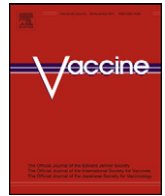




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Healthcare workers and H1N1 vaccination: Does having a chronic disease make a difference?

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ABSTRACT

Introduction: A novel H1N1 vaccine was manufactured in response to the pandemic in 2009. This study describes the willingness to be vaccinated for H1N1 among healthcare workers (HCWs) in primary healthcare clinics with and without chronic medical conditions, their reasons for refusing vaccination and whether they sought additional information to make an informed decision for the vaccination.

Materials and methods: An anonymous survey was conducted in November 2009 among all medical, nursing, allied health and operations HCWs in nine primary care clinics in Singapore. Participants were asked if they had any chronic medical conditions associated with influenza-related complications (example: asthma, stroke, heart disease, cancer, diabetes mellitus, renal disease), their perception towards vaccination for H1N1 and against seasonal influenza within the preceding 2 years.

Results: The initial response rate was 80%, of which 711 (54.7%) of the completed surveys were analysed. Among the 711 respondents, 16.6% reported having at least 1 chronic disease. Asthma (10.8%), hypertension (10.4%) and dyslipidaemia (9.8%) were the main chronic conditions. Only 39.4% of respondents were willing to be vaccinated against H1N1. Males were 2.07 (95% CI 1.19–3.62) times more likely than females to receive the H1N1 vaccination; the 45–54 and 55+ years old were 2.12 (95% CI 1.06–4.24) and 2.44 (95% CI 1.13–5.27) times more willing than those below 25 years old; and those who considered accepting the seasonal influenza vaccine were 7.0 times more likely than those who did not (95% CI 4.48–10.92). The 2 principal barriers were “fear of side effects” and “unsure of vaccine’s effectiveness”. Although 78% attended some H1N1-related talks, only 7% of all HCWs felt that they had sufficient information. Most wanted more information about the vaccine’s safety profile and contraindications.

Conclusion: Fewer than 40% of HCWs expressed willingness to receive the H1N1 vaccination, lower than past rates of influenza vaccine. HCWs in primary care clinics who had a chronic condition did not perceive themselves to be at higher risk of developing H1N1-related complications and were not more willing than the rest of the HCWs to accept H1N1 vaccination. Vaccine’s side effects and effectiveness were the main concerns. Uptake of H1N1 vaccine may improve with targeted health information covering the vaccine’s safety profile.

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1. Introduction

In April 2009, a novel influenza A virus (H1N1) of swine origin emerged in the United States [1] and triggered alarm about its pandemic potential [2] across the world. On June 11, 2009, the World Health Organisation announced that the virus had become pandemic and is now referred to as the pandemic (H1N1) 2009 virus [3].

Tropical countries experience influenza year round, with 2 peaks corresponding to the rainy seasons [4]. Singapore is a tropical island city, and as such, influenza activity is seen all year-round and usually peaks in June and December [5]. The high prevalence of seasonal influenza during peak times in Singapore is comparable to that during typical influenza seasons in temperate countries in the Southern Hemisphere and underscores the need for not neglecting seasonal influenza in Singapore [6]. Chow et al. reported in 2006 that the annual all-cause death rate from seasonal influenza in Singapore has been estimated at 14.8/100,000 person-years and the proportion of deaths among persons ≥ 65 years of age is 11.3 times higher than that among the general population [7]. It was also

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found that the previous pandemic influenza-related excess deaths in Singapore were comparable to those in temperate countries [8].

Since Severe Acute Respiratory Syndrome (SARS) in 2003, Singapore has been on the alert for pandemic influenza. With the world-wide announcement of the new H1N1 influenza strain, Singapore implemented strict containment measures for pandemic (H1N1) 2009 with enhanced surveillance and hospital isolation since April 25, 2009. Pandemic (H1N1) 2009 was first detected in Singapore during the week beginning June 14, and the weekly incidence rapidly increased until the week ending July 25, when all influenza cases were caused by pandemic (H1N1) 2009 virus [6]. Meanwhile, the primary healthcare workers (HCWs) at both private and public clinics were at the frontline, managing patients with acute respiratory illness and influenza-like illness. All HCWs were at risk of contracting the H1N1 virus from their patients.

