



## Review Article

# The perception of people regarding Covid-19 vaccines worldwide- A systematic review

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## ABSTRACT

Vaccination is a boon to humankind. Vaccines against various infectious diseases have helped strengthen our fight against the diseases and improve the health status of people around the globe. The acceptance of the vaccines is the key to the success of the vaccination programs. The covid-19 pandemic has had a tremendous impact on the lives of people all over the world. The mass vaccination against covid-19 is a weapon to fight against the disease and return to normalcy. The review looked at the various factors for vaccine acceptance and vaccine hesitancy among the population. The common perceptions are also documented. Age, gender, marital status, trust in vaccine development, occupation, educational status, race, or region of belonging are a few factors impacting vaccine acceptance or vaccine hesitancy. The various common perceptions regarding vaccine development, efficacy and Sars-Cov2 virus also significantly impact vaccine hesitancy.

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## 1. Background

The Covid 19 pandemic has created havoc in the life of people around the globe. In December 2019, the outbreak of novel coronavirus- severe acute respiratory syndrome coronavirus2 (SARS-CoV-2)- rapidly increased the threat worldwide. In the spring of 2020, despite implementing all the preventive measures to contain the spread of the disease, the number of deaths and persons infected with the virus increased daily in all the countries. It brought life to a standstill as countries went on lockdowns to curtail the spread of the infection. The limited knowledge of the infection and the accelerated increase in the infection was a matter of concern. More than 158 Billion cases have been reported worldwide, and more than 3 billion deaths by the

virus.<sup>1</sup>

The high number of cases and deaths due to this virus became a cause of panic. Despite effective treatment, protective measures like wearing masks, avoiding physical contact, maintaining hand hygiene, and social distancing were adopted worldwide.

The only measure the world could resort to in times of crisis was the development of vaccines. Vaccination has always been a means of prevention of disease. A vaccine is a biochemical component that activates our body's immune system and provides us safety against the disease. The whole world waited for a preventive vaccine that curtails the further spread of the disease but also restores social and economic activities. Simultaneously, many institutes like Oxford, Gamaleya research institute, and pharmaceutical companies like Pfizer, Moderna, and others began the race towards the production of vaccination against the SARS-

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Cov-2 virus, as a long-term solution to control the pandemic and to ensure the protection of the vaccinated population thereby generating herd immunity within the community. More than 140 vaccine candidates were registered with the world health organization for starting trials.

The perception regarding any vaccine, acceptance of vaccines, and willingness to take vaccines among people would determine the success of the planned mass vaccination program. Similarly, the most important element to start the vaccination program and to make it a success is 'vaccine acceptance' among the population.

The belief of people differs according to their social and cultural differences. Various other factors like the normative beliefs trust in the government trust in the vaccine and its development, and past experience also have a significant role in vaccine acceptance or hesitancy. Studies examining people's perception of the polio vaccine showed the changing acceptance of the oral polio vaccine to gender, religion, exposure to negative information, and educational status.

The review of the papers on the perception, acceptance, reasons of acceptance, hesitancy, reasons of hesitancy, and willingness to take the covid-19 vaccine from different countries would give an idea about the change in the perception in people of different countries and the factors affecting the people's perception.

The summary of the findings will be helpful to the policymakers in designing policies suitable to create awareness, communicate positive information, and increase the willingness to vaccinate themselves among the common public of countries of similar socioeconomic status.

## 2. Materials and Methods

### 2.1. Search strategy

The databases like PubMed and Google Scholar were used for searching papers. All papers published on people's perception regarding the COVID-19 vaccine, acceptance to take the covid-19 vaccine, hesitancy to take the vaccine, and the reasons for acceptance or hesitancy were included in the review.

A set of keywords were listed, which reflected the papers of relevance. The words like Covid-19 vaccine AND perception, Covid-19 Vaccine and people, Covid-19 Vaccination AND acceptance were used to look at people's perception regarding the Covid-19 vaccination and the reasons behind their acceptance or hesitancy to take the vaccine.

The search was done between 25 March - 30 April 2021, and all papers published between 1<sup>st</sup> January 2020 and 30<sup>th</sup> April 2021 were included.

### 2.2. Study selection

The studies were included if they met the following characteristics: 1) Script was written in English. 2) They included primary research. 3) Quantitative study design 4) the papers included research on acceptance, hesitancy, trust, concerns, perception, and attitudes about the COVID-19 vaccine. 5) Published in peer-reviewed journals.

Studies excluded if 1) They talked about the vaccine trial, 2) They were not talking about the perception of people, 3) If the paper was about vaccine development and research 4) non-peer-reviewed and non-research papers.

Two authors screened the abstract and full text of the papers and it was analyzed. The data were cross-checked for consistency.

