The *Overcoming Vaccine Hesitancy in Hong Kong* Project
by Hong Kong Baptist University
Report Series No. 14
27-August-2021

香港浸會大學
HONG KONG BAPTIST UNIVERSITY

Analyses of Public Stance towards COVID-19 Vaccination in Hong Kong on Online Social Platforms

Background and motivation

According to the statistics given by the HKSAR government,[1] as of 14 August 2021, 42.3% of Hong Kong's population had been fully vaccinated, which to some extent reflects the public's vaccine hesitancy in society. To alleviate this situation, it is necessary for the policy makers to understand the public stance on vaccination and make relevant decisions and policies to overcome people's hesitancy.

The main existing approaches to collect public stance are conducting surveys and polls. However, these traditional methods may be subject to several obvious limitations, such as high cost, being outdated, and unsustainability. Nowadays, social platforms have constituted a major component of individuals' social interaction [1]. On these platforms, people explore information and express their opinions on various topics, including the emerging ones related to COVID-19. Therefore, we are provided with an opportunity to use social platforms to learn the public stance towards COVID-19 vaccination.

Initiated by the "Overcoming Vaccine Hesitancy in Hong Kong" project at Hong Kong Baptist University, we studied the public stance towards COVID-19 vaccination in online social media messages with an aim to understand vaccine hesitancy in Hong Kong. To this end, we first

[1] Vaccination dashboard given by the HKSAR Government. https://www.covidvaccine.gov.hk/en/dashboard

collected and annotated data from several major social platforms in Hong Kong. Based on the pre-processed data, we further analysed the public stance from several perspectives. Our methods and results are as follows.

Data collection and annotation

1. Data collection

In order to study the public stance towards COVID-19 vaccination, we collected streaming data of comments through a database engine powered by HKBU and Datago company on three major social platforms in Hong Kong, namely HKDiscuss[2], HKGolden[3], and BabyKingdom[4], where people can share and exchange comments on information from various news media, e.g., HK01, Weibo, China Business News, Oriental Daily News, and Wen Wei Po. It is noteworthy that among all social platforms widely used in Hong Kong, these are the top three from where we acquired the largest number of COVID-19 vaccination-related comments. Using the keywords listed in Table 1, we first filtered out those comments of interest, posted since 23 December 2020 (i.e., the day when Carrie Lam, the Chief Executive of Hong Kong, announced for the first time that the Hong Kong government had purchased 22.5 million doses of COVID-19 vaccines and promulgated relevant regulations). Afterwards, a manual selection was conducted to remove the unrelated comments. After random sampling, the resulting dataset consisted of 10,722 comments.

[2] HKDiscuss. https://www.discuss.com.hk

[3] HKGolden. https://forum.hkgolden.com

[4] BabyKingdom. https://www.baby-kingdom.com

Table 1: Keywords used for comment retrieval

COVID-19 vaccination related keywords	疫苗, 免疫, 科興, 復必泰, 北京生物, 武漢生物, 輝瑞, 莫德納, 克爾來福, 復星, 阿斯利康, 滅活, MRNA, 蛋白, 谷針, 一針, 1 針, 兩針, 2 針, 接種, 打針, 不良反應, 副作用, VAXX, VACCIN, IMMUNIZATION, IMMUNE, INOCULATION, IMMUNE, IMMUNOSUPPRESSED, MODERNA, PFIZER, SINOVAC, CORONAVAC,COMIRNATY, BIONTECH, ASTRAZENECA

2. Data annotation

In this study, we categorised the stance of comments into four classes as defined in Table 2, which are *promotional*, *discouraging*, *querying*, and *commenting*, similar to [2,3]. Texts that do not belong to any of these categories are regarded as *unknown*. We assigned the comments collected to a few annotators in a way such that each comment was annotated by at least two annotators independently. We used the kappa coefficient as a measurement of the reliability of their annotations [4]. In this work, the mean kappa coefficient is 0.683, which indicates that the annotation results achieve a reliability that allow tentative conclusions to be drawn. Therefore, we obtained the Cantonese COVID-19 Vaccine Stance Dataset (CCVS-Dataset) for subsequent analyses. Several statistics of CCVS-Dataset are summarised in Table **3**.

