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ORIGINAL ARTICLE

Influenza Vaccine Coverage, Knowledge, and Attitude toward It among Egyptian Patients with Type 2 Diabetes Mellitus

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ABSTRACT

Background: Diabetes mellitus **(**DM) patients are prone to influenza infection. Seasonal vaccination is the most effective method to prevent influenza. Assessing the influenza coverage and the knowledge and attitude of patients toward it will help in raising the coverage and decreasing the complications.

Objectives: To detect the level of influenza vaccination coverage among people with type 2 diabetes mellitus (T2DM) and assess the knowledge about influenza infection and attitude toward influenza vaccine among those patients.

Methods: We conducted a cross-sectional study in the diabetes outpatient clinics at Zagazig University hospitals. The study included 327 diabetic patients. It took six months, from February to July 2023. A structured questionnaire was used to assess knowledge, attitudes, and practices regarding seasonal influenza vaccination and factors that may affect them.

Results: The mean age of participants was 55.2 years; most of them were female (63.3%). The vaccination coverage was only **23.9%.** Sufficient knowledge was reported (64.8%), and a positive attitude toward vaccination among those who had heard about it was reported (69.6%). The main cause of non-vaccination was that they didn't hear about the vaccine (67.8%), while the main cause of vaccination was a doctor's advice (62.8%). After logistic regression, sufficient knowledge and longer disease duration were found to be statistically significant predictors for vaccination (odds ratio 2.117, 1.081 respectively).

Conclusions: The influenza vaccination rate among T2DM patients is below the optimal level. Overall, knowledge and attitude toward the influenza vaccine among diabetic patients should be raised.

Keywords: Influenza vaccine; Type 2 diabetes mellitus;Egypt

INTRODUCTION

Diabetes mellitus (DM) is a major issue for world health. Egypt has the tenth-highest age-adjusted diabetes prevalence in the world, with 20.9% of adults aged 20 to 79 having the disease. [1]

Influenza viruses are a source of contagious respiratory disease. These viruses are easily transmitted through inhaling virus-laden aerosols, coming into contact with contaminated objects, and direct contact with sick people. It can result in a mild to extremely severe disease that manifests as an abrupt onset of fever, dry cough, musculoskeletal and joint pain, runny nose, sore throat, and headache. [2]

Patients who have type 2 diabetes (T2DM) are particularly vulnerable to influenza infection

and are at increased risk of hospitalization or influenza-related death. [3]

Numerous observational studies examining the influenza vaccine's efficacy in diabetes patients discovered that vaccination decreased hospital admissions linked to diabetes during outbreaks and decreased influenza-associated mortality. [4,5] The World Health Organization, the Centres for Disease Control and Prevention, the European Union, and the major diabetic groups advise individuals with type 2 diabetes to have an annual influenza vaccination. [6]

Although there is general agreement that individuals with type 2 diabetes should obtain influenza vaccinations, coverage differs by region, and, for the most part, the proportion of recipients falls short of ideal levels. [7] To the best of our knowledge, no research has been done to investigate influenza vaccination coverage among Egyptian patients diagnosed with type 2 DM. **So, the current study was done** to detect the level of influenza vaccination coverage among people with type 2 diabetes attending outpatient clinics at Zagazig University, in addition to assessing the knowledge about influenza infection and attitude toward influenza vaccine among those patients.

METHODS

We conducted a cross-sectional study in the diabetes outpatient clinics at Zagazig University hospitals. It took 6 months, from February to July 2023. The Institutional Review Board (IRB) at Zagazig University granted ethical approval through Letter Number 10259 dated January 1, 2023, and all study participants gave written informed consent.

Study participants were patients diagnosed with type 2 diabetes attending Zagazig University diabetes clinics. The sample size was calculated using open-epi software. Assuming the prevalence of acceptance of the influenza vaccine was 43.5% [2] and the target population was 2400, at a 95% CI and an effect size of 1, the estimated sample was 327 cases. A systematic random sampling technique was used to select the participants.

