

ORIGINAL

A survey of public knowledge, attitudes and practices towards the seasonal influenza vaccine in North Macedonia

Encuesta sobre conocimientos, actitudes y prácticas de la población en relación con la vacuna contra la gripe estacional en Macedonia del Norte

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Abstract

Introduction: Vaccination against seasonal influenza is the most effective way to prevent infections, hospitalization, morbidity, and mortality. The objective of the study was to assess the knowledge, attitude, and practices of the North Macedonia adult population towards seasonal influenza vaccine.

Materials and methods: A prospective cross-sectional study in November-December 2022 among the adult population of North Macedonia was conducted. A total of 1012 respondents filled in the 4-item semi-structured questionnaire. The questionnaire collected information on de-mographics, knowledge, attitudes, and practices towards the influenza vaccine. The chi-square test was used to test for associations and logistic regression was used to determine the effect of variables on the possibility of vaccination.

Results and discussion: The median age of the respondents was 36 years, predominantly female (73.5%). Only 7.8% of respondents received the influenza vaccine in the previous season (2021/2022) and 12.4% planned to vaccinate in the current season. A statistically significant difference between the vaccinated and non-vaccinated individuals was established in terms of age groups and the presence of comorbidity ($\chi^2=11.246$, $p=0.004$). The vaccinated respondents significantly more often tend to consider the influenza vaccine as safe ($\chi^2=5.026$, $p=0.025$) and effective ($\chi^2=11.247$, $p=0.001$). Respondents who had comorbidities, who considered the vaccine as effective, and were not afraid of possible side effects were 3 times, 2.0 times, and 1.8 times more likely respectively to have received an influenza vaccine. Additionally, the respondents who tend to rely more on social media and internet as the main source of information regarding the flu vaccine were 0.5 times more likely to have rejected the vaccine.

Conclusion: Addressing influenza vaccine safety, efficacy, patient-specific recommendations and encouraging effective physician communication and counselling are some of the key areas for increasing knowledge and awareness.

Key words: influenza vaccine, knowledge, attitudes, practices, vaccination, hesitancy.

Resumen

Introducción: La vacunación contra la gripe estacional es la forma más eficaz de prevenir infecciones, hospitalizaciones, morbilidad y mortalidad. El objetivo del estudio era evaluar los conocimientos, la actitud y las prácticas de la población adulta de Macedonia del Norte respecto a la vacuna contra la gripe estacional.

Materiales y métodos: Se realizó un estudio transversal prospectivo en noviembre-diciembre de 2022 entre la población adulta de Macedonia del Norte. Un total de 1012 encuestados rellenaron el cuestionario semiestructurado de 4 ítems. El cuestionario recogía información sobre datos demográficos, conocimientos, actitudes y prácticas con respecto a la vacuna antigripal. Se utilizó la prueba chi-cuadrado para comprobar las asociaciones y la regresión logística para determinar el efecto de las variables sobre la posibilidad de vacunación.

Resultados y discusión: La mediana de edad de los encuestados fue de 36 años, con predominio de mujeres (73,5%). Sólo el 7,8% de los encuestados recibió la vacuna antigripal en la temporada anterior (2021/2022) y el 12,4% tenía previsto vacunarse en la temporada actual. Se estableció una diferencia estadísticamente significativa entre los individuos vacunados y no vacunados en cuanto a grupos de edad y presencia de comorbilidad ($\chi^2=11,246$, $p=0,004$). Los encuestados vacunados tienden significativamente más a considerar la vacuna antigripal como segura ($\chi^2=5,026$, $p=0,025$) y eficaz ($\chi^2=11,247$, $p=0,001$). Los encuestados que tenían comorbilidades, que consideraban que la vacuna era eficaz y que no temían los posibles efectos secundarios tenían 3 veces, 2,0 veces y 1,8 veces más probabilidades, respectivamente, de haberse vacunado contra la gripe. Además, los encuestados que tendían a confiar más en las redes sociales e Internet como principal fuente de información sobre la vacuna de la gripe tenían 0,5 veces más probabilidades de haber rechazado la vacuna.

