

Overcoming Vaccine Hesitancy in Hong Kong: Where to Start?

Since the first vaccine, smallpox vaccine, in history, it is never easy for everyone to accept a new vaccine and get vaccinated. Vaccine hesitancy is described as individuals' intention to delay or refuse vaccination despite the availability of vaccine services (Butler & MacDonald, 2015). This is exactly what Hong Kong is currently facing. Since the official launch of the COVID-19 vaccination program in February 2021, only 21.4% of Hong Kong's population had received both doses of the vaccine as of 30 June 2021. Such a vaccination rate is far lower than its counterparts in other countries (e.g., 46.8% in the United States, 48.9% in the United Kingdom, and 36.1% in Singapore), and it will be a long shot to achieve the globally-recognized threshold for herd immunity.

Key Factors underneath Vaccine Hesitancy

To get a better understanding of this pressing issue in Hong Kong, we first summarized two groups of key factors that may be associated with vaccine hesitancy from a social scientific perspective: socio-psychological factors and communication factors.

Socio-psychological factors include individual-level demographic characteristics, social-economic status, and psychological orientations. For example, when comparing different age groups, scholars in the UK found that older individuals aged 65 and above were more willing to accept the COVID-19 vaccine than younger people aged 30-49 (Paul et. al., 2021), whereas studies in the U.S, U.K, and France suggested that "being young was associated with no or not sure response towards the intake of COVID-19 vaccine" (Aboelsaad et. al., 2021. p17). In terms of gender, the research findings are rather mixed. In Hong Kong, France, the US, and Turkey, men were found to be more likely to accept the COVID-19 vaccine than women (Wang et al., 2020; Gagneux-Brunon, 2020; Freeman, 2021; Kose et.al., 2020)) whereas in France, Germany, Russia, and Sweden, women were more willing to accept the COVID-19 vaccine than men (Lazarus, 2020). At the socio-economic level, low education level, low income, and an absence of full-time jobs were reasons associated with the refusal to get the COVID-19 vaccine in the U.K., U.S. and France (Paul, et.al., 2020; Fisher et.al., 2020; Freeman et.al., 2021; Ward et.al., 2020).

In terms of the psychological orientations, trust in the vaccine is a crucial factor. A recent review study suggested the strongest predictor of intentions to accept the COVID-19 vaccine was the degree to which respondents trusted the safety of the vaccine (Aboelsaad, 2021). Some other review studies also identified perceived risks of vaccination, a lack of knowledge and awareness of vaccination, and low confidence in

the health system as the major reasons for refusing the vaccine (Paul et al., 2021; Sallam, 2021).

Communication factors refer to what and how the vaccine-related information is delivered to the general public, which could vastly impact individuals' acceptance of the vaccine. Studies have shown that "transparency in reporting the number of newly diagnosed COVID-19 cases and deaths is mandatory as these factors are the main determinants of COVID-19 vaccine acceptance" (Aboelsaad, 2021; p3). Exposure to misinformation about COVID-19 could also reduce the public's willingness to be vaccinated (Daly, 2020; Roozenbeek 2020). Unfortunately, such misinformation or rumors attract more attention from the public. As found by Hou and colleagues (2021), misinformation or rumors about the COVID-19 vaccine on Twitter facilitated more public engagement, such as discussions and retweets, than other tweets. Moreover, they also found that, among the COVID-19 vaccine-related topics identified from the tweets, the one which attracted the highest engagement by the Twitter users was misinformation, and those with the least audience engagement were related to confidence in vaccine effectiveness and trust in the government.

Vaccine Hesitancy in Hong Kong

Although numerous studies have been done to investigate vaccine hesitancy since 2020 worldwide, we are only able to identify the following relevant surveys in Hong Kong, whose findings are publicly available. Wang et al. (2021) implemented two online surveys among the working population in Hong Kong in February 2020, and August to September 2020. They found that clerical/service/sales workers were less likely to accept the COVID-19 vaccine, and concerns about the vaccine safety was a key reason. Wong et al. (2021) administered a population-based, random telephone survey in August 2020 and found that perceived severity of the pandemic, perceived benefits of the vaccine, self-reported health outcomes, trust in the healthcare system or vaccine manufacturers, and perceived access barriers and harm were all associated with the COVID-19 acceptance. They also found that recommendations from the government versus recommendations from other sources, such as friends, was a stronger factor influencing vaccine acceptance. An online survey conducted by Prof. Christine Huang in the City University of Hong Kong (Liu, 2021) in September 2020 found that young people aged 20-24 had the lowest willingness to get vaccinated. Besides that, gender, educational level, and trust in the government were closely associated with the willingness to take the vaccine. We noted that all the three publicly available reports were conducted before the vaccination program was implemented in Hong Kong (on 22 February 2021).