A structured questionnaire was developed to collect data in addition to asking about some sociodemographic and clinical data. The questionnaire included questions on knowledge, attitudes, and practice regarding seasonal influenza vaccination. **Practice questions** included ever having an influenza vaccine or not, we asked also about cause of having or refusing the vaccine and the frequency of vaccination if vaccinated. **Knowledge about influenza viral infection was assessed through** questions asking about nature of the infection; is it viral, is it preventable, is there a vaccine for it, is it contagious, is it seasonal, can it be complicated? Each question was answered with yes, no or don't know with 1 point given for each correct answer. The total score was calculated for each participant; score above 60 % is considered sufficient knowledge and below 60 is considered insufficient according to bloom's cutoff categories of knowledge scores.[8] **Attitude toward influenza vaccine was assessed through** questions asking about beliefs on vaccine effectiveness, safety, importance and specific importance for diabetics and about planning to have the vaccine next season. Questions were asked in the form of do you think that vaccine is important and the answers were either yes or no or don't know. One point is given for the positive answer (yes) and no points were given to no or don't know. Total score was calculated and scores above 80% considered positive, from 60 to less than 80 is considered neutral and below 60 is considered negative according to blooms cutoff categories of attitude scores.[8] The tool was tested by pilot and revised. Reliability of the tool was assessed by Cronbach alpha test and showed adequate reliability of 0.72.

STATISTICAL ANALYSIS

The statistical package for social sciences (SPSS), version 25, was used to analyze the data. [9] For quantitative data, mean ± standard deviations (SD) were used, and frequencies and percentages were used for categorical variables. The Chi-square test was used for categorical variables to compare the examined groups and the Chi square for trend test was used to compare ordinal data between two groups. For Quantitative data, the t-test was

employed to evaluate normally distributed data and Mann Whitney test was used to compare quantitative not normally distributed data between two groups. Factors impacting vaccination practice were predicted using binary logistic regression. $P < 0.05$ and $P < 0.001$ were designated as the levels of statistical significance and high significance, respectively.

RESULTS

The mean age of our study participants was 55.2 years; most of them were female (63.3%), and more than one third were illiterate (36.4%). Regarding clinical characteristics, all were type 2 diabetics with a mean duration of 8.7 years; the majority of them were on oral drugs (81.7%), always taking their treatment regularly (72.5%), and had diabetes complications (65.7%) and comorbidities (60.6%). **(Table 1)**

Regarding the knowledge, attitude, and practice of our participants, most of them showed sufficient knowledge of influenza infection (64.8%) and a positive attitude toward vaccination among those who had heard about it (69.6%). **(Table 2)**

However, a minority of participants received the vaccine, with vaccination coverage of only **23.9%.** The main cause of non-vaccination was that they didn't hear about the vaccine (67.8%), followed by the misconception that the vaccine is not important (10%) and practicing other ways of prevention (10%), while the main cause of vaccination was a doctor's advice (62.8%). **(Table 2, Figure 1).**

Regarding vaccination coverage, there was a statistically significant relationship between vaccination practice and each of the following: residence, education, treatment regularity, disease duration, knowledge, and attitude toward vaccine. Regarding residence, 31.7% of urban versus 20.4% of rural residence have received the vaccine with a p-value of 0.02. The vaccination coverage was significantly higher in university graduate (34.2%) than in illiterates, primary and secondary school graduates (16.8%, 21.4%, 27.4% respectively) with a p-value of 0.002. Also, those who always take their drugs regularly showed statistically significant higher levels of vaccination coverage compared with others who didn't (p value<001). **(Table 3)**

Moreover, vaccination coverage was significantly affected by knowledge of influenza infection and attitudes toward vaccination; individuals with sufficient knowledge had vaccination coverage of 31.6%, compared to just 9.6% in those with insufficient knowledge (p value <0.001). Vaccination coverage was found to be 52.7%, 52.6% for those with positive and neutral attitudes, respectively, whereas those with negative attitude showed no one had received the vaccine (p value: 0.002). **(Table 3)**

