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Development and Validation of Attitudes and Concerns towards Covid-19 Vaccination Scale (ACCVS)

Shaikh Ezaz[1]* and Petare Pratika[2]

[1]*Head & Assistant Professor, Department of Psychology, Radhabai Kale Mahila Mahavidyalaya, India*

[2]*Assistant Professor, Department of Psychology, Karmaveer Bhaurao Patil College (Autonomous), India*

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***Corresponding author:** Dr. Ezaz Shaikh, Head & Assistant Professor, Department of Psychology, Radhabai Kale Mahila Mahavidyalaya, Ahmednagar. Maharashtra, India

Abstract

Background: COVID -19 vaccines are one of the fastest developed vaccines to date. People have different views and opinions about it. A positive attitude can strengthen the vaccination program whereas a negative attitude will be an obstacle for a healthy and safe nation. This study aimed at developing and validating the Attitudes and Concerns towards the COVID-19 vaccination.

Method: Initial draft of 48-items was developed based on literature review and interview of experts. After content validation with four experts and semantic validation with 20 respondents, 32-items were retained and administered to 607 Indian adults aged 18 to 60 years.

Results: Data was analyzed by IBM-SPSS Version-23 with AMOS. EFA supported the two-factor structure for the attitude towards COVID-19 vaccination and three factors structure for the concern domain. Cronbach alpha for 'Vaccine Acceptance' and 'Vaccine Hesitance' was .825 and .721. The reliability of religious concerns (α =.785), social concerns (α =.714), and health concern (α =.699) subscales were acceptable. The CFA results verified two factor model of attitude and three-factor model of concerns as the model indices were close to 1; RMSEA was .000 and PCLOSE values were .861 and .927, respectively for parts I and II.

Conclusion: This is 12-items scale measures vaccine acceptance, vaccine hesitance, religious concerns, social concerns, and health concerns related to COVID-19 vaccination.

Keywords: COVID-19; Vaccination attitude; Vaccination scale; Health concerns; Religious concerns

Abbreviations: EFA: Exploratory Factor Analysis; CFA: Confirmatory Factor Analysis; PAF: Principal Axis Factoring; KMO: Kaiser-Meyer-Olkin

Introduction

Vaccination is an important tool in the prevention of infectious diseases. Although vaccine development requires years of research; due to the highly contaminating nature of COVID-19, it was taken at the war front priority to develop herd immunity. COVID -19 vaccines are one of the fastest developed vaccines till date. However, the control of COVID-19 depends on effective implementation of vaccination programmes; especially, in India, due to its large population, sociocultural and economic diversity, educational backwardness and inequality in the access to health care services [1]. In addition, the attitude of people is also hindering factor in the effective implementation of vaccination programme.

Although scientists are certain about the benefits of COVID-19 vaccines, people at large have found to hold different views and opinions about it. The positive attitude towards the vaccine facilitates the government's initiative of effective implementation of the vaccination program for prevention and control of COVID-19 spread, whereas the unfavorable attitude towards vaccines, known as 'vaccine reluctance' or 'vaccine refusal' is an obstacle in meeting the goal of a healthy and safe nation. WHO had also listed the vaccine hesitancy as one of the ten threats to global health in 2019 [2].

Researchers have used unstandardized questionnaires and semi-structured interviews to study 'what people think about

COVID-19 vaccination?' However, they focused on average acceptance rate of COVID-19 vaccines and the age, knowledge, and employment status wise differences in vaccine acceptance and vaccine hesitancy. A study conducted in America before the introduction of COVID-19 vaccine, reported that 30% participants were unsure about the vaccination and 10% participants did not intend to get vaccinated [3]. Other studies found higher acceptance rate (61%) for adults, but unacceptance of vaccination for the children attending school (38.4%) in their respondents [4,5]. In a study of 3100 participants from Jordan, only 37% showed willingness to get vaccinated [6]. In India, the vaccine acceptance rate was ranged from 35% to 69% and the vaccine hesitancy ranged from 3.4% to 10% [7-10]. These studies reported lower vaccine hesitancy compared with other countries.

