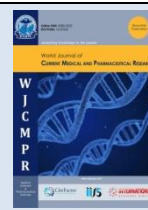




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PREVALENCE AND AWARENESS OF HERPES ZOSTER AMONG SAUDI PATIENTS WITH DIABETES MELLITUS, A CROSS SECTIONAL STUDY IN AL-AHSA, SAUDI ARABIA

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Article History	Abstract
Received on: 17-06-2023 Revised on: 04-07-2023 Accepted on: 11-08-2023	<p>Background: Herpes zoster (HZ) is a painful vesicular rash that happens when an infection with the varicella-zoster virus in the sensory ganglia is reactivated. The incidence and severity of HZ and its complications increase with advancing age, with a marked increase after 50 years of age. In addition, diabetes mellitus has been found to be a risk factor for severe, persistent postherpetic neuralgia.</p> <p>Methods: This descriptive cross-sectional primary health care based study was conducted in Al-Ahsa City, Eastern Saudi Arabia, in 2023. The study population included patients with DM who visit outpatient (ambulatory care) in primary or secondary health care setting. The convenience sample included 224 participants. A validated closed-ended interview questionnaire was used to collect data. The collected data were analyzed by the SPSS program version 28, and both descriptive and inferential statistics were used. Results: The study included 224 participants, more than half (54.5%) of whom were female. The mean (SD) age of the sample was 61.1 ± 8 years. Most of the participants (97.8%) were married, and 29.0% had a secondary school education level. More than half of the participants (56.7%) had heard of HZ. Only 6.7% had been diagnosed with HZ, and 23.7% knew someone who had been diagnosed with HZ. In addition, 18.8% had been vaccinated against HZ. Most patients (80.8%) cited healthcare providers as their primary source of HZ knowledge, followed by friends/relatives (37.9%). More than half of the participants were aware of HZ (62.1%) and had a positive attitude towards HZ (55.8%) respectively. Awareness of HZ was positively correlated with a higher level of education, a high income, a short duration of diabetes, having heard of HZ, being diagnosed with HZ, knowing someone who had been diagnosed with HZ, and being vaccinated against HZ among diabetic patients.</p> <p>Conclusion: The results revealed low vaccination rates and low awareness of HZ. The study recommends that education in simple language should be provided through various media to increase community awareness about HZ and its vaccine. Additionally, healthcare providers should promote and recommend HZ vaccinations for DM patients.</p> <p>Keywords: DM, Herpes zoster, Varicella zoster, Vaccine, Awareness, Attitude, Saudi Arabia.</p>



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Introduction

Herpes zoster (HZ), also known as shingles, is a localized disease that results from the reactivation of an endogenous varicella-zoster virus infection within the sensory ganglia. This clinical form of the disease is characterized by a painful, unilateral vesicular eruption, which usually occurs in a restricted dermatomal distribution such as the trunk and extremities [1,2]. HZ can be diagnosed clinically, with a rare need for laboratory investigation [3].

The incidence of HZ has been increasing throughout the world. In the United States, HZ affects more than 1.2 million individuals annually. The incidence and severity of HZ and its complications increase with advancing age, with a marked increase after 50 years of age, and this is temporally associated with an age-related decline in cell-mediated immunity to varicella-zoster virus [4].

Diabetes Mellitus (DM) is a common chronic disorder worldwide. According to the International Diabetes Federation, the prevalence of diabetes in Saudi Arabia is 17.7% [5]. DM patients have a higher incidence of HZ infection. Furthermore, DM was found to be a risk factor for severe, persistent post herpetic neuralgia [6]. Generally, immunocompromised individuals have a greater risk of prolonged episodes of reactivation and disseminated disease, which can be fatal [7].

