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*Article*

# Emotional reaction to the first dose of COVID-19 vaccine: Post vaccination decline in anxiety and stress among anxious individuals and increase among individuals with normal anxiety levels pre vaccination

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**Abstract:** Although vaccinating the world is adopted by the WHO to limit COVID-19 transmission, people's worries about vaccines may suppress their desire for vaccination despite vaccine availability. This study aimed to evaluate the levels of stress and anxiety among 250 Jordanians who received their first vaccine dose at a local community health center. The respondents completed the stress and anxiety subscales of the Depression Anxiety and Stress scale 21 (DASS-21) pre- and post-vaccination. The respondents expressed more moderate-severe levels of stress pre than post vaccination (20.8% and 13.2%, respectively). Meanwhile, 37.2% and 45.2% of the respondents expressed moderate-severe anxiety pre and post vaccination, respectively. Wilcoxon signed-rank test revealed that the drop in the level of stress from pre (median (IQR) = 5 (1-8)) to post vaccination (median (IQR) = 3 (1-7)) was statistically significant (z = -3.81, p = 0.001, r = 0.17) while the increase in anxiety was not. Anxiety median significantly dropped among individuals experiencing mild to severe anxiety pre vaccination. Similarly, stress and anxiety significantly increased among individuals expressing normal anxiety pre vaccination (z = -3.57 and -8.24, p values = 0.001, r = 0.16 and 0.37, respectively). Age positively correlated with post vaccination anxiety among respondents with mild pre vaccination anxiety, and it negatively correlated with pre vaccination level of stress in the normal anxiety group. Gender, marital status, respondents' level of education, and history of COVID-19 infection had no significant correlation with anxiety or stress at either point of measurement. Overcoming their hesitancy to receive COVID-19 vaccine, individuals with normal levels of anxiety experienced a rise in their distress symptoms following immunization. On the contrary, vaccination seemed to desensitize anxious individuals. Policymakers need to formulate a population-specific plan to increase vaccine preparedness and promote psychological well-being over all during the pandemic.

**Keywords:** COVID-19, vaccine/vaccination; stress; anxiety; hesitancy; preparedness; Jordan/Arab

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## 1. Introduction

Coronavirus disease 2019 (COVID-19) is caused by the novel coronavirus strain "SARS-CoV-2". Currently, as of May 2022, COVID-19 continues to have a trail of drastic negative effects on a large number of people around the world. This is because SARS-CoV-2 and its variants, Delta and Omicron, represent a highly contagious airborne infection, which spreads mainly through minute respiratory droplets or aerosols during close human contact, particularly while coughing and sneezing [1,2]. Since the commence of the pandemic, the World Health Organization (WHO) has recommended a wide range of safety measures such as hand washing, wearing a face mask, maintaining social distancing, and banning large social gatherings [2,3]. All of these measures fall short in combating the spread of this serious and highly contagious viral infection [4]. Accordingly, the WHO has approved the COVID-19 vaccine on December 31, 2020. The strategy of vaccinating the world—inoculating 70% of all the world population by mid-2022—is adopted as a promising method to limit the pandemic [5].

Vaccination seems to be the best available option for fighting off the disease [6]. In this respect, unvaccinated individuals are reported to be 14 and 68 times more likely to die from COVID-19-related complications than those who are vaccinated and boosted respectively [7,8]. Therefore, it is imperative to evoke a communal response and a sense of national purpose with the goal of combating the risk of human exposure to the virus. In other words, for the vaccine to be truly successful, the world population needs to accept and receive it [7].

The development of the vaccine was uncertain given mutations in the viral genetic structure [2]. Moreover, the rushed development of the vaccine and its rapid availability to the global population had implications for the psychological state of some individuals. Lay people, even those who view vaccination as protective against COVID-19, feel anxious about the possibilities and risks of taking the vaccine [9-11]. Unfortunately, a significant number of people around the world still refuses to receive the vaccine [5,12]. Vaccination hesitancy is evoked by uncertainty and perceptual disintegration as a result of misinformation and conspiracy beliefs [13]. Misinformation on how COVID-19 vaccines are developed and tested, as well as their safety and efficacy is widely communicated through social media [9,14]. The influence of the globalized antivaxx movement on increased vaccine hesitancy is largely expressed through social media [5,9]. As a result of the widely communicated erroneous information about COVID-19 (e.g., it is a man-made disease and vaccines are intended to cause death in certain groups), vaccine hesitancy represents a growing obstacle, which hinders the containment of the pandemic [3,5].

