Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Vaccine 28 (2010) 4632–4637

Contents lists available at ScienceDirect

Vaccine

journal homepage: www.elsevier.com/locate/vaccine

Factors in association with acceptability of A/H1N1 vaccination during the influenza A/H1N1 pandemic phase in the Hong Kong general population

Joseph T.F. Lau[a,b,*], Nelson C.Y. Yeung[a], K.C. Choi[a], Mabel Y.M. Cheng[a], H.Y. Tsui[a], Sian Griffiths[a]

[a] School of Public Health and Primary Care, Faculty of Medicine, The Chinese University of Hong Kong, Hong Kong, SAR, China
[b] Centre for Medical Anthropology and Behavioral Health, Sun Yat-Sen University, Guangzhou, China

ARTICLE INFO

Article history:
Received 2 February 2010
Accepted 23 April 2010
Available online 8 May 2010

Keywords:
Influenza A/H1N1 pandemic
A/H1N1 vaccination
Public acceptability
China

ABSTRACT

A random population-based telephone survey ($n = 301$) was conducted among the Hong Kong general population in July 2009. Past history of seasonal influenza vaccination (OR = 2.59–3.13) was associated with intention to take up A/H1N1 vaccination under three hypothetical scenarios (provided at <HK$100, HK$100–200 and >HK$200). Adjusting background variables, other significant factors were identified by stepwise models: perceived side effects (OR = 0.33), family members' recommendations and friends' acceptability toward the vaccine (OR = 2.80–4.74). In contrast to other studies on seasonal influenza and A/H1N1 vaccination, perceived susceptibility and perceived severity related to influenza A/H1N1 were non-significant. Cultural differences may therefore exist.

1. Introduction

The influenza A/H1N1 pandemic is one of the most widespread pandemics in recent history. As of January 24, 2010, it has caused over 14,711 deaths in 209 countries and territories [1]. There are worries that the virus would mutate and become more virulent [2]. As of January 27, 2010, there are at least 34,174 confirmed influenza A/H1N1 cases reported in Hong Kong, resulting in 242 severe cases and 64 deaths [3,4].

Vaccination is an important means to control the influenza A/H1N1 pandemic. Many governments announced large-scale A/H1N1 vaccination plans [5–8]; most of which provides the vaccine to some prioritized high risk groups such as elderly people, young children and health workers [6,8]. A number of countries including the U.K., Germany, the U.S. and mainland China began rolling out A/H1N1 vaccination programs from October to December 2009 [9–13]. The Hong Kong government purchased 3 million shots of A/H1N1 vaccines for several high risk groups (health care workers, pregnant women, people of age >65 years old and children of 6 months to 6 years old and others with some health conditions) and for 500,000 people in the general population, who would voluntarily pay for the vaccination. The local vaccination plan was launched on December 21, 2009.

The acceptability of the A/H1N1 vaccine is however, uncertain. A recent study reported that over half of the health care workers in Hong Kong were unwilling to take up the vaccine, due to the lack of safety and efficacy data. In that study, factors associated with the willingness included past history of seasonal influenza vaccination and perceived risk of contracting influenza A/H1N1 [14]. Another recent study reported that the prevalence of intention to take up A/H1N1 vaccine in the Hong Kong general population would be price sensitive [15]. The concern for the safety of A/H1N1 vaccines has been expressed by the general public of different countries, including those of the U.S. [16], Australia [17], Greece [18] and Germany [19]. Respectively 22.2% and 67% of the general populations in Greek and Australia intended to take up the vaccine [17,18].

As of January 22, 2010, the Vaccine Adverse Event Reporting System (VAERS) operated by the U.S. Centers for Disease Control and Prevention reported that 8755 adverse events following the A/H1N1 vaccination, with 564 cases of serious health events (like major disability, hospitalization, etc.). Among these 564 serious health events, 61 cases of Guillian-Barre Syndrome (GBS) and 42 deaths were reported [20]. As of January 29, 2010 there were at least 152,454 people in Hong Kong, mostly members of the prioritized groups, having taken up the vaccine [21]. Seventeen of those with A/H1N1 vaccination history reported adverse events [22].

During the 2005/2006 flu season, the prevalence of vaccination against seasonal influenza was around 15% in the Hong Kong general adult population [23]. Factors in association with seasonal influenza vaccination have been widely reported. The Health Belief Model (HBM) postulates that constructs such as perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cue to action and self-efficacy are determinants of health behav-

* Corresponding author at: School of Public Health and Primary Care, Centre for Health Behaviours Research, Faculty of Medicine, The Chinese University of Hong Kong, 5/F., Prince of Wales Hospital, Shatin, NT, Hong Kong.
Tel.: +852 2252 8727; fax: +852 2645 3098.
E-mail address: jlau@cuhk.edu.hk (J.T.F. Lau).

