

The impact of COVID-19 pandemic on recommended adult vaccination in the elderly: A hospital-based study

COVID-19 pandemisinin önerilen erişkin aşılamalarına etkisi: Hastane temelli çalışma

Cemile Karaçepiş¹, Hacer Hicran Mutlu², Hasan Hüseyin Mutlu², Ayşe Gülek¹

¹Department of Family Medicine, Faculty of Medicine, Istanbul Medeniyet University, Istanbul, Turkey

²Department of Medical Education, Faculty of Medicine, Istanbul Medeniyet University, Istanbul, Turkey

Submitted Date: 21 January 2024, Accepted Date: 28 August 2024

Correspondence: Hacer Hicran Mutlu
Department of Family Medicine; Faculty of Medicine, Istanbul Medeniyet University, Istanbul, Turkey
e-mail: hicranbeyca@hotmail.com

ORCID ID: CK [0000-0002-1865-7305](https://orcid.org/0000-0002-1865-7305)
HHM [0000-0003-3712-0068](https://orcid.org/0000-0003-3712-0068)
HHM [0000-0001-8947-711X](https://orcid.org/0000-0001-8947-711X)
AG [0000-0003-0196-4111](https://orcid.org/0000-0003-0196-4111)

SUMMARY

Aim: With the COVID-19 pandemic, significant changes have occurred all over the world and in Turkey. Recommended adult vaccination practices are one of them. This study aims to compare the adult vaccination rates and awareness before and after the COVID-19 pandemic.

Material and Methods: Sociodemographic characteristics (age, gender, marital status, education status, comorbidities), vaccines performed in adulthood, and reasons for getting vaccinated and avoiding vaccines before and during the pandemic were asked to the responders. The results were compared with the data of the study which was performed between 31.01.2017-01.06.2017 in the same outpatient clinic of the same hospital were used with permission of all the authors.

Results: It was observed that pneumococcal (9.9% vs 56.5%) ($p<0,001$), influenza (33.9% vs 47.7%) ($p=0,004$), tetanus (1.3% vs 20.7%) ($p<0,001$) and hepatitis B (0.7% vs 4.8%) ($p=0,04$). Vaccination rates significantly increased during pandemic compared to the period before the pandemic.

Conclusion: The adult vaccination coverage was insufficient, on the other hand with the pandemic particularly pneumococcal vaccination coverage has increased among adults. It was considered that traditional and social media had an important role in this increase.

Keywords: COVID-19 pandemics, immunization schedule, mass media, social media, vaccination, vaccine hesitancy

ÖZET

Amaç: COVID-19 salgınıyla birlikte tüm dünyada ve Türkiye'de önemli değişiklikler meydana geldi. Önerilen yetişkin aşılamaya uygulamaları da bunlardan biridir. Bu çalışma, COVID-19 salgını öncesi ve sonrası yetişkinlerde aşılamaya oranlarını ve farkındalıklarını karşılaştırmayı amaçlamaktadır.

Materyal ve Metodlar: Yanıt verenlere sosyodemografik özellikler (yaş, cinsiyet, medeni durum, eğitim durumu, yandaş hastalıklar), yetişkinlikte yapılan aşılarda, pandemi öncesi ve pandemi sırasında aşı yaptırmama ve aşılardan kaçınma nedenleri soruldu. Sonuçlar tüm yazarların izni alınarak aynı hastanenin aynı polikliniğinde 31.01.2017-01.06.2017 tarihleri arasında gerçekleştirilen çalışmanın verileriyle karşılaştırıldı.

Bulgular: Pnömonokok (%9,9 vs %56,5) ($p<0,001$), influenza (%33,9 vs %47,7) ($p=0,004$), tetanoz (%1,3 vs %20,7) ($p<0,001$) ve hepatit B (%0,7 vs %4,8) ($p=0,04$) olduğu gözlemlendi. Aşılanma oranlarında pandemi öncesi döneme göre pandemi döneminde anlamlı artış görüldü.

Sonuç: Erişkin aşı kapsamı yetersiz olmakla birlikte, pandemiyle birlikte erişkinlerde özellikle pnömonokok aşı kapsamı artmıştır. Bu artışta geleneksel ve sosyal medyanın önemli bir rolü olduğu değerlendirildi.