Anxiety and fear of COVID-19 are reported to increase intention to get vaccinated [13,15]. In fact, perceived vulnerability to COVID-19 is associated with more willingness to take the vaccine while lower perceived vulnerability is associated with more vaccine hesitancy [14-16]. Nonetheless, the intention to get vaccinated decreases when anxiety and fear of COVID-19 are associated with high levels of existential anxiety, and this effect is mediated by conspiracy beliefs [13,15]. Indeed, those who market for conspiracy beliefs tend to express greater fear and greater tendency towards psychopathology. They employ conspiracy beliefs as a method of coping with uncertainty surrounding the pandemic [3,17]. Therefore, vaccine hesitancy is largely attributed to negative emotions accelerated by antivaxx rumors about COVID-19 vaccination [5,15].

Vaccine-related psychological concerns are probably underpinned by the unforeseen consequences and mistrust of those in charge, which in turn leads to further stress, anxiety, depression, and other psychological difficulties [13,14,18,19]. This notion is better understood within the frame of vulnerability post vaccination. Before the emergence of Omicron variants, vaccines were stated to provide around 90% protection against COVID-19. However, it turned out that even with two doses of the vaccine, the efficiency dropped to

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approximately 50% protection within a few months of the second shot. In the wake of the Omicron variant, those who were fully vaccinated with two shots and an additional third booster shot, still found themselves subject to infection and unfortunately still managed to succumb to the Omicron variant [18,19]. Additionally, longitudinal investigations (6 months post vaccination) show that compared with unvaccinated COVID-19 patients, patients receiving COVID-19 vaccination do not demonstrate improved post-acute sequelae of COVID-19 such as anosmia, respiratory symptoms (e.g., cough, dyspnea, phlegm, wheezing), depression, anxiety, post-traumatic stress disorder related to COVID-19 and other trauma, and quality-of-life [20].

Vaccine-related anxiety may also be triggered by a reported cluster of anxiety-related adverse events, which take place after the administration of COVID-19 vaccines [21,22]. Sudden rise in blood pressure following vaccination may raise uncertainties, since it is a typical symptom of both pseudo allergy and anxiety [12]. In fact, high anxiety among adults attending COVID-19 vaccination centers is associated with fear that terrible consequences may happen [6,23,24]. Immunization stress-related response develops in people receiving the first as well as the second dose of the vaccine [25]. For some, vaccine fear and anxiety may be justifiable given that vaccine adverse effects can be severe in a trivial number of people (e.g., anaphylactic shock requiring resuscitation) [26,27]. Most allergic anaphylaxis occurs in individuals with a prior history of allergy such as food allergy and wasp sting [26,27]. Animal studies report higher occurrence of such anaphylaxis and relate it to C-activation [12].

Negative emotional reactions (e.g., depression or anxiety) are recorded as adverse effects post COVID-19 vaccination [22,28,29]. In particular, anxiety-related events are reported among 8,500 Janssen COVID-19 vaccine recipients—up to 8.2 episodes per 100,000 doses as announced by the WHO. Among individuals expressing emotional/neurological symptoms post-COVID-19 vaccination, 18F-FDG PET/MRI scans revealed hypometabolism in the bilateral parietal lobes. These areas play a role in the fear network model that has been implicated in anxiety, which presents an empirical support of immunization stress-related response [28].

