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Case Report

Knowledge, Attitude and Perceptions towards COVID-19 Vaccination among South Indian (Telangana) Population - A Cross Sectional Study

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Abstract

Objective: The Covid-19 pandemic caused unprecedented damage to human health all over the globe. Knowledge, Attitudes and Perceptions (KAP) are backbone to constrain Covid-19. The present study investigated the KAP in the general Telangana (South Indian) population.

Study Design: A cross sectional study was conducted on 734 people using specific questionnaire by google forms to generate data on knowledge, attitudes and perceptions among socio-demographic characteristics in the general

population for a period of 30 days from 23rd May, 2021 to 21st June, 2021.

Methods: Descriptive statistics, t-test, one way analysis of variance (ANOVA), chi-square test, multiple logistic regression analyses were performed to analyse the results.

Results: The results on knowledge showed that 96.73%, 45.64% and 88.42%, of participants (χ^2 values of 1.815, 2.044 and 3.742) know about Covid-19 vaccines, its side effects and the efficacy of Indian vaccine, etc. 66.08% and 88.28% of the participants (χ^2 Values of 7.616 and 14.00) expressed that Covid-19 vaccine is safe and they would motivate their family members and friends to take vaccine. About 60% of the participants (χ^2 Value of 2.715) felt that it is possible to control Covid-19 even without vaccine. 71.66% of participants (χ^2 Value of 21.74) said that they recommend vaccination to all irrespective of age and co-morbidities. 69.35% of the participants (χ^2 Value of 6.638) felt that people are reluctant to take vaccines, 68.53% (χ^2 Value of 0.4359) of them are thinking that they are not following Covid norms. The results have also indicated that certain percentage of people are not aware of following Covid norms and taking up of Covid vaccines.

Conclusion: Our findings highlight the immediate need for intense education/awareness programmes among the people about the Covid and vaccinations which in turn would improve the level of knowledge, attitudes and perceptions towards Covid-19 and help to control the spread of the disease.

Keywords: Knowledge; Attitudes; Perceptions; COVID-19 vaccination

Abbreviations: SARS: Severe acute respiratory syndrome; MERS: Middle East Respiratory Syndrome; SARS CoV: Severe Acute Respiratory Syndrome Corona Virus; OxCGRT: Oxford COVID-19 Government Response Tracker; ANOVA: Analysis of Variance

1. Introduction

Corona virus is a single-strand RNA genome that causes different respiratory diseases in humans, starting with the mild common cold to severe acute respiratory syndrome (SARS). The outbreak of coronavirus was happened previously in China (SARS-CoV) in the year 2003 and in Middle East Middle East respiratory syndrome (MERS) in the year 2013 [1]. The present novel Coronavirus known as severe acute respiratory syndrome corona virus 2 (SARS-CoV-2) which causes the coronavirus disease (Covid-19) was first reported in Wuhan city, Hubei province, China in December 2019. This outbreak is expected to have an epidemiological link with the Wholesale Market of Huanan Seafood where snakes, bats, and various raw seafood were vended. World Health Organisation (WHO) declared the outbreak of Covid-19 as a public health emergency of international concern on January 30, 2020, and as a pandemic on March 11, 2020 [1]. Covid-19 is currently an international public health emergency and a big global health threat. The pandemic spread has reached almost all countries of the world and started raising an important public health concern; and ever since the beginning of the outbreak, this pandemic has transcended 97.8 million cases worldwide with more than two million deaths by January 21, 2021. Amongst all the countries affected by this pandemic, the maximum rates of infection and deaths have been reported in the USA, India, and Brazil [1]. Response

of India to the pandemic of Covid-19 is one of the most rigorous in the world and it scores a perfect of 100 on the "Oxford Covid-19 Government Response Tracker (OxCGRT)" which compares various responses of governments in the global outbreak of coronavirus. The early surge in the number of cases was at the lower rates in the country, which attributed to various policies of the government in implementing a nationwide lockdown at the early stage of pandemic spread. However, being the second-highest populated country in the world, the subsequent rapid rise of the Covid 19 infection in the country could not be restrained. Covid-19 pandemic is still at its highest point in India and the struggle is continuing [2]**.** This pandemic of the corona virus started influencing the major part of human activities like the health systems and economy of the countries. Currently, despite of having various developed vaccines, the efficacy rate of vaccine has become question mark (Because of its rapid transmission and evaluation of new mutant variants) against the Covid-19 prevention. Therefore, it is very essential to practice the preventive measures in reducing the spread of the virus or early detection of initial symptoms and instant seeking of medical care for strengthened recovery from this deadly disease. Likewise, the recently implemented containment measures such as enhanced Covid-19 testing, contact tracing, isolation of Covid-19 positive confirmed cases, quarantining the people who have primary contact with the affected individual/suspected cases and non-pharmacological activities such as staying at home, usage of face masks, washing hands and rubbing alcohols, travel restrictions, work from home, social distancing, self-monitoring, self-quarantine and public awareness are expected to restrict the pandemic growth, but would not stop it. Thus, effective prevention of Covid-19 can be achieved by enhancing the knowledge, attitude, perceptions towards Covid-19 among the general public and mainly among the population groups with a high risk of suspected cases [1]

Vaccines are the most essential and cost-effective public health measures ever implemented to save millions of lives against several infections. Following the deciphering of genome sequence of SARS-CoV-2, a highly contagious virus that globally affected a wide number of people in early 2020. The competition for Covid-19 vaccine invention by scientists and pharmaceutical companies are racing against the time to halt the spread and catastrophic effects of ongoing disease and new, more effective vaccines are likely to be developed as we move through the pandemic. From the date, December 22, 2020, a minimum of 85 vaccines are in preclinical development in animals and 63 vaccines are in clinical development in humans, among them 43 vaccines are in phase I, 21 are in phase II, 18 in phase III, and 6 have been approved for initial or confined use, 2 vaccines have been approved for complete use. In United States Moderna (mRNA-1273) mRNA vaccines and Pfizer-BioNTech's (BNT162b2) have been approved for the usage in emergency conditions [3].

