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Uptake of influenza vaccination, awareness and its associated barriers among medical students of a University Hospital in Central Saudi Arabia

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ABSTRACT

Outbreaks of influenza epidemics are common but influenza vaccination is sub-optimal among the health-care staff including the medical students. The study aims to assess the rate of vaccine uptake among medical students, its associated barriers and levels of awareness. A cross sectional study was done at a University Hospital in Saudi Arabia on 421 medical students by self administered questionnaire from February to March 2015. The immunization rate of seasonal influenza vaccine was just 20.7% in 2015, while it was 57% for cumulative of previous three-year period. The intended uptake among those offered vaccination was 68%. The significant determinants of vaccine uptake were clinical years of medical study ($p < 0.05$) and previous history of vaccination ($p < 0.0001$). The major sources influencing vaccine uptake decision were health department guidelines, medical training, social and media influence. Barriers of vaccination constituted, assumption of not being at risk of influenza (37.9%), vaccine side effects (28.9%), questioned effectiveness of the vaccine (14.5%), and inability to allocate time (11%). Knowledge levels were unsatisfactory and males scored lower (5.4 ± 1.7) than females (6.5 ± 1.4) out of total score of 9. Both knowledge and uptake of annual influenza vaccination was inadequate. Policy makers can formulate strategies with a focus on larger coverage of medical students.

Introduction

Influenza is the commonest airborne infection that can be acquired. The term 'flu', as is widely known, causes a range of symptoms with severity depending on the virulence of the organism. The symptoms of influenza may vary from mild sickness like respiratory discomfort to death caused by pneumonia, congestive heart or lung failure. The susceptibility to acquire influenza increases among children, elderly and immuno-compromised, pregnant women, patients with other co-morbid conditions like chronic obstructive pulmonary disease, diabetes, kidney and liver disorders and among the health care workers, which are categorized as high risk groups. This highly contagious illness is transmitted through air borne route and may spread rapidly during seasonal epidemics affecting large population with reports of reaching pandemic proportions [1].

It is estimated that approximately 9% of the world's population is affected by influenza annually accounting to nearly one billion infections and three to five million severe cases, and deaths annually [2]. Considering the situation in developed nation like the United States, nearly 20% of the population is affected annually with around 225,000 hospitalizations every year [3]. Severity of illness, mortality rate and costs involved in management of influenza tend to escalate among high risk groups. The disease causes a huge economic burden on the national healthcare systems. It is estimated that the direct medical expenditure in US, for management of moderately severe seasonal influenza outbreak costs more than

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$10 billion [4]. Though not well documented, the burden of illness from influenza, its mortality and medical costs tend to be higher in low-middle income and developing countries. An astonishing figure of $3 trillion has been estimated as the cost incurred by a single pandemic of flu globally [5].

Since anti viral chemoprophylaxis is ineffective in management and control of influenza, the principal method of prevention is by means of immunization [6,7]. World Health Organization recommends that the high risk categories be immunized against influenza. Healthcare staff play a predominant role in transmission of infection from person to person—among patients, other healthcare staff and family members. Documented evidence from many research studies suggest that vaccination of healthcare staff considerably reduces the risk of cross transmission thereby limiting the spread of epidemic [8,9]. The Centre for Disease Control and Prevention strongly recommends annual vaccination program for all the healthcare staff—physicians, nurses, medical students, and other staff [10,11].

Saudi Arabia deserves greater attention as it serves as an abode for major pilgrimage center with an annual turnover of millions of pilgrims from around the globe. There is a high risk for transmission of infection posing major threat to the health of airport personnel, healthcare staff, security personnel and civilians. Hence Saudi Thoracic Society had issued guidelines recommending adoption of strict vaccination strategies [12]. Despite the recommendations, surveys conducted across some provinces reported lower awareness levels and lower uptake rate among the healthcare staff [13]. Data on vaccination uptake, its barriers and awareness levels is scanty and there is an urgent need to assess and review the situation in this challenging region. Medical students present a vital and a large subset of healthcare staff. Hence this study was performed with the objective of assessing the rate of vaccination uptake, identifying the associated barriers and factors influencing uptake decisions among the medical students in one of the largest tertiary care centre of the central region of Saudi Arabia so that the findings may aid in recommendations towards comprehensive coverage.