Aiming to vaccinate 80 percent of the population, the Jordanian Ministry of Health and the National Center for Crisis and Crisis Management have launched the country's largest-ever mass immunization campaign. At the beginning of this mass vaccination campaign, the country's tally of COVID-19 cases reached 309,846, out of which 4,076 resulted in death and 292,104 recovered [30]. Therefore, vulnerable individuals (healthcare workers and the elderly) were prioritized as the first to have the opportunity to take the vaccine [31]. Generally, all Jordanian citizens are required to register online to be scheduled for the COVID-19 vaccines. The government also gave the right for anyone living in Jordan to approach any out of the 29 health centers in the kingdom to take their shots, even if they opted for a drive through vaccination approach. Like other countries around the world, the local government in Jordan has pushed residents to receive COVID-19 vaccines through a wide range of actions. For example, vaccination records are authenticated through mobile and national identification numbers. Individuals have to show their vaccination records when they need access all public places (e.g., shopping malls and educational facilities). Those who totally refuse to receive the vaccine are asked to show a negative PCR test each week, which in itself is a financial, physical, and psychological burden. Since psychological reactions affect intentions to receive the vaccine, and they may stem as possible adverse effects of COVID-19 vaccine, this study opted to assess the levels of stress and anxiety before and 15 minutes after taking the first shot of the COVID-19 vaccine in a Jordanian community sample. According to the aforementioned literature, we hypothesized that the levels of stress and anxiety may increase from pre to post vaccination.

## 2. Materials and Methods

### *2.1. Design, Setting, and Sampling*

A longitudinal design was utilized to perform this study. A convenience sampling technique was used to recruit individuals attending a vaccination center in the eastern part of the Jordanian capital (Amman). A power analysis was performed in G* power 3.1 to calculate the needed sample size using based on effect size = 0.2, power = 0.85, and alpha=0.05. A sample size of 227 participants was required to successfully conduct the study, however, the questionnaire was administered to 260 respondents in order to make up for missing data. Participants were eligible to take part in this study if they met the following criteria: aged 18 years and over, were able to read and write, and were willing to participate in the study.

### *2.2. Measurements*

The questionnaire used to conduct the current survey included three sections. Section one comprised questions on the socio-demographic characteristics of the respondents: age, gender, marital status, and educational level. Section two comprised the anxiety and stress subscales of the Depression Anxiety Stress Scale 21 (DASS-21). The DASS-21 was developed by Lovibond (1995) to assess the levels of depression, anxiety, and stress symptomatology [32]. Each subscale consists of seven items. Item responses are rated on a 4-point scale ranging from 0 (not applicable) to 3 (very much, or most of the time, or a good part of the time). The total scores of each subscale range between zero and 21. Individual scores can be classified to reflect normal, mild, moderate, severe, and extremely severe levels of the symptoms based on known cut-off points, which are reported below in Table 2 [32,33]. The Arabic version of DASS-21 was adopted in this study [34]. This Arabic version has strong psychometric properties, with a Cronbach's alpha of 0.95 [34,35]. The reliability of the stress and anxiety subscales in the current sample was excellent both pre (Cronbach's alpha = 0.91 and 0.89) and post vaccination (Cronbach's alpha of both subscales = 0.90). Section three comprised a visual analogue scale with scores from zero to ten to examine pain post vaccination at the site of injection.

### *2.3. Data Collection Procedure and Ethical Considerations*

The questionnaires were distributed and collected in the waiting room of the health center during the period between August 3 and August 10, 2021. Potential respondents were given a questionnaire, which included a cover sheet introducing the purpose of the study, a consent form detailing participants rights (voluntary participation, data security, etc.), and the study questionnaires. They were also informed that we would need them to fill in an identical questionnaire 15 minutes after receiving the shot. Ethical approval for this study was obtained from the Institutional Review Board (IRB) of Isra university (No. SREC/21/08/014). Data were handled according to the Jordanian standards of data protection.