As reviewed above, the existing research on COVID-19 vaccine hesitancy in the Hong Kong context has provided valuable insights. Yet, more work has to be done in the local context, given that the society has its unique cultural, social, and political environments. To further investigate vaccine hesitancy and more importantly to improve the general public's confidence in the vaccine, scholars need to thoroughly explore how factors at individual, community, and societal levels influence vaccine acceptance. Moreover, communication factors, which have received little attention in the research in the Hong Kong context, are worth further research. For example, it is critical to explore the effects of COVID-19 related news reports, social media posts, and misinformation about the public's willingness to take the vaccine.

Our Research Initiative

The unprecedented COVID-19 pandemic has caused millions of deaths worldwide and the social and economic disruptions caused by the pandemic are devastating. The new COVID-19 variants heighten the threat of sparking another wave of the outbreak. Vaccination is considered as the key to combat the pandemic and to restore social and economic normality. An essential condition to contain the pandemic is to achieve herd immunity within the community. In the case of Hong Kong, it requires at least 70% of the population to be vaccinated. Although considerable resources and effort have been invested to develop an effective vaccine and to make them accessible to Hong Kong people, the vaccination rate remains low. Vaccine hesitancy is a major obstacle to reach herd immunity. Little is known within the Hong Kong community why people refuse to get vaccinated. As more data about COVID-19 releases and the COVID-19 infection and death rates vary from time to time, people's attitudes toward the vaccine may change over time. Tracking these attitudes can help to prioritize vaccine communication efforts and address people's concerns in a timely manner. In this age of information disorder, media and communication actors—government officials, public health institutions, professional groups, and news media—are also playing an important role in offering accurate and update-to-date public health knowledge and seeking effective ways to debunk and clarify vaccine-related misinformation and rumors. Therefore, developing and leveraging evidence-based vaccine communications to fight against COVID-19 through the vaccination program is the city's most pressing overriding goal. To achieve the city's goal, HKBU's Communication-Computer Science interdisciplinary team are playing an important part by providing empirical evidence for the issue of vaccine hesitancy. We will publish weekly reports on research related to vaccine hesitancy.

Proposed Study Areas

1. Vaccine hesitancy indicators and factors influencing vaccine acceptance

During the prevalence of COVID-19, countries with high vaccine hesitancy would have higher rates of infection, hospitalization, and mortality. Factors influencing vaccine hesitancy may include demographic, attitudinal, political, and social attitudes. To study the impact factors of vaccine hesitancy, we need to first identify the representative indices of vaccine hesitancy, which would generally fall into the following three categories: 1. number of daily vaccinations/bookings; 2. the public's attitudes towards the vaccine through surveys; 3. the public's sentiments on vaccination as reflected on social media. For the first type of indices, time-series analyses, such as correlation, granger causality and regression models, can be applied to identify influential factors. One challenge is how to investigate the impacts of discrete events, such as death cases related to the vaccine intake, and incentive policies. Some quantification strategies need to be explored. For the second type of indices, we can perform a set of statistical tests, such as chi-square tests, ANOVA and mix effect models, to identify factors related to survey observations. For the third type of indices, we need to apply some natural language processing methods to understand the changes in the public's sentiments on vaccination. People's vaccine-related discussions on forums and social media will be collected and cleaned. Then sentiment analysis based on both keyword approach and machine learning approach (e.g., topic modelling) will be performed to quantify changes in people's attitudes. Afterwards, we can perform similar time-series analyses as mentioned for the first index type. In the end, all detected impact factors can be aggregated together for causal network construction. Methods, such as Bayesian network, will be useful at this stage.

2. Information related to vaccine hesitancy on news media and social media

To fight against vaccine hesitancy, we will observe misinformation about vaccine which is propagated widely on social media. We could utilize fake news detection system to help debunk related misinformation. For instance, traditional approaches either used supervised machine learning algorithms that incorporate a wide variety of features manually crafted from post content, user profiles, and diffusion patterns of the posts, or exploited rules or regular expressions to discover unusual patterns from microblog posts or tweets. More recently, to alleviate the heavy manual effort in these methods, models without feature engineering were proposed and had achieved promising results for the task, for example, purely data-driven models using deep neural networks such as recurrent neural networks, recursive neural networks, convolutional neural networks, etc.

