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## Short communication

## Adolescents' attitudes to the COVID-19 vaccination

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## ABSTRACT

Vaccines against COVID-19 are now available for adolescents in Hong Kong but vaccine hesitancy is a major barrier to herd immunity. This survey study explores Hong Kong adolescents' attitudes towards the COVID-19 vaccination. 2609 adolescents from across Hong Kong completed an online survey focused on the intent to vaccinate and the reasons for their choice. 39% of adolescents intended to take the COVID-19 vaccination and significant factors for this decision include: having at least one parent vaccinated, knowing somebody diagnosed with COVID-19 and receiving the influenza vaccine. Adolescents' major concerns were either the safety and efficacy of the vaccine or the risk of infection. This study has proved that even in adolescents the vaccine hesitancy model is prominent with adolescents' intentions highly related to confidence in the vaccine and perception of disease risk. Future interventions should target these specific concerns to ensure adolescents are well educated to overcome vaccine hesitancy.

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## 1. Introduction

The COVID-19 pandemic has infected more than 250 million individuals and has led to over 5 million deaths [1], resulting in substantial psychological, social and economic disruption [2–4]. Apart from the vigorous implementation of non-pharmaceutical interventions (NPIs), several COVID-19 vaccines have been approved for emergency use and over 3600 million doses have been administered [1]. The ultimate goal is to achieve herd immunity through the combination of natural infection and vaccination so that NPIs can be gradually relaxed and social norms can be restored. However, 87.5% of the population will have to be vaccinated to achieve herd immunity, especially with the emergence of highly transmissible variants with a basic reproductive number ( $r_0$ ) up to 8 [5–9]. Moreover, vaccination could reduce morbidity and mortality, and protect children from severe complications like multisystem inflammatory syndrome (MIS-C) and long COVID [10–12].

While the UK and the USA have successfully vaccinated the majority of their citizens [13], only slightly above 35% of the Hong Kong population are fully vaccinated [14]. Recent surveys have also

revealed that more than 40% of the respondents would prefer to be vaccinated in the final 10% [15,16]. Vaccine hesitancy remains a significant barrier to achieve herd immunity, which is considered as one of the leading threats to public health [15,17]. Studies have shown that vaccine hesitancy is a global phenomenon influenced by a lack of knowledge and awareness as well as perceived risks and benefits [2,17–21]. Vaccine hesitancy refers to the delay in acceptance or refusal of vaccination despite the availability of vaccination services [15,21,22]. It is influenced by factors classified into three main categories: confidence (lack of trust in the safety and efficacy of a vaccine), complacency (low perception of disease risk) and convenience (access including availability and affordability) [15,21,22].

Studies from across the world have reviewed that parents' willingness to vaccinate their children varies among different jurisdictions, from 28.9% in Turkey, 48.2% in England, 72.7% in mainland China, to over 90% in Italy [2,17,18,23]. Main reasons for hesitancy included lack of perceived risk of COVID-19, concerns for safety and efficacy of the COVID-19 vaccine and a lack of trust particularly for international vaccines [2,17–21]. As far as we know, this is the first study that addresses adolescents' attitudes towards the COVID-19 vaccine, excluding their parental opinions [2,18,20,24]. Therefore, we aimed to explore our local adolescents' attitudes towards the COVID-19 vaccine to identify the factors that could improve vaccine uptake.

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## 2. Method

33 secondary schools, who have participated in our previous vaccination-related studies or have been involved in our education seminars, were invited to take part in this current study [25]. These schools covered 14 out of the 18 districts in Hong Kong, two were international schools. Three schools withdrew during the course of the study due to the initiation of a similar study carried out by the Government.

Those schools that agreed to take part were sent a link to the online questionnaire, which was disseminated to parents, who provided informed consent and in turn, asked their adolescent children (aged 12–18 years) to complete the survey before 31st June 2021. This questionnaire was presented in both English and Chinese depending on the child's preference. The questionnaire contained a series of predominantly yes–no questions or multiple-choice questions and primarily focused on the child's intent to vaccinate and the reasons for their choice. Only those adolescents within the adolescent age range (12–18 years) were included.

Unpaired *t*-test was used to analyse the association between continuous variables and intent to vaccinate whereas Chi-squared test determined the association between categorical variables and intent to vaccinate. Univariate analysis was used to detect any significant association of age, gender, having one or more parent vaccinated, receiving the influenza vaccine last year, knowing someone diagnosed with COVID-19, and having previously completed compulsory COVID-19 tests with intention to receive COVID-19 vaccination. Logistical regression, including all significant variables, with adjusted odds ratio and 95% confidence interval, determined the association between independent variables and intent to vaccinate accounting for all other significant variables. A *p*-value less than 0.05 was treated as significant.