A study of 944 Indians found 69% acceptance rate and 3.4% vaccine hesitancy among their participants [7,8]. Another study reported that 70% participants had concerns regarding COVID-19 vaccine, 10% refuse to take vaccine, and 27% were not sure if they would get the vaccine [9]. Praveen, Ittamalla, and Deepak found positive attitudes towards vaccination in 35% participants [10]. However, the findings of these studies are not directly comparable due to the differences in their research methodology, sample size and characteristics, and tools used to assess vaccine acceptance and refusal. Eniola and Sykes reported four reasons of vaccine hesitancy among health care workers namely, (a) Safety and efficacy concerns, (b) Preference for physiological immunity, (c) Distrust in government and health organizations, and (d) Autonomy and personal freedom [11]. Other studies showed that fear of ill health, lack of trust, less information on vaccine and allergic reactions were most commonly cited reasons for negative attitudes [4,7.8].

Similarly, demographic, social, and contextual constructs were also associated with intention to vaccinate among the adult population [3,5]. Thus, in the background of highly contaminating and mutating COVID-19 virus and the unavailability of standardized tool to measures the attitude and concerns of Indian adults towards COVID-19 vaccination; the present study was undertaken to develop a short, standardized and valid tool to assess the individual's attitudes and concerns towards COVID- 19 vaccination among Indian adults. In India, this scale can be used to identify the attitude as well as concerns of Indian adults towards COVID-19 vaccination. The results of the future studies based on this scale can be useful in planning the vaccination programmes and development of intervention programmes addressing the specific concerns of people.

Materials and Methods

Item Generation

Literature review was conducted through Google scholar, ResearchGate, PubMed, and Directory of Open Access Journals using "vaccine attitude", "COVID-19 scale" and "vaccination scale" as keywords. In addition, individual interviews of two medical professionals, two psychologists and three people from the community were conducted. Based on the themes identified, the initial item pool consists of 48 items was created to measure vaccine acceptance, vaccine hesitancy, social concerns, physical health concerns, psychological health concerns, financial concerns, and religious concerns. Response for each item is ranged on 5-point Likert scale from 'strongly disagree' to 'strongly agree'.

Content Validation

Four experienced experts in the field of Psychology with master or doctoral degrees assessed each on a 4-point Likert scale regarding the relevance of item to each domain and provided feedback for omission of item, adding the item and rephrasing the item to improve the respondents understanding. Sixteen items with i-CVI <.70 were omitted and four items were revised.

Semantic Validation

To identify the difficulties of the respondents in understanding the meaning of the statements/items due to their educational, cultural and religious background, the draft of 32-items was shared with 20 respondents [12]. Based on their feedback three statements were rephrased. The participants involved in the semantic validation procedure were excluded from the final data collection phase.

Scale Description

The 32-items were divided into two parts; ten items in first part measure attitudes towards COVID-19 vaccination, twenty-two items from the second part were measuring five concerns related to COVID-19 vaccination i.e., social, physical health, psychological health, financial, and religious concerns. Statements were both positively and negatively framed for different domains and arranged randomly to prevent rating errors. Items seeking information about demographic characteristics were placed at the end to avoid the effect of social desirability.

Ethical consideration

The study was approved by the institutional ethics and research promotion committee. The consent for the participation was obtained from all participants before the start of this study. They were informed that their participation in the study is voluntary and they can withdraw from the study at any point of time. They were also informed that the participation in this study does not cause physical or psychological harm. Participants didn't receive direct or indirect monetary benefits. They were assured that confidentiality of their responses and its uses.

Data Collection

The data was collected during the second wave of COVID-19 between 1st June 2021 and 30th July 2021 from 607 Indian

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adults aged 18 to 60 years. The participants were selected from the community by the Snowball sampling method. To reduce the possibility of giving socially desirable responses and increase the reliability of responses, the data was collected anonymously (Table 1).

Table 1: Demographic characteristics of the Participants (N = 607).

Gender	Female	452 (74.5%)
	Male	155 (25.5%)
Marital Status	Unmarried	509 (83.85%)
	Married	96 (15.82%)
	Widow/Widower	02 (0.33)
Religion	Hindu	431 (71%)
	Islam	84 (13.84%)
	Christian	34 (5.60%)
	Buddhism	30 (4.94%)
	Jain	09 (1.48%)
	Atheist	09 (1.48%)
	Sikh	07 (1.15%)
	Other	03 (0.49%)
Status Related to COVID-19	I never suffered fromCOVID-19	482 (79.4%)
	I had suffered fromCOVID-19	67 (11.04%)
	I Did not get diagnosed but had symptoms of COVID-19 (testing was not done)	58 (9.56%)

Result

The obtained data was closely scrutinized to check the random responding and missing data. Few items were reverse coded before calculating the item score and scale score. The data was analysed using IBM SPPS version 23 with AMOS. The respondents were randomly split into two groups [12]; the first group of 302 respondents were used to perform the Exploratory Factor Analysis (EFA) and the second group of 305 respondents were used to validate the results of the EFA by performing Confirmatory Factor Analysis (CFA).

