Political attitudes and efficacy of health expert communication on the support for COVID-19 vaccination program: Findings from a survey in Hong Kong

Vera Wing Han Yuen

Faculty of Business and Economics, University of Hong Kong, 13/F KK Leung Bldg, HKU, Pok Fu Lam, Hong Kong

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ABSTRACT

Despite evidence suggesting that vaccines offer protection against COVID-19, the uptake rates of COVID-19 vaccines have been low in some high-income regions. Support for vaccination program is important to fight the pandemic. This study aimed at exploring two research questions: first, to what extent political attitudes are associated with support for COVID-19 vaccination program; and second, whether health expert communication is effective in increasing the support. An online survey was undertaken by 1079 Hong Kong residents aged 18–77 years from May 26 to June 3, 2021. The survey found higher support in pro-government respondents, and lower support in political opposition. A strategy of positive communication by health experts could increase support in the opposition and politically attentive respondents. Other variables that were positively related to program support were quarantine experience, trust in government, preference for pandemic control over freedom, political attentiveness, and disagreement with China's influence on Hong Kong's COVID-19 policymaking. This study contributes to understanding the relationship between political attitudes and support for vaccination program and provides empirical evidence of the efficacy of health expert communication strategy in improving support for vaccination program for people with certain political attitudes.

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1. Introduction

Since early 2020, the spread of coronavirus disease 2019 (COVID-19) has severely affected the world. The World Health Organization declared nine vaccines to be safe and effective as of January 2022 and has recommended a vaccination as soon as possible [1]. Vaccination can reduce the chances of infection, the severity of illness, and death. Thus, vaccine uptake is crucial to combat COVID-19, resume normal activities, and recover from the economic downturn. An estimated 60%–70% vaccine uptake rate is required for herd immunity [2]. However, populations in different countries have varying support for vaccination programs. In particular, some people in developed countries are cautious about new vaccines, making participation in vaccination programs a continuous challenge.

Therefore, against this backdrop, it is essential to understand the factors associated with support for vaccination programs. Owing to a shortage of supplies of vaccines, COVID-19 vaccination programs in many countries are administered as state public health programs. However, they do not necessarily garner enough public support. Studies on support for public health programs have explored various programs such as disease reporting [3], smoke-free workplace laws [4], and water fluoridation [5]. One reason for not getting enough support for public health programs is the "prevention paradox." The substantial social benefits outweighed the social cost. However, individual incentives to participate were inadequate as people did not experience immediate benefits [6]. This problem is similar to that faced in vaccination programs due to vaccine hesitancy. Vaccine hesitancy is defined as refusal, reluctance, or delay in receiving vaccination [7,8], leading to below-target coverage and behind-schedule vaccination programs. A large-scale retrospective analysis across 149 countries using data collected between 2015 and 2019 established that vaccine confidence was low for some Asian and Middle Eastern countries [9]. Further, a previous study that reviewed 31 COVID-19 vaccine hesitancy studies established acceptance rates of 23.6% to 91.3%, with low rates reported in the Middle East, Russia, Africa, and several European countries [10]. These findings suggest that gathering support for public vaccination programs and boosting vaccination rates is a crucial task.

This study considers the COVID-19 vaccination program in Hong Kong and examines the relationships between political

attitudes and the support for the vaccination program. Several studies investigate the association of political attitudes and vaccine hesitancy. The partisan effect was found in studies on COVID-19 measures; many of these studies using US data found Republicans to be more vaccine-hesitant [11–13]. Other studies based on data in democracies found that the divide was not between the left and the right, but rather how far one was from the center, with the far-right and far-left showing more hesitancy [14–16]. A co-partisan effect has been found in which supporters follow advice from leaders of their political parties [11]. For example, a study based in Brazil found that supporters of the President strongly rejected Chinese vaccines because the President was critical of China [17]. However, few studies examined data in countries under authoritarian regimes, partly because political censorship is common among authoritarian regimes, and genuine opposition parties and partisan division may be non-existent. Hong Kong is in a transitory phase from being an open society to a more authoritarian one, and individuals can still report their political stances anonymously, which makes this study possible.

Another research question examined in the current study is the effect of health expert communication on directing pandemic responses. Many governments have used this strategy to boost support for their vaccination programs. There were complaints of distrust in science and the sidelining of scientists [18]; nonetheless, the pandemic provided an opportunity for scientists to gain significance in driving mainstream discourse in many countries. COVID-19 research has found that people trust experts more than the government [19] and are more interested in expert sources than government ones [20]. Previous evidence also shows that experts can help increase compliance with COVID-19 health measures [16,20] and induce changes in knowledge [21]. Further, how people respond to health expert advice has become an active research topic.

The first research question examines the political attitude variables associated with support for the government vaccination program. These factors include political stance, trust in government, preference for pandemic control over freedom, view on China's influence on the policymaking in Hong Kong, and political attentiveness. The second research question addresses the efficacy of health expert communication in increasing support for the government vaccination program. In addition, although they serve as controls, some of the previous findings on demographics, socio-economic factors, knowledge, and experience of COVID-19 were examined to determine whether they are associated with the tendency to support.

