemic

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Key Research Questions

1

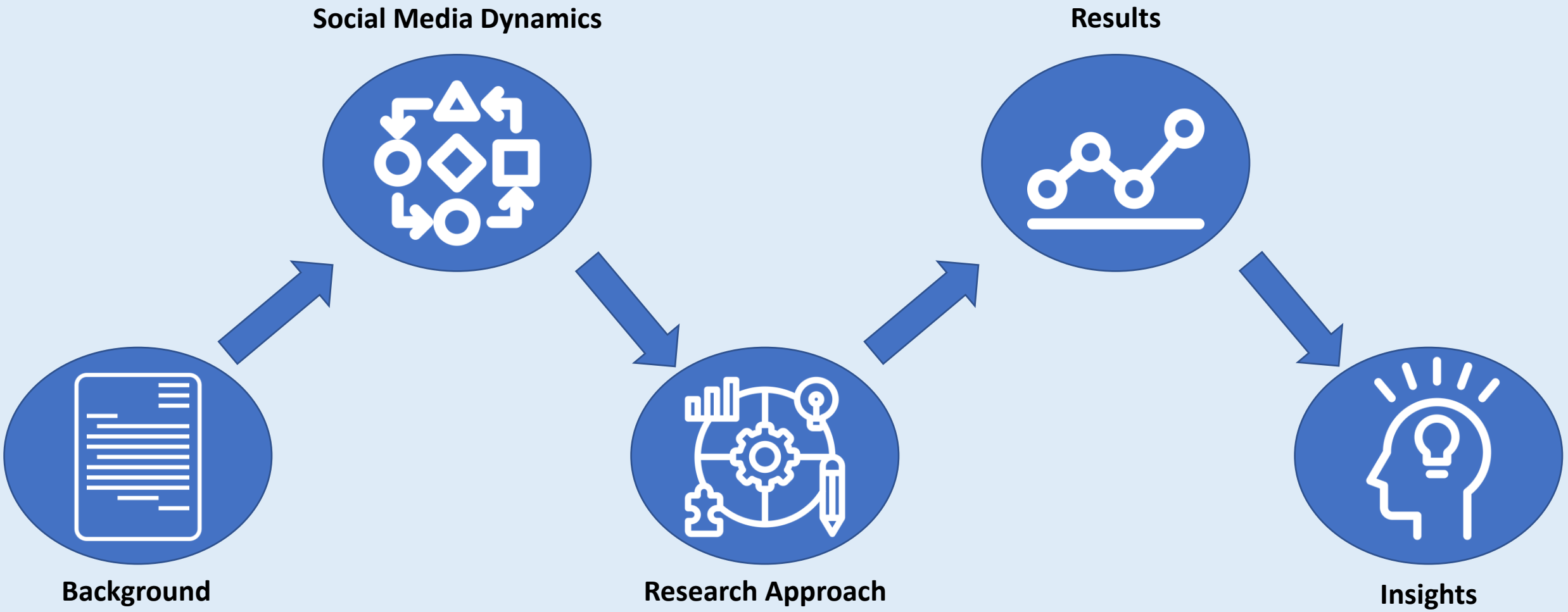
How did social media influence vaccine uptake during the Covid-19 pandemic in New Zealand?

and

2

What was the role of trust in various information sources in this relationship?

Presentation outline



Covid-19 Pandemic and Vaccines

- 540+ million cases
- 6.3+ million deaths

- Vaccines a crucial tool in combatting the Covid-19 pandemic

Low Vaccine Uptake?

