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RESEARCH PAPER

Seasonal influenza vaccine uptake among Chinese in Hong Kong: barriers, enablers and vaccination rates

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ABSTRACT

Background: Low influenza vaccination rates were observed in Asian countries including China. This study investigated the updated seasonal influenza vaccination rates among Chinese in Hong Kong, and the barriers and enablers to vaccination.

Methods: Eight focus groups were conducted among the Chinese general public, followed by a telephone survey between March and April 2018 with 2,452 respondents (response rate 41.4%).

Results: Of the survey respondents, 29.1% had received influenza vaccine in the past 12 months. A majority of them agreed with 'enhancing immunity' (94.4%) and 'feeling safer' (92.3%) as their reasons for vaccination, followed by the belief on 'quicker recovery' if they had influenza (69.5%), and free/subsidized vaccine (53.8%). Among respondents who had not received influenza vaccine, 71.2% 'believed in the strength of their own immunity' and 65.6% perceived 'low-risk of getting influenza'. Less than half were 'worried about side-effects' and 'effectiveness'. The groups aged 65–74 and 75 or above had vaccination rates of 49.1% and 69.9%, respectively, in contrast to 13.9% for the group aged 18–64. A rate of 37.9% for children was reported by the 442 respondents having children.

Conclusions: The high uptake of vaccines among the children and elderly suggests the positive impact of the subsidy and outreach programs. However, young and middle-aged adults tend to believe in the strength of their own immunity and underestimate the infection risk. Public education should emphasize that inactivated vaccines such as influenza vaccines work by means of the viral antigens stimulating the host's immune system toward the major types of seasonal influenza.

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Barriers; Chinese; enablers; seasonal influenza; vaccination rate

Introduction

Influenza is a common cause of morbidity and mortality worldwide. It was estimated that the annual influenza epidemic caused 3–5 million cases of severe illnesses, and resulted in 290,000 to 650,000 respiratory deaths globally in 2017.[1] The estimated incidence rates of seasonal influenza in the US were 8.9% in adults and 9.3% in children (aged below 18).[2] A meta-analysis including 47 influenza seasons from 1970 to 2009 estimated that the overall attack rate of influenza was 7.86% in the unvaccinated general population, and 15.2% in unvaccinated children.[3] A study in China estimated an overall attack rate of 5.5%, while children of 0–4 y old had the highest attack rate of 31.9%.[4] The influenza-associated excess mortality in northern and southern China were 18.0 and 11.3 deaths per 100,000 population respectively.[5] In Hong Kong, there are usually two influenza peaks annually, and the baseline threshold admission rate reported in public hospitals with principal diagnosis of influenza was 0.23 per 10,000 population. During peak seasons, the admission rates increased greatly to 1.5–2 per 10,000 population, and could reach up to a high-intensity level of more than 8 per 10,000 population among children aged 0–5 years old.[6]

While seasonal influenza vaccination has been identified as the most important strategy in preventing influenza,[7] it is yet to be fully utilized and vaccination rates vary greatly across different regions. Among adults aged 18 or above, the coverage of influenza vaccine in the US was 45.3% in 2018/19 (18–49 y: 34.9%; 50–65 y: 47.3% and aged 65 or above: 68.1%),[8] while England had a rate of 48.9% among those aged 6 months to under 65% and 72.6% for those aged 65 or above[9] over the same time period. In Germany, the vaccination rate among adults aged 18 to below 60 was less than 20% and 48.1% among those aged 60 or above in 2013/14.[10] Low vaccination rates were also observed in Asian countries. In Japan, it was estimated that 17% of adults were vaccinated in 2011/12,[11] while the coverage was only 9.0% in urban Mainland China in the same year.[12] Vaccination rates in Hong Kong also remained low despite the government's effort in promoting influenza vaccination. Although persons such as those aged 65 y or above and children aged 6 months to under 6 years were eligible for free and subsidized influenza vaccination through the Government Vaccination Programme (GVP) and Vaccination Subsidy Scheme (VSS) respectively, in the 2015/16 influenza season,[13] the estimated overall influenza vaccination uptake was only 12% in the same year.[14] Vaccination rates

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among children were reported to be higher than the general population in many countries. The coverage reached up to 70% in children aged 1–6 y in Japan in 2010/11,[15] while the US had a rate of 57.9% in 2017/18.[16] The phenomenon was also observed in urban China and Hong Kong. The coverage was 26% on average among children aged 5 or below in China[12] and 21% for children aged 6 months to below 5 y old in Hong Kong.[14]