Conclusiones: Abordar la seguridad y eficacia de la vacuna antigripal, las recomendaciones específicas para cada paciente y fomentar la comunicación y el asesoramiento eficaces por parte de los médicos son algunas de las áreas clave para aumentar el conocimiento y la concienciación.

Palabras clave: vacuna antigripal, conocimientos, actitudes, prácticas, vacunación, indecisión.

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Introduction

Influenza is a contagious respiratory disease caused by influenza viruses that infect the upper respiratory tract. These viruses circulate during the winter months in the northern hemisphere, and they can affect all age groups, responsible for one of the most wide-spread diseases in the world causing significant morbidity and mortality. Worldwide, the annual epidemics are estimated to result in about 3 to 5 million cases of severe illness, and about 290.000 to 650.000 respiratory deaths¹. In industrialized countries, most deaths associated with influenza occur among people aged 65 or older². The effects of seasonal influenza epidemics in developing countries are not fully known, but research estimates that 99% of deaths in children under 5 years of age with influenza-related lower respiratory tract infections are found in developing countries³. Every year epidemics caused by the influenza viruses are registered in Europe mostly during the winter months and the influenza A-type virus has pandemic potential.

Vaccination against seasonal flu is the most effective way to prevent infections, hospitalization, morbidity, and mortality from this disease^{4,5}. A 2021 study showed that among adults hospitalized with flu, vaccinated patients had a 26% lower risk of intensive care unit (ICU) admission and a 31% lower risk of death from flu compared with those who were unvaccinated⁶. Moreover, vaccination in the elderly has been shown to reduce the risk of death from influenza-related complications by 80%⁷.

To increase protection for more people, the World Health Organization (WHO) and the U.S. Center for Disease Control and Prevention (CDC) have issued new recommendations that persons aged 6 months and older be encouraged to get the influenza vaccine. Individuals in high-risk groups should have the influenza vaccine every year to lower their risk of serious complications^{8,9}.

For the season of 2021/2022, the total number of flu or flu-like diseases among the North Macedonia adult population amounts to 3 960 patients (I=178,4/100.000), which compared to the same period of season 2020/2021 (n=1 127) notes an increase of 3.3 times, and in relation to the last 10 seasons 2012/2022 (n=26 322), notes a decrease of 86.0%¹⁰.

A total of 49,320 persons received an influenza vaccine during the 2021-2022 influenza season. This is an increase of 8.3% compared to the season 2020-2021 when 45.561 doses were administered overall, and by 11.5% compared to the 2019-2020 season. The administration of influenza vaccine doses to older adults over 65 has increased by 100%, which is what caused the overall increase. Contrarily, the number of doses given to pregnant women, people with chronic illnesses, and children aged 6 months to 5 have been drastically reduced¹¹.

The objective of the study was to assess the knowledge, attitude, practices and possible factors influencing the uptake of the seasonal influenza vaccine of the North Macedonia adult population.

Materials and methods

Study design and settings

In the period of November 2022 - December 2022 a cross-sectional study using a semi-structured questionnaire was conducted in North Macedonia. For recruiting the participants, we used a random convenience sampling method using social media to distribute the questionnaire. The sample size was calculated using G* Power version 3.1.9.7. The margin of error (the maximum difference between the sample results and the total population) and the confidence interval (the probability that the sample accurately reflects the attitudes of the targeted population) were set at 5% and 95%, respectively. The number of participants needed for our study was estimated to be 902. The total sample size during our study was 1012 respondents over 18 years of age.

Questionnaire design

A 4-item semi-structured questionnaire was constructed in the Macedonian language. It was prepared using Google Forms and was disseminated through an electronically generated link. Before filling out the survey, the possible respondents had to provide informed consent for participation in the study and there was an option to drop out from the study at any time before submitting the questionnaire. The first part of the survey collected information about the demographics of the respondents such as age, gender, financial situation, education, and financial situation. The second section assessed the knowledge of the participants regarding the main characteristics of influenza (seasonality, risk groups, and recommendations for vaccination. In the third section, we collected information about the practices for vaccination with a flu vaccine- vaccination with a flu vaccine in the previous influenza season and intention to receive the vaccine in the following season. The last section of the questionnaire collected information about the attitudes and beliefs of the respondents towards influenza and the flu vaccine.