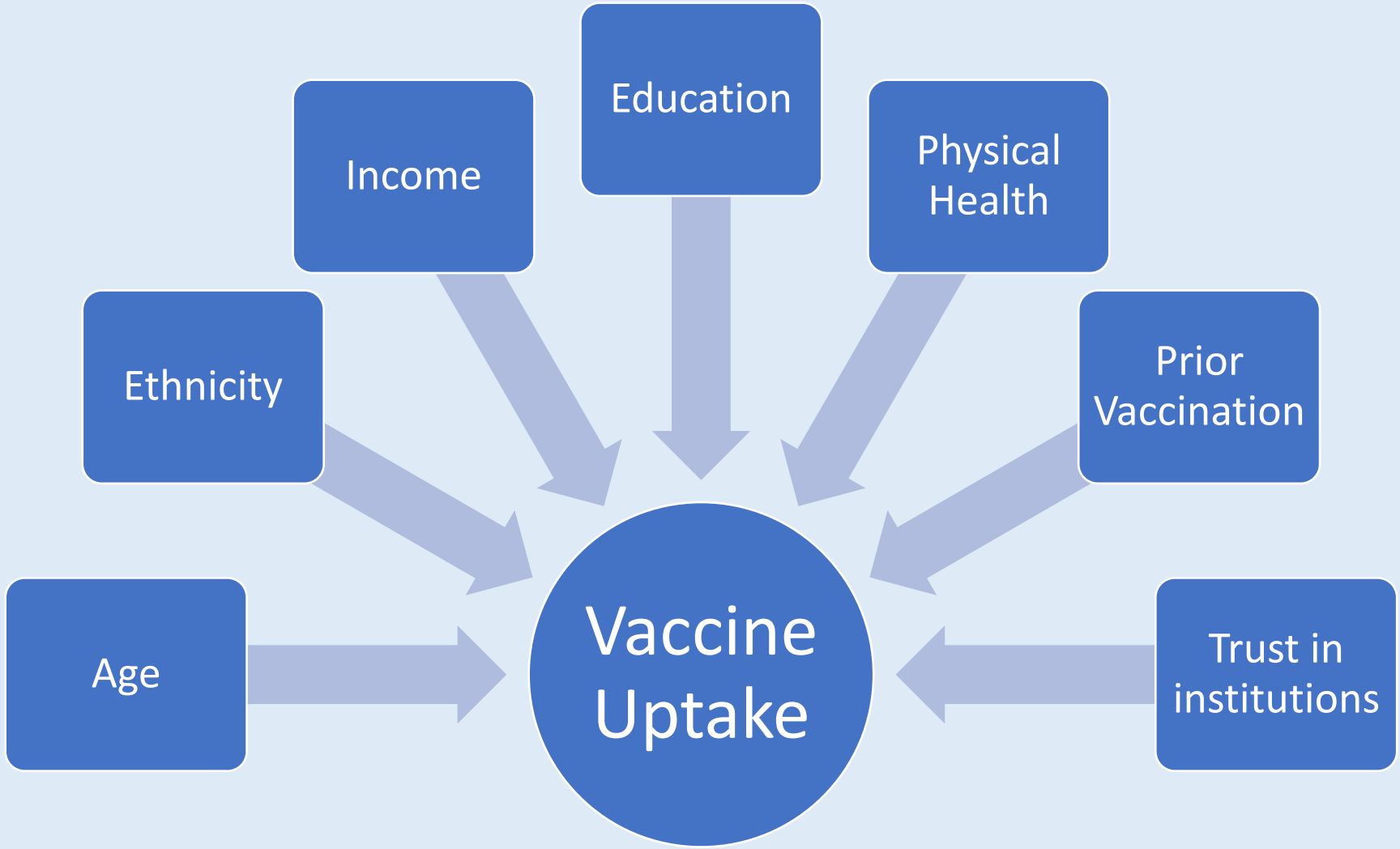
- Slow rises in uptake/stubbornly low uptake in some developed countries.
- Understanding the drivers of vaccine uptake is important!
- We have other diseases to think about (measles etc.).

How the US vaccine effort derailed and why we shouldn't be surprised

Low vaccine rates may be the predictable outcome subject to entrenched social forces that have diminished American health and life expectancy since the 1980s, health researchers say

In mid-September the US became the least vaccinated member of the world's seven most populous and wealthy democracies. Photograph: Paul Hennessy/SOPA Images/REX/Shutterstock

Traditional drivers of uptake



Social Media?

Social Media: Different platforms

Structural differences:

- Followers vs Friends
- Algorithms
- Types of Users

VS

Theocharis et al. (2021) showed vaccine **misinformation** spread much **quicker** on **Facebook** and was **less prevalent on Twitter.**

