Scope
Volume 14 Number 03 September 2024

Awareness and Acceptance Regarding Covid-19 Vaccination and Determinants of Vaccine Uptake: A Cross-Sectional Analysis

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Abstract: Background: Despite extensive efforts by both the community and government, COVID-19 remains a persistent threat. Vaccination and adherence to COVID-appropriate behaviours are crucial in curbing the pandemic. This study aimed to assess awareness, acceptance, and determinants of COVID-19 vaccination. **Materials and Methods:** An analytical cross-sectional study involving 400 respondents after obtaining verbal consent, was conducted between February 5th and February 20th, 2022. Structured questionnaires collected data on socio-demographics, COVID-19 infection/vaccination status, vaccine awareness, motivation, and reasons for refusal. **Results:** Among 400 respondents, 62.7% were aged 18-40 years, and 67.8% were male. High awareness (96%) of vaccine protection against infection was observed, with 99.8% supporting compulsory vaccination. Most (94.7%) were vaccinated for self-protection, citing efficacy doubts and side effect concerns as primary reasons for refusal. **Conclusion:** The study highlights satisfactory awareness and positive attitudes toward COVID-19 vaccination. Enhanced awareness campaigns and addressing safety concerns can further boost vaccine acceptance. Accurate vaccine information is essential to promote adherence to government guidelines in combating vaccine-preventable diseases.

Keywords: COVID-19, Vaccination, Vaccine Acceptance, Awareness, COVID-19 Vaccine

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Introduction: Since 2020, India has grappled with the COVID-19 epidemic, with the first case recorded on January 30, 2020, in Kerala.[1] Despite two years of concerted efforts by both the community and the government, COVID-19 remains a persistent pandemic. The Indian government has implemented various measures to curb COVID-19 transmission, including lockdowns, closure of educational and office institutions,

awareness campaigns, and the distribution of free COVID-19 vaccines. Balancing health measures with economic stability underscores the need for a collective effort between the government and the community. COVID-appropriate behaviours such as mask-wearing, social distancing, and hand hygiene, alongside vaccination, represent effective strategies in combating the crisis.

Previous research and ongoing clinical trials underscore the importance of safe and effective COVID-19 vaccines in controlling the pandemic.[2] Vaccination campaigns have historically proven successful in combating infectious diseases, making vaccines among the most reliable and cost-effective public health interventions, saving millions of lives annually. Immunity against the virus can be acquired either through natural infection or vaccination.[3]

Amidst the global spread of the virus, vaccination emerges as a crucial tool in halting community transmission of COVID-19. In India, vaccines like Covishield and Covaxin have been authorized for use and distributed nationwide.[4] As of May 30, 2022, India has reported over 53 crore COVID-19 cases and 63 lakh deaths globally, with approximately 43 crore cases and 5 lakh deaths occurring in India,[5] including around 10 lakh cases and over 10 thousand deaths in Madhya Pradesh.[6] Vaccination coverage stands at 60.6% globally, 64.3% in India, and 69.7% in Madhya Pradesh.[7]

Despite vaccine availability, inadequate information about vaccine types, efficacy, dosing recommendations, and prevalent vaccine hesitancy pose significant challenges to infection control efforts. This study aims to assess COVID-19 vaccination awareness and acceptance, alongside associated factors, among the general public.

Materials and Method: This analytical, cross-sectional study was conducted by the IDSP cell, Directorate of Health Services, Bhopal, Madhya Pradesh, from February 5 to February 20, 2022. A random sampling method was employed to determine the sample size. From a pool of 10,279 mobile numbers representing residents of all districts of Madhya Pradesh, obtained from the telecommunication department, 3000 participants were randomly selected to ensure representation from each district by convenient sampling. Only individuals willing to participate were included in the study, resulting in 400 responses. Confidentiality and anonymity were strictly maintained throughout the study. Ethical approval was taken from the institution board. AsThis investigation was done under the Integrated Disease Surveillance Project cell of Directorate of Health services for monitoring purpose of COVID-19 vaccination campaign and feedback. All investigators and corresponding author were affiliated with DHS.

