

## Supplementary material

When do persuasive messages on vaccine safety steer COVID-19 vaccine acceptance and recommendations? Behavioural insights from a randomised controlled experiment in Malaysia.

### Methods

#### Study setting during recruitment period

Malaysia was experiencing a surge of infections in April 2021, with over 3,300 daily cases and almost 1,500 total deaths reported at the start of our experiment.[1] By the end of our experiment, daily cases steadily increased to reach a peak of over 7,700 cases, with cumulative deaths standing at 3,378.[2] Malaysia's COVID-19 immunisation programme was initiated at the end of February 2021.[3] Our experiment coincided closely with the second and third phase of the programme which began in April and May 2021 respectively. These two phases were targeted at the general adult population.

#### Stratified sampling

Malaysia is composed of several major ethnicities. Bumiputera, which consist of Malays and the indigenous people of Malaysia, accounted for about 70% of the population.[4] This is followed by Chinese ( $\approx 23\%$ ) and Indians ( $\approx 7\%$ ). The sex ratio among Malaysian citizens stands at 102 males per 100 females. There is a sizable proportion of young Malaysian in the country, with approximately 53% of the total adult population aged between 18 to 39 years. Middle age (40 to 59 years old) and the elderly accounted for approximately 31% and 16% of the population respectively. In terms of household income, Malaysia categorizes citizens into three distinct groups; Bottom 40% (B40), Middle 40% (M40) and Top 20% (T20).[5] These categorisations represent percentages of the country's population in terms of household

income ranging from the bottom 40% to the top 20%. Except for age, stratified recruitment was conducted according to approximate national ratios for sex, ethnicity, and household income. Due to our survey panel's limitation to sample for older participants, we inflated and deflated the target sampling proportion for the younger and older age group by about 10% and 12% respectively.

### Message design

Messages were designed with a standardised dimension of 1080 x 1350 pixels in order to look similar with messages commonly found on social media posts and is conveniently displayed on computer monitors or smartphones. Font sizes used for all messages were standardised. Numbers or words which indicated a numerical or statistical meaning were printed using yellow colour fonts that were slightly enlarged to draw extra attention. The last sentence in the rally slogan; "It's safe and effective!", was printed in a green font to psychologically invoke feelings of safety about the vaccine.[6]

### References:

1. Ashman A. Malaysia's new Covid-19 cases rise to 3,332 as minister Saifuddin also infected. *Malay Mail*. 2021 Apr 29;
2. Bernama. Latest count of Covid-19 cases in Malaysia and selected countries. *The Malaysian Reserve*. 2021 Jun 7;
3. Ahmad R, Pfordten D, Koh W. INTERACTIVE: How is Malaysia's Covid-19 vaccination plan progressing? Find out here. *The Star*. 2021 Mar 12;
4. Department of Statistics Malaysia. Current population estimates, Malaysia 2020. 2020.
5. Household Income & Basic Amenities Survey Report 2019. Department of Statistics Malaysia Official Portal. 2022.  
[https://www.dosm.gov.my/v1/index.php?r=column/cthemByCat&cat=120&bul\\_id=TU00TmRhQ1N5TUxHVWN0T2VjbXJYZz09&menu\\_id=amVoWU54UTI0a21NWmdhMjFMMWcyZz09](https://www.dosm.gov.my/v1/index.php?r=column/cthemByCat&cat=120&bul_id=TU00TmRhQ1N5TUxHVWN0T2VjbXJYZz09&menu_id=amVoWU54UTI0a21NWmdhMjFMMWcyZz09) (accessed 27 Feb 2021).
6. Cherry K. How Does the Color Green Make You Feel?. *Verywell Mind*. 2022.  
<https://www.verywellmind.com/color-psychology-green-2795817> (accessed 20 Mar 2022).

**Table S1: Baseline characteristics of survey participants stratified according to experimental arms**

		DN (70%)	DN	HCW	NF	PF	RC(S)	RC(SE)	Control	DN(70%) + DN	DN(70%) + HCW	DN(70%) + NF	DN(70%) + PF	DN(70%) + RC(S)	DN(70%) + RC(SE)	T-test/Chi square P-value
		Mean±SD or N(%)	Mean±SD or N(%)	Mean±SD or N(%)	Mean±SD or N(%)	Mean±SD or N(%)	Mean±SD or N(%)	Mean±SD or N(%)	Mean±SD or N(%)	Mean±SD or N(%)	Mean±SD or N(%)	Mean±SD or N(%)	Mean±SD or N(%)	Mean±SD or N(%)	Mean±SD or N(%)	
Age		37±11.6	36±11.9	36±11.8	36±11.5	36±11.9	35±11.3	36±11.7	36±11.6	36±11.7	36±11.9	36±11.8	36±11.4	36±11.9	36±11.6	0.999
Sex	Male	210 (50.6)	203 (49.4)	206 (50.2)	206 (49.8)	208 (50.2)	210 (50.5)	205 (50.0)	207 (50.5)	211 (50.8)	207 (49.8)	207 (50.1)	211 (50.8)	211 (50.8)	205 (50.0)	1.000
Education level	Tertiary education	194(46.7)	218(53.0)	205(50.0)	209(50.5)	182(44.0)	198(47.6)	200(48.8)	217(52.9)	194(46.7)	225(54.1)	209(50.6)	204(49.2)	215(51.8)	195(47.6)	0.169
Intent to vaccinate	Definitely not	5(1.2)	8(1.9)	8(2.0)	9(2.2)	9(2.2)	7(1.7)	8(2.0)	5(1.2)	7(1.7)	9(2.2)	7(1.7)	9(2.2)	11(2.7)	4(1.0)	0.968
	Probably not	32(7.7)	28(6.8)	25(6.1)	28(6.8)	26(6.3)	29(7.0)	30(7.3)	32(7.8)	34(8.2)	33(7.9)	20(4.8)	29(7.0)	27(6.5)	17(4.1)	
	Probably yes	123(29.6)	118(28.7)	119(29.0)	120(29.0)	133(32.1)	133(32.0)	121(29.5)	111(27.1)	129(31.1)	122(29.3)	116(28.1)	132(31.8)	123(29.6)	124(30.2)	
	Definitely yes	255(61.4)	257(62.5)	258(62.9)	257(62.1)	246(59.4)	247(59.4)	251(61.2)	262(63.9)	245(59.0)	252(60.6)	270(65.4)	245(59.0)	254(61.2)	265(64.6)	
Intent to recommend:																
Healthy adults	Strongly disagree	8(1.9)	8(1.9)	5(1.2)	7(1.7)	6(1.4)	7(1.7)	7(1.7)	6(1.5)	7(1.7)	5(1.2)	8(1.9)	5(1.2)	5(1.2)	3(0.7)	0.920
	Disagree	15(3.6)	11(2.7)	11(2.7)	9(2.2)	13(3.1)	10(2.4)	18(4.4)	8(2.0)	12(2.9)	22(5.3)	13(3.1)	17(4.1)	17(4.1)	9(2.2)	
	Not sure	46(11.1)	42(10.2)	43(10.5)	53(12.8)	49(11.8)	37(8.9)	43(10.5)	36(8.8)	48(11.6)	40(9.6)	37(9.0)	49(11.8)	42(10.1)	40(9.8)	
	Agree	198(47.7)	202(49.1)	183(44.6)	198(47.8)	204(49.3)	210(50.5)	195(47.6)	206(50.2)	204(49.2)	214(51.4)	213(51.6)	201(48.4)	196(47.2)	209(51.0)	
	Strongly agree	148(35.7)	148(36.0)	168(41.0)	147(35.5)	142(34.3)	152(36.5)	147(35.9)	154(37.6)	144(34.7)	135(32.5)	142(34.4)	143(34.5)	155(37.3)	149(36.3)	
Elderly	Strongly disagree	11(2.7)	10(2.4)	12(2.9)	11(2.7)	9(2.2)	11(2.6)	13(3.2)	13(3.2)	11(2.7)	18(4.3)	8(1.9)	13(3.1)	19(4.6)	9(2.2)	0.622
	Disagree	36(8.7)	28(6.8)	23(5.6)	27(6.5)	28(6.8)	28(6.7)	30(7.3)	25(6.1)	26(6.3)	35(8.4)	16(3.9)	24(5.8)	20(4.8)	26(6.3)	
	Not sure	68(16.4)	75(18.2)	69(16.8)	78(18.8)	79(19.1)	76(18.3)	73(17.8)	64(15.6)	96(23.1)	80(19.2)	72(17.4)	79(19.0)	61(14.7)	70(17.1)	
	Agree	161(38.8)	164(39.9)	153(37.3)	156(37.7)	165(39.9)	169(40.6)	156(38.0)	182(44.4)	159(38.3)	156(37.5)	173(41.9)	165(39.8)	177(42.7)	167(40.7)	
	Strongly agree	139(33.5)	134(32.6)	153(37.3)	142(34.3)	133(32.1)	132(31.7)	138(33.7)	126(30.7)	123(29.6)	127(30.5)	144(34.9)	134(32.3)	138(33.3)	138(33.7)	
People with health conditions	Strongly disagree	15(3.6)	19(4.6)	20(4.9)	22(5.3)	18(4.3)	26(6.3)	24(5.9)	21(5.1)	18(4.3)	24(5.8)	19(4.6)	24(5.8)	26(6.3)	16(3.9)	0.941
	Disagree	63(15.2)	59(14.4)	40(9.8)	58(14.0)	55(13.3)	56(13.5)	60(14.6)	49(12.0)	58(14.0)	60(14.4)	49(11.9)	62(14.9)	46(11.1)	51(12.4)	
	Not sure	128(30.8)	113(27.5)	121(29.5)	126(30.4)	133(32.1)	128(30.8)	119(29.0)	120(29.3)	131(31.6)	121(29.1)	120(29.1)	137(33.0)	124(29.9)	131(32.0)	
	Agree	114(27.5)	120(29.2)	136(33.2)	110(26.6)	113(27.3)	103(24.8)	115(28.0)	128(31.2)	125(30.1)	123(29.6)	124(30.0)	110(26.5)	126(30.4)	124(30.2)	
	Strongly agree	95(22.9)	100(24.3)	93(22.7)	98(23.7)	95(22.9)	103(24.8)	92(22.4)	92(22.4)	83(20.0)	88(21.2)	101(24.5)	82(19.8)	93(22.4)	88(21.5)	
Negative vaccine attitude	No	272(65.5)	275(66.9)	266(64.9)	278(67.1)	267(64.5)	256(61.5)	261(63.7)	267(65.1)	273(65.8)	261(62.7)	281(68.0)	253(61.0)	266(64.1)	277(67.6)	0.603