The vaccination against HZ is indicated mainly to reduce the risk of developing HZ and postherpetic neuralgia in those at increased risk for disease (immunocompetent individuals ≥ 50 years of age, immunocompromised patients ≥ 19 years of age at increased risk of HZ [8]. The Centers for Disease Control and Prevention (CDC) recommended in 2018 that immunocompetent individuals aged 50 years and older receive a two-dose adjuvanted recombinant zoster vaccine for the prevention of herpes zoster. The second dosage is recommended to be administered between 2 to 6 months after the first dose [9]. The primary goal of this study is to estimate the percentage of patients with DM who have developed HZ throughout their lives. as well as to assess the awareness and attitude of patients who are at risk of developing HZ.

Material and Methods

This is a descriptive cross-sectional primary health care based study involved patients with DM who are at potential risk of developing HZ reactivation. The study population included patients with DM who visit outpatient (ambulatory care) facilities in primary health care setting. The study was conducted in Al-Ahsa city, Eastern Saudi Arabia, in 2023, which is the largest governorate in the Eastern Province of Saudi Arabia. The inclusion criteria were patients with diabetes mellitus, Saudi nationality, and adult patients over 18 years old. The exclusion criteria were patients less than 18 years old and patients with language barriers due to mental retardation or any psychiatric condition. The sample size was 224, calculated based on the Data from the International Diabetes Federation, in which the prevalence of DM in Saudi Arabia is 17.7% [5] with total cases of 4,274,100 from the total adult population, which is 24,194,300, with a confidence interval of 95%. The sampling technique is convenient sampling from multiple PHCs in the 4 sectors in Alhsa. technique is convenient sampling from multiple PHC in the 4 sectors in Alhsa.

The data were collected through an interview questionnaire. The questionnaire established and structured by researchers consists of four main parts: demographic data (Age, Gender, Other comorbidities), clinical characteristics of the diabetic patients, awareness toward HZ (correct description, Preventive measure, treatment, and common complications) and attitude towards HZ and its vaccine.

The pilot study was conducted to assess the validity and reliability of the data collection (Cronbach's alpha above 0.7).

The data were analyzed by the Statistical Package for Social Sciences (SPSS) program, version 28. The Kolmogorov-Smirnov test was used to ensure the normality of the data. For categorical data, descriptive statistics were calculated as frequency and percentage, and for continuous variables, they were calculated as measures of central tendency (arithmetic mean and median) and measures of dispersion (standard deviation and range). The Mann-Whitney U test and Kruskal Wallis H test were used to find the relationship between awareness and attitude with respect to patients' socio-demographic and clinical characteristics. A p-value ≤ 0.05 was considered a significant relationship.

Score grading: a common grading method was used for each variable as follows: awareness was assessed by asking 15 questions. Responses to questions were given one point if correct and zero points if incorrect. Subsequently, a cumulative score was calculated for each participant; obtaining fewer points than the median was classified as not aware, and obtaining a point total equal to or greater than the median was classified as aware. Also, the attitude of the patients towards HZ was assessed by five questions. On the 3-point Likert scale used, the answering and scoring systems were (agree = 3, neutral = 2, and disagree = 1).

Ethical Consideration

The investigators applied for approval of the Ethics Committee in Alahsa Medical cluster. The investigators obtained an informed consent from each participant and clearly explained the aim of research. All data were anonymous.

Resources

Financial recourses not required; the study was self-sponsored.

Results

The study included 224 participants, more than half (54.5%) were females, the mean (SD) age of the sample was 61.1 ± 8 years, most of them (97.8%) were married; and 29.0% had a secondary school level. More than two-thirds (68.3%) were unemployed. Almost all the participants (99.1%) had T2DM, 68.3% received oral medications; and 37.1% had a duration of diabetes less than 5 years. The average HbA1c level was 7.6 1.6%. More than half of the participants (56.7%) heard about HZ; only 6.7% were diagnosed with HZ, and 23.7% knew someone diagnosed with HZ. In addition, 18.8% had been vaccinated against HZ. Other patients' socio-demographic and clinical characteristics are shown in Tables 1 and 2 respectively.