All significant factors in the univariate analysis entered the binary regression analysis. After controlling for other covariates, sufficient knowledge and longer disease duration were found to be statistically significant predictors of vaccination (odds ratio 2.117, 1.081, respectively). Treatment regularity also predicted vaccination practice, with odds ratios of 6.716, 1.828, and 0.560, respectively, for those who always, often, and sometimes take their drugs regularly. **(Table 4).**

Table 1: Sociodemographic clinical data (N= 327)

	Mean /SD	**Range**
Age	55.2 ± 12.1	22-75
Age of onset of diabetes	46.5±12.4	18-70
Disease duration	8.7 ± 8.3	0-28
	Number	**Percent**
Sex Male Female	 120 207	 36.7 63.3

Number	Number	Percent
Residence		
Urban	101	30.9
Rural	226	69.1
Education		
Illiterate	119	36.4
Primary	70	21.4
Secondary	62	19
University	76	23.2
Marital status		
Single	0	0
Married	219	67
Divorced	10	3.1
Widow	98	30
Treatment type		
Oral drugs	267	81.7
Insulin	60	18.3
Treatment regularity		
Always	237	72.5
Often	50	15.3
Sometimes	30	9.2
No	10	3.1
Presence of complications		
Yes	215	65.7
No	112	34.3
Presence of comorbidities		
Yes	198	60.6
No	129	39.4

Table 2: Influenza knowledge, attitude towards vaccination and vaccination practice among studied group

	Number	Percent
Knowledge of influenza infection (n=327)		
Sufficient	212	64.8
Insufficient	115	35.2
Attitude towards influenza vaccine (n=158)		
Positive	110	69.6
Neutral	38	24.1
Negative	10	6.3
Vaccination Practice (n=327)	78	23.9
Yes	249	76.1
No		
Frequency of vaccination (n=78)		
Yearly	60	76.9
Others (not regularly)	18	23.1

	Number	Percent
Cause of vaccination (n= 78)	49	62.8
Doctor advice	0	
Free obligatory vaccine	10	12.8
Friend advice	19	24.4
Recurrent infections		
Cause of Non vaccination (n=249)		
Didn't hear about vaccine	169	67.8
Vaccine is not important	25	10.04
Expensive	10	4.02
Fear of needles	0	0
Practice other ways	25	10.04
Previous Serious side effects	20	8.03

Table 3: Relation between sociodemographic, clinical data, knowledge, attitude, and vaccination practice

	Vaccinated (n=78)	Not vaccinated (n=249)	x2	P value
Sex				
Male (120)	30 (25%)	90 (75%)	0.137	0.711
Female (207)	48 (23.2%)	159 (76.8%)		
Residence				
Urban (101)	32 (31.7%)	69 (68.3)	4.93	0.026*
Rural (226)	46 (20.4%)	180 (79.6)		
Education				
Illiterate (119)	20 (16.8)	99 (83.2)		
Primary (70)	15 (21.4)	55 (78.6)	9.566^	0.002 *
Secondary (62)	17 (27.4)	45 (72.6)		
University (76)	26 (34.2)	50 (65.8)		
Marital status				
Married (219)	50 (22.8)	169 (77.2)	4.460	0.108
Divorced (10)	0	10 (100%)		
Widow **(98)**	28 (28.6)	70 (71.4)		
Treatment type				
Oral drugs (267)	199 (74.5)	68 (25.5)	2.089	0.148
Insulin (60)	10 (16.7)	50 (83.3)		
Treatment regularity				
Always (237)				
Often (50)	69 (29.1)	168 (70.9)	10.172^	<0.001**
Sometimes (30)	6 (12)	44 (88)		
No **(10)**	2 (6.7)	28 (93.3)		
	1 (10)	9 (90)		
Presence of complications				
Yes (215)	46 (21.4)	169 (78.6)	2.08	0.148
No (112)	32 (28.6)	80 (71.4)		

