

Uptake of influenza vaccine among type II diabetic patients in Arar city, Saudi Arabia

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ABSTRACT

Objectives: Estimating the uptake rate of seasonal influenza vaccine among type 2 diabetic patients and determining diabetes-related factors associated with influenza vaccination uptake among type 2 diabetic patients attending the diabetic centre in Arar city, 2019. **Methodology:** A cross-sectional study conducted over one year in Arar, KSA, included all diabetic patients T2DM (≥18years) attending the diabetic centre using a pre-designed questionnaire to fulfil the study's objective. **Results:** Of 357 participants, 42.3% (151 participants) received a seasonal flu vaccination. The main reasons for taking seasonal flu vaccination were: the importance of vaccine in preventing influenza in 45.1%, health awareness through various media in 18.2%, other people's recommendation in 15.4%, and the recommendation of the attending physician or nursing in 32.8%. Reasons for abstaining from getting the seasonal flu vaccination were: Not being advised by doctors and nurses 16.5%, thought of vaccination as not important in 5.1%, 12.3% thought that vaccination isn't effective, 16.5% fear the side effects of vaccination, fear of stinging the vaccination in needle 3.1%, Thinking that vaccination led to infection in 5.3%, didn't think influenza is dangerous 11.5%, 20.4% think that the flu vaccination is not important and fear of the side effects of vaccination in 16.5%. **Conclusion:** The uptake of seasonal influenza vaccination among diabetic patients in Saudi Arabia is relatively low, with no previous papers in Arar region discussing the same problem. We found a significant correlation between receiving seasonal influenza vaccine and age, gender, gender, educational level, working status, and commitment to diabetes treatment.

Keywords: Infection, Diabetics, Vaccination, Knowledge, Practice

To Cite:

Aminah Abdullah Alhussain, Abdulrahman Abdullah Alhussain, Sabry Mohamed Hammad, Amel Elwan. Uptake of influenza vaccine among type II diabetic patients in Arar city, Saudi Arabia. *Medical Science*, 2021, 25(108), 410-423

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Peer-Review History

Received: 04 January 2021

Reviewed & Revised: 05/January/2021 to 12/February/2021

Accepted: 13 February 2021

Published: February 2021

Peer-review Method

External peer-review was done through double-blind method.

1. INTRODUCTION

Influenza is a widespread infectious respiratory disease caused by influenza viruses. Such viruses can spread rapidly through direct contact with infected individuals, through contact with contaminated objects, or through inhalation of aerosols loaded with viruses (Mubareka et al., 2009). Its severity ranges from moderate illness to serious illness. Sudden onset of fever, headache, cough (usually dry), musculoskeletal and joint pain, extreme malaise, sore throat, and runny nose are characterized. A cough can be serious and can last



for two weeks at least. Most individuals recover from these symptoms in a week without seeking medical treatment. It can, however, in high-risk individuals, cause serious illness or even death (WHO, 2017). Diabetes is considered a global problem, too. The prevalence of type 2 diabetes mellitus (T2DM) is growing globally and, as a result of its health and economic burden, poses a significant public health issue worldwide (IDF, 2015). In Saudi Arabia, diabetes mellitus type 2 affects about 46% of males and 44% of females aged over 50 years (Bahijri et al., 2016).

Diabetic patients are more vulnerable to influenza, which may raise the hospitalization rate (Basevi et al., 2011). Seasonal Influenza Vaccination is an effective method to reduce the risk of hospitalization and death from influenza complications in patients with T2DM (Wang et al., 2013). According to the American Diabetic Association (ADA), annual influenza vaccination is recommended for all individuals with diabetes because it is useful, healthy and decreases influenza-related complications, hospitalizations and deaths in these patients (ADA, 2021). Despite the evident efficacy of the seasonal influenza vaccine, its overall coverage is still poor, especially for the vulnerable group of patients, including diabetic patients, in many parts of the world (Santaularia et al., 2016). Several factors for accepting seasonal influenza vaccination have been established in different studies, including sound awareness of influenza and its vaccine and the prevalence of chronic disease. By comparison, the rejection of the vaccine was due to fear of side effects from the vaccine and a lack of faith in the vaccine's effectiveness (Wang et al., 2013; American Diabetes Association, 2015; Sato et al., 2015). In Saudi Arabia, the Ministry of Health (MOH) recommends annual vaccination against seasonal influenza, particularly for those at increased risk of severe influenza disease, including DM (Kingdom of Saudi Arabia, Ministry of health, 2020).

