Chhaya Manoj
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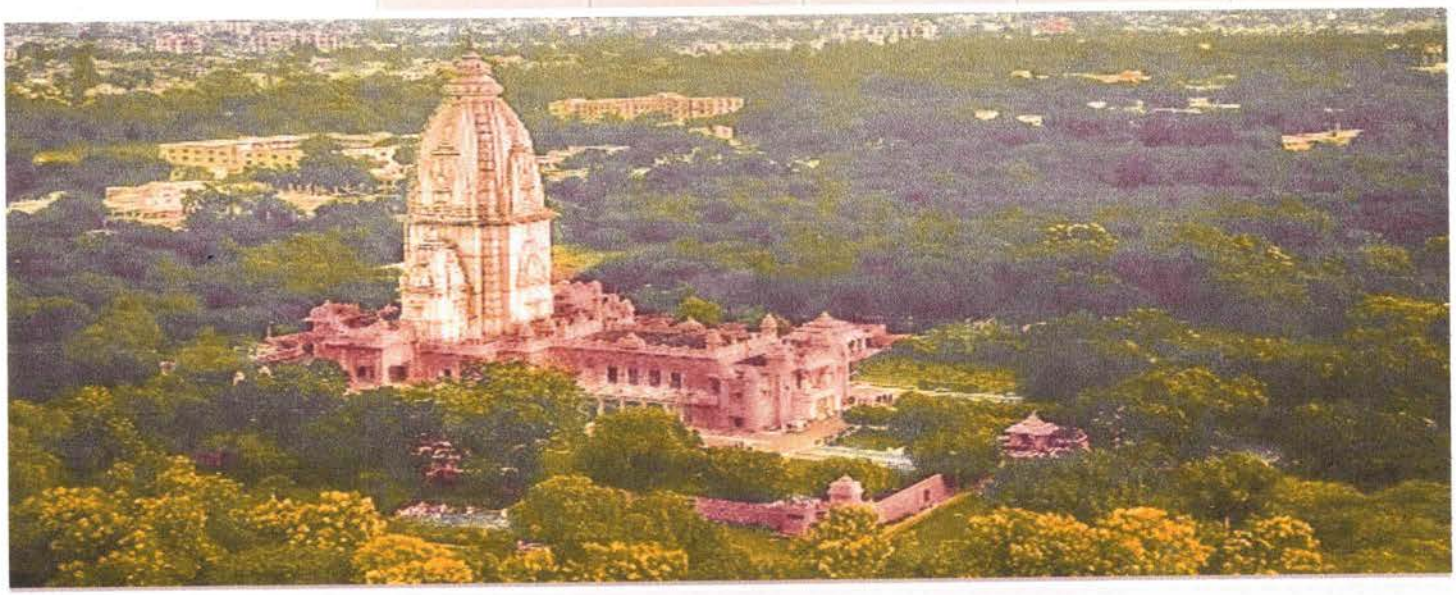

IMPORTANT LINKS

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VOLUME 65, ISSUE 9, NOVEMBER 2021

(Special Issue)

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Neeta Jain, Thakur College of Science & Commerce, Mumbai, Maharashtra

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A Statistical Review of Factors Influencing Vaccine Hesitancy in India

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Abstract: **The first phase of COVID – 19 vaccination program was launched on 16th January 2021 in India. Covaxin, manufactured by Bharat Biotech and Covishield, manufactured by Oxford – Astra Zeneca were used in the first phase. By 1st march approximately 14 million healthcare workers were vaccinated in the first phase. Second phase was rolled out for senior citizens over the age of 60 and people between the age of 45 and 60 with comorbidities. The third phase began in April 2021 for the people over the age of 18. As on 31st July 2021 India's COVID vaccination has crossed 46 crore people. According to statistics, only 5% population is fully vaccinated and about 20% have had one dose. More than 8 million people need to be vaccinated each day to curb the pandemic amidst the fear of third wave hitting India in the next few months. Many reasons like shortage of vaccine, complex cold chain supply management, lack of resources, inappropriate infrastructure, equitable access to vaccines have curbed the pace of vaccination. Vaccination hesitancy refers to delay or refuse vaccination. Many factors like fear of side effects, concerns about safety and efficacy of vaccine, inconvenience, physical availability, geographical accessibility, culture context, etc. influence vaccine hesitancy. This research emphasizes on a statistical review of factors influencing vaccine hesitancy in India. The main objective of this research is to define, identify, categorize, and analyze different practical and behavioral factors associated with vaccine hesitancy. The conclusion drawn from this research would help policy makers to comprehend these challenges and design strategies to increase the pace of vaccination in India.**

Index Terms: COVID – 19, Influencing factors, Vaccine, Vaccine Hesitancy, Statistical Review.