Methods

Cross sectional study design was used to accomplish the study objectives on 421 medical students enrolled at a tertiary care teaching hospital using random sampling method in the study period between February and March 2015. The questionnaire consisting of closed ended format was adopted from a previous study [14] and piloted on 20 students for suitable modifications. It was then self- administered to the study subjects maintaining anonymity to prevent introduction of any kind of bias. The purpose of study was briefed and written consent was obtained before administering the questionnaire. The components of the questionnaire were socio-demographic information, previous history of influenza vaccination, questions on knowledge related to influenza, determinants of vaccination denial and acceptance. The ethical clearance and approval was obtained by the Institutional Review Board.

The knowledge score was computed based on the responses given to questions on identifying priority groups for vaccination and mode of transmission of the disease. Each correct answer was awarded a positive score. A tricky and misleading question was retained from the model study [14] for determination of accuracy in choosing the right answers. Analysis was performed using Statistical Package for the Social Sciences (SPSS), version 21. (IBM; Armonk, New York). Mean and standard deviation were derived for scores and t test was applied as test of significance. Inferential statistics were analyzed to compute significance testing of differences in scores across gender, years of study and vaccine uptake using ANOVA. A p value of less than 0.05 was considered as significant.

Results

The study included 295 males (70%) and 126 females (30%) as study subjects. The mean age of male and female subjects was 21.5 ± 1.6 and 22.1 ± 1.2 years respectively. The subjects from clinical years of study (≥3rd year) contributed to the major proportion

Table 1
General characteristics of respondents.

Variables		Male N (%)	Female N (%)	Total N (%)
Gender		295(70)	126(30)	421
Age in years	(Mean ± SDSD)	21.5±1.6	22.1±1.2	
Year of study	1st year	51(17.2)	–	51(12.11)
	2nd year	65(22.3)	8(6.43)	73(17.34)
	3rd year	98(33.2)	30(23.8)	128(30.4)
	4th year	22(7.4)	35(27.7)	57(13.5)
	5th year	59(20)	53(42.0)	112(26.6)
Smoking status	Current regular	14(4.7)	–	14(3.31)
	Current Occasional	20(6.7)	10(7.3)	30(7.12)
	Ex-smoker	10(3.3)	2(1.58)	12(2.9)
	Never smoker	251(85.0)	114(90.4)	365(86.7)
History of Chronic illness	Asthma	21(7.1)	4(3.1)	25(5.93)
	Diabetes	1(0.3)	1(0.79)	2(0.47)
	Epilepsy	–	1(0.79)	1(0.23)
	Hypertension	4(1.3)	–	4(0.95
	Other	9(3.0)	15(11.9)	24(5.7)
Living with susceptible individuals	Under 16	174(58.9)	84(66.6)	258(61.2)
	Pregnancy	11(3.7)	7(5.5)	18(42.8)
	Over 65	54(18.3)	29(23.0)	83(19.7)
	Health care Professional	49(16.6)	34(26.8)	83(19.7)
	None of the above	78(26.4)	14(11.1)	92(21.9)
Seasonal flu Immunization Rate	Year 2015	67(22.7)	20(15.7)	87(20.7)
	Year 2014	42(14.2)	17(13.9)	59(14.01)
	Previous year	54(18.3)	41(32.5)	95(22.6)
	Never	132(44.7)	48(38.1)	180(42.8)
Vaccine offered group	Yes	196(66.4)	94(74.6)	290(68.9)
	No	99(33.5)	32(25.4)	131(31.1)
Any side effect	Yes	15(9.3)	13(16.6)	28(6.7)
	No	147(90.7)	65(83.4)	212(50.4)

Table 2
Determinants of vaccine uptake among those who are receiving the vaccine.