A variety of studies have been conducted on influenza vaccines in diabetic patients around the world. A retrospective research on old diabetic patients was conducted in Taiwan between 2001 and 2009 to assess vaccination benefits. The study concluded that influenza vaccination in elderly patients with DM was associated with a decreased risk of morbidity, hospitalization, ICU admission and mortality, in addition to lower hospitalization costs (Wang et al., 2013). In Pretoria, South Africa, Olatunbosun et al. (2017) found a low level of vaccination (28.8%) in their cross-sectional survey to evaluate knowledge, attitudes, and practices regarding seasonal influenza and influenza vaccination among diabetic patients. They also concluded that diabetic patients with good attitude scores for influenza vaccination were more likely to be vaccinated than those with poor attitude scores. In Abha City, Saudi Arabia, it was reported a 61% vaccination rate among diabetic patients in their study. They also found that lack of information about influenza and its vaccine, illiteracy and long-term illness were major factors associated with non-vaccination (Alnaheelah et al., 2018; Ahmed et al., 2021).

After reviewing the literature, we find no study done in the Northern border region in Saudi Arabia about the uptake of seasonal influenza vaccine among diabetic patients. So, in this study, we aim to assess the influenza vaccination rate in T2DM patients and identify reasons for accepting or refusing it.

Aim of the study

To estimate the uptake rate of seasonal influenza vaccine among type 2 diabetic patients and determine diabetes-related factors associated with influenza vaccination uptake among type 2 diabetic patients attending the diabetic center in Arar city, 2019.

2. METHODOLOGY AND MATERIAL

Study Design

A cross-sectional study

Study area and setting

Arar city is the capital of the Northern Borders Region of Saudi Arabia, with an estimated population of 311,473, 88% of whom are Saudi citizens and Muslims. The climate of Arar is as hot as a desert (Abdul Salam et al., 2014). It includes only one main diabetic center in the northern region.

Population and sample

- Inclusion criteria: All type 2 diabetic patients (T2DM) ≥ 18 years attending the diabetic centers were included.
- Exclusion criteria: healthcare workers with diabetes, mentally ill patients, and those who refused to participate in the study were excluded.

Sample size

This study's sample size is calculated using a sample size open epi online calculator, assuming a margin error (α) of 5% and 95% confidence level. Total registered diabetic patients were 8000 (according to the database in the diabetic center). The estimated percentage of influenza vaccine uptake in diabetic patients (P) was (61.2%) according to a study conducted in Abha city, Saudi Arabia. The calculated sample size is 350.

Sampling Technique

The average daily number of type 2 diabetic patients attending Arar diabetic center is 60. Three visits were conducted per week. In each visit, ten patients were selected by systemic random sampling technique. Each 6th patient was selected after the random selection of the 1st one.

Study procedures

This cross-sectional study was conducted over one year after obtaining administrative and ethical approval from the diabetic centre director. The forms were collected from participants during the three months of the study. The questionnaire applied was taken from a study conducted in Abha city, after taking consent from the author, containing questions of:

- Personal data, such as age, gender, education, and occupation
- Clinical data, such as the onset of T2DM, duration, compliance with management plans, complications, and co-morbidities.
- Seasonal influenza vaccination status
- Motivators and barrier of vaccination this year
- Five questions to know influenza vaccine knowledge.

Data collection and Statistical Analysis Plan

Collected data was analysed using SPSS software version 20. The variables used include categorical and continuous variables. Categorical variables were presented as frequencies and percentages, and continuous variables were presented as a mean and standard deviation. Appropriate statistical tests were used for comparison. P-value ≤ 0.05 was considered statically significant.

Administrative and Ethical considerations

Ethical approval was obtained to conduct this study from the research ethical local committees of northern border general health affairs. The consent form, which also explains this study's purpose, was included in the self-administered questionnaire. The participants were assured that their data was dealt with confidentiality. Approval was also obtained from the administration of Arar diabetic centre.

3. RESULTS

According to table 1, 42.3% of participants' age ranged between 46 and 60 years old, 26.1% between 31 - 45, and 14.6% aged between 61- 70 years old. 57.1% of participants were males, and 42.9% were females. Regarding marital status, 87.4% were married, and 5.3% were single. 88.2% of the sample was Saudi. 45.9% of participants were highly educated (university or more), and 19% attended secondary school.

Table 1 Sociodemographic characters of the studied population

Parameter		Frequency	Percent
Age, y	Less than 31	24	6.7
	31 – 45	93	26.1
	60 - 46	151	42.3
	61- 70	52	14.6
	More than 70	37	10.4
Gender	Male	204	57.1
	female	153	42.9
Marital status	Married	312	87.4
	Single	19	5.3

	Divorced	11	3.1
	Widowed	15	4.2
Nationality	Saudi	315	88.2
	Non-Saudi	42	11.8
Educational level	Illiterate	57	16.0
	Primary	48	13.4
	Intermediate	20	5.6
	Secondary	68	19.0
	University or more	164	45.9
Working status	Employee	144	40.5
	Housewife	75	21.0
	Retired	138	38.5
Monthly income	Insufficient for my needs	72	20.2
	Sufficient for my needs	274	76.8
	Sufficient and exceeds my needs	11	3.1