**Table S2: Average marginal effects for intention to accept the COVID-19 vaccine in each experimental arm relative to control arm**

	<b>Intention to vaccinate</b>
	Marginal effects [95% Confidence Interval] Adjusted p-value
<b>DN(70%)</b>	
Definitely no	0.00392 [-0.000780,0.00861] 0.598
Probably no	0.00516 [-0.00106,0.0114] 0.617
Probably yes	0.0163 [-0.00324,0.0359] 0.598
Definitely yes	-0.0254 [-0.0557,0.00484] 0.579
<b>DN</b>	
Definitely no	-0.000924 [-0.00519,0.00334] 1.000
Probably no	-0.00133 [-0.00745,0.00480] 1.000
Probably yes	-0.00446 [-0.0250,0.0161] 1.000
Definitely yes	0.00671 [-0.0242,0.0376] 1.000
<b>HCW</b>	
Definitely no	0.000472 [-0.00394,0.00488] 1.000
Probably no	0.000659 [-0.00550,0.00682] 1.000
Probably yes	0.00217 [-0.0182,0.0225] 1.000
Definitely yes	-0.00330 [-0.0342,0.0276] 1.000
<b>NF</b>	
Definitely no	0.00519* [0.000312,0.0101] 0.317

Probably no	0.00671* [0.000347,0.0131] 0.340
Probably yes	0.0210* [0.00134,0.0406] 0.306
Definitely yes	-0.0329* [-0.0633,-0.00240] 0.284
<hr/>	
<b>PF</b>	
Definitely no	-0.000954 [-0.00517,0.00326] 1.000
Probably no	-0.00137 [-0.00742,0.00468] 1.000
Probably yes	-0.00461 [-0.0249,0.0157] 1.000
Definitely yes	0.00693 [-0.0236,0.0375] 1.000
<hr/>	
<b>RC(S)</b>	
Definitely no	0.000399 [-0.00393,0.00473] 1.000
Probably no	0.000558 [-0.00550,0.00661] 1.000
Probably yes	0.00184 [-0.0182,0.0219] 1.000
Definitely yes	-0.00280 [-0.0332,0.0276] 1.000
<hr/>	
<b>RC(SE)</b>	
Definitely no	0.00139 [-0.00307,0.00585] 1.000
Probably no	0.00191 [-0.00422,0.00804] 1.000
Probably yes	0.00623 [-0.0138,0.0262] 1.000
Definitely yes	-0.00954 [-0.0401,0.0210] 1.000
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<b>DN(70%)+DN</b>	

Definitely no	0.00161 [-0.00281,0.00603] 1.000
Probably no	0.00220 [-0.00385,0.00825] 1.000
Probably yes	0.00716 [-0.0126,0.0269] 1.000
Definitely yes	-0.0110 [-0.0411,0.0192] 1.000
<hr/>	
<b>DN(70%)+HCW</b>	
Definitely no	0.00158 [-0.00288,0.00603] 1.000
Probably no	0.00216 [-0.00395,0.00826] 1.000
Probably yes	0.00703 [-0.0128,0.0269] 1.000
Definitely yes	-0.0108 [-0.0412,0.0196] 1.000
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<b>DN(70%)+NF</b>	
Definitely no	0.00565* [0.000671,0.0106] 0.317
Probably no	0.00726* [0.000827,0.0137] 0.340
Probably yes	0.0226* [0.00288,0.0423] 0.306
Definitely yes	-0.0355* [-0.0661,-0.00485] 0.284
<hr/>	
<b>DN(70%)+PF</b>	
Definitely no	0.00241 [-0.00211,0.00693] 1.000
Probably no	0.00325 [-0.00286,0.00936] 1.000
Probably yes	0.0105 [-0.00922,0.0302] 1.000

