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Understanding the societal factors of vaccine acceptance and hesitancy: evidence from Hong Kong

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ABSTRACT

Objectives: Vaccination is considered to be an important public health strategy for controlling the COVID-19 pandemic. Besides subjective evaluations of the vaccine and the health threat, societal factors have been seen as crucial to vaccination decisions. Based on a socioecological perspective, this study examines the role of societal factors in COVID-19 vaccine hesitancy in Hong Kong.

Study design and method: An online survey was fielded between 25 and 28 June 2021, collecting 2753 complete responses. Multinomial logistic regression was conducted to examine how subjective evaluations of the vaccine (summarised by the 5C model — Confidence, Collective responsibility, Constraints, Complacency and Calculation), threat perception, interpersonal influences and institutional trust contribute to explaining three types of decision — acceptant (vaccinated, scheduled or indicated ‘Yes’), hesitant (unvaccinated and indicated ‘Maybe’ on intention) and resistant (unvaccinated and indicated ‘No’).

Results: A total of 43.2%, 21.7% and 35.1% of respondents were acceptant, hesitant and resistant. Although the 5C model remained useful in explaining vaccination decisions, respondents were heavily influenced by the decisions of their family, although they were less influenced by friends. Second, respondents tended to accept the vaccine when they had a weaker perception that the act is supportive of the government and were less resistant if they had stronger institutional trust.

Conclusion: Under the low-incidence and low-trust environment such as Hong Kong, vaccination decisions are heavily influenced by family's decision and the perception of vaccination as socially and politically desirable. Our findings highlight the importance of a nuanced conception of interpersonal and political influence towards vaccine acceptance/hesitancy.

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Introduction

Despite strenuous efforts worldwide to promote COVID-19 vaccination, many countries are struggling with vaccine hesitancy. Previous research has suggested factors influencing hesitancy to different vaccines (e.g. influenza, human papillomavirus and measles), including demographic characteristics, health beliefs, norms, economic and political contexts and vaccine attributes. A commonly used framework is the 5C model, which highlights psychological antecedents, including attitudes (confidence), perceived invulnerability (complacency), perceived barriers (constraints), preference for deliberation (calculation) and communal orientation (collective good). The model was found efficacious in predicting the acceptance of COVID-19 vaccination in healthcare workers, community-dwelling adults, and university students during COVID-19 outbreaks. On top of these five ‘Cs,’ Geiger et al. added two more ‘Cs’—conspiratorial thinking and compliance with social monitoring and sanctioning for non-adherence—to highlight the social nature of decision-making for COVID-19 vaccination. Their findings call for deepened understanding of how societal factors shape COVID-19 vaccination decisions. Hence, based on a socioecological framework, this study examined the role of two societal factors, namely, interpersonal influences and trust towards public institutions.

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Pre-COVID-19 studies found that influences from one's family, friends and the community are crucial in determining vaccination decisions.\textsuperscript{18,21–25} For COVID-19, as a high vaccination rate is needed for effective protection for a community, interpersonal influences will be pivotal in motivating vaccination, especially among people with disparate levels of perceived vulnerability and when the incidence of COVID-19 may be low at that moment, giving people a false sense of safety. Although studies have examined interpersonal influences on preventative behaviours, such as mask-wearing, under the COVID-19,\textsuperscript{16,27} few have targeted vaccination as an invasive behavioural outcome, especially during a mass roll-out.

The second type of societal factor concerns attitudes towards the authority that administers the vaccination programme.\textsuperscript{28,29} Trust is crucial to the compliance with COVID-19 containment policies,\textsuperscript{30,31} which often require government emergency powers and limit civic freedom. As governments have rolled out COVID-19 vaccines under emergency use authorisation, attitudes towards the governments would be crucial to the receptiveness of such brand-new vaccines, especially against the backdrop of their safety and side-effect concerns.\textsuperscript{32} Attitudes on COVID-19 vaccination have been divided by political partisanship, and the behaviour is seen as politicised in politically polarised states.\textsuperscript{33–35} However, what or who is being distrusted (or trusted) — for example, the government system or the political parties — awaits clarification.