Data Collection and Tool: Structured questionnaires were utilized to collect data for this study. Drawing upon existing literature, experts prepared and validated the questionnaire. Prior to data collection, participants were briefed on the study's objectives, purpose, and implications. The questionnaire was administered via telephone interviews using a Google form, facilitated by our counsellors. It covered

various aspects including socio-demographic characteristics, COVID-19 infection and vaccine status, awareness of COVID-19 vaccine, motivations, and reasons for vaccine refusal.

Statistical Analysis: Data collected were organized and analysed using MS Excel and SPSS. Percentages were calculated for qualitative variables, while mean and standard deviation (SD) were computed for quantitative variables. Multiple logistic regression analysis was employed to assess the probability of outcomes associated with different variables.

Results:

Statistical analysis was done among 400 participants, and found following results.

Table 1: Sociodemographic characteristics of respondents:

Variables (n=400)	**Frequency**	**%**
Age in years		
< 18	*19*	*4.8*
18-40	*251*	*62.7*
41-60	*102*	*25.5*
>60	*28*	*7.0*
Gender		
Male	*271*	*67.8*
Female	*129*	*32.3*
Area		
Rural area	*224*	*56.0*
Urban area	*136*	*34.0*
Semi-urban Area	*40*	*10.0*
Education		
Illiterate	*108*	*27*
Primary education	*27*	*6.8*
Middle school	*30*	*7.5*
High school	*69*	*17.3*
Graduate	*63*	*15.8*
Professional degree	*103*	*25.8*
Marital status		
Married	*304*	*76.0*
Unmarried	*82*	*20.5*
Other	*14*	*3.5*

Table 1 shows the majority of participants (62.7%, n=251) were from the age group of 18-40 years, followed by (25.5%) 41-60 years. 67.8% (n=271) were male. More than half of the participants (56%, n=226) were from rural areas. Regarding the education level of participants, 41.6% (n=166) of the participants had education graduate and above. Whereas 27% (n=108) of the participants didn't have any formal education.Overall,most of the participants (76%, n=304) are married.

Table 2: Awareness regarding COVID-19 vaccine:

Does the COVID vaccine protect us from getting infected?		
Yes	*384*	*96*
No	*16*	*4*
Do you think the COVID vaccination also protects other people who do not get the vaccine?		
Yes	*311*	*77.8*
No	*89*	*22.3*
Is it necessary to get the COVID vaccine even if you have already been infected with COVID?		
Yes	*399*	*99.8*
No	*1*	*0.3*
Do you think vaccines can eradicate the COVID pandemic?		
Yes	*386*	*96.5*
No	*14*	*3.5*
Do you think you don't need a vaccine because you take preventive measures seriously?		
Yes	*24*	*6.0*
No	*376*	*94.0*
Do you think people under the age of 15 should get the COVID vaccine?		
Yes	*360*	*90*
No	*10*	*2.5*
Don't know	*30*	*7.5*
Should people with chronic illness get the COVID vaccination?		
Yes	*382*	*95.5*
No	*18*	*4.5*
Do you think vaccine should be compulsory for all?		
Yes	*399*	*99.8*

No	1	0.3

Table 2 is denoting awareness towards COVID-19 vaccination, The vast majority of participants (96%, n=384) were aware that COVID vaccines protect against infection. Additionally, 77.8% (n=311) believed vaccination also safeguards individuals who have not received the vaccine. Almost unanimous agreement (99.8%, n=399) was observed regarding the necessity of COVID vaccination, even for those previously infected. Furthermore, 96.5% (n=386) expressed confidence in the vaccine's potential to eradicate the pandemic. Notably, 94% (n=376) of participants recognized the importance of vaccination despite practicing preventive measures, while 90% and 95.5% advocated for vaccination among individuals under 15 years old and those with chronic illnesses, respectively. The overwhelming majority (99.8%, n=399) perceived vaccination as compulsory for all.