## 3. Results

After excluding 224 participants outside the adolescent age range and a further 82 due to incomplete surveys, 2609 surveys were included from a total of 30 schools. The median age of adolescents was 14 years old and 45% of students were female. 1007 (39%) adolescents stated they planned to take the COVID-19 vaccination when it was available to them (Table 1). The independent significant factors after logistic regression included the following: having at least one parent vaccinated, knowing somebody diagnosed with COVID-19 and receiving the influenza vaccine in the last year (Table 1). Gender, age and being previously quarantined were not significant.

**Table 1**  
Logistic regression for independent factors that associate with intention to receive COVID-19 vaccination.

	Plan to receive vaccination (n = 1007)	Do not plan to receive vaccination (n = 1602)	Chi-square p-value	Logistic p-value	Adjusted OR (95% CI)
Mean age (SD)	14.46 (1.7)	14.49 (1.6)	0.696*	–	–
Gender			0.849	–	–
Female	450 (38%)	722 (62%)			
Male	557 (33.7%)	880 (61%)			
One or more parent is vaccinated against COVID-19	750 (74.5%)	572 (35.7%)	<0.001	<0.001	5.022 (4.211–5.989)
Received the influenza vaccine in the last year	339 (33.7%)	341 (21.3%)	<0.001	<0.001	1.642 (1.355–1.988)
Know someone diagnosed with COVID-19	40 (4.0%)	25 (1.6%)	<0.001	0.009	2.098 (1.202–3.663)
Previously completed compulsory COVID-19 test	172 (17.1%)	213 (13.3%)	0.008	0.243	1.153 (0.907–1.466)

\*Unpaired *t*-test

OR: Odds Ratio

CI: Confidence interval

Adolescent's major concerns either surrounded the safety and efficacy of the vaccine or the risk of themselves or their family being infected (Table 2).

## 4. Discussion

To the best of our knowledge, our study is the first study that demonstrates that the attitudes of adolescents towards the COVID-19 vaccination is significantly associated with the following three factors: having one or more parent vaccinated with the COVID-19 vaccine, having received the influenza vaccine in the last year, and knowing someone diagnosed with COVID-19.

Parental consent is required for adolescents to be vaccinated in Hong Kong. We believe this study provides an understanding of adolescents' attitudes and the associating factors for their vaccination behaviours. This research may inform the government in choosing effective ways to promote the vaccination and educating the general population about the benefits of being vaccinated.

We found that 39% of adolescents plan to take the COVID-19 vaccine. The significant confounding factors affecting these decisions can broadly be split into two groups related to the vaccine hesitancy model, either confidence in the vaccine or life experience predominantly affecting complacency and the perception of disease risk.

It is clear to see that confidence in the vaccine was highly correlated with the decision to be vaccinated. Adolescents intending to be vaccinated are more likely to have parents who have already been vaccinated and a large proportion of them have previously been vaccinated against influenza (Table 1). This suggests that both themselves and their family are comfortable with vaccinations in general, we predict that their trust in vaccinations is higher and they would be more likely to get vaccinated against other infectious diseases if necessary [26]. The opposite is true of those that do not intend to be vaccinated as they suggest safety and efficacy as their main concerns (Table 2).

The perception of the risk of COVID-19 is the overarching theme surrounding the reasons for intending to get vaccinated, with most students suggesting their concerns surrounding themselves or their family members being infected with COVID-19 was a reason for intending to be vaccinated. Confounding factors shown to be associated with intent to vaccinate include experiences that also likely alter complacency and the perception of disease risk [26]. Knowing someone diagnosed with COVID-19 was significantly associated with intent to vaccinate (Table 1) we suspect that this is due to this experience increasing the perceived risk of COVID-19 and therefore the reducing hesitancy in vaccination. Although

**Table 2**  
Reasons underlying intention to receive COVID-19 vaccination.

	No. (%)
Do not intend to be vaccinated	
Concerned about vaccine safety	1264 (79%)
Concerned about vaccine efficacy	839 (52%)
Facemasks and social distancing are sufficient	418 (26%)
Intend to be vaccinated	
Worried to be infected	594 (59%)
To protect family	532 (53%)
To return to the normality before COVID-19	418 (42%)

previously being quarantined and completing compulsory testing were not statistically significant on analysis we predict that this is due to the small population size of these subgroups and suspect that a larger sample size may show a significant association. This is the beginning of the first phase of this study which will now be extended to the parents of primary school children in order to aid the design of interventions including school talks, promotional videos and social media promotions. After the implementation of these interventions, the attitudes and opinions of this population will be evaluated for change.

In conclusion, this study has further proved that even in adolescents the vaccine hesitancy model is prominent with adolescents' intentions highly related to confidence in the vaccine and perception of disease risk. Future interventions should target these specific concerns to ensure adolescents are well educated to overcome vaccine hesitancy.

**Ethical approval and informed consent**

This study has been approved by the Hong Kong University/Hospital Authority Hong Kong West Cluster IRB Committee (IRB No: UW 21-157). Informed consent was collected from all those participating.

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**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.

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