Hong Kong provides a useful case for investigating how societal determinants contribute to COVID-19 vaccine hesitancy. Shortly after COVID-19 vaccines were approved by COVAX, the Hong Kong government managed to procure sufficient vaccines for all adult citizens by February 2021. However, vaccine uptake was slow in the first few months. Local surveys conducted shortly before the mass vaccination programme found only about 40% of the adult population intended to be vaccinated.\textsuperscript{36,37} Five months into the programme, as of 1 September 2021, only 46% of the population was fully vaccinated, falling dramatically behind major countries, including the United Kingdom, Canada and Singapore, despite nearly no vaccine supply issues.\textsuperscript{38,39}

Two reasons may account for Hong Kong’s vaccine hesitancy. First, the low incidence of COVID-19 under the government’s zero tolerance policy and the high compliance with mask-wearing\textsuperscript{40} might have mitigated citizens’ perceived infection risks, reducing the effects of threat appraisal. Second, trust in the government had plummeted after the citywide protests in 2019 sparked off by the introduction of the extradition law amendment bill. The lack of trust was reflected in the early months of the pandemic when citizens relied heavily on civil society mobilisation to source masks and medicine, the government to close the city’s borders.\textsuperscript{39,40} Thus, when the vaccination programme was introduced, it was quickly shrouded in scepticism and distrust.\textsuperscript{41}

Hong Kong serves as an interesting context outside of the often-studied Western countries to examine how vaccination decision hinges on societal factors when perceived threat and public trust are low. Although we expected the five ‘Cs’ to remain robust factors of vaccine hesitancy, based on the socioecological framework of vaccine trust,\textsuperscript{16,42} we hypothesised that interpersonal influences as well as attitudes to public institutions are also crucial determinants.

\section*{Methods}

We conducted an online survey in traditional Chinese with Hong Kong residents aged \textgreater{}18 years through a panel from the Public Opinion Research Institute, an independent polling agency, between 25 and 28 June 2021 and collected 4386 responses. Respondents provided their e-consent before beginning the survey and were not compensated for their participation. Responses completed under 5 min were excluded on suspicion about data quality and attention to the question items.

First, to measure vaccine hesitancy, respondents were asked, ‘Have you been vaccinated? (Yes/Scheduled/No).’ Those who answered ‘No’ were further asked, ‘Are you planning to get vaccinated in the next few months? (Yes/Maybe/No).’ This allowed us to categorise respondents into \textit{acceptant}, \textit{hesitant} and \textit{resistant}. As vaccine hesitancy can be represented on a spectrum from complete refusal to temporary undecidedness,\textsuperscript{1} we distinguished the group who were undecided (i.e. \textit{hesitant}) from those who expressed refusal (i.e. \textit{resistant}). The former’s vaccination intention could be more amenable to change than the latter and render them more realistic policy targets. Hence, our analysis sought to distinguish those who accepted vaccination (i.e. vaccinated, scheduled or indicated a positive intention; i.e. \textit{acceptant}) and the resistant from the \textit{hesitant}.

The survey then asked attitudinal questions to construct the independent variables, including threat appraisal towards COVID-19 and towards the vaccine based on the 5C model,\textsuperscript{3} trust towards public institutions (Hong Kong SAR government, the public health departments and public health experts),\textsuperscript{15,20} confidence towards government’s containment measures and whether getting vaccinated is an act of supporting the government. The threat appraisal items were adapted from the Health Belief Model and were used in our previous study.\textsuperscript{42} The items for the five ‘Cs’ (except complacency) were adapted from Betsch et al.,\textsuperscript{12} with additional items constructed as per the COVID-19 containment policies at the time of data collection. To measure interpersonal influences, respondents were asked to estimate, on two self-created items, the proportion of their family and friends that had been vaccinated. Demographics, media usage and trust towards their family, friends and the community were also collected as control variables. As the study was conducted after the enactment of the National Security Law (NSL), under the sensitive political environment, we invited respondents to identify themselves in one of the following categories for their political orientation: non-pro-establishment, pro-establishment, centrist, others, unaffiliated to or unknown of any political orientation. At the point of observation, there is no conclusive remark on whether the NSL could mobilise Hong Kong citizens to further commit to their political identity or if they feel the need to withdraw from politics in fear of their safety and well-being.\textsuperscript{41} We used non-conservative as a reference group and grouped other categories as politically conservative (see Tables 1 and 2 for the items).