2. Materials and methods

An online survey was conducted from May 26 to June 3, 2021, among the general population of Hong Kong aged 18 years or above. The Hong Kong government began the COVID-19 vaccination program at the end of February 2021. On May 30, the vaccine uptake rate for people completing the first dose was 18% [22], which was lower than that in many developed countries, including Israel (62%), Canada (56%), the United States (50%), Italy (39%), and France (38%). At the time of the survey, there were no significant outbreaks in Hong Kong, with only 55 confirmed cases in May. Further, vaccination was voluntary except for workers of catering businesses and recreational or entertainment venues [23]. There were no material benefits or conveniences for the vaccinated people in most other circumstances. Occupational requirements and incentives for vaccination were only announced after the survey period. Thus, the results were unaffected by these events. Ethics approval of this study was obtained from the corresponding author's affiliated institution.

2.1. Study sample and data collection

The data were part of a larger project. Participants were recruited by an online survey company (Dynata) using quota sampling to mimic the general Hong Kong population by age and sex. Vaccinated participants were not filtered, their responses were included in this study. Electronic consent was obtained from participants before the survey began. Participants could discontinue the study at any time if they desired. The collected data were retrieved from the online survey platform and protected by passwords.

2.2. Treatment

Participants were randomly assigned to three groups of similar sizes: the conflict treatment group, the control group, and the aligned treatment group. [1] Each group of participants viewed different excerpts of the government vaccination program. The excerpt viewed by the control group only contained a neutral government announcement. The aligned treatment group received the same government announcement and positive communication from a health expert, Prof. Kwok-Yung Yuen. Further, the conflict treatment group received the government announcement and a hesitant remark given by Prof. Yuen on vaccination. Both were direct quotes from newspapers. The quote supporting vaccination was delivered on March 6, 2021, when Prof. Yuen vaccinated himself [24]; the quote indicating hesitancy was delivered on May 4, 2020, during the early phase of the pandemic [25].

Furthermore, Yuen was the Chair of Infectious Disease in the Department of Microbiology at the University of Hong Kong. He was one of the most frequently interviewed health experts in the media on the issue of COVID-19, personally worked on related research, and was rated to be among the top 1% of researchers in the world by the Essential Science Indicator [26].

The health expert whose quotes were used in the excerpt was selected among the four members of the expert advisory panel for pandemic control appointed by the government to combat COVID-19 when the pandemic began [27]. All four members were academics and held positions in the two medical schools of Hong Kong. The reason for selecting this panel is to ensure that the chosen health expert in this study was widely recognized. Furthermore, although the panel was officially given the task to advise the government and communicate with the public, the members occasionally held views different from the government, thus portraying a certain degree of professionalism and independence.

Prof. Yuen had been selected out of the four members based on two criteria: popularity and political neutrality. Prof. Yuen was a renowned scholar and an applauded SARS hero in Hong Kong due to his involvement in containing the SARS infections in 2003 [26]. Among the four members selected, Prof. Yuen appeared in local newspapers the most number of times. From the beginning of 2020 until the survey period, his name appeared in Hong Kong-based printed media and their web versions approximately 5,300 times, based on search results in *Wisenews*, an online news database. The number of appearances of the other three members was approximately 4,800 (Prof. David Shu-Cheong Hui), 1,500 (Prof. Gabriel Matthew Leung), and 100 (Prof. Keiji Fukuda). Evaluating with a more extended period, Prof. Yuen also had more media exposure before the pandemic than Prof. David Hui, who had the

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[1] A pretreatment check was considered in designing the method but was not adopted given the nature of the intervention of this study. Usually, a baseline question is conducted immediately before the intervention so that it is not affected by factors other than the intervention. Additionally, it is reasonable if it is a medical intervention or a substantial social intervention. Given the short length of the vignette, which only took respondents a few seconds to read, asking the same question with only a lapse of a few seconds could create "benchmarking bias," as participants could remember their response on the baseline question.

second most number of appearances as mentioned above. From 2003 (SARS year) to 2019, Prof. Yuen had approximately 7,000 mentions in *Wisenews*, and Prof. Hui had only about 1,600. This shows that Prof. Yuen has been a familiar figure for a long time and was well-known, not only because of the COVID-19 pandemic but also before it. Regarding political neutrality, Prof. Yuen had not been in any political appointment or joined the government. His other public positions were related to his microbiologist and academic expertise. Contrastingly, a different member (Prof. Leung) had worked in a government position.

The study used the "mirror experiment" method of survey research, which employed a real-world vignette instead of a hypothetical one [28]. Using a hypothetical health expert is beneficial because it can isolate the effect tested from other factors. However, its disadvantage is the cognitive burden due to the lack of familiarity with a hypothetical person. Additionally, results may exaggerate the treatment effect in the real world. It is questionable whether the effect size is generalizable because a hypothetical question may produce only a hypothetical answer [29]. This study chose a real person for the vignette because social-ecological validity is critical when dealing with real-world problems and prescribing potential solutions [30]. Health experts during the pandemic were largely known to the public. A hypothetical vignette is unnecessary because the research question did not isolate a precise casual mechanism.

The excerpts were as follows:.
Control group
"The government offers to members of the public the vaccination programs free of charge. The government's goal is to provide vaccines for the majority of the population within this year."

Aligned treatment group
"The government offers to members of the public the vaccination programs free of charge. The government's goal is to provide vaccines for the majority of the population within this year.