### *2.4. Statistical Analysis*

Ten respondents were excluded from the analysis because of incomplete responses—response rate = 96.1%. Based on normality tests, the stress and anxiety variables were presented using median and interquartile range (IQR) while the descriptive statistics of categorical variables were reported as frequency and percentage. Wilcoxon signed-rank test was used to examine the difference between the pre and post vaccinations levels of stress and anxiety in the whole sample. The effect size was estimated by dividing z scores by the

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square root of the number of observations in pre and post measurements. Because a considerable portion of the respondents had normal or mild levels of anxiety pre vaccination, we wanted to examine if stress and anxiety scores change according to respondents' pre vaccination levels of anxiety. Therefore, a normal, mild, and moderate to severe anxiety subsamples were derived based on the anxiety cut-off shown in Table 2. Wilcoxon signed-rank test was used to examine the difference between the pre and post vaccination levels of stress and anxiety in these subsamples. The analysis was performed in SPSS version 24, and the findings were considered to be significant at $p < 0.05$ in two-tailed tests.

## 3. Results

As shown in Table 1, the majority of the respondents were females, married, and had higher than secondary educational level. A minority had previously contracted COVID-19 infection. The respondents in the normal anxiety subsample (n = 126) had a mean age of 43.1 ± 6.9 years, were largely females (75.4%), were mostly married (69.8%), had education higher than a secondary degree (72.2%), and 6.3% of them had previously contracted COVID-19 infection.

The respondents in the mild anxiety subsample (n = 31) had a mean age of 43.1 ± 4.3 years, were largely females (64.5%), were mostly married (77.4%), had education higher than a secondary degree (74.2%), and 16.1% of them had previously contracted COVID-19 infection.

The respondents in the moderate-severe anxiety subsample (n = 93) had a mean age of 43.3 ± 6.2 years, were largely females (69.9%), were mostly married (58.1%) or single (19.4%), had education higher than a secondary degree (68.8%), and 6.5% of them had previously contracted COVID-19 infection. Mild pain severity post vaccination in the anxiety groups was expressed by 86.5% 83.9%, and 74.2% of the respondents, respectively.

**Table 1.** Demographic characteristics of the participants (n = 250).

| Characteristics of the respondents | n (%) |
|---|---|
| **Gender** | |
| Male | 70 (28) |
| Female | 180 (72) |
| **Marital status** | |
| Single | 46 (18.4) |
| Married | 166 (66.4) |
| Divorce | 15 (6.0) |
| Widow | 23 (9.2) |
| **Educational level** | |
| Secondary and less | 72 (28.8) |
| Higher than secondary | 178 (71.2) |
| **Age in years** | |
| Mean (SD) | 43.18 (6.34) |
| Range | 18-63 |
| **COVID-19 infection history** | |
| Yes | 19 (7.6) |
| No | 231 (92.4) |
| **Pain at injection site** | |
| Mild | 204 (81.6) |
| Moderate | 40 (16.0) |
| Severe | 6 (2.4) |

n: number, %: percentage, SD: Standard Deviation.

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Table 2 shows that 20.8% of the study participants had moderate to severe levels of stress before they were vaccinated. Severe and extremely severe forms of stress were reported by only 8.0 and 4.8% of the respondents, respectively. Remarkably, stress levels decreased after receiving a COVID-19 vaccine, with around 87% of the respondents reporting no stress, and only 3.2% having a severe form of stress. Around 50% of the respondents were experiencing anxiety pre vaccination, and approximately 18.8% experienced severe to extremely severe levels of anxiety. Post vaccination, 61.2% of the respondents were experiencing anxiety, with 13.4% of them reporting a severe to extremely severe form of anxiety.

**Table 2.** Levels of stress and anxiety before and after administering Covid-19 vaccine (n = 250).

| Variable | Before vaccination n (%) | After vaccination n (%) |
|---|---|---|
| **Stress** | | |
| No stress = 0-7 | 185 (74.0) | 217 (86.8) |
| Mild = 8-9 | 13 (5.2) | 12 (4.8) |
| Moderate = 10-12 | 20 (8.0) | 13 (5.2) |
| Severe = 13-16 | 20 (8.0) | 8 (3.2) |
| Extremely severe= > 17 | 12 (4.8) | 0 (0.0) |
| **Anxiety** | | |
| Normal = 0-3 | 126 (50.4) | 97 (38.8) |
| Mild = 4-5 | 31 (12.4) | 40 (16.0) |
| Moderate = 6-7 | 46 (18.4) | 82 (32.8) |
| Severe = 8-9 | 10 (4.0) | 17 (6.8) |
| Extremely severe = > 10 | 37 (14.8) | 14 (5.6) |

n: number, %: percentage.

