REVIEW ARTICLE

COVID-19 Vaccine Hesitancy and Self-reported Adverse Effects: A Narrative Review

Nurulhana Noh[1], *Mahmathi Karuppannan[2,3]

[1] Faculty of Pharmacy, Universiti Teknologi MARA (UiTM) Selangor Branch, 42300 Bandar Puncak Alam, Selangor, Malaysia
[2] Department of Clinical Pharmacy, Faculty of Pharmacy, Universiti Teknologi MARA (UiTM) Selangor Branch, 42300 Bandar Puncak Alam, Selangor, Malaysia.
[3] Cardiology Therapeutics Research Group, Faculty of Pharmacy, Universiti Teknologi MARA (UiTM) Selangor Branch, 42300 Bandar Puncak Alam, Selangor, Malaysia.

ABSTRACT

This study reviewed articles investigating the types and severity of adverse effects (AE) of COVID-19 vaccines and the reasons for vaccine hesitancy (VH). Google Scholar, the U.S. National Library of Medicine (PubMed), Science Direct, and Scopus were searched for relevant articles published between 2020 and 2022. Pfizer-BioNTech (92.1%) and Moderna (94.2%) vaccines reported the highest incidence of AEs compared to viral vector and inactivated vaccines. Local AEs were more prevalent in Pfizer-BioNTech, Moderna, Sputnik V, Sinopharm, and Covaxin vaccines, while systemic AEs were more prevalent in Johnson &Johnson, AstraZeneca, and Coronavac. The primary reasons for VH were fear of the AEs (up to 96.8%), disbelief in the efficacy (up to 93.2%), and preference to "wait and see" (up to 83.2%). VH has been a significant challenge in the global fight against COVID-19. It is crucial to address these concerns and provide accurate information to increase vaccine uptake and ultimately curb the spread of COVID-19.
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Corresponding Author:
Mahmathi Karuppannan, PhD
Email: k_mahmathi@yahoo.com
Tel: +603-32584643

INTRODUCTION

The coronavirus pandemic has had a significant impact on the world since it first emerged in Wuhan Province, China; the first death was recorded on January 11, 2020 [1]. The virus quickly spread across the globe, infecting millions of people and causing widespread panic. The World Health Organisation (WHO) proclaimed the coronavirus illness a worldwide pandemic on March 11, 2020. Due to severe acute respiratory syndrome coronavirus-2 (SARS-CoV-2), COVID-19 is a typical pneumonia-like illness where the infected patients exhibit symptoms of dry cough, fever, diarrhoea, headache, upper airway congestion, and sputum production. Patients with COVID-19 may also experience anosmia (loss of smell) and ageusia (loss of taste) [2]. The severity of the infection can vary among individuals, from a mild cold to severe respiratory failure [3].

As of January 10, 2022, while this review was ongoing, there were approximately 307 million people infected with COVID-19 and 5.49 million deaths reported globally [4]. Based on World Health Statistics 2021, COVID-19 is among the top 10 leading causes of death reported globally, along with neonatal conditions, chronic obstructive pulmonary disease (COPD), ischaemic heart disease, and stroke [5].

The COVID-19 pandemic has caused unprecedented disruptions to daily living activities, and the WHO has been at the forefront of advising people on how to remain safe. A number of measures have been suggested to prevent the spread of the virus, including donning a mask, maintaining physical distance, and self-isolation. Although these measures have demonstrated short-term efficacy in controlling the infection rate, they are not viable long-term prevention strategies. The discovery of COVID-19 vaccines has inspired optimism for a more permanent resolution to this global crisis. Until a substantial portion of the population is vaccinated, however, it is vital to continue implementing safety measures.