Authorities of the Indian government approved the usage of different vaccines such as Covaxin, Covishield from 3rd January 2021. A sanitation worker named Manish Kumar became the first person to receive the Covaxin vaccine. But still, there is a great confusion about Covid-19 vaccinations among the general population of India and a good proportion of the Indian population are still undecided to take the vaccine. A global survey on Covid- 19 vaccine acceptance among 13,426 people from 19 different countries was conducted by Jeffrey V. Lazarus et.al., which shows most of the population remained doubtful whether

they would take up the COVID-19 vaccination [4]. These comparatively minimal proportions of people ready to take up the vaccines are potentially perplexing, although the most useful measure of controlling the virus spread is to protect ourselves from being exposed to Covid-19 strains. So, there is an immediate need to vaccinate the disease susceptible group of people as soon as possible. Hence, aim of the current study is to understand whether the public is executing the preventive measures suggested by the national guidelines and their behavioural interceptions towards COVID-19 vaccination. We evaluated the KAP aspects and discussed how these sociodemographic attributes interplay with the behavioural components. This study aims to appraise the knowledge, attitude, and perceptions that enlightens the efforts to fight Covid-19 through vaccinations and how the knowledge towards Covid-19 influences the association of disease mediated by attitudinal factors (risk perceptions of vaccines regarding the disease) and determines which populations exhibit low levels of knowledge towards Covid-19.

2. Methods

2.1. Study Design, Participants & Setting:

The present study was conducted for a period of 30 days from 23rd May,2021 to 21st June,2021 at MAA Research Foundation, MAA ENT Hospitals, Hyderabad in the state of Telangana, INDIA. The hospital employees and walk-in patients, other individuals aged 18 years and above were enrolled as participants in the study. Patients undergoing emergency services like surgeries were excluded from the study. A quantitative research survey using online approach is considered as the most advantageous technique to generate data from topographically varied study population (Muhammad Arslan Iqbal and Muhammad Zeeshan Younas, 2020) [5]. Hence, the survey questionnaire was designed in English Language and was also administered as a Google form with a shareable link and disseminated via online services to study larger population in a limited time. Social media platforms were also used to endorse the call for voluntary participation in this research survey by using authors' personal and professional networks. The information was collected across various sections of population due to the diversified nature of the Covid-19 pandemic and knowledge about its vaccination. Sample size was deduced using the formula used by charan J et.al., 2013 [6] and confirmed by using Openepi software (openepi.com/SampleSize/SSPropor.htm) with 95% confidence interval for the study population. Then, a total of 734 individual responses to all the items in the questionnaire was collected. Each participant's response was transcribed by the study coordinators after the survey was completed.

2.2. Ethical Consideration

The protocol of the study and validation of survey questionnaire were approved by the MAA Ethics Committee.

2.3. Questionnaire Development & Study Measures

The Knowledge, Attitudes and Perceptions on Covid19 vaccination questionnaire comprises a total of 35 items was designed and validated by two different co-investigators by gaining knowledge after thorough review of literature published on Covid19. The questionnaire consisted of four main sections: 1) Demographic data 2) Knowledge about Covid-19 vaccination 3) Attitudes towards Covid-19 vaccination and 4) Perceptions towards Covid-19vaccination may require approximately 5–15 minutes of the participant's time to complete the e-survey.

Section 1: Demographic data included socio-demographic details of the participants such as gender, age, state of residence, marital status, education status, socio-economic status, family type, and vaccination history.

Section 2: Knowledge about Covid-19 vaccination was assessed using an 8-item questionnaire. The questions were related to the knowledge of Covid-19 vaccination types and their effects. Three options, i.e., yes, no, and don't know are provided for each of these questions.

Section 3: Attitudes towards Covid-19 vaccination were assessed using a 16-item questionnaire. The questions were related to the efficacy of different Covid-19 vaccines and attitude of people towards the vaccination programme. For each of these questions except few, three options i.e., Agree, Disagree, and Undecided are provided to participants for their response.

Section 4: Perceptions towards Covid-19 vaccination was assessed using an 11-item questionnaire. These questions include opinion on side effects of vaccines (if any), which age group to be vaccinated, how Covid-19 can be eradicated without vaccination, who should be vaccinated first, public awareness about Covid norms, administration of vaccine at free of cost, perceptions towards ongoing vaccination programme. Each of these questions was provided with different options for effective response from the study participants.

2.4. Statistical analysis

Fully completed questionnaires were extracted from Google forms and exported to Microsoft Excel 2019 for tabulating and sorting the raw survey data. The sorted data was then imported to GraphPad Prism software for further statistical analysis. Contingent analysis (i.e., Chi-square tests, ANOVA, Degrees of freedom & p-values) was performed for all the items included in the survey questionnaire. All statistical tests with p-value < 0.05 were considered significant.

3. Results

3.1. General profile of participants

Demographic data of 734 subjects participated in the study is presented in Table 1. Of the total participants, 41.55% were females and 58.45% were males. 81% of the participants were adults, 18.94% were young and 83% were from Urban areas, whereas 16.89% were from rural areas. Among them, 55.31% were married and 44.69%were unmarried (68.80%) of the individuals had university/ higher level of education and 31.2% of them had College/Below level of education. The majority of the participants were from nuclear families 69.8% and 30.11% were from joint families. In family income group, 73.57% belonged to the middle Socio-Economic Status (SES), 20.03% belonged to low SES and 6.40% belonged to upper SES. Only 43.3% of participants have reported that they received all the necessary vaccines in their lifetime, whereas 56.68% haven't received the vaccines.