Participants and eligibility criteria

1) Age \geq 18 years 2) voluntary participation without payment and with the option to withdraw at any time up until the submission of the data.

Statistical analysis

Data was entered and analyzed using SPSS software, version 25.0 (IBM Corp, Armonk NY, USA). Standard descriptive statistics was used to summarize the demographic characteristics of the respondents. The

qualitative variables were represented using numerical values in the form of absolute and relative frequencies, as well as totals and percentages (n, %). The Kolmogorov-Smirnov test was utilized to ascertain the distribution of the sampled patients. The Chi-Square test was employed to examine the presence of an association between two nominal variables. Statistical tests were considered to have statistical significance if the p-value was less than 0.05. A binomial logistic regression was used to determine the effect of the different variables on the possibility of vaccination.

Ethical considerations

The study received an exemption of the Ethical Committee of the Ss. Cyril and Methodius University in Skopje as it met one of the criteria for exemption (an anonymous survey or interview that do not involve collection of identifiable data).

Results

A total of 1012 people took part in the survey. The median age of the respondents was 36 years (25th percentile 24 yrs.; 75th percentile 48 yrs.), predominantly female (n=747, 73.8%). More than one-quarter of all participants reported that they are smokers (n = 304, 30%), and 7,8% (n = 79) reported having a comorbidity. The most common comorbidity among the participants was diabetes (n=36, 3.56%). The demographics of all respondents are presented in **table I**.

When asked whether they have been vaccinated with an influenza vaccine in the previous winter season

2021/2022, only 7.8% (n=79) of the participants gave a positive answer. We further asked the respondents if they plan to receive the influenza vaccine and 12.4 % (n=125) of them gave a positive response. When exploring the distribution of respondents in different age groups we found a statistically significant difference among the vaccinated and non-vaccinated individuals ($\chi^2=11.246$, $p=0.004$). There is also a statistically significant difference between the two groups regarding the presence of comorbidity (**Table I**).

The respondents showed an overall good knowledge of the characteristics of influenza infection in terms of contagiousness, possible complications, seasonality, and recommended groups for influenza vaccination. Most participants correctly identified the aetiology of influenza (93.7%, n = 948). Most of the participants (79,2%, n = 802) were aware that the influenza vaccine is received once a year, and 76.6% (n = 775) knew that influenza appears at a certain time of the year. Only 62.1% (n = 628) correctly identified at what time of year it is recommended to receive the influenza vaccine. The vaccinated respondents showed a better knowledge when it came to the recommendations for vaccination, and they were significantly more aware that there are specific at-risk groups in the population who should receive the influenza vaccine ($\chi^2=3.923$, $p=0.048$) (**Table II**).

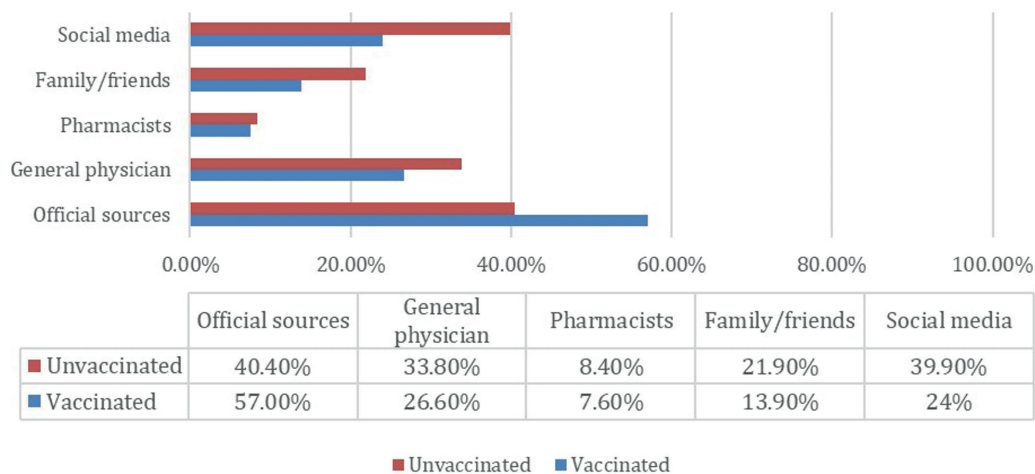
When asking the participants on the sources of information about influenza, our results showed that the most trusted source were official sites of the Ministry of Health (MH) and WHO, CDC (41,8%, n = 422) followed by Internet/ social media (38,6%, n = 390) and general physician (33,1%, n = 336) (**Figure 1**).

