



Vaccine Hesitancy: In the Age of the COVID-19 Pandemic

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

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ABSTRACT

Vaccines are one of the most significant innovations of modern science. Worldwide, millions of lives are saved each year by the vaccine. Vaccine hesitancy, which represents the refusal to receive vaccines when vaccination services are available and reachable, is a major obstacle to global health. While vaccine hesitancy has been present for many years, its damaging effects are likely to be more evident during the COVID-19 pandemic than ever before. This study aimed to find out common causes of vaccine hesitancy, assess COVID-19 vaccination acceptance rates worldwide, and present the approaches by which vaccine hesitancy rate can be reduced. This study revealed though vaccine hesitancy is a worldwide phenomenon, the causes differ from country to country or reign. More studies are needed to address COVID-19 vaccine hesitancy, especially in the Middle and South America, the Middle East and North Africa, Central Asia, Sub-Saharan Africa, Eastern Europe. The leading causes of COVID-19 vaccine hesitancy are found lack of confidence towards

the government or pharmaceutical companies, less concern about the outcome of SARS-CoV-2 infection, and shortage of supply of different types of COVID-19 vaccines. Healthcare personnel and social media play an essential role in addressing vaccine hesitancy. Convincing the general population about the safety and effectiveness of COVID-19 vaccines, the consequence of being unvaccinated, and the delivery of free vaccines in an easily accessible way can reduce vaccine hesitancy rate.

Keywords: Vaccine, social media; information science; immunization program; national vaccination campaign.

1. INTRODUCTION

Vaccinations are essential public health tools for reducing the spread and damage caused by infectious diseases. Diseases like smallpox, polio, yellow fever, and others caused millions of deaths and debility in many parts of the world. Due to effective vaccination, the world is that now almost free of these diseases. Vaccines saved at least 10 million lives worldwide between 2010–2015 [1]. If there is optimal and impartial uptake of COVID-19 vaccines worldwide, vaccines could have a similar effect on the coronavirus disease 2019 (COVID-19). Though significant evidence shows vaccines are safe, there are increasing suspicions toward vaccination. Vaccine hesitancy has reduced vaccine uptake, which increases the prevalence of vaccine-preventable diseases [2].

Researchers around the globe succeed in developing effective coronavirus disease 2019 (COVID-19) vaccines in record time due to extensive research and development works, combined with recent technological improvements. A safe and effective COVID-19 vaccine can only be a game-changer if acceptance is high enough to stop the spread of the virus. At least 75 to 90% of the population needs to be vaccinated to achieve herd immunity by a vaccine that is 80% efficient depending on primary reproduction number R^0 , duration of vaccine-derived immunity, and whether vaccines prevent transmission [3]. Ongoing vaccination rates are far from achieving this target. As of September 23, 2021, more than 6.03 billion vaccine doses have been administered worldwide [4]. In Bangladesh, 23,509,860 doses are given first, and 15,608,155 doses are given second doses [5]. A significant portion of the global population is still reluctant to get vaccinated [6]. Thus, despite recent advances in some countries, the vaccination rate remains less than the percentage required for herd immunity in most countries [7]. Besides, COVID-19 is an RNA virus with a high potential for

mutation, which can also obscure the path to herd immunity [8].

2. DEFINITION

Vaccine hesitancy can be defined as the delay in receiving, unwillingness, or denial of vaccination despite the availability of vaccination services [9]. In 2019, the World Health Organization (WHO) mentioned it as one of the top 10 threats to global health [10]. Vaccine-hesitant people are a diverse group suffering from varying degrees of indecision about specific vaccines or vaccination in general. They may receive all vaccines but remain worried; some may refuse or delay some vaccines but accept others; others may refuse all vaccines [11].

2.1 Aspects of Vaccine Hesitancy

There are three main aspects of vaccine hesitancy: confidence, complacency, and convenience (Fig 1). Confidence is the faith in the effectiveness and safety of vaccines, the vaccine delivery system, the capability of healthcare professionals, and the intentions of the vaccine policymakers [13]. Honest opinion about the safety and side effects of vaccines has an impact on confidence. They grow faith in the provider, which has a positive result on vaccine adherence [13]. The health care workers should deliver the updated information on a vaccine with an authentic source, which can help people who struggle with confidence. Complacency is the knowledge that risks of vaccine-preventable diseases are low, and vaccines are not needed to prevent that disease [13]. Facts about acute and chronic complications of vaccine-preventable diseases and personal circumstantial evidence are proper measures for fighting complacency. Convenience is the magnitude to which vaccines are available, affordable, accessible, understood (language and health literacy), and engaging [13]. This issue can be solved by offering free vaccine services at every vaccine center where

people can attend without transportation. The most common causes for Opposing COVID-19 Vaccination are described below (Table 1).