Variable	Total (n)	Percentage
Gender		
Female	305	41.55
Male	429	58.45
Age		
Adult	595	81.06
Young	139	18.94
Residence		
Rural	124	16.89
Urban	610	83.11
Marital Status		
Married	406	55.31
Unmarried	328	44.69
Education		
College/Below	229	31.2
University/Higher	505	68.8
Family		
Joint	221	30.11
Nuclear	513	69.89
Family income		
Lower SES	147	20.03
Middle SES	540	73.57
Upper SES	47	6.4
COVID-19 Vaccination History		
No	416	56.68
Yes	318	43.32

Table 1: Demographic Data of the participants.

3.2. Knowledge towards COVID-19 Vaccination

The results on the knowledge regarding Covid-19 vaccination (Table 2) have revealed that 79.43% of participants were aware about different types of vaccines that are available in India (item 3), 23.84% of the participants don't know which vaccine is efficient, while 20.71% of them reported that all vaccines are efficient (item 4), 57.9% of the participants have positive opinion that vaccines produced in India are as efficient as the ones produced in abroad (item 8) and 60.35% of participants know that over dosage of vaccines dangerous (item 5). Differences for all the knowledge items between adult and young were studied using chi-square test and the items (3, 4, and 8) were found significant with the p-value of <0.05. Similarly, differences between females and males haven't shown any significant association for all the items except the 5th item (overdoses of vaccines are dangerous) with p value of <0.05.

S. No:	Knowledge Item	Total (734)	Adult (595)	Young (139)	X^2, d.f, p-value	Female (305)	Male (429)	X^2, d.f, p-value
		N (%)	N (%)	N (%)		N (%)	N (%)	
1.	Do you know about the COVID-19 vaccine?							
	Don't Know	8 (1.09)	5 (0.84)	3 (2.16)	**1.815, 2, 0.4034**	5 (1.64)	3 (0.70)	**1.969, 2, 0.3737**
	No	16 (2.18)	13 (2.18)	3 (2.16)		8 (2.62)	8 (1.86)	
	Yes	710 (96.73)	577 (96.97)	133 (95.68)		292 (95.74)	418 (97.44)	
2.	Do you know about the effectiveness of COVID-19 vaccine?							
	Don't Know	31 (4.22)	21 (3.53)	10 (7.19)	**3.742, 2, 0.1539**	12 (3.93)	19 (4.43)	**0.6213, 2, 0.733**
	No	54 (7.36)	44 (7.39)	10 (7.19)		25 (8.20)	29 (6.76)	
	Yes	649 (88.42)	530 (89.08)	119 (85.61)		268 (87.87)	381 (88.81)	
3.	Do you know how many types of vaccination are available in India?							
	Don't know	89 (12.13)	71 (11.93)	18 (12.95)	**10.31, 2, 0.0058****	29 (9.51)	60 (13.99)	**4.822, 2, 0.0897**
	No	62 (8.45)	41 (6.89)	21 (15.11)		31 (10.16)	31 (7.23)	
	Yes	583 (79.43)	483 (81.18)	100 (71.94)		245 (80.33)	338 (78.79)	
4.	Do you think which one is efficient?							
	All	152 (20.71)	132 (22.18)	20 (14.39)	**14.71, 7, 0.0398***	60 (19.67)	92 (21.45)	**6.370, 7, 0.4973**
	Covaxine	141 (19.21)	107 (17.98)	34 (24.46)		62 (20.33)	79 (18.41)	
	Covaxine, Covisheild	34 (4.63)	22 (3.70)	12 (8.63)		18 (5.90)	16 (3.73)	
	Covaxine, Sputnik V	8 (1.09)	8 (1.34)	NIL (0.00)		5 (1.64)	3 (0.70)	
	Covisheild	170 (23.16)	140 (23.53)	30 (21.58)		66 (21.64)	104 (24.24)	
	Covisheild, Sputnik V	18 (2.45)	16 (2.69)	2 (1.44)		8 (2.62)	10 (2.33)	
	Don't Know	175 (23.84)	140 (23.53)	35 (25.18)		75 (24.59)	100 (23.31)	
	Sputnik V	36 (4.90)	30 (5.04)	6 (4.32)		11 (3.61)	25 (5.83)	
5.	Is it dangerous to use overdose vaccines?							
	Don't Know	246 (33.51)	203 (34.12)	43 (30.94)	**1.059, 2, 0.5888**	83 (27.21)	163 (38.00)	**13.52, 2, 0.0012****
	No	45 (6.13)	38 (6.39)	7 (5.04)		14 (4.59)	31 (7.23)	
	Yes	443 (60.35)	354 (59.50)	89 (64.03)		208 (68.20)	235 (54.78)	

6.	Does vaccination increase allergic reactions?							
	Don't Know	338 (46.05)	270 (45.38)	68 (48.92)	**0.5985, 2, 0.7414**	145 (47.54)	193 (44.99)	**1.868, 2, 0.3931**
	No	249 (33.92)	205 (34.45)	44 (31.65)		95 (31.15)	154 (35.90)	
	Yes	147 (20.03)	120 (20.17)	27 (19.42)		65 (21.31)	82 (19.11)	
7.	Does vaccination increase autoimmune diseases?							
	Don't Know	357 (48.64)	280 (47.06)	77 (55.40)	**3.475, 2, 0.1759**	147 (48.20)	210 (48.95)	**4.306, 2, 0.1162**
	No	208 (28.34)	176 (29.58)	32 (23.02)		97 (31.80)	111 (25.87)	
	Yes	169 (23.02)	139 (23.36)	30 (21.58)		61 (20.00)	108 (25.17)	
8.	Do you think vaccines produced in India are as efficient as the ones produced abroad?							
	Don't Know	218 (29.70)	167 (28.07)	51 (36.69)	**6.661, 2, 0.0358***	97 (31.80)	121 (28.21)	**1.501, 2, 0.4722**
	No	91 (12.40)	81 (13.61)	10 (7.19)		34 (11.15)	57 (3.29)	
	Yes	425 (57.90)	347 (58.32)	78 (56.12)		174 (57.05)	251 (58.51)	
Note: χ2: Chi-square test; d.f: Degrees of freedom; *statistically significant (p< 0.05)								

