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Prevalence and correlates of influenza vaccination among non-institutionalized elderly people: An exploratory cross-sectional survey

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ABSTRACT

Background: Worldwide pandemics of influenza virus caused extensive morbidity and mortality around the world and influenza vaccination is the most effective method for preventing influenza virus infection and its potentially severe complications. A large proportion of the Hong Kong elderly population has not undergone influenza vaccination. An exploration of the correlates will provide significant information to help identify ways of improving vaccination uptake among Chinese elderly people.
Objectives: To explore the prevalence and correlates of influenza vaccination Hong Kong Chinese elderly people aged 65 or above. To investigate any differences in attitudes toward influenza vaccination among Hong Kong elderly people with different levels of cognitive and physical functioning.
Design: An exploratory cross-sectional survey with two objective assessments was employed. Settings: Fifteen elderly centers in Hong Kong Special Administrative Region. Participants: A total of 816 Hong Kong Chinese elderly participants were recruited.
Methods: Face-to-face interviews were adopted to explore the demographic characteristics, perceptions, health status, knowledge, and resources of, and the influence of disease outbreaks on, influenza vaccination. Two objective validated instruments, the Chinese Mini-Mental State Examination (CMMSE) and the Barthel Index-Modified Chinese Version (MCBI) were used to assess the cognitive status and physical functioning of the participants.
Results: Approximately two in three individuals (62.4%) had undergone influenza vaccination. Lower cognitive and physical functioning scores were found among the non-vaccinated participants. Multivariate logistic regression analyzes revealed the significant correlates associated with influenza vaccination to be consideration of vaccination in the subsequent years (aOR = 7.877; $p < 0.001$); consideration of vaccination if all people aged 65 or above were eligible to receive free vaccination (aOR = 3.024; $p = 0.002$); the belief that there is a need to receive influenza vaccination following the Severe Acute Respiratory Syndrome (SARS) and avian influenza (aOR = 2.413; $p = 0.001$); receiving advice from nursing staff of elderly centers (aOR = 7.161; $p < 0.001$); the medical staff of elderly centers (aOR = 3.771; $p < 0.001$) or family members or friends (aOR = 3.023; $p = 0.001$).
Conclusions: The prevalence of elderly Chinese people undergoing influenza vaccination remains suboptimal. The government can promote vaccination by educating the public

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about the advantages, by publicizing locations where vaccinations are available, and having nursing, other medical staff, family and friends encourage elderly people to be vaccinated. A high vaccination coverage rate must be ensured to achieve international goals.

What is already known about the topic?

- A substantial amount of international evidence has found the following factors to be linked with influenza vaccination: perceived good health, perceived efficacy and safety of vaccination, previous experience of vaccination, recommendations by healthcare professionals, the side-effect profile of vaccination and the perceived risk of influenza.

What this paper adds

- A combination of subjective and objective explorative methods was used to examine the correlates of influenza vaccine among non-institutionalized Hong Kong Chinese elderly people aged 65 or above.
- Lower cognitive and physical functioning scores were found among the non-vaccinated participants.
- The correlates found to be associated with influenza vaccination include a consideration of vaccination in consequent years and free vaccination; the impact of the severe acute respiratory syndrome (SARS) and Avian influenza outbreaks; and advice from healthcare professionals in elderly centers and from family members or friends.

1. Introduction

Influenza is a major cause of morbidity and mortality in the industrialized world (Harper et al., 2004) and is the third leading cause of death from infectious disease after AIDS. Most of the deaths that are currently associated with influenza occur among elderly people aged 65 or above (World Health Organization, 2004a). Data from a nationally representative Chinese cohort of 169,871 men and women aged 40 years and older in China show that influenza has an age-standardized mortality rate of 43.9 per 100,000 person-years and is the fourth leading cause of death in the country (He et al., 2005).

Vaccination is the principal means of preventing influenza and reducing the impact of an epidemic (Centers for Disease Control and Prevention, 2005). It is particularly recommended that the elderly people be vaccinated, due to the ability of vaccination to reduce influenza-related morbidity and mortality rates (Egede and Zheng, 2003). Influenza vaccination can also reduce the healthcare costs (Fitzner et al., 2001) and productivity losses associated with the disease (World Health Organization, 2004b). The World Health Organization recommends annual influenza vaccinations on a priority basis for the elderly groups at high risk of serious complications (World Health Organization, 2005).

Improvements in socio-economic conditions, public health services, and medical technology have all helped to increase the life expectancy of people in Hong Kong. However, census data show that the percentage of the population who are aged 65 or above will increase from 11% in 2001 to 24% in 2031, which is a net increase of 1.35 million (Census and Statistics Department, 2001). This increase will result in an enormous expansion of the high-risk elderly group. Since the Severe Acute Respiratory Syndrome (SARS) and Avian influenza outbreaks in 2003–2004, the Hong Kong government has encouraged the elderly people to undergo influenza vaccination. Since 1998, it has provided free influenza immunization to the institutional elderly people, but not to those who are not institutionalized (Department of Health, 2004). Among the former, the vaccination rate is reported to be more than 87% (Department of Health, 2007), whereas among the latter it is only 32.2% (Lau et al., 2006). Among the non-institutionalized population as a whole, it is a mere 2.3% (Hui, 2004). This shows that a large proportion of Hong Kong's population does not undergo influenza vaccination.