Annual seasonal influenza vaccination has been found to be effective for preventing influenza virus infection and its complications. A recent study by Kheok et al. described the benefits in the reduction of morbidity with influenza vaccination of HCWs in Singapore [9]. The Singapore Ministry of Health (MOH) recommends that elderly persons aged 65 years or above, young children aged six months to five years, those with chronic heart and lung diseases and persons with diabetes mellitus or renal diseases, who are at a higher risk of developing complications from influenza [10], to undergo routine annual flu vaccination [11]. Seasonal influenza vaccination has also been shown to reduce infection and absenteeism among HCWs [9]. Despite this recommendation, and free vaccine offered by healthcare organisations, the vaccination rates among HCWs have remained low in many countries [12–18].

The same recommendations for vaccination were given with priority for vaccinating individuals at the highest risk of complications of influenza and to HCWs who are most at risk of transmitting the infection through their occupations [11]. HCWs, as described by the Association of National Health Occupational Physicians (ANHOPS), include (1) clinical staff who have regular, clinical contact with patients grouped conveniently as doctors, dentists, nurses and dental assistants, pharmacists, physiotherapists, dieticians, medical social workers, psychologists and radiographers; (2) laboratory personnel who may have direct contact with potentially infectious clinical specimens and may additionally be exposed to pathogens in the laboratory; and (3) non-clinical ancillary staff who may have social contact with patients, including receptionists, health attendants and maintenance personnel such as cleaners.

It is not known how many HCWs are willing to accept the new H1N1 vaccine and whether the individuals with chronic pulmonary or cardiovascular system disorders who are at higher risk of developing influenza-related complications are more willing to receive the vaccination. This study aims to compare the willingness to accept the novel H1N1 vaccination among HCWs in a primary healthcare clinic with and without chronic medical conditions and describes their reasons for choosing not to be vaccinated and whether they needed additional information to make an informed decision to accept the vaccination.

2. Materials and methods

An anonymous, self-administered survey was conducted in November 2009 over 1 month. All HCWs of the 9 primary care clinics in the central and western parts of Singapore were invited to participate.

The cover note on the questionnaire explained the purpose of the survey and invited participation. The questionnaire was distributed by the clinic Infection Control Nurses (ICNs) stationed at each of the 9 clinics to all HCWs in each clinic. Mandarin and Malay versions of the questionnaire were available on request.

Participants were asked to complete the questionnaire anonymously and drop them in the box provided in their respective clinics. The ICNs collected the completed questionnaires and returned to the research team for data entry and analysis.

The research team developed the questionnaire and pilot tested among ten colleagues. In addition to demographic characteristics, participants were asked if they have any of the following chronic conditions (asthma, hypertension, diabetes mellitus, high cholesterol/lipids, stroke, heart disease, cancer and chronic renal disease).

Participants were also asked their perceptions towards pandemic H1N1 and seasonal influenza vaccines and willingness to accept these vaccines if both were readily available. They were asked to indicate reasons if they did not receive the seasonal influenza vaccination in the last 2 years or chose not to be vaccinated against H1N1. All participants were asked if they needed additional information to make a decision to accept H1N1 vaccination.

Incomplete questionnaires (<90% complete) and those without any response to the designation and chronic medical history sections were excluded from this analysis. We also excluded the respondents who did not answer these 3 questions: (1) Did you receive the influenza vaccination in the last 2 years? (2) Would you be going for the influenza vaccination this year? and (3) If vaccination against H1N1 is made available, would you go for it?

