Influenza and seasonal influenza vaccination among diabetics in Singapore: knowledge, attitudes and practices

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ABSTRACT

Introduction: Seasonal influenza vaccination is recommended for diabetics; however, the vaccination uptake rate among diabetics remains low. This study explored the knowledge, attitudes and practices among diabetics in Singapore with regard to influenza and influenza vaccination.

Methods: A survey was conducted among type 1 and 2 diabetes mellitus patients who attended three management centres of the Diabetic Society of Singapore in January 2007. The pilot-tested questionnaire covered influenza and influenza vaccination in terms of the patient demographics, medical history and knowledge, attitudes and practices.

Results: A total of 307 diabetics participated in the study. Of these, 139 (45.3 percent) claimed to know the difference between influenza and the common cold, while 98 (31.9 percent) and 18 (5.9 percent) participants thought that influenza vaccines protected against all influenza strains and provided lifelong immunity, respectively. 247 (80.4 percent) participants were aware that they were at a moderate or higher risk for influenza-related complications, while 181 (58.9 percent) considered vaccination to be effective in preventing influenza and its complications. Only 94 (30.6 percent) participants were previously vaccinated. Among those unvaccinated, 117 (54.9 percent) did not think vaccination was necessary, while 104 (48.8 percent) had never considered it. As observed from the multivariate analysis, income was a key predictor of influenza vaccination. While 241 (78.5 percent) participants cited healthcare professional advice as the main guiding factor for getting vaccinated, 199 (64.8 percent) had never been advised on influenza vaccination. Of the 108 (35.1 percent) participants who had received previous advice on influenza vaccination, the majority had received it from their healthcare professionals.

Conclusion: Uptake of influenza vaccination among diabetics in Singapore is low, and the key predictor is income. Perception and knowledge are the main barriers, and hence, healthcare professionals should educate and encourage vaccination among diabetics.

Keywords: attitudes, diabetes mellitus, influenza, knowledge, vaccination

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INTRODUCTION

Influenza is one of the most common respiratory illnesses affecting people of all age groups worldwide.[1] Although influenza may occur throughout the year, infections intensify (seasonal epidemics) mostly during the winter season.[1] Seasonal influenza cases lead to substantial morbidity and mortality worldwide, including in the tropics.[2] Sentinel surveillance in Singapore indicates that acute respiratory illnesses, including influenza cases, are reported throughout the year. However, the distribution is bimodal, with April to July and November to January being the traditional "influenza seasons" with a distinct peak in the reporting of these cases. During these two influenza seasons, more than 5,000 cases have been reported in polyclinics, hospitals and tertiary care centres across Singapore.[3,4] Individuals across all ages (especially the elderly) with chronic illnesses, including diabetes mellitus, are at a greater risk from influenza and influenza-associated complications when compared with healthy individuals.[1,2] Diabetics have been found to be two to four times (age groups: > 64 years and < 64 years, respectively) more likely to die from influenza and pneumonia when compared with healthy individuals. In addition, diabetics are more prone to influenza infections during seasonal influenza epidemics when compared with healthy individuals.[5] Recent studies have identified diabetes mellitus as one of the potential risk factors for H1N1 influenza and related complications.[6-8]

One of the mainstays for protecting the general population from seasonal influenza is vaccination,[2,9] which has helped reduce the number of cases of

