

Original article

# Complications Following COVID-19 Infection or Vaccination in Libyan International Medical University Students and Their Families

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## ARTICLE INFO

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## ABSTRACT

Coronavirus disease 2019 (COVID-19) caused by a novel strain of coronavirus belonging to the genus Beta coronavirus named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2) emerged as a major pandemic worldwide. This contagious virus had spread in many different forms, and patients have demonstrated a wide range of symptoms, ranging from moderate to severe illness. This study aims to highlight the important associations between SARS-CoV-2 infection, vaccination, and possible complications at the Libyan International Medical University, Benghazi. This cross-sectional survey was conducted among students and their families at Libyan International Medical University in Benghazi, Libya. Among the 100 participants, 72% were between the ages of 18 and 39. Up to (59%) of participants were men. As for the infection with COVID-19, 77% of participants were infected. Most of the participants had no chronic diseases (69%); however, the most common chronic disease was diabetes mellitus (13%). 82% of participants were vaccinated; the most common types of vaccines administered were Sinopharm and Sputnik V (24%). Following vaccination, 71% of participants had no COVID-19 infection, while 29% did get the infection. Regarding this study, after COVID-19 infection, 66% of participants had no complications; however, 17% had pulmonary complications, which was the most common complication among the participants. As for the complications following the vaccination, 81% of participants had none, while there were pulmonary and neurological complications in 7–6%. The results of the study showed that the most frequent complications noticed among the participants following the COVID-19 infection and vaccination were pulmonary and neurological complications.

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## INTRODUCTION

Coronavirus disease 2019 (COVID-19) caused by a novel strain of coronavirus belonging to the genus Beta coronavirus named Severe Acute Respiratory Syndrome Coronavirus 2 (SARS-CoV-2). It has dramatically spread worldwide, emerging as a major pandemic [1]. It can trigger a reaction known as a respiratory tract infection. This virus may affect

the upper respiratory tract (sinuses, nose, and throat), as well as the lower respiratory tract and lungs. SARS-CoV-2 is one of seven types of coronaviruses that are known to infect humans. The other types causing severe diseases are the Middle East respiratory syndrome (MERS) and sudden acute respiratory syndrome (SARS). The virus is a single-stranded RNA (ssRNA) virus with a crown-like appearance, hence the name (Corona is the Latin term for "crown") [2]. The initial outbreak was first reported in Wuhan, China, in early December 2019 and has since spread to every country around the world, resulting in more than 1.45 million deaths globally as of November 2020 [2]. In contrast, the official declaration of the first case of COVID-19 in Libya was on the 24th of March 2020, when the patient visited Saudi Arabia and returned to Libya on March 5. The official diagnosis was 19 days later, after the return [3].

Ever since, there have been 507,266 confirmed cases of COVID-19 and 6,437 deaths reported to the WHO in Libya [4]. This contagious virus had spread in many different forms; for example, in an infected individual's mouth or nose in small liquid particles when they cough, sneeze, speak, sing, or breathe. Another individual can then contract the virus when infectious particles that pass through the air are inhaled for short periods called airborne transmission or if infectious particles directly contact either the eyes, nose, or mouth called droplet transmission. Another way of spreading is by being in poorly ventilated and/or crowded indoor settings. This happens due to aerosols remaining suspended in the air [5].

COVID-19 patients have demonstrated a wide range of symptoms, ranging from moderate to severe illness. These symptoms may emerge two to 14 days after viral contact. Some symptoms include fever or chills, shortness of breath or difficulty breathing, exhaustion, cough, headache, and muscle or body aches. Also, some slight emergence of a loss of taste or smell may occur, and other symptoms are possible [6]. This may only affect some people, while others may have none but still spread the disease (asymptomatic transmission) [5].

It has been thought that elderly patients and those with comorbid conditions (cardiovascular disease, diabetes, chronic respiratory disease, or cancer) are more likely to develop serious illnesses and more severe symptoms related to this virus. Even those with COVID-19 without other comorbidities can get sick, leading to feeling seriously ill or even death [7].

Diagnosis is usually done by polymerase chain reaction (PCR), which remains the primary COVID-19 diagnostic method. Other tests, like a CT scan, can help to get a clearer view of where the virus has spread, making it a simpler, quicker, and more reliable way to diagnose the virus. Recently, the FDA approved a rapid corona virus diagnostic test [8].