A number of studies have evaluated the factors affecting public acceptance toward influenza vaccination. Major attitudes against influenza vaccination included public concerns about the safety and effectiveness of the vaccine, which were reported in studies conducted in the US,[17] Australia,[18] and Hong Kong.[19] Worries about the side effects[17,18] and perceived low susceptibility of contracting influenza[19-21] were also found to be reasons for not receiving vaccines. Studies also revealed that perceived high level of effectiveness of the vaccine,[12,19] previous experiences of vaccination[17,19] and recommendations from health-care professionals were associated with the uptake of influenza vaccine across different age groups.[15,17,19]

Seasonal influenza is an important health care issue in crowded cities like Hong Kong. Great challenges to the primary care and hospital services were encountered continually for the recent years during every peak influenza season when the number of patients was huge. Previous studies focused on the intention of vaccination,[22,23] however, the rate of actual uptake could be significantly lower than the intention of vaccination.[24] In addition, some studies were conducted more than 5 y ago and were relatively outdated.[23,25,26] Their findings might not accurately reflect the current situation as the government has further promoted the vaccination and increased financial incentives in recent years, along with a small proportion of institutions which might sponsor staff for vaccination. This study aimed to investigate the updated seasonal influenza vaccination rates among Chinese in Hong Kong after continuous implementation of vaccination subsidy programs in recent years, and the public's barriers and enablers to vaccination. The information collected will be helpful for medical profession and the policymakers to plan for influenza vaccination and public education programs.

Methods

A mixed methods approach was adopted to collect data. Using an exploratory sequential design, we started with an exploratory qualitative phase and followed by a quantitative survey.[27] We conducted focus groups on the general public in Hong Kong. The themes on barriers and enablers to influenza vaccination based on qualitative findings from the focus groups were used to design a questionnaire for a territory-wide survey, which triangulated qualitative findings in a more generalizable approach. The qualitative and quantitative data complemented each other to enrich and enhance the validity of the overall findings.[28] Ethics approval was obtained from the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster (UW 16–1024).

Focus group discussions with the general public

We conducted focus groups to explore the general public's attitudes and behaviors toward seasonal influenza vaccination. We held eight focus groups with each group comprising six to nine Chinese adult participants (aged 18 or over) between July 2017 and January 2018. Recruitment was stopped at the point of data saturation, at which repetitive findings were seen. To reach the general public in Hong Kong, invitation letters with reply slips were sent to 3 social services centers in each of the 18 Administrative Districts (totally 54), with telephone follow-ups. We received positive responses from 8 social centers in 6 Districts with different socioeconomic background covering high to low household income. Participants were then purposively sampled based on age, gender, education, and income to ensure a wide range of demographic variables and experience. Subjects who had significant hearing difficulty, intellectual disability or were not able to communicate in Cantonese (the local dialect) were excluded. Eligible participants who agreed to participate in the discussions were contacted by telephone. Most of the focus groups were conducted in the rooms provided by the social centers. Both daytime and evening sessions were arranged for participants to fit their time schedules. Traveling allowance of HK$100 (US$12.75) was offered to each participant after the discussion.

Each focus group discussion lasted about 1 h. Employing the form of a semi-structured interview in a group format, we asked open-ended questions ('what', 'how' and 'why') to explore participants' attitudes and behaviors toward seasonal influenza vaccination, reasons for receiving vaccine or not doing so. The two facilitators were researchers with over 10 y of experience in qualitative studies on health behaviors, but they were not medical doctors. We aimed to avoid pre-assumption of the attitudes of the participants. The facilitators held a neutral stance and did not judge the views of the participants. The interviews, conducted in Cantonese and audio-recorded, were then transcribed verbatim. The accuracy of the transcripts was checked against the audio recordings.

Instead of starting from a fixed analytical framework, we adopted a grounded theory method which was an inductive approach to derive patterns, themes, and common categories based on the views and experiences shared by the participants.[29] Using the content analysis approach described by Hsieh and Shannon,[30] coding categories were inductively derived from the text data. The data were coded independently by two investigators of the research team who were experienced in qualitative research. The coding consistency between the two sets was checked and the majority of the codes were consistent. Inconsistencies were resolved by discussion to reach an agreement for a common theme.

Territory-wide cross-sectional survey on the general public

A cross-sectional household telephone survey was conducted among the general public to investigate their attitudes and behaviors toward seasonal influenza vaccination.