2.2 Regional Variation of Vaccine Hesitancy

Several studies revealed regional variability of vaccine hesitancy in observing the safety and effectiveness of vaccination before the COVID-19 pandemic [15-17]. The people of high-income countries were less sure regarding vaccine safety. In Northern America and Northern Europe, 72%–73% of people believed that vaccines are safe. In Western Europe (59%) and Eastern Europe (50%), this rate was even less, despite the presence of significant variability in countries of Eastern Europe (from 32% in Ukraine, 48% in Russia, to 77% in Slovakia). Though, permanent denial of all vaccines is rare in high-income countries, which is not more than 1 or 2% of the population. Studies show many people refuse a vaccine initially, but they eventually change their minds [18]. Studies have shown that the majority of people in low-income countries believe that vaccines are safe. This tendency is observed highest in South Asia (95%) and Eastern Africa (92%) [16].

The scenario is almost identical in the case of COVID-19 vaccines. Significant variability in COVID-19 vaccine acceptance is found around the world. The overall acceptance rates among the general people are comparatively high in East and South East Asia. In Bangladesh, the vaccine acceptance rate is 74.6% [19]. More

than 90% acceptance is revealed in Indonesia [20], Malaysia [14] and China [21]. A study reported a 79.8% vaccine acceptance rate in South Korea [22]. Australian people showed an acceptance rate of 75.8% in an online survey [23]. Singapore (67.9%) has the lowest COVID-19 vaccine acceptance rate among the general people in this region, which is 67.9% [22]. India has a vaccine acceptance rate of 74.5% [22]. In Latin America, vaccine acceptance rates were found relatively high. More than 70% acceptance rates are reported in Brazil, Ecuador, and Mexico [24]. The results are primarily inconstant in Europe. The vaccine acceptance rates are 53.7% in Italy and 58.9% in France [25]. In Malta, healthcare workers and students have a COVID-19 vaccine acceptance rate of 52.0% and 44.2%, respectively [26]. Denmark and Poland have 80.0% and 56.3% vaccine acceptance rates, respectively. The vaccine acceptance rate among the general public in Russia is only 54.9% [22]. The Middle East countries showed the lowest rate of vaccine acceptance among all regions globally. Kuwait (23.6%) has got the lowest vaccine acceptance rate, followed by Jordan (28.4%), Saudi Arabia (64.7%), and Turkey (66.0%)[27-29]. A study reported that Israel (75.0%) has the highest vaccine acceptance rate in this part of the world [30]. South Africa and Nigeria said 81.6% and 65.2% vaccine acceptance rates in the African region, respectively [22]. Evaluating such regional differences can be valuable in adopting and combating public health risks posed by vaccine hesitancy [31].

Vaccine Hesitancy

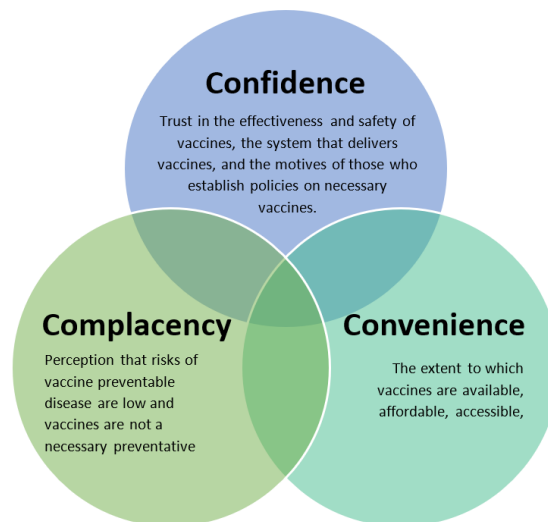


Fig. 1. Three main aspects of vaccine hesitancy [12]

Table 1. Most common causes for opposing COVID-19 vaccination [14]

<p>Personal situation</p> <p>I don't feel concerned because of age or health condition. It is a useless vaccine; COVID-19 is not very dangerous. Because of my physical condition, my health does not allow vaccination. I have been tested negative; I'm not sick; I have been ill and am immunized.</p>
<p>Effectiveness</p> <p>Lack of knowledge, I prefer to wait longer and study it over the long term to see if it is effective and safe. I prefer to treat myself in other ways. There are different treatments (hydroxychloroquine). Social distancing and other behavioural measures are sufficient. I am careful. I prefer to develop my immunity. Because of the possibility of a mutation of the virus (so the vaccine would be less effective or ineffective at all).</p>
<p>Lack of trust</p> <p>Because a vaccine developed in an emergency is potentially dangerous, side effects are unknown, and people can get sick. Because of my distrust of the pharmaceutical industry/medical profession, the laboratories are in a logic of profitability. Because there is a lack of information, divergent opinions, no scientific consensus. Because there are secret relationships between the government and the pharmaceutical industry (opinions/conspiracy theories). Because of the poor management of vaccines and masks by the government (Negative opinions/comments regarding the government and its control of the epidemic).</p>
<p>Antivax</p> <p>I am against vaccination (in general). I don't get vaccinated. Because vaccines are (possibly) harmful for health.</p>

Changes in COVID-19 vaccine acceptance rates were observed in some countries over time. In France, the vaccine acceptance rate was 62.0% to 77.1% in March and 58.9% in June. In China, the vaccine acceptance rate was 91.3% in March, 83.5% in May, and 88.6% in June. In the US, it was 56.9% in April, 67.0% to 75.0% in May, and 75.4% in June. The vaccine acceptance rate of Italy was 77.3% in April, 70.8% in June, and 53.7% in September. In the UK, it was 79.0% in April, 83.0% in May, 71.5% in June, 64.0% in July, and 71.7% in September [32].