As shown in table 2, 4.8% of participants had normal HbA1c results, 5.9% were pre-diabetics, 65.5% were diabetics, and 23.8% missed the test. Among participants who had diabetes, 31.4% had it for 5- 10 years, 29.4% had it for 1- 4 years, 20.2% for 11- 15 years, and 11.5% had it for 16- 20 years. 74.8% of diabetic patients checked their blood sugar levels regularly. Regarding complications, 0.8% had peripheral vascular disease, 1.1% had kidney disease, 0.3% had kidney disease with vision problems. 1.1% had kidney disease, vision problems, peripheral vascular disease, diabetic foot or amputation, 21.3% had vision problems, 2.0% had vision problems with peripheral vascular disease, and 71.1% didn't have complications.

Regarding the history of chronic diseases among diabetic patients, 45.6% have hypertension, 5.0% had asthma, 5.3% have hyperlipidemia, 3.0% have ischemic heart disease, and 41.2% had no associated chronic disease. 59.4% take oral tablets to treat diabetes, 26.3% take insulin, and 14.3% take both oral tablets and insulin together. 16% of participants were smokers, and 52.9% had a family history of diabetes (table 3).

Table 2 Characteristics of diabetes, other chronic diseases, complications and Hb1c results of studied population among studied diabetic patients

Parameter	Frequency	Percent	
Duration of diabetes, y	1-4	105	29.4
	5-10	112	31.4
	11-15	72	20.2
	16-20	41	11.5
	More than 20	27	7.6
Regular blood glucose checking	Yes	267	74.8
	No	90	25.2
History of chronic diseases	Hypertension	163	45.6
	Bronchial asthma	18	5.0
	Hyperlipidemia	19	5.3
	Ischemic heart disease	11	3.0
	Others	19	5.2
	Nothing	147	41.2

Treatment of diabetes	Oral tablets	212	59.4
	Insulin injections	94	26.3
	Both	51	14.3
Smoking status	Yes	57	16.0
	No	277	77.6
	Ex-smoker	23	6.4
Family history of diabetes	Yes	189	52.9
	No	168	47.1%
HbA1c result	Between 4% and 5.6%	17	4.8
	Between 5.7% and 6.4%	21	5.9
	Levels of 6.5% or higher	234	65.5
	Not available	85	23.8

Table 3 Diabetic patients' compliance with treatment and other diabetic control methods

	Parameter	Frequency	Percent
Compliance to treatment	Good	268	75.1
	Average	61	17.1
	Weak	28	7.8
Rate of commitment to diabetes clinic appointments	Good	219	61.3
	Average	77	21.6
	Weak	61	17.1
Rate of commitment to the diet	Good	61	17.1
	Average	209	58.5
	Weak	87	24.4
Rate of commitment to the sports diet	Good	52	14.6
	Average	103	28.9
	Weak	202	56.6

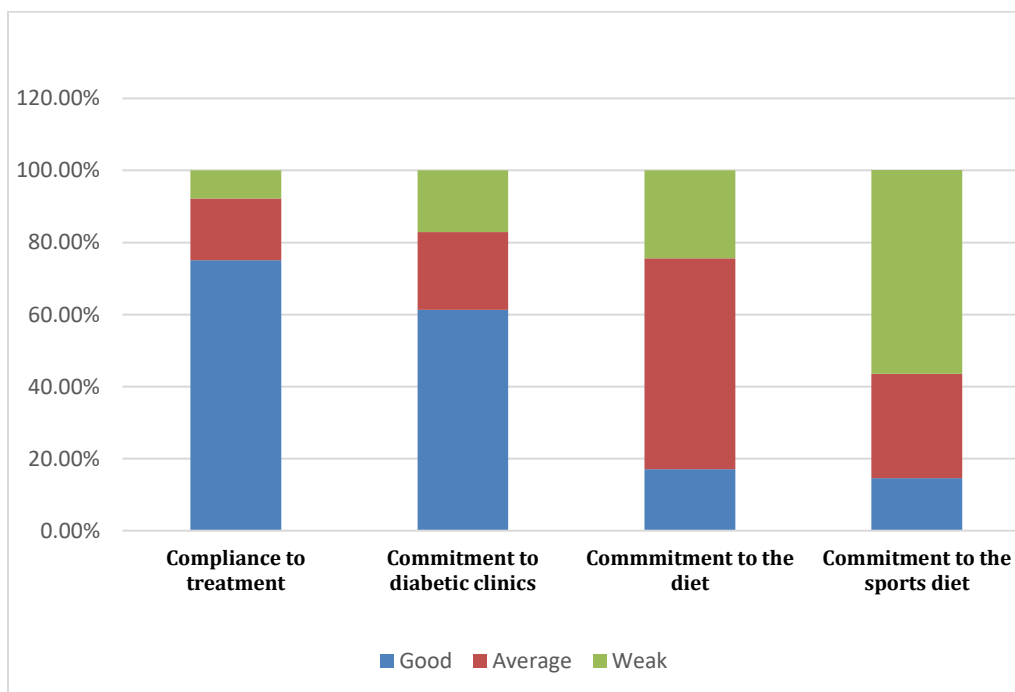


Figure 1 Diabetics compliance to treatment and diabetic clinics in the sample (N=357)

