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ORIGINAL ARTICLE

Knowledge about the pandemic influenza A (H1N1) and willingness to accept vaccination: a cross-sectional survey

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Abstract
Aims (1) To determine undergraduate medical students' knowledge about and perceptions of influenza A (H1N1) infection, (2) to explore their willingness to be vaccinated, and (3) to identify variables that could predict the likelihood of taking the vaccination.
Subject and methods A cross-sectional survey with a convenience sample of 264 medical students was performed. Data were collected using a structured questionnaire. Summary statistics, Pearson chi-square test and logistic regression were used for data analysis.
Results A total of 264 undergraduate medical students were interviewed. All of them had heard of the influenza vaccine, but none had ever been vaccinated at the time of survey. Regarding mode of transmission, 38.3% had at least two misconceptions. Of them, 43% had willingness to be vaccinated. In the binary logistic model, willingness to be vaccinated was statistically significant with those who feared the resurgence of a pandemic influenza ($p = 0.01$), those who trusted that vaccination would be effective for prevention of a pandemic influenza ($p = 0.045$), and those who were worried for family ($p = 0.03$) and if the vaccination would be freely provided ($p = 0.04$).
Conclusion The findings may be helpful for decision makers and health care planners as baseline information for designing wider coverage of newly implemented vaccination programs.

Keywords Influenza A(H1N1) · Knowledge · Willingness to be vaccinated · Survey

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Introduction

As of 6 June 2009, worldwide more than 214 countries and overseas territories or communities have reported laboratory-confirmed cases of pandemic influenza A (H1N1), including over 18,156 deaths (WHO 2009). The first laboratory-confirmed influenza A (H1N1) case in Malaysia was documented on 15 May 2010. As of December 2010, 131 cases were positively confirmed as influenza A (H1N1) in Malaysia (Malaysian Ministry of Health 2010). Infection with the pandemic A (H1N1) virus causes various clinical syndromes. Therefore, the target population's knowledge, perceptions, and behaviors concerning transmission and prevention are crucial. It has been reported that vaccination was shown to be the most efficacious and cost-effective strategy for the control of the 2009 H1N1 pandemic (Tsutsui et al. 2008; Wu et al. 2010).

Further to this, a monovalent vaccine based on the novel H1N1 strain is available to induce protective immunity, but acceptance of the vaccine depends on many factors. According to the health belief model (HBM), the acceptance of an influenza vaccine depends on factors such as individuals' perception of their susceptibility to and the severity of influenza (Tsutsui et al. 2008), individual weighting of costs, benefits, and barriers (Rosenstock et al. 1988) to accepting a vaccine (i.e. inconvenience,

expense, unpleasantness, and pain), and also cues received from other people's actions and recommendations by someone to take the vaccine (Tsutsui et al. 2008).

From the public health perspective, higher education institutions with their large concentrations of young people have the potential to become serious outbreak centers (Akan et al. 2010), especially for respiratory tract infections. To date, studies on knowledge, perceptions, and (intended) behaviors related to influenza A (H1N1) among university student populations are available from Turkey (Akan et al. 2010), Australia (Van et al. 2010), and Korea (Park et al. 2010), *inter alia*. However, studies incorporating the willingness to take the vaccination exclusively with undergraduate medical students, even though the institution does have one confirmed case, are limited.

The objectives of the present study are (1) to determine undergraduate medical students' knowledge about and perceptions of influenza A (H1N1) infection, (2) to explore their willingness to be vaccinated, and (3) to identify variables that could predict the likelihood of taking the vaccination.

Methods

The study was conducted at the International Medical University (IMU) in Kuala Lumpur, Malaysia. This cross-sectional survey was performed between June 2010 and July 2010. This institution has one confirmed case of an undergraduate student during the pandemic phase.

A convenience sample of 264 medical students in semesters 2, 3, and 5 participated in the present study. A structured questionnaire was developed based on an extensive literature review and after consultation with faculty members. The items of the questionnaire were pre-tested and prepared in English. The questionnaire consisted of six sections covering (1) socio-demographic information; (2) knowledge of pandemic influenza symptoms; (3) mode of transmission; (4) perception of risk and seriousness of pandemic influenza; (5) self–protecting preventive behaviors; and (6) willingness to be vaccinated (W2BV) with the influenza A (H1N1) vaccination. The respondents were interviewed and instructed to answer yes/no/don't know (not sure), true/false, or aware/not aware, wherever applicable. Verbal consent was obtained prior to commencing the interview. Confidentiality was also assured as the interviewers did not record either the names or ID numbers of the respondents. The respondents had the right to refuse to participate or refuse to answer any question as they wished. The research project was approved by the IMU Research Ethics Committee (CtME/07/2010).