Vaccines have played a significant role in the eradication of diseases such as smallpox, polio, and measles. Therefore, the COVID-19 vaccine is essential for preventing the virus's spread. Prior to approval by national regulatory authorities for public use, COVID-19 vaccines must undergo three phases of clinical testing to ensure that they meet the necessary safety and

immunogenicity standards [6]. The Pfizer-BioNTech vaccine, also known as Comirnaty, has been shown to be highly effective in preventing COVID-19 infections, reducing the severity of the disease, and preventing hospitalisation and death [7]. As a result, many countries around the world have started immunisation programmes to achieve herd immunity. This involves vaccinating a large proportion of the population to reduce the spread of the virus and protect those who are unable to receive the vaccine. Recently, booster doses have also been administered to provide additional protection against COVID-19 disease. These booster shots have been shown to increase antibody levels and provide greater immunity against new variants of the virus. While there is still much to learn about COVID-19 and its long-term effects, vaccination remains one of the most effective ways to prevent severe illness and reduce transmission of the virus.

While there are some adverse effects associated with COVID-19 vaccines, such as pain, swelling, and redness at the injection site, these are generally mild and short-lived. Systemic adverse effects like nausea, fever, and fatigue may also occur but are typically resolved within a few days [8]. According to Cuschieri et al. [9], the benefits of COVID-19 vaccination significantly outweigh the risks of adverse effects. However, some individuals are hesitant to receive the COVID-19 vaccine due to safety concerns, such as fear of COVID-19 adverse effects and a lack of knowledge [10]. This phenomenon is known as vaccine hesitancy, and it refers to individuals who, despite the accessibility and availability of vaccines, have refused to be vaccinated [6]. Vaccine resistance is a complex problem that necessitates a multifaceted solution. As achieving herd immunity through vaccination is critical to preventing further outbreaks of the virus, vaccine hesitancy poses a significant challenge to this goal. According to Statista, 24% of adults in the United States refuse to get the COVID-19 vaccine due to concerns about its adverse effects. It is significant to note that the vaccines have undergone extensive testing and have received a safe rating from health authorities. Vaccine hesitancy could lead to failure in achieving herd immunity [11].

In addition, a lack of knowledge and inadequate awareness regarding the safety and effectiveness of the COVID-19 vaccine have also increased public vaccine hesitancy [10]. According to Cerda and Garcia's research, 40% of respondents avoid vaccination out of fear of adverse effects, while 24% avoid vaccination due to a lack of vaccine knowledge [10]. Moreover, a study by Bogart LM et al. on the relationship between vaccine hesitancy and mistrust of COVID-19 vaccines revealed that 97% of respondents have at least one mistrust of COVID-19, such as the belief that COVID-19 vaccines are harmful and do not provide any benefits [12].

Thus far, data on COVID-19 vaccine adverse effects has been published in manufacturer-funded studies. Reporting of adverse effects following immunisation (AEFI) is also sent to a committee like the US Food and Drug Administration (FDA) or available in a database such as the US Vaccine Adverse Events Reporting System (VAERS), which monitors post-administration of vaccines [13]. However, it is anticipated that only moderate to severe adverse effects that affect the quality of life of recipients are being reported, as is the case with most of the reports received for adverse drug reactions [14]. "There are several reliable methods to collect information on adverse effects: spontaneous reporting through national pharmacovigilance databases, collecting practise data, soliciting events from healthcare professionals, direct observation, and surveying patients for adverse events" [15]. The patient's role in reporting adverse drug effects has long been established in a few countries [16]. On top of that, there are a few studies that investigated the adverse effects of receiving vaccines in different types of populations, such as healthcare professionals, the public, and the populations of different countries [17]. Thus, this study expects to identify the type and pattern of self-reported adverse effects of the COVID-19 vaccination and the reasons for vaccine hesitancy. Findings from this study could provide a basis to educate the public on the safety profile of the vaccines and increase the confidence on the effectiveness of the vaccines among those who are hesitant.

MATERIALS AND METHODS

Literature Search Strategy

The AEFI of different types of COVID-19 vaccines was reviewed to improve public awareness of the safety of COVID-19 vaccines and reduce vaccine hesitancy among the public. Database systems such as Google Scholar, the U.S. National Library of Medicine (PubMed), Scopus, and Science Direct were used to search for related and relevant articles. The terms that were used to search were "side effect" OR "adverse effect" OR "adverse reaction" OR "safety" OR "adverse effects following immunisation" AND COVID-19 vaccines" and "COVID-19 vaccines" AND "hesitancy" OR "reluctance" OR "acceptance" OR "willingness". To ensure the articles were relevant to the selection criteria and studies, all the articles were collected and screened manually. All unrelated and duplicated articles were excluded. This narrative review is based on SANRA (the scale for the quality assessment of narrative review articles) to guide the synthesis of this information into a quality narrative review [18].