Two EFA were performed separately for part-I, general attitude towards COVID-19 Vaccine and part-II, concern towards COVID-19 vaccine using Principal Axis Factoring (PAF) method of factor extraction [13] and Varimax rotation method. The sample was much higher than recommended sample size [14-17]. The items with Pearson r correlation coefficient >0.7 (to avoid redundant items), factor loading less than .60 and cross loading of >.30 on another factor/s were omitted. The criterion for factor extraction were the Eigenvalue >1, Scree plot and parallel analysis.

Part I: Attitudes towards COVID-19 Vaccination

Exploratory Factor Analysis

The result of Kaiser-Meyer-Olkin (KMO) was .838 (meritorious) [12] and the Bartlett's test was also significant (χ^2 = 774.450, p = .000). Statements with low factor loading (<.40) were omitted i.e., 'Vaccine is the only protective shield available against COVID-19' and 'I will prefer alternative ways rather than getting vaccine for COVID-19' (Table 2). The PAF method revealed the two factors with Eigenvalue higher >1 i.e., positive attitude and negative attitude. They explained 30.04% and 18.74% of variance, respectively and 48.774% total variance. Five statements had higher loading on factor 1 and three statements had higher loading on factor 2. After analysing the meaning of the statements, the factors were named as 'Vaccine Acceptance' and 'Vaccine Hesitance'. The reliability of internal consistency for 'Vaccine Acceptance' subscale was good i.e., .825 and 'Vaccine Hesitance' subscale was acceptable i.e., .721. The overall scale had good internal consistency (α = .819).

Confirmatory Factor Analysis

The validity of two-factor model of attitudes towards COVID-19 vaccination i.e., 'Vaccine Acceptance' and 'Vaccine Hesitance' was tested with CFA performed in AMOS (N = 305). The results revealed that KMO test was .717 i.e., middling [18] Bartlett's test was also significant (χ = .248, p = 0.000).. Statement 'Even if it is free, I will not take COVID-19 vaccine' was omitted due to higher cross loading. Statements such as 'If I get the chance, I will get a vaccine to prevent COVID-19 infection' and 'I'm happy to hear that scientist have developed a vaccine for COVID-19' were deleted

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because their >1 standardized residual covariance. Remaining five statements were retained in final model; three statements contributing to 'vaccine acceptance' and two statements loading on 'vaccine hesitance'. Vaccine Acceptance had explained 44.79% variance and vaccine hesitance explained 20.17% variance. These two factors had explained 64.96% of total variance. The result of model fit indices revealed that values of GFI, AGFI, NFI and RFI were more than .97. The values of CFI and IFI were exactly 1.00. Further, RMSEA was less than .05 i.e., .000 and PCLOSE value was .861 (Table 3 & 4) (Figure 1).

Table 2: Factor loadings, communalities and internal consistency results for attitude towards COVID-19 vaccination.

Items	F1	F2	Communality	Factor Name	Mean (SD)	Cronbach's α
I would recommend my family members and friends to get a vaccine for COVID-19.	0.743		0.507	Vaccine Acceptance	3.76 (1.03)	0.825
If I get the chance, I will get a vaccine to prevent COVID-19 infection.	0.693		0.483			
COVID-19 Vaccine strengthens immune system response against COVID-19.	0.691		0.408			
I'm happy to hear that scientist have developed a vaccine for COVID-19.	0.616		0.344			
COVID-19 Vaccination can protect me and my family from COVID-19 infection.	0.61		0.404			
I'm disappointed by the effects of COVID-19 vaccine.		0.702	0.326	Vaccine Hesitance	4.19 (0.885)	0.721
Even if it is free, I will not take COVID-19 vaccine.		0.647	0.399			
COVID-19 vaccine is causing serious side effects.		0.612	. 273			

Table 3: Factor loadings, communalities and internal consistency results for Attitude towards COVID-19 vaccination.