Anahtar kelimeler: Aşılamaya, aşı karşıtlığı, aşı takvimi, COVID-19 pandemisi, geleneksel medya, sosyal medya

INTRODUCTION

Novel Coronavirus Disease (COVID-19) is a virus that was first detected on January 13, 2020, and spread from person to person in a group of patients who developed respiratory symptoms (fever, cough, shortness of breath) in Wuhan Province, China, towards the end of December 2019 (1). In humans, several coronaviruses have been found to cause respiratory infections, ranging from common cold to much more severe diseases such as Middle East Respiratory Syndrome (MERS) and Severe Acute Respiratory Syndrome (SARS). The severe acute respiratory syndrome related coronavirus (SARS-CoV-2) is the causative agent of the New Coronavirus Disease (2). The first COVID-19 case detected in Turkey was announced by the Ministry of Health on March 10, 2020, and the first death due to the virus in our country occurred on March 15, 2020. The Ministry of Health announced on April 1, 2020, that the coronavirus cases had spread all over Turkey (3).

After the COVID-19 pandemic, significant changes have occurred all over the world and in our country. A number of factors played a role in the limitation to accessing healthcare of elderly people which led to a deterioration of their chronic diseases. The home quarantine processes and the burden on the healthcare system are the factors that restrained them from going to the hospitals. On the other hand, they felt the need to take many precautions, which they learned through traditional and social media, for fear of having COVID-19 and anxiety of having severe COVID-19. The spread of the perception that the pneumococcal vaccine prevents COVID-19 was one of them (4).

Aging is the process of reaching the end of life expectancy as a result of the decrease in life functions at the level of organs, tissues, cells, and genes in the life process that begins with the birth of a person. According to the World Health Organization (WHO), the aging process begins at the age of 65 (5). Infectious diseases are an important cause of morbidity and mortality in elderly individuals who have significant comorbidities and who are naturally immune suppressed (6). Vaccination is still the most effective and cost-efficient, medical therapy against infectious diseases. Providing scheduled immunizations can protect elderly individuals and communities from vaccine-preventable diseases (7). After the health reform in our country, it has been reported that childhood vaccination in primary care has reached 98%. However, the same success has not been demonstrated with elderly vaccination yet (5). In the light of these statements, we aimed to compare the adult vaccination rates, awareness, and reasons for avoiding getting vaccinated before and during the pandemic, who applied to the family medicine outpatient clinic of our hospital, particularly in individuals over 65 years of age who would be easily protected from the morbidity and mortality of infectious diseases by vaccination.

The primary outcome of this study was to evaluate the impact of the COVID-19 pandemic on adult vaccination in elderly people. The secondary outcome was the determination of vaccination coverage and the factors affecting it.

MATERIAL AND METHODS

Participants

All of the patients who consecutively applied to Family Medicine outpatient clinics between 01.11.2021-01.01.2022 in a tertiary hospital in Istanbul who met inclusion criteria were recruited in the study. The inclusion criteria were being over 65 years old and volunteering for the study.

Data Collection

A questionnaire was developed by the researchers within the scope of the research to collect some demographic information and the vaccination status of the responders. Sociodemographic characteristics (age, gender, marital status, education status, comorbidities), vaccines performed in adulthood, and reasons for getting vaccinated and avoiding vaccines before and during the pandemic were asked in the questionnaire.

As pre-pandemic data, the data of Mutlu et al. study (5) who is one of the researchers of the present study, in which vaccination rates and awareness were measured in individuals over the age of 65, between 31.01.2017-01.06.2017 in the same outpatient clinic of the same hospital were used with permission of all the authors.

Ethical Approval

The study was performed in accordance with the Declaration of Helsinki and was approved by Istanbul Medeniyet University Göztepe Research and Training Hospital Ethical Committee (2021/0532) on 27.10.2021.

Statistical Analysis

For the descriptive analysis of the study, a database was created in the SPSS 25.0 program and the frequency, percentage, mean, and standard deviation values of the data were calculated. $p < 0.05$ was considered significant in all analyses.

Normally distributed data were shown as mean \pm SD and the data that were not normally distributed were presented as median, minimum and maximum values. Significant differences of normally distributed data were assessed using a t-test and significant differences of not normally distributed data were analyzed using the Mann-Whitney U test. Categorical data were expressed as percentages.

