

Development and standardization of a COVID-19 Vaccination Anxiety scale for Adult Urban Indian Population (CVAS-A)

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ABSTRACT

Given the ongoing COVID-19 vaccination drive across the globe, a significant amount of confusion, mistrust, misunderstanding, and hesitancy had surfaced regarding the vaccine. A standardized tool to understand the possible reasons of COVID-19 vaccination anxiety and hesitancy would be valuable in this context. The current study aimed at developing a standardized tool to measure COVID-19 Vaccination Anxiety among Urban Indian adults. A 19-item scale was administered to an Urban adult Indian population (N = 760) between the period of February 2021– May 2021 to obtain factors associated with COVID-19 Vaccination Anxiety and establish reliability estimates of the scale. Infection-related anxiety, information-related anxiety and vaccine side-effect-related anxiety were the three factors determined through Factor Analysis. The scale was validated with Convergent and Discriminant Validity by finding correlation between the three factors of the scale and five factors of the Brief version of the Big-Five personality Inventory (extraversion, agreeableness, openness to experience, conscientiousness, and neuroticism). It is expected that a tool such as CVAS-A would help in understanding and managing COVID-19-related vaccination hesitancy.

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Introduction

Vaccinations are recognized and certified as being a very capable and economical method to support community wellness against widespread of diseases as they could significantly slash the mortality rate and despair caused due to the virus.¹ Nonetheless, vaccines are still considered as being risky and irrelevant by people in both developed and still developing nations.²

In developed countries like the USA, there was a widespread of measles in California from 2014 to 2015 due to lack of adequate vaccine coverage and 5 to 10% of the entire population reported having vaccine hesitancy.³ Another study⁴ found that 20–30% population from countries like the USA, New Zealand, Australia, and Europe had beliefs against vaccination programs and were reluctant to get vaccines. Inadequate information and knowledge resulting in unsurety toward vaccination programs around the world is now considered as the biggest threat to achieving complete vaccination coverage in the community.²

Hesitancy in taking vaccines integrates the reluctance to get vaccinated when vaccine doses have been readily made available and approachable. This is one of the most potential risks for global wellness. Vaccine reluctance has been existing amid a small ratio of individuals since decades, but it would have more detrimental effects during the current outbreak of COVID-19 as compared to before. Avoidance and reluctance of COVID-19 vaccination would create innumerable number of challenges and create considerable level of threat for individuals who do not take the vaccine and the society. The community would not be able to reach the optimum level of threshold that would help in building herd immunity amongst

individuals against COVID-19 which would further delay the process of bringing the pandemic to an end and cause more adversity and deaths. Vaccine hesitancy is prevalent, mislead, transmissible and is not only restricted to COVID-19 vaccine but is seen in other vaccinations too. Views on vaccination typically comprise a pervasive involvement that is dependent and conditioned on personal and social situations that could fluctuate with time. As COVID-19 vaccine is out now, adequate measures should be taken to analyze and investigate the possible reasons for vaccine hesitancy so that effective strategies could be developed to address this issue.⁵

It is pretty easy for humans to forget epidemic-causing diseases like smallpox, yellow fever, polio, and many more that once became the reason for death and physical impairment for millions of people worldwide. However, due to an effective immunization program, these diseases have ended effectively.^{6–12} Similar effect of vaccines could be seen in COVID-19 if vaccines are taken adequately and fairly across communities globally. The 73rd World Health Assembly (WHA) in May 2020, announced a judgment which recognized the role of being vaccinated against COVID-19 as a step toward achieving global wellness by prevention and containment of spread of the virus once secure, adequate, attainable, and economical vaccine shots are readily made available.¹³ According to a report¹⁴ by Observer Research Foundation, a lot of countries around the globe who have high number of vaccinated people have begun to advance toward the COVID-19 pandemic. Nonetheless, even when there is an overall decrease in the new infections reported and serious impacts

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of the virus on individuals lately, its risky and unsafe to consider this as an end of the pandemic. The different mutations of the COVID-19 virus and large number of unvaccinated individuals serve the virus with an opportunity of being deadly and the COVID-19 pandemic to take an uncertain and destructive route. Vaccination of all individuals should still be considered as a priority for nations.