The respondents were divided into 4 groups of HCWs. Doctors and dentists were grouped under “Medical”; nurses and dental assistants under “Nursing”; dieticians, pharmacists, radiographers, laboratory technicians, psychologists and social workers under “Allied Health”; clinic support and operations workers including the outsourced contract workers were under “Operations”.

We compared willingness to accept the H1N1 vaccination among respondents with and without chronic conditions. Among those who refused to accept vaccination, we analysed their reasons for refusal to be vaccinated by the 4 groups.

Data was analysed using PASW (version 18.0). Significance testing of proportions was carried out using Chi-square test, where a probability (p) of less than 0.05 was considered significant. Multivariate logistic regression was used to study the factors predicting the “willingness to receive the H1N1 vaccine”.

This study was approved by the Institution Ethics Review Board and granted a waiver of informed consent.

3. Results

The initial response rate for the survey was 80% (1035/1300). After excluding the incomplete questionnaires, 711 (54.7% of the completed surveys) were analysed.

3.1. Demographic characteristics of respondents (Table 1)

The sample consisted of 14.6% “Medical”, 25.7% “Nursing”, 21.5% “Allied Health” and 38.1% “Operations” HCWs. The majority were female (86.3%) and below 45 years old (70.2%). Among the 711 respondents, 16.6% reported having at least 1 chronic condition. Only 1.0% had 2 or more chronic conditions. Asthma (10.8%), hypertension (10.4%) and dyslipidaemia (9.8%) were the top 3 conditions.

Over three-quarters of the respondents had attended H1N1-related talks at the workplace (78.3%); 64.7% reported having received seasonal influenza vaccination in the last 2 years and 56.0% considered receiving seasonal influenza vaccine again. More than half (62.6%) of the respondents had been assigned to work in the fever/flu area in the clinics and 27.7% had experienced influenza-like illness (ILI) symptoms since the start of the H1N1 pandemic.

Table 1
Demographic characteristics of the study population and willingness to accept H1N1 vaccination.

Demographic characteristic	Sample N = 711 N	Willingness to accept H1N1 vaccination						p-Value
		Yes, N = 280		Not Sure, N = 152		No, N = 279		
		n	Row (%)	n	Row (%)	n	Row (%)	
Professional group								
Medical	104	50	48.1	22	21.2	32	30.8	NS
Nursing	183	73	39.9	37	20.2	73	39.9	
Allied health	153	56	36.6	35	22.9	62	40.5	
Operations	271	101	37.3	58	21.4	112	41.3	
Gender								
Male	97	52	53.6	12	12.4	33	34.0	0.004
Female	612	227	37.1	139	22.7	246	40.2	
Age								
<25	101	27	26.7	29	28.7	45	44.6	NS
25–34	224	90	40.2	49	21.9	85	37.9	
35–44	174	67	38.5	40	23.0	67	38.5	
45–54	132	60	45.5	21	15.9	51	38.6	
55+	80	36	45.0	13	16.3	31	38.8	
Race								
Chinese	460	154	33.5	105	22.8	201	43.7	0.001
Malay	107	58	54.2	21	19.6	28	26.2	
Indian	90	41	45.6	16	17.8	33	36.7	
Others	53	27	50.9	10	18.9	16	30.2	
Chronic condition (type)								
Asthma	77	24	31.2	22	28.6	31	40.3	NS
Hypertension	74	36	48.6	16	21.6	22	29.7	NS
Dyslipidaemia	70	36	51.4	14	20.0	20	28.6	NS
Diabetes	21	10	47.6	5	23.8	6	28.6	NS
Heart disease	6	3	50.0	1	16.7	2	33.3	NS
Stroke	0	0	–	0	–	0	–	–
Cancer	15	8	53.3	4	26.7	3	20.0	NS
Renal problems	2	1	50.0	0	–	1	50.0	NS
Number of chronic conditions								
0	593	238	40.1	121	20.4	234	39.5	NS
1	111	40	36.0	28	25.2	43	38.7	
2+	7	2	28.6	3	42.9	2	28.6	
Assigned to fever/flu sector in clinic								
Yes	445	169	38.0	97	21.8	179	40.2	NS
No	266	111	41.7	54	20.6	99	37.8	
Experienced influenza-like illness (ILI) symptoms								
Yes	197	84	42.6	42	21.3	71	36.0	NS
No	514	196	38.1	109	21.2	208	40.5	
Attended H1N1 related talks at workplace								
Yes	557	228	40.9	119	21.4	210	37.7	NS
No	154	44	31.4	32	22.9	64	45.7	
Ever received seasonal flu vaccine in last 2 years								
Yes	460	218	47.4	104	22.6	138	30.0	<0.001
No/not sure	251	62	24.7	48	19.1	141	56.2	
Considering receiving seasonal flu vaccine								
Yes	398	225	56.5	74	18.6	99	24.9	<0.001
No/not sure	313	55	17.6	78	24.9	180	57.5	