Item	Vaccine Acceptance	Vaccine Hesitance	Communality	Mean (SD)
COVID-19 Vaccine strengthens immune system response against COVID-19.	0.794		0.643	4.14 (0.836)
I would recommend my family members and friends to get vaccine for COVID-19.	0.743		0.628	
COVID-19 Vaccination can protect me and my family from COVID-19 infection.	0.723		0.555	
COVID-19 vaccine is causing serious side effects.		0.836	0.719	3.542 (1.05)
I'm disappointed by the effects of COVID-19 vaccine.		0.825	0.702	

Table 4: The goodness of fit indexes of Confirmatory Factor Analysis.

x^2	GFI	AGFI	NFI	CFI	RFI	IFI	RMSEA	PCLOSE
2.568	0.997	0.987	0.99	1	0.974	1	0	0.861

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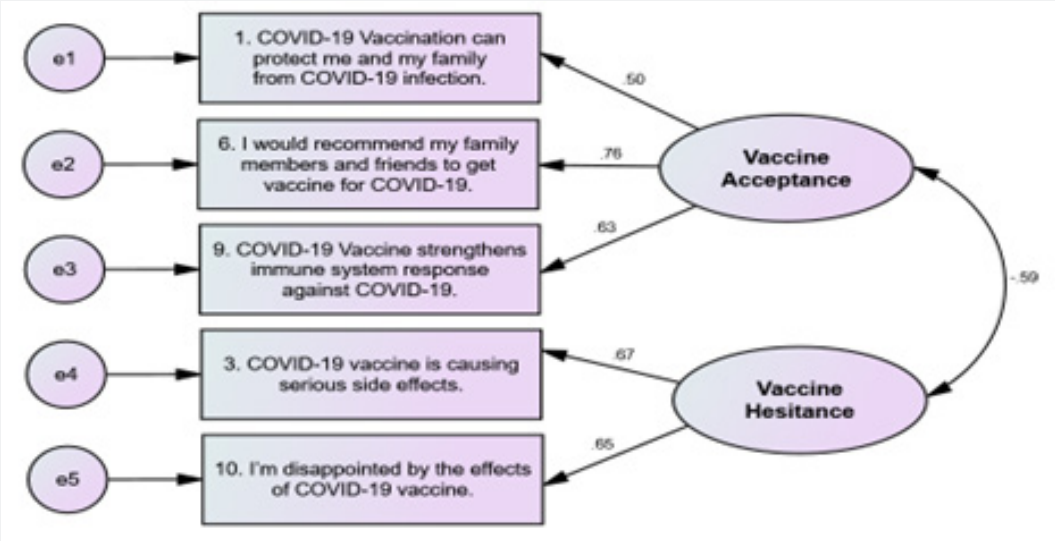

Figure 1: Standardized factor loadings and correlations among vaccine acceptance and vaccine hesitance.

Part II: Concerns towards COVID-19 Vaccination

Exploratory Factor Analysis

For the Second Part of the Scale, KMO test value was middling i.e. .759 [18] and Bartlett's test was also significant ($\chi 2 = 703.50$, $p = 0.000$). 'COVID-19 vaccine will make me impotent/infertile' was omitted due to loading on the wrong dimension. 'COVID-19 vaccine may reduce my life expectancy' and 'COVID-19 vaccine may increase the risk of being infected with COVID-19 viruses were deleted due to high cross loading. Further, eight items designed to measure economic and psychological concerns were also omitted due to very low factor loading. There were three factors with Eigenvalues >1 as shown in scree plot and those exceeded their parallel factors' average eigenvalues.

Table 5: Factor loadings, communalities and internal consistency results for concerns related to COVID-19 vaccine.

Items	F1	F2	F3	Communality	Factor Name	Mean (SD)	Cronbach's α
COVID-19 vaccine contains the ingredients that are not permitted in my religion	0.748			0.408	Religious Concerns	1.863 (1.025)	0.785
Religious rituals may protect me from COVID-19 infection than the vaccine.	0.68			0.581			
After COVID-19 vaccination, I won't be able to perform my routine religious rituals.	0.65			0.512			
My religious beliefs don't permit me to take vaccine.	0.607			0.489			
COVID-19 vaccine will bring my social life back to its earlier state.		0.728		0.415	Social Concerns	2.456	0.714
COVID-19 vaccine will help me enjoy social gatherings.		0.641		0.55		-1.024	
COVID-19 vaccine will make me more connected with people around me.		0.64		0.414			
COVID-19 vaccine may increase the risk of heart disease.			0.705	0.496	Health Concerns	2.258	0.699
COVID-19 vaccine may cause diabetes.			0.655	0.58		-0.882	

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The PAF method revealed the three factors explained 27.70%, 15.76%, and 5.93% of variance and 49.39% of total variance. After examining the content of the items, first factor (F1) was named as the 'religious concerns', second factor (F2) as the 'social concerns' and third factor (F3) as health concerns. The items best reflected underlying subscales were retained regardless of the direction of their wording. The association amongst the subscales was examined and it was found that they had weak to moderate correlation with each other (r's ranging from .239 to .529) indicate that concerns are unaffected by each other (Table 5).