Questionnaire

A questionnaire was developed based on the themes identified from focus group discussions, with reference to the literature review and comments from the research team. The questionnaire included questions about enablers and barriers in receiving the influenza vaccine, vaccination rate, demographic information, health condition, and lifestyle. The questionnaire was pilot tested for its content validity with 31 general public respondents from telephone survey. The internal consistency of the sections with opinion items on attitudes was assessed by the Cronbach's alpha coefficient. The Cronbach alpha based on the pilot sample was 0.645 which was reasonably good based on a pilot sample of size 31. Some modifications of the questionnaire were made based on the feedback, including enhancement of the clarity of several items about preventive behaviors. It ended up with a Cronbach alpha of 0.754 based on the final dataset with a large sample.

Recruitment of participants and data collection procedures

The telephone survey was done by the Social Sciences Research Center, the University of Hong Kong between 4:00 pm and 10:30 pm on weekdays in March and April 2018, using the computer-assisted telephone interview system. It was the period right after the winter peak influenza season. A total of 28 interviewers were involved in the survey. All interviewers were trained on the questionnaire and completed a standardized practice interview before making phone calls to minimize interviewers' effect in affecting responses. The target population was Cantonese-speaking residents in Hong Kong aged 18 or over. When contact was successfully established with a target household, it was first screened for persons aged 18 or over within the household. Out of the adults present, one target respondent was then selected using the 'next birthday' rule (with a birthday coming soonest), excluding those with communication difficulties. A maximum of three attempts were made for each unanswered line.

Statistical analysis

The quantitative data were analyzed using SPSS (Version 24). We used frequencies and percentages to summarize the responses to the question items. Pearson chi-squared test or Wilcoxon rank-sum test was carried out to compare the demographic characteristics between respondents with influenza vaccination in the past 12 months and those without. Multivariable logistic regression analysis was conducted with the outcome (dependent) variable being influenza vaccination status in the past 12 months (Yes/No), while the independent variables included age, education, household income, health-care setting, self-perceived health condition, frequency of physical activity and amount of rest. In addition, Pearson correlation analysis was performed to test for the association of age with education and income, whereas Pearson chi-squared test was performed to test for the association between age and responses to reasons for vaccination. A p-value <0.05 was considered statistically significant.

Results

Participants recruited

Focus groups

There were a total of 54 participants in the 8 focus groups (6–9 participants per group). There were 19 males and 35 females. Their ages ranged from 18 to 91. Among them, 24.1%, 35.2%, and 37.0% had received the highest level of tertiary, secondary, and primary education, respectively, while 3.7% had received no education. Details of their demographics are shown in Table 1.

Questionnaire survey

Of the 6108 successful calls made to households, there were 178 calls with language problems (not able to speak Cantonese) and 6 not qualified, e.g.,, mentally unable/incompetent; these were excluded from our analysis. Of the remaining 5924 calls, 230 refused to be interviewed, 175 did not complete the interview, and 3067 responded as unavailable for the survey in all three attempts of calling, leaving 2452

Table 1. Demographics of focus group participants.

	n	(%)
Total number of focus groups:	8	
Total number of participants:	54	
Age		
18–29	10	(18.5)
30–39	9	(16.7)
40–49	4	(7.4)
50–59	8	(14.8)
60–69	14	(25.9)
70–79	6	(11.1)
80–89	2	(3.7)
90–99	1	(1.9)
Gender		
Male	19	(35.2)
Female	35	(64.8)
Education		
None	2	(3.7)
Primary	20	(37.0)
Secondary	19	(35.2)
Tertiary	13	(24.1)

Table 2. Demographic information of the survey respondents.

	n	(%)
Gender		
Male	838	(34.2)
Female	1614	(65.8)
Age		
18–49	822	(33.7)
50–64	765	(31.4)
65–74	493	(20.2)
≥75	360	(14.8)
Education		
Primary or below	525	(21.5)
Secondary	1073	(44.0)
Tertiary	839	(34.4)
Income		
Low	686	(32.5)
Middle	819	(38.8)
High	607	(28.7)
Primary health-care setting		
Private	1822	(76.8)
Public	551	(23.2)

Missing responses were excluded in analysis

completed interviews (response rate 41.4%) for analysis. Our sample consisted of 838 (34.2%) males and 1614 (65.8%) females. Their demographic information is shown in Table 2. Compared to the age distribution of the Hong Kong population reported in the 2016 By-Census, our sample had a similar household income distribution, but with a larger group aged 65 or over, and had fewer people with no schooling or kindergarten education level.

Views of focus group participants

Views and experiences regarding influenza vaccination were asked among the participants. The influencing factors are classified here as enablers or barriers to compliance.

Enablers

Subsidized vaccination program in schools and clinics. Subsidized vaccination programs were available in schools and in clinics. The low cost together with the recommendation from health-care staff encouraged participants who were eligible for the program (e.g., elderly) to get vaccinated.

