

ASSESSMENT OF THE PREVALENCE OF INFLUENZA IMMUNIZATION AMONG DIABETIC PATIENTS ATTENDING PRIMARY HEALTH CARE CENTER IN MAKKAH AL-MOKARRAMAH 2019

Raghad Jameel Alhajaji¹, Atef Mohammad Raffa², Turki Abdulqader Dawaji², Asmah Ali Miswak³, Haneen Mohammad Alshamrani⁴, Abdulrahman Ahmad Alshamrani⁵, Wael Abdulqader Gamloo⁵, Juman Maid Albajaly⁶, Fahad Abdulmukrem Alsulami², Raeed Mustafa Rommani¹.

¹Family Medicine specialist, Almaabda primary health care, Saudi Arabia.

²Management of health services and hospitals, Directorate of Health Affairs in Makkah, Saudi Arabia.

³Dental hygienist, Directorate of Health Affairs in Makkah, Saudi Arabia.

⁴Information Technology, Directorate of Health Affairs in Makkah, Saudi Arabia.

⁵General nursing, Directorate of Health Affairs in Makkah, Saudi Arabia.

⁶Nursing Specialist, Directorate of Health Affairs in Makkah, Saudi Arabia.

ABSTRACT

Background:

Influenza is a seasonal epidemic with main symptoms that include fever, cough and muscle aches. Fever is a big distinguishing component between a cold and influenza. Some other common symptoms which may or may not be seen with a cold as well are headache, chills, loss of appetite, fatigue and sore throat. Diabetes, influenza is a significant burden on the healthcare systems. A significant issue and a significant big health concern happen every year is looking how we could mitigate and manage it and obviously take the burden off the health care system. Diabetic patients, as other chronic diseases patients, could catch the influenza infection, which is a respiratory infection caused primarily by influenza A and Influenza B. Diabetes Mellitus (DM) is a major health problem worldwide. It is a number of metabolic disturbances that is characterized and identified by the presence of hyperglycemia in the absence of treatment.

Aim of the study: to assessment of the Prevalence of Influenza Immunization among Diabetic Patients attending Primary Health Care Center In Makkah Al-Mokarramah,2019.

Methods: A Cross-sectional analytical study was carried out in the city of Makkah among diabetic patients attending Primary Health Care Center during the October to December 2019, the Sample size patients participants. Our total participants were (300).

Results: shows the majority of participant (39.5%) have average level of total attitude of diabetic patients towards seasonal influenza vaccination followed by (29.5%) of participant weak while Range(7-19) and Mean \pm SD(13.065 \pm 3.822), χ^2 11.59 P=0.003. **Conclusion:** Undermining the effect of influenza and misconceptions on the effectiveness of the vaccine could much be improved by increasing awareness and knowledge, seasonal vaccination among diabetics in KSA is low. Level of knowledge and perception are the main barriers to vaccination. Health care provider's advice may be an important key predictor of previous influenza vaccination and they should continue to educate and encourage all diabetics to get vaccinated for influenza at least once yearly.

Keywords: assessment, prevalence, influenza, immunization, diabetic, PHC, Makkah Al-Mokarramah

1.Introduction

Diabetes Mellitus (DM) is a major health problem worldwide[1]. Influenza is a serious vaccine-preventable disease, ranked among the top 10 infectious diseases affecting the Canadian population.1 Influenza is a frequent cause of outbreaks in acute and long-term care facilities; approximately 3,500 Canadians, mostly seniors, are estimated to die from influenza or its complications annually.2,3 Immunization is one of the most effective tools to prevent influenza; despite national recommendations, only 32.5% of Canadians and 48.8% of Nova Scotians aged 12 or older received their annual influenza vaccine.[2]

Diabetes and influenza obviously is a big problem that diabetics are at a high risk of complications, everything from hospitalizations to death, and generally a lot of it is they have multiple core movement conditions, maybe Chronic Obstructive Pulmonary Disease (COPD), hypertension, renal disease, all of which can be exacerbated by an influenza infection.[3] More recent literature reported that people with diabetes are at an increased risk of Ischemic events, such as heart attacks and strokes[4]. Diabetic patients who get an influenza infection for about seven days post the infection, they are at a six times increased risk of having a myocardial infarction or a stroke and it is thought to be because of an abrupt increase in inflammation [5], ultimately leads to that increased risk of them potentially having a heart attack or a stroke [6]. In addition, some of the other reasons why people with diabetes are a little bit more at higher risks to develop influenza and having complications are because of the

abnormal glucose metabolism[7]. So, having diabetes seems to cause a bit of a dysfunction in terms of our white blood cells, so affects the ability of the WBCs to collect up and swallow foreign invaders.

DM (Diabetes Mellitus) patients are considered a higher risk group to develop influenza infection, and this increases the risk of hospitalization. According to the American Diabetic Association (ADA), annual influenza vaccination for all individuals with diabetes recommended, because it is effective, safe, and mitigates influenza-related complications, hospitalizations, and deaths in these patients[8]

People with diabetes, even when well-managed, are at high risk for serious flu complications, often resulting in hospitalization and sometimes even death. Sinus infections and ear infections, Pneumonia, bronchitis, are examples of flu-related complications. Worldwide, these annual epidemics are estimated to result in about 3 to 5 million cases of severe illness and approximately 250 000 to 500 000 deaths.[9] In our country, seasonal outbreaks occur mainly during winter, while in tropical regions, influenza may occur throughout the year, causing outbreaks more irregularly.

