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Review Article

Major Drivers for COVID-19 Vaccine Acceptance: A Scoping Review

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Abstract

Objective: To review and identify the major drivers for COVID-19 vaccine acceptance. ***Methods***: A scoping review of studies of COVID-19 vaccine perceptions and barriers to using the COVID-19 vaccines. Two search engines, including PubMed and Google Scholar, were purposefully searched. ***Results***: Eight studies from different countries were reviewed to categorize factors influencing people's acceptance of COVID-19 according to the Health Belief Model (HBM). Perceived susceptibility, and severity of the disease (COVID-19), in addition to perceived benefits of COVID-19 vaccination and "cues to action", can enhance vaccination acceptance. In contrast, perceived barriers to the COVID-19 vaccine can increase people's hesitancy to be vaccinated. ***Conclusions***: The HBM domains are successful in the prediction of human behaviors toward preventive measures, including vaccination. In general, high perceived susceptibility, severity, and benefits and minimum barriers should always be maintained to keep the vaccination rate high. Reducing the hesitancy to get the vaccine can be achieved by increasing awareness campaigns about the vaccine's efficacy in preventing infection.

Keywords: Acceptance to use vaccines, COVID-19, Health belief model, Vaccine.

الدوافع الرئيسية لقبول لقاح مرض فيروس كورونا-19 (COVID-19) : مقال مراجعة

الخلاصة

الهدف: مراجعة وتحديد الدوافع الرئيسية لقبول لقاح كوفيد-19. **الطرق**: مراجعة نطاق لدراسات تصورات لقاح كوفيد-19، والعوائق التي تحول دون أخذ لقاح كوفيد-19. تم البحث في محركي بحث بما في ذلك PubMed و Google Scholar بطريقة غير منهجية. **النتائج**: تمت مراجعة ثماني دراسات من بلدان مختلفة لتصنيف العوامل التي تؤثر على قبول الأشخاص للقاح كوفيد-19 وفقًا لنموذج المعتقدات الصحية HBM. قبول التطعيم يعتمد على مدى الاعتقاد باحتمالية للاصابة وشدة المرض (COVID-19) بالإضافة إلى الفوائد المتصورة للقاح كوفيد-19 و الاشارات التي تدعو الى اخذ اللقاح . في المقابل ، يمكن للعوائق المتصورة أمام لقاحات كوفيد-19 أن تزيد من تردد الناس في تلقي التطعيم. **الاستنتاجات**: نجح نموذج المعتقدات الصحية HBM في التنبؤ بالسلوكيات البشرية تجاه التدابير الوقائية، بما في ذلك التطعيم. بشكل عام، يجب دائمًا الحفاظ على القابلية العالية باحتمالية الاصابة بالمرض وشدة المرض والفوائد من اخذ اللقاح والحد الأدنى من الحواجز لاخذ اللقاح للحفاظ على معدل التطعيم مرتفعًا. يمكن الحد من التردد في الحصول على اللقاح من خلال زيادة حملات التوعية حول فعالية اللقاح في الوقاية من العدوى.