RESULTS

52.6% of the participants were female and the mean age

of them was 72.35±5.31 years. The other sociodemographic characteristics and co-morbidities of the study population are presented in Table 1. The most prevalent comorbidity was hypertension (53.5%) and diabetes mellitus (30.3%).

Table 1. The sociodemographic characteristics and co-morbidities of the participants

		N (310)	%	
Age	(mean±SD) (min-max)	72,35±5,31	(65- 91)	
Gender	Female	163	52,6	
	Male	147	47,4	
Marital status	Married	207	66,8	
	Single	17	5,5	
	Divorced/widow	86	27,7	
	illiterate	29	9,4	
Educational status	Literate	13	4,2	
	Primary school	103	33,2	
	Middle school	30	9,7	
	High school	62	20,0	
Having social insurance	University	73	23,5	
	Having social insurance	295	95,2	
	Having chronic disease	Having chronic disease	263	84,8
		Diabetes mellitus	94	30,3
Hypertension		166	53,5	
Chronic lung disease		26	8,4	
Chronic cardiovascular disease		79	25,5	
Chronic renal disease		15	4,8	
Chronic liver disease		6	1,9	
Any other chronic disease		63	20,3	

The adult vaccination coverage except for the COVID-19 vaccine was 61% during the pandemic and COVID-19 vaccination coverage was 77.4% among our sample. Pneumococcal, influenza, tetanus, hepatitis B, and meningococcal vaccination coverage were 56.5%, 47.7%, 20.6%, 4.8%, and 3.9% respectively. None of the participants were vaccinated against Hepatitis A, measles, mumps and rubella (MMR), or Herpes zoster (Table 2).

The reasons for following adult vaccination recommendations before the COVID-19 pandemic were asked to the participants. 58.2% of the responders declared that they were recommended by a physician and 23.3% of them reported that it was their self-decision. The percentage of those who were affected by traditional and social media was relatively low (10.3%) (Figure 1). The reasons for the above-mentioned issues were also asked during the COVID-19 pandemic and are presented in Figure 1. It is apparent from this figure that the percentages of recommendation by a physician and self-decision had

markedly reduced during pandemics, on the other hand, the rate of the participants that heard about the necessity of adult vaccination from traditional and social media had evidently increased.

Table 2. The vaccination rates of the participants

	N	%
Adult vaccination rate during the pandemic except for COVID-19	189	61.0
Total adult vaccination rate (before or during the pandemic)	240	77.4
Pneumococcal vaccination rate	175	56.5
Influenza vaccination rate	148	47.7
Tetanus vaccination rate	64	20.6
Hepatitis B vaccination rate	15	4.8
Meningococcal vaccination rate	12	3.9
Hepatitis A vaccination rate	0	0.0
MMR vaccination rate	0	0.0
Herpes zoster vaccination rate	0	0.0
Total	310	100.0

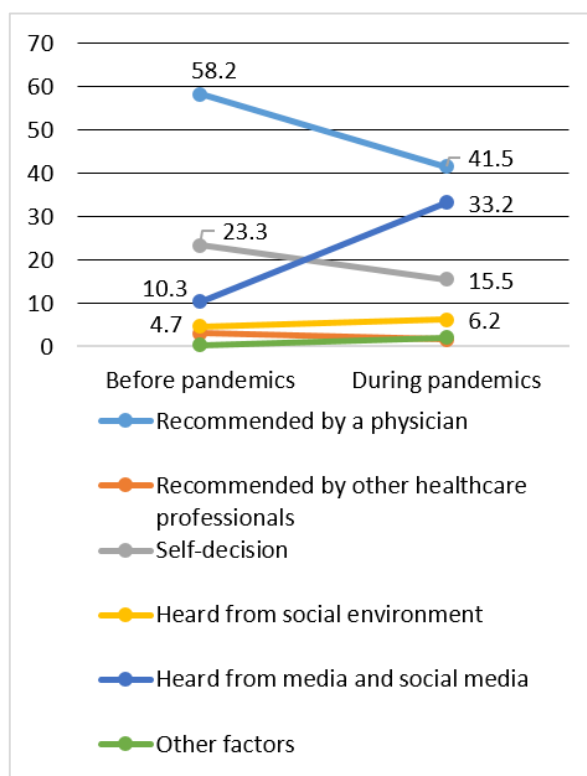


Figure 1. The reasons for following adult vaccination recommendations

The barriers to adult vaccinations were also asked. The majority of the responders reported that they were not aware of vaccination is a necessity (48.6%), 19.3% of the sample believed that a healthy person did not need to be

vaccinated and 14.7% of them were anxious about the side effects of the vaccines.