2. Literature review

A review of the literature reveals that in the past few decades much attention has been focused on influenza vaccination research among Caucasian groups (Kamal et al., 2003; Nexoe et al., 1999; Rehmet et al., 2002), but there is limited information on vaccination among non-Caucasian groups such as Chinese populations (Hui et al., 2006). An exploration of the factors that are related to influenza vaccination among such populations will help to identify ways to improve the vaccination rate among the Chinese elderly people. Previous studies have found that the important correlates of vaccination in the elderly people include perceived good health (Evans and Watson, 2003), a history of chronic illness (Mok et al., 2006), perceived efficacy of vaccination (Lau et al., 2007), previous experience of vaccination (Mok et al., 2006; Telford and Rogers, 2003), recommendations by healthcare professionals (Evans and Watson, 2003; Zimmerman et al., 2003b), and the side-effect profile of vaccination and perceived susceptibility to influenza (Mok et al., 2006; Telford and Rogers, 2003).

Empirical evidence also indicates that having been a hospital outpatient in the past 12 months is significantly related to a higher vaccination rate among the elderly people (Evans and Watson, 2003). Other studies have found that the influenza vaccination rate increases in inpatient settings (Lawson et al., 2000) and that more frequent contact with the healthcare system is a powerful indicator of being vaccinated (Pena-Rey et al., 2004).

The majority of studies on the attitudes of the elderly people toward influenza vaccination have a qualitative (Telford and Rogers, 2003) or self-reported quantitative design (Damiani et al., 2007). A number of researchers,

however, have proposed the use of a combination of subjective and objective investigations in a single study to elicit more information from different angles and of a different nature. Functional limitations (Zimmerman et al., 2003a) and cognitive impairment (Landi et al., 2005), for example, are associated with a lower likelihood of the intention to seek vaccination. Although there are a few studies of the functional or cognitive status responses to influenza vaccination among Caucasian populations in temperate regions, there is a paucity of such information among Chinese populations. To address these issues, we thus seek to answer the following research questions.

1. What is the prevalence of vaccination among the Hong Kong Chinese elderly people?
2. What are the correlates that affect influenza vaccination among this elderly population?
3. Are there any differences in attitudes toward influenza vaccination among Hong Kong elderly people with different levels of cognitive and physical functioning?

3. Methods

3.1. Design and sample

In line with the well-trodden paths in this particular research area, an exploratory cross-sectional quantitative study design, along with cognitive and functional objective assessments, was adopted to help to identify the correlates of influenza vaccination and to formulate and implement corresponding actions. The inclusion criteria for the sample were: (1) Chinese and aged 65 or above; (2) living in Hong Kong; and (3) able to understand and complete an interview conducted in Chinese. The exclusion criteria were (1) severe mental health problems such as dementia, schizophrenia, depression or anxiety; (2) poor physical health that would affect communication, such as suffering from severe deafness and dysphasia, terminal cancer or severe stroke; and (3) institutionalization. Assuming a true prevalence rate of 21.1%, as has been estimated in a previous Hong Kong study (Mok et al., 2006), about 800 participants were deemed necessary to ensure that the 95% confidence interval for the study estimates had a width of $\pm$2%.

The target population of this study were elderly Chinese people aged 65 or above, and they were recruited from all of the social centers for the elderly people in Hong Kong, including 114 Neighbourhood Elderly Centres (NECs) and 60 Social Centres for the Elderly (S/Es). A list of these centers was retrieved from the Social Welfare Department website. NECs provide community support services at the neighborhood level to enable the elderly people to remain in the community, to enhance their positive contributory role in the community and to involve the public in creating a caring community. They provide a range of comprehensive services to cater for the psycho-social needs of both healthy and mildly frail elderly people, including the provision of health education. S/Es organize indoor and outdoor social and recreational activities for the elderly people in the community, provide information on welfare services, and make referrals to appropriate services and/or organizations. Any elderly person aged 60 or above who lives in the locality can take part in the activities offered by the NECs and S/Es by paying an annual membership fee (Social Welfare Department, 2005).

The two types of social centers serve the entire elderly population in Hong Kong. Therefore, a sample drawn from them is community-based. A total of 174 centers in Hong Kong were contacted by e-mail and telephone, after which they were all mailed an invitation letter explaining the purpose of the study. The non-probability convenience sampling method was adopted because of resource restraints (Burns and Grove, 2003).

3.2. Ethical considerations

Participants were asked to sign a written consent form in Chinese that outlined the purpose, procedures and duration of the study. For those who were illiterate, the interviewers provided a standard verbal explanation, and a thumb print and an "X" were accepted as signatures. Ethical approval that complied with the Declaration of Helsinki was obtained from the Institutional Review Board of the University of Hong Kong, and the confidentiality of the data collected was strictly maintained.