Table 3: Vaccination status and Determinants of COVID-19 vaccination:

Factors	Frequency	Percent
Infected with COVID-19 in the past (n=400)		
Yes	96	24
No	297	74.3
Don't know	7	1.8
Long-term illness among persons with past COVID-19(n=96)		
Yes	69	71.9
No	27	28.1
Type of long-term effects after recovering from a COVID-19 infection (n=69)		
Weakness	36	52.2
Headache	9	13.04
Body ache	7	10.14
Anxiety/ Depression	3	4.35
Breathlessness	3	4.35
Weakness with other (body ache/ breathlessness/ headache)	7	10.14
Headache with other (Anxiety/ Depression/ Body ache/ Breathlessness)	3	4.35
Breathlessness, Anxiety/ Depression	1	1.45
H/O COVID-19 Infection of Family Member (n=400)		
Yes	56	14
No	344	86
Have you taken COVID-19 vaccination (n=400)		
Yes	396	99

No	*4*	*1*
Doses of COVID-19 vaccine taken by participants (n=396)		
1	*115*	*29*
2	*262*	*66.2*
3	*19*	*4.8*
Type of COVID-19 vaccine taken by participants (n=396)		
COVAXIN	*79*	*19.9*
COVISHIELD	*255*	*64.4*
Don't know	*62*	*15.7*
The reason behind taking the COVID vaccine (n=396)		
For protection	*375*	*94.7*
Other's pressure	*12*	*3.0*
Because it is mandatory in the office	*8*	*2.0*
Other	*1*	*0.3*
Reason behind refusal of COVID-19 vaccination(n=4)		
Other (doubt about vaccine and side effects of vaccine)	*3*	*75*
Any contraindication or co-morbidity	*1*	*25*
Different types of Chronic illness related to COVID infection in Participants(n=84)		
Hypertension	*29*	*34.52*
Diabetes	*18*	*21.43*
Thyroid problem	*11*	*13.10*
Others (COPD/ asthma, pulmonary tuberculosis/ malignancy)	*7*	*8.33*
Hypertension and Diabetes	*4*	*4.76*
Obesity	*4*	*4.76*
Hypertension with obesity/ Kidney disorders /Thyroid problems	*4*	*4.76*
Liver diseases and Obesity/ Thyroid problem	*4*	*4.76*
Diabetes and others	*2*	*2.38*
Thyroid problems and obesity	*1*	*1.19*
Total	*84*	*100.00*

Table 3 regarding the COVID infection and vaccination status of participants, only 24% (n=96) of participants had a history of COVID-19 infection as of February 2022. Among those infected, approximately 72% (n=69) reported experiencing long-term illness, with weakness (52.2%) being the most common symptom, followed by headache (13.4%), body aches (10.14%), anxiety/depression (4.35%), and breathlessness

(4.35%).The majority of participants did not have any family members with a history of COVID-19 infection.Regarding vaccination status, nearly all participants (99%, n=396) were either partially (29%) or fully (66.2%) vacci/nated, with Covishield being the most commonly received vaccine (64.4%, n=255). The primary reason for vaccination was self-protection (94.7%, n=375).

Regarding comorbidities, approximately 21% (n=84) of participants reported having chronic illnesses or comorbidities, with hypertension (4.5%, n=29) being the most prevalent, followed by diabetes (21.4%, n=18), thyroid problems (13%, n=11), and COPD/Asthma/PTB/Malignancy (8.33%, n=7). Notably, hypertension combined with other comorbidities was the most common combination.

Table 4: Factors associated with vaccination of participants:

	Frequency (n=396)	Percent
The motivation behind the vaccination of participants		
Self	*289*	*73.0*
Health personnel	*39*	*9.8*
Media	*25*	*6.3*
Family members	*23*	*5.8*
Institution as the compulsory norm	*12*	*3.0*
Friend	*3*	*0.8*
Other	*3*	*0.8*
Colleagues	*2*	*0.5*
Total	*396*	*100.0*
Has motivated others to vaccinate?		
Yes	*327*	*82.6*
No	*69*	*17.4*
The time gap between motivation and getting COVID-19 Vaccination		
< 1 month	*209*	*52.8*
1- 3 month	*140*	*35.4*
> 3 months	*47*	*11.9*
Reason for delay in taking COVID vaccine		
None	*325*	*82.1*
Fear of vaccine-related adverse effects	*26*	*6.6*
Less availability of vaccine	*13*	*3.3*
The vaccination center was located far away	*13*	*3.3*
Other Reason	*10*	*2.5*
Doubt about the safety of vaccine	*7*	*1.8*
Doubt about the effectiveness of vaccine	*2*	*0.5*
Regret about taking COVID vaccination		
Yes	*126*	*31.8*