0264-410X/$ – see front matter © 2010 Elsevier Ltd. All rights reserved.
doi:10.1016/j.vaccine.2010.04.076

iors [24–26]; these constructs were significantly associated with seasonal influenza vaccination in the general population [27]. The Theory of Planned Behavior (TPB) specifies that positive and negative attitudes, subjective norms and perceived behavioral control of the health-related behavior are key determinants of behavioral intention and hence the actual health-related behavior [28,29]. Such constructs were also associated with seasonal influenza vaccination [30]. Factors related to emerging respiratory infectious diseases such as avian influenza are important determinants of seasonal influenza vaccination [31]. It is shown that severity of the influenza A/H1N1 pandemic [17,18] and history of seasonal influenza vaccination [32] were associated with acceptance of A/H1N1 vaccine. There are only a few studies investigating factors in association with intention to take up the A/H1N1 vaccination.

This study identified factors in association with behavioral intention for A/H1N1 vaccination before such vaccines become available in Hong Kong, under three hypothetical scenarios – that it is available at <HK$100, between HK$100 and 200 (the market rate for seasonal influenza vaccination) and >HK$200. The actual market price is not yet known. It is hypothesized that past history of seasonal influenza vaccination, TPB-based factors (attitudes, subject norms and perceived control related to A/H1N1 vaccination), some of the HBM factors (perceived severity and perceived susceptibility), knowledge related to the mode of transmission of influenza A/H1N1 would be associated with behavioral intention to take up A/H1N1 vaccination in the Hong Kong general population.

2. Methods

2.1. Sampling and data collection

The target population was Chinese Hong Kong adults of age between 18 and 60 years old. The study was conducted during July 2–8, after the WHO announcement on the pandemic status of influenza A/H1N1 on June 11, 2009 [33] and the reporting of the first local community-infected case on June 10, 2009 [34] and before the reporting of first local death case associated with influenza A/H1N1 on July 27, 2009 [35].

The sampling methods were discussed in detail in the paper reporting prevalence of behavioral intention to take up A/H1N1 vaccination [15]. Telephone surveys were conducted by using a structured questionnaire. Similar study methods were used as in a number of local studies related to SARS [36,37], avian influenza [31,38] and influenza A/H1N1 [39]. Random telephone numbers were selected from up-to-date telephone directories. Over 95% of the households in Hong Kong have a fixed-line telephone installed [40]. Interviews were conducted from 6:30 pm to 10 pm to avoid over-representation of non-working people. The eligible member whose birthday was closest to the survey date was selected from each of the contacted households. Verbal consent was obtained from the respondents and the interview lasted for about 20 min. At least three phone calls were made at different hours and weekdays before a non-contact telephone number was considered invalid. The study was granted ethics approval by the Chinese University of Hong Kong. A total of 378 eligible respondents were identified and 301 completed the interview; the response rate was 79.6% (301/378).

2.2. Measures

2.2.1. Background variables

Participants were asked about socio-demographic characteristics and the past history of seasonal influenza vaccination (ever/never).

2.2.2. Behavioral intention to take up A/H1N1 vaccination-dependent variables

Respondents were asked sequentially about behavioral intentions to take up A/H1N1 vaccination under several hypothetical circumstances: it is to be provided (1) at <HK$100, (2) at HK$100–200 and (3) >HK$200 per shot. Response categories included "*unlikely/unsure*" (certainly not, mostly not or unsure) and "*highly likely*" (mostly and definitely).

2.2.3. Indices on knowledge and unconfirmed beliefs about mode of transmission

The Influenza A/H1N1 Knowledge Index was formed by counting the number of correct item responses for the three knowledge questions about modes of transmission (range = 0–3; see footnote of Table 1). The Unconfirmed Belief Index was formed by counting the number of item response indicating unconfirmed beliefs about A/H1N1 modes of transmission (range = 0–4; see footnotes of Table 1).

2.2.4. Perceptions related to the influenza A/H1N1 pandemic

A Perceived Susceptibility Index was formed by summing up the scores obtained from the three questions asking how likely the participant, his/her family members and the general public would contract A/H1N1 in the next 12 months (range = 3–15, Cronbach's alpha = 0.91). A Perceived Severity Index was formed by counting the number of item responses (range = 0–9) indicating perceived severity of the influenza A/H1N1 pandemic (e.g. *it is likely to have a large-scale local influenza A/H1N1 outbreak in the coming year*), out of the nine questions of concern. The question items were listed in the footnotes of Table 1.