When the barriers to adult vaccination during pandemics were investigated it was clearly observed that the percentage of responders who reported that they were not aware of vaccination is a necessity had decreased (Figure 2).

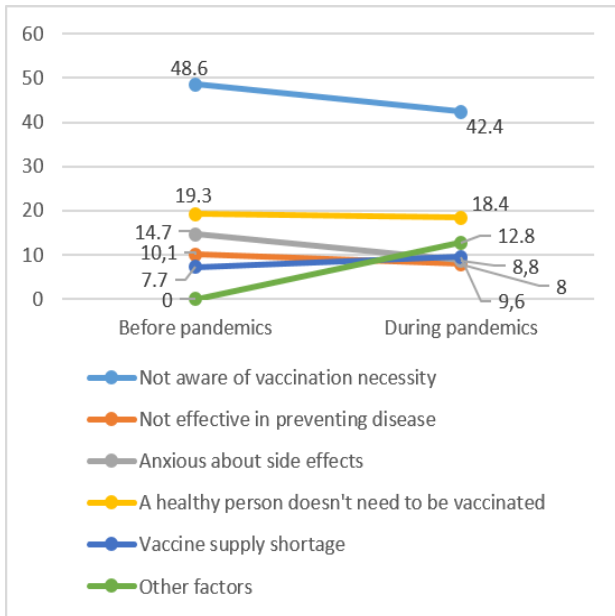


Figure 2. The barriers to adult vaccination

Pneumococcal and influenza vaccines were the most administered vaccines during COVID-19 pandemics (Figure 3).

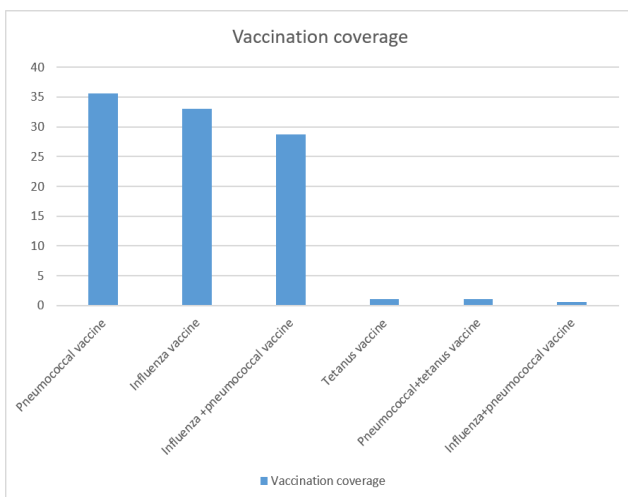


Figure 3. Adult vaccination coverage during the COVID-19 pandemic

No association was determined between pneumococcal vaccination rates and sociodemographic characteristics

and co-morbidities. The influenza vaccination rates were higher in males, married individuals, and patients with chronic heart disease (Table 3).

Table 3. The relationship between sociodemographic characteristics and influenza and pneumococcal vaccination status

		Influenza vaccination status		p	Pneumococcal vaccination status		p
		Yes	No		Yes	No	
Age		72.72±5	72.02	0.366	72.40±	72.18±5	0.621
Gender	Female	.63	±4.99	0.014	5.31	.37	0.385
	Male	(41.1)	(58.9)		(75.5)	(24.5)	
Marital status	Married	108	99	0.027	163	(78.7)	44 (21.3)
	Single	(52.2)	(47.8)		77	(74.8)	26 (25.2)
	illiterate	40	63				
Educational status	Primary+middle school	15	27	0.151	27	15	0.080
	High school+university	(35.7)	(64.3)		(64.3)	(35.7)	
	Primary+middle school	62	71		104	29	
Having social insurance	High school+university	71	64	0.932	109	26	0.698
	High school+university	(52.6)	(4.4)		(80.7)	(19.3)	
Co-morbidities	Diabetes Mellitus	141	154	0.889	229	66	0.599
	Hypertension	(47.8)	(52.2)		(77.6)	(22.4)	
Chronic lung disease	Chronic heart disease	126	137	0.308	205	58	0.340
	Chronic renal disease	(47.9)	(52.1)		(77.9)	(22.1)	
Chronic heart disease	Chronic renal disease	49	45	0.393	76	18	0.340
	Chronic renal disease	(52.1)	(47.9)		(80.9)	(19.1)	
Chronic renal disease	Chronic heart disease	83	83	0.289	132	34	0.950
	Chronic heart disease	(50.0)	(5.0)		(79.5)	(20.5)	
Chronic heart disease	Chronic renal disease	15	11	0.001	20	6	0.231
	Chronic renal disease	(57.7)	(42.3)		(76.9)	(23.1)	
Chronic renal disease	Chronic heart disease	50	29	0.001	65	14	0.231
	Chronic heart disease	(63.3)	(36.7)		(82.3)	(17.7)	
Chronic heart disease	Chronic renal disease	7	8		14	1	
	Chronic renal disease	(46.7)	(53.3)		(93.3)	(6.7)	