Prof. Yuen Kwok-Yung, Chair of Infectious Diseases, Department of Microbiology at the University of Hong Kong, said that no adverse reactions have been observed for currently available vaccines after one year of testing. Sufficient time has been given to prove that the vaccine is safe and effective. Therefore, he vaccinates himself to set an example and urges the public to vaccinate as soon as possible."

Conflict treatment group
"The government offers to members of the public the vaccination programs free of charge. The government's goal is to provide vaccines for the majority of the population within this year.

Prof. Yuen Kwok-Yung, Chair of Infectious Diseases, Department of Microbiology at the University of Hong Kong said that it is the first time in human history to undergo mass vaccination, side effect is unknown. "If there is vaccine for me now, I would say no. It would be better to keep mask on and wait until others have vaccinated."

2.3. Support for the vaccination program

After viewing the excerpts, participants were presented with the question "To what extent do you support the government vaccination program?" and were asked to rate the answer on an 11-point scale, from "0" (least support) to "10" (strongly support). A rating of 6–10 was classified as "supporting the vaccination program," following an earlier COVID-19 vaccination study in Hong Kong [31].

2.4. Political attitudes

Before presenting the excerpts, political attitudes were assessed using four items. The first two items asked participants the extent

to which they agreed with the statement "The Hong Kong government is willing to cope with the effect of COVID-19" and "Freedom is more important than pandemic control." These items were rated on an 11-point scale, from "0" (strongly disagree) to "10" (strongly agree). The other two questions were "In general, do you pay attention to politics?" and "To what extent do you see Hong Kong under the influence of China in policymaking?" Moreover, the answers to these questions were rated on an 11-point scale, with 0 indicating the least attention and lowest perceived influence of China, respectively, and 10 indicating the most for both answers.

The participants were also asked to self-report their political stance. In Hong Kong, the major political cleavage is not between the left and right but between pro-government and pro-democracy. The choices provided in the survey were "pro-establishment," "moderate/center," "pan-democratic," "pan-localist," "others," and "don't know." For statistical analysis, these responses were grouped into three categories: pro-government (pro-establishment), opposition (democrat and localist), and others (not included in the above categories).

2.5. COVID-19 experience

We examined participants' quarantine experience, COVID-19 knowledge, attention, and interest in the pandemic. Quarantine experience was assessed using a yes/no answer to the statement, "I have been in quarantine because of COVID-19." Participants' knowledge of COVID-19 was tested using five questions. Sample statements include "COVID-19 can remain in aerosols (particles suspended in the air) for up to 3 h" and "a vaccinated person will not be infected." Participants were asked to indicate whether the item was correct or not by choosing "true," "false," or "not sure." Participants received one mark for each correct answer. Total scores ranged from 0 to 5, with higher scores reflecting better knowledge. Attention on COVID-19 was assessed using the question "I am wary of COVID-19". Interest in the pandemic was measured with the statement "I pay attention and follow the news of COVID-19 closely." The two items were rated on an 11-point scale, from "0" (strongly disagree) to "10" (strongly agree). Higher scores indicated greater attention or interest.

2.6. Demographic factors

Data on participants' demographic background, including sex, education, age, self-declared social class (grassroots, lower-middle, middle, upper-middle, and upper), and origin, were collected.

2.7. Statistical analysis

Descriptive analyses were performed for all study variables divided into two treatment groups and one control group. The Chi-squared test and one-way ANOVA were used to confirm that the independent variables across the three groups were not statistically different.

Logistic regression models were used to investigate factors associated with support for the government vaccination program. COVID-19 experience, demographic factors, and political attitudes were independent variables. COVID-19 experience and demographic factors were used in Model 1. Political stances were added for Model 2. Model 3 included all the political attitude variables. Further, Model 4 tested for the interaction effect between the treatment groups and political stances. Finally, Model 5 tested the interaction effect between the treatment groups and political attentiveness. Odds ratios were adjusted using other variables in the regression models. Furthermore, all statistical analyses were

performed using Stata version 16.1 (StataCorp LLC, College Station, Texas, USA). Statistical significance was set at p < 0.05.

3. Results

3.1. Sample characteristics

A total of 1,079 respondents completed all the questions of the survey. Participants were randomly assigned to three groups, and each group contained approximately the same number of participants. Table 1 shows the characteristics of the samples in the three control and treatment groups. Overall, more women (53.5%) and individuals with university education (56.5%) completed the survey. The average age of the participants was 39.9 years. Compared with the age distribution of the Hong Kong population at the end of 2020, the 18–59-year-old group was better represented, and the ≥ 60-year-old group was underrepresented, despite strategies being employed to encourage more respondents from the ≥ 60-year-old group. This was expected, given the accessibility of the online survey. Additionally, the proportion of the eight age groups under 60 years was 9.18%–15.48% of the overall sample, which shows a sufficient representation of each age group. More than half of the participants (55.1%) reported that they belonged to the grassroots and lower-middle-class, 39.6% reported being middle class, and 5.4% reported being upper-middle and upper class, resembling the class structure of Hong Kong society.

Using the Chi-squared test and ANOVA, we could not reject the null hypothesis that the characteristics listed are not systematically different across groups (all p-values > 0.05). Thus, we were confident that the independent variables of samples randomly assigned to the three groups were not statistically different.