2.2.5. Variables related to A/H1N1 vaccination

Questions about perceptions that were derived from the TPB were asked, including positive and negative attitudes related to A/H1N1 vaccination (e.g., *it is necessary for all Hong Kong people to take up the A/H1N1 vaccine*), subjective norms (e.g., *my family members would recommend me or other family members to take up the A/H1N1 vaccine*) and perceived behavioral control (e.g. *my family member and I would be able to take up the A/H1N1 vaccine if desired*). Items were listed in Table 3.

2.3. Data analysis

The associations between the background factors (socio-demographic factors and history of seasonal influenza vaccination) and the 3 dependent variables on behavioral intention to take up A/H1N1 vaccination (provided at HK$100, HK$100–200, >HK$200 per shot; US$1 = HK$7.8) were firstly investigated by using univariate odds ratios (OR) and stepwise logistic regression modeling. Adjusting for such background variables, stepwise multivariate logistic regression models were fit for independent variables concerning perceptions related to the influenza A/H1N1 pandemic and the A/H1N1 vaccine. Odds ratios and respective 95% confidence intervals (CI) were obtained from the stepwise models. SPSS version 16.0 was used to analyze the data and p values lower than 0.05 were considered to be statistically significant.

3. Results

3.1. Background characteristics

Of all respondents, 54.8% were female; 46.5% were below 40 years old; 37.1% received some post-secondary education and 63.2% were currently married and 20.3% self-reported having ever

Table 1
Indices assessing knowledge, perceived severity, perceived susceptibility with respect to the influenza A/H1N1 pandemic.

	n (%)
Knowledge/perceptions about modes of transmission for A/H1N1	
Influenza A/H1N1 Knowledge Index (number of responses indicating correct knowledge about mode of transmission for influenza A/H1N1)	
≤1	61 (20.3%)
2	87 (28.9%)
3	153 (50.8%)
Unconfirmed Beliefs Index (whether having at least one response to the four items assessing unconfirmed beliefs about mode of influenza A/H1N1 transmission)	
No	123 (40.9%)
Yes	178 (59.1%)
Perceived severity of the A/H1N1 pandemic	
Perceived Severity Index[a] (total number of items that with a *n* response indicating perceived severity of the influenza A/H1N1 pandemic)	
0	88 (29.2%)
1	101 (33.6%)
2	76 (25.2%)
3 or more	36 (12.0%)
Perceived susceptibility of influenza A/H1N1	
Perceived Susceptibility Index[b] (sum of weighted ratings on items indicating respondents' perceived susceptibility of getting influenza A/H1N1)	
<8	234 (77.7%)
≥8	67 (22.3%)

Influenza A/H1N1 Knowledge Index: counting the number of correct item responses for the three knowledge questions about modes of transmission: (1) the disease could be transmitted via droplets (e.g. sneeze); (2) could be transmitted via touching body of infected person; (3) could be transmitted via touching contaminated objects. The range was from 0 to 3. Unconfirmed Beliefs Index: counting the number of item response indicating misconception about A/H1N1 modes of transmission: (1) the disease could be airborne across a long distance (e.g. from one building to another one); (2) transmitted via water sources (e.g. reservoirs); (3) transmitted via insect bites; (4) transmitted via well-cooked pork. It is then dichotomized as being all correct (1) or having at least one unconfirmed belief (0).

[a] Perceived Severity Index: the number of item responses indicating perceived severity of A/H1N1 (ranging from 0 to 9): (1) mortality rate of influenza A/H1N1 is >5% among adults; (2) influenza A/H1N1 would cause severe irreversible body damages for adults; (3) there is not effective drug for the treatment of influenza A/H1N1; (4) the perceived number of death cases of influenza A/H1N1 in Hong Kong is >50 in the coming year; (5) there are quite a lot/many hidden cases of influenza A/H1N1 in the community; (6) it is certainly/most likely/likely that a large-scale local influenza A/H1N1 outbreak would occur in the coming year; (7) the mortality rate of influenza A/H1N1 is much higher than that of seasonal flu; (8) the transmission rate of influenza A/H1N1 is much higher than that of seasonal influenza; and (9) the severity of body damages of H1N1 is much higher than that of seasonal flu.

[b] Perceived Susceptibility Index: the sum of the three item responses: (1) I perceived myself to have a high or very high chance of contracting influenza A/H1N1 in the coming year; (2) I perceived my family members to have a high or very high chance of contracting influenza A/H1N1 in the coming year; and (3) I perceived the general public to have a high or very high chance of contracting influenza A/H1N1 in the coming year. Each item was scored as 1 = very low, 2 = quite low, 3 = neural, 4 = quite high and 5 = very high (ranging from 3 to 15, items' Cronbach's alpha = 0.91).

received seasonal influenza vaccination in the past (data not tabulated).

