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Research Paper

Examining Psychological Characteristics and Attitudes towards Vaccination During the Pandemic: Implications for Public Health Development

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ABSTRACT

Vaccine hesitancy has been declared a threat to global health, and with the rampant spread of the deadly pandemic, the need for swift and widespread vaccine uptake is the need of the hour. Several factors affect the reasons behind the acceptance or rejection of vaccines. This study intends to examine the significant association between the factors of personality and factors of vaccine hesitancy. The online survey was conducted with a sample of 100 Indian citizens from the city of Mumbai who were 18-59 years of age. The study sample included adults aged 18-59 from Mumbai region, India. The Big 5 inventory was used as a personality measure and the 5C Scale was used to measure the factors of vaccine hesitancy. Results showed that openness had a weak negative relationship with Constraints and a weak positive relationship with Calculation. Data also showed that conscientiousness had a weak association with Complacency and a weak positive relationship with Calculation. Extraversion had a moderate negative relationship with Complacency. There was a significant relationship between neuroticism and complacency. Regression analyses showed that openness as a significant predictor of Calculation and extraversion as a significant predictor of Complacency. Regression analyses also showed that agreeableness as a significant predictor of Constraints Confidence, Collective responsibility and neuroticism as a significant predictor of complacency. The factors of personality and the factors vaccine hesitancy does show significant relations with each other. This information can be useful when developing campaigns for vaccine uptake and awareness. Implications and future scope for research is discussed.

Keywords: *Personality Factors, Vaccine hesitancy, Adults, Mumbai region and Pandemic.*

The deadly Coronavirus (COVID-19) is continuing to spread around the world, with more than 160 million confirmed cases and three million deaths across nearly 200 countries. High vaccine coverage is needed to flatten the curve of the Coronavirus

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pandemic (Al-Mohaithef & Padhi, 2020). The World Health Organization in 2019 (WHO) listed the anti-vaccination movements as one of ten biggest health threats to endanger global health. (World Health Organization, 2019)

The importance of identifying, describing, and understanding vaccine hesitant individuals as a key preparatory step for vaccine development is further emphasized by the World Health Organization's Strategic Advisory Group of Experts (SAGE) on Immunisation. (MacDonald NE, 2015)

In the past, public service campaigns that advocate a variety of health behaviours have benefitted from psychologically oriented approaches. (Rothman et al., 2003, Salovey & Wegener, 2003, Salovey & William-Piehota, 2004)

Around 12 per cent of India's unvaccinated population doesn't intend to take the Covid-19 vaccine "at all" even as the country faces the prospect of a third wave, a new survey report by Local Circles, an India-based polling company said. Twenty-four per cent don't plan to take the vaccine yet as they are not convinced about whether the currently available vaccines provide enough protection from the latest and future variants. They may opt for vaccination if more data, or if different vaccines become available, the survey showed.

Moreover, 23 percent respondents said a prevailing medical condition prevents them from taking the vaccine while another 12 per cent said they don't plan to take a shot yet amid concerns over side effects. In a statement released with the survey findings, Local Circles projected its findings on to the Indian population to claim that 33 crore people in the country are not inclined to take the vaccine. (Local Circles, 2021) This could prove very dangerous as experts are already speculating the third wave to hit India in the months of August-December with an even more infectious variant called the Delta Plus. (Bedi A, 2021)

Much of the existing literature on vaccine hesitancy and resistance focuses on the explicit reasons individuals provide for their opposition to a particular vaccine or to vaccination programmes in general (Larson et al, 2014), (Schmid et al, 2017), (Marti et al, 2017), (Siddiqui et al, 2013). Although useful, this information is limited in terms of its ability to explain why individuals come to their respective epistemological positions (Hornsey et al, 2018) A more informative approach may be to identify the psychological processes that characterize and distinguish vaccine hesitant and resistant individuals from those who are receptive to vaccines; (Hornsey et al, 2017). Doing so not only helps to account for why vaccine hesitant and resistant individuals come to hold the specific beliefs that they do, but it may also provide an opportunity to tailor public health messages in ways that are consistent with these individuals' psychological dispositions.