On the other hand, we will study the opinions expressed by individuals or social media users. To this end, we intend to utilize and explore an opinion mining system to automatically detect users' attitudes towards vaccination or an aspect of the vaccine. More specifically, several supervised models were developed for the task based on

feature engineering approach. Some systems dealt with rumor stance classification by considering both temporal and textual signals via continuous time sequence classification using Hawkes processes. Another line of work mainly focuses on using deep learning models, such as recurrent or convolutional neural networks for stance feature learning and classification. It will be straightforward to transfer the algorithms or core ideas on the task of vaccination opinion mining.

3. Public communicators' discourse on vaccination

One line of research—the government-citizen interaction as well as public health communication—believes that vaccine hesitancy can be mitigated if the public sectors and institutions as well as the news media actively debunk the rumors and clarify the myths related to vaccination. Hence, the project will also look at the public communicators' discourse on vaccination.

The substantive research questions are: To what extent are the vaccine-related issues articulated and clarified by the public sectors (such as governmental institutions and public health institutions) in Hong Kong? To what extent has the news media in Hong Kong been featuring vaccine-related rumor-clarification messages and events? To what extent the above-mentioned vaccine-related clarification messages are changing over the time and correlated to other real-world indicators (precisely, the local and global severity of the pandemic)?

By analyzing the rumours or misinformation that have been rated as false or debunked by the public or professional sectors, the results from the current investigation aims to capture the types, sources, major themes of the rumors and misinformation, and offers constructive solutions for the current rumor-clarification and debunking strategies; and further improve the quality, accuracy, and transparency of the information in the public sphere.

4. Vaccine promotion and related policies:

Vaccine promotion is essentially a persuasive attempt. Understanding what makes the persuasive attempt success and failure is the key to creating and leveraging effective vaccine communications as well as formulating vaccination program policies. To examine the factors that potentially influence the potency of vaccine communications and policies, we will employ an experiment embedded in a representative survey.

Methods

Surveys

Telephone survey: Data will be collected by a random telephone survey, including both landline and mobile phone numbers roughly in the ratio of 1:1. The survey will be conducted by real interviewers working under close supervision during July to August 2021.

The survey will comprise 3,000 successful interviews on a rolling basis (appx. 500 per week), with Cantonese-speaking local citizens of age 18 or above. The interviews will take place from 2pm to 10:30pm on weekdays but may be extended to cover other periods to chase for the appointment cases.

The questionnaire shall comprise opinion questions, including vaccine acceptance, vaccination willingness and behavior, health literacy, social capital, civic participation, plus some basic demographic variables.

Online survey: 1,000 Hong Kong adults will be recruited via a Qualtrics online panel. They will answer questions about their own beliefs and concerns over getting the COVID-19 vaccine. As well, the questionnaire will ask them to report their media consumption habits and their interpersonal communication about vaccination. If they have kids aged 12 to 15, the questionnaire will also ask their intentions to get their kids vaccinated.

Experiments

Online experiment: 1,000 Hong Kong adults will be recruited via a Qualtrics online panel. They will be randomly assigned into 6 experimental conditions.

Each participant will be shown one news article. The tentative experimental design is as follows:

	Vaccine involved		
	Comirnaty (Pfizer- BioNTech)	CoronaVac (SinoVac)	Control
Illness cases	1	2	3
Death cases	4	5	6

To be more specific, the news article will either focus on people feeling ill after getting a Pfizer-BioNTech/SinoVac vaccine or people dying after getting the vaccine or no mention of either feeling ill or dying after getting the vaccine. The news article will be displayed in the form of a Facebook post.

Survey experiment We will employ an experiment embedded in a representative survey. Based on the findings from computational analysis, we will create two vignettes that are structurally identical but vary in terms of vaccination policy and presentation. The two vignettes will be randomly assigned to participants who are selected by probabilistic sampling. Each participant will read one vignette.

After reading the vignette, the participants will evaluate the potency of the vaccination policy and their behavioral intention of vaccination. This experimental approach allows to valid the causal relationships between variables identified in the computational analysis, and enables to generalize the findings to the general population based on probabilistic sampling. The findings will shed light on the effectiveness of the vaccination policy and the potency of the presentation of the policy.

Text Mining and Content Analytics

A mixed-methods approach will be used to analyze the collected media data. It involves content analysis (to document the types, sources, modality, and the contexts of the misinformation), discourse analysis (on the frames and tones of the rumor-related messages), and (automatic) text mining (to sort out the major themes and keywords of the focal messages).

Data will largely rely on (1) the government's public data (such as press releases and the government gazette); (2) news media's reports from the local news media, and (3) the related debunkers' social media channels. The project team will track all the major local media outlets and collect related discourse on rumor-clarification messages, as well as the government's official press releases related to any clarification messages on the vaccine.