3.2. Perceptions toward A/H1N1 vaccination basing on the TPB

3.2.1. Behavioral intentions

Respectively 35.9%, 23.9% and 15% of the participants would mostly/certainly take up free A/H1N1 vaccination in the hypothetical scenarios with the price for vaccination being <HK$100, HK$100–200 and >HK$200 (data not tabulated).

3.2.2. Positive and negative attitudes

Of all participants, 39% believed that A/H1N1 vaccination would be effective for prevention against contracting the virus, 16.3% believed that it is necessary for all Hong Kong people to take up A/H1N1 vaccination (48.5% not quite necessary and 31.6% certainly unnecessary). Moreover, 27% of the participants believed that it would be troublesome to take up A/H1N1 vaccination, 30.7% believed that there would be a long waiting time to take up the vaccine and 16.4% believed that A/H1N1 vaccination would have severe or very severe negative side effects (data not tabulated).

3.2.3. Subjective norms

Of all participants, 48.8% perceived that most adults in Hong Kong are willing to take up A/H1N1 vaccination, 24.9% believed that a lot of their friends would take up the vaccine, 31.8% believed that their family members would recommend him/her or other family members to take up the vaccine (data not tabulated).

3.2.4. Perceived control over A/H1N1 vaccination

Of the respondents, 77% believed that they or their family members would be able to take up A/H1N1 vaccination if they desire to do so. Moreover, 19.9% of respondents believed that himself/herself or his/her family members would not be able to take up H1N1 vaccination due to financial difficulty (data not tabulated).

3.3. Knowledge and perceptions related to the influenza A/H1N1 pandemic

The results are summarized in Table 1. About half (50.8%) of all respondents presented the highest score of three for the Influenza A/H1N1 Knowledge Index; 59.1% gave at least one item response corresponding to a misconception about model of transmission for A/H1N1; 12.0% had a Perceived Severity Index score of ≥3 (range from 0 to 9) and 22.3% had a Perceived Susceptibility Index score of ≥8 (range = 3–15).

3.4. Factors in association with behavioral intention toward A/H1N1 vaccination

Past history of seasonal influenza vaccination was significantly associated with behavioral intention to take up H1N1 vaccination and such is true for all the three hypothetical scenarios (OR = 2.59–3.13, $p < 0.01$; Table 2). No other background factors listed in Table 2 were of statistical significance in the multivariate analysis.

Adjusting for all the background variables listed in Table 2, only those variables related to attitudes and subjective norms related to A/H1N1 (both are TPB constructs) were significantly associated with the behavioral intention variables (Table 3). A number of variables were found non-significant in the univariate analyses: perceived severity score, misconceptions about transmission of influenza A/H1N1, troublesome to take up the vaccine, long waiting time and the two variables related to perceived control (see Table 3; $p > 0.05$).

Table 2
Associations between background characteristics and intention to take up A/H1N1 vaccination.

Background characteristics	Would take up A/H1N1 vaccine at <HK$100			Would take up A/H1N1 vaccine at HK$100–200			Would take up A/H1N1 vaccine at >HK$200		
	Row %	OR_U	OR_m (95% CI)	Row %	OR_U	OR_m (95% CI)	Row %	OR_U	OR_m (95% CI)
Gender									
Male	33.8	1	–	26.5	1	–	16.9	1	–
Female	37.6	1.18		21.8	0.78		13.3	0.76	
Age									
<30	47.4	1	NS	31.6	1	–	18.4	1	–
30– 39	28.1	0.43*		23.4	0.66		14.1	0.72	
40–49	31.4	0.51*		19.8	0.53		11.6	0.58	
50–60	36.0	0.63		21.3	0.59		16.0	0.84	
Education level									
Form 3 or below	44.8	1	–	24.1	1	–	12.1	1	–
Form 4 to matriculation	30.8	0.55		19.2	0.75		14.6	1.25	
College or above	37.8	0.75		29.7	1.33		17.1	1.50	
Marital status									
Single/divorced/widowed	35.5	1	–	25.5	1	–	17.3	1	–
Married/cohabited	36.5	1.05		23.3	0.89		13.8	0.76	
Full-time employed									
No	35.0	1	–	21.1	1	–	13.0	1	–
Yes	36.2	1.05		26.0	1.31		16.4	1.31	
Ever had influenza vaccination									
No	30.4	1	1	19.2	1.00	1	12.1	1.00	1
Yes	57.4	3.08***	3.08 (1.73–5.49)***	42.6	3.13***	3.13 (1.72–5.71)***	26.2	2.59**	2.59 (1.30–5.16)**

OR_U: univariate odds ratio obtained using logistic regression; OR_m: odds ratio obtained from stepwise multivariate logistics regression analysis using univariately significant variables as candidate variables; –: not significant in the univariate analysis. NS: not statistically significant in multivariate analysis though significant in the univariate analysis.