3.2. Difference in support for the vaccination program across the control and treatment groups

Table 2 shows the percentage of supporting respondents by political stance and treatment group. A Chi-squared test was con-

ducted to test if the difference in support for vaccination program is statistically significant. Support varied widely across political stances regardless of the treatment given. Within the pro-government stance, 80.8% of the respondents supported the vaccination program, and the number was 54.2% in other political stances. Support in the opposition stance was the lowest at 38.7%. The overall treatment result matched the expected pattern, with the aligned treatment group having the highest support percentage (55.4%), followed by the control group (52.7%) and the conflict treatment group (48.7%). However, the difference was only statistically significant within the opposition political stance (p = 0.017). This may be because the efficacy of expert advice may vary across respondents with different political stances.

People of different political stances have starkly distinct political attitudes in other dimensions, as summarized in Table 3. Opposition supporters had the highest percentage of university education, had the best knowledge of COVID-19, demonstrated the lowest trust in the government, had the strongest preference for freedom over pandemic control, were most politically attentive, and strongly agreed that China influenced Hong Kong's COVID-19 policymaking. Other political stances came second in all dimensions except politically attentiveness, for which they had the lowest scores. The differences were statistically significant (p ≤ 0.001). The three political stances did not differ statistically in terms of class (p = 0.483) and age (p = 0.237).

3.3. Association of political attitude and support for the government vaccination program

The results of the logistic regression analyses are shown in Table 4. Model 1 included COVID-19 experience and demographic factors but excluded variables on political attitudes. Without controlling for political variables, the model explained 14.5% of the variance in support for the vaccination program. Expert advice did not affect the support. Quarantine experience (odds ratio [OR]: 2.098, p = 0.006) and awareness of COVID-19 news (OR: 1.248, p < 0.001) positively predicted support. In terms of

Table 1
Sample characteristics across control and treatment groups.

	Conflict treatment (n = 345)		Control (n = 389)		Aligned treatment (n = 345)		Total (n = 1,079)		Comparison among groups (p-value)
Demographics									
Sex:									
Male	158	45.8%	184	47.3%	160	46.4%	502	46.5%	0.918
Female	187	54.2%	205	52.7%	185	53.6%	577	53.5%	
University education	210	60.9%	209	53.7%	191	55.4%	610	56.5%	0.13
Age (years), Mean (SD)	38.8 (11.8)		40.2 (12.0)		40.8 (12.9)		39.9 (12.2)		0.227
Class:									
Grassroots to lower	201	58.3%	200	51.4%	193	55.9%	594	55.1%	0.117
Middle	132	38.3%	167	42.9%	128	37.1%	427	39.6%	
Upper-middle to upper	12	3.5%	22	5.7%	24	7.0%	58	5.4%	
Origin:									
Hong Kong	334	96.8%	380	97.7%	339	98.3%	1053	97.6%	0.457
Others	11	3.2%	9	2.3%	6	1.7%	26	2.4%	
COVID-19 experience									
Quarantine experience	26	7.5%	28	7.2%	19	5.5%	73	6.8%	0.52
Knowledge of COVID-19 (0–5), Mean (SD)	3.5 (1.3)		3.4 (1.4)		3.4 (1.3)		3.4 (1.3)		0.102
Wary of COVID-19 (0–10)	7.7 (1.8)		7.7 (1.8)		7.7 (1.7)		7.7 (1.7)		0.274
Aware of COVID-19 news (0–10)	7.4 (1.9)		7.5 (1.8)		7.4 (1.9)		7.4 (1.8)		0.236
Political attitudes									
Political stance:									
Pro-government	33	9.6%	39	10.0%	27	7.8%	99	9.2%	0.562
Opposition	106	30.7%	104	26.7%	95	27.5%	305	28.3%	0.456
Others	206	59.7%	246	63.2%	223	64.6%	675	62.6%	
Government trust (0–10)	4.8 (2.8)		5.0 (2.8)		5.0 (2.8)		4.9 (2.8)		0.658
Pandemic control over freedom (0–10)	6.8 (2.4)		6.9 (2.5)		7.0 (2.4)		6.9 (2.4)		0.528
China's influence on Hong Kong's policymaking (0–10)	7.9 (2.0)		7.8 (1.9)		7.8 (2.0)		7.9 (2.0)		0.768
Political attentiveness (0–10)	6.1 (2.3)		6.2 (2.3)		6.0 (2.3)		6.1 (2.3)		0.647

Table 2
Support for the vaccination program across political stances and treatment groups.

Percentage of supporting respondents	Treatment				
Political stance	Conflict	Control	Aligned	Comparison across treatment groups (p-value)	All
Pro-government	75.76%	84.62%	81.48%	0.633	80.81%
Opposition	28.30%	41.35%	47.37%	0.017	38.69%
Others	54.85%	52.44%	55.61%	0.771	54.22%
Comparison across political stances (p-value)	<0.001	<0.001	0.007	/	<0.001
All	48.70%	52.70%	55.36%	0.21	52.27%

Table 3
Differences between the pro-government, opposition, and other political stances.