### 2.3. Data extraction

We found a total of 111 Papers. Out of the total 19 were rejected after reading the abstract and 29 were rejected after reading the whole paper. Finally, a total of 63 Papers were included in the study. The data about the perception of people about vaccines, hesitancy, acceptance, intent to take vaccines, and factors associated were extrapolated. The data was then summarized based on the place of study and the factors associated with perception regarding the covid-19 vaccine.

## 3. Results

The studies looking at the perception of the covid-19 vaccine, and factors associated with its acceptance or hesitancy in a particular population have been studied in various parts of the world. The studies give us an insight into the main factors associated with vaccine acceptance or hesitancy.

The intention of receiving the vaccination is varied across many countries, some showed high acceptance while others at lower levels. The factors which influence the level of acceptance and perception of people towards the Covid-19 vaccine are discussed.

A total of 111 papers were identified. After a thorough screening, a total of 64 papers were included in the study.

### 3.1. Characteristics of papers included in the review

A total of 64 papers have been included in the review where there is a mention of vaccine acceptance, vaccine hesitancy, and perceptions regarding the Covid-19 vaccine. Most of the studies are surveys done on an online medium during the months of March 2020 until April 2021. Some studies were conducted in hospitals or provinces of a country whereas there are studies that were conducted in more than one country. There 7 studies that were conducted in more than one country.

Table 1: Summary of papers included in the study

Sl. no	Author(s)	Country	Timeline	Target Population	Vaccine acceptance or vaccine hesitancy (%)
1	Lazarus.J.V.et.al <sup>2</sup>	19 Countries	June 16- June 20	13,426	71.5% responded that they would take a vaccine if it were proven safe and effective
2	Malik.A.A.et.al <sup>3</sup>	US	May-20	600	67% Acceptance
3	Dror.A.A.et.al <sup>4</sup>	Israel	19-March 2020 onwards for 15 days.	1941	75% acceptance of the whole population.
4	Neumann-Böhme S. et.al <sup>5</sup>	Denmark, France, Germany, Italy, Portugal, the Netherlands, and the UK	2-15 April 2020	1451	73.9% of the total would take the vaccine if available.
5	Wang.J.et.al <sup>6</sup>	China	Mar-20	2058	91.3% total accept vaccine when it would be available.
6	Garcia.L.Y.et.al <sup>7</sup>	Chile	April 18- May 5 2020	566	vaccine acceptance rate 90.6%
7	Wanga.K.et.al <sup>8</sup>	Hong Kong, China	26 February to 31st march	806	40% intent to accept vaccines.
8	Fisher.K.A.et.al <sup>9</sup>	US	April 16-April 20	1000	10.8% do not intend to take the vaccine
9	chungzhang.K.et.al <sup>1</sup>	Shenzhen, China	September 1- 7 2020	2653	53.5% have the behavioral intension
10	Mohammed Al-Mohaithef. et.al <sup>11</sup>	Saudi Arabia		1000	64.7%- vaccine acceptance
11	Walid A.et.al <sup>12</sup>	Jordan	24 August to 8 September 2020	1144	52.3% won't take the vaccine
12	Ditekemena.J.D.et.al <sup>13</sup>	Congo	15-22 December 2020	4131	55.9% were going to take the vaccine.
13	Papagiannis.D.et.al <sup>14</sup>	Thessaly, Greece		1500	80% vaccine acceptance among those who reported vaccines are safe.
14	Gan.L.et.al <sup>15</sup>	China	23 October- 10 November 2020	1009	7.1 are not willing to take vaccines.
15	Wang.J.et.al <sup>16</sup>	China mainland	March 2020& nov- Dec 15, 2020	March (n = 2058 November- December (n = 2013)	23.1% rejected the vaccine
16	Skjefte.M.et.al <sup>17</sup>	16 countries	October 28- November 18, 2020	17,871	73.4% of non-pregnant women had the intention to receive vaccines. 52% of pregnant women had the intention to get a vaccine.
17	Saied.S.M.et.al <sup>18</sup>	Tanta and Kafrelsheikh University, Egypt	Jan-21	2133	46% had vaccine hesitancy
18	Alqudeimat.Y.et.al <sup>19</sup>	Kuwait	August 26- September 1, 2020	2368	53.1% -vaccine acceptance
19	Gennaro.F.D.et.al <sup>20</sup>	Italy	October1- November1, 2020	1841	Average acceptance of 67% acceptance in Italy
20	Zhang.K.C.et.al <sup>21</sup>	Shenzhen, China	September 1- 7, 2020	2,281	72.6% of parents accepted to get their children vaccinated.
21	Ward.J.K.et.al <sup>22</sup>	France	7th April to 4th May 2020	5018	a quarter of respondents would not use it.