I. INTRODUCTION

Vaccination is considered as one of the most successful public health measures. The vaccines have been proved effective to curb the mortality and morbidity of infectious diseases. COVID-19 pandemic is currently a global challenge and countries around the world are conducting programs for prevention, early diagnosis, and medical treatment. The development of safe and effective vaccine is considered as one of the most important impetus to curb the pandemic.

Government of India has been providing COVID vaccines to States as a part of nationwide vaccination drive. As per the available data, 68.34 crore vaccines are delivered, and 15.88 crore people are fully vaccinated in India as on 3rd September 2021. Only 5% of India's population is fully vaccinated and 20% population had only one dose. To achieve the target of complete vaccination in India by December, more than 8 million people need to be vaccinated every day. So far, the daily average is about 4 million. The vaccination trend in the month of August 2021 is fluctuating to a greater extent. The pace of vaccination rollout has been affected due to shortage of vaccine supply and vaccine hesitancy.

According to Strategic Advisory Group of Experts on Immunization (SAGE) Working Group "Vaccine hesitancy may be present in situations where vaccination uptake is low because of system failures, e.g. stock-outs, limited availability of vaccination services (time, place, etc.), curtailment of vaccine services in the presence of conflict or natural disaster, but in these situations hesitancy is not the main explanation for the presence of unvaccinated or under-vaccinated members of the population."

This research paper addresses the aspect of new reality of vaccination, vaccine hesitancy. It examines the factors influencing vaccine hesitancy and their implication on COVID pandemic. The present research is based on the longitudinal survey which is statistically analyzed to identify and categorize the factors influencing vaccine hesitancy.

II. REVIEW OF LITERATURE

Akhter, M., & Kamraju, A. M. (2021) A Study on Covid-19 Vaccination Drive in India. They concluded that we must

continue vaccination even if some COVID-19 virus variants are less effective.

Sharma, S., & Singh Gandhar, S. (2021) A cross sectional study to assess the willingness and hesitancy regarding COVID-19 vaccination. This study's goal is to estimate the frequency of COVID-19 vaccine refusal and identify the underlying factors.

Sharun, K., Faslu Rahman, C. K., Haritha, C. V., Jose, B., Tiwari, R., & Dhama, K. (2020) Covid-19 vaccine acceptance: Beliefs and barriers associated with vaccination among the general population in India. The study identified respondents' concerns about the efficacy and safety of COVID-19 vaccines.

III. Research Methodology

A structured questionnaire consists of questions needed is designed to gather information for measurement and for collecting data concerning vaccination. An e - survey was conducted from the key stakeholders of different educational qualification, occupation, gender above 18 years of age and are considered the best respondents. Convenience sampling method was used for collection of data. Information collected was compiled and reviewed. Results were categorized and Statistical tools such as tabulation, Charts, Chi-square test, ANOVA, Friedman test are used for analysis of the data. Factors influencing speed of vaccination were identified. The reasons for not taking the vaccine were explored. Different factors responsible for vaccine hesitancy were classified and analyzed. Tabular and graphical representation of the results elaborate the genesis of this research. Interpretation of data is reported in textual form supported by tables and graphs for better understanding.

IV. Data Representation And Statistical Analysis

Primary information regarding the study on 'Perception towards vaccination for COVID-19' is collected through a structured questionnaire.

A. Vaccination Status of all respondents.

The primary data relevant to the study is collected from 270 respondents based on demographic factors such as Gender, Age group of respondent, Educational Qualification and Occupation of respondents. Their vaccination status is as shown in figure 1.