However, to decrease this risk of influenza infection in DM patients, annual influenza vaccination of people with DM is recommended by WHO (World Health Organization), CDC (Centers for Disease Control and Prevention), and ADA. It is considered the most efficient method to prevent infection and severe outcomes caused by influenza viruses.[1,4,19]

1.2 Literature Review

A descriptive cross-sectional study published in Human Vaccines and Immuno-therapeutics journal at 2013. Jimenez-Trujillo, et al. conducted a study about (Influenza vaccination coverage rates among diabetes \geq 50 years from 2003 to 2010 in Spain). They assess influenza vaccination status by a question (yes or no). The Influenza vaccination coverage among adults with diabetes in 2010 was 65.0% (95% CI: 62.1–67.7) compared with 41.2% (95% CI 40.0–42.4) for those without diabetes. In 2003, the vaccine uptake among adults with diabetes was 61.4% and in 2006, it was 63.8%. However, the levels of influenza vaccination coverage are below desirable levels among adults with diabetes in Spain [11].

In Saudi Arabia, MOH (Ministry of Health) recommends that international pilgrims be vaccinated against seasonal influenza with most recently available vaccines before arrival. Particularly those at increased risk of severe influenza disease including children aged over five years, pregnant women, the elderly, and individuals with pre-existing health conditions such as asthma, DM, chronic heart and lung diseases and HIV/AIDS infection[12]

In Saudi Arabia, Haridi et al (2017) reported that despite the high level of knowledge regarding influenza vaccination, there is a low level of practices among the Saudi community members. In a more recent study by El Khoury et al., (2015), the findings of the study revealed that there is a very low rate of influenza vaccination among Saudi community members, which highlights the urgent need for a comprehensive awareness campaign targeting different categories of the community. Despite the availability of different studies that assessed the level of knowledge, awareness and practices related to influenza vaccination in Saudi Arabia,[13,14]

There is no recent data investigation in Makkah estimating the prevalence of influenza vaccination among DM patients. So, this study is conducted to assess the prevalence of influenza vaccination among DM patients.

Ministry of Health, 2021 reported that pointing out that influenza vaccination seasonality does not prevent infection with the emerging corona virus, but rather reduces the possibility of infection by a large percentage.[15] The results of the present study are similar to the findings of Abu-Rish et al., (2016) who found that Jordanian adults have a good level of knowledge about seasonal flu and vaccination. However, the context of the two studies is different as our study focused on adult diabetic patients.[16] On the other hand, the results of the present study are inconsistent with the findings reported by Olatunbosun et al., (2017) who found that South African diabetic patients had low level of knowledge regarding the seasonal flu and seasonal influenza vaccination. Furthermore, this high level of knowledge regarding seasonal flu and positive attitudes among diabetic patients towards seasonal flu vaccination might be referred to the activation of different communication channels to increase the diabetic patients' knowledge and awareness regarding seasonal flu vaccination. This is evidenced by the results indicated that physician's advice, fellow patient's advice, public awareness campaigns and other methods were the influencing factors that motivated the diabetic patients to take the seasonal flu vaccine.[17]

Another study carried on Spain, conducted a cross-sectional study in 2016, about (vaccination practices in patients with diabetes) involving 279 patients with diabetes attending a Primary Care Center. The prevalence of patients vaccinated for seasonal influenza was 40%. Regarding believes and attitudes for vaccination, a total of 67 (24%) of the patients did not believe in the effectiveness of the vaccination or feared side effects. However, there were only 4 (1%) patients who experienced mild adverse reactions to influenza vaccination.[18]

1.2 RATIONALE

Pneumonia is the most common complication of influenza that occurs. When the lungs become infected by bacteria then secondary bacterial pneumonia may occur .Other rarer complications may occur, such as spread of the virus to cause disease in the heart, muscles or brain. Influenza is one of the most common respiratory illnesses affecting people of all age groups worldwide. Those patients with chronic diseases including DM

patients are at a higher risk for influenza and influenza-associated complications when compared with healthy individuals. Up to the researcher knowledge, there were no local studies of influenza vaccination among people with DM. Makkah Al-Mokarramah was chosen because pilgrims come to Makkah from all over the world every year to perform Hajj, which may lead to an increase in the prevalence of influenza.

2. Aim of the study

To assessment of the Prevalence of Influenza Immunization among Diabetic Patients attending Primary Health Care Center In Makkah Al-Mokarramah,2019

.21. Objectives:

- To assessment of the Prevalence of Influenza Immunization among Diabetic Patients attending Primary Health Care Center In Makkah Al Mokarramah,2019
- To assessment of the factors associated with the success rate of influenza vaccination among diabetic patients attending the same center.2019

3. Methodology

3.1 Study Design

A Cross-sectional analytical study

3.2 Study area

The study was carried out in the city of Makkah Al-Mokarramah (the Holy capital of Saudi Arabia) which is located at the center of the Western Region of Saudi Arabia, contains a population around 1.578 million . It has a holy value for all Muslims worldwide who travel to it annually to perform Hajj and to visit the Holy Masjid and Kaaba towards which Muslims turn in prayers. The city has seven sectors of PHC divided into three inners and four outers (Al-Zahir, Al-Adel, Al-Kakyeea, Al-Sharaee, Al-Jamom, Al-Kamel, and Kolese). Each sector consists of a group of Primary Health Care Centers. The researcher is concerned with one of the inner PHC of Al-kakyeea sector called " Al-Zahir PHCC".