Analyses

Summary statistics were performed on all variables. For the comparison of responses of those with and without W2BV, the Pearson's chi-square test was done. Binary logistic regression was used to ascertain independent predictors of W2BV in the respondents. Initially, in order to include important variables, factors having a significance $p<0.25$ in univariate analysis were included in multivariate analysis. The final model was selected using a forward procedure and $p\leq0.05$. Data entry and analysis were done with the *Excel* spreadsheet and SPSS 18 (SPSS Inc; Chicago, IL).

Results

Profile of the respondents

Table 1 provides the basic characteristics of the respondents. Of 264 interviewed, more than half were females (55.7%), currently staying at the hostel (57.6%), and senior students (58.7%); their mean (± SD) age was 20.4 (±1.9) years (range, 18–36).

Knowledge about and perception of pandemic influenza

All respondents had heard about pandemic influenza. About two thirds (64%) had sufficient knowledge about the symptoms of pandemic influenza. Almost all (99.6%) correctly knew that the mode of transmission was through respiratory droplets, but only 32% could identify transmission through objects contaminated by a known case. More than one third (38.3%) had at least two misconceptions (see Table 2). There was no significant relationship between the number of semesters/classes and misconception about the mode of transmission ($r=0.04$, $p=0.48$). However, a

Table 1 Basic characteristics of the participating students (n=264)

Characteristics	Frequency (%)
Semesters	
2	109 (41.3)
3	77 (29.2)
5	78 (29.5)
Age (years): mean (± SD)	20.4 (1.9)
Gender	
Female	147 (55.7)
Living arrangement	
Live alone	18 (6.8)
Live in shared accommodation	152 (57.6)
Live with parents/guardian	80 (30.3)
Others	4 (1.5)

Table 2 Knowledge of and attitude towards influenza A (H1N1) among respondents (n=264)

Description	Number (%)
Respondents who correctly identified mode of transmission (3 items)	
Through respiratory droplets	263 (99.6)
Through bodily contact with a known case	85 (32.2)
Through objects contaminated with virus	211 (79.9)
Misconception about transmission (3 items)	
At least 2 misconceptions	101 (38.3)
Through eating semi-uncooked poultry	83 (31.4)
Through blood transfusions	118 (44.7)
Through eating food prepared by someone with A(H1N)*	112 (42.6)

*263 respondents

significant relationship was found between respondents' living arrangements and worries about their family members contracting the virus (r=0.19, p=0.02). Those students staying with their parents had more worries than those who were staying in the hostel in the current study.

The majority had perceived it as a life-threatening infection (72.7%), thought the second outbreak would be more severe than the first (75%), were worried about transmissions to their family (75%), and thought it was a severe and fatal infection (70.5%). Some thought they had a chance to contract it themselves (26.5%), were scared of resurgence of infection (43.6%) and thought that vaccination would be effective (17%). Notably, around one third had "uncertainty" (i.e., don't know/unsure) about whether vaccination would be effective (35.6%) and were uncertain about the level of transmission intensity (33.5%) (data not shown).

Self-protecting preventive behaviors

The vast majority of the respondents (94.7%) would adopt at least two preventive behaviors (i.e., sufficient self-protecting behaviors in this case). The behaviors chosen were wearing a mask in public venues (77.3%), frequent hand washing (95.8%), practicing cough etiquette (97.7%), and avoiding crowds and social gatherings (63.3%) (data not shown).

Willingness to be vaccinated

Table 3 provides the variables related to vaccination among the respondents. Less than half the respondents in the present survey had W2BV vaccination (42.8%). Of those who had W2BV vaccinations, the main reasons for such an intention were "high chance of contracting the virus" (44.6%) and "worried about family members contracting the virus" (86.7%). Of those who declined to take the vaccination, the main reason was lack of trust in the vaccine efficacy and safety (51%). Some were afraid of side effects (20.5%) or just did not want it (8.6%). A few thoughts this was not the right time (19.9%). Of those who had W2BV, the vast majority (94.7%) would like to take the vaccination if it were free. The higher the amount required to pay was, the lower the number who wanted to take the vaccination.