Attribute	Pro-government (n = 99)	Opposition (n = 305)	Others (n = 675)	Total	χ^2	p-value
Supporting vaccination program (%)	80.8	38.7	54.2	52.3	55.9	<0.001
University education (%)	50.5	65.3	53.5	56.5	13.44	0.001
Knowledge of COVID-19 (0–5)	3.15	3.69	3.31	3.40	31.74	<0.001
Trust in government (0–10)	7.20	3.54	5.23	4.93	185.94	<0.001
Pandemic control over freedom (0–10)	8.45	5.84	7.19	6.92	128.79	<0.001
Political attentiveness (0–10)	6.26	7.26	5.54	6.09	144.64	<0.001
China's influence on Hong Kong policymaking (0–10)	6.88	8.75	7.61	7.87	140.9	<0.001

demographics, men showed higher support than women (OR: 1.38; p = 0.014). An increase in age increased the likelihood to support the program (p < 0.001). University education was not a predictor in this dataset. People belonging to the grassroots and lower-middle class were 47.2% (p < 0.001) less likely to support the vaccination program than those belonging to the middle class. People of origins other than Hong Kong were 5.165 times (p = 0.001) more likely to show support.

Model 2 examined the association of political stance and support for the program using pro-government and opposition dummy variables. Pro-government respondents were more likely to support vaccination (OR: 2.820, p < 0.001), whereas opposition respondents were less likely (OR: 0.523, p < 0.001). The difference in support for vaccination program between the two groups was 5.4 (=2.820/0.523) times. Other variables such as quarantine experience, awareness of COVID-19 news, and demographic variables remained statistically significant and of a similar magnitude.

Model 3 included all variables related to political attitude, and the explained variance was 25.9 percentage points higher than that of Model 1. Trust in the government (OR: 1.307, p < 0.001), preference for pandemic control over freedom (OR: 1.404, p < 0.001), and political attentiveness (OR: 1.114; p = 0.014) increased participants' likelihood of supporting the vaccination program. A region-specific factor of China's influence on Hong Kong policymaking was included. Hong Kong is a special administrative region in China. This variable reflected the perceived relationship between Beijing and the local government. Hong Kong residents who agreed that China had influenced Hong Kong policymaking had a lower tendency to support the vaccination program (OR: 0.884; p = 0.007). After controlling for political attitudes, the political stance of pro-government (p = 0.352) or opposition (p = 0.976) did not significantly influence the support in the vaccination program.

Model 4 added the interaction terms between treatment and political stance. In this model, health expert advice remained statistically insignificant unconditionally in explaining support for the vaccination program. Concerning the interaction terms, a pro-government stance did not have an interaction effect with the treatment groups assigned. However, an opposition stance had a significant interaction with health expert advice. The opposition respondents showed less support than the pro-government respondents (OR: 0.479, p = 0.019). When compared with the conflicting health expert treatment, the opposition respondents

assigned to the control group showed higher support (OR: 2.847; p = 0.012), and when given the aligned health expert treatment, the support increased further (OR: 3.245, p = 0.006). Fig. 1 shows the predictive margins of support for the vaccination program across treatment groups and political stances with a 95% confidence interval. Opposition supporters who received the conflicting treatment showed statistically lower support for the vaccination program than those who received the aligned treatment. In contrast, there was no statistical difference regarding the treatment group for pro-government and other political stances. Wariness of COVID-19 was a statistically significant predictor of support for the vaccination program (OR: 0.880, p = 0.048).

Fig. 1 shows the predictive margins of support for the vaccination program across treatment groups and political stances with a 95% confidence interval. Opposition supporters who received the conflicting treatment showed statistically lower support for the vaccination program than those who received the aligned treatment. In contrast, there was no statistical difference regarding the treatment group for pro-government and other political stances. Wariness of COVID-19 was a statistically significant predictor of support for the vaccination program (OR: 0.880, p = 0.048).

Model 5 tested the interaction effect between the health expert advice and political attentiveness. Results show that politically attentive respondents were more affected by treatment effect in both comparisons between conflict treatment and control groups (OR: 1.190; p = 0.036) and between conflict and aligned treatment groups (OR: 1.242; p = 0.010).

4. Discussion

This study primarily aimed to understand the extent to which the support for government vaccination program is related to political attitude and the efficacy of health expert communication. A strong effect of political stance was associated with the support. Trust in the government, preference for pandemic control over freedom, political attentiveness, and perception of China's influence on Hong Kong policymaking were explanatory variables for the support. The effect of health expert communication was pronounced in the opposition stance and politically attentive respondents, and this may help inform strategies to boost support.

Table 4
Determinants of support for the vaccination program.