Most patients (80.8%) cited health care providers as the primary source of HZ knowledge, followed by friends /relatives (37.9%), but other sources were also frequently mentioned (Figure 1).

The mean awareness score was 4.9 ± 2.7 . In fact, 62.1% were aware and 37.9% were not aware (tables 3 and 4). The current study found that 25% were aware that the varicella-zoster virus is the etiology of HZ, 46% were aware that immunity against HZ decreases with advancing age, 16.5% knew that being infected with chickenpox makes a person more susceptible to getting HZ later in life, and 37.1% were aware that individuals with a weakened immune system are at a higher risk of developing HZ. Additionally, 59.8% of participants reported that people aged 50 or older were more

susceptible to getting shingles, and only 3.1% knew about the signs and symptoms c

prevention, 54.5% knew that there is a vaccine available for

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HZ, which is recommended for adults aged 50 and older. Regarding transmission, 88.4% knew that shingles can't be transmitted through direct contact, and 11.2% knew that a person can get HZ more than once. Finally, only 4.5% knew that taking antiviral medications such as acyclovir is an effective treatment for HZ. Complications of shingles reported in the study included chronic pain (83.9%), visual impairment (21.0%), meningitis (14.7%), and hearing loss (12.5%). The percentages of correct answers to questions on general HZ knowledge and on HZ symptoms and complications are shown in Table 4.

Awareness of HZ is positively correlated with a higher level of education, a high income, a short duration of diabetes, having heard about HZ, being diagnosed with HZ, knowing someone diagnosed with HZ, and being vaccinated against HZ among diabetic patients. (Table 6). The mean attitude score was 11.9 ± 2.6 , more than half of patients (55.8%) had a positive attitude towards herpes zoster (Tables 3 and 5). About one third of the patients (32.6%) were worried that they might get shingles HZ. However, only 42.0% expressed a willingness to be vaccinated with the shingles vaccine. Details of attitude items are in Table 5.

Analysis showed that factors affecting patients' attitudes towards HZ were income, hearing about HZ, being diagnosed with HZ, knowing someone diagnosed with HZ, and vaccination status. (Table 6).

Table 1: Characteristics of study participants, Al-Ahsa, KSA (n = 224).

Variables		Frequency (%)
Age (years)	(mean, SD)	(61.1 , 8)
	≤ 50	9 (4.0%)
	51-60	108 (48.2%)
	> 60	107 (47.8%)
Sex	Male	122 (54.5%)
	Female	102 (45.5%)
Marital status	Single	5 (2.2%)
	Married	219 (97.8%)
Education	Illiterate	31 (13.8%)
	Primary	45 (20.1%)
	Intermediate	48 (21.4%)
	Secondary	65 (29.0%)
	Graduate and above	35 (15.6%)
Occupation	Employed	71 (31.7%)
	Unemployed	153 (68.3%)
Income	Less than 10000 RS	119 (53.1%)
	10000 – 20000 RS	98 (43.8%)
	More than 20000 RS	7 (3.1%)

Table 2: Clinical Characteristics of the diabetic patients in Al-Ahsa, KSA (n = 224).

	Variables	Frequency (%)
Types of DM:	T1DM	2 (0.9%)
	T2DM	222 (99.1%)

Types of treatment	Tablets	153	(68.3%)
	Insulin	10	(4.5%)
	Tablets and insulin	60	(26.8%)
	No medication	1	(0.4%)
HA1c :	(mean, SD)	(7.61 %, 1.6%)	
	Control (< 7%)	71	(31.7%)
	Uncontrolled (≥ 7%)	148	(66.1%)
Duration of DM (years)	< 5	83	(37.1%)
	5 - 10	79	(35.3%)
	>10	62	(27.7%)
Heard about HZ	Yes	127	(56.7%)
	No	97	(43.3%)
Being diagnosed by HZ:	Yes	15	(6.7%)
	No	209	(93.3%)
Knowing someone diagnosed by HZ:	Yes	53	(23.7%)
	No	171	(76.3%)
Vaccinated against HZ:	Yes	42	(18.8%)
	No	182	(81.3%)