Table 2: Distribution of Knowledge about COVID-19 Vaccination between Age and Gender Variables

3.2. Attitudes towards COVID-19 Vaccination

The results on Attitudes towards Covid-19 vaccination (Table 3) revealed that 66.08% of participants have admitted that newly discovered Covid-19 vaccine is safe (1st item). About 80% of the participants have agreed to the following items: 2 (The Covid-19 vaccine is essential for us.), 3 (I will take the Covid-19 vaccine without any hesitation if it is available.), 4 (I will also encourage my family/friends/relatives to get vaccinated.), and half of the participants (50%) don't know whether the vaccination can harm either the pregnant woman (item 8) or the foetus of pregnant woman (item 9) who had vaccinated. While (39.24%) participants have agreed that ongoing vaccination programme is satisfactory (item 11) and 71.66% of them have agreed that vaccines should be fairly distributed to all irrespective of age and other comorbidities (item 12). 62.81% of the participants haven't taken the vaccine (13thitem) but 83.11% of them are ready to take vaccine (item 14). More than 60% of the participants supported that exporting of vaccines from India may get medical help from other countries (items 15-16). The differences for all the attitude items between adult and young were studied for significance using chi-square test and the items (1, 2, 3, 4, 8, 9, 11, 12, 13, and 14) were found to be significant with p-value of <0.05. Similarly, the statistical analysis between Females and Males showed that items (1, 12, 13, 15, and 16) were found to be significant with p-value of <0.05.

S.NO:	Attitudes	Total (N=734)	Adult (N=595)	Young (N=139)	χ^2, d.f, p-value	Female (305)	Male (429)	χ^2, d.f, p- value
		N (%)	N (%)	N (%)		N (%)	N (%)	
1	The newly discovered COVID-19 vaccine is safe.							
	Agree	485 (66.08)	406 (68.24)	79 (56.83)	**7.616, 2, 0.0222***	189 (61.97)	296 (69.00)	**13.07, 2, 0.0014****
	Disagree	40 (5.45)	28 (4.71)	12 (8.63)		10 (3.28)	30 (6.99)	
	Undecided	209 (28.47)	161 (27.06)	48 (34.53)		106 (34.75)	103 (24.01)	
2	The COVID-19 vaccine is essential for us.							
	Agree	626 (85.29)	518 (87.06)	108 (77.70)	**18.76, 2, <0.0001*****	262 (85.90)	364 (84.85)	**2.369, 2, 0.3059**
	Disagree	34 (4.63)	18 (3.03)	16 (11.51)		10 (3.28)	24 (5.59)	
	Undecided	74 (10.08)	59 (9.92)	15 (10.79)		33 (10.82)	41 (9.56)	
3	I will take the COVID-19 vaccine without any hesitation if it is available.							
	Agree	602 (82.02)	506 (85.04)	96 (69.06)	**23.18, 2, <0.0001*****	250 (81.97)	352 (82.05)	**1.051, 2, 0.5912**
	Disagree	40 (5.45)	23 (3.87)	17 (12.23)		14 (4.59)	26 (6.06)	
	Undecided	92 (12.53)	66 (11.09)	26 (18.71)		41 (13.44)	51 (11.89)	
4	I will also encourage my family/friends/relatives to get vaccinated.							
	Agree	648 (88.28)	538 (90.42)	110 (79.14)	**14.00, 2, 0.0009*****	269 (88.20)	379 (88.34)	**0.1610, 2, 0.9226**
	Disagree	22 (3.00)	14 (2.35)	8 (5.76)		10 (3.28)	12 (2.80)	
	Undecided	64 (8.72)	43 (7.23)	21 (15.11)		26 (8.52)	38 (8.86)	
5	It is not possible to reduce the incidence of COVID-19 without vaccination.							
	Agree	440 (59.95)	365 (61.34)	75 (53.96)	**2.715, 2, 0.2573**	176 (57.70)	264 (61.54)	**1.132, 2, 0.5678**
	Disagree	109 (14.85)	84 (14.12)	25 (17.99)		47 (15.41)	62 (14.45)	
	Undecided	185 (25.20)	146 (24.54)	39 (28.06)		82 (26.89)	103 (24.01)	
6	Vaccination causes mortality.							
	Agree	155 (21.12)	118 (19.83)	37 (26.62)	**4.058, 2, 0.1315**	54 (17.70)	101 (23.54)	**3.686, 2, 0.1583**
	Disagree	321 (43.73)	269 (45.21)	52 (37.41)		138 (45.25)	183 (42.66)	
	Undecided	258 (35.15)	208 (34.96)	50 (35.97)		113 (37.05)	145 (33.80)	