Regarding compliance to treatment; 75.1% of participants had good compliance, 17.1% had average compliance, and 7.8% had weak compliance to treatment. 61.3% of participants had a good commitment to diabetes clinic appointments, 21.6% were average, and 17.1% were weak. Only 17.1% had a good commitment to the diet, 58.5% were average, and 24.4% were weak, as mentioned in figure 1 & Table 4. Table (5) shows that only 9.5% (34 patient) of diabetic patients were admitted within the current year; 4 of them due to gall bladder removal, 4 for herniated disc, 4 for diabetic retinopathy, 4 for cardiac catheterisation, two patients for removing salivary gland, and 2 for deep vein thrombosis and 2 for the diabetic foot.

Table 4 Reasons for admission to hospital during the last year among studied patients

	Parameter	Frequency	Percent
Admission to the hospital during the current year	Yes	34	9.5
	No	323	90.5
If the answer is yes, what is the reason (N =34)	Cardiac catheterization	4	11.8
	Retinopathy	4	11.8
	Gallbladder removal	4	11.8
	Herniated disc	4	11.8
	Heart Rh catheter	4	11.8
	Cardiac catheterisation and stenting	3	8.8
	Operations	3	8.8
	Pneumonia	2	5.88
	deep vein thrombosis	2	5.88
	Removing salivary gland	2	5.88
Diabetic foot	2	5.88	

Table 5 Show the knowledge and education of participants about diabetes and seasonal influenza

Parameter		Frequency	Percent
Receiving any health education about diabetes	Yes	300	84.0
	No	57	16.0
Receiving educational messages about seasonal influenza	Yes	136	38.1
	No	221	61.9
Timing of seasonal flu vaccination	Every 6 months	10	2.8
	every year	210	58.8
	Once in a lifetime	14	3.9
	I do not know	123	34.5
Source of information about the disease and the seasonal flu vaccine	Relatives and friends	70	19.6
	Health practitioners (doctors, nurses, etc.) at the center	128	35.9
	Various media	68	19.0
	Social media	80	22.4
	Other than that	11	3.1

Regarding table 6 & figure 2, 84% of participants received health educations about diabetes, and 38.1% received educational messages about seasonal influenza. The Source of information about the disease and the seasonal flu vaccine was health practitioners in 35.9% of participants, social media in 22.4%, relatives and friends in 19.6%, and various media in 19% of participants. Among all study participants, 42.3% (151 participants) received the seasonal flu vaccination (73 participants received it

once, 34 received it twice, 19 three times, 9 four and five times). Only 29.1% received seasonal influenza vaccine during the last season. 53.8% had the intention to take the seasonal flu vaccination before the next winter season. The main reasons for taking the seasonal flu vaccination were: the importance of vaccine in preventing influenza in 45.1%, health awareness through various media in 18.2%, other people's recommendations in 15.4%, and the attending physician or nursing recommendation in 32.8%. Reasons for not having the seasonal flu vaccine were: lack of guidance to take it by doctors and nurses at 16.5 %, 5.1 % thought vaccination was not necessary, 12.3 % thought vaccination was not successful in preventing influenza, 16.5 % were afraid of the side effects of vaccination, 3.1 percent were afraid of vaccination stinging as reviewed in table 7 & figure 3.