3.3. Measures

A questionnaire based on a literature review (Evans and Watson, 2003; Telford and Rogers, 2003; Zimmerman et al., 2003a) was developed to determine the potential correlates associated with influenza vaccination. This questionnaire focused on seven major areas: (1) personal demographic characteristics that included gender, age, educational level and living condition. (The age categories was used according to the Hong Kong Census and Statistics Department (Census and Statistic Department, 2006) and the reference group of $\geq$85 years was used to compare with other groups due to the physical and cognitive status were significantly different between $\geq$85 years and $<$85.) (2) Self-perceived health status (how respondents perceived their own health. The evidence showed that person who self-perceived very good health status was less likely to receiving influenza vaccination (Steyer et al., 2004). Therefore, the group of "very good" was used the reference group in this study.) (3) History of chronic illness (including asthma, chronic chest diseases, hypertension, chronic heart diseases, diabetes and other diseases). (4) History of hospitalization (whether the respondents had been hospital inpatients or outpatients in the previous 12 months). (5) Advice about influenza vaccination (the sources of information about it). (6) The perception of influenza and efficacy and safety of vaccination, including (i) knowledge of the symptoms of influenza ("Do you know the symptoms of influenza?"), (ii) the chances of getting influenza ("Do you think you can catch influenza easily?"), (iii) the usefulness of vaccination ("Is influenza vaccination useful?"), (iv) the safety of vaccination ("It is safe to be vaccinated?"), (v) recommendation ("Would you recommend elderly people aged 65 or above should be vaccinated against influenza?" and "Would you recommend free vaccination policy for all elderly people?)", (vi)

consideration ("Will you consider vaccination in the following year?"), (vii) issues to be considered before vaccination ("Is it free? Is it safe? Is it effective? Others?"), (viii) free vaccination ("Would you consider vaccination if everyone 65 or above was eligible to receive it free of charge?"), and (ix) change in perception after the outbreaks of SARS and avian flu ("Is there a need for influenza vaccination following the SARS and avian flu outbreaks"? and "Does influenza vaccination effectively reduce the chances of getting SARS or avian flu?"); and (7) vaccination experience ("Have you ever been immunized?","How was the vaccine offered?" and "Do you wish to be offered vaccination in the future?"). The respondents were given dichotomous answers (Yes/No) from which to choose.

After the questionnaire had been administered, objective assessments of the cognitive and functional status of the respondents were undertaken using two common validated instruments: the Chinese Mini-Mental State Examination (CMMSE) (Chiu et al., 1994) and the Barthel Index-Modified Chinese Version (MCBI) (Leung et al., 2007). The duration of these assessments was about 15–30 min for each participant.

The Mini-Mental State Examination (MMSE) is widely used to assess the cognitive mental status of patients (Folstein et al., 1975). As a clinical instrument, it has been used to detect cognitive impairment, to follow the course of an illness and to monitor responses to treatment (Foreman et al., 1996). It has also been used as a research tool to screen for cognitive disorders in epidemiological studies and to follow cognitive change in clinical trials. The MMSE is an 11-question measure that tests five areas of cognitive function – orientation, attention and calculation, immediate and short-term recall, language, and the ability to follow simple verbal and written commands – thus providing a total score that allows quantitative assessment. The maximum total score is 30. The CMMSE, which is the Chinese version of the MMSE (Chiu et al., 1994), has been found to have good reliability and satisfactory discriminate validity as an instrument for detecting cognitive impairment in Hong Kong. Cutoffs of 18/19 and 24/25 have yielded satisfactory sensitivity and specificity according to the DSM III-R criteria (Chiu et al., 1994) and were thus adopted in the current study. Scores of 25–30 out of 30 are considered to be normal, scores of 19–24 indicate mild to moderate impairment, and scores of 18 or less indicate severe impairment (Crum et al., 1993).

The Barthel Index-Modified Version (MBI) is a scale that assesses the activities of daily living (ADL) and includes 10 fundamental items (Shah et al., 1989), including bathing, dressing, grooming, bowel movement control, toilet use, transfer from bed to chair and vice versa, mobility, and walking up/downstairs. It is one of the standard measuring devices for functional disability and has been shown to have satisfactory reliability (Collin et al., 1988) and good validity (Shah and Cooper, 1993). The 10 items that relate to self-care ability, continence and mobility are scored by determining the subject's level of independence (i.e., whether he or she can perform the activity in question independently, with assistance or supervision, or not at all). The scores for each item are then summed up to give a total score that ranges from 0 (complete dependence in ADL) to 100 (complete independence) and represents the subject's functional capacity. Granger et al. (1979) found that 60 is the pivotal score at which clients move from assisted independence to dependence and that 80 is the optimal cutoff score for self-reported dependency (Kay et al., 1997). The overall results of the current study are thus grouped into three dependency categories: (a) $\leq$60, (b) 61–80 and (c) 81–100. The CMBI, which is the Chinese version of the MBI and which has achieved satisfactory structural validity and test–retest reliability (Leung et al., 2007), was used in this study.