On the other hand, an exploratory study, carried out between July and August 2020 confirmed that about 36% of the South African population displayed reluctant behavior toward taking the vaccine against COVID-19. The percentage of individuals resisting the COVID-19 Vaccine in Africa is different across countries of Africa like its 41% in Congo and 6% in Ethiopia. Most commonly people were unsure about trusting the safety of the vaccine, its effectiveness, security it would provide against COVID-19 and their busy schedules.¹⁵

Social media plays a significant role in accelerated global widespread of information which could further lead to beliefs, opinions, and wrong information going viral.^{16,17} This creates enormous confusion amongst the public, thus making it hard to decide whether something is a fact or true information has been lost amidst the noise of false beliefs. This scenario has been appropriately described by Director-General of the WHO in the month of February 2020 as he spoke about fighting against an “infodemic” and not only an “epidemic”.¹⁴ The term, “infodemic” could be correctly described as the widespread of information, opinions and beliefs which could be true or mislead about the disease. The information goes viral globally similarly like the disease with the help of social media or physical information techniques, which makes it hard for individuals to have access to factual information when its most needed.^{14,18} Misleading information could build uncertainty amongst communities regarding the vaccine, which would be detrimental as it would cause vaccine hesitancy.¹⁷

Research carried out in developed countries shows that vaccine hesitancy has majorly five determinants which are restraint (convenience), confidence or trust in the vaccine, satisfaction with the vaccine (complacency), calculated risk and cumulative/collective responsibility.^{19,20} These five components together build a framework known as the 5 C model of determinants of vaccine hesitancy. Confidence suggests faith over the safety and efficiency of the vaccine, the medical team that helps in administration of the vaccine and motivation of individuals who recognize the need of taking the vaccine.²¹ The determinant “complacency” is usually seen when individuals feel that the risk of the disease is quite low and it’s not important to be vaccinated against it.²² Restraint occurs when an individual has his/her own mental blocks that prevent from taking the vaccine. Calculated risk is a determinant that occurs when an individual intentionally compares between the threat from the vaccine or risk of being infected which lets them decide whether they would take the vaccine or avoid taking it. High scores on risk calculation denotes that the person perceives the vaccine to be riskier than the infection itself. The last determinant suggests the sense of collective responsibility that a person has toward the safety of other around him and hence decides to take the vaccine in order to help the world move toward building herd-immunity against the disease.²⁰

Rationale of the study

The study was carried out recognizing the need to assess COVID-19 Vaccination Anxiety since there were a significant number of adults displaying vaccination hesitancy and bias due to various reasons. The scale development was initiated to understand the possible reasons causing the resistance toward the vaccine in an Urban Adult Indian population.

Materials and methods

Aim of the study

The study aimed at developing a standardized tool to measure COVID-19 Vaccination Anxiety among Urban Indian adults.

Objectives

- To develop a standardized tool for measuring COVID-19 Vaccination Anxiety.
- To explore possible reasons for vaccine hesitancy and bias.

Operational definition

COVID-19 Vaccination Anxiety: The uncertainty and fear experienced by individuals about the possible negative impacts that the COVID-19 vaccine could have on their or their loved one’s physical health.

Inclusion criteria

- Individuals must be Indian residents.
- The individual should be eligible for the vaccination i.e., over 18 years of age.
- The individual must have a formal education and English proficiency.
- Individuals should have access to the Internet.

Description of the tool

The scale comprised of questions that helped analyze attitude toward the vaccine and possible reasons for individuals to feel anxious about it like “I would rather wait and hear experiences of more people than take the vaccine now”. The questions are developed in a likert scale format where the participants have to choose one option among “Not at all suitable, Not suitable, neutral, suitable and very suitable” according to what fits their situation best. The questions in the scale were developed to understand the possible reasons and determine factors for COVID-19 vaccination anxiety among the Urban Indian adult population. The items of the tool have followed a unidirectional pattern to facilitate understanding and avoid any confusion regarding items and make it simpler and easier to fill as the scale was developed using google forms and was sent out to participants through various social media platforms. Due to the large sample size and an online survey

method design, the researchers could not commit their availability to all participants to solve queries over each item of the scale.

Procedure followed for scale development

Step-1: Item pool creation by primary authors based on literature review and field observation

In the first step for tool development, the primary authors constructed items to measure COVID-19 vaccination anxiety depending on a thorough study of the literature and knowledge through appropriate experience in the field of mental health. The scale was developed into a google form to have a better reach to people during the ongoing pandemic and to follow the safety protocol of COVID-19. An introductory video²³ was added to the Google form²⁴ to better explain the research.

Step-2: Item pool reviewed by an expert panel: we selected an independent panel of experts blinded to one another

The scale was sent out to 11 experts in a google form format for suggestions. Out of 11 experts, 4 hold a doctorate degree in psychology, 3 hold an MD in Psychiatry and the rest 4 have a qualification of MPhil in Clinical Psychology. The panel of experts on an average had an experience of 5–10 years in the discipline of mental health. The 11 people experts were asked to review, give their suggestions on the questionnaire, and add or delete any question they felt was necessary.