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INTRODUCTION

Coronavirus disease 2019 (COVID-19) represents one of the fastest outbreaks of viral infection in recent history. The rapid spread and infectious rate caused the World Health Organization (WHO) to declare the disease a worldwide pandemic after less than three months from the first case diagnosis in Wuhan, China, in December 2019 [1,2]. Approximately 3.5 million people were killed due to the pandemic, with multiple pathophysiological effects of the virus inside the human body [3]. Economic stagnation and social activity limitations and the application of preventive measures such as face mask-wearing, sensitizing procedures, and travel restrictions were not enough to stop the spread of the pandemic [1]. To date, data from the WHO's COVID-19 situation reports shows that COVID-19 cases are increasing, with virulent mutations being registered in some countries [4]. The best way to control an infectious disease outbreak and reopen societies worldwide on a more permanent basis is through vaccination. As a result, various institutions, funded by multiple governments and pharmaceutical companies, were racing against time to produce a COVID-19 vaccine [2]. Currently, some vaccines have been granted emergency use authorization by the Food and Drug Administration (FDA) and the European Medicines Agency (EMA), while more than 150 COVID-19 vaccine candidates are still under development or in clinical trials [1]. Although some information on the safety and effectiveness of the vaccines is available, large populations are still in doubt with their low intention of taking the vaccines [2,3]. This hesitancy is not limited to specific countries; it exists worldwide. For example, in the middle of 2020, the acceptance rate of the COVID-19 vaccine in both Russia and France was less than 60% [3]. In China, serious adverse effects of some vaccines have been attributed to a disruption in the immunization program over recent decades [5]. Herd immunity may present a significant challenge as it is required that most of the population receive the vaccine to build herd immunity. The introduction of a new vaccine can be associated with different barriers that prevent people from getting vaccinated. Therefore, it is critical to understand the insights and stimulations of the population toward the candidate COVID-19 vaccines. Information about the main reasons people don't want to get the COVID-19 vaccines and how willing they are to get them shows how important it is to have successful vaccination programs in different countries, cultures, and religions [2-4]. Humans have three basic tendencies when it comes to disease or health problems. A healthy or asymptomatic person's response to facing or preventing a severe disease is referred to as health behavior. The action conducted by a person who suffers from sick symptoms and attempts to find a possible treatment for their condition is referred to as unwell behavior. Finally, sick-role conduct is the reaction of persons who believe they are ill and wish to get better [6]. Health behavior theories have been designed to study the psychosocial predictors of vaccine behavior. The Health Belief Model (HBM) is considered one of the most particular theoretical tools for understanding health behaviors. The HBM has five primary constructs: perceived susceptibility, perceived severity, perceived benefits, perceived barriers, and cues to action, which can influence the acceptance of COVID-19 vaccine behavior [6]. The major domains of the HBM were used to look at the path that vaccination takes to get herd immunity and get rid of the main things that keep people from getting vaccinated. Perceived susceptibility means the subjective risks of contracting a condition or beliefs regarding vulnerability to infection (what is the likelihood of getting the COVID-19 virus in the upcoming future?), while perceived severity refers to patients' understanding of illness complications or personal belief in this question (if the COVID-19 has serious complications or not?). Perceived benefits are defined as an individual's reliance on being vaccinated and beliefs about the various alternatives to be taken to reduce the disease threat in general. Perceived barriers are described as obstacles to taking the vaccine for different reasons (do you have any concern about the safety and possible adverse effects of COVID-19 vaccines due to the rush and rapid developmental process?). Cues to action include information, people, and events that urge an individual to be vaccinated. For example, a person becomes more confident in

being vaccinated when friends and other family members take it [2,3,6]. Additional HBM studies were conducted to predict the behavior of vaccine acceptance after receiving emergency authorization. All conducting results came with various barriers to taking the vaccine and flatulated depending on many respondents' variable factors, such as age, job position, education level, race, and religion [2,3,6]. The goal of this review article is to explain and address the important HBM constructs that help people accept the COVID-19 vaccine and lessen their hesitance about taking it.

METHODS

Two search engines, including PubMed and Google scholar, were purposefully (non-systematically) searched using keywords such as vaccine hesitancy and barriers to taking the COVID-19 vaccine. We extracted COVID-19 perception articles that utilized the HBM domains in their studies. The review included studies from different countries and a wide range of demographic characteristics, including age, gender, occupational jobs, place of living and education levels. Generally, each study represented a country, except for one article containing global collected studies from 19 countries about the acceptance rate of COVID-19 vaccines. In these articles, nationwide and multi-country self-administered online surveys were conducted during 2020 and 2021 to assess the public's intentions to take the COVID-19 vaccine in the countries of the United States, Middle East, South Asia, India, Africa, Russia, and China [1-4,7-10].

RESULTS AND DISCUSSION

Eight studies from different countries (USA, Russia, China, Iraq, Zimbabwe, and multiple countries studies) were reviewed to categorize factors influencing people's acceptance of COVID-19 according to the HBM.