3.4. Data collection

All elderly people who attended the social centers within the data collection period from January 2005 to June 2005 were invited to participate in the study on a voluntary basis. Face-to-face interviews were conducted by six interviewers in private rooms in the aforementioned social centers for the elderly people to collect the study data. All of the interviewers were experienced healthcare professionals, including registered occupational therapists, physicians and nurses, and a training session was held for them to ensure that their assessments were consistent. A pilot test of the questionnaire and procedure was conducted with 50 participants from one center to test the response rate and to obtain preliminary data to guide the subsequent modification and improvement of the questionnaire. All of the rater pairs in the pilot study were regarded as having excellent inter-rater consistency (0.89–0.93).

3.5. Data analysis

The SPSS for Windows (version 13.0) program was employed for data analysis, and inter-rater reliability was estimated using kappa statistics at the item level. Cronbach's alpha was used to estimate internal consistency, and both descriptive and frequency data were analyzed. Univariate logistic regression analyses of each factor that potentially affect vaccination were conducted to clarify the associations between obtaining vaccination and the potential variables. The multivariate analysis results were derived using stepwise logistic regression analyses for the variables, which previous univariate analyses have found to give a statistically significant odds ratio (OR). The fit of the multiple logistic regression models was tested to identify any potentially confounding variables. The level of statistical significance was taken as being $p < 0.05$, and the Hosmer–Lemeshow goodness-of-fit (HL-GOF) test was used to fit the model (Hosmer and Lemeshow, 2000).

4. Results

A total of 174 elderly social centers in Hong Kong were invited by e-mail and telephone to join the study. All of these centers were similar in nature with regard to demographics, including membership numbers and the male to female member ratio, and most of them invite

experts to give talks about influenza and/or hold annual vaccination programs for the elderly people. However, 157 of these centers refused to participate, with the primary reasons given including a lack of space to conduct interviews, busyness and a reluctance to disclose the personal information of their members. Fifteen centers thus joined the study.

A total of 1015 eligible elderly people were recruited from these 15 centers over the 6-month period from January 2005 to June 2005, but 199 of them refused to participate. The primary reasons for refusal were busyness, tiredness and a reluctance to disclose personal information. The remaining 816 elderly participants (response rate = 80.4%) completed the questionnaires. The demographic characteristics of the participants and those who refused to take part were not significantly different (χ^2-tests; $p > 0.05$).

4.1. Demographic characteristics

The demographic characteristics of the participants are shown in Table 1. Overall vaccination coverage was 62.4%. Most (more than 80%) of the participants were female, and almost 87% were between the ages of 65 and 84. Most (84.6%) had received no formal education or only a primary level of education. Nearly 30% lived alone, and the rest lived with their families. The majority (75.8%) had one or more chronic illnesses, and more than half (54.8%) had a high level of cognitive status, with CMMSE scores of 25 or above. The majority (92.3%) had higher-level ADL functioning, with CMBI scores greater than 80 (see Table 1).

Table 1
Demographic characteristics of participant ($n = 816$).

Characteristics	% (n)
Vaccination experience (current year)	
Vaccinated	62.4 (509)
Non-vaccinated	37.6 (307)
Gender	
Female	81.0 (661)
Male	19.0 (155)
Age (year)	
65–69	23.7 (193)
70–74	23.4 (191)
75–79	22.4 (183)
80–84	17.4 (142)
85 or above	13.1 (107)
Education level	
None	46.1 (376)
Primary	38.5 (314)
Secondary	13.8 (113)
Tertiary	1.6 (13)
Living condition	
Living alone	29.7 (242)
Living with family members	70.3 (574)
Number of chronic illness	
None	24.2 (197)
One	38.1 (311)
Two	22.4 (183)
Three or more	15.3 (125)
The Chinese version of Mini-Mental State Examination (CMMSE)	
≤18	15.2 (124)
19–24	30.0 (245)
25–30	54.8 (447)
The Chinese version of Modified Barthel Index (CMBI)	
≤60	2.2 (18)
61–80	5.5 (45)
81–100	92.3 (753)

4.2. Details of vaccination experience

Table 2 provides details of the vaccination experience of those participants who had undergone influenza immunization. Most of them had leaned about influenza vaccination from the nursing staff of the elderly centers (73.3%) or from medical staff (21.0%). Most had also received their influenza vaccination from the same centers they attended (69%), followed by government hospitals or clinics (17.9%), with only a tiny proportion receiving it in a private setting or elsewhere. In most instances (89.6%), nurses had provided the vaccination.

4.3. Univariate analysis

Table 3 shows the univariate logistic regression models of the potential variables associated with influenza vaccination. The <85-year-old group was associated with a higher vaccination rate than the ≥85-year-old group (OR = 2.769; $p < 0.001$). Participants with higher CMMSE (OR = 2.108 to 2.424; $p < 0.001$) and CMBI (OR = 3.640; $p = 0.011$) scores were significantly more likely to be associated with vaccination than those with lower CMMSE (≤18) and CMBI (≤60) scores. The poorer the elderly

Table 2
Details of vaccination experience ($n = 509$).