Presence of comorbidities Yes 198 No 129	 49 (24.7) 29 (22.5)	 149 (75.3) 100 (77.5)	0.221	0.638
Knowledge of influenza infection Sufficient (212) Insufficient (115)	 67 (31.6) 11 (9.6)	 145 (68.4) 104 (90.4)	 19.876^	 <0.001**
Attitude towards influenza vaccine (n=158) Positive (110) Neutral (38) Negative(10)	 58 (52.7) 20 (52.6) 0 (0)	 52 (47.3) 18 (47.4) 10 (100)	 5.224^	 0.022*
	Mean ±SD	**Mean ±SD**	**Test value**	**P**
Age	56.8 ± 9.3	54.6 ± 12.8	1.382^^	0.168
Age of onset of diabetes	45 ± 13.4	46.9 ± 12	-1.228^^	0.22
Disease duration	7.7 ± 7.8	11.8 ± 8.7	-3.922^^^	< 0.001**

^ chi square for trend (linear by linear association), ^^t test, ^^^ Mann Whitney test
*p<0.05 is statistically significant, **p<0.001 is highly statistically significant

Table 4: Binary logistic regression for the factors affecting vaccination among studied group.

	β	S.E.	Wald	p	AOR	(95% C.I.)	
						Lower	Upper
Tx Regularity (No)			18.528	<0.001**			
Tx Regularity (Sometimes)	-0.580	1.299	0.199	0.655	0.560	0.044	7.135
Tx Regularity (Often)	0.603	1.146	0.277	0.599	1.828	0.193	17.291
Tx Regularity (Always)	1.904	1.072	3.155	0.076	6.716	0.821	54.915
Sufficient Knowledge	0.750	0.304	6.100	0.014*	2.117	1.167	3.840
Duration	0.078	0.017	20.893	0.001**	1.081	1.045	1.117

Tx : treatment, *p<0.05 is statistically significant, **p<0.001 is highly statistically significant

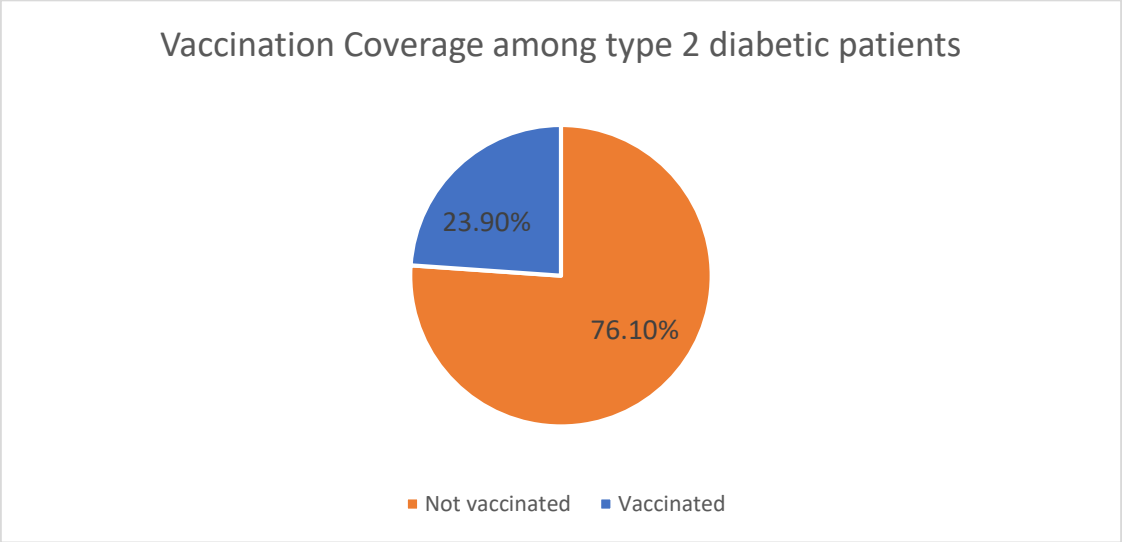

Figure 1: Vaccination coverage among the study group

DISCUSSION

DM is the fastest-growing comorbidity of the twenty-first century and a chronic health disease. Patients with diabetes are known to have weakened immune systems and to be more vulnerable to viral infections, especially respiratory infections, as a result of glycaemic fluctuations. [10] According to the World Health Organization (WHO), infections of the lower respiratory tract rank third globally in terms of causes of death. The likelihood of hospitalization for pneumonia is 1.2 times higher for those with type 2 diabetes. [11]