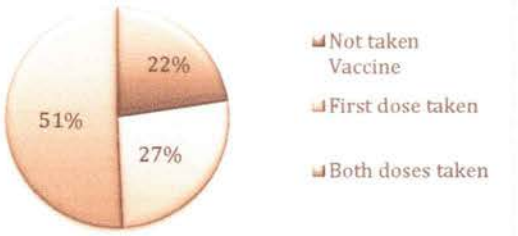

Fig. 1. Vaccination Status of all respondents.

B. To study Perception towards vaccination of respondents who have NOT taken vaccine of COVID-19:

1. *Data regarding demographic factors of Non-Vaccinated Respondents are presented using Pie chart below.*

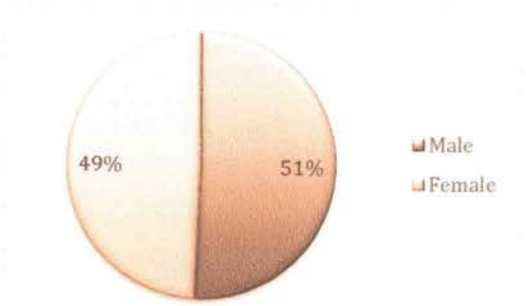

Fig. 2. Gender wise percentage of Non-Vaccinated Respondents.

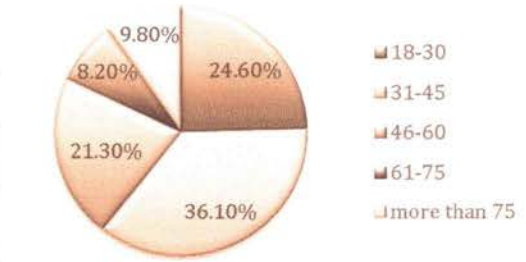

Fig. 3. Age group wise percentage of Non-Vaccinated Respondents.

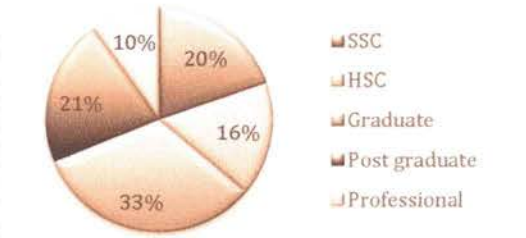

Fig. 4. Educational Qualification wise percentage of Non-Vaccinated Respondents.

2. *Perception towards Vaccination by the Non-Vaccinated Respondents is captured from the question 10 of the Questionnaire. who have NOT taken vaccine of COVID-*

19:

	Statement of perception (Reasons for not taking vaccine)	Strongly Disagree	Disagree	Agree	Strongly Agree
10.1	I do not trust COVID-19 vaccine because it was developed and approved very quickly.	8	17	24	12
10.2	I do not trust COVID – 19 vaccines because of counterfeiting.	8	28	21	4
10.3	I do not trust the process of giving COVID – 19 vaccines.	6	21	20	14
10.4	I don't need a vaccine because corona doesn't exist.	12	39	4	6
10.5	I am afraid of going outside and getting infected.	16	27	15	3
10.6	A healthy diet and use of masks and sanitizer are sufficient.	7	22	28	4
10.7	Free vaccines are not easily available.	5	12	24	20
10.8	I am afraid of Side Effects.	7	19	24	11
10.9	People diagnosed with COVID-19 despite of taking the vaccines.	1	13	33	14
10.10	At present suffering from serious illness.	40	15	6	0

Table 1: Perception towards Vaccination by the Non-Vaccinated respondents.

All the responses are rated as follows:

Strongly agree =1, Disagree = 2, Agree = 3, Strongly Agree =4

Using the above rating the mean score for Perception towards Vaccination by the Non-Vaccinated Respondents is calculated using the formula given below:

$$\textbf{Mean vaccination Perception} = \frac{\textit{Total score of rating of repondent (for 10 statements}}{\textit{Maximum rating (40)}}$$

Using the above given formula, the mean score for Perception towards Vaccination by the Non-Vaccinated Respondents is calculated for each respondent and subsequently for 61 Non-Vaccinated Respondents and represented in the table below:

	N	Minimum	Maximum	Mean	Std. Deviation
Perception without vaccine	61	37.50	77.50	60.8607	8.02191
Valid N (listwise)	61				

Table 2: Descriptive Statistics of perception towards Vaccination by the Non-Vaccinated Respondents

Table 2 indicates that the Mean score for Perception towards Vaccination by the Non-Vaccinated Respondents is 60.86 percent and corresponding Standard Deviation is 8.02, suggesting less variance in the responses.