Table 2: Definitions of Stance Categories

Promotional	**Discouraging**
• Describe public health benefits or safety of vaccination. • Describe risks of not getting vaccinated. • Encourage vaccination. • Refute the argument against vaccines. • Contain both promotional and discouraging information, but express support subjectively.	• Describe invalidity or safety risks of vaccination. • Discourage vaccination. • Question the effectiveness/safety of vaccines. • Contain negative attitude/arguments against vaccination.

	• Contain both promotional and discouraging information, but express opposition subjectively.
Querying	**Commenting**
• Contain indecision and uncertainty about the risks or benefits of vaccination. • Contain questions about effectiveness/safety or possibility of side-effects.	• Contain no elements of uncertainty, and no promotional and discouraging content, but its post does somehow relate to the vaccine. • Include factual recommendations about whether one should get vaccinated under different circumstances.

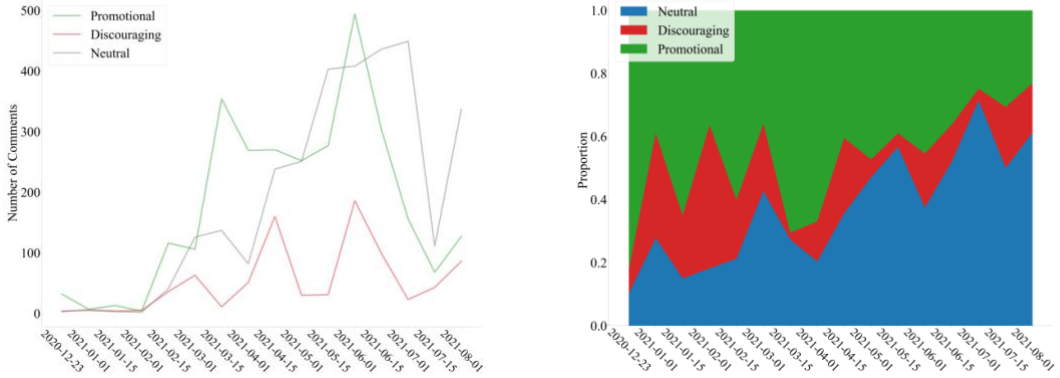
Table 3: Overview of the CCVS-Dataset

Platforms	Promotional	Discouraging	Querying	Commenting	Unknown	Total
HKDiscuss	2290	185	7	890	1834	5206
HKGolden	423	591	12	1974	1793	4793
Baby Kingdom	182	19	3	164	355	723
Overall	2895	795	19	3028	3982	10722

Exploratory Data Analysis

In this part, we analyse the public stance towards COVID-19 vaccination in Hong Kong based on the dataset collected from online social platforms, from several perspectives.

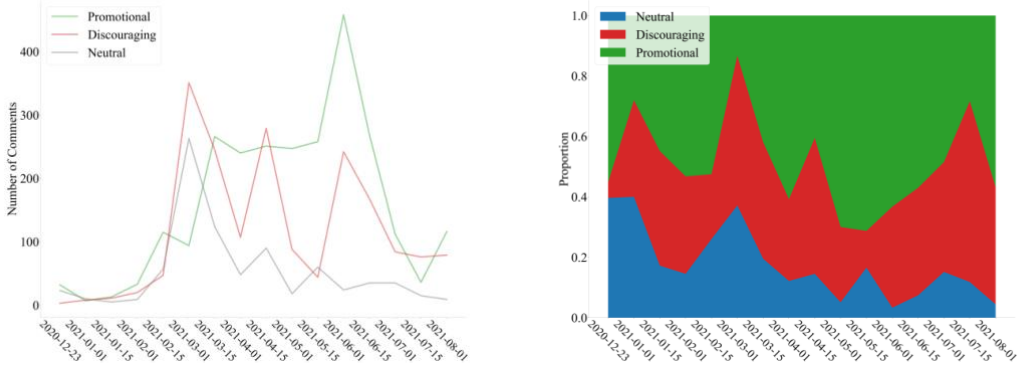
1. Temporal Distribution



(a) (b)

Figure 1: The temporal distribution of overall public stance towards COVID-19 vaccination

The overall public stance towards COVID-19 vaccination over time is summarised in Figure 1, which illustrates the rapid increase in the number of related comments disseminated on online social platforms since February 2021. This trend may be because the official start dates of vaccination of Sinovac and BioNTech were coming up respectively.[5] The overall discouragement rate of the people towards vaccination had been declining, achieving its lowest point (<5%) on 15 March 2021. After an increase during the period from mid-March to mid-April, it stayed at a relatively low level. On the whole, the proportion of comments that clearly discouraged COVID-19 vaccination has remained the lowest one since February 2021.