5_P2: Influenza vaccination was [virtually] compulsory for students in my secondary school. It should either be sixty or twenty dollars per shot. (young man)

1_P3: When I received my medication at a public clinic, the staff asked me if I had received a vaccination or not. He told me that I could get vaccinated immediately if I wanted to and it was free of charge. (elderly woman)

Recommendation from health-care professionals. Health-care professionals assured participants about vaccine safety and effectiveness. They also reminded participants that free influenza vaccines were available when patients visited public clinics.

8_P2: During my follow-up consultation, the doctor encouraged me to receive an influenza vaccination. Therefore, I got vaccinated.

[Facilitator: As an elderly, you do not have to pay for the vaccine, right?]

8_P2: Yes, it is free.

[Facilitator: If your doctor had not reminded you, would you have got vaccinated?]

8_P2: During my visit, some nurses would ask me … or staff at the cashier would ask if I wanted to get vaccinated. I would thus get vaccinated every year. (elderly man)

4_P1: Since I was sick easily last year, one of my relatives, who is a healthcare worker, encouraged me to get vaccinated. He told me not to be afraid as the vaccine could offer some sort of protection. Therefore, I went to have it. (elderly woman)

Family encouragement. Several participants had no thoughts of getting vaccinated at first, but they soon received a vaccination as they were being urged by their family members.

5_P4: I did not make the initiative to get vaccinated – my family encouraged me to do so. (young man)

Perceived effectiveness of vaccination. With the perception that the vaccination was effective in preventing influenza and reducing the severity of its symptoms, parents were willing to have their children vaccinated.

6_P2: My daughter has a relatively weak immune system and she suffered from mild influenza occasionally. However, after getting vaccinated, she neither suffered from influenza nor fever. (middle aged woman)

6_P1: Many parents claimed that the severity of their children's influenza symptoms reduced after vaccination. (middle aged woman)

Perception of having a weak immune system. Participants who felt they had a weak immune system tended to receive vaccination on a routine basis.

6_P2: One may consider getting vaccinated if he has a weaker immunity. For instance, my husband gets vaccinated every year as he has a weak immune system. (middle aged woman)

Barriers

Perceived limited benefits of vaccination. Vaccination was perceived to bring limited benefits by some participants, as they complained that they suffered from influenza despite being vaccinated.

1_P2: I received the vaccination many years ago, but I still suffered from influenza afterwards … I do not feel positive about this vaccine, I do not like it. (elderly woman)

5_P3: I caught influenza and felt sick soon after vaccination. Perhaps I was already infected when I received the vaccination. The vaccine seemed to be ineffective in preventing influenza. (young man)

A participant also questioned the effectiveness of the vaccine as he doubted that the influenza strains targeted in the vaccine did not match with the strains that became prevalent during the particular influenza season.

3_P4: These vaccines can only protect us from certain types of viruses. If the actual type of virus is different from the ones targeted by the vaccine, I would not be immune to it, am I right? (middle aged man)

Side effects of vaccination. Worries about the side effects of vaccination were common among participants. Participants who had drug allergies or had heard of negative experiences associated with vaccination were less willing to get vaccinated.

1_P1: I do not know why, but she ended up in the hospital after receiving the vaccination. Nothing happened when she received the vaccination a few years ago. However, she developed fever after vaccination in the

following two times. It was so serious that she was admitted to the hospital and had to stay there for at least a few days … My friends also had similar experiences. (elderly woman)

1_P4: I would consider getting vaccinated if healthcare professionals advise me to. I am a bit afraid of it as I am allergic to certain medications. (elderly woman)

Beliefs in own immune system. Participants who believed they had a strong immune system discouraged them from receiving vaccination. They were confident that they could be protected from influenza without getting vaccinated.

1_P1: I believe that I have a strong immune system, and it is unnecessary to inject these antibodies into my body. Everyone has antibodies inside their body, so I do not think I have to be vaccinated. (elderly woman)

3_P4: I still remember that I was safe during the time of SARS and I was alright during the recent influenza season. Hence, I do not think I have the need of receiving a vaccination. (elderly woman)

Concerns with price. Some participants not in the age range for subsidized vaccination indicated that price was one of their major concerns. Some of them remained unvaccinated as they thought the vaccination was costly.