The primary strategy to lessen the severity of an infection is vaccination, both for the general public and for DM patients specifically. [12] Since protection from influenza is not permanent, annual vaccination is advised as the best line of defence. [13] Worldwide reports indicate that influenza vaccination rates are high among those with debilitating medical problems, such as diabetes mellitus. [12]

Numerous studies assessed vaccination attitudes and knowledge in addition to influenza vaccination rates. However, there are usually few studies examining the same within a specific population—diabetic patients—especially in developing countries.

The current study included diabetic patients with a mean age of 55.2 years; most of them were females, and more than one-third were illiterate (36.4%). The study focused on two main objectives: assessing the coverage of the influenza vaccine among those patients and assessing the knowledge and attitude toward the vaccine and the factors that may affect that.

Regarding vaccination coverage, just 23.9% of individuals in our study had received the vaccine. These findings were in line with those of a 2023 study conducted in Qatar by Thomas et al.,[14] which looked into the influenza vaccination coverage among individuals with diabetes mellitus and discovered that just 21.3% of them had received the vaccine. Furthermore, only 11.3% of participants in the Ahmed et al.[15] trial reported having received the seasonal influenza vaccine. A low vaccination rate was also found in Palestine, as described in Alawneh et al. study,[16] which found that only 27.2% of the participants had ever had a vaccination against influenza. Another study by Ko et al.[17] in Korea also reported a low vaccination rate in diabetic patients (36.5%).

A higher coverage rate was reported by a cross-sectional study conducted in Saudi Arabia by Alnaheelah et al.,[18] which found a coverage rate of 61% for seasonal influenza vaccination among type 2 diabetic patients. These higher rates were also reported by Galanos et al. study[19] in Greece, which revealed that T2D had vaccination rates reaching 62.1% for influenza. Furthermore, a study by Zamorano et al. [20] reported a coverage rate of 52.1% of the influenza vaccine among patients with diabetes in Spain.

Regarding our study, the main cause of non-vaccination was that they didn't hear about the vaccine (67.8%), while the main cause of vaccination was a doctor's advice (62.8%). These results agreed with Verger et al. study,[21] which found that among T2DM participants, healthcare providers' advice is the primary motivator for vaccination. In the same manner, Ahmed et al.'s[15] study found that respondents mentioned doctors as their primary source of influenza information (35.2%) and that receiving the vaccine was most frequently motivated by their recommendation (44.3%). This guarantees the crucial role that healthcare providers play in informing patients about the importance of vaccinations for their health and motivating them to get vaccinated. Similar findings were revealed by the Alnaheelah et al.[18] study, which found that healthcare providers' advice (84.7%) and individuals' perceptions of the value of vaccination (35.6%) were the most significant motivators for vaccination. Additionally, 73% of respondents cited fear of vaccine adverse effects as the biggest obstacle to immunization. According to Kunnuru et al.,[22] doctors and the media were the main sources of information about vaccinations (12.4% and 50.77%, respectively). Approximately 23.7% of patients showed concern about potential side effects from immunizations, and 1% of individuals reported having a needle phobia. The study by Alawneh et al.[16] reported that the majority of participants (85.3%) in their study had heard of

the influenza vaccine previously. According to the findings, the primary justification for not receiving an influenza vaccination was that the illness was not dangerous enough to warrant vaccination (67%). El Feky et al.[23] also found that the key barrier to vaccination was that they felt vaccination was unnecessary (66.2%) and that doctors and health educators in hospitals were the second source of participants' knowledge about the vaccine (33%) after social media.