Inclusion and exclusion criteria

Observational studies on self-reported adverse effects and vaccine hesitancy conducted from 2020 to 2022, available in full text and in English, were included.

Commentaries, letters to the editor, conference proceedings or abstracts, reviews, and articles in languages other than English were excluded. The title and abstract of the articles were manually reviewed to ensure the eligibility of the studies. Articles were excluded from preliminary screening based on inclusion and exclusion criteria. Full-text articles were reviewed, and all relevant data (types of adverse effects of different COVID-19 vaccines, severity, and vaccine hesitancy) that aligned with the study's objectives were extracted.

RESULTS

The search yielded 28, 918 articles on self-reported adverse effects and 24,313 articles on vaccine hesitancy from all four databases. After reviewing the titles and abstracts based on inclusion and exclusion criteria, unrelated and duplicate articles were excluded. Twenty-seven articles about AEFI of COVID-19 vaccines [8, 19 - 44] and 22 [45 – 66] articles about vaccine hesitancy were identified. Of the 27 studies, the types of COVID-19 vaccines discussed were messenger ribonucleic acid (mRNA) vaccines, viral vector vaccines, and inactivated vaccines. For mRNA vaccines, 20 studies highlighted the adverse effects of Pfizer-BioNTech vaccines [8, 19 – 37], of which 18 were cross-sectional studies, one was a randomised controlled trial, and one was a case control study. The studies were conducted in the United States (n = 3), Poland (n = 2), the Czech Republic (n = 2), the United Kingdom (n = 2), Saudi Arabia (n = 2), Jordan (n = 2), Mexico (n = 1), France (n = 1), Japan (n = 1), Germany (n = 1), Ecuador (n = 1), Iran (n = 1), Milan (n = 1), and Israel (n = 1). Populations included in the studies were adults (n = 11), health care workers (HCWs) (n = 7), university students (n = 1), adolescents (n = 1), and pregnant women (n = 1).

Six cross-sectional studies highlighted the adverse effects of Moderna vaccines [20, 28, 31 – 33, 38]. These were conducted in the Czech Republic (n = 2), Germany (n = 1), the United States (n = 1), Japan (n = 1), among adults (n = 3), HCWs (n = 2), and university students (n=1). Furthermore, for viral vector vaccines, two cross-sectional studies of Janssen/ Johnson & Johnson vaccines [28, 39] were conducted in the United States (n = 1) and the United Arab Emirates (UAE) (n = 1), while 10 cross-sectional studies on AstraZeneca/Oxford vaccines [8, 19, 20, 24, 26, 35, 36, 40 – 42] were conducted in the United Kingdom (n = 2), Jordan (n = 2), Poland (n = 1), Germany (n = 1), Ethiopia (n = 1), Iran (n = 1), Saudi Arabia (n = 1), and India (n =1). Meanwhile, there was only one cross-sectional study that focused on health care workers in Iran and the Sputnik V vaccine [42].

For inactivated vaccines, there were one prospective cohort study on CoronaVac conducted among HCW in Thailand [43], three cross-sectional studies on Sinopharm [26, 35, 44] conducted in Jordan and the UAE, and one cross-sectional study on Covaxin conducted in Iran among HCW [42].

Twenty-two articles evaluated the attitude of respondents towards COVID-19 vaccination and the reasons for vaccine hesitancy [45 – 66]. All were cross-sectional studies. The studies were conducted in the United States (n = 5), the United Kingdom (n = 5), and one each in Ghana, Pakistan, Malta, Canada, Kuwait, Jordan, Palestine, Syria, France, Iraq, China, Portugal, Egypt, and Poland. These studies investigated the intention of COVID-19 vaccination among adults (n = 18), health care workers (HCWs) (n = 3), and university students (n = 3).