Theoretical models of health beliefs and risk perception are important for understanding the factors behind decision-making by assessing what motivates and inhibits people to adopt health-related behavior. The Health Belief Model (HBM) has been extensively used in the context of vaccination, particularly influenza vaccination (Bish A et al., 2011, Kan T & Zhang J. 2018, Rosenstock, 1988) According to the HBM model, the intention to get an influenza vaccine relies on a number of factors, including perceived susceptibility and perceived severity, which means perception of the threat, as well as perceived benefits and perceived barriers as a function of outcome expectation and cues to action, and self-efficacy.

In studies documenting personality factors and vaccination it was found that higher levels of neuroticism was negatively related to vaccine endorsement whereas higher agreeableness and conscientiousness related to higher levels of vaccine confidence. (Piedmont, 2014), (Lee et al., 2017), (Joyner et al., 2018), (Lin et al.,2020) (Murphy et al., 2021) Openness has had contradictory results, with two studies relating it to lower vaccine endorsement (Lee CHJ et al., 2017) (Browne M et al., 2015), and one relating it to higher benefits of vaccination (Lin, FY., Wang, CH, 2020). Extraversion was positively related to health behaviors (Joyner et al.,2018)

METHODOLOGY

Correlational Research Design was employed for present research study. Correlational research is a type of research method that involves observing two variables in order to establish a statistically corresponding relationship between them.

Study Sample

Data was collected using purposive sampling technique. The survey was sent out to adults from the Mumbai region aged 18-59 and that had no medical comorbidities. This was done in order to eliminate the effect of age and medical comorbidities on vaccination hesitancy and vaccination intent. Senior citizens (60+ years of age) and people with medical comorbidities may have biased views towards vaccination since they are at higher risk of contracting COVID-19 or having a severe case of it. 144 responses were received in total. Out of the initial 144 responses collected, 21 responses were removed on grounds of outliers that were detected by boxplots. The presence of extreme outliers could affect the data analysis results, so they were removed which left 123 responses left for analysis.

The survey was created using Google forms, and the link was circulated via various networks such as WhatsApp and Instagram. The form contained an informed consent section, wherein the participants were informed of the basic aspects of the study and about how there were no risks involved and confidentiality would be maintained. After the survey, the participants were debriefed, informing them of the purpose of the study.

Table 1. Demographic details

Variable	n	%	M	SD
Gender			1.54	.519
Male	61	29.5		
Female	61	29.5		
Prefer not to say	1	0.8		
Age			2.96	1.672
18-24	49	39.8		
25-34	3	2.4		
35-44	8	6.5		
45-54	36	29.3		
55-59	27	22		
Vaccine Intent			2.51	.82
Yes/Already got it	87	70.7		
No	29	5.7		
Maybe	7	23.6		

N= 123, M= Mean, SD= Standard Deviation

Measures

1. 5C Scale- For the factors of vaccine hesitancy the 5C scale was used (Betsch, Schmid, et al., 2018) includes 15 items which tap five psychological antecedents of vaccination: confidence, complacency, constraints, calculation, and collective responsibility. The 5C scale evaluates five psychological antecedents to vaccination and offers insight into human mental representations, attitudes, and behavioral patterns that are influenced by the respondent's environment and background.

2. Big Five Inventory- For the factors of personality, the Big Five Inventory (BFI; John et al., 1991) was used. The BFI is a 44-item assessment of five primary personality traits – Openness, Extraversion, Agreeableness, Conscientiousness, and Neuroticism. The participants respond on a 5-point Likert-type scale (1=strongly disagree, 5=strongly agree).

Statistical Analysis

All statistical analyses were conducted on IBM SPSS Statistics trial version 21.

Data Screening

Out of the initial 144 responses collected, 21 responses were removed on grounds of outliers that were detected by boxplots. The presence of extreme outliers could affect the data analysis results, so they were removed which left 123 responses left for analysis.

Descriptive statistics were performed. (Table 1)

Then inferential statistics of correlation were done. As the distributions did not meet normality assumptions even after outlier removal and other transformation techniques, non-parametric procedures were decided upon. For correlation between the factors of the two scales, Spearman's rank correlations were conducted which measures the monotonic relationship between variables.

RESULTS

Table 2 Correlation of personality factors and factors of vaccine hesitancy

Variable	M	SD	Confidence	Complacency	Constraints	Calculation	Collective Responsibility
Openness	3.46	.44	-.055	.139	-.195*	.229*	.152
Conscientiousness	3.65	.63	.136	-.187*	-.101	.190*	.030
Extraversion	3.57	.73	-.035	-.483**	-.040	.048	.081
Agreeableness	3.58	.58	.244*	-.188*	-.280**	.047	.199*
Neuroticism	2.81	.84	-.091	.479**	.158	-.102	-.007

N=123 Note ** Correlation is significant at the 0.01 level (two tailed) * Correlation is significant at the 0.05 level (two tailed) M= mean, SD= standard deviation

After testing for assumptions, Ordinary least squares regression was performed on the significant correlations, the significant results obtained are shown below.