Definitely yes	-0.0161 [-0.0464,0.0141] 1.000
<hr/>	
<b>DN(70%)+RC(S)</b>	
Definitely no	0.000300 [-0.00407,0.00467] 1.000
Probably no	0.000420 [-0.00571,0.00655] 1.000
Probably yes	0.00139 [-0.0189,0.0217] 1.000
Definitely yes	-0.00211 [-0.0329,0.0287] 1.000
<hr/>	
<b>DN(70%)+RC(SE)</b>	
Definitely no	0.00267 [-0.00198,0.00733] 1.000
Probably no	0.00359 [-0.00265,0.00983] 1.000
Probably yes	0.0115 [-0.00850,0.0316] 1.000
Definitely yes	-0.0178 [-0.0486,0.0130] 1.000
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<i>N</i>	5784

95% confidence intervals in brackets

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

**Table S3: Average marginal effects for intention to recommend the COVID-19 vaccine to healthy adults, elderly, and people with any pre-existing health conditions, in each experimental arm relative to control arm.**

	<b>Healthy adults</b> Marginal effects [95% Confidence Interval] Adjusted p-value	<b>Elderly</b> Marginal effects [95% Confidence Interval] Adjusted p-value	<b>Health condition</b> Marginal effects [95% Confidence Interval] Adjusted p-value
<b>DN(70%)</b>			
Disagree	0.0148* [0.00255,0.0271] 0.133	0.0121 [-0.00394,0.0281] 0.719	-0.00964 [-0.0298,0.0105] 0.179
Not sure	0.0237* [0.00411,0.0432] 0.133	0.0148 [-0.00480,0.0344] 0.713	-0.00919 [-0.0284,0.0100] 0.181
Agree	-0.0385* [-0.0702,-0.00673] 0.133	-0.0269 [-0.0625,0.00873] 0.713	0.0188 [-0.0204,0.0581] 0.176
<b>DN</b>			
Disagree	0.0111 [-0.00108,0.0232] 0.167	-0.000137 [-0.0160,0.0157] 1.000	-0.0411*** [-0.0616,-0.0205] 0.001
Not sure	0.0174 [-0.00167,0.0365] 0.167	-0.000165 [-0.0193,0.0189] 1.000	-0.0391*** [-0.0588,-0.0195] 0.001
Agree	-0.0285 [-0.0596,0.00271] 0.167	0.000302 [-0.0347,0.0353] 1.000	0.0802*** [0.0405,0.120] 0.001
<b>HCW</b>			
Disagree	0.00320 [-0.00891,0.0153] 0.252	0.0106 [-0.00536,0.0266] 0.719	-0.0150 [-0.0352,0.00529] 0.127
Not sure	0.00485 [-0.0135,0.0232] 0.252	0.0130 [-0.00653,0.0326] 0.713	-0.0143 [-0.0337,0.00507] 0.127
Agree	-0.00806 [-0.0385,0.0224] 0.252	-0.0236 [-0.0592,0.0119] 0.713	0.0293 [-0.0103,0.0688] 0.125
<b>NF</b>			
Disagree	0.0100 [-0.00207,0.0221] 0.167	0.00806 [-0.00783,0.0240] 0.719	-0.0187 [-0.0387,0.00132] 0.095
Not sure	0.0157 [-0.00323,0.0347] 0.167	0.00984 [-0.00954,0.0292] 0.713	-0.0179 [-0.0370,0.00128] 0.095
Agree	-0.0258 [-0.0568,0.00527] 0.167	-0.0179 [-0.0532,0.0174] 0.713	0.0366 [-0.00246,0.0756] 0.093
<b>PF</b>			
Disagree	0.0102	0.00514	-0.0288**



	[-0.00189,0.0222] 0.167	[-0.0105,0.0208] 0.719	[-0.0489,-0.00859] 0.031
Not sure	0.0159 [-0.00293,0.0348] 0.167	0.00624 [-0.0128,0.0253] 0.713	-0.0275** [-0.0469,-0.00821] 0.031
Agree	-0.0261 [-0.0569,0.00479] 0.167	-0.0114 [-0.0461,0.0233] 0.713	0.0563** [0.0171,0.0955] 0.031
<b>RC(S)</b>			
Disagree	0.0163** [0.00393,0.0287] 0.133	0.0106 [-0.00526,0.0265] 0.719	-0.0171 [-0.0372,0.00287] 0.110
Not sure	0.0262** [0.00637,0.0461] 0.133	0.0130 [-0.00641,0.0324] 0.713	-0.0164 [-0.0356,0.00278] 0.113
Agree	-0.0425** [-0.0746,-0.0104] 0.133	-0.0236 [-0.0588,0.0117] 0.713	0.0336 [-0.00553,0.0726] 0.110
<b>RC(SE)</b>			
Disagree	0.00534 [-0.00663,0.0173] 0.211	0.00154 [-0.0142,0.0173] 0.979	-0.0148 [-0.0349,0.00533] 0.127
Not sure	0.00818 [-0.0101,0.0265] 0.211	0.00186 [-0.0172,0.0209] 0.979	-0.0141 [-0.0334,0.00513] 0.127
Agree	-0.0135 [-0.0438,0.0168] 0.211	-0.00339 [-0.0382,0.0314] 0.979	0.0289 [-0.0104,0.0682] 0.125
<b>DN(70%)+DN</b>			
Disagree	0.0127* [0.000460,0.0249] 0.149	0.00193 [-0.0135,0.0174] 0.979	-0.0213* [-0.0415,-0.00114] 0.081
Not sure	0.0201* [0.000739,0.0394] 0.153	0.00234 [-0.0163,0.0210] 0.979	-0.0204* [-0.0398,-0.00107] 0.081
Agree	-0.0328* [-0.0643,-0.00125] 0.149	-0.00427 [-0.0383,0.0298] 0.979	0.0417* [0.00238,0.0811] 0.078
<b>DN(70%)+HCW</b>			
Disagree	0.00418 [-0.00782,0.0162] 0.252	-0.00548 [-0.0209,0.00989] 0.719	-0.0240* [-0.0441,-0.00396] 0.068
Not sure	0.00637 [-0.0119,0.0246] 0.252	-0.00653 [-0.0248,0.0118] 0.713	-0.0230* [-0.0423,-0.00372] 0.068
Agree	-0.0105 [-0.0408,0.0197] 0.252	0.0120 [-0.0217,0.0457] 0.713	0.0470* [0.00790,0.0862] 0.065
<b>DN(70%)+NF</b>			
Disagree	0.00936	0.0141	-0.0123