Step-3: Final item selection

Post the comments and suggestion received by the experts, the changes were incorporated in the scale for a reliable and valid development. Keeping in mind the suggestions from the experts, five items were deleted from scale. The changes were incorporated effectively.

Study design

The current study is centered around a psychometric scale development and questionnaire online survey design.

Sample selection

The data were collected through purposive and convenience sampling method. The total data collected was 790 but the data considered for the study post data cleaning was 760. The participants resided in different states of India and received the questionnaire as a Google form through different platforms of social media.

Data collection

The data were collected from individuals between the period of February 2021-May 2021 across different states in India by sending the questionnaire (converted into a google form) through different Social Media platforms like WhatsApp, Instagram, and Facebook. People were asked to fill the questionnaire after seeing the short video clip²³ attached with the form to better understand the aim of the research.

Ethical guidelines

Confidentiality, privacy, and voluntary consent were the ethical procedures complied to during the current research. The participants reserved the right to leave the study at any time without having to face any repercussions. A short video along with the informed consent form was utilized to facilitate the consent procedure.

Results

To achieve the aim and objectives of the current study, a rigorous attempt was made to collect data from a socio-demographically varied Indian population as shown in [Table 1](#)

The sample was analyzed for adequacy of Factor Analysis through KMO and Barlett's test. The KMO value of .953 was found significant ($p < .001$) and confirmed sample adequacy to carry out factor analysis with the data. The Bartlett value was found to be 7170.575 which was found significant at the .001 level ($p = .001$). The Exploratory factor analysis was carried out to fulfill the aim of the study which was to develop a standardized tool to measure COVID-19 vaccination anxiety among people.

The 19 items were analyzed through factor analysis to derive major factors that the questions could be covered under.

Through communalities, the common variance of each item on the scale was measured. A scale consisting of 19 items (excluding the demographic questions and the big five personality inventory) was administered on 760 adults residing in different parts of India.

Through Factor analysis and Rotated Matrix three factors were identified. The three factors identified through factor analysis explain 57% of the variance in the total data. In [Table 2](#), loading of each factor ($>.50$) recognized has been mentioned in a descending order. The factor loading makes the statements easily identifiable with the factor associated with them.

Analysis for reliability

To test the reliability of the items in the scale Cronbach alpha was applied to the 19 items of the scale. The coefficient alpha was found to be .933 for the entire scale which makes the scale highly reliable. The reliability for each of the 3 factors i.e., Vaccine side-effect-related anxiety was .913, infection-related anxiety was .814 and Information-related anxiety was .787. All values were found supporting the reliability of the scale and individual factors.

Analysis for validity

Convergent and Discriminant Validity: To derive validity of the scale, a correlation matrix was carried out (as shown in [Table 3](#)) between the three factors and total anxiety score and extraversion, openness to experience, agreeableness, conscientiousness, and neuroticism included in the fourth section of the scale to help understand whether the items on the scale are valid enough to test anxiety by correlating them with factors that should or should not cause anxiety in the personality scale.

Table 1. Demographic details of the participants.

Demographic Category	Age	Gender	Religion	Marital Status	State	Education
18–25 years	385 (50.6%)					
26 and above	375 (49.3%)					
Male		300 (39.4%)				
Female		458 (60.2%)				
Hindu			516 (67.8%)			
Muslim			114 (15%)			
Sikh			45 (5.9%)			
Christian			56 (7.3%)			
Others			29 (3.8%)			
Married				231 (30.3%)		
Unmarried				513 (67.5%)		
Others				16 (2.2%)		
Delhi NCR					406 (53.4%)	
Other states					354 (46.6%)	
Undergraduate						409 (53.8%)
Postgraduate and above						351 (46.2%)

Table 2. Extraction method: principal component analysis through Rotated Matrix, factors found through factor analysis, communalities, and variance.