Table 3 shows a significant decrease in stress scores in the whole sample from pre to post vaccination, with a small effect size (r = 0.17). On the contrary, anxiety level increased from pre to post vaccination, albeit that change was non-significant. Consistent with our hypothesis, the levels of stress and anxiety significantly increased in the normal anxiety group post vaccination than before they received the vaccine. The effect size for the change in stress was small while it was moderate for anxiety (Table 3). Unexpectedly, the levels of stress and anxiety dropped in the mild anxiety group, albeit the change was significant only in anxiety median. In the moderate-severe anxiety subsample, Wilcoxon signed-rank test revealed a significant reduction in the levels of stress and anxiety from pre to post vaccination, and the effect size was moderately strong (r = 0.32 and 0.33).

Among all sociodemographic characteristics, pre vaccination level of distress was significantly associated with age in the whole sample (r = -0.154, p = 0.015) and the normal anxiety subsample (r = -0.250, p = 0.005). Age was positively associated with post vaccination anxiety level in the mild anxiety subsample (r = 0.383, p = 0.033). However, Mann Whitney U test and Kruskal Wallis test revealed no significant contribution of any of the sociodemographic characteristics or previous history of COVID-19 infection to the scores of stress or anxiety at either point of measurement in the whole sample and the normal anxiety subsample (Supplementary Materials). Pre-vaccination scores of anxiety were significantly higher among respondents aged 25 years or below in the moderate-severe anxiety subsample (U = 630.0, z = -2.12, p = 0.034). Pre vaccination stress scores contributed to post vaccination pain severity at the injection site in the entire sample (H (2) = 6.98, p = 0.031) and the moderate-severe anxiety subsample (H (2) = 9.88, p = 0.007).

**Table 3.** Descriptive statistics of stress and anxiety symptoms among the respondents and differences in the levels of stress and anxiety before and after the administration of the first dose COVID-19 vaccine.

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| Variables | Samples | MD (IQR) before vaccination | MD (IQR) after vaccination | z of Wilcoxon signed-rank test | p | r |
|---|---|---|---|---|---|---|
| Stress | Whole sample (n = 250) | 5.0 (1.0-8.0) | 4.0 (1.0-7.0) | -3.81 | 0.001 | 0.17 |
| Anxiety | | 3.0 (1.0-7.0) | 5.0 (1.0-7.0) | -0.53 | 0.597 | 0.02 |
| Stress | Normal anxiety (n = 126) | 2.0 (0.0-4.0) | 4.5 (0.0-6.3) | -3.57 | 0.001 | 0.16 |
| Anxiety | | 1.0 (0.0-2.0) | 5.0 (0.0-7.0) | -8.24 | 0.001 | 0.37 |
| Stress | Mild anxiety (n = 31) | 4.0 (3.0-7.0) | 3.0 (3.0-5.0) | -1.28 | 0.201 | 0.06 |
| Anxiety | | 4.0 (4.0-5.0) | 3.0 (3.0-5.0) | -2.70 | 0.007 | 0.12 |
| Stress | Moderate-severe anxiety (n = 93) | 8.0 (7.0-14.0) | 5.0 (2.0-8.0) | -7.13 | 0.001 | 0.32 |
| Anxiety | | 8.0 (7.0-13.0) | 6.0 (1.0-8.0) | -7.27 | 0.001 | 0.33 |

MD: median; IQR: interquartile range; r: reflects effect size. N.B. Groups are described based on pre vaccine levels of anxiety on the anxiety subscale of the Depression Anxiety Stress Scale 21.