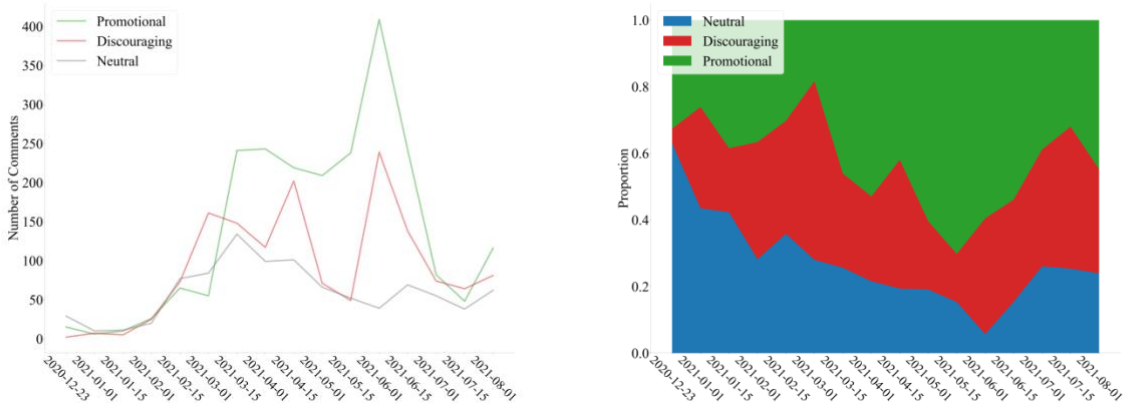


(a) (b)

Figure 2: The temporal distribution of overall public stance towards Sinovac

[5] In this report, we use Sinovac (resp. BioNTech) to denote the vaccines manufactured by Sinovac (resp. BioNTech).

Next, we investigate the public stance towards the Sinovac vaccine in particular. The results are summarised in Figure 2. We can tell from the figure that a large proportion of comments posted between March and mid-April were classified as discouraging Sinovac. The reason behind this might be that as of 7 March 2021, among all the 71 patients recorded by the Government with side effects and complications after COVID-19 vaccination, around 97% of them were vaccinated with Sinovac. The news tally with the phenomenon that the number of comments against Sinovac was about twice the number of the supporting ones in early March. Nonetheless, over time, supporting the vaccination of Sinovac has become the main stance on online social platforms.



(a) (b)

Figure 3: The temporal distribution of overall public stance towards BioNTech

As shown in Figure 3, the promotion rate of BioNTech has gradually increased since March. The number of supportive comments began to dominate the others in mid-March. Notably, there were increases in the proportions of those comments against the vaccination of Sinovac and BioNTech from 1 April to 15 April and from 1 June to 15 June, respectively. We consider that it was caused by the negative news on their side effects. For example, from 5 April to 18 April 2021, the Department of Health received 20 reports of suspected Bell's Palsy with the history of COVID-19 vaccination, among which 12 were vaccinated with Sinovac and 8 with BioNTech.

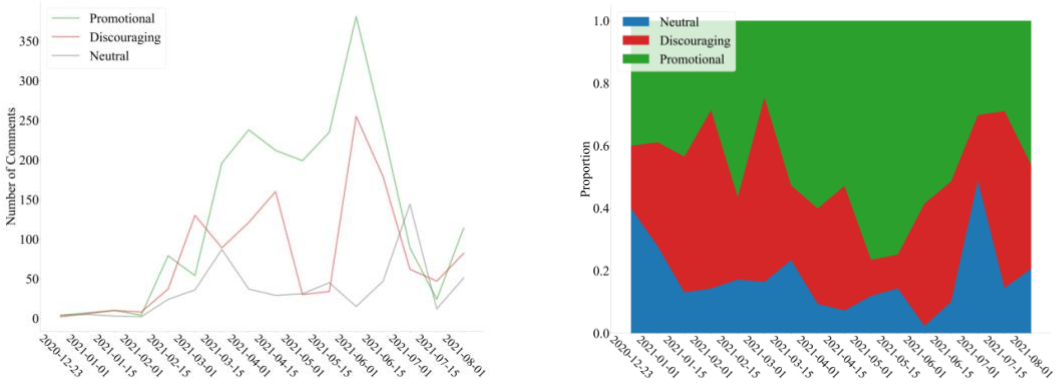


Figure 4: The temporal distribution of overall public stance towards other vaccines

We also analysed the stance towards COVID-19 vaccines of manufacturers other than Sinovac and BioNTech. The results are summarised in Figure 4. The temporal pattern of the stance towards those vaccines is similar to the one of BioNTech.