Perceived Susceptibility

One of the critical factors to taking the correct action is understanding the current disease and being aware of the risk of infection and the distress degree associated with getting sick [6]. Perceived disease susceptibility and severity can urge people to take preventive measures, including vaccination (Figure 1).

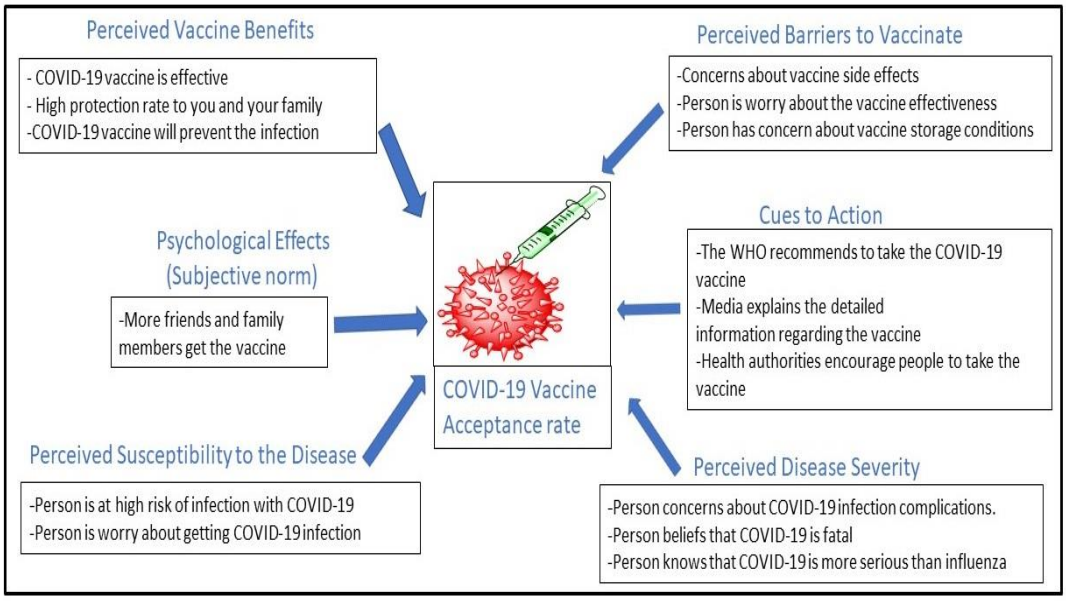

Figure 1: HBM Domains Role to Increase the Acceptance Rate of COVID-19 Vaccine. Adapted with modifications [3].

Three-quarters (73.8%) reported being at high risk of infection with COVID-19, and 61.9% reported concerns about the disease in Iraq [3]. Concerned about becoming infected, the level of concern increased (85.4%). Another Iraqi survey found that 86% of healthcare providers (HCPs) believe their family is at high risk of COVID-19 infection due to their job [11]. On the other hand, 59.3% of Malaysian respondents believe they have a great chance of getting COVID-19 in the next few months [2]. In contrast, in China, the participants had low perceptions of susceptibility. The majority contradicted that there was a great chance of getting COVID-19 in the next few months (68.7%), and they were also not worried about the possibility of getting COVID-19 (56.8%). This low level in perception susceptibility can be attributed to the time when the survey was conducted in China. During May 2020, the daily case curve was flattened, and China's government announced that the disease is under control [4]. Similarly, less than 25% of Russian participants were believed to be at a higher risk of getting infected [7]. More than half of Indian respondents were worried about getting the virus, with 83% of them related to their job nature and daily communication with people [8]. According to some studies, perceived susceptibility among Americans was low (56.19%) of public Americans believed COVID-19 had no impact on the lives of their families or close friends [9]. The urban people of Zimbabwe have a higher attitude toward taking the herbs as preventive measures than taking the vaccine. At the same time, rural areas consider themselves at less risk of getting the disease [10]. Individuals differ widely in adopting personal susceptibility to a condition and can be divided into three types. First, a person may manifest a feeling that he is in real danger of contracting the disease. This type of person represents the crucial requirements for vaccine acceptance. Second, the person may confess to the "statistical" chance of its occurrence but does not believe it will happen to him. Finally, the individual who refuses to accept the possibility of contracting a given condition has the lowest acceptance level for any prophylactic [6]. Intention to get vaccinated can be increased by focusing on the three factors that lead to increased risk perception and facilitate the control of pandemic outbreaks, including a firm belief in an increased risk of infection in the future and feeling worried about the disease in daily communication with others. It has been emphasized that using social media and innovative phone applications is critical to achieving positive behavioral changes [12].