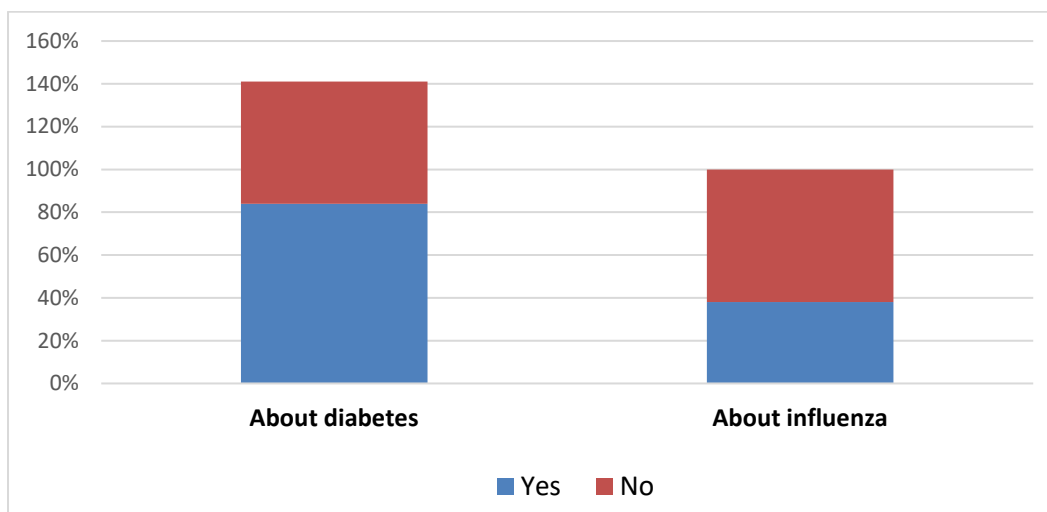


Figure 2 Distribution of health education messages among sample (N=357)

Table 6 Show numbers of participants received seasonal influenza vaccination, number of times patients received the vaccine as well as reasons for receiving the vaccine and rejecting it.

Parameters		Frequency	Percent
Vaccination against seasonal flu	Yes	151	42.3
	No	206	57.7
If the answer is (yes) number of times receiving the vaccine (N = 151)	1	73	20.4
	2	34	9.5
	3	19	5.3
	4	9	2.5
	5	9	2.5
	6	7	2.0
Seasonal flu vaccination in the last flu season (during the period from October to April of this year)	Yes	104	29.1
	No	253	70.9
Intention to take the seasonal flu vaccination before the next winter season	Yes	192	53.8
	No	165	46.2
The main reason for taking the seasonal flu vaccination	Vaccination is important in preventing influenza	161	45.1
	Health awareness through various media	65	18.2
	Other people's recommendation	55	15.4

	Because I am more vulnerable to complications from the flu	76	21.3
	Recommendation of the attending physician or nursing	117	32.8
Reasons for your abstaining from getting the seasonal flu vaccination	I have not been advised to take it by doctors and nurses	59	16.5
	I think that the flu vaccination is not important	18	5.1
	Vaccination is not effective in preventing the infection	44	12.3
	Fear of the side effects of vaccination	59	16.5
	Fear of stinging the vaccination needle	11	3.1
	Vaccination leads to infection	19	5.3
	I do not think influenza is dangerous	41	11.5
	I think that the flu vaccination is not important	73	20.4
	Fear of the side effects of vaccination	59	16.5

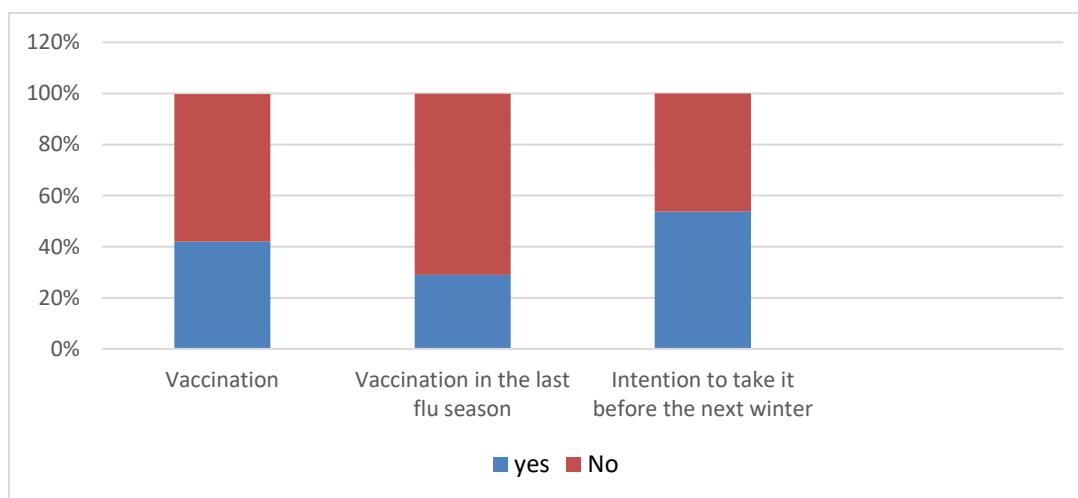


Figure 3 Vaccination history and willingness among participants (N=357)

Table 7 Shows level of knowledge of influenza vaccination among studied sample

Parameter	Yes	No	I do not know
Complications of influenza more dangerous for diabetics than others	90 25.2%	49 13.7%	218 61.1%
Vaccination with the seasonal flu vaccine prevents infection with the flu	126 35.3%	85 23.8%	146 40.9%
Vaccination with seasonal flu vaccine causes side effects	61 17.1%	8 22.4%	216 60.5%
Vaccination with seasonal flu vaccine protects against influenza only during one flu season	125 35.0%	62 17.4%	170 47.6%