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respiratory infection, influenza-related complications and influenza-associated deaths.[5,10,11] In addition, influenza vaccination in diabetics has facilitated a drop of up to 80% in influenza and pneumonia-related hospitalisations,[2] as well as a drop of 50% in influenza-related mortality.[12] In view of the excellent efficacy results of influenza vaccines, the United States (US) Centers for Disease Control and Prevention (CDC) and the Advisory Committee on Immunization Practices have recommended influenza vaccination for diabetics across all age groups.[13] However, influenza vaccine coverage continues to vary across different geographical locations. In the US, the Behavioural Risk Factor Surveillance System showed a vaccine coverage of only 40% among diabetics in 1992,[13] while a community-based survey among diabetics in the United Kingdom (UK) in 2000 found a vaccine coverage of 67.6%.[14] Unfortunately, in Asia (including Singapore), very little data is available regarding influenza vaccine uptake rates among diabetics and their behaviours pertaining to influenza, influenza-related complications and influenza vaccination. As part of the measures undertaken following the end of the severe acute respiratory syndrome (SARS) outbreak, the Ministry of Health Singapore has, since September 2003, recommended that persons at high risk of complications from influenza infection, including those with chronic metabolic diseases such as diabetes mellitus, be vaccinated against seasonal influenza.[15]

According to the National Health Survey in 2004, diabetes mellitus affects 8.2% of the Singapore population.[16] In light of the heightened risk of influenza pandemics in Southeast Asia[17] and the large number of diabetics in Singapore, this study aimed to explore the knowledge, attitudes and practices (KAPs) among diabetic patients in Singapore with regard to influenza and influenza vaccination. It also aimed to identify possible strategies for educating diabetic patients and encouraging seasonal influenza vaccination.

METHODS

This study was conducted by the Diabetic Society of Singapore (DSS), a non-profit organisation affiliated with the International Diabetes Federation and the National Council of Social Service, Singapore. The DSS conducts diabetes mellitus awareness programmes, as well as provides education and counselling to diabetics, their families and the general public. In addition, the DSS organises programmes for complication screening including podiatry, retinal photography, and blood and urine tests. It runs three "one-stop" centres across Singapore to provide these services. GlaxoSmithKline Singapore provided financial support for the conduct of this study and the preparation of this manuscript. The survey was conducted among all type 1 and type 2 diabetes mellitus patients who attended the three clinical management centres between January 8 and January 21, 2007 (pilot interviews had been conducted on December 19–21, 2007). All patients visiting the centres during the survey period were selected, and a trained personnel assisted the patients in understanding the format of the questionnaire and the questions. However, in order to standardise the procedure of filling out the questionnaire, no further clarification was provided. Individuals who attended the clinical management centres more than once during the study period were excluded from answering the questionnaire after the first time. As this was a non-interventional study with a questionnaire-based approach to the acquisition of data, no written consent was obtained from the participants and no approval was obtained from the independent ethics committee or the institutional review board.

The pilot-tested questionnaire comprised 22 quantitative questions and was divided into three sections. The first section consisted of questions on demographics and medical history. The second section consisted of questions on knowledge and beliefs regarding influenza, including the participant's individual perception of the risks of influenza-associated illness. The third section consisted of questions on influenza vaccination KAPs, including factors that could possibly influence vaccine uptake.

The target sample size was calculated to be at least 94 patients, which was based on a positive response rate of 50% among the individuals who visited the study centres, in order to ensure a maximal sample size and an allowable error of 10% (± 5%). For the descriptive analysis, chi-square and Fisher's exact tests were used to compare the categorical outcomes. To identify the significant predictors of previous vaccination, logistic regression models were used to explore the exposure factors associated with previous vaccination. Univariate analysis was performed using all relevant input variables as covariates. For the multivariate analysis, input variables were selected starting from the most significant variable identified in the univariate analysis; the likelihood ratio test was used to determine whether the inclusion of a covariate significantly improved the model's fit. All statistical analyses were performed using Stata 9.0 (Stata Corp, College Station, TX, USA). All tests were conducted at the 5% level of significance, and the odds ratios and

Table I. Perception of common symptoms and complications associated with influenza among participants (n = 307).

	Participants (%)
Symptom	
Fever	77.9
Runny nose	76.9
Muscle pain	67.1
Headache	54.0
Chills/shivers	48.2
Loss of appetite	42.6
Nausea/vomiting	13.0
Complication	
Don't know	43.0
Pneumonia/inflammation of the lungs	36.2
Bronchitis/persistent cough	35.8
Recurring high fever	29.6
Increased glucose level	14.0
Encephalopathy/brain damage	11.4

corresponding 95% confidence intervals reported were applicable.