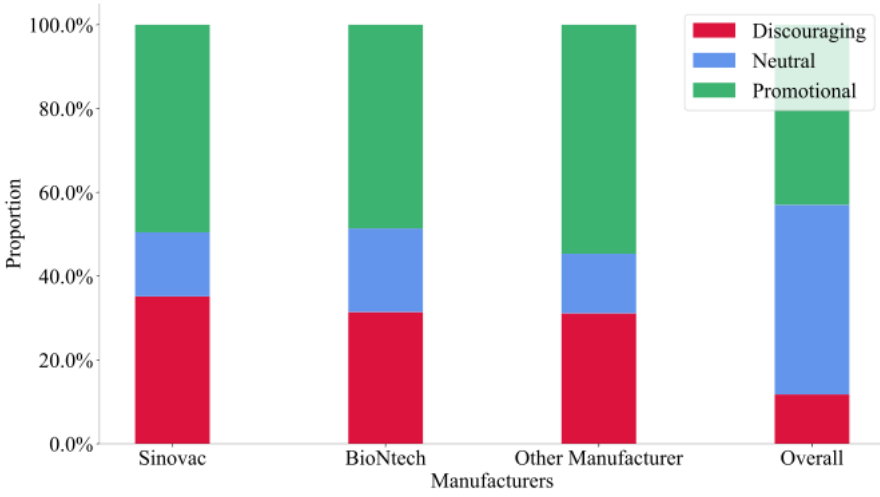


Figure 5: Comparison of the stance distributions of different vaccines

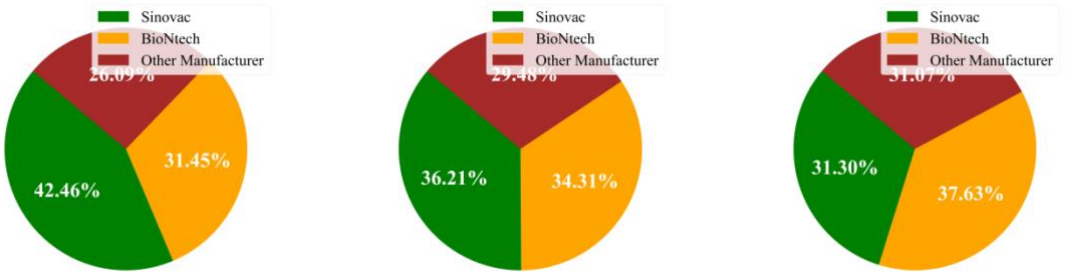
Figure 5 compares the public stance distributions towards different groups of vaccines from which we can draw the following conclusion:

1) The stance towards Sinovac and BioNTech are similar, 45% of which are promotional.
2) The promotion rate of other vaccines is greater than those of Sinovac and BioNTech.

3) Overall, approximately half of the comments promote vaccination and only about 10% expressed clear discouragement.

2. Cross-platform Differences

Kindly note that the three online social platforms that we analysed may correspond to different groups of individuals. Thus, we were interested in the inter-differences of the public stance between them.



(a)HKGolden (b)HKDiscuss (c)BabyKingdom

Figure 6: Comparison of distributions of the comments on different online social platforms

Figure 6 shows the distributions of comments related to different vaccine manufacturers on the three platforms, respectively. The proportion of comments on Sinovac on HKGolden is greater than 42%. As for HKDiscuss, the number of relevant comments related to Sinovac and BioNTech are very similar, each of which is greater than the comments related to other vaccine manufacturers. Different from the above two platforms, comments related to BioNTech has the largest proportion on BabyKingdom, which is around 38%.