* $p < 0.05$.
** $p < 0.01$.
*** $p < 0.001$.

The results of the multivariate stepwise models further showed that perceived side effects (only for the <HK$100 scenario: OR = 0.33, $p < 0.05$), recommendations from family members (for all three scenarios: OR = 4.04–4.74, $p < 0.001$), and having friends taken up the A/H1N1 vaccine (for the <HK$100 and HK$100–200 scenarios: OR = 2.80 and 3.11, $p < 0.01$) were significantly associated with behavioral intention to take up A/H1N1 vaccination under different hypothetical pricing situations (Table 3).

4. Discussion

Behavioral intention is predictive of actual behaviors [41] and it is a construct of the TPB. Despite the fact that variables related to perceived severity, perceived susceptibility of seasonal influenza and knowledge and misconceptions about mode of transmission of H5N1 were significantly associated with seasonal influenza vaccination [31], none of the similar variables used in this study that are related to A/H1N1 were significantly associated with the three behavioral intention variables. Cognitions with respect to influenza A/H1N1 are therefore not going to play a significant role in shaping behavioral intention toward A/H1N1 vaccination – the prevalence of A/H1N1 vaccination is not expected to increase even if the virus becomes more prevalent, severer or if there are changes in the level of knowledge about its mode of transmission. In contrast to our results, two recent studies suggested that perceived severity of the A/H1N1 pandemic was associated with the intention to take up the vaccine [17,18]. Cultural differences therefore exist.

It is seen that logistic problems such as anticipated long waiting time, trouble in taking up the vaccine and two perceived control variables (self-efficacy to take up the vaccine and inability to take up the vaccine due to financial difficulties) were not significantly associated with any of the three intention variables. These variables were however, significant in various seasonal influenza vaccination studies [27]. Our results therefore suggest that factors affecting behavioral intention for A/H1N1 vaccination may be different from those in association with seasonal influenza vaccination. Further research is therefore warranted.

Unlike perceptions related to influenza A/H1N1, perception related to A/H1N1 vaccination matters. Factors derived from the TPB including positive and negative attitudes, subjective norms but not perceived control, were significantly associated with some of the behavioral intention variables. The TPB has been used to explain many health-related behaviors [42–44]. The theory may be used to guide design of programs promoting A/H1N1 vaccination in the general public – forming positive attitudes and remove negative attitudes, building up subjective norms about A/H1N1 vaccination and appealing to experience and recommendations from one's significant others.

Perceived safety is a significant factor in association with intention to take up the A/H1N1 vaccine if vaccination is available at <HK$100 but not when it is available at a higher price. Safety of the vaccine is of concern [17–19]. Free or low-priced goods and health services may sometimes be less valued by the clients. Those who are ready to pay a higher price for the vaccine may value it better. That may have resolved to some degree the issue on safety. It is interesting to find out that some factors in association with intention to take up the A/H1N1 vaccine may depend on the price of the vaccination.

This study has some limitations. There may be some biases due to telephone survey methods. The distributions of the demographic characteristics of the sample are however similar to the local census data: 45.2% of the participants were men (census data 46%), 25.2% were aged less than 30 years (census data 25%), 21.3% aged 30–39 (census data 24%), 28.6% aged 40–49 (census data 27%), and 24.9% aged 50–60 (census data 24%) [45]. Secondly, Hong Kong went through a unique experience with the outbreak of severe acute respiratory syndrome, the results of the current study may not be applicable to the situations in other countries. Some observations about A/H1N1 vaccination may however, be shared among countries. Thirdly, this study could only document the willingness

Table 3
Factors in association with intention to take up A/H1N1 vaccination (adjusting for significant background characteristics).