## 4. Discussion

The success of the wide-scale vaccine campaigns in all countries of the world is highly dependent on vaccine acceptance by the majority of the population [7]. The current study examined the pre to post vaccination change in the levels of stress and anxiety in a sample of Jordanians receiving their first dose of COVID-19 vaccine. Consistent with our hypothesis, both stress and anxiety significantly increased post vaccination among individuals experiencing a normal pre vaccination level of anxiety. On the contrary, the levels of stress significantly decreased in the entire sample post vaccination. In the meantime, the levels of both stress and anxiety dropped post vaccination among those with pre vaccination anxiety, and that drop was more pronounced among individuals with moderate-severe anxiety than those with mild anxiety.

Our results are consistent with some previous studies. Mild anxiety was reported among 76.6% of Indonesian adults receiving their first shot [23]. Vaccine-related distress symptoms were reported to be high among Chinese adults, but their levels significantly dropped following vaccination [24]. Anxiety is reported to contribute to the acceptance and willingness to receive COVID-19 vaccine. Chinese patients with a formal psychiatric diagnosis (depression or anxiety disorder) were more willing to receive and pay for the COVID-19 vaccine than healthy individuals [36]. In line with a large-scale study comprising an analysis of health records and a survey of psychiatric patients, patients with substance and tobacco abuse disorders significantly expressed higher vaccine hesitancy than patients with all anxiety disorders (e.g., generalized anxiety and post-traumatic stress disorder) and major depression [37]. In an Italian sample surveyed during the lockdown in 2020, anxiety and death anxiety had a direct positive effect on the propensity to receive the vaccine [13].

Anxiety may result from high levels of perceived susceptibility to COVID-19. Perceived vulnerability and use of the vaccine for self-protection are associated with increased vaccine acceptance in China and the United Kingdom [10,14,16]. The effect of anxiety on COVID-19 vaccine acceptance may vary as a function of concerns about vaccine safety and effectiveness, which are evidently prompted by the novelty and rapid development of the vaccine [6,10,13,14]. These concerns may be largely shaped by misinformation circulated through social media. In fact, research relates social media as the most trusted information source to increased parental vaccine hesitancy compared with trusted official information sources [24,38]. Verbal reports of vaccine recipients indicate that anxiety is associated with fear of the development of serious adverse effects [6,23]. Accordingly, the noticed reduction in stress and anxiety symptoms among the anxious subset of our sample may be the result of failure of participants' priori expectations of developing serious adverse effects after receiving the vaccine—a reassuring effect of their positive experience with the vaccine.

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Contrary to our results, high anxiety is associated with decreased intention to receive the vaccine in some groups. Among health care workers, the occurrence of immunization stress-related response was significantly higher among those with strong pre-vaccination anxiety and history of allergy [25]. Anxiety symptoms among Chinese psoriatic patients were associated with high vaccine hesitancy. A slight to significant deterioration in psoriasis is reported in 20% of patients who experienced stress, anxiety, and depression post vaccination [39]. These reports may be justified by interactions taking place between anxiety and other factors. For example, death anxiety increased the tendency to take the vaccine in an Italian survey. However, it reduced the propensity to get vaccinated through a mediated path in believing in conspiracy theories, whereas paranoia was linked to a reduction in vaccination adherence with the mediation effect of mistrust in medical science [13]. Likewise, distress symptoms decreased after receiving the vaccine in China. However, those symptoms remained persistently elevated after receiving the vaccine in those with mistrust in vaccine efficacy and history of vaccine-related allergic reactions [24]. Given the role of psychological and physical vulnerability (e.g., mistrust, allergy, chronic diseases) to distress following COVID-19 vaccine [24,39], it is necessary to identify and properly manage groups liable to high levels of psychological distress following vaccination to alleviate psychological and physical morbidity.