NS, not significant.

The bold values are statistically significant.

3.2. Willingness to accept H1N1 vaccination (Table 1)

There were 280 (39.4%) respondents who were willing to be vaccinated against H1N1. This was highest among the “Medical” group (48.1%) compared to 39.9% for “Nursing”, 36.6% for “Allied Health” and 37.3% for “Operations”. There was no statistical difference in the willingness to accept vaccine by HCW type. Rate was higher among male (53.6%) than female (37.1%) respondents and increased with age, from 26.7% among those below 25 years to 45% for those 45 years and above. The rate was highest among the Malay (54%) and lowest among the Chinese (33.5%).

Significantly more respondents ($p < 0.001$) were willing to be vaccinated if they: (1) had attended H1N1 talks at their workplace (40.9% vs. 31.4%); (2) had previously received seasonal influenza vaccination in the last 2 years (47.4% vs. 24.7%); (3) were considering accepting seasonal influenza vaccine (56.5% vs. 17.6%).

The willingness to be vaccinated against H1N1 was not significantly different between respondents with or without a chronic

condition (35.6% vs. 40.1%, $p > 0.05$; see Table 2). Rates varied among the chronic conditions, cancer (53.3%), dyslipidaemia (51.4%); heart disease (50%); hypertension (48.6%); diabetes (47.6%); and lowest for asthma (31%). The differences in willingness to accept vaccine by co-morbidity were not significant ($p > 0.05$).

Table 3 provides the adjusted odds ratio (AdjOR) results for the multivariate logistic regression which illustrates the factors associated with willingness to receive the H1N1 vaccination. Males were 2.07 (95% CI 1.19–3.62) times more likely than females to receive the H1N1 vaccination. Those who were 45–54 and 55+ years old were 2.12 (95% CI 1.06–4.24) and 2.44 (95% CI 1.13–5.27) times more willing to receive the H1N1 vaccination compared to those below 25 years old. Compared to the Chinese, the Malay, Indian and Others were 2.90 (95% CI 1.74–4.84), 2.09 (95% CI 1.20–3.64) and 2.59 (95% CI 1.29–5.21) times more likely to receive the H1N1 vaccination. Those who considered accepting the seasonal influenza vaccine were 7 times more likely to receive the H1N1 vaccine compared to those who did not (6.99, 95% CI 4.48–10.92).

Table 2
Having a chronic condition and willingness to accept H1N1 vaccine.

