



Since January 2020 Elsevier has created a COVID-19 resource centre with free information in English and Mandarin on the novel coronavirus COVID-19. The COVID-19 resource centre is hosted on Elsevier Connect, the company's public news and information website.

Elsevier hereby grants permission to make all its COVID-19-related research that is available on the COVID-19 resource centre - including this research content - immediately available in PubMed Central and other publicly funded repositories, such as the WHO COVID database with rights for unrestricted research re-use and analyses in any form or by any means with acknowledgement of the original source. These permissions are granted for free by Elsevier for as long as the COVID-19 resource centre remains active.



Contents lists available at ScienceDirect

The American Journal of Surgery

journal homepage: [www.elsevier.com/locate/amjsurg](http://www.elsevier.com/locate/amjsurg)

Original Research Article

## Barriers to Coronavirus Disease 19 vaccination in patients with obesity

Mehmet Celal Kizilkaya<sup>a</sup>, Sarah Sabrine Kilic<sup>b</sup>, Deniz Oncel<sup>c</sup>, Swati Mamidanna<sup>d</sup>,  
Vasudev Daliparty<sup>e</sup>, Serhan Yilmaz<sup>a</sup>, Mehmet Abdussamet Bozkurt<sup>a</sup>, Osman Sibic<sup>a</sup>,  
Mutlay Sayan<sup>c,\*</sup>

<sup>a</sup> University of Health Sciences, Kanuni Sultan Süleyman Training and Research Hospital, Istanbul, Turkey

<sup>b</sup> Taussig Cancer Institute, Cleveland Clinic, Cleveland, OH, USA

<sup>c</sup> Dana-Farber Cancer Institute and Brigham and Women's Hospital, Harvard Medical School, Boston, MA, USA

<sup>d</sup> Rutgers Cancer Institute of New Jersey, New Brunswick, NJ, USA

<sup>e</sup> Raritan Bay Medical Center, Perth Embay, NJ, USA

### ARTICLE INFO

#### Keywords:

Obesity  
COVID-19  
Vaccination  
Vaccine hesitancy

### ABSTRACT

**Background:** Patients with obesity are at a high risk of severe disease and death from Coronavirus Disease 2019 (COVID-19). Vaccination offers a safe and effective means of reducing this risk. The rate of COVID-19 vaccine refusal in patients with obesity is unknown.

**Methods:** Patients with obesity were administered validated questionnaires assessing COVID-19 fear, general vaccine hesitancy, and COVID-19-specific vaccine hesitancy.

**Results:** 507 participants completed the study. COVID-19 vaccine hesitancy was high: Fifteen percent of patients refused COVID-19 vaccine. Hesitancy related to other vaccines was also high: Eight percent of patients refused a vaccine in the past, and 15% delayed a vaccine. Fear of side effects and doubts regarding effectiveness were the most common reasons for vaccine refusal.

**Conclusions:** Despite high risk for complications, vaccine hesitancy is high among patients with obesity. Targeted public health interventions are critical to reduce vaccine hesitancy and improve vaccination rates.

### 1. Introduction

The COVID-19 pandemic is one of the world's largest and most lethal in recorded history, with over 250,000,000 cases and over 5,000,000 deaths as of November 2021.<sup>1</sup> Patients with overweight and obesity are at high risk with regard to COVID-19 infection. Patients with overweight and obesity who contract COVID-19 have a higher risk of hospitalization, severe disease, need for mechanical ventilation, and death from COVID-19 compared to patients with a BMI within the normal range.<sup>2</sup> The prevalence of overweight and obesity has increased significantly in both developed and developing countries over the past thirty years, with over thirty percent of the populations of many developed and developing countries suffering from these conditions, and attempts to decrease prevalence have been unsuccessful. Therefore, efforts to prevent COVID-19 infection in this high-risk and increasingly populated group are critical.