RESULTS

A total of 307 diabetics participated in the study and completed the questionnaire. There were 167 male (54.4%) and 140 female (45.6%) participants. Most of the patients (n = 196, 63.8%) were aged > 50 years and the majority (n = 227, 73.9%) were of Chinese origin. There was a large number of retired/unemployed participants (n = 111, 36.2%). The monthly household income were as follows: < S$2,000 (n = 83, 27.0%), S$2,000–S$2,999 (n = 68, 22.1%), S$3,000–S$3,999 (n = 55, 17.9%) and > S$4,000 (n = 61; 19.9%). 40 (13.0%) patients did not respond to this question.

Of all the participants, 139 (45.3%) claimed that they knew the difference between influenza and the common cold. When asked what they thought the major symptoms of influenza were, the top three choices were fever (n = 239, 77.9%), runny nose (n = 236, 76.9%) and muscle aches (206, 67.1%) (Table I). Regarding complications due to influenza, only 111 (36.2%) participants indicated pneumonia and 43 (14.0%) indicated increased glucose levels as possible complications, while 132 (43.0%) indicated that they did not know what the complications of influenza were (Table I). In addition, 78 (25.4%) participants thought that influenza was not a fatal illness, and 167 (54.4%) reported having had an influenza-like illness over the past year. With regard to the participants' perception of risk, 247 (80.5%) thought that diabetics were at moderate or higher risk for influenza-related complications (Table II). Those who had received previous influenza vaccination had a significantly better perception of risk for complications. Regarding the participants' knowledge of influenza vaccines, 98 (31.9%) participants thought that influenza vaccines protected against all influenza strains and 18 (5.9%) thought that influenza vaccines provided immunity for life. 182 (59.3%) participants thought that vaccination is effective in preventing influenza and its complications (Table III). Those who had received previous influenza vaccination had a significantly more accurate perception that vaccination prevented influenza and its complications compared with those who had never been vaccinated. A total of 179 (58.3%) participants would recommend influenza vaccination to others (Table III).

Although a majority of participants believed that vaccination was effective, only 94 (30.6%) participants had been previously vaccinated against influenza, among whom 57 (60.6% of those who had previous vaccination) had been vaccinated at least once a year. From the multivariate analysis, only a higher income was significantly and independently associated with previous influenza vaccination, after adjusting for age, gender and comorbid conditions. Participants who earned more than S$4,000 per month were three times more likely to be vaccinated than those who earned less than S$2,000 per month. Among those who had never been vaccinated, 117 (54.9%) did not think that vaccination was necessary, while 104 (48.8%) had never thought of vaccination (Table IV). Factors that encouraged vaccination included advice from healthcare professionals (n = 241, 78.5%), encouragement from family members (n = 86, 28.0%), better information about influenza vaccination (n = 80, 26.1%) and cheaper vaccines (n=58, 18.9%). Many participants (n = 199, 64.8%) reported that they had never been advised on vaccination. Of the 108 (35.2%) participants who had obtained previous advice on influenza vaccination, 77 (71.3%) had received it from healthcare professionals.

DISCUSSION

From this study, it is clear that knowledge about influenza and influenza vaccination among diabetics in Singapore is suboptimal. The majority of the participants did not know the difference between influenza and the common cold. The participants were unaware of the symptoms that distinguish the two illnesses, as defined by the US CDC. Fever, body ache, extreme tiredness and dry cough are more common and intense in the case of influenza, while common colds are comparatively milder and often accompanied by rhinorrhoea.[18] The majority of the participants considered "runny nose" (rhinorrhoea) to be a major symptom of influenza, which is more closely

Table II. Knowledge and attitudes pertaining to influenza based on previous influenza vaccination history.