Vaccination with seasonal flu vaccine is important for diabetics	142 39.8%	45 12.6%	170 47.6%
Vaccination with the seasonal flu vaccine protects diabetics from dangerous complications of the flu	128 35.9%	53 14.8%	176 49.3%
Diabetic should be vaccinated with the seasonal flu vaccine every year	133 37.3%	55 15.4%	169 47.3%
Diabetic patients more prone to catching the flu than others	122 34.2%	38 10.6%	197 55.2%
Seasonal influenza vaccination effective in preventing influenza	122 34.2%	35 9.8%	200 56.0%
Influenza infection leads to serious (life-threatening) complications	96 26.9%	58 16.2%	203 56.9%
Flu symptoms more severe in diabetics than others	89 24.9%	58 16.2%	210 58.8%

In Table (8), only 25.2% of all the sample agreed that influenza complications were more dangerous for diabetics than others. 35.3% agreed, and 23.8% disagreed that vaccination with the seasonal flu vaccine prevents infection with the flu. 17.1% of all the sample knew that vaccination with seasonal flu vaccine had side effects. 35% agreed, and 47.6% didn't know that vaccination with seasonal flu vaccine protects against influenza only during one flu season, 39.8% agreed that vaccination with the seasonal flu vaccine is important for diabetics. 35.9% agreed, and 14.8% disagreed that vaccination with the seasonal flu vaccine protects diabetics from dangerous complications of the flu, 37.3% agreed that diabetics should be vaccinated with the seasonal flu vaccine every year, 34.2% agreed, 10.6% disagreed that diabetic patients are more prone to catching the flu than others, and 34.2% agreed that seasonal influenza vaccination effective in preventing influenza (figure 4). A significant association between receiving seasonal influenza vaccine and age, gender, educational level, working status and commitment to diabetes treatment ($P < 0.005$) could be noted as shown in table (8).

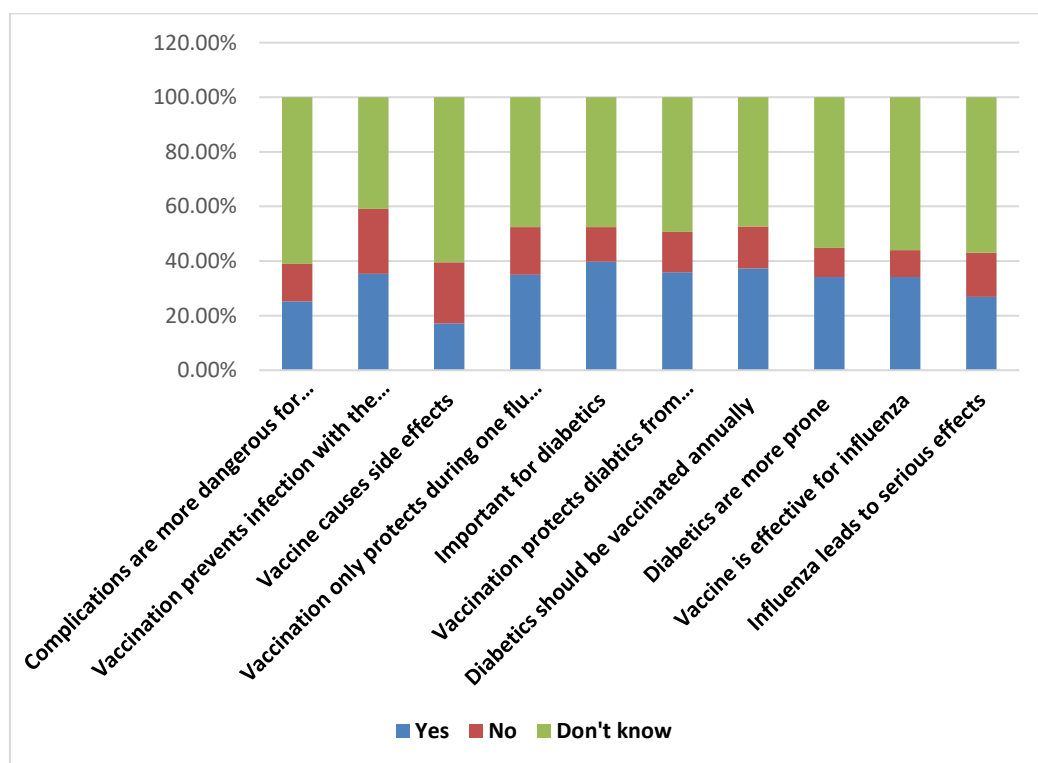


Figure 4 Knowledge about the vaccine among study participants (N=357)

Table 8 Relation between vaccinations about seasonal influenza in the last flu season and sociodemographic characters of participants and other variables