Table I: Demographic characteristics of the respondents (n=1012).

Variables	All respondents (n=1012)	Vaccinated (n=79)	Non-vaccinated (n=933)	p-value
Age	36 (24;48)	39 (24;56)	36 (24;48)	0.876
Age group n (%)				0.004
18-30 y.o.	379 (37.4)	32 (8.4)	347 (91.6)	
30-50 y.o	424 (41.9)	21 (4.9)	403 (95.1)	
>51 y.o	209 (20.7)	26 (12.4)	183 (87.6)	
Gender n (%)				0.092
Male	265 (26.2)	27 (10.2)	238 (89.8)	
Female	747 (73.8)	52 (7.0)	695 (93.0)	
Education n (%)				0.323
University degree	642 (63.4)	44 (6.8)	598 (93.2)	
Middle school	346 (34.2)	33 (9.5)	313 (90.5)	
Primary school	24 (2.4)	2 (8.3)	22 (91.7)	
Financial situation, n (%)				0.136
Comfortable	51 (5.0)	7 (13.7)	44 (86.3)	
Good	610 (60.3)	41 (6.7)	569 (93.3)	
Difficult	351 (34.7)	31 (8.8)	320 (91.2)	
Smoking, n (%)				0.746
Yes	304 (30.0)	25 (8.2)	279 (91.8)	
Comorbidities, n (%)				0.000
Yes	78 (7.7)	16 (20.5)	62 (79.5)	

Table II: Knowledge of the participants regarding influenza and the influenza vaccine (n=1012).

Variable	Vaccinated (n=79)	Non-vaccinated (n=933)	p-value
Influenza is caused by a virus, n (%)			
Yes	70 (7.4)	878 (92.6)	0.054
Flu can lead to serious complications, n (%)			
Yes	62 (7.4)	774 (92.6)	0.216
Influenza can be prevented with a vaccine, n (%)			
Yes	68 (7.8)	801 (92.2)	0.956
How often should we vaccinate? n (%)			
Once a year	64 (8.0)	738 (92)	0.547
Influenza is more common in the winter months, n (%)			
Yes	59 (7.6)	716 (92.4)	0.678
There are specific at-risk groups of the population recommended to receive the vaccine., n (%)			
Yes	77 (8.3)	849 (91.7)	0.048

Figure 1: Primary sources of information about the influenza virus and the influenza vaccine of the respondents (n=1012).

We then further explored the main source of information of the vaccinated and non-vaccinated respondents and there were some statistically significant differences. A higher share of people who decided to receive the influenza vaccine trust official sources such as MH, WHO, and CDC for information regarding the influenza vaccine compared to non-vaccinated (n=45, 57.0 vs. n=378, 40.4% $\chi^2=8.099$, p=0.004). Additionally, the respondents who haven't received the vaccine significantly more trust internet and social media as the main source of information about the vaccine compared to the vaccinated individuals (n=368, 39.4% vs. n=19, 24.0% $\chi^2=6.968$, p=0.008).

The attitudes of the respondents towards the influenza vaccine were explored with several statements using a 5-level Likert scale. A statistically significant higher share of vaccinated individuals considered the influenza vaccine as safe (n=50, 63.2% vs n=468, 50.1%, $\chi^2=5.026$, p=0.025). A similar significant difference in the attitudes of the vaccinated and non-vaccinated

respondents was established when they were asked if they considered the influenza vaccine as effective in preventing an illness (n=52, 65.8 for vaccinated vs. n=431, 46.2% for non-vaccinated $\chi^2=11.247$, p=0.001). Positive is the fact that 605 respondents stated that they would recommend the influenza vaccine to family or friends (n=605, 59.8%). More than half of the respondents (62,2%, n = 630) were willing to receive the influenza vaccine after recommendations and advice from their general physician (**Table III**).