7	Vaccination causes severe irreparable loss for health in the long run.							
	Agree	127 (17.30)	103 (17.31)	24 (17.27)	**0.2428, 2, 0.8857**	59 (19.34)	68 (15.85)	**2.976, 2, 0.2258**
	Disagree	320 (43.60)	257 (43.19)	63 (45.32)		137 (44.92)	183 (42.66)	
	Undecided	287 (39.10)	235 (39.50)	52 (37.41)		109 (35.74)	178 (41.49)	
8	Vaccination cause harm to pregnant woman?							
	Don't Know	374 (50.95)	290 (48.74)	84 (60.43)	**7.568, 2, 0.0227***	151 (49.51)	223 (51.98)	**4.538, 2, 0.1034**
	No	218 (29.70)	189 (31.76)	29 (20.86)		84 (27.54)	134 (31.24)	
	Yes	142 (19.35)	116 (19.50)	26 (18.71)		70 (22.95)	72 (16.78)	
9	Vaccination cause damage to foetus if pregnant mother is vaccinated?							
	Don’t Know	460 (62.67)	368 (61.85)	92 (66.19)	**5.685, 2, 0.0583***	187 (61.31)	273 (63.64)	**0.5012, 2, 0.7783**
	No	163 (22.21)	142 (23.87)	21 (15.11)		69 (22.62)	94 (21.91)	
	Yes	111 (15.12)	85 (14.29)	26 (18.71)		49 (16.07)	62 (14.45)	
10	I would recommend vaccination for all.							
	Agree	533 (72.62)	441 (74.12)	92 (66.19)	**5.202, 2, 0.0742**	220 (72.13)	313 (72.96)	**0.1469, 2, 0.9292**
	Disagree	71 (9.67)	51 (8.57)	20 (14.39)		31 (10.16)	40 (9.32)	
	Undecided	130 (17.71)	103 (17.31)	27 (19.42)		54 (17.70)	76 (17.72)	
11	Ongoing vaccination programme is satisfactory.							
	Agree	288 (39.24)	245 (41.18)	43 (30.94)	**8.531, 2, 0.0140***	114 (37.38)	174 (40.56)	**4.694, 2, 0.0957**
	Disagree	325 (44.28)	262 (44.03)	63 (45.32)		130 (42.62)	195 (45.45)	
	Undecided	121 (16.49)	88 (14.79)	33 (23.74)		61 (20.00)	60 (13.99)	
12	Vaccines should be distributed fairly to all of us irrespective of age and other comorbidities.							
	Agree	526 (71.66)	445 (74.79)	81 (58.27)	**21.74, 2, <0.0001*****	222 (72.79)	304 (70.86)	**6.187, 2, 0.0453***
	Disagree	89 (12.13)	57 (9.58)	32 (23.02)		27 (8.85)	62 (14.45)	
	Undecided	119 (16.21)	93 (15.63)	26 (18.71)		56 (18.36)	63 (14.69)	
13	Have you taken the vaccination?							
	No	461 (62.81)	360 (60.50)	101 (72.66)	**7.130, 1, 0.0076****	212 (69.51)	249 (58.04)	**10.03, 1, 0.0015****
	Yes	273 (37.19)	235 (39.50)	38 (27.34)		93 (30.49)	180 (41.96)	

14	Will you take the vaccination?							
	No	124 (16.89)	92 (15.46)	32 (23.02)	**4.586, 1, 0.0322***	56 (18.36)	68 (15.85)	**0.7998, 1, 0.3711**
	Yes	610 (83.11)	503 (84.54)	107 (76.98)		249 (81.64)	361 (84.15)	
15	Do you support export of vaccines from India?							
	Don't Know	111 (15.12)	97 (16.30)	14 (10.07)	**4.033, 2, 0.1331**	55 (18.03)	56 (13.05)	**9.738, 2, 0.0077****
	No	182 (24.80)	149 (25.04)	33 (23.74)		59 (19.34)	123 (28.67)	
	Yes	441 (60.08)	349 (58.66)	92 (66.19)		191 (62.62)	250 (58.28)	
16	Do you think because of export of vaccines, we are getting medical help and support from other countries?							
	Don't Know	122 (16.62)	103 (17.31)	19 (13.67)	**1.079, 2, 0.5831**	66 (21.64)	56 (13.05)	**14.22, 2, 0.0008*****
	No	133 (18.12)	107 (17.98)	26 (18.71)		41 (13.44)	92 (21.45)	
	Yes	479 (65.26)	385 (64.71)	94 (67.63)		198 (64.92)	281 (65.50)	
Note: χ2: Chi-square test; d.f: Degrees of freedom; *statistically significant (p< 0.05)								

Table 3: Distribution of Attitudes towards COVID-19 Vaccination between Age and Gender Variables.

3.3. Perceptions towards COVID-19 Vaccination

The analysis of perceptions regarding Covid-19 vaccination (Table 4) reveal that 54.36% of participants think that Covid-19 vaccine may not have any side-effects (1st item), 40.46% of them think that vaccine should be given to all irrespective of age (3rd item), 57.22% of them think that Covid-19 pandemic can be eradicated without the vaccination if everyone follows the preventive measures (4th item),69% of the participants think that many are reluctant to take-up Covid-19 vaccine (7th item).while 74% of them are ready to afford vaccine at their own expense (11thitem). The statistical analysis of perception items have revealed that 7 and 11 items of perceptions were found to be significant between adults and young with P-value of <0.05, while the analysis between females and males showed that items 1, 3, 4 and 7 were found to be significant with P-value of <0.05.

S. No:	**Perceptions**	**Total (734)**	**Adult (595)**	**Young (139)**	**χ^2, d.f, p-value**	**Female (305)**	**Male (429)**	**χ^2, d.f, p-value**
		N (%)	**N (%)**	**N (%)**		**N (%)**	**N (%)**	
1	Do you think the newly discovered COVID-19 vaccine may have side effects?							
	No	399 (54.36)	331 (55.63)	68 (48.92)	**2.044, 1, 0.15**	140 (45.90)	259 (60.37)	**15.05, 1, 0.0001*****
	Yes	335 (45.64)	264 (44.37)	71 (51.08)		165 (54.10)	170 (39.63)	