3.3 Study Population

The study was conducted among DM patients attending Al-Zahir PHCC in Makkah Al-Mokarramah, during the period of study in 2019 .

Selection criteria:

3.4 A- Inclusion criteria:

- All adult DM patients.
- Both males and females.
- All nationalities.

3.5 Exclusion criteria:

- Age < 18
- DM with impaired cognitive functions

3.6 Sampling technique:

The researcher used Multi-stage random sampling technique, giving each sector code number from one to seven (1- Al-zahir, 2- Al-adel, 3- Al-kakyeea, 4- Al-sharaee, 5- Al-jamom,6- Al-kamel, 7- Al- Kolese). After that, by using random number generator, the minimum number was one, and the maximum was seven, the generation number was three which is Al-kakyeea sector. Then simple random sampling technique was applied to select the PHCC from Al-Kakyeea sector (1- Al-Kakyeea, 2- Al-Khaldya, 3- Al-Hejra,4- Al-Eskan,5- Al-Masflah, 6-Al-Nakash, 7-Alhilar Alahmer, 8-Al-Heglah, 9- Al-Hndaweeah, 10- Um-Alrakah, 11- Al-Khadhra) the given number was 4 " Al-Eskan PHCC". Also, convenience sampling technique was utilized to select the participants in the study.

.37 Data collection tool:

Self-administered questionnaire was used for data collection, validated from the previous study's published , after permission was taken through email from the researcher, with some modification and preamble letter was issued to explain the aim of the study, request to participate, and appreciation for a response. Then, the questionnaire was validated by three consultants. After that, it was translated to Arabic language and validated again by three consultants. The questionnaire consists of three sections:

Section A: Socio-demographics.

Section B: Attitude towards seasonal flu and influenza vaccine.

Section C: Reasons for accepting or reasons for refusing flu vaccine .

Responses to attitude questions were scored in the way that, the highest the score, the more positive the attitude towards seasonal influenza vaccination and vice versa. Then, the total score for each participant was computed and its median vale was identified (it was 8). Patients scored at median or above were regarded as having "positive attitude" whereas those scored below the median were regard as having "negative attitude".

Reliability:

The researcher tested the reliability by retesting 10% of participants to compare the answers. An average coefficient of correlation of 0.89 has been achieved which is accepted.

3.9 Data collection technique:

After the arrival of the patient to the PHCC, they should go to the reception first to register and ensure the presence of the center's card. Then, the receptionist gives a number to every patient who waits until called by the nurse to detect the vital signs. During that period of waiting the researcher will select patient conveniently until the target number achieves and gives the questionnaire for answering after taking the consent.

3.10 Study variables:

3.10 a- Dependent variable: Influenza immunization status

3.10 b-Independent variables: Age, gender, marital status, educational level, occupation, home/living, reasons for accepting flu vaccination, or reasons for refusing.

3.11 Data entry and analysis:

The Statistical Package for Social Sciences (SPSS) software version 22.0 was used for data entry and analysis. Descriptive statistics (e.g., number, percentage) and analytic statistics using Chi-Square tests (χ^2) to test for the association and the difference between two categorical variables were applied. A p-value ≤ 0.05 was considered statistically significant.

3.12 Pilot study:

A pilot study was conducted in one PHCC in the same sector due to the similarity to the target group using the same questionnaire to test the methodology of the study. As a feedback, the questionnaire was clear and no defect was detected in the methodology.

3.13 Ethical considerations:

- Permission from the Makkah joint program of family medicine was obtained.
- Permission from the Directorate of Health Affairs of the Holy Capital Primary Health Care was obtained.
- Verbal consents from all participants in the questionnaire were obtained.
- All information was kept confidential, and results will be submitted to the department as feedback.

3.14 Relevance:

- This study was carried out to assess the prevalence of influenza immunization among DM patients in "Al-Zahir PHCC".
- At the end of this study we are able to identify some factors associated with the success rate of influenza vaccination among DM patients in "Al-Zahir PHCC".

3.15 Budget: Self-funded

4. Result

Table 1: Distribution of socio-demographic characteristics of diabetic patients in primary health care center, Makkah Al-Mokarramah(n-200)

Age		
Mean±SD	11.18	
Gender		
Male		
Female		
Marital status		
Single		
Married		
Divorced		
Widow		
Level of education		
Less than secondary		
Secondary		
University		
Postgraduate		
Home/living		

he		
n spouse and children		
n parents		
ation		
king		
working		
ion of diabetes mellitus (years)		
ge		
n±SD	20.540	

The study included 200 diabetic patients, table 1 show the remaining socio-demographic characteristics of the diabetic patients. Their age ranged between <60 and >60 years most of participants >60 were (71.0%) with Mean±SD (68.45±11.18) and Range (53-81)years, More than half of them (65.0%) were males. About two-thirds were married (70.2%). More than one-third of the participants were either less than secondary (42.0%) or secondary school educated (35.0%). Almost two-thirds of them (55.0%) live with spouse and children whereas (30.0%) live alone. Approximately half of them (70.0%) were not working, the duration of diabetes was >10 years were(40.0%) or between 5-10 years were patients (38.0%) while ranged between 4-40 and Mean±SD(39.58±20.540)