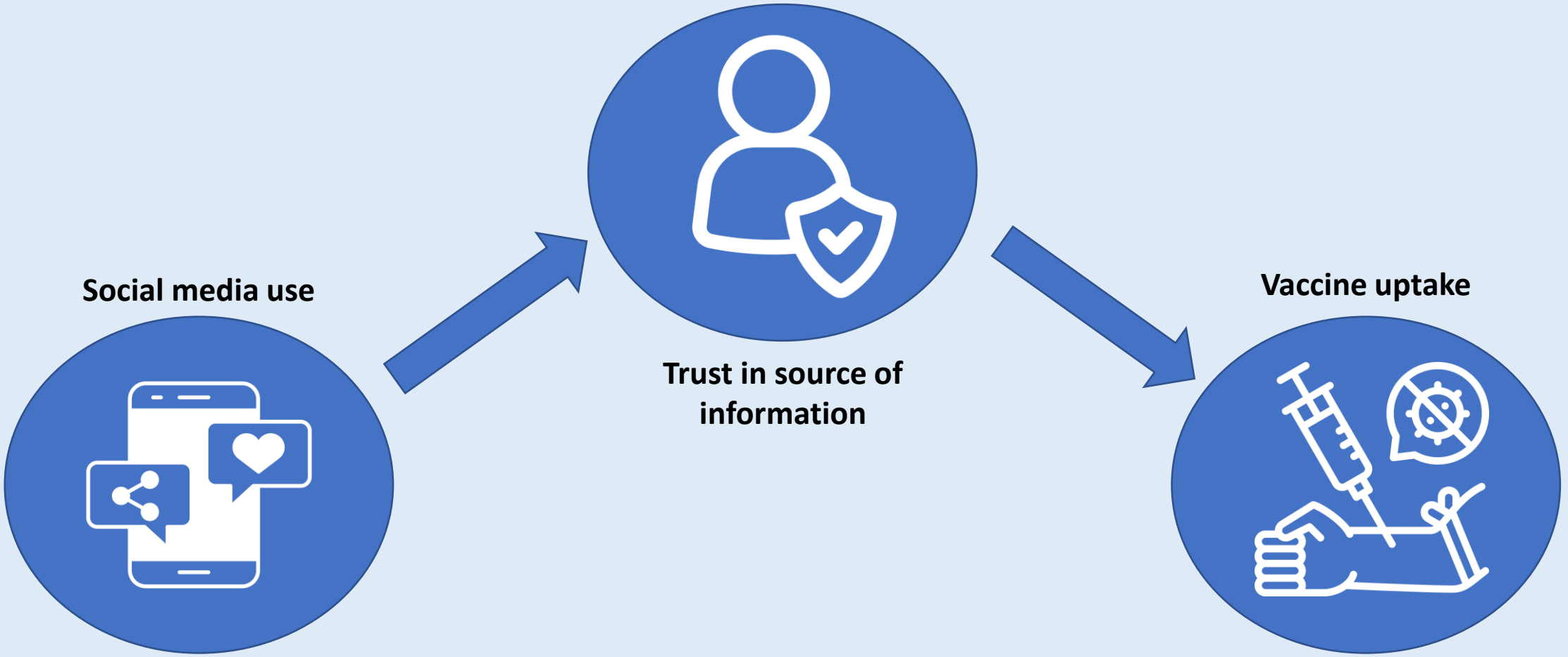
Q1: Social media and vaccine uptake?

Increasing vaccine uptake

Spreads vaccine misinformation

Provides access to important vaccine information

Q2: Social media, trust and vaccine uptake?