Demographic characteristic	Chronic condition [a]				No chronic condition [b]				p-Value [a] vs. [b]		
	Willing, N = 42		Unwilling ^a , N = 76		Willing, N = 238		Unwilling ^a , N = 355				
	N	n	Row (%)	n	Row (%)	N	n	Row (%)			n
Professional group											
Medical	14	6	42.8	8	57.1	90	44	48.9	46	51.1	NS
Nursing	31	12	38.7	19	61.3	152	61	40.1	91	59.9	NS
Allied health	25	7	28.0	18	72.0	128	49	38.3	79	61.7	NS
Operations	48	17	35.4	31	64.6	223	84	37.7	139	62.3	NS
Gender											
Male	16	6	37.5	10	62.5	81	46	56.8	35	43.2	NS
Female	102	36	35.3	66	64.7	510	191	37.5	319	62.5	NS
Age											
<25	9	0	0	9	100	92	27	29.3	65	70.7	NS
25–34	48	15	31.3	33	68.8	176	75	42.6	101	57.4	NS
35–44	16	5	31.3	11	68.8	158	62	39.2	96	60.8	NS
45–54	21	12	57.1	9	42.9	111	48	43.2	63	56.8	NS
55+	24	10	41.7	14	58.3	56	26	46.4	30	53.6	NS
Race											
Chinese	68	21	30.9	47	69.1	392	133	33.9	259	66.1	NS
Malay	19	9	47.4	10	52.6	88	49	55.7	39	44.3	NS
Indian	21	11	52.4	10	47.6	69	30	43.5	39	56.5	NS
Others	10	1	10.0	9	90.0	43	26	60.5	17	39.5	0.005
Assigned to fever/flu sector in clinic											
Yes	69	21	30.4	48	69.6	376	148	39.4	228	60.6	NS
No	49	21	42.9	28	57.1	213	88	41.3	125	58.7	NS
Experienced influenza-like illness (ILI) symptoms											
Yes	34	13	38.2	21	61.8	163	71	43.6	92	56.4	NS
No	83	29	34.9	54	65.1	430	167	38.8	263	61.2	NS
Attended H1N1 related talks at workplace											
Yes	98	36	36.7	62	63.3	459	192	41.8	267	58.2	NS
No	19	6	31.6	13	68.4	121	38	31.4	83	68.6	NS
Ever received seasonal flu vaccine in last 2 years											
Yes	73	32	43.8	41	56.2	387	186	48.1	201	51.9	NS
No/not sure	45	10	22.2	35	77.8	206	52	25.2	154	74.8	NS
Considering receiving seasonal flu vaccine											
Yes	67	34	50.7	33	49.3	331	191	57.7	140	42.3	NS
No/not sure	51	8	15.7	43	84.3	262	47	17.9	215	82.1	NS

NS, not significant.

The bold values are statistically significant.

^a Unwilling includes “No” and “Not Sure”.

3.3. Reasons for not wanting H1N1 vaccination

Among the respondents who were unwilling to be vaccinated for H1N1, the main reasons were given: (1) the fear of side effects (61.0%); (2) unsure of the effectiveness (55.9%); (3) dislike of injections (21.3%); and (4) feel not at high risk of getting complications from H1N1 (19.5%). Nearly 10% cited having a medical reason and 5.1% believed to be immune to H1N1. The most common reason given by all groups was “fear of side effects”, except for “Nursing” where 60% indicated “unsure of the vaccine’s effectiveness” as the most common reason.

A significantly higher proportion of respondents from the “Medical” group (18.8%) believed they were immune to H1N1 compared to “Nursing” (5.6%), “Allied Health” (3.3%) and “Operations” (1.9%). Similarly, significantly more in the “Medical” group (37.5%) felt they were not at high risk of getting complications from H1N1 compared to 11.1% for “Nursing”, 21.7% for “Allied Health” and 18.5% for “Operations” (Table 4).

3.4. Additional information needed to make an informed decision for vaccination

Only 7.0% of respondents indicated that they had sufficient information and did not need to know more. The rates were not statistically different between the HCW groups (Table 5).

Before deciding to receive the H1N1 vaccination, significantly fewer “Operations” compared to “Medical”, “Nursing” and “Allied

Health” HCWs wanted to know more about (1) safety and risks associated with accepting the H1N1 vaccine, (2) effectiveness, and (3) potential severity of second wave of H1N1 pandemic.