1. ***To test hypothesis related to Gender:***

   Null Hypothesis H_{0A}: There is no significant difference in the Perception towards Vaccination by the Non-Vaccinated Respondents across the Gender.

   Alternative Hypothesis H_{1A}: There is a significant difference in the Perception towards Vaccination by the Non-Vaccinated Respondents across the Gender.

To test the above Null Hypothesis ANOVA is obtained and F-test is applied. Results are shown in the table.

ANOVA					
	Sum of Squares	df	Mean Square	F	p-value
Between Groups	153.142	1	153.142	2.437	0.124
Within Groups	3707.923	59	62.846		
Total	3861.066	60			

Table 3: Analysis of variance of perception towards Vaccination by the Non-Vaccinated Respondents across the gender.

Interpretation: The above results indicate that calculated p-value for Perception towards Vaccination by the Non-Vaccinated Respondents is 0.124. It is more than 0.05. Therefore F-test is accepted. Hence Null hypothesis is accepted, and Alternative hypothesis is rejected

Conclusion: There is no significant difference in the Perception towards Vaccination by the Non-Vaccinated Respondents across the Gender.

Finding: The difference in the mean score of for Perception towards Vaccination by the Non-Vaccinated Respondents is highly insignificant across their Gender. It is highly similar for

both male and female respondents. This can be observed in the Table 4.

Gender	N	Mean	Std. Deviation
Male	31	62.4194	6.56645
Female	30	59.2500	9.12438
Total	61	60.8607	8.02191

Table 4: Perception towards Vaccination by the Non-vaccinated Respondents across gender.

The mean score for Perception towards Vaccination by the Non-Vaccinated Respondents is highest at 62.41 percent for Male respondents, while it is lowest at 59.25 percent for the Female respondents. This verifies our findings.

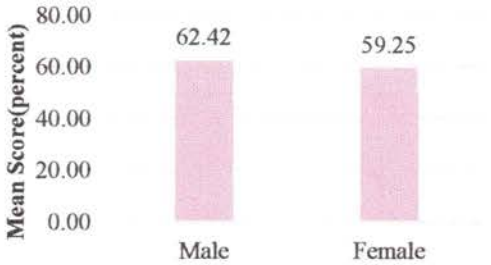

Fig. 5: Perception towards vaccination by Non-Vaccinated Respondents across gender

2. ***To test hypothesis related to Age group:***

Null Hypothesis H_{0A}: There is no significant difference in the Perception towards Vaccination by the Non-Vaccinated Respondents across the *Age group.*

Alternative Hypothesis H_{1A}: There is a significant difference in the Perception towards Vaccination by the Non-Vaccinated Respondents across the *Age group.*

To test the above Null Hypothesis ANOVA is obtained and F-test is applied. Results are shown in Table 5.

ANOVA					
	Sum of Squares	df	Mean Square	F	p-value
Between Groups	426.739	4	106.685	1.740	0.154
Within Groups	3434.327	56	61.327		
Total	3861.066	60			

Table 5: Analysis of variance of perception towards Vaccination by the Non-Vaccinated Respondents across the age group.

Interpretation: The above results indicate that calculated p-value for Perception towards Vaccination by the Non-Vaccinated Respondents is 0.154. It is more than 0.05. Therefore F-test is accepted. Hence Null hypothesis is accepted, and Alternative hypothesis is rejected.

Conclusion: There is no significant difference in the Perception towards Vaccination by the Non-Vaccinated Respondents across the Age group.

Finding: The difference in the mean score of for Perception towards Vaccination by the Non-Vaccinated Respondents is highly insignificant across their Age group. It is highly similar for all respondents irrespective of their age group. This can be observed in the Table 6.

Age of respondent	N	Mean	Std. Deviation
18 to 30 years	15	58.5000	8.80341
31 to 45 years	22	61.2500	7.82053
46 to 60 years	13	62.8846	7.89555
61 to 75 years	5	66.5000	7.20243
More than 75 years	6	56.2500	4.67707
Total	61	60.8607	8.02191

Table 6: Perception towards Vaccination by the Non-Vaccinated Respondents across age group.