COVID-19 vaccination coverage among our sample was also investigated in the current study. The percentage of the participants who were vaccinated with any of the COVID-19 vaccines was 99.4%. The distribution of COVID-19 vaccine percentages among our sample is shown in Figure 4. 80% of the responders had been vaccinated with two doses of inactivated COVID-19 vaccine (Sinovac). The rate of those who were vaccinated with two doses of mRNA COVID-19 vaccine (BioNtech) was 38.1%.

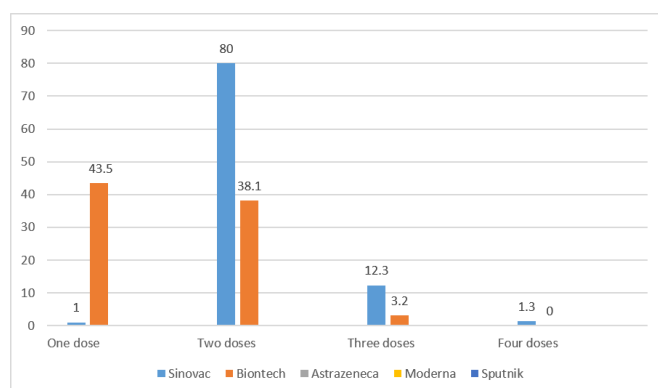


Figure 4. The distribution of COVID-19 vaccine percentages among our sample

When vaccination rates before and during the pandemic were compared, it was observed that pneumococcal, influenza, tetanus, and hepatitis B vaccination rates significantly increased during the pandemic compared to the period before the pandemic.

DISCUSSION

The results of the study showed that almost all of the participants were vaccinated at least with one dose of vaccine against COVID-19. The most striking finding of this study was the increase in particularly pneumococcal vaccination coverage during the pandemic in adult vaccination.

A Center for Disease Control and Prevention (CDC) report declared influenza, pneumococcal, herpes zoster, tetanus, hepatitis B, and hepatitis A vaccination coverage respectively as 61%, 69%, 39.5%, 22.2% and 6.2% in the elderly population who were ≥ 65 years. These rates are quite higher than our results except for tetanus vaccination coverage which was similar to our results. This result may be due to the fact that the individuals are vaccinated against tetanus in case of an injury or an animal bite occurs beyond the periodical vaccinations (8). In a study conducted in Denmark with elderly individuals influenza vaccination coverage was lower (41%) than ours. The studies from China reported that the vaccination coverage of the elderly with influenza ve pneumococcal vaccines is much more lower than the results in the literature. Influenza and pneumococcal vaccination coverage in elderly individuals was 7.3% and 0.7%, respectively (9,10). Another study reported that pneumococcal vaccination coverage in persons >65 years old was 49.5% which is again lower than our pneumococcal vaccination coverage (11). The pneumococcal vaccination coverage (56%) of > 65 years old people in Australia was similar to our results, however, influenza vaccination coverage differed from our findings. The influenza vaccination rates were higher (74.8%) than the current study's finding like the study conducted in Greece (12). In this study, the influenza

vaccination coverage was 83%, and pneumococcal vaccination coverage was 49.7% (13).