No	*270*	*68.2*
Observed any adverse event after COVID vaccination		
Yes	*107*	*27.0*
No	*289*	*73.0*
Adverse events after Vaccination (n=107)		
Fever	*46*	*43.0*
Anxiety	*25*	*23.4*
Rash	*14*	*13.1*
Chills	*12*	*11.2*
Localized pain	*6*	*5.6*
Nausea/ Vomiting	*3*	*2.8*
Others	*1*	*0.9*

Table 4 shows approximately three-fourths of participants (73.0%, n=289) were self-motivated to receive the COVID vaccination.

- Among these, a significant proportion (82.6%, n=327) encouraged others to get vaccinated, and more than half (52.8%, n=208) received their vaccination within a month.
- The majority (82%, n=325) did not cite any reason for delaying vaccination, while reasons for delay included fear of adverse effects (6.6%, n=26), limited vaccine availability (3.3%, n=13), and distance to vaccination centers (3.3%, n=13).
- A substantial number of participants (31.8%, n=126) expressed regret after vaccination.
- Among vaccinated individuals, 27% (n=107) reported experiencing some form of adverse event, with fever (43%, n=46) and anxiety (23.4%, n=25) being the most common.

The multivariate logistic regression model adjusted for various confounders, including age category, past COVID infection, presence of chronic illness, past COVID infection among family members, motivation for vaccination, and observation of adverse events post-vaccination. Predictors with p-values less than 0.1 in the bivariate analysis were included in the multivariate analysis.

Table 5: The multivariate logistic regression model for vaccination status of participants and different confounders:

Variables	Category	Fully vaccinated 281 (71%)	Partial vaccinated 115 (29%)	p-value (Chi-square)	OR 95% CI	Adjusted OR 95% CI	Adjusted p-value
Age category	41-60, >60	102 (78.5%)	28(21.5%)	1.85 (1.14 – 3.02)	0.013* (6.214)	2.34 (1.34-4.07)	0.003*
	<18,18-40 years	179 (66.3%)	91 (33.7%)				
Past COVID infection	No, Don't know	222 (73.0%)	82 (27.0%)	1.70 (1.05 – 2.75)	0.031* (4.672)	1.18 (0.67 - 2.05	0 .564
	Yes	59 (61.5%)	37 (38.5%)				
Presence of chronic illness	Yes	52 (61.9%)	32 (38.1%)	0.62 (0.37 – 1.02)	0.060 (3.543)	0.61 (0.33-1.12)	0.113
	No	229 (72.5%)	87 (27.5%)				
Past COVID infection of family members	No, don't know	252 (73.3%)	92 (26.7%)	2.55 (1.43 – 4.54)	0.001* (10.622)	2.10 (1.11-3.97)	0.023*
	Yes	29 (51.8%)	27 (48.2%)				
Motivation to vaccinate	Family, Friends, Health care personnel, Others	94 (87.9%)	13 (12.1%)	3.94 (2.10 – 7.39)	<0.001* (20.299)	3.21 (1.68 - 6.14)	<0.001*
	Self	187 (64.7%)	102(35.3%)				

After adjusting for confounders, age, past COVID infection of family members, and motivation to vaccinate showed significant associations with vaccination status, with p-values of 0.003, 0.023, and <0.001, respectively. Individuals aged 41-60 and those over 60 years had 2.34 times higher odds of being fully vaccinated (95% CI= 1.34-4.07) compared to those aged under 18 or between 18-40 years. Participants without any family members who had experienced past COVID infection had 2.10 times higher odds of being fully vaccinated (95% CI= 1.11-3.97) compared to those with affected family members. Furthermore, individuals motivated by family, friends, healthcare personnel, or others

had 3.21 times higher odds of being fully vaccinated (95% CI= 1.68 -6.14) compared to those who were self-motivated. (**Table 5)**

Table 6: Association of gender, educational status vs. Vaccination status:

		Vaccination status		**Odd's ratio with 95% CI**	**P-value and Chi-square**
		Fully vaccinated 281 (70.3%)	Partially or not vaccinated 119 (29.8%)		
Gender	Male	187 (69.0%)	84 (31.0%)	0.83 (0.52 – 1.32)	0.429 (0.625)
	Female	94 (72.9%)	35 (27.1%)		
Educational category	Graduate and above	109 (65.7%)	57 (34.3%)	0.84 (0.50-1.41)	0.109 (4.439)
	Primary to high school	97 (77.0%)	29 (23.0%)	1.47 (0.82 – 2.64)	
	Illiterate	75 (69.4%)	33 (30.6%)	Reference	
		Does vaccination also protect other people who do not get the vaccine?			
		No	Yes		
Vaccination status	Fully vaccinated	81 (28.8%)	200 (71.2%)	5.62 (2.62 – 12.05)	<0.001* (23.608)
	Partial vaccinated	8 (6.7%)	111 (93.3%)		
Total		89 (22.3%)	311 (77.8%)		

Table 6shows a higher proportion of females (72.9%, n=94) were fully vaccinated compared to males (69%), although no significant association was found between gender and vaccination status.

Participants who had completed primary, middle, or higher school (77.0%, n=97) exhibited a higher rate of full vaccination compared to those with graduate and professional degrees (65.7%, n=109) and individuals with no formal education (69.4%, n=75). However, there was no significant association between educational status and vaccination status.

A highly significant association was observed between COVID vaccination status and the perception of vaccination providing protection to unvaccinated individuals (p-value < 0.001). Fully vaccinated individuals were 5.62 times more likely to perceive that

vaccination does not protect unvaccinated people (95% CI = 2.62-12.05) compared to those who believed that vaccination provides protection to non-recipients.

There is a highly significant association between the presence of chronic illness and past COVID infection, with a p-value of <0.001 and odds ratio of 4.85 (95% CI= 2.89- 8.15).

Table 7: Association of the presence of chronic illness with past-COVID infection and motivation to vaccine with motivating others to vaccinate:

		Past COVID infection		**Odd's ratio with 95% CI**	**P-value and Chi-square**
		Yes	No, Do not know		
Presence of chronic illness	Yes	42 (50.0%)	42 (50.0%)	4.85 (2.89- 8.15)	<0.001* (39.407)
	No	54 (17.1%)	262 (82.9%)		
Total		96 (24.0%)	304 (76.0%)		
		Motivating others to vaccinate			
		Yes	No		
Motivation to vaccinate	Self	266 (92.0%)	23 (8.0%)	8.72 (4.92 - 15.46)	<0.001* (66.606)
	Friends, family, health care personnel, and others	61 (57.0%)	46 (43%)		
Total		327 (82.6%)	69 (17.4%)		

Additionally, there is a highly significant association between individuals being motivated and motivating others for vaccination, with a p-value of <0.001. Individuals who were self-motivated for vaccination had 8.72 times higher odds of motivating others to vaccinate (95% CI= 4.92- 15.46) compared to those motivated by friends, family, health care personnel, or others. (**Table 7**)

Discussion: The success of any COVID-19 vaccination campaign hinges upon widespread acceptance among the general population. Our questionnaire was instrumental in gauging vaccine acceptance and assessing knowledge and attitudes surrounding the COVID-19 vaccine. We included a total of 400 respondents in our study, with 62.7% falling within the 18-40 age bracket. The gender distribution showed that 67.8% were male and 32.3% were female, while 56% hailed from rural areas. A majority (58.9%) of participants had received education up to high school level or above. These demographics differ from findings in other regions. For instance, a study in Jammu & Kashmir [8] reported 69.6% male and 30.4% female participants, with a mean age of 34.2 ± 11.2 years. Furthermore, 68.5% of participants were from urban areas, contrasting with our predominantly rural sample. Similar result found in the study of AlrefaeiAf et al, Saudi Arabia, there were 73.5% male. More than half of respondents were 18–28 (65%), and 95.8% had education at high school and higher.[9]