	Would take up A/H1N1 vaccine at <HK$100				Would take up A/H1N1 vaccine at HK$100–200				Would take up A/H1N1 vaccine at >HK$200			
	Row %	OR_U	OR_A (95% CI)	OR_m (95% CI)	Row %	OR_U	OR_A (95% CI)	OR_m (95% CI)	Row %	OR_U	OR_A (95% CI)	OR_m (95% CI)
Influenza A/H1N1 Knowledge Index												
≤1	–	–	–	–	–	–	–	–	6.6	1	1	NS
2									12.6	2.06	2.24 (0.65–7.69)	
3									19.6	3.48*	3.47 (1.13–10.66)*	
Attitudes related to A/H1N1 vaccine												
The A/H1N1 vaccine is very effective for prevention of influenza A/H1N1												
Disagree/strongly disagree/unsure	29.0	1	1	NS	18.0	1	1	NS	–	–	–	–
Agree/strongly agree	46.2	2.10**	1.82 (1.08–3.06)*		32.5	2.19**	1.87 (1.06–3.30)*					
Perceived side effects of A/H1N1 vaccine												
Completely no/slight/don't know	38.8	1.00	1	1	25.6	1.00	1	–	16.4	1.00	1	–
Quite severe/severe	20.4	0.40*	0.37 (0.17–0.81)*	0.33 (0.13–0.80)*	16.3	0.57	0.52 (0.22–1.21)		8.2	0.45	0.42 (0.14–1.25)	
Necessity for all HK people to be vaccinated												
Completely not necessary/not quite necessary	32.4	1	1	NS	21.2	1	1	NS	12.0	1	1	NS
Quite necessary/highly necessary	49.0	2.01*	2.09 (1.05–4.13)*		34.7	1.98*	1.80 (0.88–3.69)		26.5	2.64*	2.71 (1.23–5.96)*	
Don't know/unsure	54.5	2.51	2.16 (0.53–8.75)		36.4	2.13	1.68 (0.41–6.79)		27.3	2.74	2.07 (0.47–9.11)	
Subjective norms												
Most adults are willing to be vaccinated												
Disagree/strongly disagree/unsure	22.7	1	1	NS	13.6	1	1	NS	9.7	1	1	NS
Agree/strongly agree	49.7	3.35***	3.52 (2.05–6.04)***		34.7	3.36***	3.06 (1.68–5.56)***		20.4	2.38*	2.14 (1.08–4.25)*	
Your family members would recommend you or other family members to be vaccinated												
Disagree/strongly disagree/unsure	22.1	1	1	1	11.8	1	1	1	7.8	1	1	1
Agree/strongly agree	66.3	6.96***	7.19 (3.96–13.04)***	4.51 (2.26–8.97)***	50.5	7.66***	7.03 (3.77–13.10)***	4.04 (1.97–8.27)***	30.5	5.16***	4.82 (2.37–9.80)***	4.74 (2.33–9.65)***
A lot of friends would be vaccinated												
Disagree/strongly disagree/unsure	25.2	1	1	1	13.7	1	1	1	10.2	1	1	NS
Agree/strongly agree	68.0	6.30***	5.47 (2.97–10.07)***	2.80 (1.34–5.83)**	54.7	7.59***	6.41 (3.43–11.99)***	3.11 (1.49–6.49)**	29.3	3.66***	3.00 (1.50–6.03)**	

OR_A: odds ratio adjusted for background variables listed in Table 2; OR_U: univariate odds ratio; OR_m: odds ratio adjusted for background variables listed in Table 2 obtained from stepwise multiple logistic regression analysis using univariately significant variables as candidate variables; –: not significant in univariate analysis; NS: not statistically significant in multivariate analysis but significant in univariate analysis. Variables that were not significant for all the three dependent variables in the univariate analysis were not tabulated. These variables include Unconfirmed Beliefs Index, Perceived Severity Index (see footnote a in Table 1), Perceived Susceptibility Index (see footnote b in Table 1), some attitude variables (it is troublesome to take up A/H1N1 vaccination, need to wait for a long time to be vaccinated), and perceived control variables (respondent and his/her family members would be able to be vaccinated if desired, respondent and his/her family members would not be vaccinated because of financial difficulty).

* $p < 0.05$.

** $p < 0.01$.

*** $p < 0.001$.

of people to accept vaccination against influenza A/H1N1, which may not necessarily reflect their actual behavior. Fourthly, we did not record participants' chronic disease status; those with chronic disease may have different intentions from the rest of the general population.

In summary, this is one of the first few studies investigating factors in association with behavioral intention toward A/H1N1 vaccination in the general population. The identified factors demonstrate significant cultural diversities and differences between seasonal influenza and A/H1N1 vaccinations. To some extent, those factors may also be dependent on the pricing for taking up the vaccine. Promotion programs may take attitudes, norms and perceived control related to A/H1N1 vaccination into account. As this is a new vaccine and major vaccine plans have been implemented in many countries, further research is warranted for different population groups in different countries. Such studies would also expand our understanding on vaccination against influenza-related diseases.

Acknowledgements

The study was supported by the Food and Health Bureau of the Hong Kong SAR Government and the Li Ka Shing Institute of Health Sciences.The authors would like to thank all participants of this study. Thanks are extended to Mr. Tony Yung and Mr. Johnson Lau for their assistance in the preparation of the questionnaire, Ms. Mei Wah Chan, Mr. Mason Lau, and Ms. Cheri Tong for coordination of the telephone survey and all colleagues who served as telephone interviewers of this study.