	No. (%)			p-value*
	Total (n = 307)	Vaccinated (n = 94)	Not vaccinated (n = 213)	
Claim to know the difference between influenza and the common cold	139 (45.3)	48 (51.1)	91 (42.7)	0.20
Believe that avian influenza is caused by the seasonal influenza virus	81 (26.4)	25 (26.6)	56 (26.3)	0.89
Believe that influenza is not a fatal disease	78 (25.4)	27 (28.7)	51 (23.9)	0.38
Likelihood that a diabetic will develop influenza-related complications				0.02
Extremely low	19 (6.2)	4 (4.3)	15 (7.0)	
Low	41 (13.4)	9 (9.6)	32 (15.0)	
Moderate	172 (56.0)	49 (52.1)	123 (57.7)	
High	67 (21.8)	31 (33.0)	36 (16.9)	
Extremely high	8 (2.6)	1 (1.1)	7 (3.3)	

*Comparing participants who had been previously vaccinated with those who had never been vaccinated.

Table III. Knowledge and attitudes pertaining to influenza vaccination based on previous influenza vaccination history.

	No. (%)			p-value*
	Total (n = 307)	Vaccinated (n = 94)	Not vaccinated (n = 213)	
Believe that the influenza vaccine protects against all strains of influenza viruses	98 (31.9)	27 (28.7)	71 (33.3)	0.47
Believe that the influenza vaccine protects for life	18 (5.9)	3 (3.2)	15 (7.0)	0.29
Believe that influenza vaccination prevents influenza and its complications	182 (59.3)	77 (81.9)	105 (49.3)	< 0.01
Who should be protected against influenza?				
Young children	108 (35.2)	22 (23.4)	86 (40.4)	< 0.01
Elderly	132 (43.0)	40 (42.6)	92 (43.2)	0.92
Immunocompromised individuals	97 (31.6)	23 (24.5)	74 (34.7)	0.06
Frequent travellers	95 (30.9)	28 (29.8)	67 (31.5)	0.83
Those with a chronic illness	71 (23.1)	23 (24.5)	48 (22.5)	0.78
Everybody	136 (44.3)	54 (57.4)	82 (38.5)	< 0.01
Would recommend influenza vaccination	179 (58.3)	77 (81.9)	102 (47.9)	< 0.01

*Comparing participants who had been previously vaccinated with those who had never been vaccinated.

associated with the common cold and non-influenza-like upper respiratory illnesses. This lack of understanding of upper respiratory tract infections among lay people is in line with similar experiences from previous studies in the US and Malaysia.[19,20] However, in routine clinical practice, rhinorrhoea is generally not considered to be the sole differentiating factor between these two illnesses.[18] In a study conducted in metropolitan Boston in the US, 60% of parents reported a belief that changes in the weather caused common colds,[16] while a Malaysian study found that 59% of parents believed that the weather was the main cause of acute upper respiratory tract infection in their children.[17] In addition, as in the present study, a large proportion of the participants in these studies did not know about the complications of influenza, and very few were aware of the key complications of influenza such as pneumonia and impaired glucose control.

The level of understanding of a disease may influence specific healthcare-seeking behaviour.[14] This is indicated by the fact that most of the participants knew that influenza vaccines do not provide lifelong protection. However, almost one-third of the participants assumed that influenza vaccination protected against all strains of influenza, whereas in reality, the vaccine only protects against influenza strains that are identical or similar to the vaccine strains. This variation in awareness could possibly be attributed to the minimum public attention to education on respiratory diseases before the recent advent of SARS and the more recent threat of H5N1 influenza in Singapore. As such, the overall public understanding of respiratory diseases and vaccination may be limited in the region. Outbreaks of avian influenza in the region led to increased demand for the seasonal influenza vaccine by the general Singapore population at the end of 2005, causing a temporary shortage of influenza vaccine in

Table IV. Reasons cited by the participants for not being vaccinated previously (n = 213).