	Factors			
	Vaccine Side Effect Related Anxiety	COVID-19 Infection Related Anxiety	Information Related Anxiety	Comm (h ²)
I am unable to convince myself to take the vaccine due to fear of the worst happening.	.740			.705
There are serious consequences that are associated with taking the vaccine.	.739			.664
It makes me nervous to take a decision whether I should get my parents vaccinated.	.697			.636
Some people I know have got the vaccine and complained of side effects which makes me more fearful.	.689			.608
I feel the COVID-19 Vaccine contains unknown substances which can harm my body.	.655			.620
I feel the vaccine does not work.	.653			.593
I would rather wait and hear experiences of more people than take the vaccine now.	.649			.624
I am not sure whether I would get my children vaccinated when the Vaccine is made available for them.	.598			.522
I have heard of people getting contaminated with COVID-19 Virus even after the vaccine which causes worry.		.668		.532
I feel I will contract the virus if I visit the hospital to get vaccinated as it is a highly contaminated zone.		.641		.480
With rising forms of mutants of the virus, it's difficult to say which vaccine would give better protection.		.592		.545
Its distressing to find out that females might experience problems with their reproductive health after taking the Vaccine.		.572		.475
I fear getting vaccinated from frontline workers/doctors as they are the most exposed to the virus.		.569		.556
There is a concern whether I need to get tested for COVID-19 before taking the jab (Vaccine) as individuals who are suffering or have just recovered from it cannot take the vaccine.		.551		.466
In my social circle, I know people who are scared and skeptical about the COVID-19 Vaccine which creates fear in my mind.		.524		.424
The unsurety regarding the better vaccine causes confusion in my mind.			.715	.669
Lack of genuine information on the media has created feelings of confusion and fear.			.708	.554
The lack of adequate information about COVID-19 Vaccine and its side-effects causes me to feel uneasy.			.693	.698
The information about COVID-19 Vaccine side effects makes me feel overwhelmed.			.547	.500
Eigenvalue	4.785	3.313	2.771	
Percentage of variance	25.186	17.436	14.586	
Cumulative percentage of variance	25.186	42.622	57.208	

There was a significant negative correlation found between Extraversion and all three factors of the scale, negative correlation between Agreeableness and two factors of the scale namely vaccine side-effect-related anxiety and infection-related anxiety, no correlation between conscientiousness and any of the three factors, significant positive correlation between neuroticism and all three factors of the scale and no correlation between openness to experience and any three factors of the scale. These correlations were found significant enough to justify convergent and discriminant validity of the scale.

Norms for the administration of the scale

Scores below 46 on the scale would be conclusive of low COVID-19 vaccine anxiety, 47–61 would be conclusive of moderate anxiety and 62 and higher scores would indicate high anxiety as depicted in Table 4. COVID-19 vaccination anxiety could be rated as low, moderate, and high as the scale has been developed for use on the non-clinical population of India and COVID-19 vaccination anxiety is a situation-based anxiety which is very likely to subside once the circumstances change. The scale has been developed for the lay population of India and has not been compared to clinical population.

Table 3. Correlation between factors of the scale and factors of a personality test.

	Extraversion	Openness to experience	Agreeableness	Conscientiousness	Neuroticism
Information Related Anxiety	-.114*	.051	-.077	-.041	.150*
Vaccine Side-Effect-Related Anxiety	-.179*	-.008	-.145*	-.047	.130*
COVID-19 Infection Related Anxiety	-.128*	.011	-.104*	-.036	.153*
Total	-.163*	.012	-.128*	-.046	.155*

*0.05 level of significance.

Table 4. Norms for the scale.

Category	Percentile Rank	Information Related Anxiety (Raw Score)	Vaccine Side-Effect-Related Anxiety (Raw Score)	Covid-19 Infection Related Anxiety (Raw Score)	Total
Low	0 to 30	Less than 11	Less than 15	Less than 19	Less than 46
Moderate	31 to 70	12 to 14	16 to 23	20 to 24	47 to 61
High	71 to 100	15 and above	24 and above	25 and above	62 and above

The norm values have been set (Below 46: Low COVID-19 vaccine anxiety, 47-61: moderate COVID-19 vaccine hesitancy and above 62: High COVID-19 vaccine hesitancy) according to the percentile ranks.

Discussion

The prime contribution of this study is the construction and development of a standardized tool for measuring COVID-19 vaccination anxiety (CVAS-A) in adult Indian population. The development of CVAS-A represents a significant potential toward mitigating vaccination hesitancy through a detailed understanding of beliefs and attitudes of people about the COVID-19 vaccine. The data collection for the present study was done between the period of February–May 2021. India began its vaccination drive on the 16 January 2021²⁵ but according to a study²⁶ India had only fully vaccinated 2.1% of its entire population by 4 May 2021 which is a very low number keeping in mind the large population of India. The study also suggests that India should work around building effective strategies and mitigations that could help speed up the process of vaccination to battle COVID-19 effectively.