6_P2: We would like to get vaccinated, but … it is expensive. They said that the government was involved in vaccine production, but why are the vaccines so expensive? It is alright if you ask a single person to get vaccinated. However, there are usually more than one person in the family. (middle aged woman)

3_P7: I have heard of influenza vaccination, but I didn't pay attention to the details. I think they are too expensive and you have to pay out of your own pocket. (middle aged woman)

Despite the high cost, a participant claimed that she would be willing to pay for it if the vaccine was truly effective.

[Facilitator: Does it mean that price is also an important factor for consideration?]

6_P3: Maybe. (middle aged woman)

6_P5: Probably, but if it is really useful, I would still spend several hundred dollars on it. (young woman)

Family's vaccination habits. Participants' families without routine vaccination habits did not see the need of vaccination. Therefore, these participants had not received any influenza vaccination.

7_P3: I think whether one gets vaccinated depends on his/her family practice. For instance, my parents and siblings are not vaccinated. We rarely consider getting vaccinated when we talk about influenza. It is actually quite common for people to get an influenza vaccine, as I see a lot of students being vaccinated at the clinic after school. However, I do not have the habit of getting vaccinated, and I am not sure if it is because of my family practice. (young woman)

Survey results

Of the 2452 respondents, 713 (29.1%) had received influenza vaccine in the past 12 months, 1737 (70.8%) had not done so, and 2 (0.1%) were unsure about this. Vaccination rates varied between different age groups. Only 13.9% of respondents aged 18–64 were vaccinated, while 49.1% aged 65–74 were vaccinated. The highest vaccination rate was found in those aged 75 or above, among them 69.9% were vaccinated. The 713 respondents were asked whether they agreed with the given list of reasons for vaccination uptake (Table 3). The majority of them agreed with 'enhancing immunity' (94.4%) and 'feeling safer' (92.3%) after vaccination as their reasons, followed by the belief on 'quicker recovery if they had influenza' (69.5%) and 'free/subsidized vaccine' (53.8%). Only 35.0% regarded 'recommendation by their doctor' as the reason.

On the other hand, the 1737 respondents who had not received influenza vaccine in the past 12 months were asked if they agreed with a given list of reasons for not taking vaccines (Table 3). Among them, 71.2% agreed that they 'wanted to rely on their own immunity' and 65.6% perceived 'low-risk of getting influenza'. Besides, 45.2% were 'worried about side-effects of the vaccine'; 38.3% 'suspected its effectiveness' and 31.7% were 'unaware of the information related to the influenza vaccination'. Around a quarter (25.2%) of respondents had not received a vaccine as they had 'no time', while one-fifth of them (20.8%) were 'unwilling to pay' for it.

Association of vaccination with demographic characteristics, health condition, and lifestyle

Significant differences were shown for the variables age, education, household income, health-care setting, self-perceived health condition, frequency of physical activity and amount of rest by Pearson χ^2 test/Wilcoxon rank-sum test (Table 4). Respondents who had received influenza vaccine in the past

Table 3. Reasons for receiving or NOT receiving influenza vaccine.

	Yes[a]		No	
	n	(%)	n	(%)
Reasons for receiving influenza vaccine (N = 713)				
Felt safer after vaccination	663	(94.4)	39	(5.6)
Being vaccinated would enhance immunity against influenza	638	(92.3)	53	(7.7)
Being vaccinated would speed up influenza recovery	423	(69.5)	186	(30.5)
Vaccine was free or subsidized	383	(53.8)	329	(46.2)
Recommended by doctors	249	(35.0)	463	(65.0)
Reasons for NOT receiving influenza vaccine (N = 1737)				
Wanted to rely on one's own immunity	1219	(71.2)	494	(28.8)
Perceived low risk of getting influenza	1096	(65.6)	575	(34.4)
Worried about the side-effects	766	(45.2)	929	(54.8)
Suspected the effectiveness of the vaccine	642	(38.3)	1036	(61.7)
Unware of information related to influenza vaccination	548	(31.7)	1178	(68.3)
Had no time for vaccination	436	(25.2)	1295	(74.8)
Unwilling to pay for the vaccine	357	(20.8)	1360	(79.2)

Missing responses were excluded in analysis

[a]Items are ordered in this table by % of 'Yes' responses.

Table 4. Association of demographic characteristics, health condition, and lifestyle with vaccination.