The variable rates of vaccine hesitancy across countries or regions are complicated and depend on the differences in religious views, demographics, and context-specific factors. In lower-middle-income countries or areas, the leading causes of vaccine hesitancy are cost, inequalities in access, and awareness of vaccines [113]. On the other hand, concerns related to the safety of vaccines are the leading cause of vaccine hesitancy in higher-income countries [33]. People are hesitant to take the COVID-19 vaccine because of newer technology and long-term safety concerns.

2.3 Vaccine Hesitancy among Healthcare Workers

In general, healthcare workers have a higher vaccine acceptance rate, but inconsistent results came up in some studies. In the earlier stage of the pandemic, up to one-third of HCWs were found as vaccine-hesitant [34] [35]. Some studies found no difference between healthcare workers and the general population [30], [36]. A study revealed that some healthcare workers even stand against vaccination in general [37]. Nurses in Hong Kong had only 40.0% and 63.0% vaccine acceptance rates at the beginning of the COVID-19 pandemic, two studies dated back to the early part of the pandemic [38]. A study found only a 27.7% vaccine acceptance rate among the healthcare workers in Congo [39]. Over time the vaccine acceptance rate has increased around the globe among healthcare workers.

2.4 Vaccine Hesitancy and Social Media

Social media allow the rapid spread of rumors and myths regarding vaccination, thus increasing vaccine hesitancy. People's decision to receive, delay or refuse vaccination can be influenced by the Internet, which may increase the incidence of

vaccine-preventable diseases among unvaccinated people [40]. The Internet has become the primary source of vaccine-related content. Integration of an online information monitoring system is vital in addressing vaccine hesitancy [41]. In the last decade, social media have become an essential tool for opinion research. Different social media sites allow people from other countries to participate in public discussions about vaccination in real-time. Public health professionals Healthcare workers can play an active role in these discussions. Therefore, social media is a platform for real-time surveillance of vaccine-hesitancy and an effective communication tool for global health performers [42].

2.5 Approaches to Reduce Vaccine Hesitancy

2.5.1 National vaccination campaign

Earlier studies found that a mass media campaign is an efficient approach to decrease vaccine hesitancy. The motivation should be noble, focusing on the hazards of the disease, the safety of the vaccine, and the possible outcome of remaining unvaccinated. While mass media campaigns have the advantage of reaching most of the population, their effects remain uncertain [14]. Public messages are more acceptable when they are delivered by a trusted source like a healthcare worker. One study revealed that the acceptance of the human papillomavirus vaccine went from 2 to 38% among boys when their parents had received a recommendation by a medical person (44). According to another study, the influenza type H1N1 vaccine acceptance rate was increased 55% to 75% when the people were questioned by an expert [43]. In a recent study, a chatbot programmed to address disagreements against the COVID-19 vaccine had proved effective in shifting vaccination mindsets and behavioral objectives [44].

2.5.2 Nationwide vaccination program

The vaccine should be offered to the people vaccine free of cost without the requirement of any prescription. The vaccine should be easily accessible. Vaccine centers should be placed all over the country equally. The registration process for vaccination should be free and easy. The registered person should be notified by SMS. Studies have revealed that the vaccination

rate was higher among the prescheduled people for a flu vaccine appointment[45]. There should be an onsite registration facility in every vaccine center. On-the-spot vaccination has also been proven as a very effective tool to boost the vaccination rate. It found that continuous reminders from the healthcare workers to the general population in different formats like SMS, email, postcards about the vaccination date increase the vaccination rate [46]. This approach is crucial in the case of the COVID-19 vaccination. More attention should be given to the high-risk population living in rural areas and having lower socioeconomic conditions. Local healthcare and social workers can play a vital role here.

2.5.3 Utilization of social standards

Vaccinated people can change the mindset of vaccine hesitate ones. Wearing a badge or using a profile picture on Facebook that wrote, "I'm vaccinated against COVID-19," can make a difference. In an earlier hospital-based study, the vaccination rate was increased when the healthcare workers wore a badge reading, 'I am vaccinated against influenza to protect you' [47]. A study in the Netherlands revealed similar results [48]. These examples prove, when positive decisions are made visible, they influence others to take their own decisions. It's crucial to understand the social standard of a community to change their behavior. The contents of the national vaccination campaign should be selected according to the social norm of that particular reign. The healthcare providers should deliver public messages which match the intellectual level of people of that area. Improvement of communication skills is needed for both healthcare providers and the general population.

3. CONCLUSION

To combat the extensive prevalence of COVID-19 vaccine hesitancy, governments, health policymakers, and media sources need combined efforts, including different types of social media authorities. Timely and clear messages through trusted sources should be delivered to build COVID-19 vaccination trust among the mass people. They should be educated about the safety and efficacy of currently available COVID-19 vaccines. COVID-19 vaccines should be presented to the general population free of cost and in an easily accessible way.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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