Confirmatory Factor Analysis

The CFA was conducted in AMOS to validate three factor structures about concerns related to COVID-19 vaccination. The KMO test results (.767, i.e., middling) supported the adequacy of the sample size [16] and Bartlett's test (χ = .758.623, p = .000) was significant too. Statements such as 'My religious beliefs don't permit me to take vaccine' and 'Religious rituals may protect me from COVID-19 infection than the vaccine' were omitted from the model before assessing the model fit because >1 standardized residual covariance. Inter correlation between the factors was less than .50. The religious concerns explained highest i.e., 28.49% variance, followed by social concern (15.75%) and health concern (7.43%). The total variance explained by these three factors was 51.66%. The model fit indices revealed that the values of GFI, AGFI, NFI and RFI are more than .95. The values of CFI and IFI are exactly 1.00. Further, RMSEA is less than .05 i.e., .000 and PCLOSE value is .927 (Table 6 & 7) (Figure 2).

Table 6: Factor loadings, communalities and internal consistency results for concerns related to COVID-19 vaccine.

Items	F1	F2	F3	Commu-nality	Factor Name	Mean (SD)
COVID-19 vaccine contains the ingredient that are not permitted in my religion	0.75			0.602	Religious Concerns	1.884 (0.996)
After COVID-19 vaccination, I won't be able to perform my routine religious rituals.	0.693			0.603		
COVID-19 vaccine will bring my social life back to its earlier state.		0.716		0.418	Social Concerns	2.46 (0.990)
COVID-19 vaccine will help me enjoy social gatherings.		0.641		0.519		
COVID-19 vaccine will make me more connected with people around me.		0.625		0.397		
COVID-19 vaccine may increase the risk of heart disease.			0.761	0.617	Health Concerns	2.29 (0.856)
COVID-19 vaccine may cause diabetes.			0.637	0.474		

Table 7: The goodness of fit indexes for concerns related to COVID-19 vaccine.

x^2	GFI	AGFI	NFI	CFI	RFI	IFI	RMSEA	PCLOSE
9.685	0.991	0.978	0.977	1	0.957	1	0	0.927

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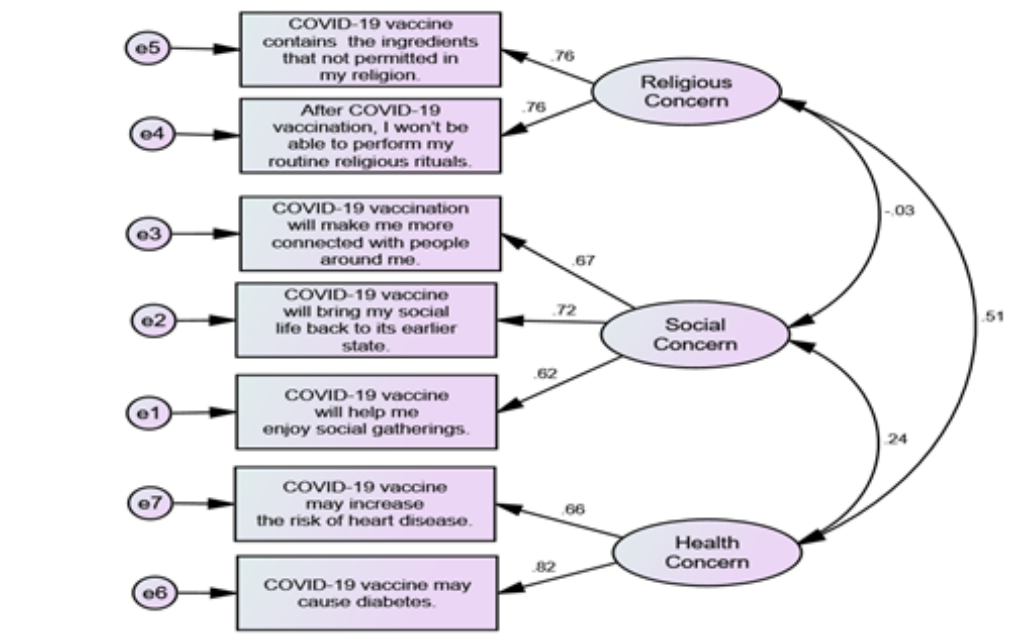

Figure 2: Standardized factor loadings and correlations among religious, social and health concern.