	[-0.00304,0.0218] 0.181	[-0.00210,0.0302] 0.719	[-0.0326,0.00789] 0.145
Not sure	0.0146 [-0.00477,0.0340] 0.185	0.0173 [-0.00254,0.0371] 0.713	-0.0118 [-0.0311,0.00755] 0.145
Agree	-0.0240 [-0.0558,0.00778] 0.181	-0.0313 [-0.0673,0.00462] 0.713	0.0241 [-0.0154,0.0637] 0.145
<b>DN(70%)+PF</b>			
Disagree	0.0101 [-0.00188,0.0221] 0.167	0.0159 [-0.0000648,0.0319] 0.719	-0.0198 [-0.0398,0.000177] 0.085
Not sure	0.0159 [-0.00292,0.0347] 0.167	0.0196 [-0.0000347,0.0392] 0.713	-0.0190 [-0.0381,0.000176] 0.085
Agree	-0.0260 [-0.0568,0.00477] 0.167	-0.0355 [-0.0711,0.0000810] 0.713	0.0387 [-0.000198,0.0777] 0.083
<b>DN(70%)+RC(S)</b>			
Disagree	0.0124* [0.000140,0.0247] 0.149	0.00325 [-0.0129,0.0194] 0.943	-0.0235* [-0.0436,-0.00327] 0.068
Not sure	0.0196* [0.000215,0.0390] 0.153	0.00393 [-0.0156,0.0235] 0.943	-0.0225* [-0.0418,-0.00310] 0.068
Agree	-0.0320* [-0.0636,-0.000404] 0.149	-0.00718 [-0.0428,0.0285] 0.943	0.0459* [0.00658,0.0853] 0.065
<b>DN(70%)+RC(SE)</b>			
Disagree	0.00744 [-0.00497,0.0199] 0.204	0.0136 [-0.00261,0.0299] 0.719	-0.00524 [-0.0254,0.0149] 0.243
Not sure	0.0115 [-0.00770,0.0307] 0.204	0.0167 [-0.00317,0.0366] 0.713	-0.00499 [-0.0242,0.0142] 0.243
Agree	-0.0190 [-0.0506,0.0127] 0.204	-0.0304 [-0.0665,0.00577] 0.713	0.0102 [-0.0291,0.0496] 0.241
<i>N</i>	5784	5784	5784

95% confidence intervals in brackets

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

**Table S4: Chi-square analysis describing associations between all experimental arms and proportion of hesitant participants who cited reasons of vaccine safety or side effect concerns after message exposure.**

Hesitancy to:	Intention to vaccinate		Recommend healthy adults		Recommend elderly		Recommend people with health conditions	
	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)	No (%)	Yes (%)
Worried about the safety or side effects of the vaccine.								
DN(70%)	22.78	77.22	30.00	70.00	20.00	80.00	18.95	81.05
DN	27.74	72.26	28.81	71.19	20.43	79.57	20.92	79.08
HCW	22.86	77.14	33.33	66.67	14.85	85.15	14.55	85.45
NF	32.67	67.33	34.48	65.52	22.86	77.14	25.53	74.47
PF	21.92	78.08	31.15	68.85	14.15	85.85	20.24	79.76
RC(S)	26.67	73.33	29.51	70.49	18.18	81.82	19.78	80.22
RC(SE)	20.53	79.47	19.3	80.7	25.24	74.76	19.34	80.66
Control	18.71	81.29	38.46	61.54	23.08	76.92	20.32	79.68
DN(70%) + DN	27.04	72.96	26.56	73.44	17.12	82.88	23.56	76.44
DN(70%) + HCW	22.73	77.27	27.27	72.73	15.6	84.4	19.66	80.34
DN(70%) + NF	29.33	70.67	28.07	71.93	20.41	79.59	23.3	76.7
DN(70%) + PF	30.67	69.33	40.00	60.00	28.57	71.43	21.76	78.24
DN(70%) + RC(S)	24.32	75.68	30.77	69.23	18.89	81.11	21.69	78.31
DN(70%) + RC(SE)	27.86	72.14	24.44	75.56	18.45	81.55	19.35	80.65
Pearson chi-square:	16.7902		9.7281		14.3616		9.3312	
P-Value:	0.209		0.716		0.349		0.747	

**Table S5: Average marginal treatment effects based on interaction with age category with respect to selecting the intent option for definitely accepting the COVID-19 vaccine, and agreeing to recommend the vaccine to healthy adults, elderly, and people with pre-existing health conditions; in each experimental arm relative to control arm.**

	<b>Intention to vaccinate</b>	<b>Healthy adults</b>	<b>Elderly</b>	<b>Health condition</b>
	Marginal effects [95% Confidence Interval]	Marginal effects [95% Confidence Interval]	Marginal effects [95% Confidence Interval]	Marginal effects [95% Confidence Interval]
	Adjusted p-value	Adjusted p-value	Adjusted p-value	Adjusted p-value
<b>DN(70%)</b>				
Age ≤ 30	-0.0210 [-0.0685,0.0265] 1.000	-0.0357 [-0.0840,0.0127] 1.000	0.0127 [-0.0424,0.0677] 1.000	0.00830 [-0.0570,0.0736] 1.000
Age > 30	-0.0289 [-0.0680,0.0103] 0.429	-0.0387 [-0.0803,0.00287] 0.317	-0.0512* [-0.0974,-0.00510] 0.317	0.0242 [-0.0249,0.0732] 0.296
<b>DN</b>				
Age ≤ 30	0.0207 [-0.0273,0.0687] 1.000	-0.0280 [-0.0750,0.0189] 1.000	0.0131 [-0.0420,0.0681] 1.000	0.0656* [0.00108,0.130] 0.977
Age > 30	-0.00321 [-0.0435,0.0371] 0.549	-0.0278 [-0.0687,0.0132] 0.356	-0.00806 [-0.0532,0.0370] 0.843	0.0873*** [0.0370,0.138] 0.014
<b>HCW</b>				
Age ≤ 30	0.0121 [-0.0352,0.0593] 1.000	-0.0128 [-0.0576,0.0321] 1.000	-0.00853 [-0.0631,0.0461] 1.000	0.0249 [-0.0408,0.0906] 1.000
Age > 30	-0.0147 [-0.0553,0.0259] 0.549	-0.00527 [-0.0462,0.0356] 0.61	-0.0349 [-0.0814,0.0116] 0.455	0.0308 [-0.0187,0.0803] 0.249
<b>NF</b>				
Age ≤ 30	-0.00890 [-0.0559,0.0381] 1.000	-0.0302 [-0.0778,0.0174] 1.000	0.000910 [-0.0557,0.0575] 1.000	0.0518 [-0.0124,0.116] 0.977
Age > 30	-0.0493* [-0.0892,-0.00942] 0.141	-0.0218 [-0.0623,0.0186] 0.409	-0.0286 [-0.0735,0.0162] 0.586	0.0263 [-0.0228,0.0753] 0.296
<b>PF</b>				
Age ≤ 30	0.0224 [-0.0256,0.0703] 1.000	-0.0513* [-0.102,-0.000985] 1.000	0.00780 [-0.0468,0.0624] 1.000	0.0574 [-0.00624,0.121] 0.977
Age > 30	-0.00322 [-0.0428,0.0363] 0.549	-0.0104 [-0.0495,0.0286] 0.610	-0.0234 [-0.0682,0.0213] 0.586	0.0529* [0.00324,0.103] 0.102
<b>RC(S)</b>				
Age ≤ 30	0.0192 [-0.0277,0.0661] 1.000	-0.0329 [-0.0800,0.0143] 1.000	0.00768 [-0.0447,0.0600] 1.000	0.0432 [-0.0192,0.106] 0.977
Age > 30	-0.0186 [-0.0585,0.0212] 0.549	-0.0487* [-0.0917,-0.00572] 0.317	-0.0504* [-0.0977,-0.00300] 0.317	0.0219 [-0.0282,0.0720] 0.296
<b>RC(SE)</b>				