	Model 1 Without political attitudes	Model 2 With political stances	Model 3 With all political attitudes	Model 4 Interaction with political stances	Model 5 Interaction with political attentiveness
Support for the government vaccination program (n = 1079)					
Treatment (base = conflict treatment group)					
-Control group	1.071	1.053	1.094	0.787	0.382
	(0.169)	(0.170)	(0.198)	(0.180)	(0.204)
-Aligned treatment group	1.308	1.333	1.388	0.974	0.383
	(0.213)	(0.221)	(0.259)	(0.227)	(0.204)
COVID-19 experience					
Quarantine experience	2.098**	2.063**	1.832*	1.944*	1.906*
	(0.129)	(0.563)	(0.166)	(0.159)	(0.162)
Knowledge of COVID-19	0.939	0.978	1.051	1.048	1.054
	(0.0473)	(0.0508)	(0.0631)	(0.0635)	(0.0634)
Wary of COVID-19	0.964	0.968	0.885	0.880*	0.881*
	(0.0516)	(0.0527)	(0.0564)	(0.0566)	(0.0566)
Aware of COVID-19 news	1.248***	1.228***	1.076	1.087	1.075
	(0.0650)	(0.0648)	(0.0668)	(0.0683)	(0.0672)
Political attitudes					
Pro-government		2.820***	1.329	1.061	1.289
		(0.781)	(0.406)	(0.531)	(0.396)
Opposition		0.523***	1.006	0.479*	0.988
		(0.0796)	(0.187)	(0.150)	(0.185)
Pro-govt. X control				1.404	
				(0.995)	
Pro-govt. X aligned treatment				1.278	
				(0.967)	
Opposition X control				2.847*	
				(1.184)	
Opposition X aligned treatment				3.245**	
				(1.379)	
Trust in government			1.307***	1.312***	1.312***
			(0.0431)	(0.0435)	(0.0436)
Pandemic control over freedom			1.404***	1.410***	1.413***
			(0.0296)	(0.0298)	(0.0296)
China's influence on Hong Kong policymaking			0.884**	0.879**	0.887**
			(0.0402)	(0.0404)	(0.0406)
Political attentiveness			1.114**	1.109**	0.977
			(0.0426)	(0.0427)	(0.0611)
Political attentiveness X control					1.190*
					(0.0987)
Political attentiveness X aligned treatment					1.242*
					(0.105)
Demographics					
Male	1.380*	1.458**	2.027***	2.052***	2.044***
	(0.181)	(0.196)	(0.318)	(0.325)	(0.322)
University education	1.043	1.086	1.300	1.307	1.319
	(0.146)	(0.156)	(0.210)	(0.213)	(0.215)
Age	1.030***	1.024***	1.022***	1.022***	1.023***
	(0.00588)	(0.00599)	(0.00669)	(0.00673)	(0.00673)
Class (base = middle class)					
-Grassroots & lower-middle	0.528***	0.521***	0.566***	0.559***	0.558***
	(0.0739)	(0.0745)	(0.0910)	(0.0907)	(0.0902)
-Upper-middle & upper	1.016	1.106	1.010	0.983	1.001
	(0.315)	(0.349)	(0.368)	(0.359)	(0.365)
Origins other than Hong Kong	5.165**	5.430***	4.038*	3.849*	4.002*
	(2.613)	(2.779)	(2.227)	(2.113)	(2.223)
Constant	0.227**	0.279**	0.743	1.042	1.674
	(0.110)	(0.137)	(0.492)	(0.707)	(1.227)
Model statistics					
-(Cox-Snell) R^2	0.109	0.142	0.303	0.309	0.308
-Cragg-Uhler (Nagelkerke) R^2	0.145	0.19	0.404	0.412	0.411

Standard errors in parentheses; *** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$.

It is essential to understand the political and social contexts before and when the study was conducted to interpret the results. Before the COVID-19 pandemic, 2019 was a year of political instability in Hong Kong, triggered by the introduction of an extradition bill that would allow criminal suspects to be arrested in the Hong Kong jurisdiction and transferred to the jurisdiction of mainland China for trial. At their peak, anti-government protests attracted 1.5–2 million people (or more than one-fifth of all residents) to the street [32]. After social unrest, China's National People's Congress Standing Committee passed the Hong Kong National Security Law to restore stability. With extraordinary measures, including the disqualification of opposition lawmakers and the postpone-
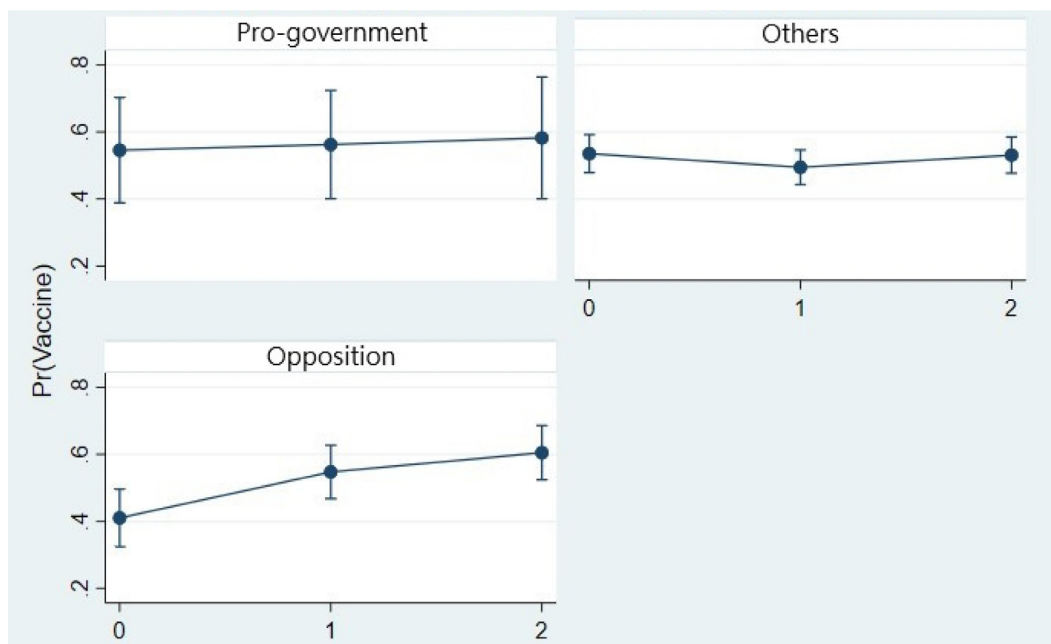
On x-axis, 0 = conflict treatment group; 1 = control group; 2 = aligned treatment group.