Figure 2 denotes the graphical representation of the standardized factor loadings and correlations among religious, social and health concern. The figure indicated that all the loadings were positive and higher than .60. The correlation between the religious concerns and health concern was moderately positive (r = .51) and significant (p = 0.05) and the relationship between social concern and health concern (r = .24) was also significant at .05.

Conclusion

This 12-items scale is a short, simple, valid, reliable and easy to administer measure of attitudes and concerns toward COVID-19 vaccination. The scale measures vaccine acceptance, vaccine hesitance, religious, social and health concerns related COVID-19 vaccination.

Acknowledgement

We are thankful to the experts for their contribution in item development and content validation phase. We are also thankful to the participants for their valuable feedback during semantic validation phase.

Attitude & Concerns toward COVID-19 Vaccine Scale

Description

This 12-items five points Likert type scale was developed to assess the general attitude and concerns of adults towards COVID-19 vaccine. This scale is divided into two parts; five items in first part measures general attitude towards COVID-19 vaccine i.e., acceptance and hesitance of vaccine, whereas seven items in second part measures three types of concerns, namely, religious, social and health concerns, related to COVID-19 vaccine. The scale easy to administer either individually or in a group, in both face-to-face and online mode. The administration and scoring can be completed within five minutes. With it good and acceptable reliability, the scale can be used for the research purpose. The Cronbach alpha for the subscale ranges from Vaccine Acceptance .825, Vaccine Hesitance .721, Religious Concerns .785, Social Concerns .714, and Health Concerns .699.

Scoring Guidelines: (Table 8 & 9)

Instructions

This scale is intended to study how you think about COVID-19 vaccine. Read each statement carefully and choose appropriate option to indicate what you think about each of these statements. There is no 'RIGHT' or 'WRONG' answer.

a) If you 'Strongly Disagree' with the statement, select "Strongly Disagree".

b) If you 'Disagree' with the statement, select "Disagree".

c) If you 'Neither Agree or Disagree' with the statement, select "Neutral".

d) If you 'Agree' with the statement, select "Agree".

e) If you 'Strongly Agree' with the statement, select "Strongly Agree" (Table 10).

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Table 8: Scoring of an individual item.

Statement Number	Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1, 3, 4, 7, 9, 11, 12	1	2	3	4	5
2, 5, 6, 8, 10	5	4	3	2	1

Table 9: Calculation of scores for subscales.

Scale No.	Subscale	Statement Number	Scale Score Range	Description
I	Vaccine Acceptance	1, 3, 4	15-Mar	Higher the score, higher the acceptance of vaccine
II	Vaccine Hesitance	2, 5	10-Feb	Higher the score, higher the resistance to get vaccinated
III	Religious Concerns	7, 12	10-Feb	Higher the score, higher the religious concerns related to COVID-19 vaccine
IV	Social Concerns	6, 8, 10	15-Mar	Higher the score, higher the social concerns
V	Health Concerns	9, 11	10-Feb	Higher the score, higher the health concerns related to COVID-19 vaccine

Table 10: Instructions.

Sr. No.	Statement	Responses				
		Strongly Disagree	Disagree	Neutral	Agree	Strongly Agree
1	COVID-19 Vaccination can protect me and my family from COVID-19 infection.					
2	COVID-19 vaccine is causing serious side effects.					
3	I would recommend my family members and friends to get vaccine for COVID-19.					
4	COVID-19 Vaccine strengthens immune system response against COVID-19.					
5	I'm disappointed by the effects of COVID-19 vaccine.					
6	COVID-19 vaccination will make me more connected with people around me.					
7	COVID-19 vaccine contains the ingredients that not permitted in my religion.					
8	COVID-19 vaccine will bring my social life back to its earlier state.					
9	COVID-19 vaccine may increase the risk of heart disease.					
10	COVID-19 vaccine will help me enjoy social gatherings.					
11	COVID-19 vaccine may cause diabetes.					
12	After COVID-19 vaccination, I won't be able to perform my routine religious rituals.					

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