Herpes zoster vaccination coverage was more than our findings though not enough yet in various studies (13,14). According to a CDC report the herpes zoster vaccination coverage was 34.5% which is better than in European countries (8). In the present study, not a single person was vaccinated against herpes zoster because we don't have a herpes zoster vaccine in our country. In the aforementioned studies conducted in Italy and Greece tetanus or tetanus, diphtheria, and pertussis (Tdap) and hepatitis B vaccination coverage was lower than our findings (13,14). This result may be due to the fact that the present study was conducted during the pandemic and the most important finding of the present study was that, it was observed that the awareness for adult vaccination increased with the pandemic.

The findings about the relationship between sociodemographic factors and influenza and pneumococcal vaccination are conflicting in the literature. In a review where many studies from different countries were collected, the influenza vaccination rate increased with age and the older female gender was more vaccinated (15). Another study declared that females were more vaccinated against pneumococcal (11). The study investigating the racial and socioeconomic disparities in adult vaccination found an association with low educational status and adult vaccination coverage (16). Hellfritsch et al reported that the predictors of influenza vaccination in adults were age, having heart and vascular disease, chronic pulmonary disease, and diabetes. There was no difference in terms of gender and educational status in this study (17). Heart and pulmonary disease were found to be predictors of pneumococcal vaccination among Australian adults (18). In our study no association was found between pneumococcal vaccination and sociodemographic factors, on the other hand, male gender, being married, and having heart disease was the predictors of influenza vaccination. In Turkey, while the pneumococcal vaccine could be easily supplied during the pandemic, the influenza vaccine was limited to those with special conditions which having a chronic ischemic heart disease was one of them. Men could have been more vaccinated against influenza because of being a risk factor for chronic ischemic heart disease.

The reasons for following adult vaccination recommendations before and during the pandemic were also asked to the responders in the current study. The doctor and healthcare professionals' recommendations were the most reasons for following adult vaccination recommendations in this study which is in line with Gürsoy et al's study conducted in another region in Turkey (19). The advice of doctors and healthcare professionals has been shown to be the most important factor that promotes vaccination in the elderly (5,20-22). Therefore, it

is important to recommend vaccination to elderly individuals at every healthcare professional visit. In the literature, most of the studies claimed that unawareness of necessity was the most frequent barrier to vaccination likewise the current study's findings (1,5,9,19,23). Hence, it is important to increase awareness of adult vaccination among the elderly to promote vaccination.

Another interesting finding in the present study is the impact of traditional and social media on vaccination. The percentage of participants that were recommended for vaccination by a doctor had evidently decreased, on the other hand, the rate of participants that heard about the necessity of adult vaccination from traditional and social media had evidently increased during the pandemic. During the pandemic, public exposure to health communication from traditional and social media has risen due to both lockdowns and coronaphobia, by contrast, direct communication between patients and healthcare

providers had reduced (4). Therefore, traditional and social media became a tool for seeking information about healthcare and this information played an important role in vaccination decision-making (24). While traditional media pursued a pro-vaccine approach, some social media sources had antivaccine content (25). Meanwhile, there was also misinformation that every person should be vaccinated against pneumococcal for protection from catching COVID-19. Our data showed this misinformation has achieved its purpose. The most striking result of this study was the increase of pneumococcal vaccination coverage from 9.9% to 56.5% during the pandemic. On the other hand, some increase has been seen in influenza vaccination rates supporting other findings in the literature (26-31), but this increment is not as dramatic as with the pneumococcal vaccine.

Another important finding of our study was the high levels of COVID vaccination coverage. The vaccination coverage with any COVID-19 vaccines was 99.4% in our sample. The percentage of the participant that has vaccinated with two doses of inactivated COVID-19 vaccine (Sinovac) was 80%, on the other hand, 38.1% of the responders were vaccinated with two doses of mRNA COVID-19 vaccine (BioNtech). These percentages are quite higher than the average coverage of Turkey which is 63% within the dates that the study was conducted (32). Our findings were also higher than the study's findings performed in China. This study declared that the COVID-19 vaccination coverage was 73.6% and the coverage was increased to 82.2% when the vaccines became free (33).

The current study has a few limitations. First, it is a single-center hospital-based study. Second, the vaccination coverage has obtained with self-report questionnaires. Third, the sample size is relatively low.

In our study, it was revealed that adult vaccination

coverage was insufficient in adults over 65 years of age before the pandemic and adult vaccination coverage increased during the pandemic. It was shown that this increase was particularly evident in pneumococcal vaccination. It was thought that this significant increase may be due to misinformation in traditional and social media that pneumococcal vaccination can protect individuals from catching COVID. As a result, with the right information, traditional and social media can have important implications for increasing vaccination rates, as with improving many health issues.