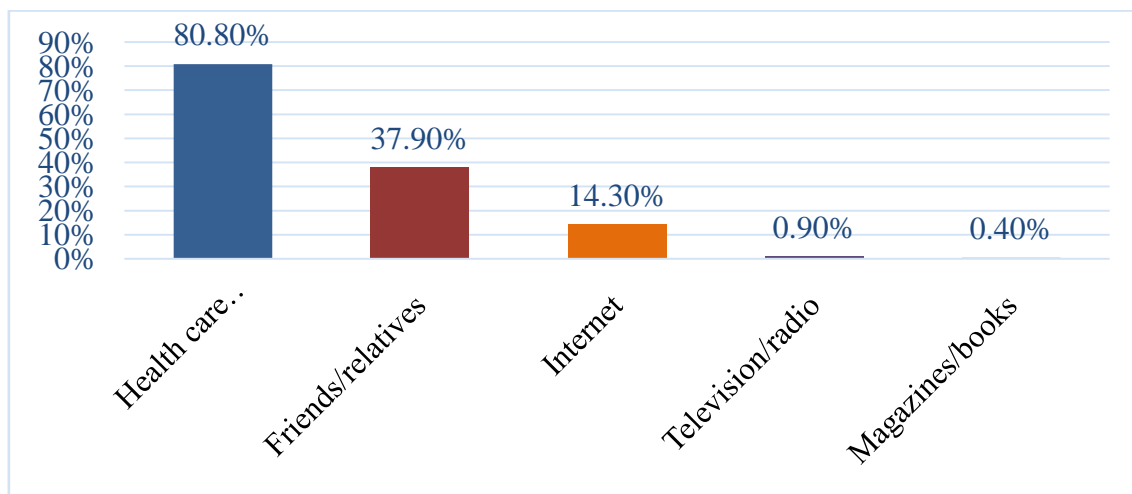


FIGURE 1: Sources of information regarding herpes zoster among diabetic patients in Al-Ahsa.

Table 3. Overall awareness and attitude about herpes zoster among diabetic patients in Al-Ahsa, KSA (n = 224).

Variables	Classification	Frequency	Percent
Awareness score	Not aware	85	37.9
	Aware	139	62.1
Attitude score	Negative	99	44.2

	Positive	125	55.8
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Table 4. Awareness about herpes zoster among diabetic patients in Al-Ahsa, KSA (n = 224).

Awareness items		Frequency (%)
Etiology	Viral*	56 (25.0 %)
	Bacteria	3 (1.3 %)
	I don't know	165 (73.7 %)
Immunity against shingles decreases with advancing age	Yes*	103 (46.0 %)
	No	1 (0.4 %)
	I don't know	120 (53.6 %)
infected with chickenpox makes a person more susceptible to getting shingles (herpes zoster) later in life	Yes*	37 (16.5 %)
	No	2 (0.9 %)
	I don't know	185 (82.6 %)
Individuals with a weakened immune system are at a higher risk of developing shingles (herpes zoster).	Yes*	83 (37.1 %)
	No	3 (1.3 %)
	I don't know	138 (61.6 %)
In your opinion, who is more susceptible to getting shingles	Less than 40 years	3 (1.3 %)
	41-49 years	2 (0.9 %)
	50 years and more*	134 (59.8 %)
	I don't know	85 (37.9 %)
What do you know about signs and	Chronic back pain	29 (12.9 %)