Details of vaccination experience	Vaccinated elderly ($n = 509$) % (n)
Where do you get the information of influenza vaccination?	
Nursing staff of the elderly centers	73.3 (373)
Medical staff of the elderly centers	21.0 (107)
Family members or friends	5.9 (30)
Posters or educational pamphlet in hospital	1.6 (8)
Mass media (television or radio)	8.8 (46)
Others	4.9 (25)
Where do you get vaccinated?	
Government hospital or clinic	17.9 (91)
Private hospital or clinic	9.6 (49)
Elderly centers	69.0 (351)
Home	2.8 (14)
Others	5.5 (28)
Who help you to do the vaccination?	
Nurse	89.6 (456)
Doctor	9.0 (46)
Others	2.4 (12)
Do you feel any discomfort (including fever, painful arm) after the vaccination?	
Yes	9.6 (49)
No	90.4 (460)
Doctors give sufficient information about the side-effect of vaccination before vaccination	
Yes	75.0 (382)
No	25.0 (127)

participants perceived their own health to be, the more likely they were to have undergone vaccination (OR = 2.300; $p < 0.001$).

Participants with fewer chronic illnesses were more likely to have been immunized than those with three or more such illnesses (OR = 0.599; $p = 0.017$). The most striking finding in this regard was that participants with hypertension (OR = 1.488; $p = 0.008$), asthma or chronic obstructive airway disease (COAD) (OR = 3.289; $p = 0.001$) were associated with a higher rate of vaccination. Those who had required a hospital follow-up in the previous 12 months also had a higher immunization rate than those who had not (OR = 1.872; $p < 0.001$). Participants who had received advice from medical staff, family members, friends or others were found to be 4.083–4.559 times more likely to have undergone vaccination (OR = 4.083–4.559; $p < 0.001$). However, those who had been advised by the nursing staff of the elderly centers were found to be 8.493 times more likely to have done so (OR = 8.493; $p < 0.001$).

The elderly participants were found to be more likely to have undergone vaccination if they were familiar with the symptoms of influenza (OR = 1.719; $p < 0.001$), thought that they had a significant chance of contracting it (OR = 1.743; $p = 0.001$), believed vaccination to be useful in preventing it (OR = 2.457; $p < 0.001$) or regarded receiving such vaccination to be safe (OR = 4.604; $p = 0.002$). Participants who recommend that elderly people aged 65 or above should be vaccinated had either sought vaccination or were considering it in the near future (OR = 3.737; $p < 0.001$). Participants were also more likely to have undergone vaccination if they recommend the policy of free vaccination for all those aged 65 or above (OR = 15.656; $p < 0.001$) or for those receiving Comprehensive Social Security Assistance (CSSA) (OR = 2.757; $p < 0.001$), living in an old age home (OAH) (OR = 3.087; $p < 0.001$) or suffering from chronic illness or pulmonary disease (OR = 4.100; $p < 0.001$). A high proportion of the vaccinated subjects said they had been concerned about the safety (OR = 2.339; $p < 0.001$) and effectiveness (OR = 1.738; $p < 0.001$) of the vaccines before they received them. The vaccination rate was lower among those participants who had had to travel for a long distance and for a long time to reach the vaccination venue or lacked specific ideas or expectations about the vaccination process (OR = 0.295; $p < 0.001$).

Participants were more likely to have accepted vaccination if they believed that it was particularly important in the wake of the SARS and avian influenza outbreaks (OR = 6.464; $p < 0.001$) or if they thought it would effectively reduce their chance of contracting these illnesses (OR = 5.798; $p < 0.001$; Table 3).

4.4. Multivariate analysis

Table 4 shows the multivariate analysis results using stepwise logistic regressions for the demographic characteristics, objective assessments, self-perceived health status, chronic illness status, history of hospitalization in the past 12 months, advice about vaccination, and perceptions of influenza illness and vaccine efficacy and safety, all of which have been found to have a statistically significant OR in previous univariate analysis models of influenza vaccination. The correlates of such vaccination in this study include "consideration of influenza vaccination in subsequent years" (aOR = 7.877; $p < 0.001$); "consideration of vaccination if all people aged 65 or above were eligible to receive free vaccination" (aOR = 3.024; $p = 0.002$); "the belief that there is a need to receive influenza vaccination following SARS and avian influenza" (aOR = 2.413; $p = 0.001$); and "receiving advice from 'the nursing staff of elderly centers' (aOR = 7.161; $p < 0.001$), the 'medical staff of elderly centers' (OR = 3.771; $p < 0.001$) or 'family members or friends'" (aOR = 3.023; $p = 0.001$; see Table 4).

Table 3
Univariate logistic regression models of potential variables associated with influenza vaccination ($n = 816$).