References

[1] World Health Organization. WHO Pandemic (H1N1) 2009 – update 85; 2010 http://www.who.int/csr/don/2010_01_29/en/index.html [assessed February 1, 2010].
[2] msnbc. Swine flu deaths climb, raising next-wave fears; September 4, 2009 http://www.msnbc.msn.com/id/32690557 [assessed February 1, 2010].
[3] Centre for Health Protection HK. Number of notifications for notifiable infectious diseases in 2009. http://www.chp.gov.hk/en/data/1/10/26/43/375.html [assessed February 1, 2010].
[4] Centre for Health Protection HK. Swine and seasonal flu monitor 2010; January 28, 2010. http://www.chp.gov.hk/files/pdf/ssfm_28_01_10.pdf [assessed February 1, 2010].
[5] Directgov UK. Swine flu – treatment and prevention; 2009. http://www.direct.gov.uk/en/Swineflu/DG_177814 [assessed February 1, 2010].
[6] Department of Health and Aging, Australian Government. Health Emergency – Q&As on pandemic vaccine; 2009. http://www.healthemergency.gov.au/internet/healthemergency/publishing.nsf/Content/pandemic-vaccine-qna [assessed February 1, 2010].
[7] Public Health Agency of Canada. Vaccine for H1N1 flu virus; 2009. http://www.phac-aspc.gc.ca/alert-alerte/h1n1/info_vaccine_vaccin-eng.php [assessed February 1, 2010].
[8] Flu.gov US. Vaccination; 2009. http://pandemicflu.gov/individualfamily/vaccination/index.html#h1n1 [assessed February 1, 2010].
[9] Directgov UK. Swine flu – everything you need to know; 2009 [cited December 30, 2009]; Available from: http://www.direct.gov.uk/en/Swineflu/DG_177831 [assessed February 1, 2010].
[10] Flu.gov US. Vaccination; 2009. http://pandemicflu.gov/index.html [assessed February 1, 2010].
[11] TIME. In Germany, a better vaccine for politicians? October 27, 2009. http://www.time.com/time/health/article/0,8599,1932366,00.html [assessed February 1, 2010].
[12] China Daily. WHO: China's H1N1 vaccine safe, effective; October 27, 2009. http://www.chinadaily.com.cn/china/2009-10/27/content_8856605.htm [assessed February 1, 2010].
[13] Stone R. China first to vaccinate against novel H1N1 virus. Science 2009;325:1482–3.
[14] Chor JSY, Ngai KLK, Goggins WB, Wong MCS, Wong SYS, Lee N, et al. Willingness of Hong Kong healthcare workers to accept pre-pandemic influenza vaccination at different WHO alert levels: two questionnaire surveys. BMJ 2009;339:b3391.
[15] Lau J, Yeung N, Choi K, Cheng M, Tsui H, Griffiths S. Acceptability of A/H1N1 vaccination during pandemic phase of influenza A/H1N1 in Hong Kong: population based cross sectional survey. BMJ 2009;339:b4164.
[16] msnbc. 60 million in U.S. vaccinated against swine flu; December 22, 2009. http://www.msnbc.msn.com/id/34525214/ns/health-cold_and_flu [assessed February 1, 2010].
[17] Eastwood K, Durrheim D, Jones A, Butler M. Acceptance of pandemic (H1N1) 2009 influenza vaccination by the Australian public. MJA 2010;192:33–6.
[18] Sypsa V, Livanios T, Psichogiou M, Malliori M, Tsiodras S, Nikolakopoulos I, et al. Public perceptions in relation to intention to receive pandemic influenza vaccination in a random population sample: evidence from a cross-sectional telephone survey. Euro Surveill 2009;14(49):1–5.
[19] Stafford N. Only 12% of Germans say they will have H1N1 vaccine after row blows up over safety of adjuvants. BMJ 2009;339:b4335.
[20] Centers for Disease Control and Prevention. Summary of 2009 Monovalent H1N1 Influenza Vaccine Data–Vaccine Adverse Event Reporting System (Data through January 22, 2010); 2010. http://vaers.hhs.gov/resources/2010H1N1Summary_Jan28.pdf [assessed February 1, 2010].
[21] Centre for Health Protection HK. Statistics on human swine influenza vaccinations; January 29, 2010. http://www.chp.gov.hk/en/content/116/20058.html [assessed February 1, 2010].
[22] Centre for Health Protection HK. Report of adverse effects with human swine influenza vaccination history; January 29, 2010. http://www.chp.gov.hk/files/pdf/aefi_report_for_chp_web.pdf [assessed February 1, 2010].
[23] Lau J. Influenza vaccination coverage and self-reported reasons for not receiving influenza vaccination among different groups of Hong Kong Community (DH Ref: DH SEB CDD/001/06). Report submitted to the Department of Health, HKSAR; 2006.