	Received influenza vaccine in the past 12 months				Pearson χ^2 test/ Wilcoxon rank-sum test[a]	Multivariable logistic regression	
	Yes		No				
	n	(%)	n	(%)	p-value	p-value	Adjusted odds ratio (95% CI)[a]
Gender							
Male	245	(29.3)	592	(70.7)	.894	.672	Ref
Female	468	(29.0)	1145	(71.0)			0.948 (0.742, 1.212)
Age							
18–49	114	(13.9)	707	(86.1)	<.001**	<.001**	Ref
50–64	106	(13.9)	659	(86.1)			1.044 (0.745, 1.463)
65–74	242	(49.1)	251	(50.9)			8.226 (5.584, 12.118)
≥75	251	(69.9)	108	(30.1)			19.610 (12.322, 31.209)
Education							
Primary or below	238	(45.4)	286	(54.6)	<.001**	.030*	Ref
Secondary	278	(25.9)	794	(74.1)			1.234 (0.896, 1.701)
Tertiary	193	(23.0)	646	(77.0)			1.687 (1.135, 2.506)
Household income							
Low	309	(45.1)	376	(54.9)	<.001**	.042*	Ref
Middle	151	(18.4)	668	(81.6)			0.852 (0.623, 1.165)
High	130	(21.4)	477	(78.6)			1.271 (0.876, 1.844)
Primary health-care setting							
Private	467	(25.7)	1353	(74.3)	<.001**	.553	Ref
Public	219	(39.7)	332	(60.3)			1.085 (0.829, 1.420)
Perceived health condition							
Very good	112	(23.1)	373	(76.9)	<.001**	<.001*	Ref
Good	218	(25.7)	630	(74.3)			1.542 (1.064, 2.234)
Fair	343	(33.6)	678	(66.4)			2.196 (1.520, 3.171)
Bad	26	(38.2)	42	(61.8)			2.865 (1.351, 6.077)
Very bad	13	(50.0)	13	(50.0)			1.398 (0.472, 4.142)
Perceived dietary habits							
Very good	149	(31.1)	330	(68.9)	.776	.848	Ref
Good	216	(26.8)	589	(73.2)			0.930 (0.647, 1.336)
Fair	334	(30.6)	757	(69.4)			0.880 (0.617, 1.256)
Bad	5	(9.8)	46	(90.2)			0.582 (0.199, 1.704)
Very bad	4	(33.3)	8	(66.7)			1.262 (0.255, 6.255)
Frequency of physical activity							
Often	383	(34.4)	729	(65.6)	<.001**	.107	Ref
Sometimes	188	(25.6)	546	(74.4)			1.109 (0.838, 1.467)
Seldom	121	(24.1)	382	(75.9)			1.041 (0.752, 1.442)
Never	21	(21.2)	78	(78.8)			0.492 (0.261, 0.925)
Perceived amount of rest							
Very adequate	151	(43.3)	198	(56.7)	<.001**	.744	Ref
Adequate	351	(32.8)	718	(67.2)			0.865 (0.622, 1.202)
Fair	153	(22.2)	536	(77.8)			0.838 (0.573, 1.226)
Inadequate	47	(16.8)	232	(83.2)			0.717 (0.441, 1.165)
Very inadequate	11	(18.0)	50	(82.0)			0.740 (0.317, 1.725)

*p < .05; **p < .001. [a]Pearson χ^2 test for the nominal variables gender and health-care setting, and Wilcoxon rank-sum test for the other ordinal variables; some data in the categories were missing due to respondents' refusal to answer or invalid response.

12 months were more likely to be older ($p < .001$), with lower education level ($p < .001$), lower household income ($p < .001$), attended public clinics ($p < .001$), self-perceived to have fair or bad health condition ($p < .001$) but had higher frequency of physical activity ($p < .001$) and more rest ($p < .001$). It was noted that the groups aged 65–74 and ≥75 had vaccination

rates of 49.1% and 69.9%, respectively, compared with 13.9% for the groups aged 18–64.

When considering all these factors in a multivariable logistic regression model, age ($p < .001$), education ($p = .030$), household income ($p = .042$) and perceived health condition ($p < .001$) are significant predictors of vaccination. Higher odds of vaccination compared with their reference category were found in groups who were aged 65 or above (adjusted odds ratio (AOR) for group aged 65–74: 8.226, 95%CI: 5.584, 12.118, and AOR for grouped aged ≥75: 19.610; 95%CI 12.322, 31.209) and those perceived bad health condition (AOR: 2.865; 95%CI: 1.351, 6.077). In opposite to the univariate association results, respondents with tertiary education (AOR: 1.687; 95%CI: 1.135, 2.506) and high household income (AOR: 1.271; 95%CI: 0.876, 1.844) showed higher odds of vaccination after adjusting for other factors in the multivariate regression.