In the bivariate association using the chi-square test, the W2BV influenza A (H1N1) vaccination was statistically significant with some variables. Perception of a severe and fatal infection (p=0.016), perception of it as life-threatening (p=0.001), worries about family members contracting the virus (p<0.001), fears of the resurgence of pandemic influenza (p=0.001), if vaccination would be freely provided (p=0.001) and trust that vaccination would be effective (p<0.001) were significant contributing factors (see Table 4).

In the final binary logistic regression model, W2BV vaccination was statistically significant with those who fear the resurgency of a pandemic influenza (p=0.01), those who trusted that vaccination would be effective (p=0.045), those who were worried for family (p=0.036), and if the vaccination would be freely provided (p=0.041). The Cox and Snell (r^2=0.11) and the Nagelkerke (r^2=0.15) indicated

Table 3 Vaccination-related variables

	Description	Frequency (%)
1	Willingness to be vaccinated (n=264)	
	Yes	113 (42.8)
	No	151 (57.2)
2	Reasons to decline (n =151)	
	Do not trust in vaccine efficacy	77 (51)
	Not the right time	30 (19.9)
	Side effects	31 (20.5)
	Just don't want it	13 (8.6)
3	The maximum amount willing to pay for vaccination•	
	Free	107 (94.7)
	RM 10–15	99 (87.6)
	RM 15–30	86 (76.1)
	RM>30	69 (61.1)

• Based on those who had W2BV (n=113)

Table 4 The selected variables associated willingness to take the vaccination in bivariate analysis

Description	WTT vaccination		P-value*
	Yes (%)	No (%)	
High chance of contracting			0.6
Yes	50 (18.9)	61 (23.1)	
No	63 (23.9)	90 (34)	
Perceived as severe and fatal infection			0.016
Agree	46 (17.6)	39 (14.9)	
Disagree	67 (25.6)	110 (42)	
Life threatened			0.001
Agree	92 (35.1)	94 (35.9)	
Disagree	21 (8)	55 (21)	
Worried about contracting infection for family			< 0.001
Agree	98 (37.3)	100 (38)	
Disagree	15 (5.7)	50 (19)	
Fear resurgence of pandemic influenza			0.001
Yes	67 (25.4)	48 (18.2)	
No	26 (9.8)	56 (22)	
Don't know	21 (8)	44 (16.7)	
Vaccination was free			0.001
Yes	107 (47.3)	119 (52.7)	
No	6 (2.3)	32 (12.1)	
Vaccination was effective			< 0.001
Agree	78 (29.5)	47(17.8)	
Disagree	8 (3)	37 (14)	
Don't know	28 (10.6)	66 (25)	

*Pearson chi-square test

the predictive ability of this model. Residual statistics, both Cook's distance and DFbeta for constant are <1, confirming that the model fits.

Discussion

Universities are not immune from any emerging infectious diseases, and such institutions must maintain a balance among academic continuity, infection control and minimizing morbidity (CDC 2010). In the present study, more than one third of respondents had misconceptions about disease transmission, indicating that this important knowledge was still lacking in the respondents. This calls attention to the need to strengthen evidence-based health education (Lu et al. 2010). To do this, online resources such as lecture recordings and forum tutorials allow for off-campus education, and can provide continuity of learning for students undergoing isolation (Van et al. 2010). As a matter of fact, some fundamental building-block concepts of medicine (immunology and virology in this case) must be understood in depth, perhaps requiring even more intensive attention in the curriculum (Dawson-Saunders et al. 1990). In a Korean study with university students, female participants were more likely to perceive their own personal susceptibility to influenza A (H1N1) (Park et al. 2010). But this was not found in our study. As the present study was conducted among undergraduate medical students attending a private university, we can assume that these factors are likely to be homogenous.

In the present study, about 43% of respondent students indicated that they were W2BV. This was only 7% in the Turkish study with university students (i.e., from a non-medical school) (Akan et al. 2010). This difference may relate to the level of information available to the medical students. Another possible explanation in the context of HBM is that people who perceive higher seriousness or severity of illness will tend to get the vaccine (Tsutsui et al. 2008); the current study was conducted at a university where a confirmed case had been revealed. This was supported by the fact that those students staying with their parents had more worries than those who were staying in the hostel in our study.

Being an infectious disease and since the vaccine is currently available, vaccination remains important as a means of reducing the morbidity and mortality caused by the influenza virus. WHO strongly recommends vaccination of high-risk individuals in countries where influenza vaccines are available (WHO 2010b). None of the students participating in this study had taken the vaccination at the

time of this survey. A possible explanation is that messages that the student population should receive the vaccination had not been, at the time of the survey, diffused to this group of the population. However, the recommendation was publicized to the general population via the mass media. Greater vaccine effectiveness and broader population coverage are the principal reasons (Khazeni et al. 2009) for an effective control. A side effect is also related to the construct of perceived harm, which is used in the HBM (Tsutsui et al. 2008; Lu et al. 2010), but this was not a significant factor in our study as fewer respondents were concerned with vaccine-related side effects.