Table 3 Regression analysis of Openness predicting Calculation

Variable	B	95% CI [LL, UL]	β	t	p
constant	3.715	.149,.986	.237	5.040	<0.001
openness	.568			2.684	.008

R^2= 0.56 (N=123, p=0.008[b], CI= confidence interval for B, LL, UL indicate lower limit and upper limit respectively)

The R^2 value indicates how much of the total variation in the dependent variable, Calculation, can be explained by the independent variable, Openness. In this case, 56% can be explained, which is a large portion of the variance. The p value is 0.008, which is less than 0.01, indicates that, overall, the regression model statistically significantly predicts the outcome variable (i.e., it is a good fit for the data).

Table 4 Regression analysis of Conscientiousness predicting Complacency

Variable	B	95% CI [LL, UL]	β	t	p
constant	3.615			11.471	<0.001
Conscientiousness	-.185	-.353,-.016	-.194	-2.172	.032

R^2=.038 (N=123, p=0.032[b], CI= confidence interval for B, LL, UL indicate lower limit and upper limit respectively)

The R^2 value indicates how much of the total variation in the dependent variable, Complacency, can be explained by the independent variable, Conscientiousness. In this case, 3.8% can be explained, which is a small portion of the variance. The p 0.32, which is less than 0.05, which indicates that, overall, the regression model statistically significantly predicts the outcome variable (i.e., it is a good fit for the data).

Table 5 Regression analysis of Extraversion predicting Complacency

Variable	B	95% CI [LL, UL]	β	t	p
constant	4.357			18	<0.001
extraversion	-.396	-.528,-.265	-.477	-5.97	<0.001

R^2= .228 (N=123, p=<0.001[b], CI= confidence intervals for B, LL, UL indicate lower limit and upper limit respectively)

The R^2 value indicates how much of the total variation in the dependent variable, Complacency, can be explained by the independent variable, Extraversion. In this case, 22.8% can be explained, which is a moderate portion of the variance. The p <0.001, which is less than 0.01, which indicates that, overall, the regression model statistically significantly predicts the outcome variable (i.e., it is a good fit for the data).

Table 6 Regression analysis of Agreeableness predicting Constraints

Variable	B	95% CI [LL, UL]	β	t	p
constant	4.074			6.263	<0.01
Agreeableness	-.548	-.893,-.203	-.275	-3.143	.002

R^2= 0.75 (N=123, p=0.002[b], CI= confidence intervals for B, LL, UL indicate lower limit and upper limit respectively)

The R^2 value indicates how much of the total variation in the dependent variable, Constraints, can be explained by the independent variable, Agreeableness. In this case, 75% can be explained, which is a large portion of the variance. The p level is 0.002, which is less than 0.01, which indicates that, overall, the regression model statistically significantly predicts the outcome variable (i.e., it is a good fit for the data).

Table 7 Regression analysis of Agreeableness predicting Confidence

Variable	B	95% CI [LL, UL]	β	t	p
constant	3.031			3.919	<0.001
Agreeableness	.562	.151,.972	.239	2.709	.008

R^2= 0.57 (N=123, p=.008[b], CI= confidence intervals for B, LL, UL indicate lower limit and upper limit respectively)

The R^2 value indicates how much of the total variation in the dependent variable, Confidence, can be explained by the independent variable, Agreeableness. In this case, 57% can be explained, which is a large portion of the variance. The p level is 0.008, which is less than 0.01, which indicates that, overall, the regression model statistically significantly predicts the outcome variable (i.e., it is a good fit for the data).

Table 8 Regression analysis of Agreeableness predicting Collective Responsibility

Variable	B	95% CI [LL, UL]	β	t	p
constant	4.587			6.912	<0.001
Agreeableness	.398	.045,.750	.199	2.234	.027

R^2=0.40 (N=123, p=0.27[b], CI= confidence intervals for B, LL, UL indicate lower limit and upper limit respectively)

The R^2 value indicates how much of the total variation in the dependent variable, Collective Responsibility, can be explained by the independent variable, Agreeableness. In this case, 40% can be explained, which is a moderate portion of the variance. The p level is 0.027, which is less than 0.05, which indicates that, overall, the regression model statistically significantly predicts the outcome variable (i.e., it is a good fit for the data).