Table 1 Con....					
22	Biasio.L.R.et.al <sup>23</sup>	Northern, central, and southern Italy	5th June 2020- 25 June 2020	885	66% had the intention to take the vaccine.
23	Caserotti.M.et.al <sup>24</sup>	Italy	February to June end 2020	3691	40.1% vaccine hesitancy
24	Kourlaba.G.et.al <sup>25</sup>	Greece	28 April - 3 May, 2020	1000	26% unwilling to take the vaccine
25	Vergert.P.et.al <sup>26</sup>	France, Belgium, and Canada	October- November 2020	2,678	46% of vaccine acceptance
26	Alley.S.J.et.al <sup>27</sup>	Seattle, Washington, Provo	9-19 April 2020, 30th July- 16 August 2020	2343	Approximately 86% are willing to get vaccinated.
27	Seale.H.et.al <sup>28</sup>	Australia	18-24 March 2020	1420	4.1% disagreed
28	Lin. Y.et.al <sup>29</sup>	Wuhan, China	1-19 May	3,541	28.7% definite intent to take the vaccine.
29	Winardi.W.et.al <sup>30</sup>	Indonesia	March 25- April 6, 2020	1,359	93.3% and 67.0% of participants would like to be vaccinated if the vaccine had 95% and 50% effectiveness
30	Sallam.M.et.al <sup>31</sup>	Arab speaking population	14-18 December 2020	3414	29.4% vaccine acceptance.
31	Yigit. M.et.al <sup>32</sup>	Children's Hospital of Ankara City Hospital, Turkey		428	66.1% of parents were reluctant to receive foreign COVID-19 vaccines
32	Gagneux- Brunon.A.et.al <sup>33</sup>	University Hospital of Saint-Etienne (France)	26th march- 2nd July 2020	1421 online and 626 on site	25.9% - vaccine hesitancy

Table 1 Cont....

33	Kutera.B.J.et.al <sup>34</sup>	Philadelphia	November 13, 2020 and December 6, 2020	12,034	63.7% of these employees said they planned to receive a COVID-19 vaccine
34	Yoda. T.et.al <sup>35</sup>	Japan	Sep-20	1067	65.7%-vaccine acceptance
35	Grech. V. et.al <sup>36</sup>	Malta-Europe	sep 11- 16,2020	1002	57.6% intended to be vaccinated, 31.6% were uncertain and 10.8% did not intend to be vaccinated
36	Sallam.M.et.al <sup>37</sup>	Jordan	Jan 19-23, 2020	1106	Yes, -34.9%, no -39.6%, and maybe 25.5%
37	EdwardsI.B.et.al <sup>38</sup>	Australia	august	3000	36 per cent of Australians are hesitant and 6 percent resistant
38	Kelkar.A.H.et.al <sup>39</sup>	Florida	31 Dec2020- 16 Jan2021	600	vaccine acceptance- 67%
39	Malik.A.A.et.al <sup>40</sup>	UK and Turkey	May-20	5025	UK: 14%; 3% rejection of the vaccine
40	Kuok.K.O.et.al <sup>41</sup>	Hong Kong	mid-March and late April 2020	1,660	Intention to take 63%
42	Qiao.S.et.al <sup>42</sup>	South Carolina	September and October 2020.	1370	more intent to take the vaccine
43	Reiter.P.L.et.al <sup>43</sup>	USA	May 2020	2,006	69%- vaccine acceptance
44	Robertson.E.et.al <sup>44</sup>	UK	monthly from April to July, then every two months	42,330	18% being vaccine-hesitant
45	Salmon.D.A.et.al <sup>45</sup>	USA	November 25 and December 7, 2020	2525	Intenders (50%), Wait and Learn (40%), and Unlikely (10%)
46	Eguia.H.et.al <sup>46</sup>	Spain	mid-March 2020	731	22.43%-vaccine-hesitant
47	Gadoth.A.et.al <sup>47</sup>	Los Angeles	24 September 2020 and completed online through 16 October 2020.	1069	1.30% never intend to get vaccinated
48	Qunaibi.E.A.et.al <sup>48</sup>	Arab countries	14-Jan 2021 to 29-Jan, 2021	1069	12.6%-answered "Yes"; 4.5%- "Depends on the type of vaccine"; 20.9%- answered "I will wait and see its effects on others"; 21.7%-answered "I am not sure";40.4% chose "No"
49	Soares.P.et.al <sup>49</sup>	Portugal	29 September 2020- 8 January 2021	1943	35.3%- take the vaccine as soon as possible; 55.5% would wait before taking the vaccine ; 44.7% would wait some time; 10.8% would wait a long time; 9.2% would not take the vaccine.
50	Vallée.A.et.al <sup>50</sup>	Foch Hospital, Suresnes, France	Jan-21	690	vaccine hesitancy-28.7%
51	Jagadish Thaker <sup>51</sup>	New Zealand	June 26 to July 13, 2020	1040	vaccine hesitancy-26%
52	Dickerson.J.et.al <sup>52</sup>	Bradford	April-June 2020	1727	29%would want a COVID- 19 vaccine
53	Reno.C.et.al <sup>53</sup>	Northern Italy	January 19 to January 26, 2021	1011	68.9% confident about the vaccine while 31.1% reported hesitancy
54	Machida.M.et.al <sup>54</sup>	Japan	14 January 2021 and 18 January 2021	2956	62.1%-were vaccine acceptance

Table 1 Cont....