Variable		Receiving vaccine N (%)	Not receiving vaccine N (%)	P-value
Total sample = 421		Total: 241(57.2)	Total: 180 (42.7)	
Gender	Male	163 (67.6)	132 (73.3)	0.207
	Female	78 (32.2)	48 (26.6)	
Smoking status	Ever smoker	37 (15.3)	19 (10.5)	0.152
	Never smoker	204 (84.6)	161 (89.5)	
Year of study	1st year	27 (11.2)	24 (13.3)	0.508
	2nd year	24 (9.9)	49 (27.2)	0.0001*
	3rd year	75 (31.1)	53 (29.4)	0.712
	4th year	42 (17.4)	15 (8.3)	0.007*
	5th year	73 (30.2)	39 (21.6)	0.048*
Had Chronic Illness	Yes	33 (13.6)	20 (11.1)	0.430
	No	208 (86.3)	160 (88.8)	
Living with susceptible individuals	Yes	188 (78.0)	141 (78.3)	0.936
	No	53 (21.9)	39 (21.6)	
History of seasonal influenza vaccination	Yes	241 (100)	–	
	No	–	180 (100)	0.0001*

* *P*-value <0.05 is considered statistically significant.

of the sample. The general characteristics of the study subjects are shown in Table 1.

The results showed that a total of 241 subjects (163 males:78 females) responded 'yes' to the question on having ever taken vaccination in last three years. The rate was similar across the gender and did not reach any statistical significance ($p = 0.124$). The three year trend however did not demonstrate a steady pattern showing 22.6%, 14.0%, and 20.7% for the years 2013–2015 respectively for the study sample.

Out of the total sample of 421, vaccine was offered to 290 subjects (196:94; male: female), of which 198 (68.2%) accepted to take the vaccine and 92 (31.7%) declined. Thus the intended uptake rate was 68% when offered. Among those who were not offered the vaccine, 87 (66.4%) revealed that they would have taken the vaccine and the rest would have rejected the vaccine if offered.

The determinants of vaccine uptake were clinical years of study; 4th year ($p = 0.007$) and 5th year ($p = 0.04$) and previous history of vaccination ($p < 0.0001$). The uptake of vaccination was lowest among second year male students which reached level of statistical significance. Table 2 illustrates the details between two groups, those receiving the vaccine and those not receiving.

The foremost reasons given for acceptance of vaccine are; decreased likelihood of acquiring seasonal influenza (75.1%), to reduce transmission to patients (66.20%), and to decrease the likelihood of transmission to family members (59.60%). The main reasons for declining the vaccine among those offered were; not at risk of influenza infection (37.90%), worried about side effects (28.90%), questioned effectiveness of the vaccine (14.50%), and that they could not schedule/make the time to get vaccinated (11.03%). These constitute the barriers of vaccination. The two main sources of information that influenced the decision to get vaccinated, among male and female subjects were department of health guidelines (60.3%; 65.1%) and medical training (54.9%, 67.5%). The other reasons are depicted in Fig. 1.

Scores were computed for the knowledge based questions and the highest attainable knowledge score was 9. Female students obtained higher mean knowledge score of 6.5 ± 1.4 than the male students who attained a mean score of 5.4 ± 1.7. The difference in the mean knowledge score between gender reached statistical significance $p < 0.001$ by independent sample test indicating that female students fared better. The knowledge levels according to years of study was higher among the fifth year students in the overall sample (6.2 ± 1.6) and the lowest score was attained by second year students (5.1 ± 2) which again showed statistical significance of $p < 0.0001$ across all years of study by ANOVA. Within males the highest mean knowledge score was obtained by fourth year students (6.1 ± 1.7) and among females the third year students achieved the highest score of (6.9 ± 1.3). Multiple comparisons within the groups showed that mean scores were significantly different between all years of study ($p < 0.05$) among males and between third–fourth years among females. With the highest attainable score of 9, it can be said that both male and female respondents had achieved a mean score far lesser than the highest score which is suggestive of lack of adequate knowledge about influenza vaccination. The categories which reached statistical significance to the question on priority groups for receiving influenza vaccine were those aged >65 years ($p = 0.02$), pregnant women ($p = 0.006$), healthcare workers ($p = 0.009$) and those with chronic illness ($p < 0.0001$). To the other question on methods of transmission of influenza virus, the only option which reached the significance level was touching contaminated objects ($p = 0.002$), (Table 3).