symptoms of shingles?		(%)
	Painless skin rash	13 (5.8 %)
	Heart disease	175 (78.1 %)
Is there a vaccine for shingles?	Painful skin rash*	7 (3.1 %)
	Yes*	122 (54.5 %)
	No	3 (1.3 %)
Can shingles transmit through direct contact?	I don't know	99 (44.2 %)
	Yes*	26 (11.6 %)
	No	30 (13.4 %)
Can a person get shingles more than once?	I don't know	168 (75.0 %)
	Yes*	25 (11.2 %)
	No	7 (3.1 %)
Is taking antiviral medications such as acyclovir an effective treatment for shingles?	I don't know	192 (85.7 %)
	Yes*	10 (4.5 %)
	No	9 (4.0 %)
What are the complications of shingles	I don't know	205 (91.5 %)
	Hearing loss (Yes*)	28 (12.5 %)
	UTI (No*)	205 (91.5 %)
	Meningitis (Yes*)	33 (14.7 %)

				%)	
		Chronic pain (Yes*)	188	(83.9%)	
		visual impairment (Yes*)	47	(21.0%)	
Total	Minimum	Maximum	Mean	SD	Median
	0	12.0	4.9	2.7	4.0

*: True answer

Table 5. Attitude about herpes zoster among diabetic patients in Al-Ahsa, KSA (n = 224).

Attitude items			Agree	Natural	Disagree
I am worried that may get shingles (Herpes Zoster).			78 (34.8%)	73 (32.6%)	73 (32.6%)
I am willing to be vaccinated with the shingles vaccine.			94 (42.0%)	65 (29.0%)	65 (29.0%)
I am interested in seek more information about the shingles			146 (65.2%)	65 (29.0%)	13 (5.8%)
Herpes Zoster has a significant effect on health.			133 (59.4%)	79 (35.3%)	12 (5.4%)
I am willing to learn more about methods of HZ prevention.			144 (64.3%)	66 (29.5%)	14 (6.3%)
Total	Minimum	Maximum	Mean	SD	Median
	5.0	15.0	11.9	2.6	12.0

Table 6: Mean score of awareness and attitude with respect to personal and diseases characteristics:

Variables		N	Awareness score 4.9 ± 2.7 Mean rank	P-value	Attitude score 11.9 ± 2.6 Mean rank	P-value
Sex^a	Male	122	115.5	.363	117.0	.185
	Female	102	108.9		107.1	
Age^b	≤ 50	9	155.0	.057	149.6	.112
	51-60	108	110.4		109.1	
	> 60	107	111.0		112.8	
Marital status^a	Single	5	110.2	.924	94.8	.473
	Married	219	112.6		112.9	

Education^b	Illiterate	31	111.6	.030*	93.4	.103
	Primary	45	115.2		114.7	
	Secondary	48	92.0		103.7	
	Higher secondary	65	117.1		120.6	
	Graduate and above	35	129.4		123.6	
Employment^a	Employed	71	117.1	.385	116.3	.492
	Unemployed	153	110.3		110.8	
Income^b	Less than 10000 RS	119	101.4	.004*	103.6	.037*
	10000 - 20000 RS	98	124.1		123.1	
	More than 20000 RS	7	139.0		114.0	
Types of DM^a	T1DM	2	99.0	.725	162.0	.207
	T2DM	222	112.6		112.1	
Duration of DM^b	< 5 years	83	122.6	<.001*	116.1	.384
	5 - 10 years	79	119.6		115.2	
	>10 years	62	90.0		104.2	
Heard about HZ^a	Yes	127	136.5	<.001*	128.5	<.001*
	No	97	81.1		91.6	
Being diagnosed by HZ^a	Yes	15	140.1	.042*	147.1	.013*
	No	209	110.5		110.0	
Knowing someone diagnosed by HZ^a	Yes	53	140.2	<.001*	136.6	<.001*
	No	171	103.9		105.0	
Vaccinated against HZ^a	Yes	42	149.7	<.001*	162.0	<.001*
	No	182	103.9		101.1	

a= Mann-Whitney U test
significant at level 0.05

b=Kruskal-Wallis test * =

Discussion

The International Diabetes Federation (IDF) has observed that type 2 diabetes (T2D) is a rapidly growing global health concern that has reached epidemic proportions. Additionally, the number of new cases of T2D is projected to affect one out of every ten individuals worldwide by 2035[10,11]. Furthermore, according to the World Health Organization (WHO), Saudi Arabia ranks as the second-highest country in terms of diabetes prevalence in the Middle East and the seventh highest in the world[12]. A twenty-year audit study of herpes zoster (HZ) in the Asia-Pacific region identified immune senescence and immunosuppression as the principal risk factors for HZ[13].