Reason	Partcipants (%)
Do not think it is necessary	54.9
Did not cross my mind	48.8
Do not need it as I am healthy	20.7
Do not believe vaccination can provide full protection	15.0
Vaccination is expensive	9.9

Singapore and denying those at risk of complications from influenza the opportunity to obtain their influenza vaccine. This episode may have been caused by the belief that the seasonal influenza vaccine would afford protection against the avian influenza virus, as evidenced by the present study, which showed that 26.4% of the participants thought that avian influenza is caused by the seasonal influenza virus. Hence, there is a need to increase general awareness through health education that avian influenza is caused by the H5N1 virus and not the seasonal influenza virus. In Hong Kong, an increase in influenza vaccination was noted only after the SARS epidemic,[21] indicating that it might have induced the public to seek vaccination against influenza. Despite the fact that Singapore has faced the SARS outbreak and that Singapore is surrounded by countries affected by the H5N1 influenza outbreak, vaccination rates among diabetic patients in this study remained low. Following SARS in 2003, the Ministry of Health Singapore has regularly reminded all registered medical practitioners to administer influenza vaccination to their patients who are at risk of complications arising from influenza on an annual basis, or even half yearly, if there is a significant change in the circulating influenza strains. Better public education and education targeted at high-risk groups is necessary in order to improve the vaccination uptake rates.

A relatively high proportion of participants in this study believed that they were at moderate or higher-than-moderate risk for complications. In addition, the majority of participants thought that influenza vaccination prevents influenza-related complications and would recommend influenza vaccination to others. Previous studies have shown that influenza vaccination uptake is influenced by the beliefs that the individual is susceptible to complications from influenza,[22] and that one can be protected by vaccination.[14] Influenza vaccination using vaccine strains that are well matched with the circulating strains reduces the possibility of influenza in healthy adults by 70%–90%,[23] while in the elderly, the rate of hospitalisation and death can be reduced by up to 48%.[7] Even in situations in which the circulating strains are not well matched with the vaccine strains (arising from antigenic drifts), influenza vaccines can still confer cross protection.[23] However, in this survey, only 30.6% of the participants had received prior vaccination against influenza.

Although there is no official published data available on influenza vaccination coverage in Singapore, independent studies have reported that between 1990 and 1997, influenza vaccination was almost negligible in Singapore.[24] With the increased awareness of influenza vaccination in subsequent years, separate studies of healthcare workers have reported influenza vaccine uptake rates of 56.8% (highest in ancillary workers at 72.9%) in 2004 and 66.4% in 2005.[25,26] However, a study published in 2006 reported that 88% of chronic obstructive pulmonary disease patients remained unvaccinated.[27] Data on influenza vaccination coverage in other Asian countries, such as Hong Kong and South Korea, is available. In Hong Kong, a community-based study noted an influenza vaccination coverage rate of 31.2% among residents aged 65 years and above,[19] which is similar to the rates reported in this study. On the other hand, the influenza vaccine uptake rate in South Korea is notably higher at 79.9% for those aged 65 years and older.[28] The higher vaccination coverage may be due to several factors. South Korea has a longer history of vaccination programmes. In addition, compared with the tropical and subtropical climates of Singapore and Hong Kong, respectively, South Korea has a temperate climate, where the effects of influenza are felt more strongly. Influenza vaccination coverage is also high in some countries in Europe.[9,14] A study among Spanish women aged 65 years and older found a vaccine uptake rate of 56.3%,[9] while diabetics in the UK had a vaccine uptake rate of 67.6%.[14]

Multivariate analyses showed that income was an important factor that influenced influenza vaccination uptake in Singapore. Individuals with higher incomes were more likely to have been vaccinated as compared to those with lower incomes. Other factors that may be associated with higher income levels, such as a higher education level and greater awareness of healthcare matters and travel patterns, also influence influenza vaccination uptake. In addition, the ease of access to the vaccine is one of the key predictors of influenza vaccine uptake. This is evident from lower-than-expected influenza vaccine coverage levels recorded in the developed regions of the world despite higher income levels and ongoing efforts to create awareness about influenza and influenza vaccination. These

aspects should be explored in further studies that look specifically at the reasons individuals get vaccinated against influenza or other diseases, in order to improve the vaccination rates of targeted interventions.