55	Luciano.B.et.al <sup>55</sup>	Maranhão, Brazil	October 19 to 30, 2020	3000	17.5%-vaccine hesitancy
56	Kociotek.L.K.et.al <sup>56</sup>	Ann & Robert H. Lurie Children's Hospital of Chicago	21 dec- 13 January, 2021	7,012	59.8% will receive vaccine
57	Kreps.S.et.al <sup>57</sup>	US	9-Jul-20	2000	Higher vaccine acc the eptance
58	Doherty.R.A.et.al <sup>58</sup>	North Carolina	August 27, 20Decand December 15, 2020	1004	69% of respondents reported Vaccine hesitanthe
58	Gerussi.V.et.al <sup>59</sup>	Italy	1 March 2020 to 30 May 2020.	1067	accepted 34.2% or reluctant to receive 24.9% hesitant
60	Hossain.M.B.et.al <sup>60</sup>	Bangladesh	1-7 February 2021	1497	41.1% of the respondents acceptance.respondents'
61	Wang.C.et.al <sup>61</sup>	China	January 10 to January 22, 2021.	9508	67.1% participants reported willingness to accept
62	Raja.A.S.et.al <sup>62</sup>	Amazon mechanical trunk, US	17018 November 2020	1756	37.8% hesitant to take the vaccine. 21.3% non-accepting
63	Paul.E.et.al <sup>63</sup>	U.K	21 March 2020	32,361	64% intent to take vaccine
64	Rzymiski.P.et.al <sup>64</sup>	Poland	17 February and 11 March 2020	1020	Less vaccine acceptance among women

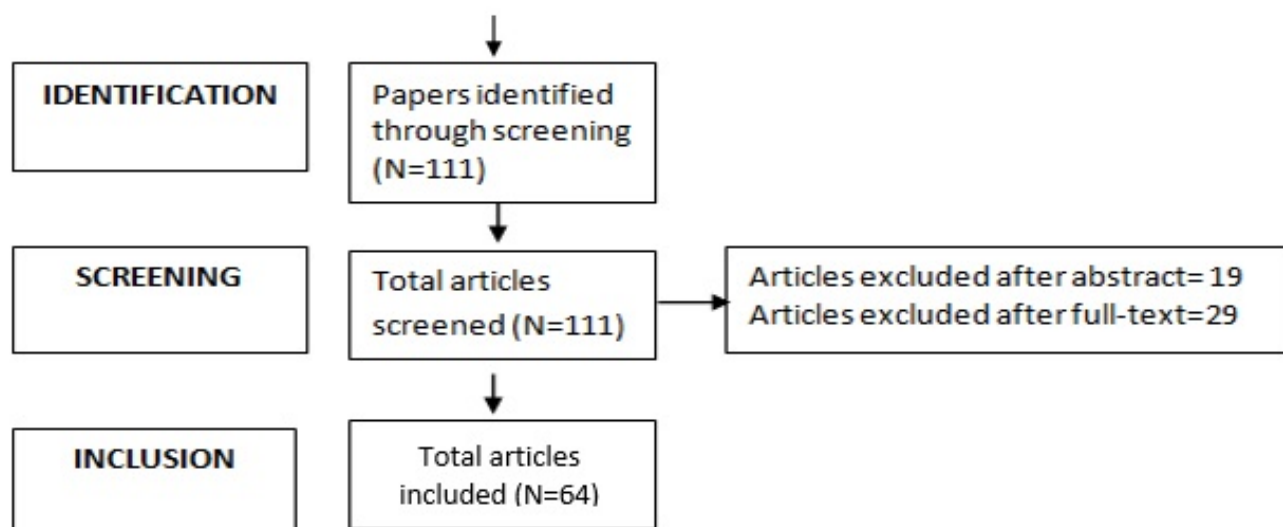


Fig. 1:

There are 13 papers from the USA; six studies were conducted among the common public, one from Seattle, and Washington, one from the Ann & Robert H. Lurie Children's Hospital of Chicago, one from Amazon mechanical trunk, USA one each from North Carolina and South Carolina provinces, one from Chile and one from Los-Angeles. There are 10 studies from China, 2 from Shenzhen province, 2 from Hong Kong, 1 from Wuhan, one from the mainland, and 4 from China as a whole. There are 3 studies from UK and Italy.

There are 2 papers each from France, Italy, Australia, Japan, Jordan, Philadelphia, and Greece. There are also studies from countries like Congo, Portugal, Bangladesh, Turkey, Israel, Kuwait, Lithuania, New Zealand, Spain, Portugal, and Poland.