Parameter		Vaccinations about seasonal influenza in the last flu season		Total (N=357)	P-value
		Yes	No		
Age, y	Less than 31	6	18	24	0.007
		5.8%	7.1%	6.7%	
	31 – 45	16	77	93	
		15.4%	30.4%	26.1%	
	60 - 46	49	102	151	
		47.1%	40.3%	42.3%	
	61 - 70	15	37	52	
		14.4%	14.6%	14.6%	
	More than 70	18	19	37	
		17.3%	7.5%	10.4%	
Gender	Male	74	130	204	0.001
		71.2%	51.4%	57.1%	
	Female	30	123	153	
		28.8%	48.6%	42.9%	
Educational level	Illiterate	19	38	57	0.0001
		18.3%	15.0%	16.0%	
	Primary	22	26	48	
		21.2%	10.3%	13.4%	
	Intermediate	7	13	20	
		6.7%	5.1%	5.6%	
	Secondary	29	39	68	
		27.9%	15.4%	19.0%	
	University or more	27	137	164	
		26.0%	54.2%	45.9%	
Commitment to treating diabetes	Good	91	177	268	0.0001
		87.5%	70.0%	75.1%	
	Average	13	48	61	
		12.5%	19.0%	17.1%	
	Weak	0	28	28	
		0.0%	11.1%	7.8%	

4. DISCUSSION

For diabetics, seasonal influenza vaccination is recommended, but the rate of vaccination uptake among diabetic patients remains poor. Diabetics are more vulnerable to influenza outbreaks during seasonal influenza epidemics than healthy individuals. Recent studies have established diabetes mellitus as a possible risk factor and associated complications for H1N1 influenza (Abdul Salam et al., 2014; Valdez et al., 1999; Hanslik et al., 2010; Koegelenberg et al., 2010). Among our study participants, 42.3% received the seasonal flu vaccination. Only 29.1% received the seasonal influenza vaccine during the last season. A previous study indicated that the influenza vaccine was obtained in 2013 by 65.7% of the sampled diabetic patients. From 2007 to 2013, the mean number of influenza vaccines obtained was 3.24 (SD = 1.15) (Rodrigo et al., 2017).

A longitudinal observational study based on electronic medical records found that influenza vaccination coverage in persons with diabetes decreased significantly from 85.1% in the 2008 season to 74.7% in the 2013 season, 63% of patients reported having

been vaccinated in the previous year (Tacken et al., 2015). Another research found that only 94 (30.6%) participants were previously vaccinated against influenza, of which 57 (60.6% of previously vaccinated participants) were vaccinated at least once a year (Tan et al., 2010). Other studies in Europe have reported coverage of around 60–70% in the diabetic population (Achtymichuk et al., 2015). Similar rates have been reported in the US and Canada (O'Halloran et al., 2016).

Another study reported that 28.8% of the participants were previously vaccinated (Olawale et al., 2017). Feng et al. (2019) reported that 9.7% of the participants said they had previously been vaccinated. Studies have shown that factors that improve the likelihood of obtaining the vaccine are: inclusion in the age-based recommendation (about 60 years), chronic respiratory disease, prior pneumococcal vaccination, a higher number of general practitioner visits, excess of influenza vaccinations, and longer periods after diagnosis of diabetes (Rodrigo et al., 2017). In Europe and the US, some of the other main predictors of high influenza vaccine uptake were: prior family member vaccination, understanding of influenza vaccination, media exposure gained, and vaccine accessibility (Ma et al., 2006; Takahashi et al., 2003; Horby et al., 2005).

The key reasons supporting the use of the vaccine have varied considerably. The key reason for the seasonal flu vaccination in our research was the importance of vaccines in the prevention of influenza. Another research indicated that, because of their age or their chronic conditions, most patients (both sexes) received the vaccine following the recommendation of their primary care physician (Rodrigo et al., 2017). Factors that encouraged vaccination in another study were also reported as advice from healthcare professionals (78.5%), encouragement from family members (28.0%), and better information about influenza vaccination (26.1%), and cheaper vaccines (18.9%) (Tan et al., 2010). A different study reported that their doctors' advice was the main factor encouraging vaccination (97.6%) (Olawale et al., 2017). Three main reasons were recorded among willing 342 participants to take the vaccine. The first reason was the effectiveness of the vaccine in minimizing the risk of influenza (68.4%), the second was believing that the vaccine was safe and reliable (30.4%), and the third was its free cost or its coverage by their insurance (27.8%) (Feng et al., 2019).

Reasons for not having the seasonal flu vaccine in our sample were: the absence of physicians' and nurses' recommendation to take it in 16.5%, thought of vaccination as not necessary in 5.1 %, believing that vaccination is not successful in preventing influenza in 12.3%, fear of the side effects of vaccination in 16.5%, fear of stinging of the vaccination needle in 3.1%. Another study found that the most common reason for refusal among men was the assumption that they were not at risk (41.6 % vs 29.79 % in women); while fear of adverse reactions (32.53 % vs 20.23 % in men) was the most common reason for refusal among women (Rodrigo et al., 2017). A research showed that those who had never been vaccinated (54.9 %) did not agree that vaccination was important (Tan et al., 2010). The key reasons provided by participants who had never been vaccinated in a different study (71.2 %) included: use of alternative protection (51.4%), vaccination being not mandatory because influenza is only a minor disease (44.7%), and that vaccine is expensive in 31.3 % (Olawale et al., 2017). The most frequently stated reasons among 1407 reluctant respondents in a different study were: feeling in good health with no need for vaccines (36.2 %), fear of adverse reactions (19.0 %), and high vaccine costs (17.1%) in another study (Feng et al., 2019).