The items of CVAS-A have been developed by the three authors of the study for the urban Indian adult population relying on their thorough understanding of the collectivistic Indian family setup. The items such as “*It makes me nervous to take a decision whether I should get my parents vaccinated*” and “*I am not sure whether I would get my children vaccinated when the Vaccine is made available for them*” have been added to the scale keeping in mind the collectivistic family setup of India where decisions are usually taken by mutual understanding and agreement. A study²⁷ conducted over understanding the mind-set of Indian families toward treatment suggests that Indian families are very close knit and decisions regarding career, future or treatment plans for a family member are made collectively over a mutual understanding and agreement. In a country like India, that follows the hierarchic system of power and family setup, usually decisions of the family are taken by men, wise aged individuals or someone who is superior in qualification or has a set of respectable qualities.²⁸ Hence, these items have been included in the scale keeping in mind that elder parents in India usually depend on their elder children for deciding for them.

Studies^{29,30} in the Indian context have reported that the elder male child of the family is responsible to provide care for his elder parents and elder parents in India usually live with their elder male child and his family.

The results of the current study demonstrate that the CVAS-A measures COVID-19 Vaccination anxiety based on three factors, namely, Vaccine side-effect-related anxiety, Infection related anxiety and information related anxiety. The coefficient alpha was found to be significantly high for the entire scale and establishes the internal consistency of the scale. The validity of CVAS-A was tested against the five factors of the brief NEO-PI, namely, extraversion, openness to experience, agreeableness, conscientiousness, and neuroticism using convergent and discriminant validity. Neuroticism is the vulnerability of an individual to mental health disorders like anxiety, mood, and depression.³¹ Higher the neuroticism higher the vulnerability to mental health disorders. This factor showed a significant positive correlation with all three factors of CVAS-A which justifies the convergent validity of the scale. Extraversion encompasses the social involvement and characteristics of an individual.³² It is negatively correlated with each of the three factors of CVAS-A i.e., an individual is likely to experience more anxiety if they are less socially involved and score lower on extraversion. Another factor, Agreeableness has shown negative correlation with Vaccine side-effect-related anxiety and infection related anxiety. Whereas openness to experience and conscientiousness had no correlation with any three factors of the CVAS-A as conscientiousness and openness to experience have no relationship with anxiety per se. The five factors of the big-five personality inventory were correlated with the three factors of the CVAS-A to understand whether the factors that could or could not cause anxiety on the big-five personality inventory had any correlation with the three factors of CVAS-A that helped determine Convergent and Discriminant validity of the scale.

CVAS-A was found to have a high validity and internal consistency. The validity and reliability of a scale are factors that are dependent upon the nature of the items of the scale. The convergent and discriminant validity of CVAS-A was determined through finding correlation with the NEO-PI³³ Scale which itself has a high coefficient alpha value of .86 to .95 for both self and observer and has been validated with the help of convergent and discriminant validity.

It is expected that a tool such as CVAS-A would help in understanding and managing COVID-19 related vaccination hesitancy. CVAS-A cannot be generalized to the entire adult population of India as the scale has been developed in English and requires the participant to have access to the internet. According to the 2011 about 10% population of India can speak in English, and the Lok foundation survey conducted in India has reported that people living in urban areas of India are more literate in English (about 12%) as compared to the rural population (roughly 3%). A report³⁴ on statistics of Indian internet users suggests that in the year 2020, roughly about 45% of Indians had access to the Internet and Delhi-NCR reported having the highest number of internet users in India.

An exploratory study³⁵ conducted on understanding the vaccine hesitancy in India reported alarming results of approximately 70% of the participants having some concerns regarding the COVID-19 vaccine. A report³⁶ and few studies^{37,38} have suggested that the most prominent reason for hesitancy in Indians toward the COVID-19 vaccine is the anxiety toward the unknown possible side-effects that the vaccine could have on their bodies and how safe and reliable are the vaccines that are currently available in India. The current study observed similar results as participants reported feeling concerned about the possible side-effects the vaccine could have and whether they were reliable and safe enough for use. According to a report³⁹ involving healthcare professionals in helping individuals and communities in India to clear their doubts and concerns regarding the vaccine through telephonic conversations could encourage individuals even in the urban parts of the country to uptake the vaccine. Healthcare professionals could discuss the importance and advantage of taking the vaccine and help individuals by listening empathetically to their concerns which would calm their anxieties toward the vaccine.

Limitations of the study

Individuals without a formal education, absence of English proficiency as well as those lacking internet access could not be included as the data collection was done online and the tool was developed in English language. Another limitation is that the participants of the study were predominantly female and Delhi-NCR residents. The convenience sampling technique may be a limitation to the current research.

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