Age ≤ 30	0.0184 [-0.0299,0.0668] 1.000	-0.0222 [-0.0685,0.0240] 1.000	-0.000669 [-0.0546,0.0533] 1.000	0.00916 [-0.0544,0.0728] 1.000
Age > 30	-0.0277 [-0.0674,0.0119] 0.429	-0.00708 [-0.0467,0.0325] 0.61	-0.00515 [-0.0505,0.0402] 0.843	0.0391 [-0.0109,0.0891] 0.192
<b>DN(70%)+DN</b>				
Age ≤ 30	0.00925 [-0.0376,0.0561] 1.000	-0.0237 [-0.0697,0.0222] 1.000	0.00825 [-0.0450,0.0615] 1.000	0.0340 [-0.0293,0.0974] 0.977
Age > 30	-0.0249 [-0.0643,0.0145] 0.429	-0.0386 [-0.0809,0.00374] 0.317	-0.0125 [-0.0565,0.0315] 0.843	0.0432 [-0.00711,0.0935] 0.161
<b>DN(70%)+HCW</b>				
Age ≤ 30	0.0138 [-0.0333,0.0610] 1.000	-0.0163 [-0.0612,0.0285] 1.000	0.0221 [-0.0300,0.0741] 1.000	0.0166 [-0.0460,0.0792] 1.000
Age > 30	-0.0281 [-0.0680,0.0117] 0.429	-0.00652 [-0.0469,0.0339] 0.61	0.00483 [-0.0392,0.0488] 0.843	0.0651* [0.0149,0.115] 0.043
<b>DN(70%)+NF</b>				
Age ≤ 30	-0.0175 [-0.0647,0.0298] 1.000	-0.00655 [-0.0526,0.0395] 1.000	-0.0202 [-0.0768,0.0364] 1.000	0.0214 [-0.0422,0.0850] 1.000
Age > 30	-0.0481* [-0.0883,-0.00788] 0.141	-0.0340 [-0.0767,0.00858] 0.317	-0.0388 [-0.0850,0.00755] 0.455	0.0220 [-0.0284,0.0724] 0.296
<b>DN(70%)+PF</b>				
Age ≤ 30	-0.00288 [-0.0507,0.0450] 1.000	-0.0227 [-0.0698,0.0244] 1.000	-0.0520 [-0.109,0.00516] 1.000	-0.0198 [-0.0840,0.0444] 1.000
Age > 30	-0.0246 [-0.0637,0.0145] 0.429	-0.0261 [-0.0663,0.0142] 0.356	-0.0244 [-0.0695,0.0208] 0.586	0.0740** [0.0252,0.123] 0.019
<b>DN(70%)+RC(S)</b>				
Age ≤ 30	0.0183 [-0.0304,0.0671] 1.000	-0.0155 [-0.0626,0.0315] 1.000	0.0147 [-0.0412,0.0705] 1.000	0.0393 [-0.0238,0.103] 0.977
Age > 30	-0.0152 [-0.0549,0.0245] 0.549	-0.0395 [-0.0813,0.00236] 0.317	-0.0216 [-0.0678,0.0246] 0.586	0.0463 [-0.00412,0.0966] 0.149
<b>DN(70%)+RC(SE)</b>				
Age ≤ 30	0.00311 [-0.0448,0.0510] 1.000	-0.0113 [-0.0580,0.0353] 1.000	-0.0203 [-0.0764,0.0358] 1.000	0.0187 [-0.0452,0.0826] 1.000
Age > 30	-0.0322 [-0.0723,0.00791] 0.429	-0.0235 [-0.0657,0.0187] 0.409	-0.0375 [-0.0845,0.00940] 0.455	0.00169 [-0.0482,0.0516] 0.573
<i>N</i>	5784	5784	5784	5784

95% confidence intervals in brackets

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

**Table S6: Average marginal treatment effects based on interaction with sex with respect to selecting the intent option for definitely accepting the COVID-19 vaccine, and agreeing to recommend the vaccine to healthy adults, elderly, and people with pre-existing health conditions; in each experimental arm relative to control arm.**

	<b>Intention to vaccinate</b>	<b>Healthy adults</b>	<b>Elderly</b>	<b>Health condition</b>
	Marginal effects [95% Confidence Interval]	Marginal effects [95% Confidence Interval]	Marginal effects [95% Confidence Interval]	Marginal effects [95% Confidence Interval]
	Adjusted p-value	Adjusted p-value	Adjusted p-value	Adjusted p-value
<b>DN(70%)</b>				
Male	-0.0306 [-0.0743,0.0132] 0.418	-0.0352 [-0.0800,0.00960] 0.779	-0.0149 [-0.0663,0.0364] 1.000	0.0333 [-0.0228,0.0894] 0.264
Female	-0.0208 [-0.0626,0.0211] 1.000	-0.0419 [-0.0869,0.00317] 0.482	-0.0371 [-0.0866,0.0124] 0.739	0.00432 [-0.0507,0.0593] 1.000
<b>DN</b>				
Male	0.00891 [-0.0358,0.0536] 0.569	-0.0228 [-0.0658,0.0202] 0.779	0.00913 [-0.0423,0.0605] 1.000	0.0677* [0.0120,0.123] 0.080
Female	0.00378 [-0.0390,0.0466] 1.000	-0.0347 [-0.0799,0.0106] 0.482	-0.00717 [-0.0547,0.0403] 0.810	0.0942** [0.0379,0.151] 0.014
<b>HCW</b>				
Male	-0.0313 [-0.0747,0.0122] 0.418	-0.0203 [-0.0649,0.0242] 0.779	-0.00954 [-0.0605,0.0415] 1.000	0.0320 [-0.0231,0.0872] 0.264
Female	0.0271 [-0.0176,0.0719] 1.000	0.00283 [-0.0391,0.0447] 0.559	-0.0362 [-0.0857,0.0133] 0.739	0.0273 [-0.0295,0.0841] 0.763
<b>NF</b>				
Male	-0.0461* [-0.0900,-0.00210] 0.316	-0.0397 [-0.0844,0.00497] 0.779	-0.00518 [-0.0564,0.0461] 1.000	0.0449 [-0.0109,0.101] 0.209
Female	-0.0205 [-0.0626,0.0216] 1.000	-0.0114 [-0.0545,0.0316] 0.491	-0.0290 [-0.0774,0.0195] 0.739	0.0277 [-0.0268,0.0823] 0.763
<b>PF</b>				
Male	-0.00465 [-0.0489,0.0396] 0.569	-0.0202 [-0.0646,0.0242] 0.779	0.0124 [-0.0386,0.0634] 1.000	0.0736** [0.0179,0.129] 0.08
Female	0.0177 [-0.0244,0.0598] 1.000	-0.0312 [-0.0743,0.0119] 0.482	-0.0320 [-0.0793,0.0153] 0.739	0.0391 [-0.0160,0.0942] 0.695
<b>RC(S)</b>				
Male	-0.0254 [-0.0688,0.0181] 0.418	-0.0382 [-0.0822,0.00578] 0.779	-0.0137 [-0.0651,0.0376] 1.000	0.0401 [-0.0152,0.0955] 0.249
Female	0.0190 [-0.0235,0.0614] 1.000	-0.0476* [-0.0947,-0.000469] 0.482	-0.0318 [-0.0801,0.0164] 0.739	0.0266 [-0.0285,0.0817] 0.763
<b>RC(SE)</b>				