In our study, only 6.7% of diabetic patients were diagnosed with herpes zoster. Additionally, 23.7% of them knew someone who had been diagnosed with herpes zoster, whether diabetic or non-diabetic. This rate is lower than the rates in previous studies in Korea, where 14.7% of respondents had a history of herpes zoster[14] and 26.1% among COPD patients in the USA[15]. People with diabetes have a 20% higher risk of developing HZ, which can lead to deterioration of glycemic control and increased consumption of healthcare resources [9]. Although the literature has demonstrated the efficacy of HZ vaccination in reducing incidence rates[16], the vaccination rate in our study was 18.8%. Notably, this rate is significantly higher than the vaccination rates reported in previous studies among general populations in the Western Region of Saudi Arabia (3.4%)[17], in Qassim region KSA (8.5%) [18], Korea (9%)[14] and the United Arab Emirates (3.3%)[19]. One quarter of Saudi diabetic patients were willing to accept the herpes zoster (HZ) vaccine [18]. Furthermore, studies show that healthcare providers play a crucial role in promoting and recommending vaccination to improve vaccination rates [18,20,21].

The present study indicated that 62.1% of participants were aware of various aspects of HZ, this result is higher than previous studies in Korea, where 42.3% were knowledgeable about HZ and its vaccine[14] and UAE where only 1.9% had a knowledge score of 80% and above[19]. The possible variation in awareness of herpes zoster (HZ) can be attributed to the fact that most participants in this study cited healthcare providers as their primary source of knowledge regarding HZ.

In the current study, only 25% of participants were aware that the varicella-zoster virus is the etiology of shingles. This result is consistent with the results of studies in Hong Kong (29.6%)[22], United Arab Emirates (26.7%)[19] and among undergraduate students at the University of Namibia (70.7%)[23].

In the present study, only 3.1% of participants were aware of the signs and symptoms of shingles. This is lower than the rates of awareness in previous studies in Hong Kong (85.7%)[22] and the United Arab Emirates (58.7%)[19].

Regarding risk factors of HZ, our study found that only 46% of participants were aware of the decreased immunity against HZ with advancing age, 16.5% knew about the increased susceptibility for those previously infected with chickenpox, and 37.1% knew about the higher risk for individuals with weakened immune systems. These findings are consistent with previous studies. In Saudi Arabia, the most identifiable risk factors for HZ were found to be immunodeficiency (63.2%),

age (36.3%), and chronic diseases (36.3%)[18]. The Hong Kong study reported that the majority of responders (84.7%) identified immunocompromised state as a risk factor for HZ[22], while in the United Arab Emirates, participants identified immunodeficiency (35.5%), chronic illnesses (18%), advanced age (32.7%), and stress (41.9%) as predisposing and risk factors for HZ[19]. Overall, the results highlight the need for increased public education and awareness of the risk factors for HZ. Effective public health policies and interventions should be developed to improve the uptake of HZ vaccine and reduce HZ burden in different populations and regions.

Awareness of HZ is positively correlated with a higher level of education, a high income, a short duration of diabetes, having heard about HZ, being diagnosed with HZ, knowing someone diagnosed with HZ, and being vaccinated against HZ among diabetic patients. Previous studies in Saudi Arabia[18], Hong Kong [22] and UAE [19] have found that higher levels of education are associated with higher levels of knowledge about HZ.