### 3.2. Factors associated with vaccine acceptance/hesitancy

#### 3.2.1. Age

The majority of studies conducted in the US, UK, China, Japan, and Australia (2,5,27,34,37,43,53,60) reported that vaccine acceptance is high among the elderly when compared to middle and young age groups. In a study conducted in Spain, there is a slight difference in acceptance levels among middle and older age groups.<sup>46</sup> The middle-aged group is more inclined to take vaccines in a study conducted in China between 23<sup>rd</sup> October to 10<sup>th</sup> November 2020.<sup>15</sup> Participants aged 21-24 years accepted vaccines the most, least acceptance to the vaccine is reported among people between 55- 64 years of age in a study conducted in Kuwait and in France and Canada).<sup>19,22</sup> In another study conducted in Brazil, individuals more than

60yrs of age group are more hesitant to take vaccines as compared to middle and younger age groups.<sup>55</sup> In Seattle willingness to get vaccinated decreased in all age groups with time.<sup>27</sup>

In a dual survey conducted in Australia, during the months of April and August, Willingness to get themselves vaccinated decreased from April to August in all age groups.<sup>38</sup> In Indonesia, a cross-sectional study on the acceptance of vaccines reported that the highest acceptance is 95.5% among people of age 21-30 years and the lowest acceptance of 88.8% was among people of age 31-40 years.<sup>30</sup> In the majority of surveys, the less than 30years age group were more hesitant to take vaccines and has lower confidence levels followed by the people belonging to the 30-50 years of the middle age group.

#### 3.2.2. Gender

Based on the studies from China, Denmark, France, Germany, Italy, Portugal Netherlands, and the UK done between the months of March 2020 to April 2021, Males are more likely to get vaccinated for covid-19<sup>3-8,22,26,40,61</sup> as compared to women but in a study from China between the month of October, and November and in Indonesia women are more intended to get themselves vaccinated.<sup>15,30</sup> 72% of men are likely to get vaccinated in the US,<sup>1</sup> . Women are more likely to take vaccines only if they have high efficacy in Shenzhen, China.<sup>10</sup>

#### 3.3. Educational level

The acceptance is increasing with an increase in the level of education in countries like the US, UK, China, Egypt, France, Saudi Arabia, Australia, Japan, and other countries.<sup>3,9,15,18,22,38,42-48,54-62</sup> A study conducted

in Jordan shows that Higher percentages of those who work/study in the medical field responded: “Yes’ ’ rather than “Not sure” (39.7 vs. 23.9%).<sup>11</sup> In a cross-sectional study conducted in Indonesia, in School graduates there is 94.2% acceptance, 93.3% acceptance among university graduates;<sup>30</sup> in another study conducted in Children’s Hospital of Ankara City Hospital, Turkey on parents, shows that parents who are highly educated, are less likely to accept the vaccine<sup>32</sup> and also in the study conducted in China reported that, the participants with a master’s degree or above had a higher rate (42.8%) of vaccine hesitancy compared to those with a bachelor’s degree.<sup>61</sup>

### 3.4. Employment

Working in the private sector more likely to accept vaccines, was reported in studies conducted in Hong Kong<sup>8</sup> and a study conducted in Indonesia showed that Private sector employees had 93.6% acceptance, 91.9% acceptance among civil servants.<sup>30</sup> A study conducted among Italian patients who recovered from COVID-19 Infection shows that employees working in contact with the public seemed to be more prone to undertake the SARS-CoV-2 vaccination.<sup>59</sup> A national cross-sectional study conducted in China shows that those working in port affairs or customs reported the highest rate of vaccine willingness 84.0%, followed by medical employees 80.8%, and transportation 9.8%.<sup>61</sup> There was a 96% of acceptance among people who lost their job during the pandemic, 75% among those who are at home but were confident to return to work, and 72% of acceptance among people with essential occupations like education and security was noted in a study conducted in Israel.<sup>4</sup> 48.1% acceptance was based on employer recommendation in the survey conducted in the 18 countries.<sup>2</sup>

Among the health care professionals, 72.4% of hourly employees and 88.6% of salaried employees are willing to accept vaccines in a cross-sectional study conducted in Ann & Robert H. Lurie Children’s Hospital of Chicago.<sup>56</sup> The intention to receive a COVID-19 vaccine was 61.6% at hospital A and 67.3% at hospital B, in a survey of employees in two large hospitals in Philadelphia among clinical and non-clinical staff.<sup>34</sup> Rates of intention were 92.1% in physicians, 88.8% in pharmacists, 64.7% in nurses, 60.1% in assistant nurses, 70.3% in midwives, 95.8% in physiotherapists, and 67.1% in other HCWs, was reported in a cross-sectional study conducted among French healthcare professionals during the first pandemic wave.<sup>33</sup> Vaccine acceptance among Maltese health workers shows that doctors- 86%; nurses- 64%; allied health professionals- 67%; others- 63% willing to take.<sup>36</sup> Intention to take the vaccine was about 60% among nurses in Hong Kong.<sup>41</sup>