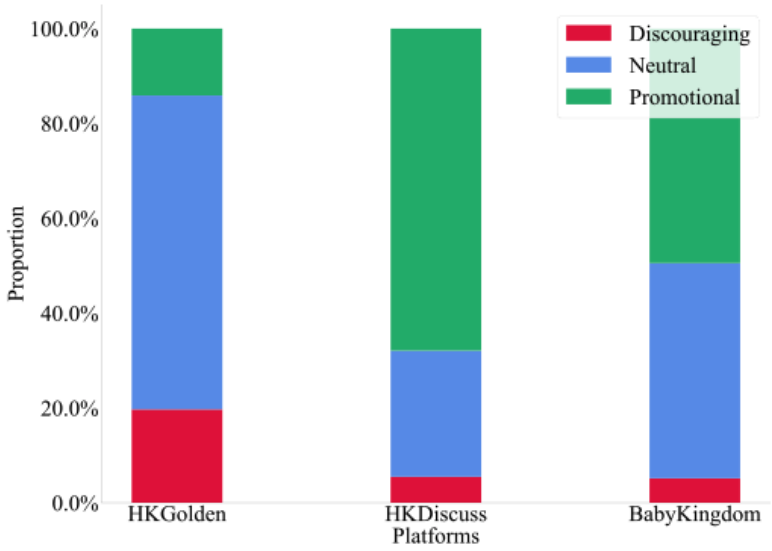


Figure 7: The distribution of public stance towards COVID-19 vaccination on different online social platforms

Figure 7 illustrates the distribution of the overall public stance on different online social platforms. On HKGolden, most of the comments remain neutral on COVID-19 vaccination, while the proportion of those discouraging vaccination is slightly higher than that of the promotional ones. Most of the comments on HKDiscuss and BabyKingdom promote vaccination, and less than 10% of the comments are discouraging vaccination. It is worth noting that, compared with HKDiscuss, BabyKingdom has a larger proportion of comments with a neutral stance. The reason behind this result is likely to be that most of the users on BabyKingdom are parents of infants and children, who could be more cautious about vaccination than others.

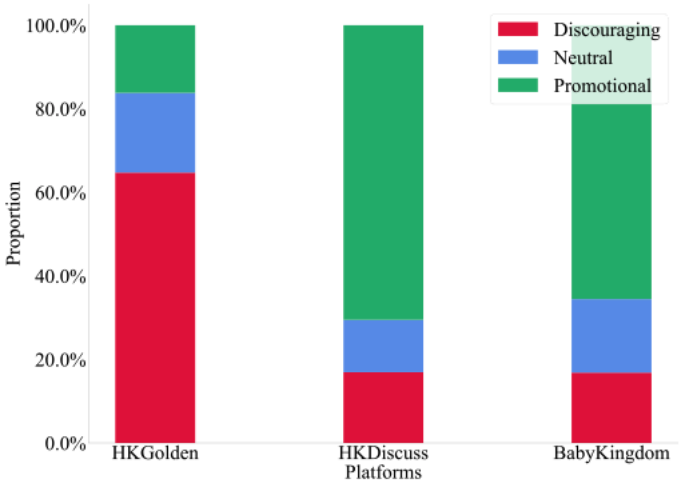


Figure 8: The distribution of public stance towards Sinovac on different online social platforms

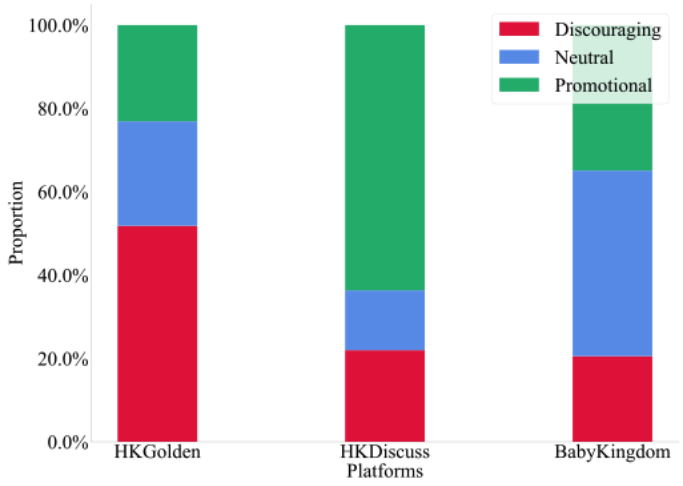


Figure 9: The distribution of public stance towards BioNTech on different online social platforms

The distribution of public stance towards Sinovac and BioNTech on different online social platforms are presented in Figure 8 and Figure 9, respectively. More than half of the comments on HKGolden expressed discouragement to both Sinovac and BioNTech. In sharp contrast, the comments that discourage Sinovac or BioNTech made up only about 20% of the total comments on HKDiscuss and BabyKingdom respectively.