The FDA has authorized a few antiviral medications along with monoclonal antibodies to treat mild to moderate COVID-19 symptoms. The majority of people who had COVID-19 had a mild illness and improved by using over-the-counter medications at home, such as acetaminophen or ibuprofen, to help alleviate symptoms [9]. Furthermore, optimal supportive care includes oxygen for severely ill patients and those who are at risk for severe disease, as well as more advanced respiratory support, including ventilation, for those who are critically ill. Dexamethasone, a type of corticosteroid, helps reduce the length of time on a ventilator, saving the lives of patients suffering from severe and critical illnesses [10].

The development of vaccines played a critical role in restraining the virus. Each type of vaccine provides protection in its own unique way; however, with all vaccines, the body is left with a supply of "memory" T- and B-lymphocytes that will remember how to fight that virus in the future. T-lymphocytes and B-lymphocytes are normally produced a few weeks after vaccination. As a result, it is possible that a person might get infected with the virus that causes COVID-19 prior to or following immunization and then become ill as a result of the vaccine failing to provide sufficient defense. Symptoms such as fever can occur after vaccination due to the process of developing immunity. These symptoms are natural indications that the body is developing immunity.

In the United States, three types of COVID-19 vaccines are currently available: mRNA, protein subunit, and viral vector vaccines. Johnson & Johnson's Janssen COVID-19 vaccine, a viral vector vaccine that uses a modified version of a different virus (a vector virus) to deliver important instructions to cells, has expired and is no longer available in the United States as of May 6, 2023. However, the mRNA vaccines (Pfizer-BioNTech or Moderna) work by using mRNA created in a laboratory and making human cells produce antibodies. In regard to the protein subunit vaccines (Novavax), they include only the parts of a virus that best stimulate the immune system. This type of COVID-19 vaccine contains what are known as S proteins, which are harmless. Once the immune system recognizes the S proteins, it creates antibodies and defensive white blood cells. If the person later becomes infected with the COVID-19 virus, the antibodies will fight the virus [11,12].

The vaccination program began in early December 2020, and the number of vaccination doses received is updated daily. There are a minimum of 13 different vaccines across four platforms that have been administered. Since January 15, 2023, a total of over 3,739,158 vaccine doses have been administered across Libya [13].

While most cases will not require hospitalization, unfortunately, some patients who suffer from COVID or have received vaccinations may experience some complications [14].

Since the emergence of COVID-19, there have been no previous published studies about the outcomes or complications of patients with COVID-19 in Libya regarding vaccination and post-COVID-19; however, several studies have been constructed in countries such as India, America [15] and Sudan [16].

The aim of this study is to highlight the important associations between SARS-CoV-2 infection, vaccination, and possible complications at the Libyan International Medical University, Benghazi.

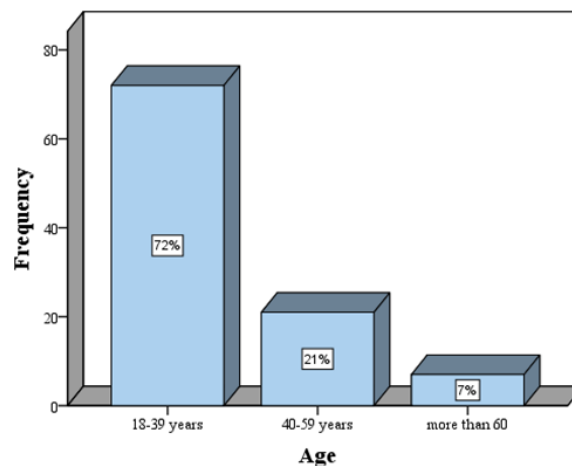
## METHODS

This cross-sectional study included a 15-item questionnaire containing both qualitative and quantitative questions distributed among students and their families at the Libyan International Medical University in Benghazi, Libya, between the 24th of February and the 10th of March 2023. The questionnaire was validated, provided in English on campus and included only Libyan participants. Verbal consent was obtained from participants, and they were informed that their participation was entirely voluntary and that their replies would be kept anonymous and confidential. The sample size was 100 participants. After the data was collected, it was analyzed and described using IBM SPSS Statistics version 21. The data was presented as percentages and frequencies.