Discussion

It is well established fact that influenza vaccination of medical students and other healthcare staff reduces the transmission of infection [15–17]. Influenza is given high priority in Saudi Arabia where numerous reports of different types of influenza outbreaks have occurred in recent years [18,19]. Hence by performing the study, we obtain the details of the rate of uptake of influenza vaccination along with its determinants, barriers and the knowledge levels which serve as a means to supplement data from an urban center.

The findings of the present study showed that uptake of influenza vaccination and knowledge about the vaccination was inadequate among the medical students. The medical students lacked knowledge about the perception of disease transmission and could not accurately identify the high risk groups for vaccination. It was surprising to note that male students had lower scores than their female colleagues' .The study found second year students to have the lowest rate of vaccination, the reason probably being not exposed to clinics. However the results are highly suggestive of poor compliance not only in the pre clinical but all years of study. Although there is scanty literature from Saudi Arabian region on the current topic, the existing published reports demonstrate similar results from the middle-eastern region. Al Shammari reported vaccination rates as low as 38% among healthcare professionals and enormously low knowledge levels wherein 75% were unaware of CDC's influenza vaccination guidelines [20]. While another study

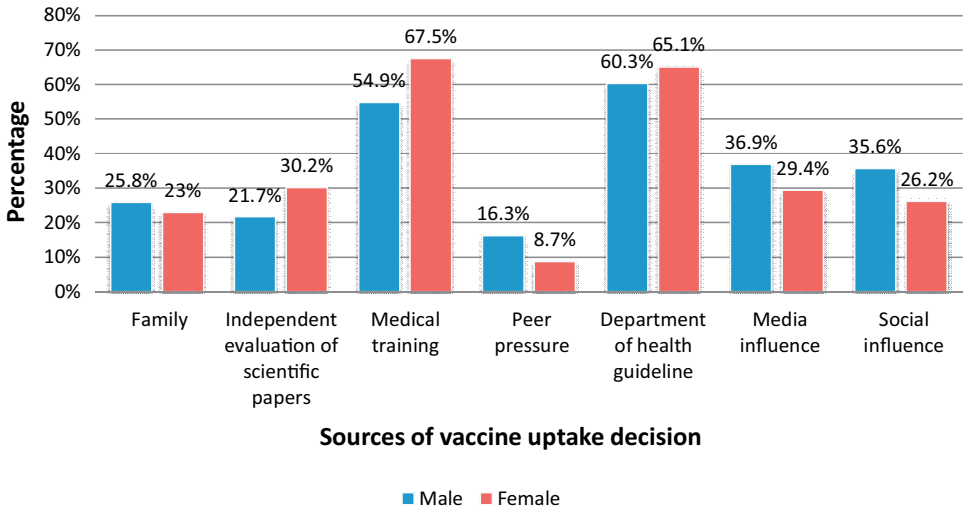

Fig. 1. Sources of information that influence vaccine uptake decision.

Table 3
Illustration of the knowledge of students who gave correct response for knowledge based questions on influenza vaccination.

Knowledge questions		Male N (%)	Female N (%)	
		295 (70)	126 (30)	*P-value*
Priority group receiving seasonal influenza vaccine	Over 65 years	192 (65)	101 (80.1)	0.002*
	Below 16 years	165 (55.9)	60 (47.6)	0.117
	Pregnant women	110 (37.2)	65 (51.6)	0.006*
	Healthcare workers	194 (65.7)	99 (78.6)	0.009*
	People with chronic health condition	164(55.6)	99 (78.6)	0.0001*
	Other	8 (2.7)	6 (4.7)	0.214
Methods of transmission of seasonal influenza virus	Cough/sneeze	273 (92.5)	122 (96.8)	0.095
	Consuming Infected meat**	18 (6.1)	5 (3.9)	0.378
	Direct contact with an infected person	151 (51.2)	76 (60.3)	0.085
	Touching contaminated object	109 (36.9)	67 (53.1)	0.002*
	Other	2 (0.6)	2 (1.5)	0.347