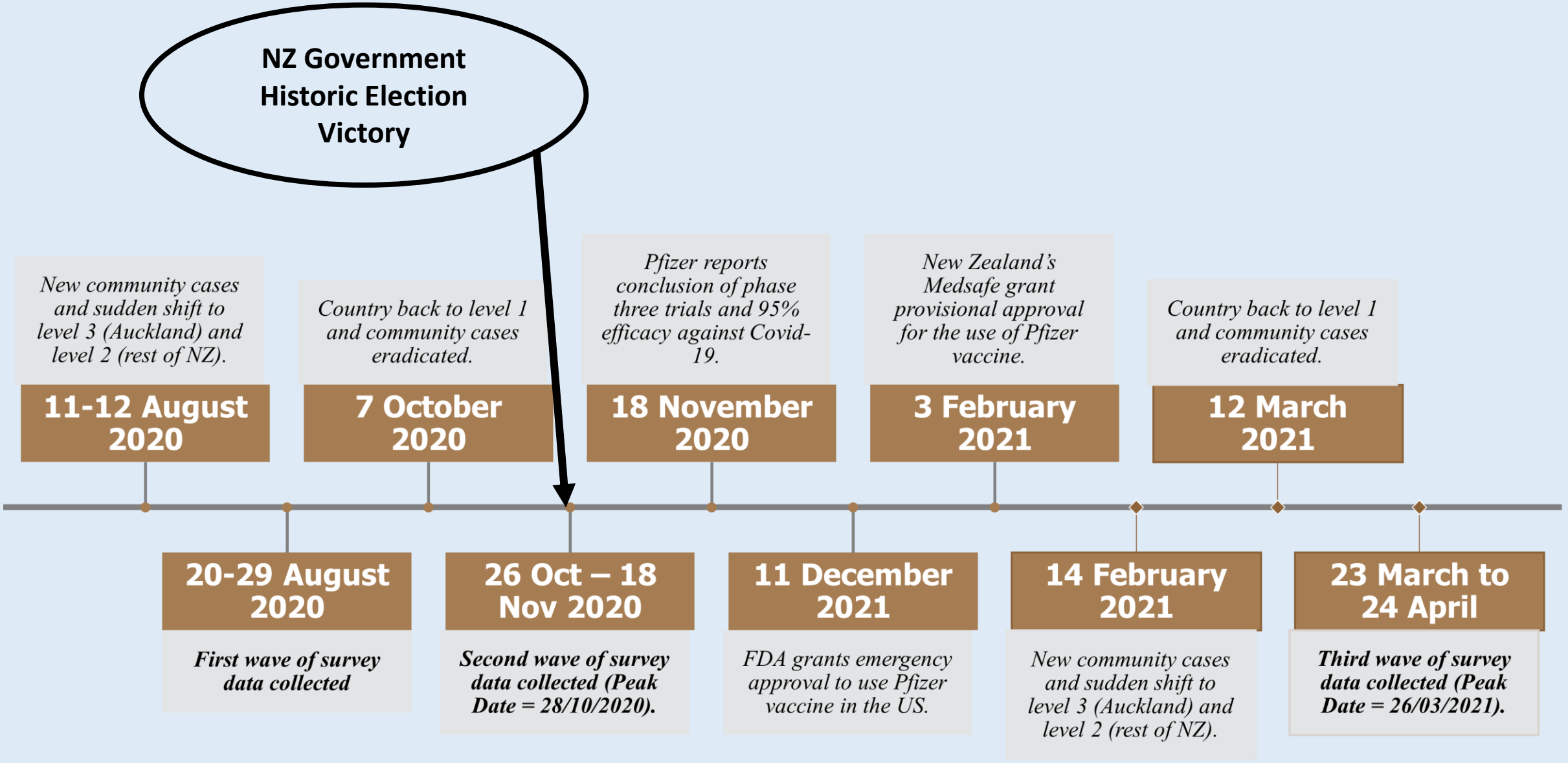


Does trust in information sources (government, friends and family) moderate the relationship between social media use and vaccine uptake?

Methods: Data

- We use a unique stated preference discrete choice experiment (DCE) dataset from Hess et al. (2022).
- The DCEs used a D-efficient design from the NGene software package.
- Three waves were collected (Aug 2020, Nov 2020 and March 2021).
- In wave 3 (only), we asked about social media use over the past six months. We asked about Facebook, Instagram, Twitter and Tik Tok.

Data Context



Methods: DCE Data

- In each wave, participants were presented with six hypothetical, but realistic, choices about taking a Covid-19 vaccine.
- Each choice scenario gave participants five options (four options where they take a vaccine and one no-vaccine option).
- The data gives us an overall view of Covid-19 vaccine preferences.
- The six question blocks (choice scenarios) were balanced. Hence, the number of times a vaccine option was chosen (out of six) is comparable between individuals.

Methods: Example DCE Choice Set

Scenario 1:

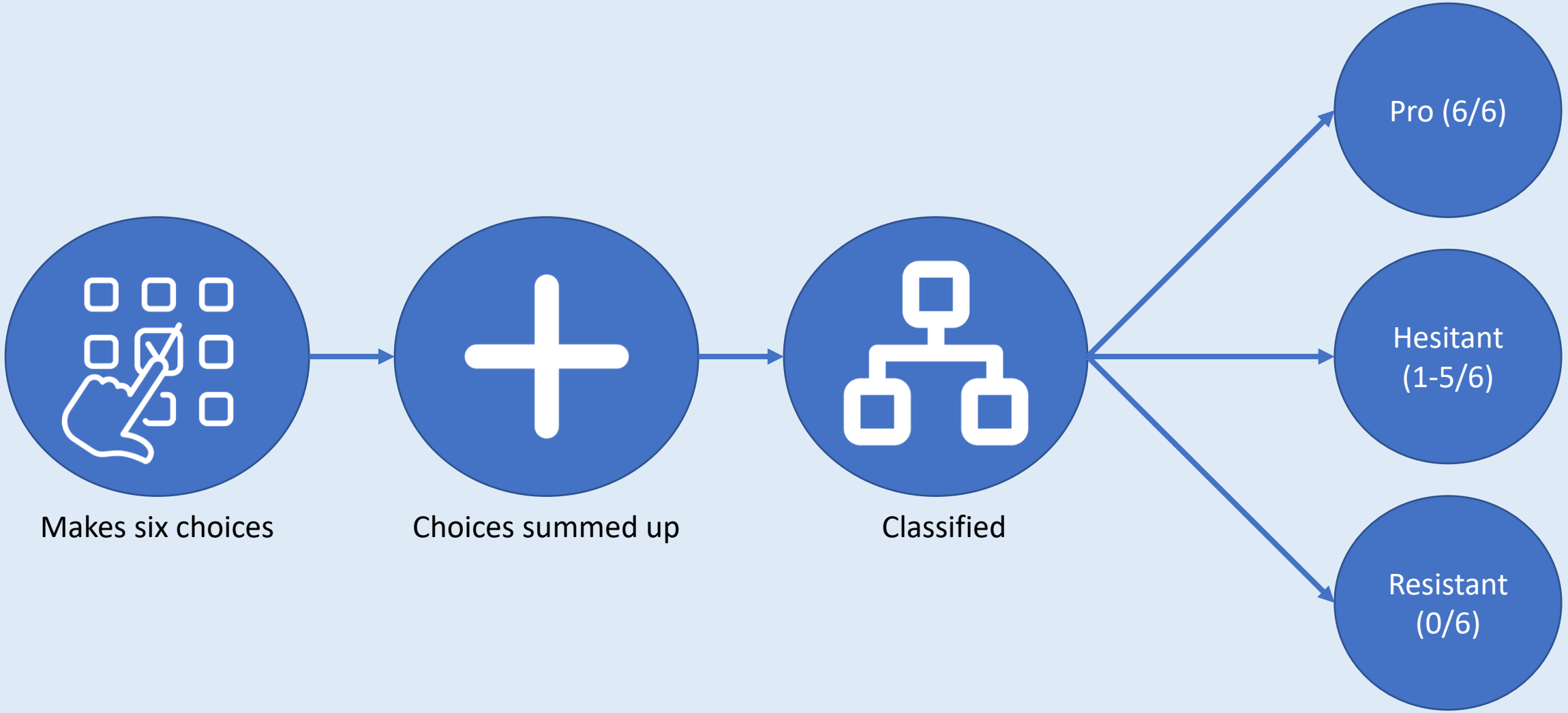
Please consider the following vaccination options and make your choice as if they happened in the current environment. Please remember there is no right or wrong answer.

	Vaccine A	Vaccine B	No vaccine
Risk of infection (out of 100,000 people coming in contact with infected person):	3,000 (3%)	4,000 (4%)	7,500 (7.5%)
Risk of serious illness (out of 100,000 people who become infected):	2,000 (2%)	4,000 (4%)	20,000 (20%)
Estimated protection duration:	five years	one year	
Risk of mild side effects (out of 100,000 vaccinated people):	100 (0.1%)	1,000 (1%)	
Risk of severe side effects (out of 100,000 vaccinated people):	20 (0.02%)	10 (0.01%)	
Population coverage:	40%		
Exemption from international travel restrictions:	exempt		restrictions apply
Waiting time (free vaccination):	1 month	2 months	
Fee (no waiting time):	£250	£50	

	Vaccine A free	Vaccine A paid	Vaccine B free	Vaccine B paid	No vaccine
Your preferred choice is:	○	○	○	○	○

Final decision for this choice:

Methods: DCE Data



- Run a PPO model to predict group membership. N = 257

Methods: PPO models

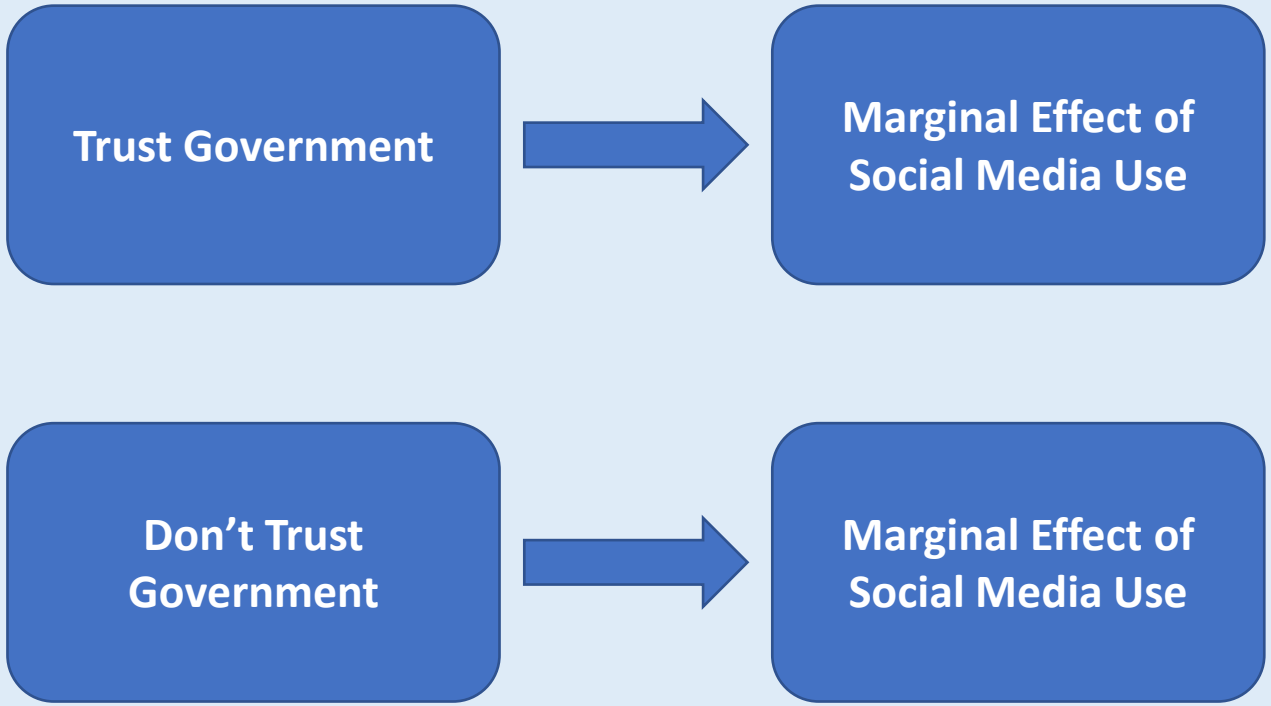
- The PPO model is special case of a generalised ordered logit (gologit) model.
- Relaxes the proportional odds assumption where needed.
- Our PPO model estimates the probability that individual i in wave t is anti-vaccine, vaccine hesistant, or pro-vaccine, represented by $U_{it} \in \{1,2,3\}$:

- $$P(U_{it} > k) = \frac{\exp(\alpha_k + X_{it}\beta 1_k + Z_{it}\beta 2)}{1 + [exp(\alpha_k + X_{it}\beta 1_k + Z_{it}\beta 2)]}, k = (1, 2).$$

- where $\beta 1$ are the coefficients for the covariates that vary by k and $\beta 2$ are the coefficients for the covariates that do not violate the proportional odds assumption.

Methods: Vaccine uptake and trust interactions

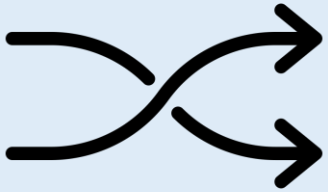
- We investigate whether social media use (0,1) - generally, and by platform - impacts the probability of being in each vaccine uptake group.
- We then interact trust in government (shown on right) and trust in friends and family with social media use to see if this affects the marginal effect of social media use.
- This is in-line with the literature on the importance of trust in info.



Results: Descriptive statistics

	Variable	Mean	Standard Deviation	N	Obs.
Vaccine Uptake Categories	Resistant	5.60%	-	257	771
	Hesitant	18.30%	-	257	771
	Pro	76.10%	-	257	771
Social Media Use Variables	Social Media User	73.20%	-	257	257
	Facebook User	68.90%	-	257	257
	Instagram User	30.40%	-	257	257
	Twitter User	15.20%	-	257	257
	Tik Tok User	7.00%	-	257	257
	Female	42.90%	-	257	257
	Male	57.10%	-	257	257
	Maori and Pacific	5.40%	-	257	257
Trust in Info Variables	Trusts Family/Friends	32.70%	-	257	257
	Trusts Government	77.40%	-	257	257
	University-Educated	43.20%	-	257	257
	Income ($000s)	46.1	35	257	771
	Age (years)	52	15.7	257	257

Results: Switching uptake categories



	Wave 3 Vaccine Uptake			
Wave 1 Uptake	Pro	Hesitant	Resistant	Total
Pro	83.0% (161)	11.9% (23)	5.2% (10)	75.5% (194)
Hesitant	71.7% (38)	22.6% (12)	5.7% (3)	20.6% (53)
Resistant	30.0% (3)	10.0% (1)	60.0% (6)	3.9% (10)
Total	78.6% (202)	14.0% (36)	7.4% (19)	100.0% (257)

Note: Number of respondents (N) are in parentheses.