A multiple logistic regression was performed to determine the possible association between flu vaccination as the dependent variable (vaccinated vs. non-vaccinated) with the responses of the respondents on the statements of vaccine and the flu itself-safety, effectiveness, side effects, seriousness of the diseases (completely agree/agree vs disagree/completely disagree), and the three most cited sources of information about the flu vaccine as independent variables (official sources, general physician, social

media and internet). Additionally, to the model gender and the presence of comorbidities were added. The logistic regression model was statistically significant $\chi^2(3) = 41.864, p < 0.001$). The model correctly classified 92.3% of the cases. Respondents who had comorbidities were 3 times more likely to have received an influenza vaccine and this was the strongest predictor for vaccination. The participants who considered the

vaccine as effective in preventing illness and were not afraid of possible adverse events following vaccination were 2.0 times and 1.8 times more likely to have been vaccinated respectively. Additionally, the respondents whose main source of information for influenza were social media and internet were 0.5 time more likely to have refused to get vaccinated with a flu vaccine (**Table IV**).

Table III: Attitudes of the respondents towards the influenza vaccine.

Questions	Vaccinated group (n=79)	Non-vaccinated group (n=933)	p-value
The influenza vaccine is safe, n (%) Agree/Completely agree	50 (9.6)	468 (90.4)	0.025
If I get the Flu/Influenza, I can be seriously ill for more than a week, n (%) Agree/Completely agree	46(9.0)	467 (91)	0.163
The flu is a more serious illness than a bad cold, n (%) Agree/Completely agree	51 (8.0)	588 (92)	0.786
The vaccine cannot always prevent the onset of influenza, n (%) Disagree/Completely disagree	42 (8.3)	463 (91.7)	0.546
Concerned of side effects of the vaccine, n (%) Agree/Completely agree	29 (9.1)	291 (90.9)	0.311
The vaccine is effective, n (%) Agree/Completely agree	52 (10.8)	431 (89.2)	0.001
Would recommend the vaccine to family or friends, n (%) Yes	60 (9.9)	545 (90.1)	0.002
Would get the influenza vaccine if the GP recommend it, n (%) Yes	64 (10.1)	566 (89.9)	0.000

Table IV: Multiple linear regression model on the likelihood of receiving the influenza vaccine.

Model	Unstandardized Coefficients		Wald	df	Sig.	Exp(B)	95% Confidence Interval for B	
	B	Std. Error					Lower Bound	Upper Bound
Constant	-2.441	1.213	4.046	1	0.044	0.087		
Gender								
Female (baseline)								
Male	1.263	1.164	1.179	1	0.278	0.283	0.029	2.765
Comorbidities								
No (baseline)								
Yes	1.169	0.324	13.01	1	0.000	3.218	1.705	6.072
Flu is a serious disease								
Disagree/Completely disagree (baseline)								
Agree/Completely agree	0.515	0.283	3.305	1	0.069	1.674	0.961	2.917
Considers the vaccine as safe								
Disagree/Completely disagree (baseline)								
Agree/Completely agree	0.270	0.318	0.718	1	0.397	0.764	0.409	1.425
Afraid of vaccine side effects								
Agree/Completely agree (baseline)								
Disagree/Completely disagree	0.585	0.268	4.772	1	0.029	1.794	1.062	3.032
Considers the vaccine as effective								
Disagree/Completely disagree (baseline)								
Agree/Completely agree	0.716	0.312	5.253	1	0.022	2.046	1.109	3.772
Main source of information- official authorities								
No (baseline)								
Yes	0.322	0.273	1.383	1	0.240	1.379	0.807	2.358
Main source of information- general physician								
No (baseline)								
Yes	0.467	0.290	2.594	1	0.107	1.596	0.904	2.818
Main source of information- social media, internet								
No (baseline)								
Yes	0.601	0.301	3.995	1	0.046	0.548	0.304	0.988

Discussion

Seasonal influenza vaccination is the primary and the most effective way to prevent influenza and its potentially serious complications. The results from our study revealed an overall vaccination rate of only 7.8% which is suboptimal. Low vaccination rates are a worldwide public health problem. European countries are likewise having difficulty meeting the specified immunization goals for influenza¹². A study from Bulgaria showed that only 11% of the respondents have been vaccinated with an influenza vaccine which is a result similar to ours¹³. Our study's findings show rates that are much lower than those of other nations, including Germany (40.4%), France (37.5%), Spain (56.4%), and Italy (48.6%)^{14,15}. A recent study from North Macedonia exploring the effect of the COVID-19 pandemic on the influenza vaccine uptake showed an increase in the administered vaccine doses by 8.3% but still the vaccination coverage is extremely low (2.5%)¹¹. Due to this, the development of a national program to boost influenza vaccination coverage is of crucial importance.