Perceived Severity

COVID-19 is characterized by severe consequences that affect multiple organs, such as the lungs and kidneys. The disease severity was increased after the appearance of variant species with a highly infectious and fatal rate. The perceived severity of the disease is critical for taking preventative measures. Understanding the differences between COVID-19 and influenza infection, fatality rate, and risk factors such as age and coexisting diseases is a significant driver of increasing awareness of COVID-19 vaccine necessity [3,6]. Iraqi people who took part in the HBM survey thought COVID-19 infection could be fatal, and 87.5% thought it was more severe than influenza [3]. In a Malaysian study, 95.5% and 90.5% of the population are afraid of COVID-19 disease and will suffer from its serious effects, respectively [2]. In China, the participants had high perceptions of the severity of COVID-19; 86.6% admitted that the complications of COVID-19 are fatal, and the vast majority (84.3%) were afraid of getting COVID-19 [4]. The Zimbabwean general population recorded high disease awareness, especially among the recovered patients and those who lost close family members to COVID-19 infection [10]. In contrast, low perceived severity was demonstrated by Indian people during the high recovery rate period [8]. Many factors can affect the judgment concerning the seriousness of any disease, including age, education level, and health information source. Promoting awareness regarding the risk degree of the disease and how it will affect a person's life, job, and physical activities may enhance people's acceptance of

the vaccination. In Russia, young male participants were more willing to take the COVID-19 vaccine than females because they had higher prediction scores on the infection severity [7]. It will be more likely for people to want to get the COVID-19 vaccine if their perceptions of severity go up [6].

Perceived benefits of COVID-19 vaccination

Perceived susceptibility and the severity of the disease provide incentives for action, but they do not fully explain the course of action that is probably to be taken. Persons' beliefs in the effectiveness of the available vaccines in preventing the disease (COVID-19) that threatens their lives and families will determine the action direction. A person's social group's rules and pressures (subjective criteria) play a big role in how this person thinks about things (Figure 1). The potential for healthy behavior is determined by two major factors: readiness to act and likely negative perceptions. High readiness to act, accompanied by low possible negative aspects, represents the required state for every health promotion activity to be considered [6]. Perception benefits in the HBM studies of COVID-19 vaccine acceptance can be translated into two main questions: will the vaccine be effective? And will the vaccine succeed in protecting my family members and me from the infection? Two-thirds (64.5%) of Iraqi respondents thought the vaccine to be effective, and the majority expected the vaccine to protect themselves (63.4%) and their families (57.0%) from infection [3]. A higher perception of benefits was obtained from the HBM study in Malaysia. More than 94% of the respondents thought vaccination would decrease the infection severity and complications and leave them less worried about the infection [2]. In China, a high percentage (87.2%) perceived the benefit of feeling less concerned about getting COVID-19 after receiving the vaccine. The majority (92.5%) perceived the use of the COVID-19 vaccine as reducing the risk of infection and associated complications [4]. In Africa, studies conducted on general populations in Zimbabwe revealed the primary concern of people about the vaccine's safety and side effects were more remarkable than its efficacy to stop the disease spread. In contrast, other populations were intended to receive the vaccine produced in China, the virus's origin place, and we're confident in the vaccine's ability to protect them [10]. The safety of the vaccine and comprehensive information about its effectiveness are the major factors controlling people's intention to get the COVID-19 vaccine. The general rate of willingness to get the vaccine was above half of the respondents from different countries; the acceptance rate (61.7%, 94.3%, 83.5%, and 60%) of participants responded "yes" in general to the COVID-19 vaccine from Iraq, Malaysia, China, and the USA, respectively [1-4]. The vaccine acceptance rate increased from 40% to 63% among the Russian population when the survey stated that the vaccine would be proven in efficacy and safety profiles [7]. The definite intentions to take the vaccine among different HBM studies were low or not comparable to the high national and global rates of COVID-19 infection and death. The surveys in the USA, Iraq, China, and Malaysia showed the perceived benefit of the COVID-19 vaccine as a significant predictor for increasing the definite intention to take the COVID-19 vaccine [1-4]. On the other hand, the HBM study for predicting intent to get a future COVID-19 vaccine in the USA explained 66.6% of participants' intent. In contrast, the model for predicting whether people would be willing to get a COVID-19 vaccine under the EUA predicted that 35.5% of people would be willing to do so. Similarly, the potential global acceptance rate for taking the COVID-19 vaccine was conducted across 19 countries with high reported cases of COVID-19 disease before a few months of starting the vaccination in December 2020. More than 70% of those chosen at random said they would take the vaccine if it was safe and effective. Various factors were detected to affect the future vaccine in that study. Asian countries with high trust in their central governments, such as China, South Korea, and Singapore, reported a high acceptance rate. Middle-income countries such as Brazil, South Africa, and India arrived with strong