Correlates associated with influenza vaccination	Vaccinated ($n = 509$) % (n)	Non-vaccinated ($n = 307$) % (n)	Odds ratio (OR) (95%CI)	p-Value
Demographic characteristics				
Gender: female (vs. male)	82.3 (419)	78.8 (242)	1.250 (0.876–1.785)	0.219
Age: <85 (vs. ≥85)	88.8 (452)	83.7 (257)	1.543 (1.024–2.323)	0.038*
Living condition: living with family members (vs. living alone)	68.2 (347)	73.9 (227)	1.325 (0.966–1.816)	0.081
Education: primary to tertiary (vs. no education)	51.9 (264)	57.3 (176)	1.247 (0.937–1.658)	0.130
Objective assessments				
The Chinese version of Mini-Mental State Examination (CMMSE)				
19–24 (vs. ≤18)	32.4 (165)	26.1 (80)	2.108 (1.410–3.154)	<0.001**
25–30 (vs. ≤18)	56.4 (287)	52.1(160)	2.424 (1.557–3.774)	<0.001**
The Chinese version of Modified Barthel Index (CMBI)				
61–80 (vs. ≤60)	3.3 (17)	9.1 (28)	1.214 (0.384–3.836)	0.741
81–100(vs. ≤60)	95.5 (486)	87.0 (267)	3.640 (1.351–9.808)	0.011*
Self perceived health status				
Good (vs. very good)	26.5 (135)	30.6 (94)	1.632 (1.007–2.646)	0.047*
Fair to poor (vs. very good)	64.8 (330)	53.1 (163)	2.300 (1.472–3.595)	<0.001**
Chronic illness				
Number of chronic illnesses				
Three or above (vs. <3)	17.7 (90)	11.4 (35)	0.599 (0.394–0.911)	0.017*

Table 3 (*Continued*)

Correlates associated with influenza vaccination	Vaccinated (n = 509) % (n)	Non-vaccinated (n = 307) % (n)	Odds ratio (OR) (95%CI)	p-Value
Types of chronic illness				
Diabetes mellitus (yes vs. no)	18.3 (93)	16.6 (51)	1.122 (0.771–1.633)	0.547
Hypertension (yes vs. no)	45.4 (231)	35.8 (110)	1.488 (1.112–1.991)	0.008**
Asthma/chronic obstructive airway disease (COAD) (yes vs. no)	9.0 (46)	2.9 (9)	3.289 (1.587–6.818)	0.001**
Heart disease (yes vs. no)	12.8 (65)	10.1 (31)	1.303 (0.828–2.051)	0.251
Immuno-compromised disease condition (yes vs. no)	0.2 (1)	0.3 (1)	0.602 (0.038–9.665)	0.720
Medication allergy (yes vs. no)	2.9 (15)	5.5 (17)	0.518 (0.255–1.053)	0.065
Dementia (yes vs. no)	0.4 (2)	0.3 (1)	1.207(0.109–13.366)	0.878
Depression (yes vs. no)	2.2 (11)	2.6 (8)	0.826 (0.328–2.076)	0.683
Others (yes vs. no)	44.8 (228)	37.1 (114)	1.374 (1.028–1.836)	0.032*
Hospitalization in past 12 months				
Hospital out-patient in past 12 months (vs. no out-patient follow up in past 12 months)	75.2 (383)	61.9 (190)	1.872 (1.378–2.541)	<0.001**
Hospital in-patient in past 12 months (vs. non-hospital in-patient in past 12 months)	23.4 (119)	26.4 (81)	0.851 (0.614–1.180)	0.334
Advisor of influenza vaccination				
Nursing staff of elderly center (vs. no nursing staff of elderly centers' advice)	81.5 (415)	33.9 (104)	8.493 (6.136–11.757)	<0.001**
Medical staff of elderly centers (vs. no medical staff's advice)	33.0 (168)	10.1 (31)	4.385 (2.897–6.638)	<0.001**
Family members or friends (vs. no family members or friends' advice)	24.0 (122)	7.2 (22)	4.083 (2.529–6.591)	<0.001**
Others (vs. no others' advice)	9.6 (49)	2.3 (7)	4.559 (2.039–10.195)	<0.001**
Perception of influenza illness, vaccine efficacy and safety				
Know the symptom of influenza (yes vs. no)	73.1 (372)	61.2 (188)	1.719 (1.271–2.324)	<0.001**
High chance to get influenza (yes vs. no)	34.0 (173)	22.8 (70)	1.743 (1.261–2.409)	0.001**
Vaccination useful (yes vs. no)	92.3 (470)	83.1 (255)	2.457 (1.579–3.824)	<0.001**
"It is safe to receive vaccination" (yes vs. no)	98.8 (503)	94.8 (291)	4.604 (1.782–11.894)	0.002**
Agree recommendation that elderly over 64 should be vaccinated (yes vs. no)	96.5 (491)	87.9 (270)	3.737 (2.087–6.692)	<0.001**
Agree free vaccination policy/recommendation for elderly				
(a) Under comprehensive social security assistance (CSSA) scheme (yes vs. no)	95.7 (487)	88.9 (273)	2.757 (1.580–4.809)	<0.001**
(b) Living in old age home (OAH) (yes vs. no)	95.9 (488)	88.3 (271)	3.087 (1.766–5.395)	<0.001**
(c) With chronic illness/pulmonary disease (yes vs. no)	97.1 (494)	88.9 (273)	4.100 (2.194–7.661)	<0.001**
Consider vaccination if all >64 years old elderly eligible to receive free vaccination (yes vs. no)	96.5 (491)	63.5 (193)	15.656 (9.266–26.454)	<0.001**
Consider vaccination in the subsequent years (yes vs. no)	90.4 (460)	33.2 (102)	18.865 (12.923–27.541)	<0.001**
Reasons to be considered before vaccination				
(a) Is it free? (yes vs. no)	36.3 (185)	42.3 (130)	0.777 (0.582–1.039)	0.088
(b) Is it safe? (yes vs. no)	73.9 (376)	54.7 (168)	2.339 (1.734–3.155)	<0.001**
(c) Is it effective? (yes vs. no)	58.4 (297)	44.6 (137)	1.738 (1.306–2.314)	<0.001**
(d) Others (e.g. distance, time or no specific reason)? (yes vs. no)	11.2 (57)	30.0 (92)	0.295 (0.204–0.426)	<0.001**
After SARS and Avian influenza				
"There is a need on influenza vaccination after Severe Acute Respiratory Syndrome (SARS) and Avian influenza" (yes vs. no)	91.9 (468)	63.8 (196)	6.464 (4.354–9.597)	<0.001**
"Influenza vaccination effectively reduce the chance to get SARS and Avian influenza" (yes vs. no)	92.9 (473)	69.4 (213)	5.798 (3.822–8.797)	<0.001**