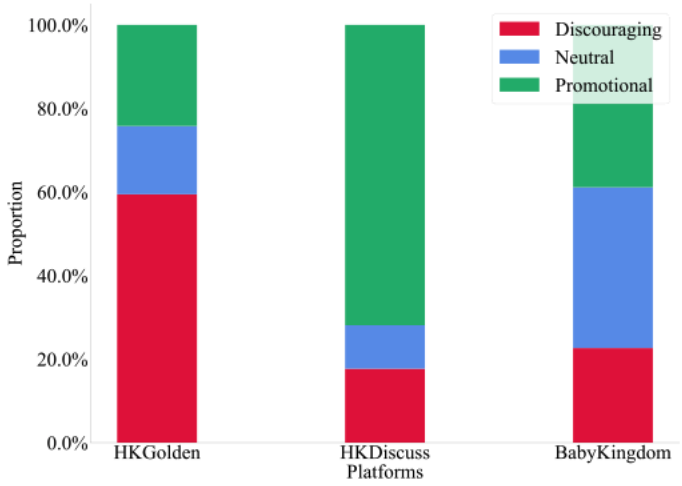
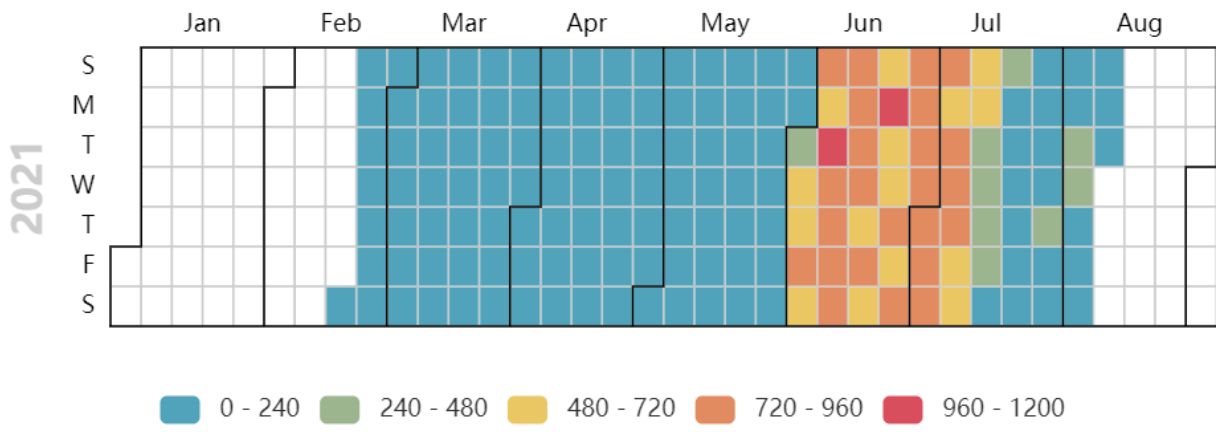


Figure 10: The distribution of public stance towards vaccines other than Sinovac or BioNTech on different online social platforms

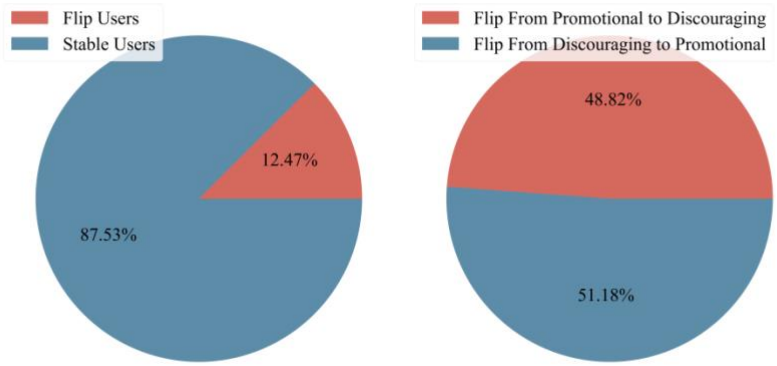
As shown in Figure 10, the distribution of stance towards vaccines by other manufacturers are similar to that of their counterpart, BioNTech on both HKDiscuss and BabyKingdom, while the case is different on HKGolden. Specifically, the comments discouraging vaccines other than Sinovac or BioNTech account for around 60% on HKGolden.