The understanding of the disease can influence healthcare-seeking behaviors. In our study, 39.8% agreed that vaccination with the seasonal flu vaccine is important for diabetics, 35.9% agreed; however, 14.8% disagreed that vaccination with the seasonal flu vaccine protects diabetics from dangerous flu vaccination complications. 37.3% agreed that diabetics should be vaccinated with the seasonal flu vaccine every year, 34.2% agreed, and 10.6% disagreed that diabetic patients were more prone to catching the flu than others, and 34.2% agreed that seasonal influenza vaccination was effective in preventing influenza. Another study reported that of all the participants, 139 (45.3%) claimed that they knew the difference between influenza and the common cold. (43.0%) indicated that they did not know what the complications of influenza were. Furthermore, 78 (25.4 %) respondents thought that influenza was not a deadly disease, and during the past year, 167 (54.4 %) confirmed having experienced an influenza-like disease. Nearly one-third of the participants, however, believed that the vaccination against influenza protected against all influenza strains, while in fact the vaccine only protects against influenza strains that are identical or similar to the strains of the vaccine (Tan et al., 2010).

Olawale et al. (2017) recorded that only 86 (29.5 %) participants viewed vaccination as an effective way of avoiding severe influenza-related complications; 32.9 % participants were informed that they were at a higher risk of influenza complications. 88% indicated that the vaccine is safe, and 83.8% believed it works to prevent flu, however, 38.3% of participants who believed in the vaccine's efficacy indicated that one can still develop flu despite being vaccinated. The majority of participants had a positive attitude (68.5%) towards seasonal flu vaccination, even though only 37.7% and 11.3% have good knowledge about seasonal flu and vaccine, respectively. Most participants agreed that annual influenza vaccination is important among people with diabetes.

Vaccination promotion policies need to concentrate on motivating health care professionals to address vaccination with their high-risk patients to give those lots of reliable and unbiased information about the potential impact of influenza infection and the benefits of vaccination (Burns et al., 2005). Health services and continuous quality assurance will enable the provider and the

patient to maintain an awareness of areas where vaccinations are available and to gain convenient access to influenza vaccines at a reduced cost through effective communication methods (Riphagen et al., 2012). 84% of our participants receive diabetes health education, and 38.1% receive seasonal influenza educational updates. Studies have also shown that some of the other predictors of influenza vaccine uptake include: awareness of vaccination recommendations, previous vaccination history, perceived susceptibility to influenza infection, and perceived benefits of influenza vaccination (Yuen et al., 2013).

Improved knowledge and access can be important, however, and it has been widely observed that they do not necessarily lead to better acceptance. The CDC believes that new strategies are needed to increase influenza vaccines coverage in all age groups and high-risk communities (Centers for Disease Control and Prevention, 2009).

5. CONCLUSION

It has been documented in many studies that the seasonal influenza vaccine effectively prevents and reduces the burden of influenza infection in T2DM patients; despite this, the uptake of the vaccine is generally unsatisfactory. The uptake of seasonal influenza vaccination among diabetic patients in Saudi Arabia is relatively low, with no previous study conducted in the Arar region. Thus, in this study, we aim to fill in the knowledge gap and help policy makers target the most important groups.

Acknowledgement

We would like to thank our participants who were all dedicated to the study. We would also like to thank our professors who spared no effort in mentoring us and providing us with proper feedback.

Authors' contributions

Aminah Abdullah Alhussain, shared in setting the study design, research objectives, preparing study instrument, pilot administration, data collection, and reviewing the results. Prof. Sabry Mohamed Hammad, held study approvals and supervised study phases. Dr. AmelElwan, shared in preparing study proposal, logistics plan, data collection plan, supervised data entry and conducted the statistical analysis, data display, discussion guidelines, and final write up. All authors read and approved the final manuscript.

Funding

This study has received no external funding.

Conflict of interest

The authors would like to declare that there are no conflicts of interests.

Informed consent

Written & Oral informed consent was obtained from all individual participants included in the study. Additional informed consent was obtained from all individual participants for whom identifying information is included in this manuscript.

Ethical approval for study protocol /study design /Methodology

The study was approved by research ethical local committees of General Health Affairs of Northern Border region (ethical approval code: H-09-A-51).

Data and materials availability

All data associated with this study are present in the paper.

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