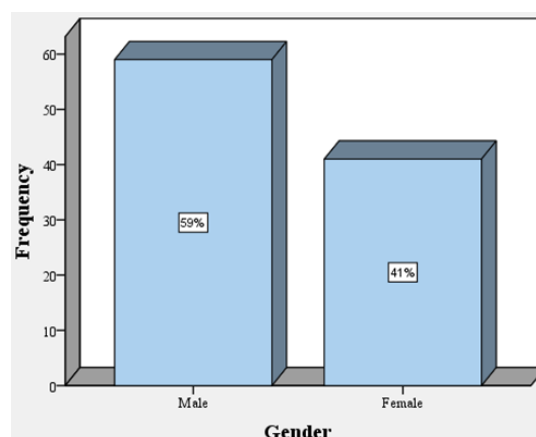
## RESULTS

### *Age and gender distribution*

Age distribution as in figure 1, showed that the majority of participants were between the ages of 18 and 39 years, followed by 40 and 59 years, and a few above 60 years. Gender distribution as in figure 2, showed that the majority of the participants were males (59%) and the rest were females (41%).



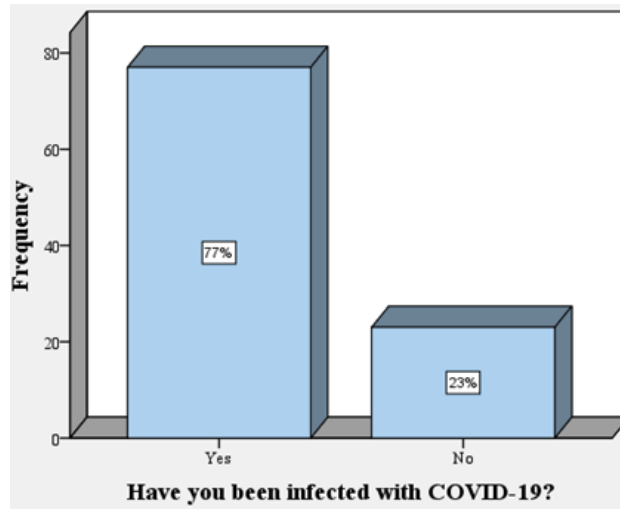
*Figure 1. Age distribution*



*Figure 2. Gender distribution*

**Infection with COVID- 19**

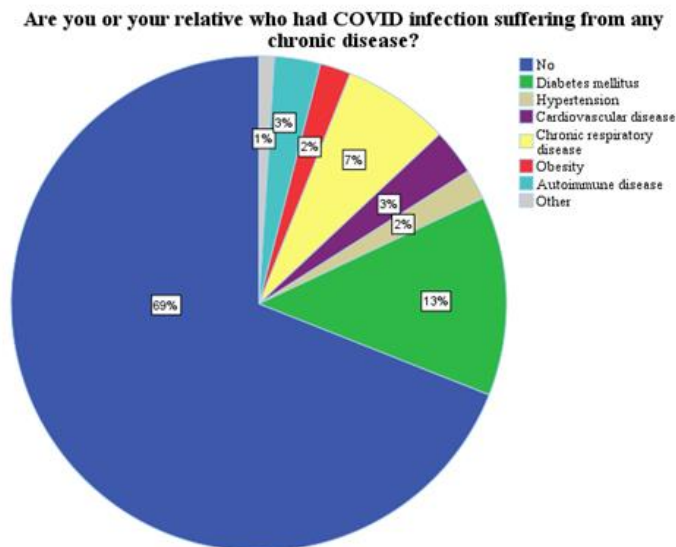
As in Figure 3 shows that the majority of participants got infected with COVID-19 (77%).



**Figure 3. Infection with COVID- 19**

**Comorbidities status**

Figure 4 shows that the majority had no comorbidities (69%), while others had diabetes milieus (13%), chronic respiratory diseases (7%), cardiovascular diseases (3%), autoimmune diseases (3%), hypertension (2%), and obesity (2%).