It was noted that when considering education level and influenza vaccination status only, tertiary-educated respondents had the lowest vaccination rate (23.0%). However, the multivariable logistic regression indicated that the tertiary-educated group had the highest odds of influenza vaccination. We found strong association between age and education level (Pearson correlation coefficient −0.504, $p < .001$). It suggested that the high vaccination rate in the primary education group was masked by the old age of the respondents. There was similar observation for income which had strong association with age (Pearson correlation coefficient −0.520, $p < .001$). When the effect of age was controlled, the tertiary educated and high-income group showed a higher chance of vaccination.

Furthermore, we ran a Pearson chi-squared test to test for the association between age and response to the reason 'vaccine was free or subsidized' for receiving influenza vaccine among the 713 respondents who had answered this question. Significant differences ($p < .001$) between age groups were found. The results showed that 59.1% and 59.6% of respondents aged 65–74 and ≥75, respectively, agreed with this reason, in contrast to only 43.9% and 38.7% of respondents aged 18–49 and 38.7% respectively perceived it.

Vaccination for their children

Of all the respondents, 442 (18.0%) reported that they had children (aged 12 or below) in their family. If they had more than one child, they would answer the question based on the behaviors of their youngest child. Among the 442 parents, 167 (37.9%) reported that their children had received influenza vaccine in the past 12 months, 262 (59.4%) had not done so, and 12 (2.7%) were unsure about this. Their intention for vaccination was also explored. Two hundred and fifty-seven (58.1%) of the respondents wanted their children to receive influenza vaccine for the next peak influenza season, 140 (31.7%) did not want so, and 45 (10.2%) were unsure about this. These 257 respondents were further asked about the most preferred place for their children's vaccination. Excluding 3 unsure responses, 140 (55.8%) preferred the vaccination to be done in school, 89 (35.5%) preferred private clinics, and only 22 (8.8%) preferred public clinics.

Discussion

The overall adult vaccination rate found in our study was 29.1%, but the vaccination rate of those aged 18–64 (13.9%) was similar to the rate of 12% recorded in 2015/16. The age-specific rate for those aged 65 or above (57.9%) in our study was much higher than the corresponding rate of 33% found in 2015/16.[14] The increased rate indicates the success of continuous implementation and development of vaccination subsidy programs in recent years. The Hong Kong government launches two influenza vaccination programs – the Government Vaccination Programme (GVP) and the Vaccination Subsidy Scheme (VSS) – annually to encourage vaccination. In 2015/16, the programs only covered persons aged 65 y or above and children aged 6 months to below 6 y.[13] In 2017/18 influenza season, persons including pregnant women, persons aged 65 y or above, children aged 6 months to under 12 y, persons with intellectual disability and persons receiving Disability Allowance were eligible for free influenza vaccination in the public health-care setting under the GVP.[31] Alternatively, for individuals among these groups who wished to get vaccinated in a private health-care setting, they would receive an HK$190 (US$ 24.3) per dose subsidy under the VSS, covering around 60% of the fee.

Although the overall adult vaccination rate found in Hong Kong was already much higher than in Germany and Japan (below 20%),[10,11] Hong Kong's was still lagging behind some developed regions such as the US, which had a coverage of 45.3%. The variation of vaccination programs and policies implemented in each of the countries might have accounted for the differences in vaccination rates. Regarding vaccination for children, we had a rate of 37.9%, which was higher than the rate of 21% recorded in another local study in 2017/18.[14] Such differences might be due to the different age groups included in the study. Our study included children aged 12 or below, while the other study only included children aged under 5. However, the child vaccination rate in our locality was still relatively low when compared to other developed countries such as the US and Japan, which achieved a coverage of 57.9% among children aged 6 months to 17 y and 64% among children aged 6–13 y, respectively.[15,16]

Similar to findings from the US and Australia, our study found that concerns for safety and effectiveness, as well as worries about the side effects, were the barriers to influenza vaccination.[17,18] However, the most important reason for non-vaccination among Chinese in our study was their desire to rely on own immunity. Our survey found that the vaccination rates remained relatively low among the young and middle-aged adults. Our qualitative findings revealed that non-vaccinated respondents believed they had a good immune system and thus perceived a low susceptibility of influenza. Low-perceived susceptibility had also been identified as one of the barriers to vaccination in a number of qualitative studies including two which involved Chinese pregnant women and elderly.[32,33] Additionally, previous qualitative studies reported low-perceived severity as a barrier to vaccination, as respondents