The year 2021 has seen the advent and widespread availability of

several vaccinations against COVID-19, offering a highly safe and effective method of prevention.<sup>3</sup> However, the rate of increase in the fully-vaccinated proportion of the population in most developed countries has slowed, with vaccination rates falling well short of the approximately 65% needed for herd immunity.<sup>4</sup> Vaccine hesitancy, defined by the World Health Organization (WHO) as "a delay in acceptance or refusal of vaccination despite the availability of vaccination services,"<sup>5</sup> is a major contributor to suboptimal COVID-19 vaccination rates. COVID-19 vaccine hesitancy has been well-studied in other marginalized groups, but the lack of dedicated studies regarding COVID-19 vaccine hesitancy in patients with obesity is a concerning gap in the obesity literature. One prior study of COVID-19 vaccination attitudes in patients with obesity does exist, but it was conducted in mid-2020, before vaccines were available, and when the question of vaccine acceptance was purely hypothetical.<sup>6</sup> Revised data in the era of widely-available vaccines are sorely needed.

An understanding of the motivations and intentions regarding

\* Corresponding author. Dana-Farber Cancer Institute, Brigham and Women's Hospital, Harvard Medical School, 75 Francis Street. ASB1 - L2, Boston, MA, 02115, USA.

E-mail address: [msayan@bwh.harvard.edu](mailto:msayan@bwh.harvard.edu) (M. Sayan).

<https://doi.org/10.1016/j.amjsurg.2022.08.021>

Received 5 January 2022; Received in revised form 14 June 2022; Accepted 27 August 2022

Available online 1 September 2022

0002-9610/© 2022 Elsevier Inc. All rights reserved.

COVID-19 vaccination in patients with obesity is critically needed to guide public health interventions to maximize vaccination rates in this high-risk group. Bariatric surgeons are highly trusted by their patients and are perceived by patients as empathetic and understanding<sup>7</sup>; these are crucial qualities that can be used to surgeons' advantage to promote vaccine awareness and uptake among this patient population. Furthermore, patients who have undergone bariatric surgery continue to follow closely with their surgeons,<sup>8</sup> in many cases making the surgeon the patient's primary contact with the medical system and again providing an opportunity for vaccine advocacy. Therefore, in this study, we present the first investigation of COVID-19 vaccine hesitancy among patients with obesity who are being evaluated for bariatric surgery in the era of widespread vaccine availability.

## 2. Materials and methods

A cross-sectional questionnaire-based survey was conducted among patients who visited a university hospital in Istanbul, Turkey in August–September 2021. All participants were aged 18 and older, presented with a chief complaint of obesity (body mass index [BMI] 30 or above), and were seeking or had previously had bariatric surgery. Patients with a diagnosis of cancer were excluded. Demographic and clinical data regarding chronic medical conditions, previous COVID-19 testing and diagnosis, and bariatric surgery status were collected; for analysis, participants were stratified by bariatric surgery status. A pilot with 20 participants was initially performed, and the survey was found feasible by the participants. Informed consent was obtained from each participant. The response rate was 100%. This study was approved by the Institutional Review Board of the university hospital.

COVID-19 fear was assessed with the Fear of COVID-19 Scale (FCV-19S). FCV-19S was developed in 2020 by a multinational collaborative.<sup>9</sup> FCV-19S assesses various aspects of COVID-19-related fear, including fear of death from COVID and symptoms of COVID-19-related anxiety, and quantifies these as a scale ranging from 7 (lowest fear of COVID-19) to 35 (highest fear of COVID-19). FCV-19S has robust psychometric properties and reproducibly quantifies the severity of fear. Response patterns are not affected by respondent age or gender. The scale has been validated in Turkey and other countries.<sup>10–18</sup>

Vaccine hesitancy was assessed per the World Health Organization (WHO) Strategic Advisory Group of Experts on Immunization (SAGE) definition, which has been employed worldwide for assessment of vaccine hesitancy.<sup>19</sup>

COVID-19 vaccine hesitancy was assessed via the Vaccination Attitudes Examination (VAX) scale. VAX measures anti-vaccination sentiment and was initially developed in 2017.<sup>20</sup> The VAX scale can be adapted to assess attitudes toward specific vaccines and has high internal consistency and validity. Responses are associated with past vaccine acceptance as well as intentions regarding future vaccines. The VAX scale has been adapted to assess COVID-19 vaccine hesitancy, and has been implemented in several countries.<sup>21–24</sup>

Statistical analysis: Statistical analyses were performed with SPSS statistical software version 24 (IBM Corporation, Armonk, New York, USA). Results are presented as frequencies and percentages for categorical variables, the mean and standard deviation for normally distributed continuous variables, and the median, range and interquartile range (IQR) values for non-normally distributed continuous variables. The normality of the variables was checked with the Shapiro-Wilk test. The Mann-Whitney *U* Test was used for the comparison between independent groups of continuous variables that did not show normal distribution. Wilcoxon Signed Rank Test was used for the comparison of continuous variables that did not show normal distribution between dependent groups. Chi-square test was used to compare categorical variables between independent groups. Results with a *p*-value of less than 0.05 were considered significant.