We first performed univariate analyses by one-way analyses of variance with Tukey’s adjustment to identify significant predictors, followed by multinomial logistic regression using the statistically significant predictors to predict vaccine hesitancy with \textit{hesitant} as the reference category. Among the 4386 respondents, 2753 provided complete responses for the analysis. Following the simulation study of Pepinsky,\textsuperscript{44} we opted for listwise deletion over multiple imputation, as the data have been identified as missing-not-at-random and multiple imputation may produce more biased results than listwise deletion. The data have been weighted with raking by the age group and gender of the respondents according to the Hong Kong census. This study was approved by the Human Research Ethics Committee of the University of Hong Kong (EA2003003).

\section*{Results}

Our sample had a vaccination rate of 34.6\% (\textit{n} = 952), whereas 4.6\% (\textit{n} = 125) had scheduled their vaccination and 60.9\% (\textit{n} = 1675) had not been vaccinated. The vaccination rate was very similar to the official estimate of 33.0\% population coverage rate.
(excluding those aged <18 years) as on 28 June 2021, supporting the representativeness of our data regarding vaccination status. Among the 1675 respondents who had not vaccinated, only 6.6% (111/1675) were planning to do so (Yes). Meanwhile, 35.7% (598/1675) were considering getting vaccinated (Maybe), and 57.4% (967/1675) were not planning to do so (No). Hence, the three groups — acceptant, hesitant, and resistant — constituted 43.2% (1188/2753), 21.7% (598/2753) and 35.1% (967/2753) of the sample, respectively.

Sample characteristics are presented in Table 2. About half were male, with 40–44 years being the median age group. About one-third of the sample had at least one health condition, and 46.4% were living with a vulnerable individual. About 10% were in an occupation that requires regular COVID-19 testing, and 66.2% identified themselves as non-pro-establishment.

Univariate comparisons across the three groups (acceptant, hesitant and resistant) are presented in Table 3. The three groups were significantly different on all 5Cs, except calculation, which indicated a ceiling effect (mean scores over six out of seven). Acceptant was highest on confidence and collective good and lowest on complacency and constraints. The three groups were also significantly different in institutional trust. Resistant was most distrustful of public institutions and were most likely to see vaccination as supportive of the government.

Acceptant indicated more vaccinated family members and friends than hesitant and resistant. The proportions of respondents...
indicating more than half of their family or friends being vaccinated were 34.6% and 12.5%, respectively, for acceptant, but only 1.3% and 0.7% for resistant. A total of 16.8% of acceptant and 57.8% of resistant indicated none of their family members have been vaccinated. The estimation for friends’ vaccination tended to be more conservative and clustered around ‘Quite a bit’ (79.3% [resistant] to 90.3% [resistant]). Acceptant reported highest reliance on traditional media (television and newspaper), whereas resistant indicated highest reliance on online information. Interpersonal trust was similar across the three groups. All groups had low threat appraisal (less than 3 out of 10).

All predictors were used in the multinomial logistic models together with the demographic variables, except calculation, interpersonal trust and threat appraisal, which did not vary