The current study found that more than half of patients (55.8%) had a positive attitude towards HZ and its vaccine. Specifically, about two-thirds of the participants (65.2%) were interested in seeking more information about HZ, 64.3% were willing to learn more about methods of HZ prevention and 59.4% agreed that HZ has a significant effect on health. In addition, one-third of the patients (32.6%) were worried that they might get HZ. However, only 42.0% expressed a willingness to be vaccinated with the HZ vaccine. These results are in line with previous studies in Saudi Arabia [17] and the UAE[22].

Limitations of the study

The current study had some limitations, such as a lack of generalizability due to the use of convenience sampling to recruit participants and the fact that it was conducted in only one region.

Conclusion

Even though more than half of the diabetic patients in this study were aware of herpes zoster (HZ) and had a positive attitude towards HZ and its vaccine, the vaccination rate for HZ was low. This study highlights the need for healthcare providers to play an active role in promoting and recommending HZ vaccination, as well as providing health education in simple language through various media to increase community awareness about HZ and its vaccine. By increasing awareness and vaccination rates, the burden of HZ on this vulnerable population can be reduced.

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Conflict of Interest

No conflict of interest

Informed Consent

Informed consent was obtained from the entire participant prior to filling the questionnaire

Ethical Statement

This study IRB was obtained from King Fahad Hospital - Hufuf No. (H-05-HS-065)

Author Contribution

Me, Ahmed Alhaid, and my colleagues Co-authors worked together as a team in conducting this research project reviewing the literature, collecting and analyzing data and making the conclusion.