## 3. Results

A total of 507 eligible participants were recruited to the study and completed the questionnaire. Eighty-seven percent of participants were female. The median participant age was 35 years (range: 19–59 years). The majority of participants (65%) had at least a high school education. Fifty-three percent of patients had a history of bariatric surgery. Demographic and clinical data for the cohort are displayed in Table 1.

Twenty-nine percent of participants (148 participants) had a personal history of COVID-19. Of these, 13% required hospitalization for COVID-19-related complications, and 53% had at least one long-term side effect of COVID-19. Characteristics of the subset of patients with a history of COVID-19 infection are displayed in Table 2.

Fear of COVID-19 was moderate to high among participants: the mean FCV-19 score was  $19 \pm 6$ .

General vaccine hesitancy sentiment was high among participants. Eight percent of patients stated they had refused a recommended vaccine for themselves or their child in the past, and an additional 15% of patients had delayed a vaccine. Vaccine hesitancy responses are displayed in Table 3.

COVID-19-specific vaccine hesitancy was also high: 15% of participants stated that they would refuse COVID-19 vaccination. Of the subset of patients who did not have a history of COVID-19, 12% stated that they would refuse vaccination. Of the subset who had a history of COVID-19, a significantly higher proportion, 24% ( $p = 0.001$ ), stated that they would refuse vaccination. There was no difference in COVID-19 vaccine hesitancy based on level of education: 16% of patients with less than a college education stated that they would refuse vaccination, compared to 12% of patients with a college education or higher ( $p = 0.375$ ). The most common reasons for vaccine refusal were fear of side effects (64%), doubt about effectiveness (54%), and suspicion of short production timeline (50%). COVID-19 vaccine hesitancy responses are displayed in Table 4.

A subset analysis based on bariatric surgery history (group 1, surgery; group 2, no surgery) was performed to identify potential differences between subgroups. Mean BMI was significantly lower in group 1 (group 1, 31.1 kg/m<sup>2</sup>; group 2, 40.4 kg/m<sup>2</sup>;  $p < 0.001$ ). There were no other statistically significant differences between subgroups with regard

**Table 1**  
Demographic and clinical characteristics of participants.

	Median (range)
Age (years)	35 (19–59)
	N (%)
Gender	
Female	439 (86.6)
Male	68 (13.4)
Highest level of education attained	
Elementary school	84 (16.6)
Middle school	86 (17.0)
High school	206 (40.6)
College or beyond	122 (24.1)
Unknown	9 (1.8)
History of bariatric surgery	
Yes	268 (52.9)
No	239 (47.1)
If bariatric surgery history, number of medical comorbidities prior to surgery	
0	142 (53.0)
1	80 (29.9)
2	28 (10.4)
3 or more	18 (6.7)
Number of medical comorbidities at present	
0	386 (76.1)
1	69 (13.6)
2	25 (4.9)
3 or more	27 (5.3)
History of COVID-19 infection	
Yes	148 (29.2)
No	359 (70.8)

**Table 2**  
Clinical characteristics of participants with a history of COVID-19 infection.

	Median (range)
Age (years)	35 (20–54)
	N (%)
Gender	
Female	131 (88.5)
Male	17 (11.5)
Hospitalization for COVID-19	
Yes	19 (12.8)
No	129 (87.2)
Long-term COVID-19 side effects <sup>a</sup>	
None	70 (47.3)
Fatigue	18 (12.1)
Myalgias	21 (14.1)
Taste or smell changes	17 (11.4)
Respiratory	6 (4.1)
Cardiac	18 (12.2)
Gastrointestinal	2 (1.4)

<sup>a</sup> Percentages total more than 100 because participants could select more than one response.