Studies conducted in the UK, Northern Italy, and Japan reported that individuals and families with low monthly income are more hesitant to vaccinate;<sup>53,54,63</sup> a study conducted in the USA to determine the factors associated

with vaccine hesitancy shows that people who being unemployed were more unwilling<sup>3</sup> and A higher odds of delay and refusal was also found for individuals who lost income during the pandemic compared to those who did not was reported in a study conducted in Portugal.<sup>49</sup> More hesitancy was reported among self-employed individuals in a study conducted in Northern Italy from January 19th to 26th, 2021.<sup>53</sup> Nurses and assistant nurses were less inclined to get vaccinated against COVID-19 than physicians in the study conducted among French healthcare professionals.<sup>33</sup>

#### 3.4.1. Region

A study conducted in China during the first round of vaccination shows that urban participants received more vaccinations when compared to rural participants.<sup>61</sup> A dual survey conducted in Australia during the months of April and between July and August in 2020, reported that non-Victorians were more willing to take vaccines in the initial survey and Victorians were more willing in the later period.<sup>38</sup>

Anationwide survey conducted in China reported that people staying in the central region were more willing when compared to people living in southern areas.<sup>29</sup>

#### 3.4.2. Race

A study conducted in the US to determine the factors associated with vaccine acceptance shows that Asians are more willing to take the vaccine(2); a survey conducted among the employees in two hospitals in Philadelphia reported that Asians are more willing, next comes the white people than in Hispanics and blacks<sup>34</sup> Non-Kuwaitis were more likely to accept the vaccine than Kuwaitis in a cross- sectional study conducted among the general adult population in Kuwait.<sup>19</sup>

Studies conducted in the USA, North Carolina, U.K, Philadelphia show that black Americans and black people from Africa were less willing to take the vaccine when compared to other racial people.<sup>3,34,44,57,58</sup> lower influenza uptake and lower Covid 19 vaccine acceptance were reported among black Americans living in the USA than nearly all other racial groups<sup>3</sup> and in another conducted in the US, non-Latin black were less willing to vaccinate.<sup>3,43</sup>

Following blacks, the Pakistani/ Bangladeshi were the next most hesitant group followed by mixed ethnicity as reported in a longitudinal study conducted in the UK.<sup>44</sup> A cross-sectional study among health care workers in Los Angeles showed that Asians or Latinos were less likely to accept the covid-19 vaccine.<sup>47</sup> Pakistani heritage respondents from Branford were less willing to get themselves vaccinated when compared to white British respondents.<sup>52</sup> The people of Maori ethnicity living in New Zealand show less vaccine acceptance when compared to Asians and people of other ethnicities.<sup>51</sup> People from minority ethnic groups living in the UK reported lesser



acceptance of vaccines.<sup>63</sup>

### 3.4.3. Place of stay

Cross-sectional studies conducted among Chinese adults and in Indonesia have reported that people living in urban areas are more willing to accept the vaccine when compared to rural areas<sup>15,30,61</sup> In contrast to these studies, a study conducted in Japan reported that participants from rural areas were more willing to vaccinate than those from central areas.<sup>35</sup> In the study in Congo, 94% of people from Kasai central, and 85% people of from Kasai oriental were ready to take the vaccine.<sup>13</sup>

High rates of vaccine hesitancy were reported among people living in the western region of Saudi Arabia<sup>48</sup> A study in the USA to determine the factors associated with vaccine acceptance reported that there were notable geographic differences in vaccine acceptance in different regions in the USA.<sup>3</sup>

### 3.4.4. Doctor's advice

Studies conducted in China, Australia, and the USA<sup>3,28,43</sup> reported that participants were more willing and show high vaccine acceptance if they were recommended by their doctors and a study.

conducted in the US reported that, participants preferred vaccine uptake in their primary doctor's office or clinic and pharmaceutical offices.<sup>62</sup>

### 3.4.5. COVID-19 infection

In Saudi Arabia, it was seen that the people believed that those who were concerned about acquiring the disease were more likely to get themselves vaccinated.<sup>11</sup> In Congo, the people who tested positive for Covid-19 were more likely to take the vaccine.<sup>13</sup> In Tanta, Egypt 77.7% of participants who had a fear of infecting Covid were more motivated to take the vaccines.<sup>18</sup> In Kuwait individuals who reported that they are likely to contact Covid were more accepting of vaccines.<sup>19</sup> There was a 66% of vaccine acceptance among family members of people who have a previous of current SARs infection in Italy<sup>20</sup> There was a 95.6% acceptance who perceived the risk of covid-19 in Indonesia.<sup>30</sup> In France, there was a 60.9% acceptance among people who did not feel the risk of COVID-19 infection whereas there was an 85.8% acceptance among people who felt the risk of covid-19 infection.<sup>33</sup> There was a positive correlation among perceived severity and intent to take vaccine among the people from South Carolina.<sup>42</sup>