4. Discussion

Vaccinations are an important strategy to control the spread of influenza and protect a susceptible population, especially in a novel influenza pandemic [19–23]. All HCWs in the health facility should be protected against the new H1N1 strain and minimise the risk of transmitting the infection to their patients and among colleagues. Employers may wish to consider offering workplace influenza vaccination.

A recent study in 2008 by Kheok et al. showed benefits in the reduction of morbidity with influenza vaccination of HCWs in Singapore [9]. Despite that finding, the coverage of seasonal influenza vaccination in Singapore among workers in the health-care clinics remained low. In this study, only 64.7% of respondents had received influenza vaccination in the last 2 years and 56.0% would want to receive it again. However, the willingness to receive the H1N1 vaccine was much lower than that for seasonal influenza vaccine. The rates varied, being highest among doctors than other professional groups, higher among males than females, increased with age, and highest among the Malay and lowest among the Chinese. It appeared that a higher percentage of people with cardiovascular conditions were willing to accept the H1N1 vaccine compared to people with asthma, although this was not found to be

Table 3
Logistic regression for willingness to accept H1N1 vaccine.

Independent variable	Willing to accept H1N1 vaccination (Yes)			Adjusted OR	95% CI	p-Value
	Unadjusted OR	95% CI	p-Value			
Have a chronic condition						
Yes	0.82	0.55–1.24	NS	0.68	0.42–1.10	NS
[No]	1			1		
Professional group						
[Medical]	1			1		
Nursing	0.72	0.44–1.16	NS	0.81	0.43–1.51	NS
Allied health	0.62	0.38–1.03	NS	0.76	0.40–1.44	NS
Operations	0.64	0.41–1.01	NS	0.91	0.50–1.66	NS
Gender						
Male	1.96	1.27–3.02	0.002	2.07	1.19–3.62	0.010
[Female]	1			1		
Age						
[<25]	1			1		
25–34	1.84	1.10–3.08	0.020	1.75	0.92–3.33	NS
35–44	1.72	1.00–2.93	0.048	1.61	0.83–3.16	NS
45–54	2.28	1.31–3.99	0.004	2.12	1.06–4.24	0.034
55+	2.24	1.20–4.18	0.011	2.44	1.13–5.27	0.023
Race						
[Chinese]	1			1		
Malay	2.35	1.54–3.60	<0.001	2.90	1.74–4.84	<0.001
Indian	1.66	1.05–2.63	0.030	2.09	1.20–3.64	0.009
Others	2.06	1.16–3.66	0.013	2.59	1.29–5.21	0.008
Assigned to fever/flu sector in clinic						
[Yes]	1			1		
No	1.16	0.85–1.59	NS	1.60	1.09–2.34	0.016
Experienced influenza-like illness (ILI) symptoms						
Yes	1.20	0.86–1.68	NS	1.21	0.80–1.81	NS
[No]	1			1		
Attended H1N1 related talks at workplace						
Yes	1.51	1.02–2.24	NS	1.05	0.65–1.70	NS
[No]	1			1		
Ever received seasonal flu vaccine in last 2 years						
Yes	2.75	1.95–3.86	NS	1.13	0.71–1.78	NS
[No/not sure]	1			1		
Considering receiving seasonal flu vaccine						
Yes	6.10	4.29–8.68	<0.001	6.99	4.48–10.92	<0.001
[No/not sure]	1			1		

[], depicts reference group; OR, odds ratio; CI, confidence interval; NS, not significant.

* $p < 0.05$ by stepwise logistic regression analysis.

The bold values are statistically significant.

statistically significant. Similarly, no differences were found overall for those with or without a chronic condition.