3. Stance Flipping

Interactions on social networks have an impact on individuals' stance [5]. We conducted an analysis of the stance flipping in terms of COVID-19 vaccination. The kind of assessments can provide an understanding of the trend of changes in vaccine hesitancy, which may be beneficial to the policy makers to design strategies to increase vaccine uptake.



(a)



(b) (c)

Figure 11: The statistics of stance flipping in terms of COVID-19 Vaccination

It can be observed from the heat map in Figure 11 that the peak period of stance flipping was between early-June and mid-July. This is probably because the HKSAR government announced that a number of restrictions could be relaxed accordingly with the Vaccine Bubble policy on 21 June, including *restrictions on certain premises and social distancing measures after vaccination*. Specifically, 12.47% of the users have at least one stance flip on the online social platforms. Among them, more people have changed their stance from discouragement to promotion towards COVID-19 vaccination.

4. Stance towards the HKSAR Vaccination Programme

On 26 February 2021, to ensure the public health and gradually resume normal operations during the epidemic prevention period, the HKSAR government published the vaccination programme, which officially granted all Hong Kong citizens free COVID-19 vaccination.

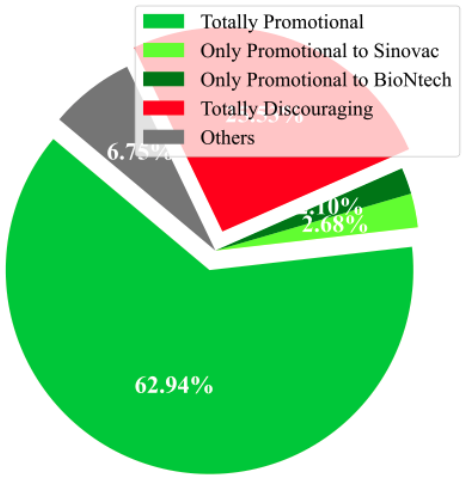


Figure 12: The distribution of public stance towards the HKSAR vaccination programme

We can observe from Figure 12 that around 68% of the population promotes the HKSAR vaccination programme, with 63% of them being fully and 5% being partially promotional, while only about 25% hold a stance that discourages the programme.

5. Word Cloud

Figure 13: Word cloud of comments collected

The word cloud of the comments collected is shown in Figure 13. Words such as “vaccine”, “government”, and “experts” occur frequently. Meanwhile, the public also keeps a high degree of attention to keywords related to the economy, e.g., “economy”, “tourism”, “job”, and “development”, which indicates the public concerns about the economic impact brought by the outbreak of COVID-19. This would provide guidance to inform policy makers to optimise targeted objectives in the post-pandemic period.

Conclusions

Initiated by the “Overcoming Vaccine Hesitancy in Hong Kong” project, we studied the public stance towards COVID-19 vaccination using the data from online social platforms. The aim is to understand vaccine hesitancy in Hong Kong. By analysing the data from several perspectives, we observed that the proportion of comments posted on social platforms which promote COVID-19 vaccination has been growing over time. This may reflect that people gradually learn about the effectiveness of the vaccination. Our study helps the public understand the stance of the online social community towards the overall vaccination as well as specific vaccines. In addition, our investigation can be beneficial to the policy makers to evaluate how the policies had affected the public stance, and, accordingly, to make further arrangements to mobilise resources to increase the vaccine uptake.

References

[1] P. Sobhani, “Stance detection and analysis in social media,” Ph.D. dissertation, University of Ottawa, 2017.

[2] S. Martin, E. Kilich, S. Dada, P. E. Kummervold, C. Denny, P. Paterson, and H. J. Larson, “’vaccines for pregnant women. . . ?! absurd’–mapping maternal vaccination discourse and stance on social media over six months,” Vaccine, vol. 38, no. 42, pp. 6627–6637, 2020.

[3] S. Mohammad, S. Kiritchenko, P. Sobhani, X. Zhu, and C. Cherry, “Semeval-2016 task 6: Detecting stance in tweets,” in Proc. of SemEval, 2016.

[4] J. Carletta, “Assessing agreement on classification tasks: the kappa statistic,” arXiv preprint cmplg/9602004, 1996.

[5] L. H. X. Ng and K. Carley, “Flipping stance: social influence on bot’s and non bot’s covid vaccine stance,” arXiv preprint arXiv:2106.11076, 2021.