| Variable                              | Category                          | Valid, n (%) | Mean (SD)     |
|---------------------------------------|-----------------------------------|--------------|---------------|
|                         | (a) Acceptant (n = 1188), Mean (SD) |              | (b) Hesitant (n = 598), Mean (SD) | (c) Resistant (n = 967), Mean (SD) | Omnibus P | (a) vs (b) P | (b) vs (c) P | (a) vs (c) P |
| Confidence                           | 4.20 (0.96)                        | 3.27 (0.78)  | 2.71 (0.81)   | <0.001       | <0.001       | <0.001       | <0.001       |
| Collective good                       | 4.86 (1.52)                        | 3.66 (1.39)  | 2.77 (1.46)   | <0.001       | <0.001       | <0.001       | <0.001       |
| Complacency                           | 2.78 (1.66)                        | 3.53 (1.47)  | 3.92 (1.75)   | <0.001       | <0.001       | <0.001       | <0.001       |
| Constraints                           | 2.73 (1.53)                        | 3.60 (1.65)  | 3.48 (1.90)   | <0.001       | <0.001       | 0.397        | <0.001       |
| Calculation                           | 6.08 (1.05)                        | 6.07 (0.96)  | 6.10 (1.23)   | 0.826        | 0.988        | 0.843        | 0.873        |
| Threat appraisal of COVID-19          | 2.90 (1.45)                        | 2.92 (1.37)  | 2.82 (1.58)   | 0.386        | 0.975        | 0.463        | 0.469        |
| Institutional trust                   | 2.74 (1.31)                        | 2.34 (1.00)  | 1.97 (0.88)   | <0.001       | <0.001       | <0.001       | <0.001       |
| Confidence in government policy       | 2.64 (2.10)                        | 2.12 (1.57)  | 1.86 (1.45)   | <0.001       | <0.001       | 0.013        | <0.001       |
| Vaccination as support to government  | 2.94 (1.86)                        | 3.95 (1.95)  | 4.22 (2.12)   | <0.001       | <0.001       | 0.023        | <0.001       |
| Extent of family vaccinated           | 2.32 (0.92)                        | 1.59 (0.59)  | 1.44 (0.53)   | <0.001       | <0.001       | <0.001       | <0.001       |
| Extent of friends vaccinated          | 2.09 (0.40)                        | 1.94 (0.31)  | 1.81 (0.42)   | <0.001       | <0.001       | <0.001       | <0.001       |
| Interpersonal trust                   | 4.44 (0.87)                        | 4.33 (0.85)  | 4.27 (0.90)   | <0.001       | 0.027        | 0.400        | <0.001       |
| Reliance on traditional media         | 4.04 (1.72)                        | 3.93 (1.59)  | 3.84 (1.70)   | 0.021        | 0.389        | 0.549        | 0.015        |
| Reliance on online media              | 5.85 (1.11)                        | 5.93 (0.97)  | 6.04 (1.06)   | <0.001       | 0.301        | 0.112        | <0.001       |

Note. The omnibus P values were determined by analysis of variance. The P values of the paired comparisons were determined by post-hoc analyses with Tukey’s adjustment.
significantly across the groups. Table 4 presents the results of the multinomial regressions (Akaike information criterion = 4038.5; Bayesian information criterion = 4275.4; −2LogLikelihood = 3958.5; Likelihood test: χ²(38) = 1887.5, P < 0.001).

First, the 5C model only partially explained vaccination decisions. Respondents who had confidence in the vaccines were more likely to be acceptant and less likely to be resistant. Those who were more complacent (i.e. perception that COVID-19 is not serious enough for warranting vaccination) were more likely to be resistant and less likely to be acceptant. However, collective good only had a partial positive effect. Although respondents who thought vaccination promotes the collective good were less likely to resist the vaccine (compared with hesitant), they were not statistically more likely to accept it (also compared with hesitant). Meanwhile, although constraints were statistically significant, its effect was not linear – hesitant tended to report facing more constraints than acceptant and resistant.

Second, trusting public institutions made people less resistant to the vaccine, but it did not make them more acceptant. A partial effect was also found with perceiving vaccination as supportive of the government. The construct divided respondents who accepted the vaccine from those who did not, but it was not helpful in further dividing those who were hesitant from the resistant respondents. No significant effect, meanwhile, was shown in respondents’ confidence in the government’s containment policy.

Third, vaccination among family members had a particularly important impact. Not only did it make respondents less resistant to the vaccine but also significantly enhanced their likelihood of accepting it. However, there was only a partial effect in vaccination among friends. Respondents who had more friends who were vaccinated were less likely to resist, but they were not necessarily more likely to accept the vaccine.