regarded symptoms of influenza as manageable and tolerable.[32,34] Other than finding influenza manageable, our qualitative findings suggest that previous disease outbreaks might also be linked to the low-perceived severity of seasonal influenza, as participants made reference to the previous SARS outbreak when explaining the reason for relying on their own immunity. Over the past two decades, Hong Kong successfully managed major disease outbreaks such as SARS epidemic in 2003 and H1N1 pandemic in 2009. They felt seasonal influenza was comparatively mild and tolerable in contrast to SARS and H1N1. The public should be educated about the unreliability of one's own immune system toward seasonal influenza which mutates to new subtypes nearly every year. Moreover, their misconceptions about how vaccines worked might have led to the preclusion of vaccination. Influenza vaccines commonly contain inactivated viruses and are used to prevent influenza and its complications. Misunderstanding that the vaccine injected 'additional' antibodies which had already existed in the body and one would not catch any cold or influenza after vaccination made respondents doubt about the usefulness of the vaccine. Holding such beliefs, they deemed influenza vaccination as unnecessary. Future public education should emphasize a basic concept that inactivated vaccines such as influenza vaccines work by means of the viral antigens stimulating the host's immune system toward the major types of seasonal influenza. This can reduce their concern about getting external source of immunity rather than building their own.

The local government has made attempts to improve influenza vaccination rates in children by providing vaccination services to primary school children through its School Outreach Vaccination Pilot Programme, and the vaccine coverage was improved in schools with visiting teams for vaccine administration. In our survey, over half of our respondents (55.8%) preferred their children to be vaccinated at schools. This implies that it would be worthy to further expand the existing School Outreach Vaccination Programme to all kindergartens and primary schools in the territory to further increase the coverage of influenza vaccine in children. Similarly, we found that 57.9% of the elderly group had received vaccine, and such might be related to the vaccination subsidy offered by the government to citizens aged 65 or above during the study period. Although adults aged 50–64 are also at higher risk of medical complications attributable to severe influenza,[35] our survey found that the vaccination rate in adults aged 50–64 and 18–49 was similar. Since October 2018, the government has expanded the target population of its vaccination subsidy, and those aged 50 or above are now eligible to receive subsidized influenza vaccine, and the subsidized amount has increased from HK$190 (US$ 24.3) to HK$210 (US$26.8) per dose.[36] We expect that the vaccination rate of adults aged 50–64 will rise in the near future. We found that half (53.8%) of the respondents who had taken vaccine regarded free/subsidized vaccine as a reason. This implies that vaccination subsidy schemes can motivate around half of the public to take vaccines. The target population for the subsidy schemes should be expanded further to encourage the general public to get vaccinated. This would reduce the impact of influenza to Hong Kong and other urban cites of China during peak influenza seasons.

This study had some limitations. First, the study findings were based on self-reported data from the respondents. Nevertheless, potential recall bias should be minimal as the questions were asking about their attitudes, usual practice or the most recent experiences. The telephone survey was conducted right after the end of the winter peak influenza season. Second, while the household income distribution of our sample was similar to that of the Hong Kong population reported in the 2016 By-Census, our sample had more females, a larger group aged 65 or over, and had fewer people with no schooling or kindergarten education level. Despite this, we have analyzed the vaccination rates by gender, age, education level, and other demographic characteristics.

Conclusion

An overall increased influenza vaccination rate was found among the Chinese in Hong Kong in 2018. However, the rate was still much lower than that in some developed countries like the US. The high uptake of vaccines among the children and the elderly suggests the strong positive impact of the vaccination subsidy and outreach programs, which should be extended to wider age groups. However, young and middle-aged adults tend to underestimate the risk of getting influenza, relying more on own immunity than vaccination. They should be educated about the unreliability of one's own immune system toward seasonal influenza which mutates to new subtypes nearly every year. Besides, the Chinese public have vague knowledge of how vaccines work and some may regard vaccines as injected antibodies. Public education should emphasize the risk of infection without vaccination and explain that inactivated vaccines such as influenza vaccines work by means of the viral antigens stimulating the host's immune system toward the major types of seasonal influenza. This can reduce their concern about getting external source of immunity rather than building their own.

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No potential conflicts of interest were disclosed.

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Authors' contributions

All authors participated in the design of the study. TP Lam, PL Ho, KS Sun, D Wu and KF Lam wrote the protocol. TP Lam and KS Sun coordinated the study. KW Kwok and KS Sun did the qualitative analysis, and KF Lam conducted the statistical analysis. KW Kwok, KS Sun and TP Lam wrote the first draft. All authors participated in the drafting and approval of the final version of the manuscript.

Ethics approval and consent to participate

Ethics approval was obtained from the Institutional Review Board of the University of Hong Kong/Hospital Authority Hong Kong West Cluster (UW 16-1024). Written informed consent was obtained from the focus group participants, and verbal consent from the telephone survey respondents.

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