Although many participants of the current study thought that vaccination prevents complications and would recommend vaccination to others, the majority found vaccination unnecessary or had never considered it. Many participants were never advised on vaccination, which may be another reason for the low vaccination rates. This indicates a need to educate diabetic patients on the importance of influenza vaccination. Community education programmes have been found to increase influenza vaccine uptake.[29] Through campaigns aimed at the general public, the Health Promotion Board in Singapore has encouraged all Singaporeans, especially those suffering from medical conditions and chronic diseases like diabetes mellitus, to get vaccinated against influenza.[30] The price of vaccines was not a substantial barrier to vaccination nor was it cited as a main deciding factor in this study. On the other hand, advice from healthcare professionals strongly influenced the decision for influenza vaccination, with 71.2% of the participants reporting that advice from a doctor or nurse would encourage them to get vaccinated. This finding is consistent with that of previous studies.[31,32] Healthcare professionals are therefore a good source of patient information, and should be the focus of prevention efforts. This may include providing healthcare professionals with training and materials to encourage those at risk of influenza complications to be vaccinated.

Studies have found that some of the other major predictors of high influenza vaccine uptake in Europe and the US were previous vaccination of a family member, awareness of influenza and influenza vaccination, awareness drives through the media, and accessibility of the vaccine.[33-35] According to the CDC, placing emphasis on these two key areas may assist in increasing the influenza vaccine uptake rates: providing better access to vaccines (through extended vaccination hours, vaccine-only clinics and healthcare professionals who offer influenza vaccination at all medical visits) and increasing efforts to reach and vaccinate underserved populations in order to reduce disparities in the influenza vaccination rates.[36] However, while improved awareness and access are prerequisites, it has been commonly observed that they do not necessarily translate into better uptake, and the CDC considers that new strategies are required to improve influenza vaccine coverage in all age groups and high-risk groups.[37]

The limitations of this study include the lack of local comparisons with previous KAPs and vaccination uptakes among diabetics, other high-risk populations and the general Singapore population. In addition, data from polyclinics across Singapore was not available. Hence, the results of this study may not be truely representative of the larger diabetic population in Singapore and could be biased toward diabetics who visited the DSS centres for education, counselling and screening. However, the demographics of this study were similar to those in previous studies which showed a higher proportion of diabetics of Indian origin compared with the general population, and a preponderance of respondents above 50 years old.[38,39] Furthermore, the questionnaire did not specifically enquire whether the availability of the vaccines free of charge or at subsidised rates would encourage vaccination. A previous study among the elderly in high-risk groups reported that vaccine uptake rates increased considerably when the option of reimbursement for the cost of vaccination was included.[40] Further studies among diabetics, other high-risk groups and the general population in Singapore should be conducted to enable policy-makers and healthcare professionals to address the key aspects of this important issue, which, once better addressed, could help in preventing influenza outbreaks in the future.

In conclusion, the uptake of influenza vaccination among diabetics in Singapore is low. The lack of knowledge regarding the risks of influenza and the advantages of influenza vaccination is the main barrier to vaccination. Diabetics are known to be at high risk of complications from influenza, and efforts should be made to increase the uptake of the influenza vaccine in this population. Healthcare professionals, as the main initiators of healthcare education for patients, should increasingly educate and encourage influenza vaccination among diabetics.

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A/Prof C Rajasoorya	2000 – 2003
Prof Wilfred CG Peh	2004 – 2009
A/Prof Teo Eng Kiong	From 2010