DISCUSSION

mRNA vaccines

It was found that the incidence of local adverse effects following vaccination with either the Pfizer-BioNTech vaccine or the Moderna vaccine was significantly higher than the incidence of systemic adverse effects (Fig. 1). Both Pfizer and Moderna reported that the most common adverse effect was pain at the injection site, with percentages ranging from 31.8–92.1% and 31.6–94.5%, respectively. Due to the fact that these effects are self-reported, the intensity of pain and the ability to tolerate it can vary from person to person; consequently, these differences reflect, to a large extent, individual differences in pain sensitivity [67]. Systemic adverse effects such as fever, fatigue, headaches, and muscle aches still occurred in a significant proportion of vaccine recipients. These adverse effects typically resolved within a few days and were more common after the second dose of the vaccine. Despite these adverse effects, both Pfizer and Moderna vaccines have been shown to be highly effective at preventing COVID-19 infection and severe illness [23, 38].

The prevalence of pain at the site of injection was more common in people above 60 years old [34]. This may be because older people are more fragile and

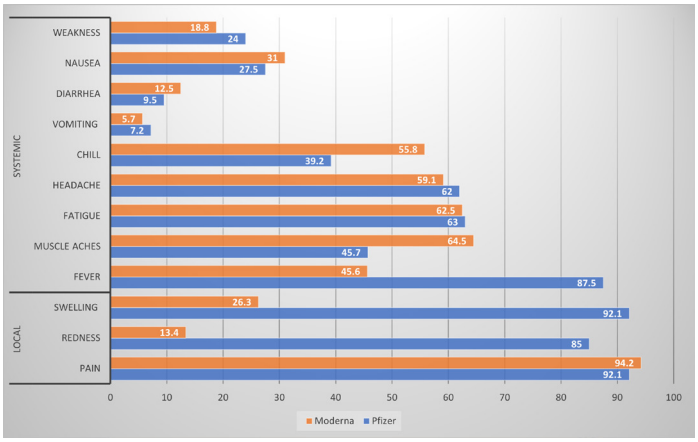

Fig. 1 : mRNA vaccines adverse effects.

have underlying health issues which could intensify pain compared to younger individuals. Meanwhile, the prevalence of adverse effects of the mRNA vaccine was higher in females than males [19]. Additionally, it was also found that the prevalence of adverse effects among Pfizer recipients who were infected with COVID-19 was higher than that of those who were not infected with COVID-19, as 95.0% of those who had been infected with COVID-19 reported at least one side effect, compared to only 70.0% of non-infected individuals [30]. This finding highlights the potential impact of the COVID-19 infection on the immune response to the Pfizer vaccine. It suggests that individuals who have been infected with COVID-19 may be more likely to experience adverse effects following vaccination. However, it is important to note that the majority of individuals in both groups still reported experiencing at least one adverse effect. This underscores the importance of monitoring and managing vaccine adverse effects, regardless of COVID-19 infection status. It also highlights the need for continued research into the long-term safety and efficacy of COVID-19 vaccines, particularly in populations with a history of infection. Ultimately, these findings reinforce the importance of vaccination as a key tool in controlling the spread and impact of COVID-19.

The adverse effects of both mRNA vaccines were mostly mild to moderate and could be resolved between one and three days after the vaccination. The duration of adverse effects was mainly one day (45.1%) or three days (35.8%) [21]. Despite the adverse effects of the mRNA vaccine, 79.7% of Pfizer recipients were able to continue their daily activities [23]. Whereas, 59% of Moderna recipients had no difficulty carrying out their daily lives, 25% temporarily had trouble performing daily activities, and 28% required transient time off from work [38]. The fact that some recipients experienced adverse effects that required time off from work or temporarily impacted daily activities suggests that the impact of the vaccine may not be entirely mild for everyone. The percentage of recipients that required medical intervention after injection of the mRNA COVID-19 vaccine was also low, at only 3% for the Pfizer vaccine [23] and 4% for the Moderna vaccine [38]. The low percentage of recipients requiring medical intervention after receiving the mRNA COVID-19 vaccine may suggest that the adverse effects are manageable and not be a significant concern for majority of the recipients. While the adverse effects of the mRNA vaccines may be manageable, it is still important to consider the potential risks for individuals with underlying health conditions or allergies.