2	Did you get any of the following side-affects after vaccination? / Have you noticed any of the following Symptoms in already vaccinated persons?							
	Any Other	285 (38.83)	234 (39.33)	51 (36.69)	**1.646, 4, 0.8005**	107 (35.08)	178 (41.49)	**5.930, 4, 0.2044**
	Body Pains	149 (20.30)	121 (20.34)	28 (20.14)		58 (19.02)	91 (21.21)	
	Fever	80 (10.90)	65 (10.92)	15 (10.79)		35 (11.48)	45 (10.49)	
	Headache	216 (29.43)	171 (28.74)	45 (32.37)		103 (33.77)	113 (26.34)	
	Nausea	4 (0.54)	4 (0.67)	NIL (0.00)		2 (0.66)	2 (0.47)	
3	Which age group you think should be taken up?							
	Adolescents	96 (13.08)	81 (13.61)	15 (10.79)	**4.097, 3, 0.2512**	46 (15.08)	50 (11.66)	**15.96, 3, 0.0012****
	Adult	142 (19.35)	121 (20.34)	21 (15.11)		41 (13.44)	101 (23.54)	
	All irrespective of Age	297 (40.46)	239 (40.17)	58 (41.73)		141 (46.23)	156 (36.36)	
	Senior Adult	199 (27.11)	154 (25.88)	45 (32.37)		77 (25.25)	122 (28.44)	
4	Do you think that if everyone in the society maintains the preventive measures, the COVID-19 pandemic can be eradicated without vaccination?							
	No	314 (42.78)	257 (43.19)	57 (41.01)	**0.22, 1, 0.6391**	118 (38.69)	196 (45.69)	**3.567, 1, 0.0589***
	Yes	420 (57.22)	338 (56.81)	82 (58.99)		187 (61.31)	233 (54.31)	
5	Who should have been vaccinated, do you think?							
	Everyone	562 (76.57)	464 (77.98)	98 (70.50)	**11.71, 8, 0.1648**	237 (77.70)	325 (75.76)	**9.835, 9, 0.364**
	Newly recovered from COVID-19	11 (1.50)	8 (1.34)	3 (2.16)		8 (2.62)	3 (0.70)	
	People infected with COVID-19	52 (7.08)	34 (5.71)	18 (12.95)		21 (6.89)	31 (7.23)	
	People infected with COVID-19, Newly recovered from COVID-19	1 (0.14)	1 (0.17)	NIL (0.00)		NIL (0.00)	1 (0.23)	
	People infected with COVID-19, Newly recovered from COVID-19, Everyone	1 (0.14)	1 (0.17)	NIL (0.00)		1 (0.33)	NIL (0.00)	
	Those who have not yet been infected	95 (12.94)	77 (12.94)	18 (12.95)		33 (10.82)	62 (14.45)	
	Those who have not yet been infected, Everyone	7 (0.95)	5 (0.84)	2 (1.44)		2 (0.66)	5 (1.17)	
	Those who have not yet been infected, Newly recovered from COVID-19	3 (0.41)	3 (0.50)	NIL (0.00)		2 (0.66)	1 (0.23)	
	Those who have not yet been	2	2	NIL		1	1	

	infected, People infected with COVID-19	(0.27)	(0.34)	(0.00)		(0.33)	(0.23)	
6	Who is supposed to be vaccinated first, you think?							
	Any other group	26 (3.54)	17 (2.86)	9 (6.47)	**9.292, 5, 0.098**	12 (3.93)	14 (3.26)	**0.9206, 5, 0.9687**
	Businessman	3 (0.41)	2 (0.34)	1 (0.72)		1 (0.33)	2 (0.47)	
	General Public	232 (31.61)	184 (30.92)	48 (34.53)		100 (32.79)	132 (30.77)	
	Health Worker	451 (61.44)	375 (63.03)	76 (54.68)		184 (60.33)	267 (62.24)	
	Public/private Employee	16 (2.18)	11 (1.85)	5 (3.60)		6 (1.97)	10 (2.33)	
	Teacher/student	6 (0.82)	6 (1.01)	NIL (0.00)		2 (0.66)	4 (0.93)	
7	Do you think many are reluctant to take vaccination?							
	No	225 (30.65)	195 (32.77)	30 (21.58)	**6.638, 1, 0.01***	75 (24.59)	150 (34.97)	**9.026, 1, 0.0027****
	Yes	509 (69.35)	400 (67.23)	109 (78.42)		230 (75.41)	279 (65.03)	
8	Do you think public awareness about the COVID norms is important?							
	No	59 (8.04)	49 (8.24)	10 (7.19)	**0.1652, 1, 0.6844**	28 (9.18)	31 (7.23)	**0.9210, 1, 0.3372**
	Yes	675 (91.96)	546 (91.76)	129 (92.81)		277 (90.82)	398 (92.77)	
9	Do you think all the people are following COVID norms?							
	No	503 (68.53)	411 (69.08)	92 (66.19)	**0.4359, 1, 0.5091**	212 (69.51)	291 (67.83)	**0.2322, 1, 0.6299**
	Yes	231 (31.47)	184 (30.92)	47 (33.81)		93 (30.49)	138 (32.17)	
10	Do you think the vaccine should be administered free of charge?							
	No	78 (10.63)	63 (10.59)	15 (10.79)	**0.004895, 1, 0.9442**	26 (8.52)	52 (12.12)	**2.428, 1, 0.1192**
	Yes	656 (89.37)	532 (89.41)	124 (89.21)		279 (91.48)	377 (87.88)	
11	Would you afford the vaccine at your own expense if it were not provided free by the government?							
	No	185 (25.20)	138 (23.19)	47 (33.81)	**6.741, 1, 0.0094****	82 (26.89)	103 (24.01)	**0.7821, 1, 0.3765**
	Yes	549 (74.80)	457 (76.81)	92 (66.19)		223 (73.11)	326 (75.99)	
Note: χ2: Chi-square test; d.f: Degrees of freedom; *statistically significant ($p < 0.05$)								

Table 4: Distribution of Perceptions Regarding COVID-19 Vaccination between Age and Gender Variables.

3.4. Bivariate Analysis

In addition to the above contingent analysis, bivariate analysis has also been performed to understand the significance between knowledge, attitudes and perceptions towards Covid-19 vaccination and socio-demographic variables and data is presented in Table 5. Bivariate analysis of socio-demographic variables with respect to knowledge has shown that positive vaccination history is found to be significantly associated with higher mean scores (2.67, $p<0.0099$) followed by adults with higher mean scores of 2.58, $p<0.0315$. Similarly, the bivariate analysis of attitudes revealed that the rural residents are found to be significantly associated with higher mean scores (1.77, $p<0.044$) followed by adult individuals with mean scores of 1.76, $p<0.0355$. None of the socio-demographic variables have shown significant association with perceptions regarding Covid-19 vaccination.