**Table 3**  
Vaccine hesitancy.

	Yes [N (%)]	No [N (%)]
Have you ever refused a vaccine for yourself or a child because you considered it as useless or dangerous?	40 (7.9)	467 (92.1)
Have you ever postponed a vaccine recommended by a physician?	15 (3.0)	492 (97.0)
Have you ever had a vaccine for a child or yourself despite doubts about its efficacy?	134 (26.4)	373 (73.6)

**Table 4**  
Intentions regarding COVID-19 vaccine.

	N (%)
If a vaccine against the coronavirus was available, would you get vaccinated?	
Yes	429 (84.6)
No	78 (15.4)
If no, why? <sup>a</sup>	
Fear of side effects	50 (64.1)
Doubt about effectiveness	42 (53.8)
Suspicion of short production timeline	39 (50.0)
Lack of concern about COVID-19	13 (16.7)
I don't know where or how to receive it	0 (0.0)
Other	3 (3.8)

<sup>a</sup> Percentages total more than 100 because participants could select more than one response.

to age, gender, education, prior COVID-19 infection, hospitalization for COVID-19, incidence of long-term COVID-19 side effects, general vaccine hesitancy sentiment, COVID-19 vaccine refusal, reasons for vaccine refusal, or FCV-19S score.

Clinical characteristics of participants in group 1 prior to versus after bariatric surgery were compared. The mean number of medical comorbidities was statistically significantly lower postoperatively ( $p < 0.001$ ). BMI decreased by a mean of 15 kg/m<sup>2</sup> after surgery (mean percent total body weight loss, 33%; mean percent excess BMI lost, 75%). Mean postoperative body mass was significantly lower than preoperative body mass ( $p < 0.001$ ).

#### 4. Discussion

In this study, we present the first investigation of COVID-19 vaccine hesitancy rates among patients with obesity. Using validated

questionnaires to assess general vaccine hesitancy behaviors and COVID-19-specific vaccine hesitancy, we found alarming rates of vaccine hesitancy in this population: Fifteen percent of participants stated that they would refuse COVID-19 vaccination, and eight percent of participants stated that they had refused at least one other vaccine in the past. The lack of data regarding vaccine hesitancy rates in overweight and obese patients has been specifically highlighted as a shortcoming of the current COVID-19 literature<sup>25</sup>; the present study fills this critical gap.

Vaccine hesitancy has had serious detrimental effects on global health in recent decades and has resulted in the failure to eradicate several preventable infectious diseases as well as the reemergence of previously-eradicated diseases. Vaccine hesitancy in the setting of the ongoing COVID-19 pandemic adds even more urgency to this global health concern. As of November 2021, multiple COVID-19 vaccines have been developed, and mass administration programs have been initiated in most countries, including Turkey.<sup>3,26</sup> However, vaccination rates have generally not reached the 60–70% required for herd immunity even in countries where vaccines are the most widely available.<sup>4</sup> Vaccine hesitancy is a major contributor to this failure, and understanding the underlying drivers of vaccine hesitancy is critical to improve vaccination rates, particularly in high-risk populations such as patients with obesity in the present study.<sup>4</sup>

Our finding of high COVID-19 vaccine hesitancy rates in patients with obesity is alarming given that patients with overweight and obesity are at a higher risk of severe disease and death from COVID-19 compared to patients with normal BMI. An American series of over 149,000 patients with COVID-19 identified increasing BMI as a risk factor for hospitalization, mechanical ventilation, and death.<sup>2</sup> These findings are not unique to American patients: Similar findings have been observed in series from Turkey<sup>27</sup> and numerous other countries. Therefore, prevention of initial infection is critically important in this population, and the high rates of vaccine hesitancy in this population identified in the present study are of even greater concern than in the general population. Interventions to address vaccine hesitancy and increase vaccine uptake in this population are therefore critically needed.