Although the mRNA vaccine recipients are aware of the adverse effects of the vaccine during the first dose of injection, 97.6% [23] and 97.0% [38] of Pfizer and Moderna vaccine recipients, respectively, are willing to get a second dose of the vaccine. The willingness of recipients to receive a second dose does not necessarily negate the fact that some individuals may still experience adverse effects that impact their daily lives or require medical intervention, and it does not necessarily mean that the adverse effects are not a significant concern for those who experience them. The high percentage of willingness could be more likely due to the effectiveness of the vaccines in preventing severe illness and death from COVID-19. In fact, studies have shown that both Pfizer and Moderna vaccines have an efficacy rate of over 90% [23, 38]. This high efficacy rate may have instilled confidence in many individuals who were previously hesitant about getting vaccinated. In addition to protecting oneself from severe illness and death, getting vaccinated also helps to protect others who may be more vulnerable to COVID-19, such as elderly individuals or those with underlying health conditions. This is especially important as new variants of the virus continue to emerge.

In an observational case control study, comparing non-pregnant women to pregnant women receiving the Pfizer vaccination, it was found that pregnant women had a lower risk of experiencing local adverse effects such as myalgia, arthralgia, headache, local pain or swelling, and axillary lymphadenopathy [28]. In addition, there was no discernible difference in the frequency of adverse effects whether the vaccination was given in the first, second, or third trimester of pregnancy. On the other hand, pregnant women had a significantly increased risk of experiencing paraesthesia. It was also found that the rate of obstetric complications such as uterine contractions, vaginal bleeding, and pre-labor membrane rupture was low [28]. Despite the low rate of obstetric complications, it is still important for pregnant women to discuss the risks and benefits of receiving a vaccine with their healthcare provider. The argument does not address concerns about the potential long-term effects of the vaccine on pregnant women and their foetuses, as there is limited data available on this population. Nevertheless, vaccines manufactured by Pfizer seem safe for use in pregnant women at all stages of pregnancy. However, pregnant women should first consult with their obstetricians and gynaecologists (O&G) to ensure that receiving an injection of the COVID-19 vaccine is safe for them to do so before moving forward.

In the meantime, a study that compared a Pfizer vaccine to a placebo in adolescents aged 12 to 15 years old found that the vaccine had a favorable safety and adverse effect profile [27]. The vaccine was associated with predominantly transient mild-to-moderate effects, primarily injection-site pain, fatigue, and headache, which typically subsided within one or two days after receiving the vaccine. There were no serious adverse

events linked to the vaccine, and there were relatively few severe adverse events overall. Overall, the vaccine appears to be safe and well-tolerated by most individuals. It is important to continue monitoring for any potential side effects as more people receive the vaccine, but early indications are positive and suggest that this vaccine will be an important tool in the fight against COVID-19.

Viral vector vaccine

When compared to recipients of the mRNA vaccine, those who received the Johnson & Johnson vaccine (J&J) exhibited a different result, one in which the occurrence of systemic adverse effects was more common than local adverse effects (Fig. 2). Following the vaccination, recipients experienced fatigue at a rate ranging from 27.4% to 59.1%, pain at the injection site (9.2-57.9%), headache (41.7-52.2%), and muscle aches (11.1-47.1%). A review of the Vaccine Adverse Events Reporting System (VAERS), which is a passive surveillance system, discovered that 97% of the adverse effects reported for this vaccine were classified as non-serious events [68]. However, there were reports of 17 events that were consistent with the newly defined condition of thrombosis with thrombocytopenia syndrome. This included three reports of non-cerebral venous sinus thrombosis (CVST) thrombotic events with thrombocytopenia among women aged more than 60 years. It was approved for use in an emergency, but only with the warning that it may cause rare clotting events with low platelets. These events primarily affect women between the ages of 18 and 49.