**Figure 4. Comorbidities status**

**Vaccination and types of vaccines**

Figure 5 shows that only 18% were unvaccinated, while vaccines types as in figure 6 showed that the majority got vaccinated with Sinopharm (24%), and Sputnik V (23%), while the others got vaccinated with AstraZeneca/Oxford (19%), Pizer-BioNTech (15%), Johnson &Johnson (3%), and Moderna (1%). Further, 15 % did not get vaccinated.

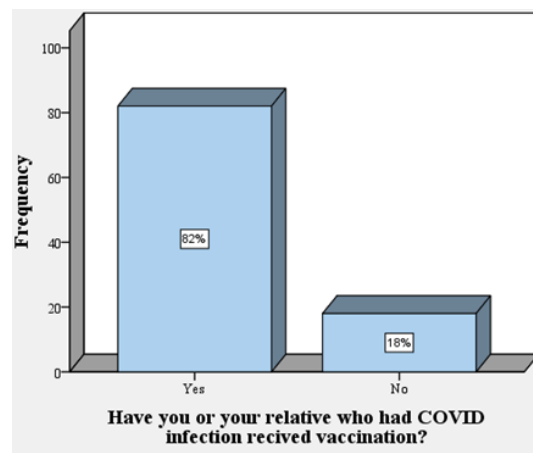


Figure 5. Vaccination.

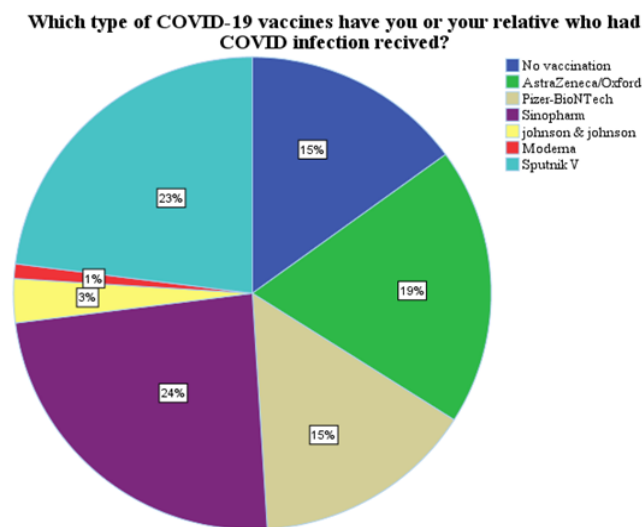


Figure 6. Types of vaccines

**Infection with COVID- 19 after vaccination**

Figure 7 shows that 71% didn't get infected after vaccination.

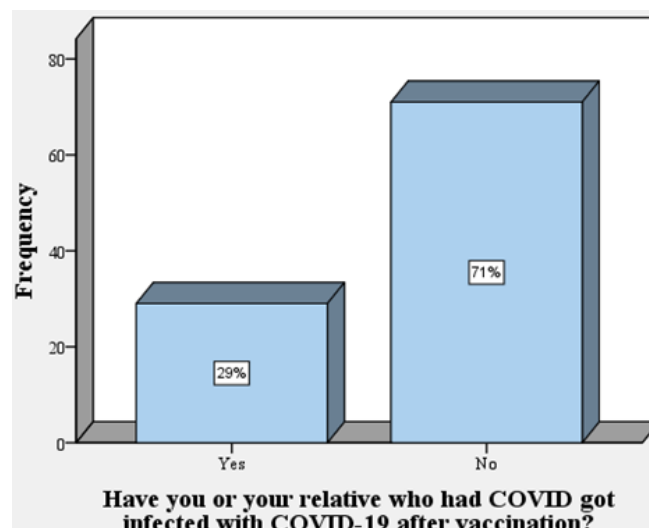
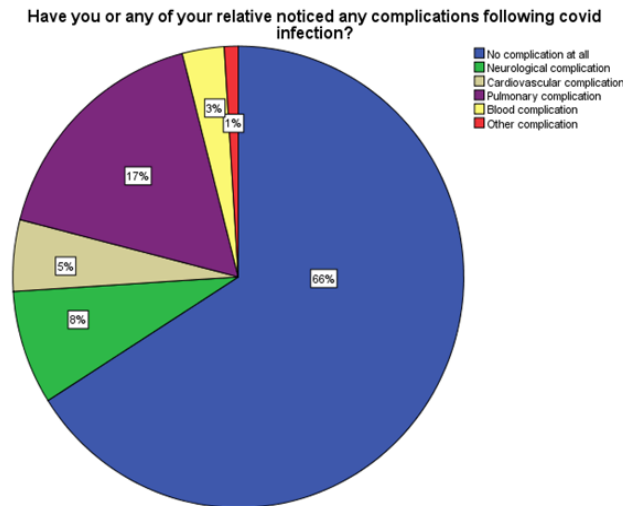