* $p \leq 0.05$.
** $p \leq 0.01$.

5. Discussion

5.1. Prevalence of influenza vaccination among the Hong Kong elderly people

The overall prevalence of influenza vaccination among the Hong Kong elderly participants, who were aged 65 or above, was 62.4% in the previous year, which tallies with the results for their Western (Burns et al., 2005; Landi et al., 2005) and other Asian counterparts (Wang et al., 2002). U.S. health authorities have pointed out that the target vaccination rate for people aged 65 or above is 90% (Singleton et al., 2000); thus, there is a need to increase vaccination coverage in Hong Kong, especially in the hospital setting, as elderly hospital patients are a highly vulnerable group and perhaps the one that would benefit most from vaccination. A strategic promotion program designed to enhance the acceptance of influenza vaccination should be implemented. A recent local study found that the prevalence of influenza vaccination and its relevant perceptions in the elderly population would continue to change over time (Lau et al., 2007). However,

Table 4
Multivariate logistic regression model of significant variables associated with influenza vaccination ($n = 816$).

Correlates	Vaccinated ($n = 509$) % (n)	Non-vaccinated ($n = 307$) % (n)	(Adjusted odds ratio[a] (aOR) 95% CI)	p-Value
Consider vaccination in subsequent years	90.4 (460)	33.2 (102)	7.877 (4.855–12.782)	<0.001**
Consider vaccination if all >64 years old elderly eligible to receive free vaccination	96.5 (491)	63.5 (193)	3.024 (1.504–6.083)	0.002**
"There is a need on Influenza vaccination after SARS and Avian influenza"	92.9 (473)	69.4 (213)	2.413 (1.412–4.122)	0.001**
Advice from nursing staff of the elderly centers	81.5 (415)	33.9 (104)	7.161 (4.718–10.868)	<0.001**
Advice from medical staff of the elderly centers	33.0 (168)	10.1 (31)	3.771 (2.232–6.369)	<0.001**
Advice from family members or friends	24.0 (122)	7.2 (22)	3.023 (1.610–5.677)	0.001**

** $p \leq 0.01$.
[a] Adjusted for demographic variables, settings, objective assessment, self perceived health status, chronic illness, hospitalization in past 12 months, hospitalization in past 12 months, advisor of influenza vaccination, perception of influenza illness, vaccine efficacy and safety.

the prevalence was found in only 15 out of the 174 centers therefore it would limit the generalizability of the results in Hong Kong. Therefore, continuing studies are warranted to further investigate the prevalence of such vaccination.

5.2. Advice from nursing staff

In the current study, advice from the nursing staff of elderly centers was found to be an even stronger influence than was advice from others. One possible explanation is that these staff members are highly effective in screening the elderly people and delivering appropriate health promotion advice during their day-to-day contact with them. Another possible explanation is that the elderly people who visit such centers are more receptive to and more likely to adapt to current societal changes (Aranceta et al., 2001). It may therefore be logical to suggest that the elderly participants in this study, all of whom visit these centers, were similarly open-minded about and more ready to accept preventive medicine. The organization of regular health promotion activities by the centers may also have heightened their awareness of their own health, and the rapport established with the nursing staff may have made the vaccination advice offered more convincing. This result also confirms the increasingly prominent role played by the nursing staff in elderly centers.

5.3. Advice from medical staff

This study also reinforces the importance of advice from doctors in influencing elderly Chinese people's decision to obtain influenza vaccination. This finding echoes those of a number of Western studies (Nowalk et al., 2004; Rey et al., 2004) and confirms the important role played by physicians' recommendations in such decisions (Zimmerman et al., 2004).