On the other hand, the adverse effect that occurred most frequently with the Sputnik V vaccine was pain at the injection site. The effectiveness of the Sputnik V vaccine against COVID-19 was reported to be 91.6%; however, the vaccine may be less effective in elderly or immunocompromised patients. In addition, the vaccine should not be administered during pregnancy and breastfeeding, to individuals with a history of severe allergic reactions or any acute illness, and it is not licensed for individuals under the age of 18 [69].

In contrast to the other two viral vector vaccines, more than 90% of recipients of vaccines manufactured by AstraZeneca experienced pain at the injection site (91%), and feeling fatigued (92%). In addition, the prevalence of local adverse effects was found to be higher in individuals who were younger as compared to individuals who were older [40]. Particularly effective against the Delta variant of COVID-19, the AstraZeneca vaccine has been demonstrated to be very useful in reducing the risk of severe illness and hospitalisation due to COVID-19. After a second dose, those patients who had a dosing interval of 12 weeks or longer saw their effectiveness increase to 82.4% [70]. Because it can be kept for a longer period of time and transported with less difficulty than some of the other vaccines, it is an extremely helpful tool in the fight against the pandemic. Studies have shown that the benefits of vaccination significantly outweigh the risks, despite the fact that there have been a few isolated cases of blood clots that have been linked to the vaccine [71].

Inactivated vaccine

The majority of the inactivated vaccine's adverse effects were recorded at a rate that was lower than 60%, which indicates a low prevalence of adverse effects (Fig. 3). Pain at the injection site is the most common and persistent adverse effect of the Covaxin vaccines, which are responsible for the highest incidence of local adverse effects. On the other hand, the Sinovac vaccine was associated most frequently with pain at the injection site as well as muscle aches. All adverse effects that were reported for Sinopharm fell below the 50% threshold. It is important to note that there have been fewer than five studies conducted on inactivated vaccines, which indicates a lack of knowledge regarding these vaccines. The lack of information on inactivated vaccines raises concerns about their safety and efficacy compared to the more widely studied vaccines. However, it is important to note that inactivated

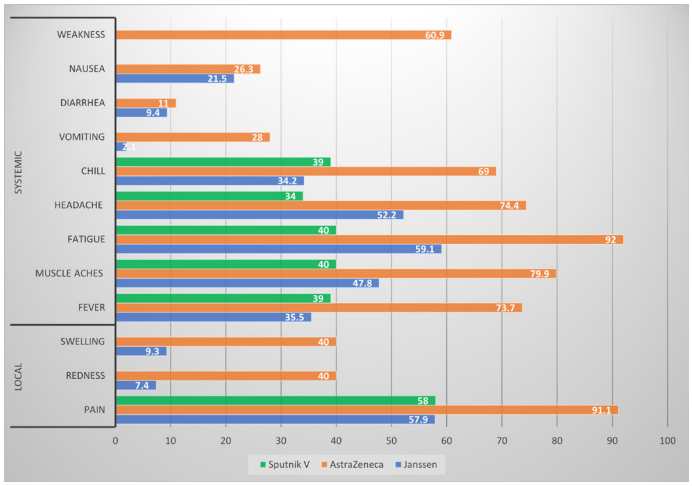

Fig. 2 : Viral vector vaccines adverse effects.

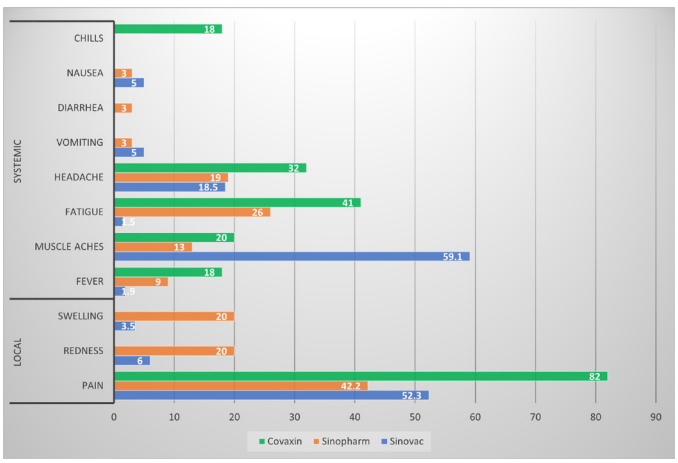

Fig. 3 : Inactivated vaccines adverse effects.