Respondents were more willing to receive H1N1 vaccine if they attended talks about H1N1 or had prior experience with seasonal influenza vaccination or were already considering accepting the seasonal influenza vaccine again. In order to increase vaccination rates of the HCWs, the management would need to identify those who had never received the influenza vaccination and reach out to the females and the younger group. Special effort should be

made to encourage those who have chronic conditions to have their vaccination.

It is important to appreciate the reasons for not wanting to receive the H1N1 vaccination. In this study, the “fear of side effects” and “unsure of vaccine’s effectiveness” were the 2 principal reasons given by all groups. It was not surprising as the H1N1 was a new vaccine being developed rapidly in response to the new pandemic in 2009. Some doctors and nurses were concerned about the possibility of Guillain–Barré syndrome which plagued the National

Table 4
Reasons for not wanting to receive the H1N1 vaccination (by professional group).

Reason	Professional group										p-Value
	Medical, N = 32		Nursing, N = 72		Allied health, N = 60		Operations, N = 108		Total, N = 272		
	n	%	n	%	n	%	n	%	n	%	
Fear of side effects	20	62.5	37	51.4	39	65.0	70	64.8	166	61.0	NS
Unsure of effectiveness	18	56.3	43	59.7	33	55.0	58	53.7	152	55.9	NS
Dislike getting injections	4	12.5	14	19.4	17	28.3	23	21.3	58	21.3	NS
Feel not at high risk of getting complications from H1N1	12	37.5	8	11.1	13	21.7	20	18.5	53	19.5	0.018
Medical reasons	1	3.1	9	12.5	6	10.0	11	10.2	27	9.9	NS
Believe to be immune to H1N1	6	18.8	4	5.6	2	3.3	2	1.9	14	5.1	0.002
Others	3	9.4	7	9.7	4	6.7	6	5.6	20	7.4	NS

NS, not significant.

The bold values are statistically significant.

Table 5

Additional information needed to make a decision to receive the H1N1 vaccination if it is made available (by professional group).

Reason	Professional group										p-Value
	Medical, N = 104		Nursing, N = 183		Allied health, N = 153		Operations, N = 271		Total, N = 711		
	n	%	n	%	n	%	n	%	n	%	
Safety and risks associated with taking vaccine	85	81.7	142	77.6	124	81.0	188	69.4	539	75.8	0.024
Side-effects associated with H1N1 vaccine	78	75.0	122	66.7	113	73.9	169	62.4	482	67.8	NS
Effectiveness of vaccine	64	61.5	134	73.2	109	71.2	148	54.6	455	64.0	<0.001
Potential severity of second wave of H1N1 influenza	56	53.8	84	45.9	70	45.8	93	34.3	303	42.6	0.003
Conditions when it is not advisable to take the vaccine	45	43.3	71	38.8	60	39.2	90	33.2	266	37.4	NS
Cost of vaccine	24	23.1	35	19.1	39	25.5	43	15.9	141	19.8	NS
Others	3	2.9	3	1.6	0	0	1	0.4	7	1.0	NS
I have sufficient information and do not need to know more	7	6.7	13	7.1	6	3.9	24	8.9	50	7.0	NS

NS, not significant.

The bold values are statistically significant.

Influenza Immunization Programme in the United States during 1976–77 [24].

One in 8 doctors or dentists and 1 in 5 nurses or dental assistants reported a dislike of receiving injections. It was surprising to know that while these groups of HCWs would administer injections to their patients, a small group would rather not be vaccinated themselves because of the dislike for needles. Although the rate among those with chronic conditions was lower than those without, this was not statistically significant (13.6% vs. 22.8%, $p = 0.174$).

Being directly involved in patient care, about 18.8% of “Medical” group believed that they were immune to H1N1 and 37.5% felt not at high risk of getting complications from H1N1 and would not accept the vaccination. These rates were much higher than the other groups. This could be because the doctors and dentists were younger in age and were already using PPE or had prior exposure to working in the fever/flu area or experienced symptoms of ILL. On the other hand, the “Operations” group had minimal or no direct patient contact and only 18.5% “feel not at high risk of getting complications from H1N1”. Overall, 80.5% of respondents who rejected the vaccine felt at-risk but there was no difference between those with and without a chronic condition.