S.No:	Variables	Knowledge				Attitudes				Perceptions			
		Mean	SD	t/F	p-value	Mean	SD	t/F	p-value	Mean	SD	t/F	p-value
1	Age												
	Adult	2.58887	2.2515	2.68	0.0315*	1.69979	1.29848	2.31	0.0355*	2.01849	1.62987	1.077	0.3069
	Young	2.52788	2.21549			1.76978	1.38393			2.04971	1.65393		
2	Gender												
	Male	2.5877	2.24513	0.3326	0.7492	1.70615	1.30412	0.8626	0.4019	2.0125	1.62487	0.9089	0.3848
	Female	2.57576	2.24327			1.72275	1.33253			2.04113	1.64644		
3	Residence												
	Rural	2.56452	2.24762	0.2859	0.7832	1.77369	1.38972	2.199	0.044*	2.05279	1.67164	0.5398	0.6012
	Urban	2.58402	2.24312			1.70072	0.93133			2.01863	1.6251		
4	Marital Status												
	Married	2.58898	2.24884	0.5232	0.617	1.68996	1.29009	1.683	0.113	2.00761	1.61742	1.166	0.2708
	Unmarried	2.5705	2.23778			1.74162	1.34438			2.04518	1.65339		
5	Education												
	College level	2.56496	2.22497	0.3431	0.7416	1.71834	1.3421	0.3143	0.7576	2.02263	1.62349	0.08695	0.9324
	University level	2.58787	2.252			1.71064	1.30356			2.0252	1.63803		

6	Family												
	Joint Family	2.5517	2.22288	0.8516	0.4226	1.88295	1.33887	1.106	0.286	2.00041	1.61734	0.9213	0.3786
	Nuclear Family	2.59314	2.28725			1.64032	1.29106			2.03467	1.64066		
7	Monthly Family Income												
	Lower SES	2.59161	2.24663	0.003	0.997	1.72474	1.35546	0.039	0.962	2.04732	1.65486	0.011	0.989
	Middle SES	2.57925	2.24316			1.70691	1.30051			2.02	1.63099		
	Upper SES	2.56383	2.23281			1.74734	1.33862			2.00387	1.56772		
8	Vaccination History												
	Yes	2.67067	2.31563	3.507	0.0099*	1.73272	1.27426	0.7427	0.4692	2.04002	1.63114	0.4079	0.692
	No	2.49944	2.17357			1.6873	1.32751			2.01246	1.63323		
Note: SD: Standard Deviation; t/F: t-test/f-test; *statistically significant (p< 0.05)													

Table 5: Group difference analysis of Knowledge, Attitudes and Perceptions scores of COVID -19 Vaccination Survey.

3.5. Multivariate Regression Analysis

Further we have also performed multiple regressions for the knowledge and attitudes by taking only the variables that were found to be statistically significant in bivariate analysis and the data was presented in Table 6. This analysis revealed that Age and Vaccination History are the significant socio-demographic variables associated with knowledge regarding Covid-19 vaccination. Similarly, Age and Residence is found to be the significant variables in the context of attitudes towards Covid-19 vaccination.

Variables	**Knowledge**				**Attitudes**			
	B	**S. E**	**t**	**p-value**	**B**	**S. E**	**t**	**p-value**
Age [a]	1.015	0.03404	29.82	<0.0001*	1	0.08105	12.34	<0.0001*
Residence [b]	-	-	-	-	0.8719	0.07717	11.3	<0.0001*
Vaccination History [c]	1.129	0.05797	19.47	<0.0001*	-	-	-	-
Note: B=coefficient Estimate; S. E=Standard Error; *statistically significant (p< 0.05) a1=Adult, 2=Young; b1=Rural, 2=Urban; c1=Yes, 2=No								

Table 6: Multivariate Regression analysis of Knowledge and attitudes towards the COVID-19 vaccination.

4. Discussion

Vaccination is the only available potential source for controlling the spread of the present Covid-19 pandemic throughout the world. Various vaccines have been developed to serve this purpose, and vaccination drives around the globe are in progress. In order to control the pandemic, the government of India has also begun the vaccination jabs to the general population irrespective of their age (except the children below 18 years). Regardless of various vaccine(s) availability, acceptance and distribution of Covid-19, vaccines have raised a massive controversy among the population of India. For the present study, we have developed a validated questionnaire to generate data on the general population's knowledge, attitudes, and perceptions towards the Covid-19 vaccine and vaccination by adopting novel methods (Questionnaire-Google docs). The present study involves socio-demographic variables impacting Knowledge, attitudes and perceptions towards Covid-19 vaccination in the participants. In the present study, demographic data was collected from 734 individuals and presented in Table 1.

The study includes different variables such as gender, age, residence, marital status, education level, family type, family income and vaccination history. Contingent (chi-square test, degree of freedom and p-value), Bivariate and Multivariate regression analyses were performed to know the association between Knowledge, attitudes, perceptions and socio-demographic characteristics towards the Covid-19 vaccines. In our study, Knowledge towards Covid-19 vaccine among people was assessed by the questions on availability of vaccines in India, their effectiveness, the side effects of Covid-19 vaccines, harmful effects of vaccine overdose, opinion on causation of reactions, the role of vaccination on increasing of the autoimmune diseases, etc. Attitudes and Perceptions of people towards the Covid-19 vaccine were evaluated by understanding their inclination and motivation to their family and friends to get vaccinated. Moreover, we also assessed various sources of information that might influence general people's decision in receiving the vaccines.