Table 2: Distribution of reasons for accepting flu vaccination among adult diabetic patients

ing flu vaccination		
ns for accepting flu vaccination (n=110)		
tor told me it's important		
as free of charge		
ent/friend told me it's effective		
rmation from mass media		
lth awareness within the health center		
ns for refusing flu vaccination (n=90)		
not necessary because flu is just a minor illness		
cern about vaccine's side effects		
ef that the vaccine was not effective		
of needles and injection		
getting		

Regarding the receiving flu vaccination the majority of participant . Not received were(55.0%) among patients accepting flu vaccination(n=110) , the main reasons were doctor told me it's important (66.36%) and health awareness within the health center (54.55%). While reasons for refusing flu vaccination (n=90) the majority of participant Concern about vaccine's side effects were(44.44%) followed by It is not necessary because flu is just a minor illness were(37.78%).

Figure (1): Distribution of reasons for accepting flu vaccination among adult diabetic patients.

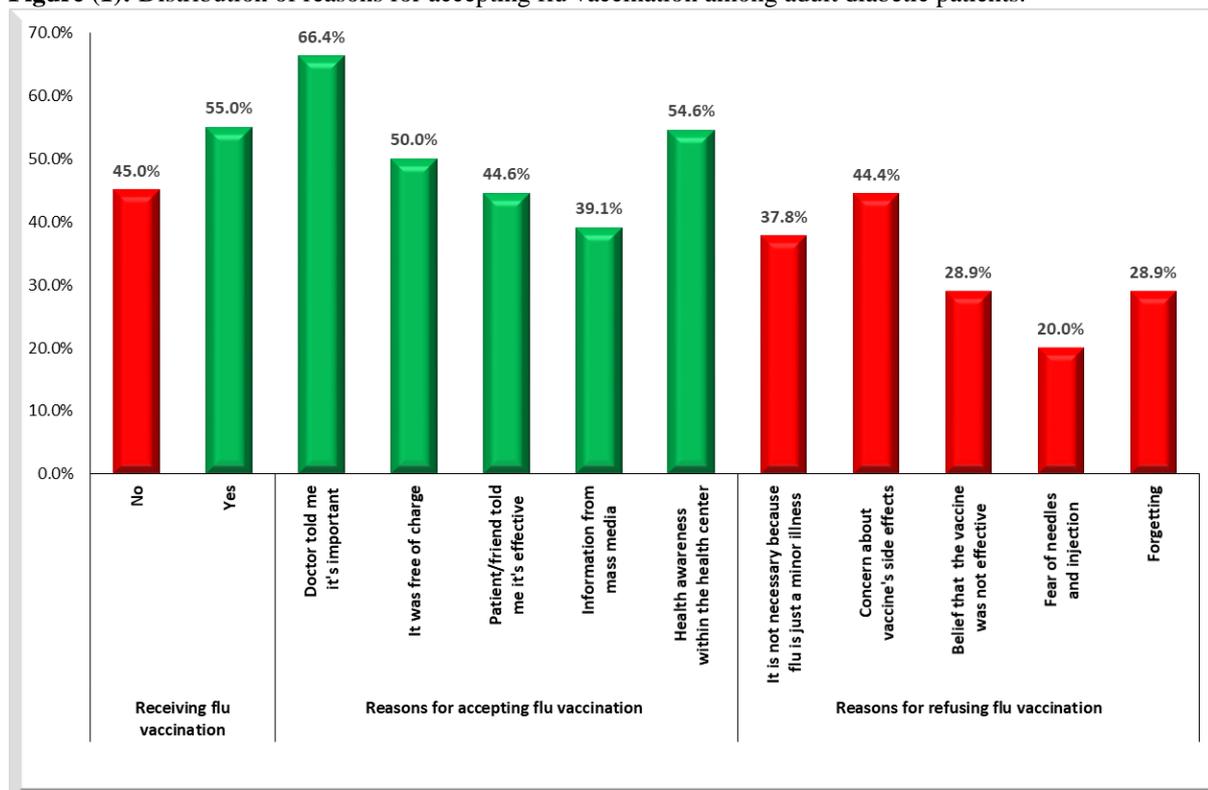


Table 3: description of attitude of diabetic patients towards influenza vaccination

	s flu vaccination			Agreement	Share	
	Disagree	Agree	Strongly agree		Disagree	Agree
Influenza vaccination is important among diabetics and should be taken						
Influenza vaccine prevent serious complication among diabetics						
Influenza vaccine has serious side effect and therefore should not be taken						
All diabetics should receive influenza vaccine						
Flu is a mild illness and therefore vaccination is not necessary						
I don't need the flu vaccine because I have immunity against flu						
If I believe that the flu vaccine is an effective vaccine to prevent flu, I will take it						