Finally, male respondents were more likely to be resistant than hesitant, whereas younger respondents were more likely to be acceptant than hesitant. No independent significant effect was found with education, socio-economic status, sources of information and political orientation. Respondents who were required to have regular testing because of their occupation were more acceptant than hesitant. However, the presence of a health condition rendered respondents not only hesitant (compared with acceptant) but also resistant (compared with hesitant) to the vaccine.

**Discussion and conclusion**

This study investigated how individual and societal factors shape vaccination hesitancy in Hong Kong – a context where there has been both low incidence of COVID-19 due to the government’s zero tolerance policy,45–40 and low trust in the government after the year-long social unrest since the mid-2019.39–41 While confidence and complacency had significant effects similar to the findings of extant studies,3,14,16 the other 3 ‘Cs’ – collective good, constraints and calculation – had either minimal or partial effects. Our findings are interesting in several ways. First, Hong Kong’s low COVID-19 incidence may have made ‘protecting others’ a less compelling reason for getting vaccinated. Although collective good makes people less resistant to the vaccine, it does not lead them to accept it. Second, resistant and acceptant reported fewer constraints than hesitant. Hence, perceived barriers may only matter when people are juggling with getting vaccinated or not, rather than swaying them towards a positive or negative stance. Third, calculation was consistently high across all three groups, indicating that Hong Kong citizens carefully weigh the cost against the benefits of vaccination regardless of their stances. In a local study, which examined parental decision on COVID-19 vaccination for their children, these findings were not consistent. Overall, our findings contribute to the understanding of vaccine hesitancy in a low-incidence context.
school-aged children, only confidence emerged as a significant predictor.\textsuperscript{30} Parental decisions about COVID-19 vaccination are often heavily impacted by concerns over safety and side-effects, especially the long-term ones.\textsuperscript{51} The contrasting findings of this study with ours call for investigation on the potentially differentiated cognitive processes behind a vaccination decision for oneself vs one for a vulnerable relative.

Beyond the 5C model,\textsuperscript{12} our results show that societal factors are essential in explaining vaccine hesitancy in Hong Kong. On the one hand, decisions are evidently shaped by attitudes towards public institutions in this low public trust environment.\textsuperscript{39–41} This echoes with a recent study from Korea, which shows an inverse relationship between vaccine hesitancy and trust in government’s COVID-19 countermeasures.\textsuperscript{52} Their measurement of trust was competence based, which is slightly different from ours. Nonetheless, these findings make intuitive sense because trusting public institutions can reduce people’s misgivings about the consequences of getting the COVID-19 vaccines under the concerns over them being newly developed, entailing new technologies, and bearing unknown side-effects.\textsuperscript{52} However, trusting public institutions does not necessarily entail acceptance — it only makes people more likely to consider it. We found that what differentiates people who accept from those who hesitate or resist is an alternative measure of trust in the government — the extent to which people perceive vaccination as an act of supporting the government. This measure captures a more relational dimension of trust, with the implication that people may not want to be publicly seen as supporting the government when public trust in the government remains low.\textsuperscript{39–41} Altogether, our findings reveal that it is not institutional trust or political orientation that makes people accept the vaccine; instead, it is the perception that vaccination is a socially — or politically — sensitive behaviour that matters. Although extant studies have shown political partisanship may affect the intention to receive COVID-19 vaccination,\textsuperscript{33–35,52,53} we urge future studies to account for the sociopolitical meaning of vaccination, especially in highly polarised states. This study also offers a sociocultural perspective for studying the antivaccine movement or how people withdraw from vaccination campaign due to bundling of vaccination and political identity. In principle, strategies such as borrowing trust from trusted experts to improve the trustworthiness of the vaccination programme, promoting vaccination when the perceived risk is elevating or offering realistic incentives to reward vaccination (e.g. relaxing social distancing for vaccinated individuals) may work. However, the effectiveness of these strategies may be sensitive to the social context, and the empirical findings regarding why they work in one context but not in the other remain scant and inconclusive.\textsuperscript{54}

Furthermore, family is an important medium in which vaccination decisions are transmitted in Hong Kong. Yet, friends are weak influencers. Our findings indicate that the socialisation of decision making seldom goes beyond the family, which underlines the networked effect of vaccination. An important point to note here, however, is that our findings merely point to correlation, rather than causation. While it could be friends and family that influence individuals’ vaccination decisions, it could also be the other way around. Thus, we call for more family-friendly arrangements for vaccination, such as allowing a family member to register and attend the vaccination session together with a vulnerable relative.