Table 9 Regression analysis of Neuroticism predicting Complacency

Variable	B	95% CI [LL, UL]	β	t	p
constant	1.954			11.721	<0.001
Neuroticism	.350	.238,.462	.490	6.178	<0.001

R^2= .240 (N=123, p=<0.001[b], CI= confidence intervals for B, LL, UL indicate lower limit and upper limit respectively)

The R^2 value indicates how much of the total variation in the dependent variable, Complacency, can be explained by the independent variable, Neuroticism. In this case, 24% can be explained, which is a moderate portion of the variance. The p <0.001, which is less than 0.01, which indicates that, overall, the regression model statistically significantly predicts the outcome variable (i.e., it is a good fit for the data).

DISCUSSION

From the relationships between the Five factor Personality traits and the 5C Psychological antecedents of vaccination, one of the important findings of the study is that the association between Openness to experience and vaccine hesitancy was not confirmed.

The factor of Openness was seen as significantly positively related to Calculation and significantly negatively correlated with Constraints, which was against what we had hypothesized. This interesting finding goes against the findings of other studies where it was

found that higher scores on the Openness personality dimension were negatively related to vaccination endorsement. (Browne M et al., 2015, Lee, Duck, & Sibley, 2017) but it is in line with one study where Openness to experience was significantly positively correlated with attitude toward health benefits of vaccination (Lin, FY., Wang, CH, 2020) Openness in this study was hypothesized as being positively related to factors of vaccine hesitancy as it has been shown in a previous study that Openness to experience was positively associated with preference to alternative medicine. The finding that Openness is positively associated with alternative medicine goes in line with previous research (Browne et al., 2015; Smith et al., 2008; Toivonen et al., 2018). Taking into account that alternative medicine is considered unconventional and can be seen as a way of variety seeking, the mechanism of the relation between Openness to experience and alternative medicine becomes clear and thus our hypothesis that people scoring higher on this trait would most likely be more vaccine hesitant. What we can interpret from this is that while Openness to experience may predict a preference for alternative medicine, it may not mean that the individual is vaccine hesitant, they might have favourable opinions of both. The trait of Openness being positively related to Calculation can be explained by people being higher on this trait are more curious and receptive to information about the vaccine and researching it. (Power, R. A. & Pluess, M. 2015, Fleischhauer M et al., 2010) The negative relationship with constraints can also be understood as those higher on Openness will more likely be more open-minded and receptive to a new vaccine and will find ways to work around barriers to receiving it as they value novel experiences rather than backing away from them.

The trait Conscientiousness had a weak negative relationship with Complacency, and a weak positive relationship with Calculation which is in line with the hypotheses proposed.

These findings can be backed up by the findings of previous studies. (Lee CHJ et al., 2017) (Lin, FY., Wang, CH, 2020) (Murphy, J., et al 2021) Conscientiousness is characterized by the tendency to show self-discipline and act dutifully and thus people high in conscientiousness tend to abide by social norms (John, O.P., Srivastava, S., 1999). Since substantial research has documented that social norm are associated with vaccination (Oraby, T., Thampi, V., Bauch, C.T., 2014; Quinn SC et al., 2014), the emphasis of norm abidance would motivate conscientious people to be more receptive to vaccination. Besides, in line with previous research showing that people low in conscientiousness are more likely to violate precaution rules (Fiddick L et al., 2016) their finding suggests that people high in conscientiousness tend to adopt preventive health measures.

Extraversion had a moderately negative relationship with Complacency which was in line with our hypothesis. While there have been no previous studies that have documented a relationship between Extraversion and vaccine hesitancy, we theorized that participants scoring higher on Extraversion would more likely be less complacent as in previous studies it was associated with positive health behaviours. (Jerram, Kathryn & Coleman, Peter., 2010, Joyner C, Rhodes, R.E. & Loprinzi, P.D., 2018). With extraversion being characterized by the tendency to be sociable, assertive, energetic, and seek excitement, it is understandable that this personality trait was associated with high (vs. low) behavioral clustering.