Further complicating the high rates of vaccine hesitancy among patients with obesity identified in the present study is the influence of weight stigma on healthcare for patients with obesity. Weight stigma is the pervasive and complex set of societal biases toward individuals with overweight and obesity that are founded upon blaming these individuals for their weight. Weight stigma affects individuals with obesity in essentially every interpersonal domain of modern life, including healthcare. Studies of healthcare provider attitudes toward patients have revealed negative feelings toward patients with obesity, and misconceptions about patients with obesity, including laziness, low intelligence, and lack of self-control, are frequent.<sup>28,29</sup> These biases translate not only into negative perceptions of the healthcare system and reluctance to seek care on the part of patients with obesity, but into decreased use of healthcare interventions by objective measures. Higher BMI is associated with lower receipt of numerous preventive health interventions, including, notably, influenza vaccination, even after adjusting for other socioeconomic characteristics such as education level and income.<sup>30</sup> The effect of weight stigma on preventive health seeking among patients with obesity is life-threatening when applied to refusal of a lifesaving vaccine, and must be taken into consideration when designing vaccine outreach programs for patients with obesity, as discussed below.

Despite compelling safety and efficacy data, concerns regarding side effects and doubts regarding vaccine effectiveness are the most frequently-identified drivers of COVID-19 vaccine hesitancy. The present study identified similar themes. Of the 15% of patients who stated that they would refuse the COVID-19 vaccination, fear of side effects and doubt about effectiveness were the most commonly cited reasons for refusal. These fears and doubts are objectively unfounded. The available vaccines for COVID-19 are highly effective.<sup>3</sup> Furthermore, they are

extremely safe. The overwhelming majority of vaccine-related adverse events are mild in severity, and even the most dreaded severe side effects are exceedingly rare. For example, vaccine-related myocarditis, which was widely sensationalized in the media in mid-2021, was observed in only 5565 individuals out of a total of 129,000,000 vaccinated individuals, or only 0.004%.<sup>3</sup> Another widely-publicized adverse event observed after administration of the AstraZeneca vaccine (AZD1222), cerebral venous thrombosis due to vaccine-induced immune thrombotic thrombocytopenia, had an incidence of 5.0 per million, still favorable compared to the incidence of 39.0 per million observed for cerebral venous thrombosis from COVID-19.<sup>3</sup>

Public health outreach is essential to correct misinformation regarding COVID-19 vaccine efficacy and safety, especially among patients with obesity. Methods to reduce vaccine hesitancy and increase vaccination rates in marginalized populations have been well-described by other groups. In general, successful strategies involve the wide dissemination of accessible and understandable public health messaging via both traditional media and social media channels, personal storytelling from a source with whom the target population can personally identify, and the involvement of the target population and their community leaders in the public health education process. For example, an educational campaign aimed at increasing vaccination rates in patients with obesity can feature a patient with obesity sharing their personal story of hospitalization from COVID-19 and expressing their wish that they had been vaccinated to avoid contracting this potentially life-threatening disease, and can also feature a bariatric surgeon who is well-known and trusted in the target community providing their professional recommendation to get vaccinated.

COVID-19-related fear was high among study participants. The mean FCV-19S score was 19; a score of 16.5 or higher is predictive for anxiety and post-traumatic stress disorder.<sup>31</sup> High COVID-19-related fear coexistent with high vaccine hesitancy seems contradictory: High fear of a disease would be expected to coincide with high uptake of its preventive measure. Misinformation and false beliefs regarding side effects and efficacy, as discussed above, likely contribute to this contradiction. Trustworthy vaccine education that replaces misinformation, and rationally describes this population's high-risk status without using scare tactics, will likely convert fear of COVID-19 into a motivating factor to improve vaccination rates.

As expected, we identified statistically significantly lower mean BMI in the subgroup of patients who had a history of bariatric surgery (mean 31.1 kg/m<sup>2</sup>) compared to patients who had not had bariatric surgery (mean 40.4 kg/m<sup>2</sup>), concordant with numerous previous studies demonstrating the effectiveness of bariatric surgery for weight reduction. However, there were no significant differences between these subgroups with regard to any other demographic or clinical variable measured, including, notably, fear of COVID-19, general vaccine hesitancy, and COVID-19 vaccine refusal. These findings suggest that pre- and post-bariatric surgery patients should both be monitored equally and carefully for refusal of COVID-19 vaccination as well as other recommended adult vaccinations.