Author Contributions: Working Concept/Design: HHM, Data Collection: CK, AG, Data Analysis / Interpretation: HHM, HHM, Text Draft: CK, AG, Critical Review of Content: HHM, HHM, AG, Final Approval and Responsibility: CK, HHM, HHM

Conflict of Interest: The authors state that there is no conflict of interest regarding this manuscript.

Financial Disclosure: The authors declared that this study has received no financial support.

REFERENCES

- Balcı UG, Şimşek Y, Öngel K. Level of knowledge and attitude of the patients older than 65 years about pneumococcal vaccine. *J Heal Sci.* 2015;3:113-116.
- Krammer F. SARS-CoV-2 vaccines in development. *Nature.* 2020;586(7830):516-527.
- Akdi Y, Emre Karamanoğlu Y, Ünlü KD, Baş C. Identifying the cycles in COVID-19 infection: the case of Turkey. *J Appl Stat.* 2022;1-13.
- Puri N, Coomes EA, Haghbayan H, Gunaratne K. Social media and vaccine hesitancy: new updates for the era of COVID-19 and globalized infectious diseases. *Hum Vaccin Immunother.* 2020;16(11):2586-2593.
- Mutlu HH, Coşkun FO, Sargın M. Aile hekimliği polikliniğine başvuran 65 yaş ve üstü kişilerde aşılama sıklığı ve farkındalığı. *Ankara Med J.* 2018;18(1):1-13.
- Yılmaz T, Yılmaz TE, Ceyhan Ş, Kasım I, Abdülkadir K, Odabaş ÖK, et al. Evde sağlık hizmetleri birimine kayıtlı geriatrik hastaların influenza ve pnömokok aşısı ile aşılama durumları ve doktor önerisinin etkisi. *Ankara Med J.* 2018;18(3):391-401.
- de Gomensoro E, Del Giudice G, Doherty TM. Challenges in adult vaccination. *Ann Med.* 2018;50(3):181-192.
- Report MW. Surveillance of Vaccination Coverage Among Adult Populations — United States , 2018. 2021;70(3).
- Yan S, Wang Y, Zhu W, Zhang L, Gu H, Liu D, et al. Barriers to influenza vaccination among different populations in Shanghai. *Hum Vaccin Immunother.* 2021;17(5):1403-1411.
- Liu Y, Xu Y, Wang J, Che X, Gu W, Du J, et al. Vaccination pattern of the 23-valent pneumococcal polysaccharide vaccine (PPV23) in Hangzhou, China: A coverage and adverse events following immunization of different age