Male	-0.00755 [-0.0521,0.0370] 0.569	-0.00113 [-0.0428,0.0406] 0.779	0.0411 [-0.00898,0.0912] 1.000	0.0580* [0.00182,0.114] 0.121
Female	-0.0114 [-0.0535,0.0307] 1.000	-0.0260 [-0.0700,0.0181] 0.482	-0.0429 [-0.0914,0.00563] 0.739	0.00147 [-0.0536,0.0565] 1.000
<b>DN(70%)+DN</b>				
Male	-0.0286 [-0.0717,0.0144] 0.418	-0.0287 [-0.0719,0.0146] 0.779	-0.00707 [-0.0576,0.0435] 1.000	0.0323 [-0.0231,0.0876] 0.264
Female	0.00629 [-0.0359,0.0485] 1.000	-0.0375 [-0.0836,0.00851] 0.482	-0.00104 [-0.0466,0.0446] 0.811	0.0521 [-0.00375,0.108] 0.333
<b>DN(70%)+HCW</b>				
Male	-0.0337 [-0.0771,0.00977] 0.418	-0.0243 [-0.0673,0.0187] 0.779	0.0155 [-0.0340,0.0651] 1.000	0.0233 [-0.0324,0.0790] 0.332
Female	0.0118 [-0.0309,0.0545] 1.000	0.00619 [-0.0364,0.0488] 0.559	0.00999 [-0.0357,0.0557] 0.740	0.0698* [0.0149,0.125] 0.085
<b>DN(70%)+NF</b>				
Male	-0.0583** [-0.102,-0.0150] 0.117	-0.0305 [-0.0741,0.0131] 0.779	-0.0407 [-0.0931,0.0117] 1.000	0.0326 [-0.0230,0.0882] 0.264
Female	-0.00992 [-0.0542,0.0344] 1.000	-0.0138 [-0.0612,0.0336] 0.491	-0.0172 [-0.0669,0.0325] 0.739	0.0155 [-0.0406,0.0716] 1.000
<b>DN(70%)+PF</b>				
Male	-0.0272 [-0.0710,0.0165] 0.418	-0.0252 [-0.0686,0.0183] 0.779	-0.0229 [-0.0743,0.0285] 1.000	0.0452 [-0.00948,0.1000] 0.209
Female	-0.00577 [-0.0475,0.0360] 1.000	-0.0271 [-0.0707,0.0165] 0.482	-0.0465 [-0.0957,0.00279] 0.739	0.0322 [-0.0231,0.0875] 0.763
<b>DN(70%)+RC(S)</b>				
Male	-0.0134 [-0.0572,0.0304] 0.555	-0.0229 [-0.0664,0.0207] 0.779	0.00517 [-0.0458,0.0561] 1.000	0.0673* [0.0125,0.122] 0.08
Female	0.00870 [-0.0346,0.0520] 1.000	-0.0418 [-0.0877,0.00418] 0.482	-0.0178 [-0.0678,0.0322] 0.739	0.0234 [-0.0329,0.0797] 0.856
<b>DN(70%)+RC(SE)</b>				
Male	-0.0412 [-0.0855,0.00299] 0.352	-0.00707 [-0.0501,0.0359] 0.779	-0.0366 [-0.0895,0.0162] 1.000	0.0129 [-0.0425,0.0683] 0.427
Female	0.00501 [-0.0381,0.0481] 1.000	-0.0320 [-0.0785,0.0145] 0.482	-0.0217 [-0.0709,0.0275] 0.739	0.00761 [-0.0482,0.0634] 1.000
<i>N</i>	5784	5784	5784	5784

95% confidence intervals in brackets

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

**Table S7: Average marginal treatment effects based on interaction with education level with respect to selecting the intent option for definitely accepting the COVID-19 vaccine, and agreeing to recommend the vaccine to healthy adults, elderly, and people with pre-existing health conditions; in each experimental arm relative to control arm.**

	<b>Intention to vaccinate</b>	<b>Healthy adults</b>	<b>Elderly</b>	<b>Health condition</b>
	Marginal effects [95% Confidence Interval]	Marginal effects [95% Confidence Interval]	Marginal effects [95% Confidence Interval]	Marginal effects [95% Confidence Interval]
	Adjusted p-value	Adjusted p-value	Adjusted p-value	Adjusted p-value
<b>DN(70%)</b>				
Below tertiary	-0.0209 [-0.0633,0.0214] 1.000	-0.00277 [-0.0465,0.0410] 1.000	-0.0429 [-0.0917,0.00600] 0.283	0.000846 [-0.0547,0.0564] 1.000
Above tertiary	-0.0305 [-0.0739,0.0129] 1.000	-0.0792*** [-0.126,-0.0322] 0.014	-0.00658 [-0.0590,0.0458] 1.000	0.0287 [-0.0270,0.0844] 0.103
<b>DN</b>				
Below tertiary	0.00112 [-0.0430,0.0453] 1.000	-0.0113 [-0.0572,0.0346] 1.000	0.00700 [-0.0417,0.0557] 0.831	0.0726* [0.0165,0.129] 0.167
Above tertiary	0.0123 [-0.0311,0.0558] 1.000	-0.0455* [-0.0875,-0.00349] 0.066	-0.00643 [-0.0565,0.0436] 1.000	0.116*** [0.0574,0.174] 0.001
<b>HCW</b>				
Below tertiary	-0.0143 [-0.0569,0.0284] 1.000	0.0163 [-0.0269,0.0595] 1.000	-0.0415 [-0.0911,0.00803] 0.283	0.00298 [-0.0539,0.0599] 1.000
Above tertiary	0.0125 [-0.0337,0.0587] 1.000	-0.0336 [-0.0770,0.00974] 0.097	-0.00318 [-0.0543,0.0479] 1.000	0.0502 [-0.00489,0.105] 0.052
<b>NF</b>				
Below tertiary	-0.0315 [-0.0743,0.0114] 1.000	0.00302 [-0.0406,0.0466] 1.000	-0.0186 [-0.0673,0.0300] 0.675	0.00534 [-0.0503,0.0610] 1.000
Above tertiary	-0.0342 [-0.0776,0.00920] 1.000	-0.0567* [-0.101,-0.0121] 0.038	-0.0179 [-0.0690,0.0333] 1.000	0.0618* [0.00695,0.117] 0.031
<b>PF</b>				
Below tertiary	0.00972 [-0.0321,0.0515] 1.000	-0.0128 [-0.0566,0.0311] 1.000	-0.0214 [-0.0683,0.0255] 0.590	0.0183 [-0.0357,0.0724] 1.000
Above tertiary	0.00348 [-0.0420,0.0490] 1.000	-0.0358 [-0.0796,0.00802] 0.097	0.00157 [-0.0507,0.0538] 1.000	0.0895** [0.0314,0.148] 0.012
<b>RC(S)</b>				
Below tertiary	0.00604 [-0.0363,0.0484] 1.000	-0.0377 [-0.0849,0.00951] 1.000	-0.0459 [-0.0950,0.00314] 0.283	-0.0181 [-0.0737,0.0375] 1.000
Above tertiary	-0.0138 [-0.0576,0.0301] 1.000	-0.0446* [-0.0881,-0.00114] 0.071	0.00356 [-0.0473,0.0544] 1.000	0.0815** [0.0263,0.137] 0.012
<b>RC(SE)</b>				