**Limitations:** This study was conducted among participants with obesity who sought care at a bariatric surgery clinic in an urban metropolis, and therefore may not be generalizable to individuals with obesity in other settings. The majority of participants were young and female, and findings may not be entirely generalizable to older and/or male patients. Most demographic and clinical variables were self-reported by participants and were not verified by the investigators. The validated, quantitative assessments used to measure vaccine hesitancy in this study did not allow further qualitative exploration of patient attitudes. Patients in the present study were those who have interacted with a bariatric clinic, and patients with obesity who have not interacted with a bariatric clinic are not represented; this population of patients may have even higher vaccine hesitancy associated with healthcare mistrust and hesitancy to seek care.

## 5. Conclusions

Patients with obesity are at high risk of COVID-19-related complications and death. Unfortunately, COVID-19 vaccine hesitancy in this population is high, with 15% of patients refusing vaccination. Fear of side effects and doubts regarding effectiveness are the most common reasons for refusal. Tailored public health education is essential to correct misinformation and false beliefs and improve vaccination rates in this high-risk population.

## Financial disclosure

No.

## Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

## Declaration of competing interest

None.

## References

1. Reuters COVID-19 Tracker. Reuters; 2021. <https://graphics.reuters.com/world-coronavirus-tracker-and-maps/countries-and-territories/turkey/>.
2. Kompaniyets L, Goodman AB, Belay B, et al. Body mass index and risk for COVID-19-related hospitalization, intensive care unit admission, invasive mechanical ventilation, and death - United States, march-december 2020. *MMWR Morb Mortal Wkly Rep*. 2021;70(10):355–361.
3. Tregoning JS, Flight KE, Higham SL, Wang Z, Pierce BF. Progress of the COVID-19 vaccine effort: viruses, vaccines and variants versus efficacy, effectiveness and escape. *Nat Rev Immunol*. 2021;21(10):626–636.
4. Aschwanden C. Five reasons why COVID herd immunity is probably impossible. *Nature*. 2021;591(7851):520–522.
5. MacDonald NE, Hesitancy SWGoV. Vaccine hesitancy: definition, scope and determinants. *Vaccine*. 2015;33(34):4161–4164.
6. Vallis M, Glazer S. Protecting individuals living with overweight and obesity: attitudes and concerns toward COVID-19 vaccination in Canada. *Obesity*. 2021;29(7):1128–1137.
7. Widmer J, Gero D, Sommerhalder B, et al. Online survey on factors influencing patients' motivation to undergo bariatric surgery. *Clin Obes*. 2022;12(2), e12500.
8. Mechanick JI, Youdim A, Jones DB, et al. Clinical practice guidelines for the perioperative nutritional, metabolic, and nonsurgical support of the bariatric surgery patient—2013 update: cosponsored by American Association of Clinical Endocrinologists, the Obesity Society, and American Society for Metabolic & Bariatric Surgery. *Obesity*. 2013;21(Suppl 1):S1–S27.
9. Ahorsu DK, Lin CY, Imani V, Saffari M, Griffiths MD, Pakpour AH. The fear of COVID-19 scale: development and initial validation. *Int J Ment Health Addiction*. 2020;1–9.
10. Al-Shannaq Y, Mohammad AA, Khader Y. Psychometric properties of the Arabic version of the fear of COVID-19 scale (FCV-19S) among Jordanian adults. *Int J Ment Health Addiction*. 2021;1–14.
11. Hossain MA, Jahid MIK, Hossain KMA, et al. Knowledge, attitudes, and fear of COVID-19 during the rapid rise period in Bangladesh. *PLoS One*. 2020;15(9), e0239646.
12. Kaya S, Uzdil Z, Cakiroglu FP. Evaluation of the effects of fear and anxiety on nutrition during the COVID-19 pandemic in Turkey. *Publ Health Nutr*. 2021;24(2): 282–289.
13. Korukcu O, Ozkaya M, Faruk Boran O, Boran M. The effect of the COVID-19 pandemic on community mental health: a psychometric and prevalence study in Turkey. *Health Soc Care Community*. 2021;29(5):e204–e213.
14. Magano J, Vidal DG, Sousa H, Dinis MAP, Leite A. Validation and psychometric properties of the Portuguese version of the Coronavirus anxiety scale (CAS) and fear of COVID-19 scale (FCV-19S) and associations with travel, tourism and hospitality. *Int J Environ Res Publ Health*. 2021;18(2).
15. Martinez-Lorca M, Martinez-Lorca A, Criado-Alvarez JJ, Armesilla MDC, Latorre JM. The fear of COVID-19 scale: validation in Spanish university students. *Psychiatr Res*. 2020;293, 113350.
16. Soraci P, Ferrari A, Abbiati FA, et al. Validation and psychometric evaluation of the Italian version of the fear of COVID-19 scale. *Int J Ment Health Addiction*. 2020;1–10.
17. Tsiropoulou V, Nikopoulou VA, Holeva V, et al. Psychometric properties of the Greek version of FCV-19S. *Int J Ment Health Addiction*. 2020;1–10.
18. Tzur Bitan D, Grossman-Giron A, Bloch Y, Mayer Y, Shiffman N, Mendlovic S. Fear of COVID-19 scale: psychometric characteristics, reliability and validity in the Israeli population. *Psychiatr Res*. 2020;289, 113100.