vaccines have been used for decades and have a proven track record of safety and effectiveness [72]. In fact, inactivated vaccines have been used to successfully control and eradicate many infectious diseases, including polio and influenza. While there may be less data available on these vaccines compared to other types of vaccines, the existing research suggests that they are a viable option for preventing disease. It is also worth considering that inactivated vaccines may have advantages over other types of vaccines, such as longer-lasting immunity and fewer side effects. Ultimately, the decision to use an inactivated vaccine should be based on a careful evaluation of the risks and benefits, taking into account factors such as the prevalence of the disease, the age and health status of the individual being vaccinated, and any potential contraindications or allergies.

Vaccine hesitancy

Willing to accept the COVID-19 vaccine refers to those individuals who are willing to immediately take the vaccine once it becomes available [50], while unwilling or hesitant to accept COVID-19 vaccines refers to the opposite. Meanwhile, respondents who have already received COVID-19 vaccines are those who have received the first, second, or booster doses of COVID-19 vaccines [45]. Those in the uncertain category refer to respondents who are not sure whether they would want to receive the vaccine or not.

Most of the studies showed that the percentage of respondents who were willing to get vaccinated and who had received vaccines outweighed the percentage of respondents who hesitated and were unwilling to receive the vaccine. Up to 95%, ranging from 13.2 to 94.8%, of respondents were willing to get vaccinated. Despite the highest percentage of willingness to get vaccinated, the percentage of respondents who hesitated to get vaccinated (8.0–55.5%) and were uncertain of getting vaccinated (6.0–60.0%) is quite concerning. It is important to understand the reasons behind the reluctance to receive the vaccine. Addressing these concerns through education and outreach efforts may help increase vaccination rates and ultimately lead to a safer and healthier population. It is also crucial to recognise that vaccine hesitancy is not limited to a single demographic or geographic region but rather a global issue that requires a multifaceted approach. Encouraging open dialogue and providing accurate information can help combat vaccine hesitancy and promote widespread vaccination.

The fear of adverse effects following vaccination with COVID-19 vaccines is the leading cause of hesitation (Fig. 4). This concern is very valid, as evidenced by the testimonies of family, friends, and neighbours. This circumstance leads to misunderstanding, fear, and refusal of the COVID-19 vaccine. Therefore, medical practitioners and the government should increase their

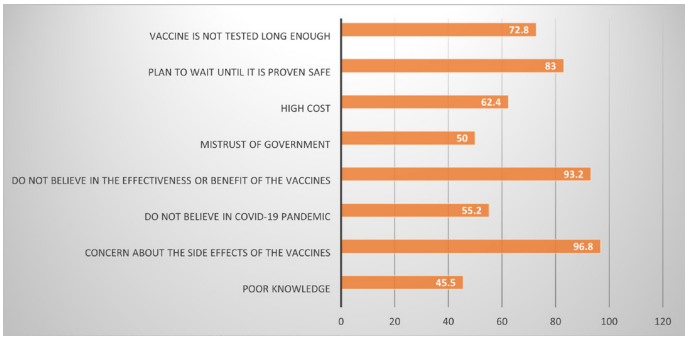

Fig. 4 : Reasons for vaccine hesitancy.

efforts to explain and assist the public in comprehending how the COVID-19 vaccine works and why it causes adverse reactions. The concern is reasonable, as normally it takes 10–15 years to develop a new vaccine, in contrast to the COVID-19 vaccine, which was developed in less than 2 years. It is crucial to emphasise that the vaccine is safe and effective at preventing COVID-19-caused severe illness and death. The benefits of the vaccine outweigh the risks of adverse effects, which are typically mild and transient. Additionally, medical professionals should dispel common myths about the vaccine, such as its ability to alter DNA or cause infertility. In order to build confidence in the vaccine's safety and efficacy, it is also crucial to make information about its development, testing, and approval process easily accessible and accurate.