plans to use the vaccine. Well-educated and older people showed a higher tendency to get vaccinated. They may change over time and not be good predictors of vaccine acceptance, so these factors may not be the best ones [13].

Perceived barriers

In pandemics, the goal is to achieve herd immunity by vaccinating most people (70–80%). Thus, hesitancy to receive a newly approved vaccine is the biggest challenge that requires special attention. The COVID-19 vaccine, like other new vaccines, is surrounded by a slew of negative myths. According to several global surveys, the main barriers to using COVID-19 vaccines include concerns about their safety and effectiveness [1-4]. The COVID-19 vaccines were developed relatively quickly (less than a year), increasing people's worries about conducting sufficient clinical trials to show long-term adverse events [1]. More than 44% of Iraqi participants in the HBM survey were concerned about the vaccine effectiveness, while 62.6% were concerned about adverse events [3]. A higher percentage was obtained; 97.3% and 96.3% of respondents from Malaysia were worried about the vaccine efficacy and safety, respectively [2]. Concerns about safety (72.6%) and effectiveness (71.2%) were also reported by Chinese respondents [4]. In Russia, 60% of the respondents were focused on the vaccine's efficacy rather than its affordability [7]. Some COVID-19 vaccines (e.g., Pfizer-BioNTech) require an extremely low storage temperature; this can be raised as a significant barrier in countries with inadequate infrastructure and limited resources. For example, 84.7% of Iraqi participants were concerned about vaccine storage conditions [3]. A shortage of COVID-19 vaccines can be a concern in the international competition to obtain sufficient doses to achieve herd immunity [1]. The COVAX initiative (co-led by Gavi, the Coalition for Epidemic Preparedness Innovations (CEPI), UNICEF, and WHO) has been working to ensure equitable access to COVID-19 vaccines among countries. The target is to vaccinate at least 20% of the population, particularly in low-income countries [14]. Vaccine origin can be a barrier for specific regions, such as Muslims who are not permissive towards taking non-halal (pork-related) products. In Malaysia, 52.3% of respondents were concerned about whether the vaccine was halal or not [2]. Because there are so many Muslims around the world, it is likely that vaccine manufacturers will pay attention to this important point. Misconceptions about the vaccines and using unofficial media sources are other reasons to increase hesitancy about the COVID-19 vaccine. During the pandemic, social media, newspapers, and television contributed to a lot of misinformation regarding the COVID-19 vaccine. The majority (68.3%) of Iraqi participants reported reliance on these information sources [3]. A higher percentage (91.2%) was obtained from a USA survey on people using traditional media as a source of COVID-19 news [1]. Unconfirmed reports about the adverse side effects of the Sinopharm vaccine in social media contributed to increased vaccine barriers among the Zimbabwean population [10]. Willingness to pay (WTP) for the COVID-19 vaccine can be considered another reason for hesitancy to take the vaccine [1,2]. Lowering the vaccine prices or making it accessible and affordable for the public will result in a higher acceptance rate for the COVID-19 vaccine. Fear of needles, reliance on preventive measures like wearing face masks, beliefs in natural remedies, and social distancing are considered more minor contributors' barriers to getting COVID-19 vaccines [1].