Our study revealed that 96% of participants were aware of the protective role of COVID-19 vaccines against infection, and a similar percentage believed in its potential to eradicate the pandemic. Additionally, 90% and 95.5% of respondents endorsed vaccination for individuals under 15 years of age and those with chronic illnesses, respectively. Notably, 99.8% of participants felt that vaccination should be mandatory for all. This contrasts with findings by Subramani et al. [3], where only 38% believed in the preventive efficacy of the COVID-19 vaccine, and 27% people believe that COVID-19 vaccine will provide complete protection against COVID-19 disease. Another study states that the awareness regarding COVID-19 and its vaccination was about 74% among the study population.[8]

Motives for vaccination varied across studies. While Štěpánek et al.[10] found family protection to be the primary motive (76.2%) and 49.1% for self-concern, whereas our study indicated that 94.7% of respondents were vaccinated for self-protection.

Post-vaccination adverse effect was reported by 27% of vaccinated participants, with fever (43%) and anxiety (23.4%) being the most prevalent in present study. This differs slightly from finding of central India study, where 29.8% reported adverse events, with pain at the injection site (14.6%), fever (9.7%), and myalgia (5.9%) being commonly reported.[11]

A notable proportion (75%) of respondents had doubts about the vaccine and feared its side effects, while 25% reported chronic illness as a reason for vaccine refusal. These findings echo those of Cerda and García,[12] who identified concerns about vaccine side effects and risk perception as primary reasons for vaccine hesitancy.

In conclusion, our study sheds light on the nuanced factors influencing COVID-19 vaccine acceptance and hesitancy in Madhya Pradesh, India. These insights are vital for tailoring vaccination strategies and addressing public concerns, ultimately enhancing vaccine uptake and mitigating the impact of the ongoing pandemic.

Factors Associated with Participants' COVID-19 Vaccination Status:
In our study, after adjusting for potential confounding factors through multivariable logistic regression analysis, several variables emerged as significantly associated with vaccination status ($p < 0.05$). Specifically, age, family history of COVID-19 infection, and sources of motivation for vaccination showed significant associations.

- Age Categories: Participants aged 41-60 and those above 60 years exhibited 2.34 times higher odds of being fully vaccinated (95% CI= 1.34-4.07) compared to individuals below 18 and those between 18-40 years old.
- Family History of COVID-19 Infection: Individuals without any family members infected with COVID-19 in the past demonstrated 2.10 times higher odds of being fully vaccinated (95% CI= 1.11-3.97) compared to those with affected family members.
- Sources of Motivation for Vaccination: Participants motivated by family, friends, healthcare personnel, or other sources showed 3.21 times higher odds of being fully vaccinated (95% CI= 1.68 -6.14) compared to those who were self-motivated.

Additional Observations:

- Gender Disparity: A higher proportion of females (72.9%) were fully vaccinated compared to males (69%).
- Educational Attainment: Interestingly, a higher proportion (77.0%) of individuals who had completed primary, middle, or higher school were fully vaccinated compared to those with graduate and professional degrees (65.7%) and individuals with no formal education (69.4%). However, no significant association was found between educational status and vaccination status.

Conclusion:
This study delved into various population characteristics to glean insights essential for effective vaccination awareness campaigns aimed at combating COVID-19 transmission. While appreciable awareness levels regarding the COVID-19 vaccination was observed amongst the study population, sustained efforts are imperative to further educate the populace on the safety, efficacy, and benefits of vaccination.

Policymakers can utilise diversified methods in disseminating information regarding pandemic appropriate behaviour and vaccination through various channels, including social media platforms and mass communication methods. Additionally, the establishment of specialized media cells is recommended to combat the proliferation of rumours, myths, and misinformation, which pose significant obstacles to vaccination efforts. Vigilance in this regard is crucial as the threat of infection resurgence remains ever-present.

By prioritizing robust vaccination awareness initiatives and leveraging effective communication strategies, we can empower individuals to make informed decisions regarding vaccination, thereby support public health resilience against any pandemic similar to the COVID-19 and other future health threats.

Acknowledgment: We would like to acknowledge the support from higher state officials, Additional Chief Secretary Health Commissioner Health, and Director of Health and District IDSP team Bhopal.

Funding: none
Conflict of interest: None

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