In their responses, "do not know" answers were included. These results call for enhancing information on the safety profile of the vaccination. Moreover, it has been reported that the public acceptability of vaccines depends on both fear of the disease (when perceived as rampant and/or dangerous) and fear of vaccine-associated adverse events (when the disease is less or no longer visible) (Siegrist and Peroutkova 2008). The available data show that pandemic H1N1 vaccines are immunogenic and have an acceptable safety profile. They provide an important public health tool to minimize further harm from the virus (Pfeifer et al. 2010). A recent study in China has reported that the rate of serious adverse events related to the influenza A (H1N1) vaccine was low in all age groups, and no potential vaccine-associated cases of the Guillain-Barré syndrome were identified (Khazeni et al. 2009). Regarding the Swedish experiences with vaccination with the "Pandemrix" vaccine, after administration of up to 2 million doses, about 600 adverse event reports were received from health care professionals and almost 900 reports from consumers (MPA 2010). The known adverse events reported were soreness, redness, and pain at the injection site and in the arm, and flu-like symptoms, such as fever, shivering, fatigue, moderate to severe headaches, body aches, and malaise in the clinical trials (MPA 2010). Along this line, eight deaths have sofar been reported in Sweden, and all these patients were on chronic medical treatment. According to a post-mortem reports on four of the eight deaths, a relation between the vaccination and death was considered unlikely. For the remaining four deaths, there was insufficient information, and autopsy protocols are lacking, which limits the assessment. As such, there is currently no basis to support a causal association between the vaccination and the deaths (MPA 2010). Further research in this field is needed.

Although the H1N1 influenza virus has moved into the post-pandemic period, localized outbreaks of various magnitudes are likely to continue (WHO 2010a). National systems of public health law are essential for influenza pandemic control (Martin et al. 2010) internationally. Updated scientific information should be diffused to the medical students through teaching/learning modes, as they will be a good source of communication to their families and the community. According to the social learning theory, provision of accurate information will foster health behaviors (Lu et al. 2010). The HBM prescribes that perceived severity, perceived susceptibility, perceived efficacy, perceived benefits and barriers, and cues for actions predict health-seeking behaviors (Rosenstock et al. 1988; Lu et al. 2010). In the current study, the factors of perceived severity and being life-threatening were only supported by the univariate association.

It has been highlighted that time preferences are the extent to which decision makers appear to value future outcomes relative to immediate ones (Tsutsui et al. 2008). This pattern was also found in our study. About 20% of respondents who were inclined to accept vaccination reported that "it is not the time to take vaccination." People with future-oriented time preferences would be more likely to adopt preventive measures (Shahrabani and Benzion 2006). An important observation from our study is that W2BV is sensitive to financial issues. Even though the vaccination is free, indirect costs, such as those for time and travel, are unavoidable. This means the closer the point of vaccination, the better coverage can be expected, and vice versa. These issues require further detailed research.

In case of an infectious disease pandemic, the willingness and ability of the general public to adhere to recommendations regarding personal hygiene, vaccination, prophylaxis, quarantine, travel restrictions, or closing down of public buildings such as schools (WHO 2006; de Zwart et al. 2009) are crucially important. Our findings indicated that there were sufficient preventive behaviors among study participants. However, actual practice is a concern. To increase vaccination coverage, there are debates on free and compulsory public measures to limit the dissemination of an infection. Although disease notification responsibility is generally common across Europe (Martin et al. 2010), compulsory vaccination is less common. All can agree that while public health policy and pandemic planning may propose measures beneficial to the public health, those measures cannot be applied without legal support (Martin et al. 2010).

There are limitations to the current study. Being a sample of convenience, generalization is limited to the study population in particular. Furthermore, a cross-sectional survey of this nature can only capture a snapshot of information about the participants. As such, our findings may change over time. Nevertheless, predictors that are significantly associated with W2BV in our study are consistent with the HBM, which are also theory-driven.

In this very complex context, medical students who also are tomorrow's doctors have valuable potential for the health care industry and will have a fundamental role in the

educational process for the health of the community. The findings of our study may be of immense value for decision makers and health care planners as baseline information for designing wider coverage of newly implemented vaccination programs.

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Conflict of interest None.

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