Cues to action

Regarding the COVID-19 vaccine, the HMB revealed important information applicable to the urge to take the vaccine. The cue to action domain includes a trigger to increase the readiness to act by enhancing the HBM major drivers (perceived susceptibility, severity, and benefits) and reducing perceived barriers [3,6]. The definite intention to take the vaccine was highly associated with subjective norms. Many respondents were significantly more likely to vaccinate if their colleagues or friends were vaccinated first, as shown in Iraq (66%), Malaysia (74.3%), and China (82.3%)

[2-4]. Adequate vaccine information should be available through official and trusted resources. This will increase the tendency to get the COVID-19 vaccine. A large percent (81.3%) of Iraqi participants showed the readiness to accept the WHO recommendations about vaccines [3]. In Malaysia, nearly all (98%) of the respondents reported that they would only take the COVID-19 vaccine if enough information about the vaccine became available, and a very high percentage (92.1%) was reported in China [2,4]. Thus, the awareness campaign to get people to get vaccinated should focus on the drivers (perceived susceptibility, severity, and benefits) and lessen the perceived barriers. The percentage of potential vaccination rates and the current ratio of actual vaccination in different countries have been made (Table 1).

Table 1: Comparison Between The Percentage of Potential And Actual Vaccination Rate [13,15]

Country	Potential Acceptance rate (%) [13]	Actual Vaccination rate (%) [15]
China	88.62	76
Brazil	85.36	73
South Africa	81.58	23
South Korea	79.79	79
Mexico	76.25	53
USA	75.42	65
India	74.53	50
Spain	74.33	81
Ecuador	71.93	65
UK	71.48	72
Italy	70.79	77
Canada	68.74	78
Germany	68.42	68
Singapore	67.94	80
Sweden	65.23	71
Nigeria	65.22	2.4
France	58.89	75
Poland	56.31	53
Russia	54.58	35

The results are exceptionally compatible and consistent with the theoretical framework anticipated by HBM predictors. It was noticed that in some African countries, the actual vaccination rate was wholly different and much less than the potential vaccination rate; this deviation explains the negative score of HBM primary constructs such as perceived severity, benefits, and barriers. Some demographic predictors, such as gender, income, and education level, require careful attention to achieve tremendous behavioral changes and increase the vaccination rate [13,15]. The strength of this short review article is that it chooses multiple studies with diverse and large-sized samples from different countries. The main theoretical predictors of HBM were extremely helpful in guiding the suitable interventions to be made by governments and policymakers to encourage people to get the vaccine and control the pandemic. This review article reflected the positive correlation between the actual vaccination rate and the intention to take the vaccine and identified barriers to actual behavior. It includes some limitations. First, the results of selected studies conducted through online surveys due to movement restrictions that applied during the pandemic may not reflect the generalizable distribution of the participants and may have led to selection bias. Second, in most selected studies, aged adults 45–70 were underrepresented, while young adults aged 26–36 had the most participants. Third, studies conducted before the vaccine's existence were subjected to many factors that negatively affected the final responses.

CONCLUSIONS

The HBM domains are successful in the prediction of human behaviors toward preventive measures, including vaccination. In general, high perceived susceptibility, severity, and benefits and minimum barriers should always be maintained to keep the vaccination rate high. Reducing the hesitancy to get the vaccine can be achieved by increasing awareness campaigns about the vaccine's efficacy in preventing infection. This can be achieved through harmonic collaboration between national health authorities and the WHO. Targeting the crucial barriers such as an explanation of the vaccine safety profiles, minimum risk of side effects, zero out of pocket or free vaccine to the public, all these factors together can lead

to a higher acceptance rate and low hesitancy to take the COVID-19 vaccines.

Conflict of interests

No conflict of interests declared by the authors.

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Data sharing statement

The corresponding author can provide the data source in response to a reasonable request.