5.4. Advice from family and friends

It was also revealed that family members and friends also positively and significantly influence the elderly people to receive influenza vaccination. This finding is consistent with those of previous studies (Takahashi et al., 2003; Zimmerman et al., 2003c) in which the subjects considered advice from friends and family members to be important in their decisions about vaccination. This effect appears to be even stronger among Chinese people, largely because the family is the center of the universe in Chinese culture, and thus family influence is huge (Smith, 1991). From another angle, earlier studies have noted that family experiences of having and preventing influenza are as important as personal experiences in determining elderly people's acceptance or rejection of influenza vaccination (Telford and Rogers, 2003). Therefore, the promotion of such vaccination among elderly people should involve family and friends.

5.5. Consideration of vaccination in subsequent years

The study also reveals that the intention to undergo vaccination during the following year's vaccination season also significantly increases vaccination among the elderly people. This result is in line with the findings of previous studies (Evans and Watson, 2003; Zimmerman et al., 2003b).

5.6. Free vaccination

It has also been found that the elderly people would be more likely to consider vaccination if all those aged 65 or above were eligible to receive it free of charge, which is in line with the findings of another local study (Hui et al., 2006) and one carried out in the West (Damiani et al., 2007). In the current study, most of the participants were retired and had no reliable regular income, thus placing them in the group vulnerable to poverty. Except for a minority who were in receipt of CSSA, these elderly people would be charged at least HK$50 (~US$7) of their scanty income for vaccination; thus, many of them said they had chosen to forgo it for financial reasons. The Hong Kong SAR Government's current policy primarily provides free vaccination to the institutionalized elderly people and those with chronic illness, thus excluding most of the non-institutionalized elderly people. Our findings suggest the need for extending free influenza vaccination to all persons in Hong Kong who are aged 65 or above, thus easing the financial constraints of this disadvantaged group and most likely dramatically increasing the vaccination rate among it.

5.7. Perceived need to be vaccinated following the SARS and avian influenza outbreaks

The SARS and avian influenza outbreaks in 2003 and 2004 had a deep impact on the people of Hong Kong. Due to these unforgettable crises and continued health promotion efforts, their awareness of their own health and of disease prevention has risen markedly. Given the similarity between the symptoms of influenza and those of SARS and avian influenza, the Department of Health and Social Welfare took the high-profile lead in arranging influenza vaccinations for all elderly people or disabled residents in state-run institutions (Hong Kong Special Administrative Region, 2003) following these outbreaks. This may have helped to raise awareness among Hong Kong elderly people in general and thus positively influenced their decision to seek such vaccination (Lau et al., 2006).

5.8. Influence of functional and cognitive status

Attempts have been made in this study to investigate the relationship between the functional status and cognitive capacity of the elderly participants and their decision to seek influenza vaccination. Although it was not statistically significant in the final multivariate logistic regression model, there was still an increasing vaccination trend among those participants with higher CMBI and CMMSE scores. Other studies that have investigated the factors that drive the independently living elderly people to participate in health promotion activities have found that both physical health and cognitive status directly influence health behavior (Gallant and Dorn, 2001; Messecar, 2000; Resnick, 2000). It may be that elderly people with better physical health and cognitive functioning are more likely to participate in primary and secondary health-promotion activities (Resnick, 2003), although this is a speculative result that requires further examination in future studies.

5.9. Limitations of the study

This study has several limitations. In terms of methodology, the main limitations are the use of convenience sampling and the cross-sectional design, which may have resulted in the identification of associations between vaccination and some of the variables that may not be causal. Generalizing the results of this study would therefore require further longitudinal research using probability sampling. Another limitation is that the majority of the elderly participants had good cognitive and physical status; thus, it is difficult to elucidate the true correlation between this variable and having undergone vaccination. In addition, only 15 out of the 174 centers agreed to participate in this study, which limit the generalizability of the results to general populations of elderly people in Hong Kong.

6. Conclusion

In Hong Kong, the number of elderly Chinese people undergoing influenza vaccination remains suboptimal, and the awareness of the benefits of such vaccination among this population remains insufficient. Therefore, the implementation of an influenza vaccination program is recommended for the population at large or at least for high-risk populations. Governments can successfully promote vaccination by educating the public about its advantages, through encouragement by nursing and other medical staff at centers for the elderly people, as well as family and friends, by making known the locations at which vaccination is available, and by making it accessible to everyone. In addition, the influence of the SARS and avian influenza outbreaks in Hong Kong has not only raised health awareness among the elderly people, but it has also revolutionized their attitudes toward influenza vaccination. Free vaccination and a consideration of vaccination in the following year are also correlated with vaccination among this population. Furthermore, although the levels of cognitive and physical functioning among the elderly participants in this study did not affect their decision to seek influenza vaccination in a statistically significant manner, further exploratory studies should be undertaken to raise awareness of the importance of a combination of subjective and objective assessments of vaccination.

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