### 3.4.6. Cost of vaccines

It was seen in a study from China that 59.9% of participants mentioned taking the decision to take vaccine based on the price of the vaccine<sup>6</sup> In Chile, 92.4% of participants were willing to pay for the vaccines if needed.<sup>7</sup> In Shenzhen, China 80% were ready to take the vaccine only if it was

free of cost<sup>10</sup> In China, mainland people are said to accept vaccines based on the price of the vaccine.<sup>16</sup> In Egypt, 68% of participants said they won't take the vaccine if it is not free.<sup>18</sup> In Italy, those who are willing to pay are more likely to get themselves vaccinated.<sup>24</sup> In Wuhan, China 82% of participants agreed to take vaccines only if they are affordable.<sup>29</sup> In the USA indicated the participants mentioned that they would pay out-of-pocket for a COVID-19 vaccine. The price and proportion of people ready to pay was \$0 (30%), \$1-\$19 (15%), \$20-\$49 (20%), \$50-\$99 (14%), \$100-\$199(10%), and \$200+ (11%).<sup>43</sup>

### 3.5. Co-morbid conditions

In Hong-Kong China people with chronic diseases were more likely to accept the Covid-19 vaccines.<sup>8</sup> In Jordan 37.1% would take the vaccine if they have other health complications.<sup>12</sup> In Congo, 33.3% of students who believed to have bad health were more accepting of the vaccine.<sup>13</sup> In Kuwait, the people who are underweight, overweight, and obese were more willing to get vaccinated.<sup>19</sup> In Italy, 70% of people with disabilities, 74% who were immune-compromised or in treatment with immune-suppressors had greater acceptance of vaccines compared to others.<sup>20</sup> In Australia, 25% of people with chronic health conditions were ready to take vaccines.<sup>28</sup> There was a higher acceptance seen in people with a history of chronic diseases among the Arab-speaking population.<sup>31</sup> In Japan, 78.4 % of people with chronic diseases were willing to take vaccines as compared to 61.3% of people without chronic diseases.<sup>35</sup> In the USA, 73% with underlying conditions and 66% without any underlying conditions were willing to get vaccinated<sup>43</sup> In Portugal, people with co-morbid conditions had lower refusal than people without comorbid conditions.<sup>49</sup>

### 3.6. Political inclination

38.8% of participants of the survey done in 16 countries around the world believed that vaccine development and distribution was rushed due to political reasons<sup>17</sup> In France, it was seen that the people who didn't prefer the party in power were hesitant to take the vaccine<sup>22</sup> The hesitancy was higher among people in Portugal who found the measures implemented by the government inadequate.<sup>49</sup> In another study conducted in the USA during July 2020, the democratic supporters had a higher acceptance of the vaccine.<sup>57</sup> Here, people also mentioned that they would trust the vaccine more if the president recommends it. In France, lower hesitancy among people with lower party preference.<sup>22</sup>

### 3.7. Family and marital status

In China, Greece, married people or people who were co-habiting or with children were more likely to accept

vaccines (5,24). In a survey done across 16 countries around the world, it was seen that non-married were reluctant to take the vaccine.<sup>17</sup> In Wuhan, China 30% of married showed higher intent of getting vaccines.<sup>29</sup> 72.6% of parents were willing to get their children vaccinated in Shenzhen, China.<sup>21</sup> On the contrary in Indonesia, 94.6% unmarried and 91.7% married accepted the vaccine.<sup>30</sup> In Japan, 43.5% unmarried and 33.8% married were unlikely to get themselves vaccinated.<sup>54</sup> In China, 51.7% are willing to get their children vaccinated whereas 10.9% are not willing to vaccinate their children.<sup>15</sup> The survey from 16 countries showed that 73.4% of non-pregnant women had the intention to receive the vaccine whereas 52% of pregnant women had the intention to get the vaccine. 69.2% of women had the intention to vaccinate their children.<sup>17</sup>

COVID-19 vaccine acceptance level was above 80% for pregnant women in Mexico and India; and below 45% for the US, Australia, and Russia. 73.4% of non-pregnant women intended to receive the vaccine.

COVID-19 vaccine acceptance level was above 90% for non-pregnant mothers in India, Brazil, and Mexico. COVID-19 vaccine acceptance levels among mothers for their children was above 85% in India, Mexico, Brazil, and Colombia whereas it was 56% for Australia, the US, and Russia and below 52% for Australia, the US, and Russia.<sup>17</sup> In Portugal, individuals with children of school age were hesitant to get their children vaccinated.<sup>49</sup> In New Zealand, individuals without children were intended to get vaccinated compared to those with children.<sup>51</sup>