19. Martin LR, Petrie KJ. Understanding the dimensions of anti-vaccination attitudes: the vaccination attitudes examination (VAX) scale. *Ann Behav Med.* 2017;51(5): 652–660.
20. Rey D, Fressard L, Cortaredona S, et al. Vaccine hesitancy in the French population in 2016, and its association with vaccine uptake and perceived vaccine risk-benefit balance. *Euro Surveill.* 2018;23(17).
21. Danabal KGM, Magesh SS, Saravanan S, Gopichandran V. Attitude towards COVID 19 vaccines and vaccine hesitancy in urban and rural communities in Tamil Nadu, India - a community based survey. *BMC Health Serv Res.* 2021;21(1):994.
22. Gagneux-Brunon A, Detoc M, Bruel S, et al. Intention to get vaccinations against COVID-19 in French healthcare workers during the first pandemic wave: a cross-sectional survey. *J Hosp Infect.* 2021;108:168–173.
23. Taylor S, Landry CA, Paluszek MM, Groenewoud R, Rachor GS, Asmundson GJG. A proactive approach for managing COVID-19: the importance of understanding the motivational roots of vaccination hesitancy for SARS-CoV2. *Front Psychol.* 2020;11, 575950.
24. Verger P, Scronias D, Dauby N, et al. Attitudes of healthcare workers towards COVID-19 vaccination: a survey in France and French-speaking parts of Belgium and Canada, 2020. *Euro Surveill.* 2021;26(3).
25. Townsend MJ, Kyle TK, Stanford FC. COVID-19 vaccination and obesity: optimism and challenges. *Obesity.* 2021;29(4):634–635.
26. *Turkey Ministry of Health COVID-19 Vaccine Information Platform*; 2021. <https://covid19asi.saglik.gov.tr/>. Accessed October 30, 2021. . Published.
27. Sahin I, Haymana C, Demir T, et al. Clinical characteristics and outcomes of COVID-19 patients with overweight and obesity: Turkish nationwide cohort study (TurCObesity). *Exp Clin Endocrinol Diabetes.* 2021;130(2):115–124.
28. Teachman BA, Brownell KD. Implicit anti-fat bias among health professionals: is anyone immune? *Int J Obes Relat Metab Disord.* 2001;25(10):1525–1531.
29. Price JH, Desmond SM, Krol RA, Snyder FF, O'Connell JK. Family practice physicians' beliefs, attitudes, and practices regarding obesity. *Am J Prev Med.* 1987;3(6):339–345.
30. Ostbye T, Taylor Jr DH, Yancy Jr WS, Krause KM. Associations between obesity and receipt of screening mammography, papanicolaou tests, and influenza vaccination: results from the health and retirement study (HRS) and the asset and health dynamics among the oldest old (AHEAD) study. *Am J Publ Health.* 2005;95(9): 1623–1630.
31. Nikopoulou VA, Holeva V, Parlapani E, et al. Mental health screening for COVID-19: a proposed cutoff score for the Greek version of the fear of COVID-19 scale (FCV-19S). *Int J Ment Health Addiction.* 2020:1–14.