Fig. 1. Predictive margins of support for vaccination program across treatment groups and political stances with 95% confidence intervals.

ment of the Legislative Council election, the swift change in the political landscape undermined political trust in the government. Satisfaction with the Hong Kong government dropped to an all-time low in March 2020, with 82.5% expressing dissatisfaction. In May 2021, when this survey was conducted, 62.8% of the respondents were still dissatisfied with the government [33]. As reported in the literature, low trust in health authorities and government institutions correlates with low compliance with public health policies [34,35], which could undermine COVID-19 control measures.

After the COVID-19 outbreak, the government implemented several pandemic control measures that opposition supporters viewed to have the hidden aim of silencing anti-government voices [36,37]. For example, the social gathering ban meant that demonstrators would be subject to fines. The opposition supporters saw the government using pandemic control as a reason to postpone the Legislation Council election [38]. Given the low satisfaction with the government amidst social unrest, the involvement of independent health experts in providing professional advice and disseminating information about pandemic control measures was a potential way to encourage compliance. Scientists have gained high levels of public trust in many countries [39]. Health experts could help frame the issue as a public health problem rather than a political problem [40], package the choice of measures as informed by scientific evidence rather than driven by bureaucratic or political concerns [41]. Consequently, this could depoliticize COVID-19 measures [18].

The first research question of this study examined the association between political attitude and government vaccination program support. This study measured political attitudes using different variables and examined them individually. Further, Model 2 found the partisan effect to be strong. In authoritarian regimes, the major political cleavage is between the government and the opposition. Support for the vaccination program among the pro-government participants was 5.4 times higher than opposition participants. A possible explanation for this is a co-partisan effect—an endorsement from the government or politicians from

the same parties can enhance compliance [11,16,17]. Another possible explanation for this is "affective polarization," meaning that people choose positions different from the party they distrust or dislike. For instance, opposition supporters may refuse to vaccinate to show defiance against the government. This tendency has been supported by evidence on the adherence to COVID-19 measures [42].

Partisanship was found to be a strong predictor of vaccine acceptance/hesitancy in other studies [11–13]. Conservatives in the US, Brazil, and globally were more anti-science and had less perceived risk of COVID-19 than liberals, which led to their lower support for COVID-19 measures [43–45]. Interestingly, in Hong Kong, the more liberal opposition supporters had lower support for the vaccine program than conservative pro-government supporters. The political attitudes of different partisan supporters in multiple dimensions can help us understand the results of this study. In Model 3, when trust in government, preference for pandemic control over freedom, China's influence on Hong Kong policymaking, and political attentiveness were statistically significant, political stance became statistically insignificant. In the following sections, each of these political attitude variables is discussed.

For each unit increase in trust in the government on a scale of 0–10, support for the vaccination program increased by 30.1%. A strong association is observed in the existing literature on COVID-19 vaccination [46–48]. Political trust in a government is the belief in the government to take care of citizens' interests [49], which can be issue-specific and relational, or whether one can trust a party to perform a specific job to a certain standard [50], which influences the extent to which government actions are supported [51]. Respondents were asked whether they trusted the government to perform the specific task of coping with the effects of COVID-19. This question was taken as institutional and heuristic, as no separate government authorities, departments, or officials were asked. The trust level measured in this study was 4.93/10, similar to that in another study conducted in 2020, which measured 3.75/7 [19]. Trust in the Hong Kong government is reflected in the common ratings of "satisfaction with the govern-

ment" (from −100% to +100%) in a rolling survey conducted since 1997 [33]. The net value dropped dramatically in April 2019, from −18.3% to its lowest value of −73.7%, and did not return to previous levels in August 2021.

Preference for pandemic control over freedom is another robust predictor for program support. For each unit increase in preference for pandemic control over freedom on a scale of 0–10, support increased by 40.8%. Other recent studies of the Hong Kong population have yielded seemingly contradictory results. One study found that perceived infringement of freedom had no statistical association with social distancing behavior [52]. Another study found that people from Hong Kong disagreed on whether the requirement of vaccination for travel was an infringement of personal freedom more than they agreed [53]. Notably, this study refers to the freedom to choose to vaccinate, whereas the other studies referred to freedom to gather or travel. Acceptance rates depend heavily on the type and degree of freedom being restricted. For example, people living in Hong Kong were more resistant to privacy infringement by digital contact tracing than travel restrictions [53]. Similar results were obtained in the US and the UK [16]. The second explanation for this was the different time frames in which the surveys were conducted. In 2020, when people first became aware of COVID-19, people were more cautious and willing to sacrifice freedom for helping control the pandemic. As the pandemic continued, with more information about the nature of the pandemic and the effectiveness of counter-virus measures, people may have reassessed their risk perception and reevaluated the need for vaccination. This time-variation argument is supported by the different COVID-19 vaccine acceptance in two waves of the same study in Hong Kong [54].