In our analysis, pre vaccination level of stress was associated with more pain at injection site 15 minutes post vaccination. Local side effects after COVID-19 vaccines are common, and they have been reported in 79% of Jordanian health care workers who received the vaccine [40]. Activation of the hypothalamic adrenal axis in stressful conditions is associated with modulation of the immune response [41-43]. Modulation of stress signaling by drugs that regulate the activity of the hypothalamic adrenal axis (e.g., corticosteroid) is involved in the mitigation of chronic pain (e.g., musculoskeletal and spinal pain). These drugs are reported to interfere with the activity of COVID-19 vaccines [44,45]. Additionally, alterations in humoral immunity are reported six months following COVID-19 vaccination among patients with inflammatory bowel disease on anti-TNF (infliximab, adalimumab) therapy [46]. Therefore, we might expect that high pre vaccination level of stress might disrupt immune regulation, resulting in increased flux of immune cells and accelerated release of cytokines, chemokines, and reactive oxygen species at injection site, eventually leading to more local pain, redness, and swelling and probably more other adverse effects (e.g., generalized muscle ache) [47,48].

In our study, young age was associated with high pre vaccination stress in normal anxiety individuals while older age was associated with high post vaccination stress in the mild anxiety subsample. This result is in accordance with reports associating age with greater vaccine hesitancy and anxiety among Chinese population, psoriatic patients, and Indonesian adults [23,24,39]. Gender is known to exert significant effects on emotional processing and related emotional and behavioral consequences [49,50]. Gender and education are reported to be associated with vaccine hesitancy/anxiety [6,23,24,38,51]. Being previously infected with COVID-19 is a reported predictor of vaccine hesitancy [24,37]. However, none of the respondent's demographic characteristics or history of being infected with COVID-19 was associated with vaccine-related anxiety and stress in this study. This difference may be attributed to the high presentation of females and those with above high school level of education, as well as the small number of previous COVID-19 cases in our sample (Table 1).

**Strength, implications, and limitations**

This study provides new information, denoting a desensitization effect of COVID-19 vaccine among anxious adults. The findings also show that adults with normal anxiety level are more prone to develop distress symptoms following vaccination than their anxious counterparts. Moderate-severe anxiety pre vaccination was higher among younger

groups. Higher levels of pre vaccination stress in individuals with moderate-severe anxiety pre vaccination are associated with increased pain severity at injection site. Because the study did not follow up the respondents for a long time after receiving the vaccine, the nature of subsequent changes in the symptoms of distress and local pain in different groups is unclear. This issue needs to be handled in future studies, given that elevated mental symptoms after COVID-19 vaccine may deteriorate pre-existing pathologies if not properly managed [39]. Policy makers should adopt strategies that may combat conspiracy theories and increase participants' vaccine preparedness [5]. Access to trusted vaccine-related information is associated with reduced vaccine hesitancy and post vaccine distress [24]. Therefore, key strategies to promote vaccine acceptance should focus on the use of social media to disseminate correct information about the vaccine as well as hotline service to provide post-vaccination follow up and support for vaccine recipients [52,53]. Youth represent an important target group for infodemic campaigns, given their high use of social media as a source of information and method of socialization during the pandemic [24,49,54]. Gaming has been recommended by the WHO as a method to maintain during COVID-19 lockdown. Moreover, some games (e.g., Go Viral!) have been introduced to reduce perceived reliability of fake vaccine news by an average of 21% [52,55].

The use of a convenience sample from a single health care center study is another limitation, which may limit the generalizability of the results. In addition, we were not able to identify factors associated with the change in mental symptoms because of lack of assessment of other variables, which may explain such change such as COVID-19 fear, perceived susceptibility, conspiracy beliefs, and sources of information on COVID-19 vaccine. The credibility of the results would be better if the levels of vaccine distress symptoms were also examined in a comparison group of unvaccinated individuals, which was not applicable in the current study. Moreover, the data were collected in 2020, and the pandemic is ongoing. Therefore, more studies are needed to examine the stability of the findings over time.

## 5. Conclusions

The COVID-19 vaccine represents a source of distress for first dose recipients, with increased levels of stress and anxiety among those with pre vaccination normal levels of anxiety. COVID-19 vaccine seems to exert a desensitization effect among anxious individuals. Further investigations of the dynamics of the change in distress symptoms in different groups is needed.

**Supplementary Materials:** The following supporting information can be downloaded at: www.mdpi.com/xxx/s1, Supplementary excel file: Additional statistical analysis not reported in the manuscript.

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