Regarding the knowledge and attitude of our participants, most of them showed sufficient knowledge of influenza infection (64.8%) and a positive attitude toward vaccination among those who had heard about it (69.6%). However, there was a discrepancy between this high level of knowledge and attitude and low level of vaccination practice (23.9%). These results were consistent with the study of Alawneh et al. [16] in 2021, as about 69.9% of participants had good knowledge about influenza infection. Although nearly half of them (53.6%) believed that the influenza vaccine was safe, only 27.2% of participants had received a prior vaccination. Another study by Jiang et al. [24] also found a gap between positive attitude (57.3%) and vaccination uptake (22.3%).

This is in contrast with Kunnuru et al. cross-sectional study,[22] which showed that only 4.1% of participants had knowledge of influenza infections. Approximately 98.7% of patients were unaware that immunizations were necessary and readily available. Influenza vaccinations were administered to only 0.5% of patients. Also, ElFeky et al.[23] assessed adult population knowledge and attitudes in Riyadh and found that the majority of participants in all groups had inadequate knowledge. Merely 15.6% of those involved had received vaccinations this year.

Another study by Alhatim et al.[25] showed that 64.5% of participants had good knowledge about influenza infection. In addition, only 52% of individuals scored positive attitudes regarding the seasonal influenza vaccination. There was an increase in vaccination coverage among those who had previously been vaccinated because they exhibited considerably greater levels of knowledge and more positive attitudes.

Regarding vaccination practice in our study, it was significantly affected by education level. This is consistent with Jiang et al.,[24] who found that those with a lower educational level were less likely to be vaccinated. Also, Alnaheelah et al.[18] reported a significant association between non-vaccination and illiteracy (OR = 1.93).

There was no statistically significant relationship between vaccination practice and both age and sex distribution in our study (25% of males and 23.2% of females). This is also similar to the results of the Thomas et al. study,[14] which revealed that vaccinated males were 17.3% and vaccinated females were 25.3%. But unlike the current study, the study by Ko et al.[17] illustrated a significantly higher age in the vaccinated group than that in the unvaccinated group. In the diabetic group under 65 years old, the vaccination rate was higher in women.

Moreover, our study reported that vaccination coverage was significantly affected by knowledge of influenza infection and attitudes toward vaccination; individuals with sufficient knowledge had vaccination coverage of 31.6%, compared to just 9.6% in those with insufficient knowledge (p value <0.001). Sufficient knowledge was found to be a statistically significant predictor of vaccination (OR 2.1). These results agreed with the study of Alnaheelah et al.,[18] as the study reported a significant association between non-vaccination and poor influenza and its vaccine knowledge. The study by Ko et al.[17] revealed that in diabetic patients, the vaccinated group had significantly higher awareness than the unvaccinated group.

This can be explained by the fact that people's mental and physical health are greatly impacted by their educational attainment. Compared to illiterate people, educated participants are better able to receive, comprehend, and be motivated toward vaccination messaging.[26]

The current study also revealed that regularity in taking medication is positively associated with higher incidence of vaccination with odds

ratios of 6.716, 1.828, and 0.560, respectively, for those who always, often, and sometimes take their drugs regularly. This can be explained by that patient who are regular on their treatment are committed persons who usually keen on any doctors' instructions on preventive measures as influenza vaccine. These results agreed with the study of Ko et al. [17] and Lee et al. [27] which illustrated that good glycemic control (which is a result of adherence to treatment and doctors' instructions) is associated with more administration of influenza vaccine.

The main limitations of our study were the relatively small sample size that was selected from one medical center, which makes generalizing the results to all diabetic patients difficult. Also, the cross-sectional design, which gives only association, does not prove it.

Conclusion:

The influenza vaccination rate among T2DM patients is below the optimal level. The main cause of vaccination was a doctor's advice (62.8%), and the main cause of non-vaccination was that they didn't hear about the vaccine (67.8%), which highlights the need for more counselling about the effectiveness of the influenza vaccine. Sufficient knowledge and treatment regularity were among the predictors of vaccination practice.

Overall, knowledge and attitude toward the influenza vaccine among diabetic patients should be raised. We recommend the implementation of educational programs at the level of primary health care and family health care centres to raise awareness and encourage influenza vaccination among T2DM patients.

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