In addition to the data being cross-sectional and therefore un-able to infer the direction of causality, some items were constructed in response to the fast-changing and specific context of COVID-19 in Hong Kong rather than based upon standardised instruments. We acknowledge the limitation of this approach in psychometric terms, yet this would have safeguarded the contextual relevance and validity of our findings. The sample was recruited from a panel of the polling company, and hence, a non-probability one. Representation by individuals who are less educated, unable to access the internet or have difficulties reading traditional Chinese was constrained. As foreign workers and foreign domestic helpers were excluded as the survey was conducted in traditional Chinese, our vaccination rates might be slightly lower than the actual number. As the survey was self-reported, there was no way to verify the accuracy of respondents’ vaccination status and whether they got vaccinated eventually. Finally, we witnessed a high incompleteness rate, especially among male, older and less educated respondents, similar to other surveys.\textsuperscript{55,56} However, the political orientation of those who completed the survey and those who dropped out was not significantly different. Hence, their attrition is unlikely due to political stances and should not bias our findings.

To conclude, the case of Hong Kong reveals that vaccination for COVID-19 is as much a social decision as a personal decision. COVID-19 vaccination decisions are shaped by societal factors, namely, interpersonal influences and institutional trust. Although most policies to boost vaccination uptake pre-COVID-19 relied on information provision, education, incentives, reminders and quasi-mandatory schemes,\textsuperscript{57} policymakers — especially those in a low-trust, low-incidence context — should examine the interpersonal and political determinants and devise solutions accordingly to render COVID-19 vaccination socially desirable.

Author statements

Ethical approval

This study was approved by the Human Research Ethics Committee of the University of Hong Kong (EA2003003).

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Competing interests

None declared.

References

1. MacDonald NE. Vaccine hesitancy: definition, scope and determinants. Vaccine 2015;33(34):4161–4. https://doi.org/10.1016/j.vaccine.2015.04.036.
2. Bonnevie E, Gallegos-Jeffrey A, Goldberg J, Byrd B, Smyser J. Quantifying the rise of vaccine opposition on Twitter during the COVID-19 pandemic. J Commun Healthc. 2021;14(1):12–9. https://doi.org/10.1080/17538068.2020.1858222.
3. Caserotti M, Girardi P, Rubaltelli E, Tasso A, Lotto L, Gavaunzi T. Associations of COVID-19 risk perception with vaccine hesitancy over time for Italian residents. Soc Sci Med 2021;272:113688. https://doi.org/10.1016/j.socscimed.2021.113688.
4. Chadwick A, Kaiser J, Vaccari C, Freeman D, Lambe S, Loes BS, et al. Online social endorsement and Covid-19 vaccine hesitancy in the United Kingdom. Soc Media + Society 2021;7(2):20563051211008817. https://doi.org/10.1177/20563051211008817.
5. Murphy J, Vallières F, Bentall RP, Shevlin M, McBride O, Hartman TK, et al. Psychological characteristics associated with COVID-19 vaccine hesitancy and resistance in Ireland and the United Kingdom. Nat Commun 2021;12(1):1–15. https://doi.org/10.1038/s41467-020-20226-9.
6. Okubo R, Yoshioka T, Ohfuji S, Matsuura T, Tabuchi T. COVID-19 vaccine hesitancy and its associated factors in Japan. Vaccines 2021;9(6):662. https://doi.org/10.3390/vaccines9060662.
7. Sallam M, Dahabshel D, Eid H, Al-Mahouz K, Al-Haidar A, Taim D, et al. High rates of COVID-19 vaccine hesitancy and its association with conspiracy beliefs: a study in Jordan and Kuwait among other Arab countries. Vaccines 2021;9(1):42.
8. Sallam M, Al-Sanafi M, Sallam M. A global map of COVID-19 vaccine acceptance rates per country: an updated concise narrative review. J Multidiscip Healthc 2022;15:21–45. https://doi.org/10.2147/JMDH.S347669.
9. Sallam M. COVID-19 vaccine hesitancy worldwide: a concise systematic review of vaccine acceptance rates. *Vaccines* 2021;9(2):160. https://doi.org/10.3390/vaccines9020160