Figure 7. Infection with COVID- 19 after vaccination

**Complications following Covid-19 infection**

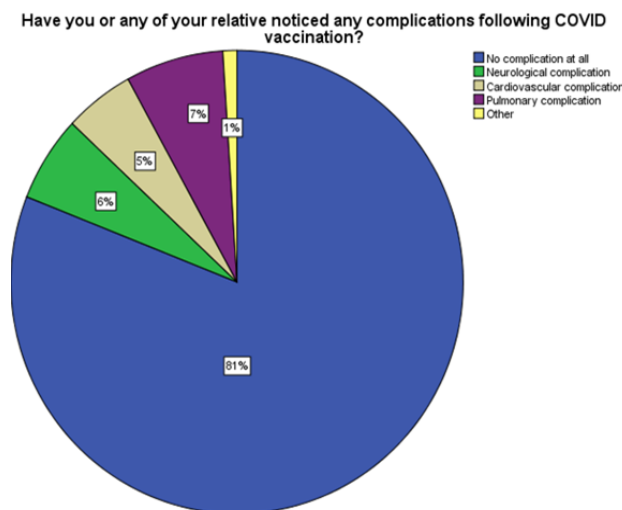
Figure 8 shows that the majority had no complications after the infection (66%). While (17%) had pulmonary complications, (8%) had neurological complications, (5%) had cardiovascular complications, and (3%) had blood complications.



**Figure 8. Complications following Covid-19 infection**

**Complications following Covid-19 vaccination**

Figure 9 shows that the majority had no complications after vaccination (81%). While (7%) had pulmonary complications, (6%) had neurological complications, and had (5%) cardiovascular complications.



**Figure 9. Complications following Covid-19 vaccination**

**DISCUSSION**

The majority of the participants in this study were between the ages of 18 and 39 years (72%). This may suggest why the results showed fewer participants suffering from any post-COVID (66%) or post-vaccination (81%) complications. This may also suggest why the majority had no comorbidities (69%). Moreover, the majority of the participants had been infected with COVID-19 (77%), on January 2, 2020. A study done in Wuhan, China, also demonstrated that more patients aged 25-49 years had been infected with COVID (49%) [17].

Results showed that the male group (59%) exceeded the females (41%), which agreed with the study conducted in Wuhan, China. showing that men are more susceptible to SARS-COV-2. According to the study, it was thought that this may be due to several factors, one of which is the high expression of coronavirus receptors (ACE2) in men [17].



When exploring the effects of smoking on COVID-19, results showed that the majority were non-smokers (69%). According to this study, there is no direct link between smoking and COVID-19 complications. On the other hand, another study in Miami, Florida claimed that smokers were more likely to die of COVID-19 [18].

Among the studied cases, no comorbidities were the most recorded (69%), as discussed above. It was revealed that diabetes is the most common underlying comorbidity (13%). At the same time, chronic respiratory disease, autoimmune disease and cardiovascular disease were reported by 7%, 3% and 3% of participants, respectively. Hypertension (2%) and obesity (2%) were identified. It was found that diabetes mellitus is the most chronic disease that may increase the risk of SARS-CoV-2, with drug-induced expression of angiotensin converting enzyme type 2 (ACE-2) being the most likely explanation [19].

When it came to allergies, the majority (85%) had no allergy, claiming that it was generally associated with a lower risk of complications. These findings were consistent with a comparative article suggesting that allergic asthma and food allergies had a low contribution to COVID-19 [16].

Out of the 100 contributors, 84% had received vaccinations, the two most common being Sinopharm (24%) and Sputnik (23%). In a study conducted in Pakistan, it was thought that Sinopharm was responsible for only mild, non-life-threatening side effects [20]. This may suggest why, in the results, it was found that 81% had not noticed any complications following any type of vaccine. 15% had received the Pfizer vaccine, which, in a study in Korea, showed a significant increase in the rate of pulmonary complications with a 95% confidence interval. Additionally, neurological manifestations (6%) had been reviewed; headache was the most common manifestation. In terms of cardiac manifestation, it made up 5% of all complications [21].