Table 2 shows all the items is had attitude a statistical significant relation towards flu vaccination while P=0.001, that more than half of the diabetic patients (65.0%) agreed that Influenza vaccination is important among diabetics while Chi-square X^2 (91.000), the majority of the participants (55.0%) agreed that all that Influenza vaccine prevent serious complication among diabetics while Chi-square X^2 (50.920) On the other hand, 98 patients (49.0%) disagreed that Influenza vaccine has serious side effect and therefore should not be taken while X^2 (24.520), 90 patients (45.0%) agree that All diabetics should receive influenza vaccine while X^2 (19.000), 90 patients (45.0%) agree that Flu is a mild illness and therefore vaccination is not necessary while X^2 (37.480), 88 patients (44.0%) disagreed that they don't need the flu vaccine because they

have life immunity against flu while X^2 (16.120) and 100 patients (50.0%) there is an effective vaccine to prevent flu, I will take it while X^2 (28.000)

Table 4: Distribution of the total attitude of diabetic patients towards seasonal influenza vaccination

Attitude		
ge		
	+SD	± 3.822
quare		
	e	

This table shows the majority of participant (39.5%) have average level of total attitude of diabetic patients towards seasonal influenza vaccination followed by (29.5%) of participant weak while Range(7-19) and Mean \pm SD(13.065 \pm 3.822), X^2 11.59 P=0.003

Figure (2): Distribution of the total attitude of diabetic patients towards seasonal influenza vaccination