REFERENCES

1. Guidry JPD, Laestadius LI, Vraga EK, Miller CA, Perrin PB, Burton CW, et al. Willingness to get the COVID-19 vaccine with and without emergency use authorization. *Am J Infect Control*. 2021;49(2):137-142. doi: 10.1016/j.ajic.2020.11.018.

2. Wong LP, Alias H, Wong PF, Lee HY, AbuBakar S. The use of the health belief model to assess predictors of intent to receive the COVID-19 vaccine and willingness to pay. *Hum Vaccin Immunother*. 2020;16(9):2204-2214. doi: 10.1080/21645515.2020.1790279.

3. Al-Metwali BZ, Al-Jumaili AA, Al-Alag ZA, Sorofman B. Exploring the acceptance of COVID-19 vaccine among healthcare workers and general population using health belief model. *J Eval Clin Pract*. 2021;27(5):1112-1122. doi: 10.1111/jep.13581.

4. Lin Y, Hu Z, Zhao Q, Alias H, Danaee M, Wong LP. Understanding COVID-19 vaccine demand and hesitancy: A nationwide online survey in China. *PLoS Negl Trop Dis*. 2020;14(12):e0008961. doi: 10.1371/journal.pntd.0008961.

5. Yang R, Penders B, Horstman K. Addressing Vaccine hesitancy in China: A scoping review of Chinese scholarship. *Vaccines (Basel)*. 2019;8(1):2. doi: 10.3390/vaccines8010002.

6. Rosenstock IM. Why people use health services. *Milbank Q*. 2005;83(4):10.1111/j.1468-0009.2005.00425.x. doi: 10.1111/j.1468-0009.2005.00425.x.

7. Tran VD, Pak TV, Gribkova EI, Galkina GA, Loskutova EE, Dorofeeva VV, et al. Determinants of COVID-19 vaccine acceptance in a high infection-rate country: a cross-sectional study in Russia. *Pharm Pract (Granada)*. 2021;19(1):2276. doi: 10.18549/PharmPract.2021.1.2276.

8. Goruntla N, Chintamani SH, Bhanu P, Samyuktha S, Veerabhadrappa KV, Bhupalam P, et al. Predictors of acceptance and willingness to pay for the COVID-19 vaccine in the general public of India: A health belief model approach. *Asian Pac J Trop Med*. 2021;14:165-175. doi: 10.4103/1995-7645.312512

9. Mercadante AR, Law AV. Will they, or won't they? Examining patients' vaccine intention for flu and COVID-19 using the Health Belief Model. *Res Social Adm Pharm.* 2021;17(9):1596-1605. doi: 10.1016/j.sapharm.2020.12.012.

10. Chigevenga R. Commentary on the Zimbabwean people's response towards the anticipated COVID-19 vaccine. *J Biomed Res Environ Sci*. 2021;2(3):174-177. doi: 10.37871/jbres1206.

11. Al-Jumaili AA, Al-Fatlawi BG, Al-Jalehawi AK, Al-Hamadani FY, Alsawad OS. Impact of COVID-19 pandemic on healthcare providers: save the frontline fighters. *Int J Pharm Pract*. 2021;29(4):369-375. doi: 10.1093/ijpp/riab018.

12. Verelst F, Willem L, Beutels P. Behavioural change models for infectious disease transmission: a systematic review (2010-2015). *J R Soc Interface*. 2016;13(125):20160820. doi: 10.1098/rsif.2016.0820.

13. Lazarus JV, Ratzan SC, Palayew A, Gostin LO, Larson HJ, Rabin K, et al. A global survey of potential acceptance of a COVID-19 vaccine. *Nat Med*. 2021;27:225-228. doi: 10.1038/s41591-020-1124-9.

14. Organization, T.W.H., COVAX: Working for global equitable access to COVID-19 vaccines. 2021, WHO: https://www.who.int/initiatives/act-accelerator/covax.

15. Richie H, et al. Coronavirus (COVID-19) Vaccinations– Statistics And Research. Our World In Data, 2021. https://ourworldindata.org/covid-vaccination (accessed May 21, 2021)