When assessing the complications following the infection with COVID-19, 66% of participants had no complications at all; however, like the vaccine complications, pulmonary complications were the most noted (17%). Similarly, in a systemic review, the most common long-term complication was thought to be lung disease [22]. Neurological complications made up 8%, followed by cardiovascular complications (5%). 3% had some sort of blood complications. This study's strengths are that it is considered one of the first to describe the vaccine complications in Benghazi, Libya and one of the fewest studies in Africa. It was seen that this study's size was representative of the Libyan International Medical University students and their families.

## CONCLUSION

This study concluded that the most frequent complications noticed among the participants following the COVID-19 infection and vaccination were pulmonary complications and neurological complications. Overall, up to half of the participants had no complications after infection with COVID-19 or the vaccination.

### *Conflict of interest*

The authors declare that they have no competing interests.

### *Declarations*

Ethical approval had been taken from the Ethics Research Committee of the Libyan International Medical University, Benghazi, Libya. Permission was obtained from university and faculty dean. Study participant's consent was taken however the study did not use identifiable data.

### *Acknowledgment*

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## المضاعفات بعد الإصابة بفيروس كورونا أو التطعيم لطلاب الجامعة الليبية للعلوم الطبية وعائلاتهم

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### المستخلص

ظهر مرض فيروس كورونا 2019 (كوفيد-19) الناجم عن سلالة جديدة من فيروس كورونا تنتمي إلى جنس فيروس كورونا بيتا المسمى فيروس كورونا المتلازمة التنفسية الحادة الوخيمة 2 (سارس-كوف-2) كجائحة كبرى في جميع أنحاء العالم. وقد انتشر هذا الفيروس المعدى بأشكال مختلفة، وأظهر المرضى مجموعة واسعة من الأعراض، تتراوح بين المرض المعتدل والشديد. تهدف هذه الدراسة إلى تسليط الضوء على الارتباطات المهمة بين الإصابة بفيروس سارس-كوف-2 والتطعيم والمضاعفات المحتملة في الجامعة الليبية الدولية للعلوم الطبية في بنغازي. أُجري هذا المسح المقطعي بين الطلاب وعائلاتهم في الجامعة الليبية الدولية للعلوم الطبية في بنغازي، ليبيا. من بين 100 مشارك، كان 72% منهم تتراوح أعمارهم بين 18 و39 عامًا. وكان ما يصل إلى (59%) من المشاركين من الرجال. أما بالنسبة للإصابة بفيروس كورونا المستجد (كوفيد-19)، فقد أصيب 77% من المشاركين. لم يكن معظم المشاركين مصابين بأمراض مزمنة (69%)؛ ومع ذلك، كان أكثر الأمراض المزمنة شيوعًا هو داء السكري (13%). تم تطعيم 82% من المشاركين؛ وكانت أكثر أنواع اللقاحات التي تم إعطاؤها شيوعًا هي لقاح سينوفارم وسبوتنيك (24%). بعد التطعيم، لم يصاب 71% من المشاركين بعدوى كوفيد-19، بينما أصيب 29% منهم بالعدوى. فيما يتعلق بهذه الدراسة، بعد الإصابة بفيروس كورونا المستجد (كوفيد-19)، لم يعاني 66% من المشاركين من أي مضاعفات، ولكن 17% منهم أصيبوا بمضاعفات رئوية، وهي المضاعفات الأكثر شيوعًا بين المشاركين. أما بالنسبة للمضاعفات التي أعقبت التطعيم، لم يعاني 81% من المشاركين من أي مضاعفات، بينما كانت هناك مضاعفات رئوية وعصبية لدى 7-6% من المشاركين. أظهرت نتائج الدراسة أن المضاعفات الأكثر شيوعًا التي لوحظت بين المشاركين بعد الإصابة بفيروس كوفيد-19 والتطعيم كانت المضاعفات الرئوية والعصبية

**الكلمات الدالة.** مرض فيروس كورونا، كوفيد-19، سارس-كوف-2، لقاحات كوفيد-19، مضاعفات فيروس كورونا.