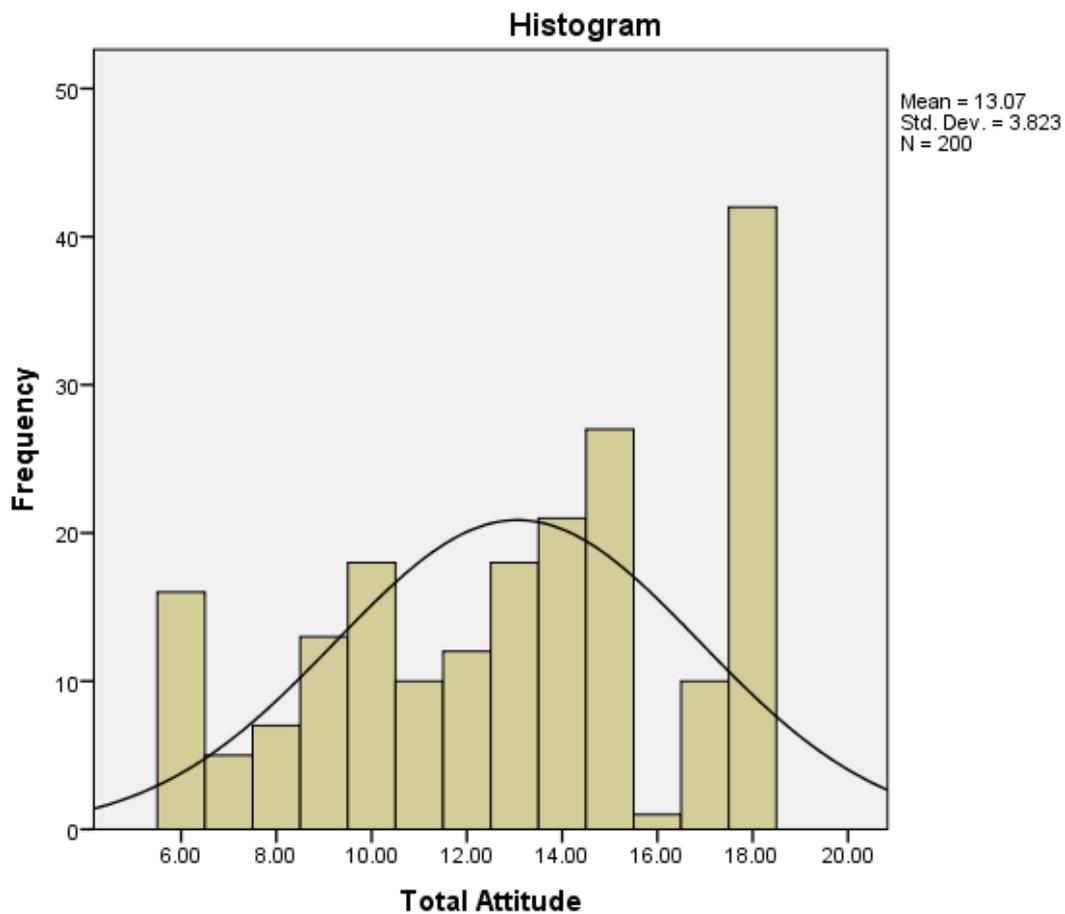


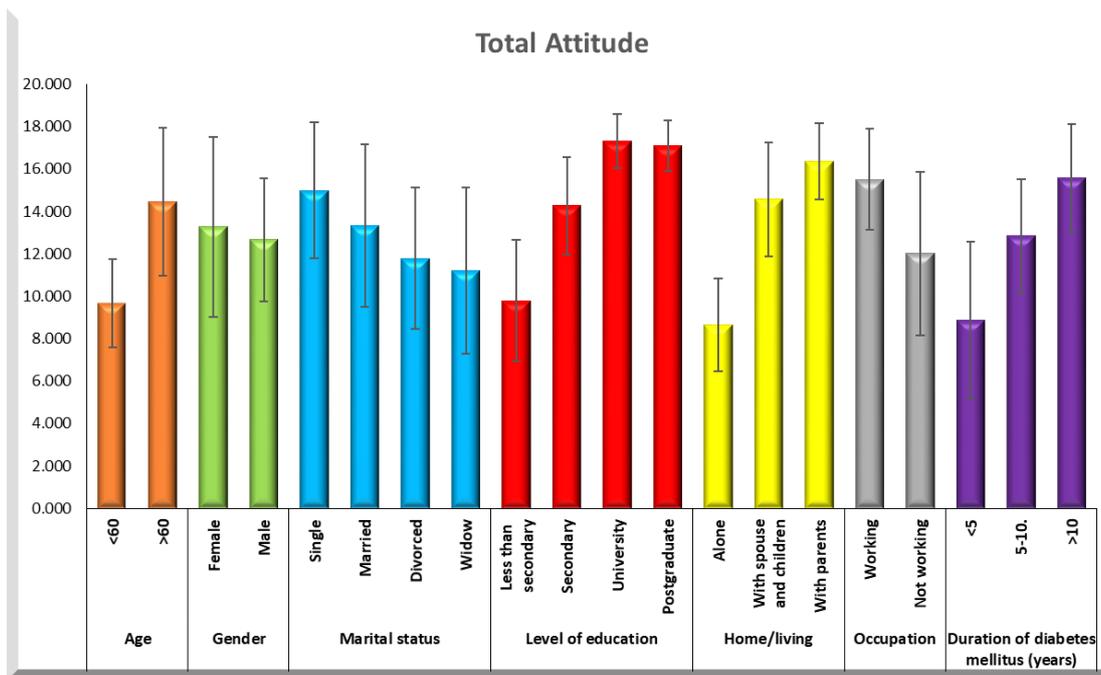
Table 5: Distribution of the associated of the total attitude of diabetic patients towards seasonal influenza with socio-demographic factors with vaccination .

		Attitude	VA or T-test	
			Value	Significance
			4	
Gender	Female			
Marital status	Married			
	Unmarried			
Level of education	Primary		2	
	Secondary			
	University			
	Postgraduate			
Home/living	With spouse		6	
	With children			
	With parents			
Occupation	Not working			
	Working			
Duration of diabetes mellitus (years)	<10			
	10-20			
	>20			

Table 5 shows regarding The age and total attitude towards influenza vaccination who had a significantly while $T=-11.904$ and $P=0.000$, increase in age >60 were $Mean \pm SD(14.451 \pm 3.492)$ also regarding marital status and total attitude towards influenza vaccination who had a significantly while $F=4.262$ and $P=0.006$ increase in married were $Mean \pm SD(13.329 \pm 3.817)$, regarding level of education and total attitude towards influenza vaccination who had a significantly while $F=105.942$ and $P=0.000$ increase in university were $Mean \pm SD(17.308 \pm 1.289)$, regarding Home/living and total attitude towards influenza vaccination who had a significantly while $F=148.116$ and $P=0.000$ increase in parents were $Mean \pm SD(16.367 \pm 1.810)$, while occupation and total attitude towards influenza vaccination who had a significantly while $T=7.842$ and $P=0.000$ increase in working were $Mean \pm SD(15.517 \pm 2.369)$ and duration of diabetes mellitus (years) and total attitude towards influenza vaccination who had a significantly while $T=77.013$ and $P=0.000$ increase in <10 years were $Mean \pm SD(15.575 \pm 2.530)$

Other factors gender and total attitude towards influenza vaccination who had not significantly while $T=1.193$ and $P=0.234$ increase in female were $Mean \pm SD(13.277 \pm 4.235)$

Figure (3): associated of the total attitude of diabetic patients towards seasonal influenza with socio-demographic factors with vaccination



5. DISCUSSION

The present study aimed at assessment of the Prevalence of Influenza Immunization among Diabetic Patients attending Primary Health Care Center In Makkah Al-Mokarramah 2019. The outcome of this research showed that a high majority of the participating diabetic patients were not aware of the details about this infection as the majority of them reported that it is a viral infection, which could be transmitted from one person to another and could be prevented. In addition, a great majority of the participating diabetic patients showed average knowledge regarding the difference in severity of seasonal flu between diabetic and diabetic individuals, which is evidenced by reporting that seasonal flu symptoms and complications might be more serious among diabetic patients.

It has been reported that diabetic patients, even well controlled are 3 to 6 times more likely to be hospitalized as a result of influenza complications, particularly pneumonia than others and death rates among them increase between 5 and 15% during epidemics of influenza [19, 20]

In a retrospective cohort study carried out in Taiwan (2013), the vaccinated elderly diabetic patients had lower incidences of pneumonia and respiratory failure compared with the non-vaccinated patients. Additionally, they had an 11% lower hospitalization rate than the non-vaccinated patients. Moreover, they were less likely to be admitted to the intensive care unit (ICU) [21]

More than half of diabetic patients in the present study perceived Influenza vaccination as an important tool for diabetics and should be taken yearly. This positive attitude was associated with higher uptake of the vaccine. Similarly, in South Africa [17], uptake of influenza vaccine was higher among diabetic patients who had better perception that influenza can be prevented and believe that it is an effective vaccine. Therefore, it is recommended to improve awareness of diabetics regarding the importance of influenza vaccination to reduce morbidity and mortality in this vulnerable group[21]. The effectiveness of the seasonal influenza vaccine depends mostly on characteristics of patients, whether there is matching between the circulating viruses and the viruses contained in the vaccine, and finally on the types and subtypes of influenza virus.[22, 23]