[24] Chen J, Fox S, Cantrell C, Stockdale S, Kagawa-Singer M. Health disparities and prevention: racial/ethnic barriers to flu vaccination. J Epidemiol Commun Health 2007;32:5–20.
[25] Glanz K, Rimer B, Lewis F. Health behavior and health education. Jossey-Bass: San Francisco; 2002. p. 45–66.
[26] Rosenstock I. Historical origins of the Health Belief Model. Health Educ Monogr 1974;2:328–35.
[27] Looijmans-van der Akker I, van den Heuvel P, Verheij T, van Delden J, van Essen H. No intentions to comply with influenza and pneumococcal vaccination: behavioral determinants among smokers and non-smoker. Prev Med 2007;45:380–5.
[28] Ajzen I. The theory of planned behavior. Organizational behavior and human decision processes 1991;50:179–211.
[29] Kam J, Matsunaga M, Hecht M, Ndiaye K. Extending the theory of planned behavior to predict alcohol, tobacco, and marijuana use among youth of Mexican heritage. Prev Sci 2009;10:41–53.
[30] Daley M, Crane L, Chandramouli V, Beaty B, Barrow J, Allred N, et al. Influenza among healthy young children: changes in parental attitudes and predictors of immunization during the 2003 to 2004 influenza season. Pediatrics 2006;117(2):268–77.
[31] Lau J, Kim J, Tsui H, Griffiths S. Perceptions related to bird-to-human Avian influenza, influenza vaccination, and use of face mask. Infection 2008;36:434–43.
[32] Maurer J, Harris KM, Parker A, Lurie N. Does receipt of seasonal influenza vaccine predict intention to receive novel H1N1 vaccine: evidence from a nationally representative survey of U.S. adults. Vaccine 2009;27:5732–4.
[33] World Health Organization. World now at the start of 2009 influenza pandemic. Statement to the press by WHO Director-General Dr Margaret Chan; June 11, 2009. http://www.who.int/mediacentre/news/statements/2009/h1n1_pandemic_phase6_20090611/en/index.html [assessed February 1, 2010].
[34] Hong Kong SAR Government. Fight against pandemic, three new cases of human swine influenza; June 10, 2009. http://www.info.gov.hk/gia/general/200906/10/P200906100349.htm [assessed February 1, 2010].
[35] Hong Kong SAR Government. Fatal case of human swine influenza recorded; July 27, 2009. http://www.info.gov.hk/gia/general/200907/27/P200907270272.htm [assessed February 1, 2010].
[36] Lau JT, Yang X, Tsui HY, Kim J. Impacts of SARS on health-seeking behaviors in general population in Hong Kong. Prev Med 2005;41(2):454–62.
[37] Lau JT, Yang X, Tsui HY, Kim J. Monitoring community responses to the SARS epidemic in Hong Kong: from day 10 to day 62. J Epidemiol Commun Health 2003;57:864–70.
[38] Lau JT, Tsui HY, Kim J, Griffiths S. Perceptions about status and modes of H5N1 transmission and associations with immediate behavioral responses in the Hong Kong general population. Prev Med 2006;43:406–10.
[39] Lau J, Griffiths S, Choi K, Tsui H. Widespread public misconception in the early phase of the H1N1 influenza epidemic. J Infect 2009;59:122–7.
[40] Lee S, Tsang A. A population-based study of depression and three kinds of frequent pain conditions and depression in Hong Kong. Pain Med 2009;10:155–63.
[41] Kaltman S, Tracetenberg RE, Taylor K, Green BL. Modeling dimensions of choice in accepting the smallpox vaccine. Am J Health Behav 2006;30:513–24.
[42] de Wit JB, Vet R, Schutten M, van Steenbergen J. Social-cognitive determinants of vaccination behavior against hepatitis B: an assessment among men who have sex with men. Prev Med 2005;40:795–802.
[43] Armitage C, Conner M. Social cognition models and health behavior: a structured review. Psychol Health 2000;15:173–89.
[44] Godin G, Kok G. The theory of planned behavior: a review of its application to health related behaviors. Am J Health Promot 1996;11:87–98.
[45] Census and Statistics Department HK. Hong Kong Statistics: Population by age group and sex; 2009. http://www.censtatd.gov.hk/hong_kong_statistics/statistical_tables/index.jsp?subjectID=1&tableID=002 [assessed February 1, 2010].