Very few studies were undertaken, particularly in India, in the context of Knowledge, attitude and perceptions towards the Covid vaccine. In the light of the above scenario, the present study gains importance. Harapan et al. [7] in Indonesia and Lazarus et al. [4] in different countries carried out studies to understand the acceptance of the Covid-19 vaccine with a few limited questions in each area in their questionnaire. In the present study, we have evaluated these features using a reasonably good number of questions. The results of the present study shows that 96.73 % of the participants are aware of the vaccine and vaccination program. 66.08 % of participants opined that the Covid-19 vaccine is safe and felt that it is important to control the disease. 88.28% of our participants expressed their willingness to encourage their family members and friends to go for vaccination. Among all the participants, 71.66% of them expressed that the vaccination should be given to all irrespective of age and any comorbidities, 61.44% of them said that Health workers should be vaccinated first, 89.37% of them expressed that vaccination should be given free of cost. 74.80% of participants are willing to buy with their own funds if the government does not provide the vaccine at free of cost.

Participants differed on the efficacy of various types of vaccines. While some expressed Covishield is best, some others felt it is Covaxin or Sputnik. 44.28% of participants opined that the vaccination program is not satisfactory.

68.53% of participants said that people are not following Covid norms. Certain percentage of participants do not have any knowledge about vaccines, the efficacy of Covid-19 vaccines, side effects of vaccines, the safety of the vaccine, mortality due to vaccine, effects on pregnant women & foetus. A high percentage of the participants have expressed that the Covid-19 vaccine is safe and should be distributed fairly to all regardless of age and other health problems. Our results are in accordance with Mesesle et al. [8], who carried out a study in Ethiopia and showed that the Covid-19 vaccine is safe and should be fairly distributed to all irrespective of age and other comorbidities. Cai et al. [9], who carried out a study in the Chinese population, also reported that the Covid-19 vaccine is safe. Majority of the participants have agreed to take the vaccine without any hesitation and also encourage their family, friends, and relatives to get vaccinated. These results are similar to the study conducted by Verger Pierre et al. [10] in France and French-speaking regions (Belgium and Canada).

In another study by Cordina et al. [11] showed that people in Malta (Europe) are willing to take the vaccine. Cai et al. [9] conducted an observational study in Chinese adolescents and revealed that the vaccine is safe and the participants want to motivate their family/friends to get vaccinated. In our study, both young and adult participants majorly expressed that they would be vaccinated at their own expense if the government did not supply vaccines free of cost. These results are found to be consistent with Harappan et al. [12] in Indonesia, Wong et al. [13] in Malaysia, Sarasty et al. [14] in Ecuador, who reported that most of the participants are willing to pay for Covid-19 vaccine. Studies from different countries are inconsistence regarding the purchase of vaccines by individuals, wherein some of them agreed to purchase the vaccines, while some others disagreed. This might be attributed to the financial crisis of people due to the Covid-19 pandemic from under developing countries. In our study, more than half of the participants have opined that the Covid-19 vaccines do not cause any side effects. Our results do not agree with the study conducted in the Indian population by Mir et al. [15], who has reported a positive perception of participants' towards side effects caused by the Covid-19 vaccine.

Our study also revealed that more than half of the participants have agreed that the Covid-19 pandemic can be eradicated without vaccination if everyone maintains the prescribed preventive measures. A study by Christy et al. [2] from India also reported that most of their participants had optimistic hope that Covid-19 could be eradicated. Table 5 depicts a significant association of Knowledge regarding Covid-19 vaccination between the variables of age and vaccination history with the p values of 0.0315 and 0.0099, respectively. In particular, adults with positive vaccination history have more Knowledge towards Covid-19 vaccination. Ahmed et al. [16] carried out a study on Knowledge and attitudes in health professionals in Ethiopia and demonstrated that educational status, age, and profession were the variables associated with the Knowledge regarding the Covid-19 vaccination. Mohamed et al. [17] also showed that education and income were the significant variables of Knowledge about Covid-19 vaccination in Malaysians. Our findings showed no significant difference in the Knowledge towards the Covid-19 vaccine between males and females. Zannatul et al. [18] in Bangladesh also reported no significant difference in Knowledge regarding Covid-19 between male and female participants. However, a study conducted by Banik et al. [19] in Bangladeshi youth revealed that a significant ratio of females has the Knowledge of the Covid-19 pandemic.

Bivariate and Multivariate regression analysis as depicted in Tables 5 & 6 shows that age and residence variables were significantly associated with attitudes towards Covid-19 vaccination. However, the study conducted by Zhong et al. [20] among Chinese residents revealed that marital status and education are significant variables associated with attitudes of Covid-19. Another study by Paul et al. [21] reported that a lower level of household income and education variables were associated with negative attitudes towards vaccines. While the study conducted by Ahmed et al. [16] reported that Education status, age, marital status, and profession were found to be significantly associated with the attitudes of Covid-19 vaccines. In the present study, we have also performed bivariate and multivariate regression analysis regarding perceptions towards Covid-19 vaccination, and we did not find any significant association with the socio-demographic variables such as age, gender, economic status etc. However, a study conducted by Paudel et al. [22] among healthcare workers and staff at medical colleges in Nepal reported that gender, monthly income and education are the variables that have shown significant association towards the perceptions of Covid-19 vaccination.

4.1. Limitations of the study

The study questionnaire is restricted to participants who are educated, English speaking and also having the internet access. Findings of the current study represents the KAP towards COVID-19 vaccination limited to general Telangana population.

5. Conclusion

Knowledge, Attitudes and Perceptions play a very important role to contain the Covid-19 infection. Some people in the present study have shown low to moderate levels of knowledge, negative attitudes and undesirable perceptions which will hamper to contain Covid infection. Therefore, findings from this research study may have positive implications towards promoting greater acceptance of the Covid-19 vaccination among the public. Thus, it is necessary to organize awareness programmes and educational campaigns at different levels to enhance their KAP about the pandemic and its consequences on community.

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Declarations

Ethics Approval

The protocol of the study and validation of survey questionnaire were approved by the MAA Ethics Committee.

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Conflicts of interest/Competing interests

None Declared.

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