- Top row: 83% of pro-vaccine individuals in wave 1 remained pro-vaccine by wave 3. 11.9% became hesitant.
- Middle row: 71.7% of vaccine-hesitant individuals in wave 1 became pro-vaccine by wave 3.
- Bottom row: 30% of resistant individuals in wave 1 became pro-vaccine. 60% remained resistant.

Results: Marginal Effects of Social Media Use

Platform	Resistant	Hesitant	Pro
Social Media	-0.0102	-0.0395	0.0496
	(0.0120)	(0.0449)	(0.0565)
Facebook	-0.00945	-0.0369	0.0464
	(0.0114)	(0.0434)	(0.0545)
Instagram	-0.0308**	-0.177***	0.208***
	(0.0134)	(0.0621)	(0.0612)
Twitter	-0.0485***	-0.107	0.155**
	(0.0132)	(0.0689)	(0.0680)
Tik Tok	-0.0121	-0.0518	0.0639
	(0.0172)	(0.0732)	(0.0901)
N	771	771	771

*Note: Cluster robust standard errors in parentheses, calculated using the delta-method; *** p<0.01, ** p<0.05, * p<0.10*

Results: Trust in Friends and Family Interaction

	Trust *in Government*			***Trust*** *in Friends and Family*		
AMEs	Resistant	Hesitant	Pro	Resistant	Hesitant	Pro
Social Media [Trust = 0]	-0.00527	-0.00823	0.0135	-0.0222	-0.0668	0.0891
	(0.0420)	(0.0651)	(0.107)	(0.0167)	(0.0481)	(0.0638)
Social Media [Trust = 1]	-0.0470**	-0.00534	0.0524	0.0227	0.0768	-0.0995
	(0.0184)	(0.0523)	(0.0633)	(0.0189)	(0.0660)	(0.0840)
Difference Significance				*	*	*
Facebook [Trust = 0]	0.0445	-0.0824	0.0379	-0.0209	-0.0635	0.0844
	(0.0462)	(0.0796)	(0.111)	(0.0157)	(0.0459)	(0.0606)
Facebook [Trust = 1]	-0.0255*	-0.0274	0.053	0.0229	0.0757	-0.0986
	(0.0150)	(0.0560)	(0.0617)	(0.0191)	(0.0647)	(0.0829)
Difference Significance				*	*	*
Instagram [Trust = 0]	-0.260***	-0.00929	0.269**	-0.0905***	-0.107*	0.197***
	(0.0413)	(0.0983)	(0.104)	(0.0203)	(0.0632)	(0.0696)
Instagram [Trust = 1]	-0.0455**	-0.133**	0.179***	-0.0653**	-0.175**	0.240***
	(0.0189)	(0.0599)	(0.0625)	(0.0325)	(0.0708)	(0.0875)
Difference Significance	***	*				
Twitter [Trust = 0]	-0.117***	-0.306***	0.424***	-0.0525***	-0.00257	0.0551
	(0.0315)	(0.0849)	(0.0887)	(0.0148)	(0.0994)	(0.0990)
Twitter [Trust = 1]	-0.0393***	-0.0104	0.0496	-0.0746***	-0.196**	0.270***
	(0.0104)	(0.0751)	(0.0763)	(0.0189)	(0.0770)	(0.0815)
Difference Significance	***	***	***		*	*
Tik Tok [Trust = 0]	-0.106***	-0.302***	0.408***	-0.0522***	-0.0571	0.109
	(0.0280)	(0.0588)	(0.0693)	(0.0138)	(0.106)	(0.107)
Tik Tok [Trust = 1]	-0.0364***	0.127	-0.0906	-0.0384	0.0245	0.0139
	(0.00972)	(0.116)	(0.116)	(0.0267)	(0.157)	(0.156)
Difference Significance	***	***	***			
N	257	257	257	257	257	257
Obs	771	771	771	771	771	771

*Note: Cluster robust standard errors in parentheses; *** p<0.01, ** p<0.05, * p<0.1*

Trust in Both?

AME of social media use for those who trust:	Resistant	Hesitant	Pro
Neither (no trust)	0.0228	0.0355	-0.0583
	(0.0472)	(0.0755)	(0.122)
Government only	-0.0329*	-0.102*	0.134*
	(0.0189)	(0.0543)	(0.0708)
Friends only	-0.0189	-0.0462	0.065
	(0.0674)	(0.155)	(0.222)
Both	-0.0176	0.186**	-0.169*
	(0.0136)	(0.0841)	(0.0877)
Significance of differences between AMEs			
Govt (only) vs Both		***	***
Friends (only) vs Both			

Note: Cluster robust standard errors in parentheses; $^{*}p < 0.10$, $^{**}p < 0.05$, $^{***}p < 0.01$.
Results have been re-weighted on age, gender and ethnicity.