* *P*-value <0.05 is considered statistically significant.
** Tricky question.

reported that the vaccination rate was 24.7%, 67.2% and 46.4% in UAE, Kuwait and Oman, respectively and concluded that the vaccination rate among the health care workers was sub optimal in Middle Eastern region [21]. A European study highlighted the role of prevalence of low knowledge among its sample of medical students and concluded that lower knowledge levels along with decreased risk perception during early years of medical graduation studies are key determinants of lower vaccination rate [22]. Today's medical students are tomorrow's physicians, making it imperative that the students across all years of study be regularly exposed to the vaccination guidelines to facilitate improved awareness. It is also important that the translation of knowledge into practice becomes effective by integration of recommended methods to increase the uptake.

A significant point of discussion is the importance of identifying the factors that are responsible to the denial of vaccine uptake. Assumption of not being at risk and fear of side effects of vaccination were two major factors identified in the present study. Other reasons for denial were doubting the effectiveness of vaccine, lack of time and lack of information about the vaccine which constitute the barriers of vaccination hindering the accomplishment of mass coverage. Contemplating upon these findings, we realize that these are mere misconceptions which can be overcome by proper education and awareness campaigns. Many studies elicit similar reasons as barriers for immunization, in addition to needle phobia and lack of availability of vaccines [23]. A recent detailed systematic review of 470 articles on barriers of influenza vaccination published in 2017 generated a 4C vaccine hesitance model for various risk groups, reported past vaccination history influenced uptake while complacency and decreased confidence in vaccine constituted main barriers of pandemic vaccine uptake among the group of healthcare professionals [24]. Our findings also suggest the same which indicate consistency in our results thereby generating ideas for improved adequacy measures on awareness campaigns for those involved in the health systems. By addressing these issues, there can be a substantial improvement in achieving a higher vaccination rate. Some researchers have reported that the rate of vaccination coverage significantly increases after an effortful practical information campaign [25]. However, among the subjects who had previous history of vaccination, the study did not investigate the reasons for denying continuing annual vaccination in the following years.

Another issue of vital concern is the high intended rate for uptake of vaccination among those offered vaccines indicating that intense vaccination campaigns may have a positive impact on improving immunization rates. Nonetheless the study had obtained an unsatisfactory rate of mere 57% immunization over a period of three years which should be considered inadequate for the medical professionals.

An essential point of discussion is considering the factors influencing vaccine uptake decision that are highly influential like the training programs at the medical centers and guidelines issued by state department of health point towards the important role played by these factors while planning strategies for vaccination programs. Social and media influence turned out to be moderate sources influ-

encing decision which still can be roped- in by the policy makers. The results of this study provide valuable information for health policy makers to plan influenza vaccination programs and make recommendations at the national level. Both the barriers of vaccine uptake and the motivating factors for vaccination are inter-related and point towards one common source of action—focus on massive awareness campaigns followed by vaccination of the medical students.

More elaborate studies are needed in future taking a representative sample of population involving all health care workers from different medical centers across Saudi Arabian region to understand the level of knowledge, psychological and health related perspectives of influenza immunization. As this study is limited to a single source of sample population, generalizability is restricted. But the results can be considered to supplement the existing information which still has a marked potential to highlight the situation from an urban tertiary care centre prompting future assessment studies in smaller towns to facilitate comparison and formulate strategies for programs targeting larger coverage.

Conflict of interest

The authors state that there is no potential conflict of interest.

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Disclaimer

The views expressed in the submitted article are his or her own and not an official position of the institution or funder.

Contributorship

AMS, AMS, AKA, AMA, AMA and ABS participated in design of the study, reviewed the literature, obtained ethical clearance and collected data. ST and IG helped with design of study, analysis, interpretation, writing of manuscript and final review.

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