Below tertiary	-0.00230 [-0.0453,0.0407] 1.000	0.00582 [-0.0381,0.0498] 1.000	-0.0144 [-0.0634,0.0345] 0.696	-0.00624 [-0.0626,0.0501] 1.000
Above tertiary	-0.0177 [-0.0612,0.0258] 1.000	-0.0326 [-0.0742,0.00897] 0.097	0.00795 [-0.0415,0.0574] 1.000	0.0585* [0.00354,0.113] 0.035
<b>DN(70%)+DN</b>				
Below tertiary	-0.0179 [-0.0596,0.0238] 1.000	-0.0219 [-0.0667,0.0228] 1.000	-0.0159 [-0.0629,0.0312] 0.687	-0.0126 [-0.0686,0.0434] 1.000
Above tertiary	-0.000547 [-0.0451,0.0440] 1.000	-0.0382 [-0.0832,0.00671] 0.097	0.00924 [-0.0403,0.0588] 1.000	0.0929** [0.0373,0.148] 0.007
<b>DN(70%)+HCW</b>				
Below tertiary	-0.00594 [-0.0502,0.0383] 1.000	0.0155 [-0.0273,0.0583] 1.000	0.0235 [-0.0240,0.0711] 0.590	0.0310 [-0.0257,0.0877] 1.000
Above tertiary	-0.0151 [-0.0569,0.0268] 1.000	-0.0380 [-0.0810,0.00503] 0.097	0.00278 [-0.0447,0.0503] 1.000	0.0597* [0.00578,0.114] 0.031
<b>DN(70%)+NF</b>				
Below tertiary	-0.0414 [-0.0847,0.00202] 1.000	-0.0117 [-0.0582,0.0349] 1.000	-0.0723** [-0.124,-0.0209] 0.085	-0.0245 [-0.0805,0.0314] 1.000
Above tertiary	-0.0287 [-0.0722,0.0149] 1.000	-0.0353 [-0.0786,0.00793] 0.097	0.0162 [-0.0346,0.0670] 1.000	0.0694* [0.0129,0.126] 0.022
<b>DN(70%)+PF</b>				
Below tertiary	-0.00792 [-0.0512,0.0354] 1.000	0.00264 [-0.0412,0.0465] 1.000	-0.0333 [-0.0840,0.0173] 0.354	0.0307 [-0.0254,0.0868] 1.000
Above tertiary	-0.0243 [-0.0666,0.0180] 1.000	-0.0555* [-0.0987,-0.0122] 0.038	-0.0372 [-0.0874,0.0130] 1.000	0.0428 [-0.0115,0.0970] 0.054
<b>DN(70%)+RC(S)</b>				
Below tertiary	0.00694 [-0.0370,0.0509] 1.000	-0.000504 [-0.0447,0.0437] 1.000	-0.00328 [-0.0531,0.0465] 0.935	0.00893 [-0.0479,0.0657] 1.000
Above tertiary	-0.0113 [-0.0543,0.0317] 1.000	-0.0660** [-0.111,-0.0205] 0.025	-0.0113 [-0.0623,0.0397] 1.000	0.0776** [0.0230,0.132] 0.012
<b>DN(70%)+RC(SE)</b>				
Below tertiary	-0.0162 [-0.0596,0.0271] 1.000	-0.00923 [-0.0548,0.0364] 1.000	-0.0552* [-0.106,-0.00451] 0.247	-0.0343 [-0.0904,0.0217] 1.000
Above tertiary	-0.0193 [-0.0633,0.0247] 1.000	-0.0253 [-0.0691,0.0185] 0.162	-0.00203 [-0.0534,0.0494] 1.000	0.0497 [-0.00570,0.105] 0.052
<i>N</i>	5784	5784	5784	5784

95% confidence intervals in brackets

\*  $p < 0.05$ , \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

## Supplementary Figures

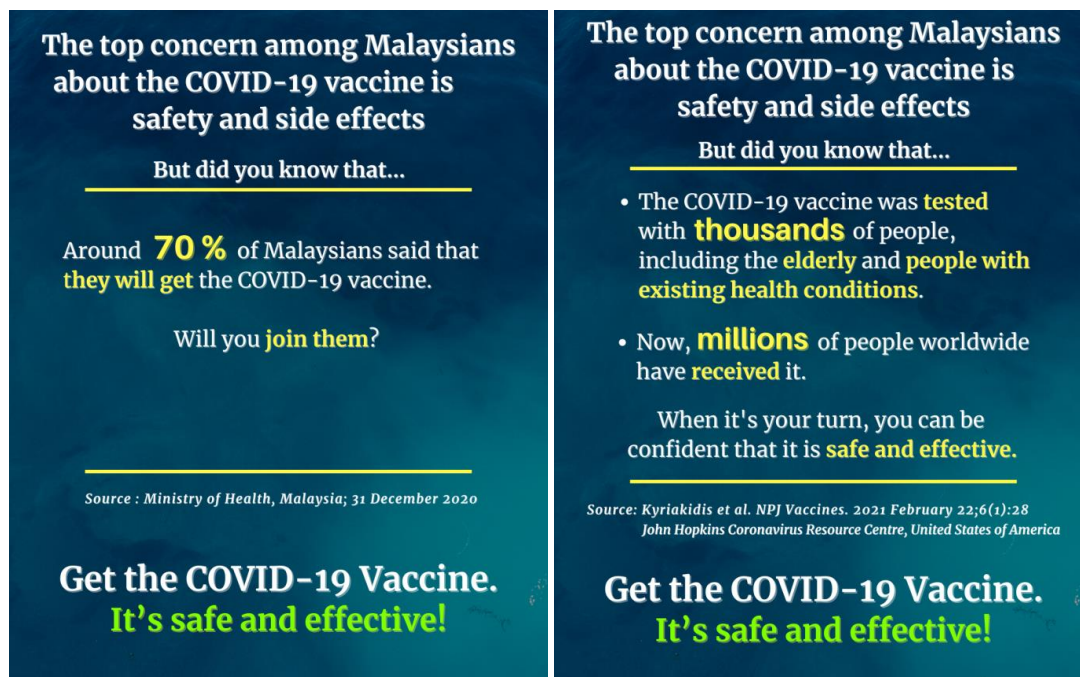
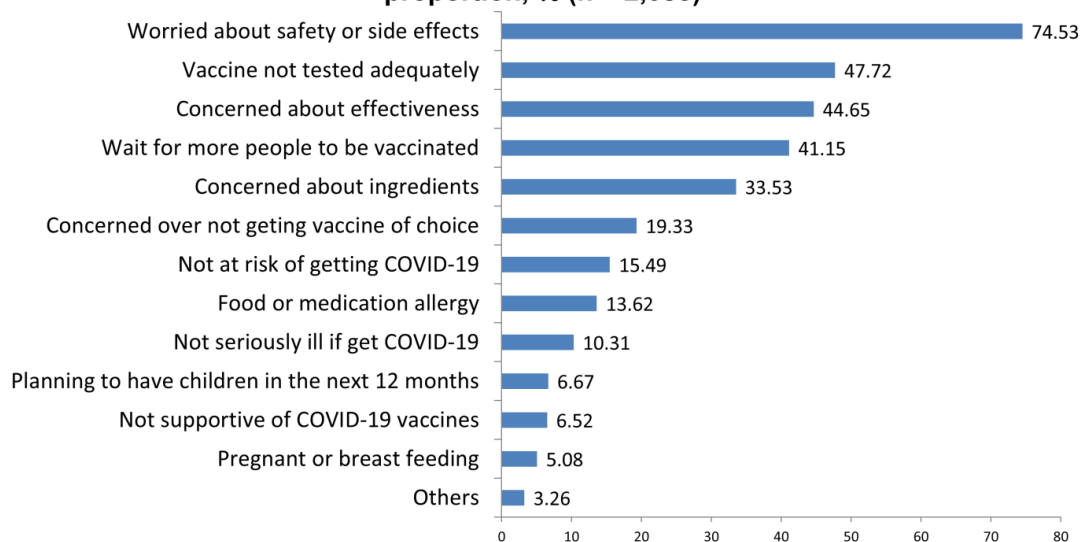