- groups. *Hum Vaccin Immunother.* 2021;17(1):157-161.
- 11.Sabapathy D, Strong D, Myers R, Li B, Quan H. Pneumococcal vaccination of the elderly during visits to acute care providers: Who are vaccinated? *Prev Med (Baltim).* 2014;62:155-160.
- 12.Dyda A, Karki S, Hayen A, MacIntyre CR, Menzies R, Banks E, et al. Influenza and pneumococcal vaccination in Australian adults: a systematic review of coverage and factors associated with uptake. *BMC Infect Dis.* 2016;16(1):1-15.
- 13.Papagiannis D, Rachiotis G, Mariolis A, Zafiriou E, Gourgoulialis KI. Vaccination coverage of the elderly in Greece: a cross-sectional nationwide study. *Can J Infect Dis Med Microbiol.* 2020;2020:5459793.
- 14.Veronese N, Vassallo G, Armata M, Cilona L, Casalicchio S, Masnata R, et al. Multidimensional Frailty and Vaccinations in Older People: A Cross-Sectional Study. *Vaccines.* 2022;10(4):555.
- 15.Kini A, Morgan R, Kuo H, Shea P, Shapiro J, Leng SX, et al. Differences and disparities in seasonal influenza vaccine, acceptance, adverse reactions, and coverage by age, sex, gender, and race. *Vaccine.* 2022;40(11):1643-1654.
- 16.Kawai K, Kawai AT. Racial/ethnic and socioeconomic disparities in adult vaccination coverage. *Am J Prev Med.* 2021;61(4):465-473.
- 17.Hellfritzsch M, Thomsen RW, Baggesen LM, Larsen FB, Sørensen HT, Christiansen CF. Lifestyle, socioeconomic characteristics, and medical history of elderly persons who receive seasonal influenza vaccination in a tax-supported healthcare system. *Vaccine.* 2017;35(18):2396-2403.
- 18.Trent MJ, Salmon DA, MacIntyre CR. Predictors of pneumococcal vaccination among Australian adults at high risk of pneumococcal disease. *Vaccine.* 2022;40(8):1152-1161.
- 19.Yalçın Gürsoy M, Tanrıverdi G, Özsezer G, Chousko Mehmet F. Vaccination coverage and related factors among the elderly: A cross-sectional study from Turkey. *Public Health Nurs.* 2022;39(2):390-397.
- 20.Dardalas I, Pourzitaki C, Manomenidis G, Malliou F, Galanis P, Papazisis G, et al. Predictors of influenza vaccination among elderly: a cross-sectional survey in Greece. *Aging Clin Exp Res.* 2020;32(9):1821-1828.
- 21.Higuchi M, Narumoto K, Goto T, Inoue M. Correlation between family physician's direct advice and pneumococcal vaccination intention and behavior among the elderly in Japan: a cross-sectional study. *BMC Fam Pract.* 2018;19(1):1-11.
- 22.Qendro T, de la Torre ML, Panopalis P, Hazel E, Ward BJ, Colmegna I, et al. Suboptimal immunization coverage among Canadian rheumatology patients in routine clinical care. *J Rheumatol.* 2020;47(5):770-778.
- 23.Uzuner A, Arabacı Ş, Yücel AI, Kocatürk AC, Kaynar E, Khan A. Knowledge, attitude and behaviors of adults about adulthood immunization. *TJFMPC.* 2018;12(3):215-225.
- 24.Zimand-sheiner D, Kol O, Frydman S. To Be (Vaccinated) or Not to Be : The Effect of Media Exposure , Institutional Trust , and Incentives on Attitudes toward COVID-19 Vaccination. 2021;18(24):12894.
- 25.Viswanath K, Bekalu M, Dhawan D, Pinnamaneni R, Lang J, Mcloud R. Individual and social determinants of COVID-19 vaccine uptake. 2021;1-10.
- 26.Kong G, Lim N-A, Chin YH, Ng YPM, Amin Z. Effect of COVID-19 Pandemic on Influenza Vaccination Intention: A Meta-Analysis and Systematic Review. *Vaccines.* 2022;10(4):606.
- 27.Gallant AJ, Nicholls LAB, Rasmussen S, Cogan N, Young D, Williams L. Changes in attitudes to vaccination as a result of the COVID-19 pandemic: A longitudinal study of older adults in the UK. *PLoS One.* 2021;16(12):e0261844.
- 28.Aşılari E, Bilgi H, Davranışları T, Bachtiger P, Adamson A, Peters NS, et al. Social media and vaccine hesitancy: new updates for the era of COVID-19 and globalized infectious diseases. *Ankara Med J [Internet].* 2020;17(3):155-160.
- 29.Zingel R, Beinker P, Kostev K. The Impact of the COVID-19 Pandemic on Immunization Rates for Preventable Diseases in Primary Care and Pediatric Practices in Germany. *Dtsch Arztebl Int.* 2022;119(11):195.
- 30.Bachtiger P, Adamson A, Chow J-J, Sisodia R, Quint JK, Peters NS. The impact of the COVID-19 pandemic on the uptake of influenza vaccine: UK-wide observational study. *JMIR public Heal Surveill.* 2021;7(4):e26734.
- 31.Domnich A, Cambiaggi M, Vasco A, Maraniello L, Ansaldi F, Baldo V, et al. Attitudes and beliefs on influenza vaccination during the COVID-19 pandemic: Results from a representative Italian survey. *Vaccines.* 2020;8(4):711.
- 32.HASUDER Bulaşıcı Hastalıklar Grubu. COVID-19 PANDEMİSİNDE GÜNCEL DURUM VE ÖNERİLER [Internet]. Available from: <https://hasuder.org.tr/wp-content/uploads/HASUDER-COVID-19-RAPORU.pdf>
- 33.Liu R, Zhang Y, Nicholas S, Leng A, Maitland E, Wang J. COVID-19 vaccination willingness among Chinese adults under the free vaccination policy. *Vaccines.* 2021;9(3):292.