While most confirmed cases of the new H1N1 virus infection have thus far been self-limiting uncomplicated febrile respiratory illness with symptoms similar to those of seasonal influenza, severe illness and death have been reported in adults below 60 years of age, especially those at high risk of complications [25,26]. The HCWs with chronic conditions should be strongly encouraged to obtain the annual influenza vaccine.

Although several rounds of communication were presented to all HCWs in each clinic and 78.3% attended the talks, only 7.0% felt that they had sufficient information and did not need to know more. This was consistent across all HCW groups. From the time of announcement of the pandemic in April 2009 to the time of survey in Nov 2009, there remained a lot of confusion about the natural history of the novel H1N1 virus and the promise of the new H1N1 vaccine. All HCW groups, regardless of whether they had a chronic condition, were keen to have additional information in order to make an informed decision about the H1N1 vaccination. They were mostly concerned about the medical profile of the vaccine including its safety and risks, side-effects and contraindications. The same concerns were reported in several studies [16,27–31]. The doctors and dentists were also more interested to know how severe the second wave of H1N1 was compared to other professional groups. The cost of the vaccine was, however, the least of all their concerns as the management was providing the vaccine free of charge as part of employment benefit.

Our study involved HCWs in an ambulatory primary healthcare setting which is less complex than the hospital environment. Only 16.6% of respondents in this survey reported to have a chronic condition and we were unable to compare between the HCW groups or individual disease condition because of small numbers. A study with comparison of HCWs and patients with multiple chronic conditions would be useful.

As this study aimed to compare the willingness to be vaccinated against H1N1 and seasonal influenza and having a chronic condition, we had to exclude those with incomplete responses. Only 69% of the returned questionnaires were analysed. There was potential recall bias in this survey as respondents were asked if they had experienced influenza symptoms, attended talks on influenza at the workplace and ever received the influenza vaccine in the preceding two years.

While there are many studies reporting the vaccine uptake of medical and nursing professionals, few have included allied health professionals, operations and ancillary workers in a large ambulatory setting. Our study was an anonymous survey with a large sample size of HCWs in 9 primary care clinics in Singapore. The results could be generalised to public sector primary care clinics in Singapore. In this study, we were also able to compare the willingness to receive the H1N1 vaccine by HCWs with chronic conditions who were at higher risk of influenza-related complications.

We now know that HCWs with a chronic condition were not more likely to receive the H1N1 vaccination. It would be interesting to know whether they would recommend the H1N1 vaccination to their high-risk patients with multiple chronic medical problems.

As this survey was conducted in November 2009 when the H1N1 vaccine was still new, attitudes among HCWs towards this vaccine could change with the development of the pandemic and after more information was gathered after initial use. A follow-up survey could be conducted to assess any change in perception and attitude towards the pandemic and willingness to be vaccinated.

5. Conclusions

This survey of HCWs in the public primary healthcare clinics in Singapore showed fewer than 40% expressed willingness to receive the H1N1 vaccination, lower than past rates of influenza vaccination. Those with a chronic condition were not more likely to perceive themselves as being at high risk of getting H1N1 related-complications compared to people without chronic condition. They were also not more willing to be vaccinated for H1N1. Vaccine safety was a major concern as the fear of side effects and uncertainty of the vaccine’s effectiveness were the key reasons for refusing the

H1N1 vaccine. Uptake of pandemic influenza vaccine may improve with targeted health information focussing on the vaccine's safety and risks, side-effects and contraindications.

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Appendix A. Supplementary data

Supplementary data associated with this article can be found, in the online version, at doi:10.1016/j.vaccine.2011.12.037.

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