References

1. Oxman MN: Herpes zoster pathogenesis and cell-mediated immunity and immunosenescence. *J Osteopath Med*. 2009, 109:13–7. 10.7556/jaoa.2009.20009
2. Gilden D, Mahalingam R, Nagel M, Pugazhenth S, Cohrs R: The neurobiology of varicella zoster virus infection. *Neuropathol Appl Neurobiol*. 2011, 37:441–63. 10.1111/j.1365-2990.2011.01167.x.
3. Opstelten W, van Loon AM, Schuller M, van Wijck AJ, van Essen GA, Moons KG, Verheij TJ: Clinical diagnosis of herpes zoster in family practice. *Ann Fam Med*. 2007, 5:305–9. 10.1370/afm.707
4. Yawn BP, Saddier P, Wollan PC, Sauver JLS, Kurland MJ, Sy LS: A population-based study of the incidence and complication rates of herpes zoster before zoster vaccine introduction. *Elsevier*; 2007. 1341–9. 10.4065/82.11.1341
5. [Diabetes in Saudi Arabia \(2021\)](https://idf.org/our-network/regions-and-members/middle-east-and-north-africa/members/saudi-arabia/). (2021). <https://idf.org/our-network/regions-and-members/middle-east-and-north-africa/members/saudi-arabia/>.
6. Papagianni M, Metallidis S, Tziomalos K: Herpes zoster and diabetes mellitus: a review. *Diabetes Ther*. 2018, 9:545–50. 10.1007/s13300-018-0394-4
7. Anderson TC, Masters NB, Guo A, et al.: Use of recombinant zoster vaccine in immunocompromised adults aged ≥ 19 years: recommendations of the Advisory Committee on Immunization Practices—United States, 2022. *Am J Transplant*. 2022, 22:986–90. 10.15585/mmwr.mm7103a2
8. Harbecke R, Cohen JI, Oxman MN: Herpes zoster vaccines. *J Infect Dis*. 2021, 224:S429–42.
9. Munoz-Quiles C, López-Lacort M, Ampudia-Blasco FJ, Díez-Domingo J: Risk and impact of herpes zoster on patients with diabetes: a population-based study, 2009–2014. *Hum Vaccines Immunother*. 2017, 13:2606–11. 10.1080/21645515.2017.1368600
10. Unnikrishnan R, Pradeepa R, Joshi SR, Mohan V: Type 2 diabetes: demystifying the global epidemic. *Diabetes*. 2017, 66:1432–42. 10.2337/db16-0766
11. Galanos G, Dimitriou H, Pappas A, Perdikiogianni C, Symvoulakis EK, Galanakis E, Lionis C: Vaccination coverage of patients with type 2 diabetes mellitus: Challenging issues from an outpatient secondary care setting in Greece. *Front Public Health*. 2022, 10:10.3389/fpubh.2022.921243
12. Abdulaziz Al Dawish M, Alwin Robert A, Braham R, Abdallah Al Hayek A, Al Saeed A, Ahmed Ahmed R, Sulaiman Al Sabaan F: Diabetes mellitus in Saudi Arabia: a review of the recent literature. *Curr Diabetes Rev*. 2016, 12:359–68. 10.2174/1573399811666150724095130
13. Chen L-K, Arai H, Chen L-Y, et al.: Looking back to move forward: a twenty-year audit of herpes zoster in Asia-Pacific. *BMC Infect Dis*. 2017, 17:1–39. 10.1186/s12879-017-2198-y
14. Roh NK, Park YM, Kang H, et al.: Awareness, knowledge, and vaccine acceptability of herpes zoster in Korea: a multicenter survey of 607 patients. *Ann Dermatol*. 2015, 27:531–8. 10.5021/ad.2015.27.5.531
15. Yawn BP, Merrill DD, Martinez S, Callen E, Cotton J, Williams D, Loskutova NY: Knowledge and attitudes concerning herpes zoster among people with COPD: an interventional survey study. *Vaccines*. 2022, 10:420. 10.3390/vaccines10030420
16. Tricco AC, Zarin W, Cardoso R, et al.: Efficacy, effectiveness, and safety of herpes zoster vaccines in adults aged 50 and older: systematic review and network meta-analysis. *bmj*. 2018, 363:10.1136/bmj.k4029
17. Alhothali OS, Alhothali AS, Hanif AA, et al.: A Cross-Sectional Study of the Knowledge, Practice, and Attitude Towards Herpes Zoster Vaccination Among the General Population in the Western Region of Saudi Arabia. *Cureus*. 2023, 15:10.7759/cureus.33508
18. Al-Orini D, Alshoshan AA, Almutiri AO, et al.: Acceptability of Herpes Zoster Vaccination among Patients with Diabetes: A Cross-Sectional Study in Saudi Arabia. *Vaccines*. 2023, 11:651. 10.3390/vaccines11030651
19. Al-Khalidi T, Genidy R, Almutawa M, et al.: Knowledge, attitudes, and practices of the United Arab Emirates population towards Herpes Zoster vaccination: a cross-sectional study. *Hum Vaccines Immunother*. 2022, 18:2073752. 10.1080/21645515.2022.2073752
20. Baalbaki NA, Fava JP, Ng M, et al.: A community-based survey to assess knowledge, attitudes, beliefs and practices regarding Herpes Zoster in an urban setting. *Infect Dis Ther*. 2019, 8:687–94. 10.1007/s40121-019-00269-2
21. Wang Q, Yang L, Li L, Liu C, Jin H, Lin L: Willingness to Vaccinate Against Herpes Zoster and Its Associated Factors Across WHO Regions: Global Systematic Review and Meta-Analysis. *JMIR Public Health Surveill*. 2023, 9:e43893. 10.2196/43893
22. Lam AC, Chan M, Chou H, et al.: A cross-sectional study of the knowledge, attitude, and practice of patients aged 50 years or above towards herpes zoster in an out-patient setting. *Hong Kong Med J*. 2017, 23:365. 10.12809/hkmj165043
23. Tomas N, Kampanza F: Awareness of varicella-zoster virus among undergraduate students at the University of Namibia. *J Public Health Afr*. 2022, 13:10.4081/jphia.2022.1923