Insights

- We use a unique stated preference DCE data in a novel way and employ PPO modelling on those data
- Positive associations between Instagram and Twitter use and vaccine uptake.
- The AME of social media use was greater for those who **did not** trust the government.
- Some mixed findings for trust in friends and family.
- Some evidence that trusting multiple sources reduces AME of social media use
- Results vary by platform.

Limitations and Future Work

- There are likely sample selection issues.
  - We may be missing those worst affected by social media use.
  - We know misinformation was prevalent during pandemic.
- We didn’t include some platforms which are becoming more prominent for misinformation – Telegram.
- Our social media variable was cross-sectional – hard to get at a causal mechanism.
- The effects of multiple sources of information is a complex topic and should be an area for future research.

Thanks for listening!

Questions?

If you have any further questions, comments or suggestions, please get in touch.

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Appendix - Brief Look at PPO Model Output

	Dependent variable: Vaccine preference, where resistant is 1 and pro is 3.									
	(1) Social Media		(2) Facebook		(3) Instagram		(4) Twitter		(5) TikTok	
	1 vs 2, 3	1, 2 vs 3	1 vs 2, 3	1, 2 vs 3	1 vs 2, 3	1, 2 vs 3	1 vs 2, 3	1, 2 vs 3	1 vs 2, 3	1, 2 vs 3
Social Media User	0.265	-	0.249	-	3.760***	1.274***	14.99***	1.024*	0.377	-
	(0.292)		(0.287)		(0.764)	(0.410)	(0.436)	(0.576)	(0.587)	
Income	0.00796*	-	0.00815**	-	0.0544***	0.00855*	0.00820**	-	0.00835**	-
	(0.00404)		(0.00410)		(0.0194)	(0.00438)	(0.00392)		(0.00398)	
University	-0.352	-	-0.358	-	-0.361	-	-0.250	-	-0.335	-
	(0.348)		(0.349)		(0.304)		(0.291)		(0.358)	
Age	-0.0115	-	-0.0118	-	0.00885	-	-0.00426	-	-0.00967	-
	(0.00984)		(0.00975)		(0.0101)		(0.00898)		(0.00851)	
Male	0.0593	-	0.0652	-	0.284	-	-0.0757	-	0.00144	-
	(0.309)		(0.310)		(0.299)		(0.297)		(0.277)	
Māori and Pacific	-0.935*	-	-0.944*	-	-0.947**	-	-0.847*	-	-0.999*	-
	(0.515)		(0.515)		(0.446)		(0.442)		(0.512)	
Trust Government	0.841***	-	0.853***	-	2.465***	0.895***	0.849***	-	0.820***	-
	(0.298)		(0.298)		(0.562)	(0.292)	(0.263)		(0.292)	
Trust Family/Friends	-0.126	-	-0.136	-	-1.399**	-0.110	-0.139	-	-0.178	-
	(0.352)		(0.349)		(0.552)	(0.313)	(0.302)		(0.323)	
Wave 2 FE	0.146	-	0.146	-	0.183	-	0.169	-	0.153	-
	(0.259)		(0.259)		(0.275)		(0.263)		(0.260)	
Wave 3 FE	-0.618*	0.340	-0.618*	0.340	-0.618	0.352	-0.584	0.338	-0.604*	0.348
	(0.360)	(0.256)	(0.360)	(0.256)	(0.406)	(0.243)	(0.390)	(0.259)	(0.363)	(0.254)
Intercept	3.128***	0.726	3.153***	0.752	-0.255	-0.644	2.704***	0.390	3.229***	0.826
	(0.883)	(0.775)	(0.882)	(0.770)	(0.846)	(0.655)	(0.665)	(0.532)	(0.850)	(0.670)
M		257		257		257		257		257
Obs		771		771		771		771		771

*Note: Cluster robust standard errors in parentheses, clustered at the individual level; * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$. Results have been re-weighted on age, gender and ethnicity. 1 vs 2, 3 shows the model predicting the likelihood of being 2 (hesitant) or 3 (pro), over 1 (resistant), where a positive number shows more likely to be in 2 or 3. No coefficient in 1, 2 vs 3 means the model is restricted to assume the same coefficient across both columns as the proportional odds assumption is not violated for that variable.*