China's influence on Hong Kong COVID-19 policymaking is a region-specific variable. However, it could also be understood as the influence of the central government on local government and, given the political context of Hong Kong, influence from an authoritarian source. Hong Kong has been a special administrative region with the autonomy of its policymaking granted by its mini constitution. The 2014 Umbrella Movement and the 2019 anti-extradition law movement were vital signs that parts of the society were resistant to interventions from Beijing. The results show that each unit increase of this belief (on a scale from 0 to 10) reduced support for the vaccination program by 11.6%. The result suggests that the sentiment of China's intervention in Hong Kong affects political issues and public health.

Political attentive respondents were 11.4% more likely to undergo vaccination for each unit increase in the 11-point scale. This may be because politically attentive respondents are more civilly engaged. Thus, they are more likely to support pro-social measures for the public good. Notably, a study in the early phase of the pandemic in Hong Kong found that a robust civil society that was politically engaged in the 2019 political movement helped cope with the shortage of masks and fill gaps in government measures [19]. To the best of our knowledge, few studies have examined the association of political attention and pandemic control. This factor was included in one US and UK comparative study on COVID-19 [16] but only served as a control. Another US study included related questions on political interest and political knowledge, which were not associated with changes in behavior and policy support during COVID-19 [42]. Therefore, the present study is the first to identify the association of political attentiveness and vaccination program support.

The second research question concerns the efficacy of health expert communication. Health expert communication of vaccination did not affect support for the government vaccination program. Nonetheless, it affected the opposition stance and politically attentive respondents. Previous studies have revealed the enhancing effect of expert advice on compliance during

COVID-19 [16,55] and other epidemics [34,35]. However, the result was assumed to be general, and the expert communication effect was found to be similar across partisanship in a cross-country comparative study [16]. In contrast, this study revealed that the expert communication strategy has a differentiating impact on specific political groups, which is novel and needs further exploration.

In Model 4, health expert communication only focused on the opposition's stance. It increased the support for the vaccination program by 185% and 225% for the control and aligned treatment groups, respectively, compared to conflict treatment, but not among the pro-government supporters. This shows that the strategy of health expert communication worked well for the opposition and could compensate for their low program support. In contrast, there was no statistically significant difference regarding the treatment given between pro-government and other political stances. One possible explanation for the strong expert communication effect in the opposition respondents was the need for an outside source to verify the government's claim on the vaccine. Similar to another Hong Kong study, people critical of an authoritarian government found the information provided by a non-government source to be more credible than that by a government source [56]. The result also supports the finding that liberals are more pro-science [43–45] and, hence, more receptive to scientific advice from health experts. Moreover, the results point to the importance of health experts not publicly providing advice that conflict with the government, as it may reduce support for public health measures for people with certain political stances. However, ethical issues may arise when scientific evidence is inconsistent with the government's position.

Finally, Model 5 examines the interaction effect between the treatment group and political attentiveness. For each unit increase in political attentiveness on a scale of 0–10, expert communication increased support for the vaccination program by 19.0% and 24.2% for the control and aligned treatment groups, respectively, compared to the conflict treatment group; this is another novel finding of the expert communication effect. Public health experts come from the epistemological community and represent a source of expertise independent of the government. The explanation may be that politically attentive people are more civilly engaged. Therefore, they are more receptive to advice from other members of society.

This study had several limitations. First, the survey was not conducted using random representative sampling. It should be stressed that the result was not meant to infer the population support rate. The study's main contributions are the political explanations and the effects of health expert advice on the support for vaccination programs, which do not strictly require representative sampling. Second, the data were cross-sectional and not temporal. This study was concentrated on a point in time to determine the support for the vaccination programs. Third, there might be a possible question order effect. The appearance of political attitude questions before treatment may have affected participants' responses. However, considering a reverse order, if respondents were given different excerpts before they answered the political attitude questions, there may have been a treatment effect on the independent variables of political attitudes. Fourth, Prof. Yuen's words were used in the excerpts. Respondents' perception of him and other past exposures would reduce the size of the effect. However, a few reasons establish why this may not seriously affect the soundness of the results. First, Prof. Yuen appeared in the media frequently before the survey period. The respondents would also have heard about different recommendations given by various people and authorities throughout the vaccine debate. Therefore, it is not likely that a respondent would remember the specific excerpts used in this survey. Second, this study partially captured

the pretreatment exposure by including variables such as knowledge of COVID-19 and awareness of COVID-19 news. Moreover, participants were randomly allocated to experiment groups. Thus, there is no compelling reason to believe that respondents assigned to different groups had different pretreatment effects. Future studies may examine the impact of expert advice over a more extended period. The prolonged use of public health experts by a weakly trusted government may, in turn, reduce people's trust in experts over time.

5. Conclusion

Political attitudes were associated with support for the government vaccination programs in the authoritarian regime in Hong Kong. The support was divided across political stances. Further investigation found that trust in the government, preference for freedom over pandemic control, political attentiveness, and China's influence on policymaking in Hong Kong were associated with the tendency to support vaccination programs. Further, these associations were more robust than education and knowledge of COVID-19, which other studies have explored. Participants in the opposition political stance had significantly lower support rates. This could be countered by positive health expert communication of the government's vaccination program. Politically attentive people were more receptive to health expert advice. This shows that governments could utilize health experts to encourage vaccination even in communities with low trust in the government. If forced vaccination imposes personal costs and reduces one's welfare, then using health experts in a persuasive capacity could encourage voluntary vaccine uptake, maintaining the individuals', and thus collective, social welfare.

6. Ethics approval

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

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