In our study only 20.5 % of the respondents with comorbidities have received the influenza vaccines which is significantly lower than the recommendations of the European Union regarding the target vaccination rates of the high-risk group of 75%¹⁵. According to recent data, acceptance rates have reportedly reached around 44% among high-risk categories in the European region¹⁶. In the logistic regression analysis, the presence of comorbidity proved to be strongly associated with the likelihood of influenza vaccination and the respondents with comorbidities were 3 times more likely to have the vaccine administered. Therefore, from both a governmental and healthcare professional standpoint, greater attention must be placed on immunizing high-risk groups in North Macedonia.

The respondents in our study had an overall good knowledge regarding influenza and the recommendations for vaccination and there was no association between the knowledge of the participants and the possibility of vaccination that has been established in similar studies^{16,17}.

When analyzing the attitudes of the survey respondents towards the influenza vaccine we established that the vaccinated individuals tend to consider significantly more often the influenza vaccine as safe ($n=50$, 63.2% for vaccinated vs $n=468$, 50.1% for non-vaccinated, $\chi^2=5.026$, $p=0.025$) and effective in preventing the occurrence of infection ($n=52$, 65.8 for vaccinated vs. $n=431$, 46.2% for non-vaccinated $\chi^2=11.247$, $p=0.001$). The respondents who tend to believe the influenza vaccine is effective had 2.0 times higher chance for vaccination. This result correlates with the results from similar studies^{18,19}.

One of the concerns among the respondents regarding the influenza vaccine was the fear of possible side effects after vaccination ($n=320$, 31.6%). The respondents from our study who were not afraid of possible side effects were 1.8 times more likely to have received the vaccine. A similar study done in Turkey showed that around 50% of the participants avoid the vaccination due to this reason²⁰. Additionally, a German study conducted on the general public reported that "fear of side effects" and "vaccination was not necessary" were the most reported concerns influencing influenza vaccine uptake²¹.

Another important factor that might influence the vaccination uptake is the source of information. Among the studied respondents the main source of information were official authorities such as MH, WHO, CDC, followed by social media, and physicians as third main source. These results correspond to other similar studies^{22,23}.

When asked what their main source of information is regarding influenza and the influenza vaccine the vaccinated respondents significantly more often tend to rely on official sources such as MH, WHO, and CDC ($n=45$, 57.0 vaccinated vs. $n=378$, 40.5% non-vaccinated $\chi^2=8.099$, $p=0.004$) whereas the non-vaccinated respondents prefer the internet and social media statistically significantly more often compared to the vaccinated individuals ($n=368$, 39.4% vs. $n=19$, 24.0% $\chi^2=6.968$, $p=0.008$) and those relying on social media were 0.5 times more likely to have rejected to receive the vaccine. It is important to note that 60.6% of the non-vaccinated respondents would be willing to receive the influenza vaccine if recommended by their GPs. Our findings are in line with earlier research that demonstrates that recommendations from medical professionals are one of the most powerful motivators for influenza vaccination²⁴⁻²⁷. Particularly doctors have a critical role in encouraging their patients to adopt appropriate attitudes and practices about influenza vaccination²⁴. This research encourages doctors to have open discussions with their patients about their attitudes and opinions towards influenza vaccination.

This study is a crucial step in educating scientists and decision-makers in the nation about the level of public knowledge regarding influenza and its vaccine, as well as the low vaccination rate. As was already mentioned, the media significantly affects how the general population thinks about vaccination²⁸. By utilizing the country's available multi-media content, such as explainer videos, flyers, or SMS text messages to inform the public about influenza and the availability of influenza vaccines, the country can achieve equitable access to information about influenza infection and influenza vaccine.