Apart from the fear of side effects, the other top reasons for COVID-19 vaccine reluctance was a lack of confidence in the effectiveness and utility of COVID-19 vaccines (up to 93.2%) and respondents' preference for a "wait and see" approach (up to 83.0%). In addition, up to 72.8% of the public believes that the vaccines have not been adequately tested, and that more research and clinical trials should be conducted before they are administered to the population. Lack of confidence in vaccines is a significant concern, as it can result in low vaccination rates and prolong the pandemic. Social media play a significant role in the dissemination of false information that generates negative attitudes towards the COVID-19 vaccine [60]. To increase the positive perception of COVID-19, the government should take action against those who spread misinformation, particularly anti-vaccination activists, and be transparent when delivering the most recent information on the virus. All of these concerns were also partially attributable to a lack of knowledge regarding COVID-19 vaccines. According to a study by Saied et al., those who refused vaccination had limited knowledge of the COVID-19 vaccine [64]. This emphasises the need to educate the public on the safety and effectiveness of vaccines. Healthcare providers, public health officials, and community leaders must collaborate to engage individuals who may be hesitant or sceptical about vaccines in order to increase their trust in vaccinations. Ultimately,

increasing vaccination rates is essential for ending the pandemic and restoring normalcy.

Interestingly, the cost of the vaccine (4.0–62.4%) was cited as one of the reasons for vaccine hesitancy. Vaccines are given free of charge, and this misinformation leads to further confusion and distrust among the public. It is important to educate individuals on the availability and accessibility of vaccines as well as the potential benefits they offer in preventing serious illness and death. One of the studies quoted reported that no access to a vehicle and disabilities are positive predictors of vaccine hesitancy [45]. Efforts to increase vaccine uptake should also prioritise reaching underserved communities, which may face additional barriers to accessing healthcare. This includes providing language and culturally appropriate information, as well as offering vaccines at convenient locations and times. Ultimately, a comprehensive approach that addresses both individual concerns and systemic barriers is necessary to achieve high levels of vaccine uptake and end the pandemic. The self-reported adverse effects in the reviewed studies may lack validity, as there is no medical practitioner confirmation that the respondents experienced adverse effects after receiving the COVID-19 vaccine. There is a high likelihood of recall bias, and the subjects may have reported false adverse effects. In addition, since self-reported adverse effects are the focus of this study, over- or under-reporting may have occurred. In addition, the majority of studies do not examine the patient's medical history, so non-AEFI of COVID-19 may be reported as AEFI. Furthermore, the majority of studies recruited participants through convenience sampling. People who do not use social media are very unlikely to be aware of the questionnaire. Consequently, the results may not be representative of the entire population. In addition, the majority of questionnaires evaluate only short-term adverse effects; long-term adverse effects are not assessed. In addition, studies on the adverse effects of certain COVID-19 vaccines, including those manufactured by Johnson & Johnson, Sputnik V, CoronaVac, Sinopharm, and Covaxin, are scarce.

CONCLUSION

In conclusion, the main adverse effects of COVID-19 vaccines are pain, fatigue, and muscle aches. Concern over potential side effects and a lack of faith in the vaccine's efficacy were the leading causes of vaccine reluctance among respondents. Vaccines have been demonstrated to significantly reduce the spread of COVID-19 and lessen the severity of symptoms in those who contract the virus. The government should prioritise education and outreach initiatives to dispel myths about vaccines and increase public confidence in their safety and effectiveness. When making decisions regarding their own health and wellbeing, it is also essential for individuals to consult with healthcare professionals and trustworthy sources. In addition, addressing the public's concerns and fears through open communication and transparency can aid in reducing vaccine reluctance. This can be accomplished by communicating clearly and concisely about the safety and efficacy of the vaccine, as well as any potential side effects. It is also crucial for governments to ensure equitable access to vaccines, especially for marginalised communities that may face obstacles in gaining access to healthcare services. Building trust in the healthcare system through effective communication and community engagement can go a long way towards increasing vaccination rates.

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