In a systematic review carried out in 2015, influenza vaccination prevented all-cause hospitalization with vaccine effectiveness of 58% and hospitalization admission due to influenza with vaccine effectiveness of 43% [18]

It is recommended to have seasonal influenza vaccine before winter season as antibody response generally needs about two weeks to be developed. [22, 23]

In this study, more than half of diabetic patients (50.0%) reported that if there is an effective vaccine to prevent flu, they will take it and 55.0% believe in effectiveness of influenza vaccine in preventing serious influenza complications, however, 30.0% of them fear from serious side effects of the vaccine. In a study carried out in Spain, 24% of diabetic patients did not believe in the effectiveness of the vaccination or feared side effects. However, only 4 (1%) of patients experienced mild adverse reactions to influenza vaccination.[24] In South Africa, only 29.5% of diabetic patients considered vaccination as an effective means of preventing severe influenza-related complication [17]

In the present study, the main reasons for accepting seasonal influenza vaccine among diabetics were being the vaccine free of charge and patients being informed by doctor that the vaccine is important. Therefore,

physicians` recommendation is very important in educating patients regarding the benefits of influenza vaccination utilizing accurate information and encourage them to uptake it to prevent adverse outcomes of influenza [25, 26]. In a similar study conducted in South Africa [17], better knowledge of vaccine and influenza, positive attitude towards vaccination, being informed by doctors and fellow patients who have been previously vaccinated and availability of the vaccine free of charge were the main contributors for having the vaccine. Other studies reported that awareness of seasonal influenza vaccination recommendations, previous history of influenza vaccination, perception of the harmful effects of influenza infection, particularly for diabetics, and perceived advantages of being vaccinated against influenza were predictors for up taking the vaccine [27, 28]

In the current study, the main reasons to refuse seasonal influenza vaccine by diabetic patients were being not necessary because flu is just a minor illness (37.78%), forgetting (28.89%) and belief that the vaccine was not effective (28.89%). In a similar study carried out in South Africa, the main reason was use of other different protection (51.4%) [17,29].

also the associated of the total attitude of diabetic patients towards seasonal influenza with socio-demographic factors with vaccination regarding the age, marital status, level of education, home/living, occupation were a significantly while P =value 0.000 , also factors gender and total attitude towards influenza vaccination who not significantly while P =value 0.234.(See table5)

6. CONCLUSION

The main reasons for up taking seasonal influenza vaccine were being free of charge and doctor informed the patients that it is important. The main reasons for refusal of seasonal influenza vaccine were being not necessary because flu is just a minor illness, forgetting and belief that the vaccine was not effective .

Almost half of diabetic patients in Makkah had positive attitude towards seasonal influenza vaccine and have been vaccinated. Positive attitude was associated with higher uptake of the vaccine. Additionally, higher uptake of the seasonal influenza vaccine was associated with younger diabetic patients and those with less than 5 years or more than 15 years of diabetes.

7. REFERENCES

1. Chentli, F., Azzoug, S., & Mahgoun, S. (2015). Diabetes mellitus in elderly. *Indian journal of endocrinology and metabolism*, 19(6), 744.
2. Ghandora, H., Halperin, D. M., Isenor, J. E., Taylor, B. A., Fullsack, P., Di Castri, A. M., & Halperin, S. A. (2019). Knowledge, attitudes, behaviours, and beliefs of healthcare provider students regarding mandatory influenza vaccination. *Human vaccines & immunotherapeutics*, 15(3), 700-709.
3. Hulme, K. D., Gallo, L. A., & Short, K. R. (2017). Influenza virus and glycemic variability in diabetes: a killer combination?. *Frontiers in microbiology*, 8, 861.
4. El Khoury, G., & Salameh, P. (2015). Influenza vaccination: a cross-sectional survey of knowledge, attitude and practices among the Lebanese adult population. *International journal of environmental research and public health*, 12(12), 15486-15497.
5. Sah, P., Medlock, J., Fitzpatrick, M. C., Singer, B. H., & Galvani, A. P. (2018). Optimizing the impact of low-efficacy influenza vaccines. *Proceedings of the National Academy of Sciences*, 115(20), 5151-5156.
6. Bhai, S., & Lyons, J. L. (2015). Neurosyphilis update: atypical is the new typical. *Current infectious disease reports*, 17(5), 20.
7. Goeijenbier, M., Van Sloten, T. T., Slobbe, L., Mathieu, C., Van Genderen, P., Beyer, W. E., & Osterhaus, A. D. (2017). Benefits of flu vaccination for persons with diabetes mellitus: a review. *Vaccine*, 35(38), 5095-5101.
8. American Diabetes Association. (2018). Economic costs of diabetes in the US in 2017. *Diabetes care*, 41(5), 917-928.
9. Fan, V. Y., Jamison, D. T., & Summers, L. H. (2018). Pandemic risk: how large are the expected losses?. *Bulletin of the World Health Organization*, 96(2), 129.
10. Garout, M. A., Jokhdar, H. A., Aljahdali, I. A., Zein, A. R., Goweda, R. A., & Hassan-Hussein, A. (2018). Mortality rate of ICU patients with the Middle East respiratory syndrome-coronavirus infection at King Fahad Hospital, Jeddah, Saudi Arabia. *Central European journal of public health*, 26(2), 87-91.
11. Jimenez-Trujillo, I., López de Andrés, A., Hernández-Barrera, V., Carrasco-Garrido, P., Santos-Sancho, J. M., & Jiménez-García, R. (2013). Influenza vaccination coverage rates among diabetes sufferers, predictors of adherence and time trends from 2003 to 2010 in Spain. *Human vaccines & immunotherapeutics*, 9(6), 1326-1332.
12. Ghandora, H., Halperin, D. M., Isenor, J. E., Taylor, B. A., Fullsack, P., Di Castri, A. M., & Halperin, S. A. (2019). Knowledge, attitudes, behaviours, and beliefs of healthcare provider students regarding mandatory influenza vaccination. *Human vaccines & immunotherapeutics*, 15(3), 700-709.