Conclusions

This study discovered that the participants in our study had low vaccination rate despite having an appropriate level of flu vaccine knowledge. It is essential to increase the flu vaccination rate among residents of North Macedonia to reach a consistent population-immunity level. Addressing influenza vaccine safety, efficacy, ideal vaccination administration times, patient-specific vaccination recommendations, encouraging effective physician communication and counseling, and using social media platforms to disseminate information from authentic and dependable sources are some of the key areas for increasing knowledge and awareness as well as combating false information about the influenza

vaccination. Medical professionals should be constantly reminded of the importance of screening and guiding patients on vaccinations.

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Conflict of Interest

None

References

1. World Health Organization. Influenza (seasonal). [https://www.who.int/news-room/fact-sheets/detail/influenza-\(seasonal\)](https://www.who.int/news-room/fact-sheets/detail/influenza-(seasonal)).
2. Thompson WW, Weintraub E, Dhankhar P, Cheng PY, Brammer L, Meltzer MI, et al. Estimates of US influenza-associated deaths made using four different methods. *Influenza Other Respir Viruses*. 2009 Jan; 3(1):37-49.
3. Nair H, Brooks WA, Katz M, Roca A, Berkley JA, Madhi SA, et al. Global burden of respiratory infections due to seasonal influenza in young children: a systematic review and meta-analysis. *Lancet* 2011 Dec; 3;378(9807):1917-30.
4. Salgado CD, Giannetta ET, Hayden FG, Farr BM, Preventing nosocomial influenza by improving the vaccine acceptance rate of clinicians. *Infect Control* 2004 Nov; 25(11):923-8.
5. Hayward AC, Harling R, Wetten S, Johnson AM, Munro S, Smedley J, et al. Effectiveness of an influenza vaccine programme for care home staff to prevent death, morbidity, and health service use among residents: Cluster randomized controlled trial. *BMJ* 2006 Dec; 16;333(7581):1241.
6. Ferdinands JM, Thompson MG, Blanton L, Spencer S, Grant L, Fry AM, Does influenza vaccination attenuate the severity of breakthrough infections? A narrative review and recommendations for further research. *Vaccine*. 2021 Jun; 23;39(28):3678-95.
7. Kamal KM, Madhvan SS, Amonkar MM, Determinants of adult influenza and pneumonia immunization rates. *J. Am. Pharm. Assoc*. 2003 May-Jun; 43(3):403-11.
8. World Health Organization. (2012). Weekly Epidemiological Record, 2012, vol. 87, 23 [full issue]. Relevé épidémiologique hebdomadaire, <https://apps.who.int/iris/handle/10665/241925> [Last accessed 07 November 2023].
9. Fiore AE, Uyeki TM, Broder K, Finelli L, Euler GL, Singleton JA, et al. Centers for Disease Control and Prevention (CDC). Prevention and control of influenza with vaccines: recommendations of the Advisory Committee on Immunization Practices (ACIP), 2010. *MMWR Recomm Rep*. 2010 Aug 6;59(RR-8):1-62. Erratum in: *MMWR Recomm Rep*. 2010 Aug 13;59(31):993. Erratum in: *MMWR Recomm Rep*. 2010 Sep; 10;59(35):1147.
10. Sostojba so grip/zaboluvanja slicni na grip sezona 2021/2022. Institute of public health of Republic of North Macedonia. 2022. Final report 2021-2022; 1-7. <https://www.iph.mk/en/?s=%D0%B3%D1%80%D0%B8%D0%BF>
11. Mustafa Z, Memeti S, Karadzovski Z, Sarafinowska Z, Mihajloska E, Netkovska K, et al. The influence of Covid-19 pandemic on the vaccination of the population with the influenza vaccine in the Republic of North Macedonia, *MEDIS - Medical Science and Research*, 2020;1(2): 49-53.
12. European Centre for Disease Prevention and Control. Implementation of the Council Recommendation on seasonal influenza vaccination (2009/1019/EU). Stockholm: ECDC; 2014. <https://www.ecdc.europa.eu/en/publications-data/implementation-council-recommendation-seasonal-influenza-vaccination>
13. Rangelova V, Kevorkyan A, Raycheva R, Amudzhyan D, Sariyan S, Knowledge, attitudes, and practices towards the influenza vaccine among adult population in Plovdiv, Bulgaria. *Arch Balk Med Union*. 2021;56(3):329-35.
14. European Centre for Disease Prevention and Control. Seasonal Influenza Vaccination in Europe. Vaccination Recommendations and Coverage Rates in the EU Member States for Eight Influenza Seasons: 2007–2008 to 2014– 2015. Stockholm; 2017. <https://www.ecdc.europa.eu/en/publications-data/seasonal-influenza-vaccination-europe-vaccination-recommendations-and-coverage-2007-2015>