Topics of Forthcoming Reports

1. Communicating vaccination and medical science

- The role of public intermediaries in the dissemination of vaccine-related news and information

- How citizens digest and understand scientific and experts' messages regarding vaccination
- News framing about vaccination across different platforms in Hong Kong
- Network structure and vaccine-related coordination behavior on social media in Hong Kong
- Rumor detection and verification of COVID-19 and vaccine-related news on social media
- Measuring the impact of misinformation on vaccination intent in Hong Kong
- How vaccine related rumors are debunked and clarified by the public sectors and news media (*Report No.2*)

2. Health and social behavior

- Factors related to the willingness of parents to have their children vaccinated (*Report No.4*)
- Factors related to vaccination choices and preferred timing of vaccination (*Report No.1*)
- Social capital, information processing and vaccination in the era of social media
- Public perceptions about the medium-term and long-term effects of vaccines and vaccination
- Acceptance and risk perception of the COVID-19 vaccine

3. Public health intervention and practices

- The barriers, facilitators, and policy packages of vaccination in Hong Kong (*Report No.3*)
- Social pressure and individuals' willingness to get vaccinated
- Developing and evaluating evidence-based communication tactics to alleviate vaccination hesitancy
- Incentives and barriers of vaccinating vulnerable population
- Why citizens would or would not rally/campaign others to get vaccinated
- Ethical issues (e.g., whether people should be forced to get vaccinated, by either the government or employers)

Implications on Vaccination Policy

To improve population adoption of COVID-19 vaccination, it is imperative to implement multilevel, evidence-based efforts from social, behavioural, communication, and implementation science to overcome vaccine hesitancy. Implementation of such evidence-based strategies at the *policy, community, organizational, interpersonal*, and

individual levels is the crucial last leg of the arduous race to increase vaccine uptake (Rutten, 2021).

1. Policy-level interventions

Vaccine interventions are effective in increasing vaccine uptake (Community Preventive Services Task Force, 2021). Some examples are to reduce the costs for patients to take the vaccine, to make vaccination mandatory for school attendance, etc.

2. Interpersonal communication via clinicians

Reiter et al., (2020) found that people are likely to accept the COVID-19 vaccine if vaccination is recommended by their doctors. Hence, good communication between the government and clinicians is very important. The government should build stronger ties with local clinicians and in turn promote vaccination through local clinician networks. Besides building ties, the government can also support the work of local doctors by removing barriers to vaccination, such as increase of nurse visits, the establishment of reminder systems, as well as point-of-care prompts (Hopkins, 2001; Community Preventive Services Task Force, 2021).

In addition, to support local clinicians to offer strong recommendations to their patients, the government should provide adequate training for them, such as supplying them with evidence supporting COVID-19 vaccination (Rutten, 2021).

3. Misinformation and trust

Misinformation is a dangerous cause of the vaccine hesitancy issue (Carrieri et al., 2019). According to a recent finding, hesitancy around the COVID-19 vaccine appears to be rooted in anxiety fuelled by misinformation, and there is a need to ensure the public to receive responsive information, which is “sensitively framed and non-judgmental” at the same time (Lockyer et al., 2021). In fact, it has shown that Hong Kong citizens who have not been vaccinated are in fear (Tsang, 2021). Hence, it is necessary to counter the effects of misinformation on vaccine hesitancy by generating local-targeted responses. According to the authors, a systematic monitoring of the circulation of (mis)information on social media might be helpful.

Also, the Associated Press-University of Chicago National Opinion Research Center (2020) found that misinformation created by anti-vaccine efforts usually aims to induce fear among citizens, and that instructing the citizenry about misinformation tactics used by these campaigns is recommended. As a result, citizens are capable of making informed decisions about COVID-19 vaccination.

Besides, efforts should be made to build trust in governments, local and national, scientists and health professionals (Udow-Phillips & Lantz, 2020; Verger & Dubé, 2020). In order to develop successful vaccination programs, it is suggested that healthcare professionals and community workers provide an updated list or a summary of locally circulating misinformation to the public such that citizens' concerns can be addressed.

Lastly, to further harness the connections among citizens and related stakeholders, trusted community networks should be built to reassure the spread of accurate vaccine-related information.

4.Context-based solutions

Since localized vaccine campaigns are beneficial to counter misinformation (Lockyer et al., 2020), our research team will aim to further examine how the above interventions can be applied to the situation in Hong Kong.

Vaccine hesitancy is the biggest challenge to achieve herd immunity to COVID-19. Our research team will focus on the local context and shed new light on the factors that influence vaccinations. By developing knowledge and expertise in communication planning, execution and evaluation of the vaccination program, we hope our work can help restore trust and end the devastating pandemic.

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