Agreeableness showed a significant positive relationship with Confidence, Collective responsibility and a significant negative relationship with Complacency and Constraints, in line with what we had hypothesized. Agreeableness has been found to be related to lower

levels of vaccine hesitancy (Murphy, J., et al 2021, Lee CHJ et al., 2017) and has been significantly positively correlated with attitudes towards support for health benefits of vaccination and support for school vaccination. (Lin, FY., Wang, CH, 2020)

This makes sense considering the dimension of agreeableness. Agreeableness, reflected a general respect for social convention that was conducive to engaging in health-promoting behaviours (Booth-Kewley & Vickers, 1994). Those who score low are likely to be argumentative, uncooperative, or unsympathetic, thus engaging in violent acts with increasing frequency. Agreeableness dimension in the Big Five model is more about interpersonal cooperation and is known to be a good predictor of antisocial versus prosocial behaviors (Ashton & Lee, 2007).

Neuroticism had a significant positive relationship with Complacency which was in line with our hypothesis. A possible explanation for this could be that since individuals who are high in neuroticism respond worse to stressors, they might deliberately be complacent towards the severity of COVID-19 and may not see it as a threat since it might cause anxiety and stress to them if they would look further into the severity of the disease. Individuals with high scores for neuroticism are more likely than average to be moody and to experience such feelings as anxiety, worry, fear, anger, frustration, envy, jealousy, guilt, depressed mood, and loneliness. They are also more likely to interpret ordinary situations, such as minor frustrations, as appearing hopelessly difficult. (Thompson, E.R, 2008)

Neuroticism has been linked with vaccine hesitancy in the past (Murphy, J., et al 2021). With regards to health behaviours, Individuals who express high levels of neuroticism tend to be less physically active than those who express lower levels of neuroticism (Rhodes & Smith, 2006). A potential explanation for this finding is that individuals with higher levels of neuroticism tend to experience high levels of anxiety and this may pose a potential barrier to physical activity participation.

The regression analyses conducted on the statistically significant correlations between the Big-5 factor and 5C Psychological antecedents of vaccination revealed that there were seven significant regression models. It was found that the trait Agreeableness predicted significant proportions of the antecedents of Calculation, Constraints, and Collective responsibility.

The trait Openness predicted a significant portion of Calculation, Conscientiousness predicted a significant but small portion of Complacency, Extraversion predicted a significant amount of Complacency, and Neuroticism predicted a significant proportion of Complacency as well.

Complacency was most predicted compared to all the other 5C Psychological antecedents of Vaccination by the Big-5 traits of Personality.

Openness was a positive predictor of Calculation. Thus, people who are curious and open to new ideas, are also prone to a more detailed and extensive search for information. They carefully weigh the risks associated with vaccination against the risks of possible disease. According to Betsch and colleagues (2018), the more people look for information about vaccination and weight risks, the more vaccine hesitant they will become. Personality traits may be associated with the certain sub-scales of vaccine hesitancy scale, and not with a

whole one. The authors explain this finding by the fact that vaccine hesitancy is a complex process, which can vary across place, time and type of vaccine.

CONCLUSION

The results of the present study were somewhat mixed, with some hypotheses confirmed and one contradicted, and some relationships non-significant.

This study found several relationships between the Big-5 Factors of Personality and the 5C Psychological Antecedents of Vaccination. It can be said that personality factors like do have a small but significant effect on factors associated with the antecedents or determinants of vaccination according to the 5C model (Betsch et al, 2018) Some personality factors were even found to predict a significant amount of variance in the antecedents of vaccination.

Delimitations

Due to limited sample size, the results cannot be generalized to the global population.
The data was collected from Mumbai city urban participants, not from a diverse demographic.

Significant Implications

- Identifying and understanding the personality factors of vaccine hesitancy within distinct populations may aid future public health messaging to increase vaccine uptake.
- The results can also provide clarity about the amount of COVID-19 vaccine hesitancy and reasons for it to further implement strategies for vaccination uptake.
- Individual differences have been largely unexplored in previous studies related to vaccine hesitancy so the present study contributes to a literature concerning this topic while relating it to the 5C model of vaccine hesitancy.

Scope for future research

Future research can focus on methodological improvements and also can include other measures of personality that may influence vaccine hesitancy. Studies on larger sample sizes of varying demographic populations can be conducted for a generalizable result. Qualitative research can delve deeper into the personality factors and reasons against vaccination.

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Conflict of Interest

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