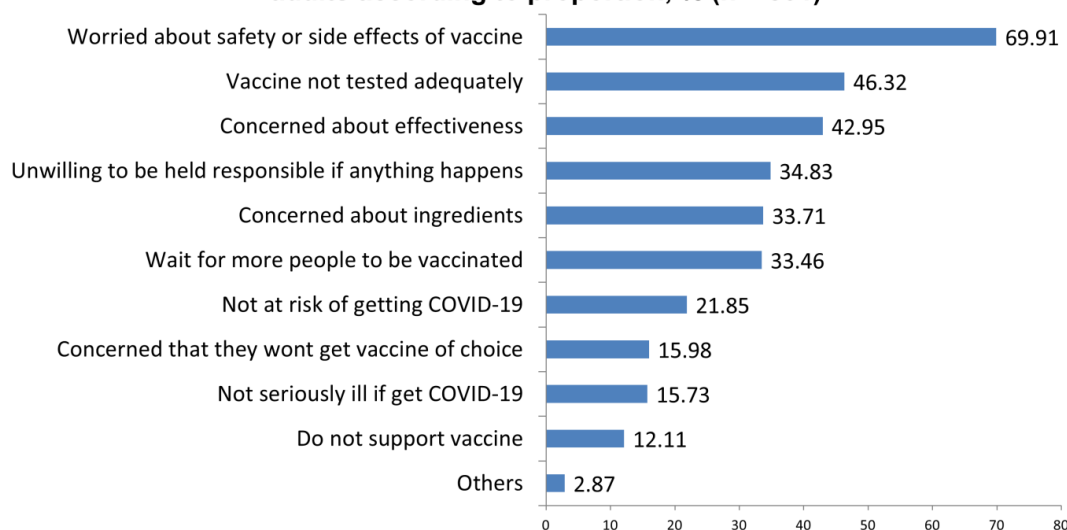
Figure S1: Examples of actual messages used in the survey experiment.

### Reasons cited by respondents who remained hesitant to vaccinate according to proportion, % (n = 2,085)



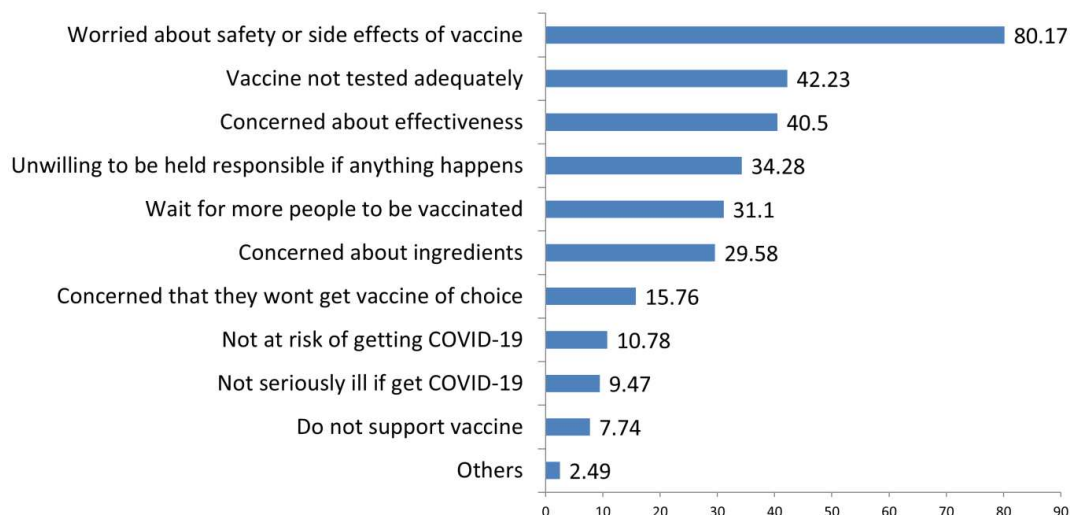
**Figure S2: Tabulation of reasons for remaining hesitant to vaccinate according to proportion of participants who remained hesitant after message exposure.**

### Reasons cited by respondents who remained hesitant to recommend healthy adults according to proportion, % (n = 801)



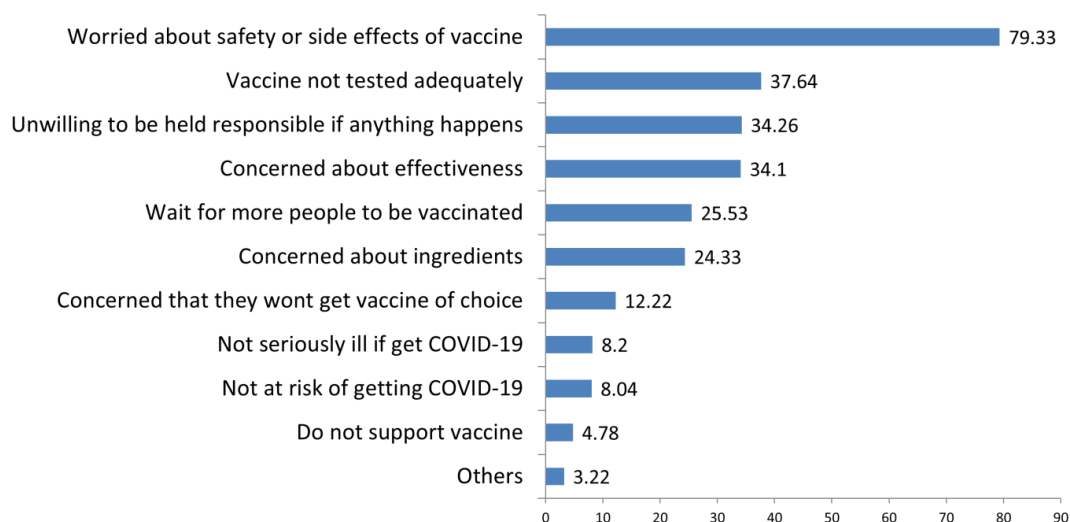
**Figure S3: Tabulation of reasons for remaining hesitant to recommend the COVID-19 vaccine to healthy adults according to proportion of participants who remained hesitant after message exposure.**

### Reasons cited by respondents who remained hesitant to recommend elderly according to proportion, % (n = 1,447)



**Figure S4: Tabulation of reasons for remaining hesitant to recommend the COVID-19 vaccine to the elderly according to proportion of participants who remained hesitant after message exposure.**

### Proportion of respondents citing reason for vaccine recommendation hesitancy to family members with medical condition, % (n = 2,487)



**Figure S5: Tabulation of reasons for remaining hesitant to recommend the COVID-19 vaccine to people with any pre-existing health conditions according to proportion of participants who remained hesitant after message exposure.**