13. Haridi, H. K., Salman, K. A., Basaif, E. A., & Al-Skaibi, D. K. (2017). Influenza vaccine uptake, determinants, motivators, and barriers of the vaccine receipt among healthcare workers in a tertiary care hospital in Saudi Arabia. *Journal of Hospital Infection*, *96*(3), 268-275.
14. El Khoury, G., & Salameh, P. (2015). Influenza vaccination: a cross-sectional survey of knowledge, attitude and practices among the Lebanese adult population. *International journal of environmental research and public health*, *12*(12), 15486-15497.
15. Schmid, P., Rauber, D., Betsch, C., Lidolt, G., & Denker, M. L. (2017). Barriers of influenza vaccination intention and behavior—a systematic review of influenza vaccine hesitancy, 2005–2016. *PloS one*, *12*(1), e0170550.
16. Abu-Rish, E. Y., Elayeh, E. R., Mousa, L. A., Butanji, Y. K., & Albsoul-Younes, A. M. (2016). Knowledge, awareness and practices towards seasonal influenza and its vaccine: implications for future vaccination campaigns in Jordan. *Family practice*, *33*(6), 690-697.
17. Olatunbosun, O. D., Esterhuizen, T. M., & Wiysonge, C. S. (2017). A cross sectional survey to evaluate knowledge, attitudes and practices regarding seasonal influenza and influenza vaccination among diabetics in Pretoria, South Africa. *Vaccine*, *35*(47), 6375-6386.
18. Remschmidt, C., Wichmann, O., & Harder, T. (2015). Vaccines for the prevention of seasonal influenza in patients with diabetes: systematic review and meta-analysis. *BMC medicine*, *13*(1), 1-11.
19. Allard, R., Leclerc, P., Tremblay, C., & Tannenbaum, T. N. (2010). Diabetes and the severity of pandemic influenza A (H1N1) infection. *Diabetes care*, *33*(7), 1491-1493.
20. Karlsson, E. A., Milner, J. J., Green, W. D., Rebeles, J., Schultz-Cherry, S., & Beck, M. A. (2019). Influence of obesity on the response to influenza infection and vaccination. In *Mechanisms and manifestations of obesity in lung disease* (pp. 227-259). Academic Press.
21. Wang, I. K., Lin, C. L., Chang, Y. C., Lin, P. C., Liang, C. C., Liu, Y. L., ... & Sung, F. C. (2013). Effectiveness of influenza vaccination in elderly diabetic patients: a retrospective cohort study. *Vaccine*, *31*(4), 718-724.
22. Walaza, S., & Cohen, C. (2016). Recommendations pertaining to the use of influenza vaccines and influenza antiviral drugs, 2016. *South African Medical Journal*, *106*(3), 251-253.
23. Nyhan, B., & Reifler, J. (2015). Does correcting myths about the flu vaccine work? An experimental evaluation of the effects of corrective information. *Vaccine*, *33*(3), 459-464.
24. Alvarez, C. E., Clichici, L., Guzmán-Libreros, A. P., Navarro-Francés, M., & Ena, J. (2017). Survey of vaccination practices in patients with diabetes: A report examining patient and provider perceptions and barriers. *Journal of clinical & translational endocrinology*, *9*, 15-17.
25. Burns, V. E., Ring, C., & Carroll, D. (2005). Factors influencing influenza vaccination uptake in an elderly, community-based sample. *Vaccine*, *23*(27), 3604-3608.
26. Szucs, T. D., & Müller, D. (2005). Influenza vaccination coverage rates in five European countries—a population-based cross-sectional analysis of two consecutive influenza seasons. *Vaccine*, *23*(43), 5055-5063.
27. Riphagen-Dalhuisen, J., Gefenaite, G., & Hak, E. (2012). Predictors of seasonal influenza vaccination among healthcare workers in hospitals: a descriptive meta-analysis. *Occupational and environmental medicine*, *69*(4), 230-235.
28. Yuen, C. Y. S., Fong, D. Y. T., Lee, I. L. Y., Chu, S., Siu, E. S. M., & Tarrant, M. (2013). Prevalence and predictors of maternal seasonal influenza vaccination in Hong Kong. *Vaccine*, *31*(45), 5281-5288.
29. Lee, J. K., Lam, G. K., Shin, T., Kim, J., Krishnan, A., Greenberg, D. P., & Chit, A. (2018). Efficacy and effectiveness of high-dose versus standard-dose influenza vaccination for older adults: a systematic review and meta-analysis. *Expert review of vaccines*, *17*(5), 435-443.