#### 4. The Common Perception About Covid-19 Vaccines

##### 4.1. Covid vaccine development and safety

11% of participants in Denmark, France, Germany, Italy, Portugal, the Netherlands, and the UK thought vaccines were not dangerous to health and 15% of participants did not wish to get themselves vaccinated as they had doubts regarding the safety of the vaccine.<sup>5</sup> In Japan, 31.7% felt that the newer vaccines are riskier than older vaccines.<sup>35</sup> 46.1% of participants of a study in Arab countries and people from Germany and Canada felt that the vaccine production was rushed and there were doubts on the credibility of the vaccine production.<sup>22,48</sup> In Bangladesh, people who believed that COVID-19 vaccines made in America and Europe are safer than those made in other countries, and the COVID-19 vaccines made in India are safer than those made in other countries had more hesitancy.<sup>60</sup> In a study in Congo, it was found that 14.4% believed that vaccines would kill people from Africa, and 5.9% believed that it would sterilize people.<sup>13</sup> 20.8% of people in a study from Italy believed that they won't need vaccines either because of previous conditions or age.<sup>59</sup> In Poland, women believed that vaccines may cause infertility among women.<sup>64</sup> In the study among the health

care professionals in Thessaly, Greece 93% who refused the vaccine were in fear of side effects.<sup>14</sup> 83% of people thought that vaccines are not safe in Italy.<sup>23</sup>

#### 5. Effectiveness and Efficacy of Vaccine

A cross-sectional study conducted among Chinese factory workers reported that if the vaccine efficacy is 80% more than 60% of the participants were willing to accept and confident about the vaccine<sup>10</sup> and the same was reported in studies conducted in Japan, the UK,(34,43) and among pregnant and mothers of a young children-a study conducted in 16 countries.<sup>17</sup> Vaccine acceptance was more among participants with an increase in trust and belief in the efficacy of the vaccine was noticed in studies conducted in China, Kuwait.<sup>15,16,19</sup> studies conducted in Hong Kong-China, more than 50% of the participants suspected the efficacy of the vaccines<sup>8</sup> and there were more than 70% concerns and doubts raised on the ineffectiveness of vaccines were reported in studies conducted in Egypt, Kuwait, Italy.<sup>18-20</sup> A less than 20% of concerns about vaccine ineffectiveness were reported in studies conducted in the US, Italy, France, Spain,<sup>46,50,59,62</sup> and around 30% were reported in a study conducted in Philadelphia.<sup>34</sup>

##### 5.1. Place of development of the vaccine

Vaccine development also had an impact on vaccine acceptance. In a study from china, it was seen that 32.5% preferred the domestic vaccine or vaccine produced in their country and this preference increased to 48.2% by October 2020.<sup>6</sup> Only 3.4% of people preferred imported vaccines over domestic vaccines in China.<sup>16</sup> In another study from china in May 2021, 64.2% preferred domestic vaccines whereas only 11.9% preferred foreign vaccines.<sup>29</sup> In a study from the USA, it was found that the participants were least likely to choose vaccines developed outside the US, mainly in China.<sup>57</sup> 53% of participants from the USA thought that the government and the pharmaceutical companies were conducting a vaccine trial on common people.<sup>45</sup>

##### 5.2. Sars-CoV2 virus

People who believed that the virus was developed by humans were less likely to be vaccinated. In Jordan, 29.7% believed Covid-19 was a man-made disease.<sup>37</sup> 6.8% believed that they could contact COVID-19 from the vaccine in Turkey.<sup>32</sup> whereas in Philadelphia 25.4% believed that they could contact the virus from a vaccine.<sup>34</sup> 2% of participants of the study in Florida believed that they could get infected by the vaccine.<sup>39</sup> In Bangladesh, people believed that Corona virus is a myth to force vaccinations on people and they were more hesitant to take the vaccine.<sup>60</sup> In Hong-Kong, China 27.9% of people believed that the Covid-19 vaccine was unnecessary.<sup>8</sup> In UK and Turkey, higher acceptance could be seen among participants who believed

in the natural origin of the virus.<sup>40</sup>

## 6. Conclusion

In almost all countries the individuals who were married and had children were more likely to get themselves vaccinated but they were hesitant to get their children vaccinated. In China, the preference for domestic vaccines increased over the period of time. In almost all studies the vaccine acceptance was more in the case of people who perceived the risk of Covid-19 infection than those who did not. There was more acceptance to vaccines if they were free but in the USA 11% of people were ready to pay more than 200\$ for vaccines. Women and the unemployed and the young were more hesitant to go for vaccination.

It can be seen that the health belief model and protection motivation theory, have identified the factors influencing vaccine acceptance and hesitancy, they are safety and side effects, effectiveness and efficiency, age & gender, mistrust, religious beliefs, development of the vaccine, etc., these are some major issues stated by a greater number of people.

Thus, the misconceptions regarding vaccines are a major reason for vaccine hesitancy among the public. So, the government has to put in efforts to improve vaccine acceptance among the public through transparency to information, behavior change communication strategies, and improving awareness.

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## 8. Conflict of Interest

None.

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