15. Williams WW, Lu PJ, O'Halloran A, Kim DK, Grohskopf LA, Pliishvili T, et. al Surveillance of Vaccination Coverage among Adult Populations - United States, 2015. *MMWR Surveill Summ*. 2017 May 5;66(11):1-28.
16. El Khoury G, Salameh P, Influenza Vaccination: A Cross-Sectional Survey of Knowledge, Attitude and Practices among the Lebanese Adult Population. *Int J Environ Res Public Health*. 2015 Dec; 12(12):15486-97.
17. Alhatim N, Al-Bashaireh AM, Alqudah O, Knowledge, attitude, and practice of seasonal influenza and influenza vaccine immunization among people visiting primary healthcare centers in Riyadh, Saudi Arabia. *PLoS One*. 2022;17(4):e0266440.
18. Alqahtani AS, Althobaity HM, Al Aboud D, Abdel-Moneim AS, Knowledge and attitudes of Saudi populations regarding seasonal influenza vaccination. *J Infect Public Health*. 2017 Nov-Dec; 10(6):897-900.
19. Aljamili AA, Knowledge and practice toward seasonal influenza vaccine and its barriers at the community level in Riyadh, Saudi Arabia. *J Family Med Prim Care*. 2020 Mar;9(3):1331-39.
20. Savas E, Tanriverdi D, Knowledge, attitudes and anxiety towards influenza A/H1N1 vaccination of healthcare workers in Turkey. *BMC Infectious Diseases*, 2010 Sep; 10(1):281.
21. Bödeker B, Remschmidt C, Schmich P, Wichmann O. Why are older adults and individuals with underlying chronic diseases in Germany not vaccinated against flu? A population-based study. *BMC Public Health*. 2015 Jul 7; 15:618.
22. Sagor KH, AlAteeq MA. Beliefs, attitudes, and barriers associated with the uptake of the seasonal influenza vaccine among patients visiting primary healthcare clinics. *Saudi Med J*. 2018 Jul;39(7):690-96.
23. Sales IA, Syed W, Almutairi MF, Al Ruthia Y. Public Knowledge, Attitudes, and Practices toward Seasonal Influenza Vaccine in Saudi Arabia: A Cross-Sectional Study. *Int J Environ Res Public Health*. 2021 Jan 8;18(2):479.
24. Bertoldo G, Pesce A, Pepe A, Pelullo CP, Di Giuseppe G; Collaborative Working Group. Seasonal influenza: Knowledge, attitude and vaccine uptake among adults with chronic conditions in Italy. *PLoS One*. 2019 May 1;14(5):e0215978.
25. Mo PK, Lau JT. Influenza vaccination uptake and associated factors among elderly population in Hong Kong: the application of the Health Belief Model. *Health Educ Res*. 2015 Oct;30(5):706-18.
26. Ye L, Fang T, Cui J, Zhu G, Ma R, Sun Y, et al. The intentions to get vaccinated against influenza and actual vaccine uptake among diabetic patients in Ningbo, China: identifying motivators and barriers. *Hum Vaccin Immunother*. 2021 Jan 2;17(1):106-18.
27. Nagata JM, Hernández-Ramos I, Kurup AS, Albrecht D, Vivas-Torrealba C, Franco-Paredes C. Social determinants of health and seasonal influenza vaccination in adults ≥65 years: a systematic review of qualitative and quantitative data. *BMC Public Health*. 2013 Apr 25;13:388.
28. Yaqub O, Castle-Clarke S, Sevdalis N, Chataway J. Attitudes to vaccination: a critical review. *Soc Sci Med*. 2014 Jul;112:1-11.