The mean score for Perception towards Vaccination by the Non-Vaccinated Respondents is highest at 66.5 percent for respondents aged between 61 and 75 years, while it is lowest at 56.25 percent for the respondents aged more than 75 years. This verifies our findings.

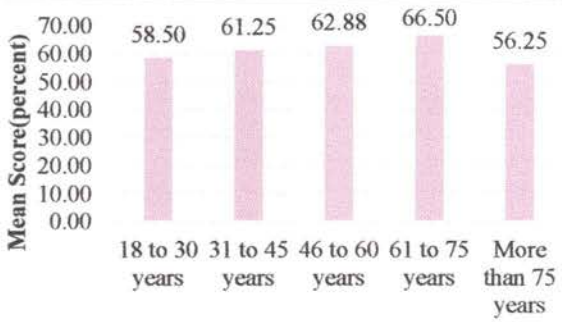

Fig. 6: Perception towards vaccination by Non-Vaccinated Respondents across age group.

3. ***To test hypothesis related to Educational Qualification***

Null Hypothesis H_{0A}: There is no significant difference in the Perception towards Vaccination by the Non-Vaccinated Respondents across the Educational Qualification.

Alternative Hypothesis H_{1A}: There is a significant difference in the Perception towards Vaccination by the Non-Vaccinated Respondents across the Educational Qualification.

To test the above Null Hypothesis ANOVA is obtained and F-test is applied. Results are shown in the table 7.

ANOVA					
	Sum of Squares	df	Mean Square	F	p-value
Between Groups	22.668	4	5.667	.083	.987
Within Groups	3838.397	56	68.543		
Total	3861.066	60			

Table 7: Analysis of variance of perception towards Vaccination by the Non-Vaccinated Respondents across the educational qualification.

Interpretation: The above results indicate that calculated p-value for Perception towards Vaccination by the Non-Vaccinated Respondents is 0.987. It is more than 0.05. Therefore F-test is accepted. Hence Null hypothesis is accepted, and Alternative hypothesis is rejected.

Conclusion: There is no significant difference in the Perception towards Vaccination by the Non-Vaccinated Respondents across the Educational Qualification.

Finding: The difference in the mean score of for Perception towards Vaccination by the Non-Vaccinated Respondents is highly insignificant across their Qualification. It is highly similar for all respondents irrespective of their Qualification. This can be observed in the Table 8.

Educational Qualification	N	Mean	Std. Deviation
SSC	12	60.2083	5.05181
HSC	10	61.0000	5.91608
Graduate	20	60.6250	7.85874
Postgraduate	13	60.9615	12.18514
Professional	6	62.5000	7.58288
Total	61	60.8607	8.02191

Table 8: Perception towards Vaccination by the Non-Vaccinated Respondents across Educational Qualification.

The mean score for Perception towards Vaccination by the Non-Vaccinated Respondents is highest at 62.50 percent for respondents who are professionally qualified, while it is lowest at 60.20 percent for the respondents who are educated up to SSC. This verifies our findings.

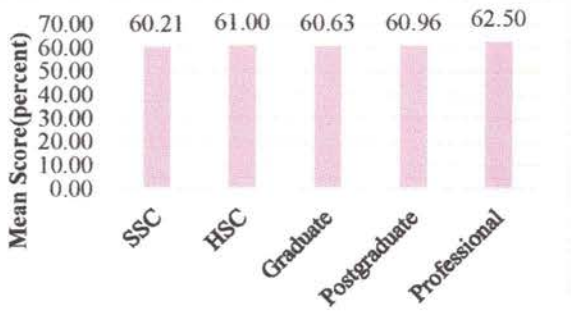

Figure 7: Perception towards vaccination by Non-Vaccinated Respondents across educational qualification.

4. ***Since perceptions of non- Respondents have no effect of demographic factors, we check for other influencing factors for vaccine hesitancy. Hence we test following hypothesis.***

Null Hypothesis H_0: There are no influencing factors for hesitance of vaccine.
Alternative Hypothesis H_1: There are influencing factors for hesitance of vaccine.

To test this hypothesis, Friedman test is applied. Results are shown below.