10. Larson HJ, Jarrett C, Ekersberger E, Smith DM, Paterson P. Understanding vaccine hesitancy around vaccines and vaccination from a global perspective: a systematic review of published literature, 2007-2012. *Vaccine* 2014;32(19):2150–9. https://doi.org/10.1016/j.vaccine.2014.05.055

11. Xiao X, Wong JG, Guo A, Burrell MR, Bergquist P, Kohler JE. The French public’s attitudes to a future COVID-19 vaccine: the politicization of a public health issue. *Soc Sci Med* 2020;265:113414. https://doi.org/10.1016/j.socscimed.2020.113414

12. Ward JK, Alleaume C, Peretti-Watel P, Seror V, Cortaredona S, Laouy N, et al. The French public’s attitudes to a future COVID-19 vaccine: the politicization of a public health issue. *Soc Sci Med* 2020;265:113414. https://doi.org/10.1016/j.socscimed.2020.113414

13. Wong MC, Wong EL, Huang J, Cheung AW, Law K, Chong MK, et al. Acceptance of the COVID-19 vaccine based on the health belief model: a population-based survey in Hong Kong. *Vaccine* 2021;39(7):1148–56. https://doi.org/10.1016/j.vaccine.2021.03.055

14. Yan E, Lai DW, Lee YW. Predictors of intention to vaccinate against COVID-19 in the general public in Hong Kong: findings from a population-based. *Cross-Sectional Survey*. *Vaccines* 2021;9(7):696.

15. Nam V, Jang SY, Poon WK, Law HKW, Lee SW. A reality check on the use of face masks during the COVID-19 outbreak in Hong Kong. *J Clinical Medicine*. 2020;22:100356. https://doi.org/10.1016/j.jclinme.2020.100356.

16. Park KM, Ho LKK, Wong NW, Chiu A. Fighting COVID-19 in Hong Kong: the effects of community and social mobilization. *World Development*. 2020;134:105055.

17. Van E, Lai DW, Lee YW. Predictors of intention to vaccinate against COVID-19 in the general public in Hong Kong: findings from a population-based. *Cross-Sectional Survey*. *Vaccines* 2021;9(7):696.

18. Marlow I, Tam F. Unused shots piled up as mistrust mars Hong Kong vaccinations. *Prognosis: Bloomberg*. 2021 May 9. Retrieved from https://www.bloomberg.com/news/articles/2021-05-09/unused-shots-pile-up-as-mistrust-blight-hong-kong-vaccine-drive.

19. Lam HY, Lam TS, Wong CH, Lam WH, Leung CME, Au KWA. The epidemiology of COVID-19 cases and the successful containment strategy in Hong Kong. *Am J Infect Control*. 2021;49(8):160. https://doi.org/10.1016/j.ajic.2021.09.029.

20. Wu P, Tsang TK, Jessica Y, Tiffany WY, Ng FH, Gao H, et al. Supressing COVID-19 transmission in Hong Kong: an observational study of the first four months. *J Prevent*. Available from: https://doi.org/10.1210/jsr/3.3-34047/v1; 09 June 2020.

21. Wong MC, Ng RW, Chung KC, Lai CK, Huang J, Chen Z, et al. Stringent containment measures without complete city lockdown to achieve low incidence and mortality across two waves of COVID-19 in Hong Kong. *BMJ Global Health*. 2020;5(10):e003573.

22. Kwock KO, Li CK, Wei WI, Tang A, Wong SYS, Lee SS. Editor’s choice: influenza vaccine uptake, COVID-19 vaccination intention and vaccine hesitancy among nurses: a survey. *Int J Nurs Stud* 2021;114:103854. https://doi.org/10.1016/j.ijnurstu.2020.103854

23. B.H.P. Lau, S.W.H. Yuen, R.P.H. Yue et al. Public Health 207 (2022) 39-45.