Serial no.	Influencing factor for hesitance of vaccine	Mean Rank
10.1	I do not trust COVID-19 vaccine because it was developed and approved very quickly.	6.04
10.2	I do not trust COVID – 19 vaccines because of counterfeiting.	5.16
10.3	I do not trust the process of giving COVID – 19 vaccines.	6.07
10.4	I don't need a vaccine because corona doesn't exist.	4.18
10.5	I am afraid of going outside and getting infected.	4.56
10.6	A healthy diet and use of masks and sanitizer are sufficient.	5.81
10.7	Free vaccines are not easily available.	7.03
10.8	I am afraid of Side Effects.	6.18
10.9	People diagnosed with COVID-19 despite of taking the vaccines.	7.20
10.10	At present suffering from serious illness	2.76

Table 9: Mean rank given to influencing factors for hesitance of vaccine under Friedman test.

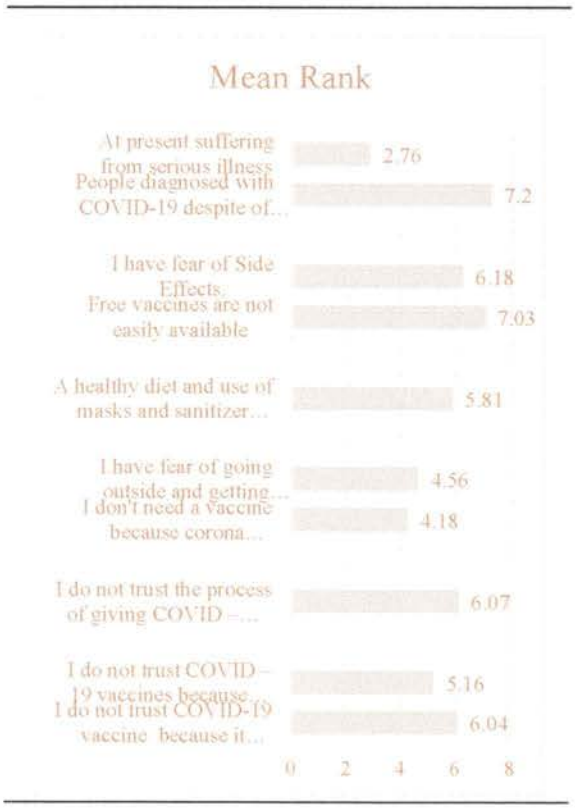

Table 9: Mean rank given to influencing factors for hesitance of vaccine under Friedman test.

We use Chi square test to test this hypothesis.

N	61
Chi-Square	136.868
Df	9
p-value	0.000

Table 10: Test statistic under chi square test.

Interpretation: Table 10 indicates that p-value is 0.000. It is less than 0.05. Therefore, test is rejected. Hence null hypothesis is rejected, and alternative hypothesis is accepted.

Conclusion: There are influencing factors for hesitance of vaccine.

Discussion: In conclusion, most influencing factors / reasons for hesitance of vaccine observed in this research study are as follows:

1. People diagnosed with COVID-19 despite of taking the vaccines.
2. Free vaccines are not easily available.
3. Fear of Side Effects.
4. Distrust about the process of giving COVID – 19 vaccines.
5. Distrust about COVID-19 vaccine because it was developed and approved very quickly.

The above-mentioned factors influencing vaccine hesitancy emphasize the need to design strategies to address vaccine hesitancy. Widespread public interventional educational campaigns by health workers could be promoted to combat misinformation and to reveal the facts about successful inoculation against the disease. Government, pharmaceutical industry, and supply chain management should take extra efforts to provide better quality of vaccine in large quantity. In addition to this, government should provide extra facilities in transportation of vaccine in remote areas. Medical professionals, family doctors, People working at vaccine centres should spread the appropriate information about efficacy and safety of COVID 19 vaccine. People should be convinced about clinical trials of vaccine and process of vaccination. Social workers, NGOs should reach to people in gatherings, use internet and social media to spread awareness and educate domestic helpers about precautionary measures and post vaccine care. This research study would encourage policy makers to designs new strategies to combat vaccine hesitancy and increase the pace of vaccination in India. Hence, we suggest further study should be conducted which would include respondents from diverse economic and social background and in terms of location, technology reach and education.

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