

Effectiveness Of Evidence-Based Educational Intervention On Covid-19 Vaccine Acceptability Among Healthcare Students Of Rural India: A Randomized Controlled Trial

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ABSTRACT

Purpose:

To fight against the COVID-19 epidemic, improving COVID-19 vaccine acceptance amongst the future healthcare workforce (healthcare students) is crucial since, being front liners, they are in authority for endorsing vaccination to their future patients. High and ongoing vaccine acceptance also relies on persons' knowledge, attitudes, and perceptions toward the vaccine. With the advent of misinformation and myths about vaccines, lower acceptance rates are observed in rural areas of India that demand evidence-based education to train future healthcare professionals in the first place. Considering this background, this study aimed to evaluate the impact of an education-based intervention to improve COVID-19 vaccine acceptance among healthcare students in rural parts of India.

Method: To achieve this purpose, a randomized controlled trial was performed to measure the effect of an evidenced-based educational intervention (The COVID-19 vaccination 100 Questions Resource Booklet) among healthcare students in rural India. A total of 165 sample size participants in each of the two study arms was planned to detect a significant difference of at least 20% in vaccine acceptability among arms. All participants completed an anonymized questionnaire survey collecting data on socio-demographics, COVID-19 vaccine knowledge, attitude, perception, willingness to accept the vaccine, vaccine hesitancy, and its associated factors after completing their randomization assignments. The efficacy of the evidence-based intervention was tested by evaluating the outcomes between the control and intervention groups. Multivariable logistic regression, ANOVA test, and Descriptive statistics were performed to analyze the correlation level among study variables and to assess the associated outcomes between co-variables and intervention.

Result: Analysis of the questionnaires demonstrated that participants in the Interventional group who read an educational interventional COVID-19 vaccination booklet were likelier to report (p-value <.0.05) acceptance toward the COVID-19 vaccine than the control group. Multivariate analysis exhibited overall improved "excellent" knowledge scores, and the mean value of students' perception and attitude regarding the COVID-19 vaccine were also improved in the intervention group.

Conclusion:

The experimental study demonstrated the significance of healthcare students' knowledge, attitudes, and perceptions by incorporating educational intervention initially in their degree curricula to enhance the vaccine acceptance rate. These encouraging results may help future similar studies to promote vaccines among the general population in their future

careers. However, further research studies in more extensive settings and different populations are needed to determine whether this intervention also increases vaccine acceptance rates as booster vaccination programs continue across the globe.

Background:

SARSCoV-2, identified in January 2020, soon announced "The Corona Virus Disease 2019" pandemic by WHO [1] spread significantly faster over 200 countries, resulting in significant mortality and morbidity while hitting the economy and the national healthcare system. India, the country with the 2nd highest population (1.34 billion), has a current healthcare structure distribution system that has already been encountering challenges of affordability and accessibility and deserves greater attention amid the COVID-19 pandemic, specific rural parts of states like Madhya Pradesh, Rajasthan, etc. which has reported more than 250k cases and more than 4000 deaths till March 2021 [2]. By August 2020, it was noted that approx.3000 healthcare workers were infected with COVID-19, the deaths of doctors were 200, and healthcare personnel were 16 in every 1 lakh COVID-19 patients in India [3]. No specific antiviral medications are available for COVID-19, so healthcare personnel follow WHO and national guidelines in prevention, like wearing face masks, social distancing, washing hands, early diagnosis, etc. [4]. However, humans cannot use face masks and social distancing for a long time. Thus, the best approach to prevent the pandemic is immunization. [5]. Subsequently, at the beginning of 2021, India permitted the COVID-19 vaccine for emergency use against COVID-19, aiming for successful vaccination [6].

Over the months after the vaccine approval, it was accessible all over India. Nevertheless, it is well established that healthcare students (future healthcare workers) can substantially benefit healthcare systems during eras of crisis. A vaccinated future healthcare workforce can continue functioning as the front responders in the battle against the pandemic, advising their prospective patients and being representatives for more comprehensive vaccination coverage for upcoming generations. However, one of the critical challenges regarding successful COVID-19 vaccination is hesitancy towards the vaccine, even though great work is being put into developing and deploying vaccines [7]. Anti-vaccination activists agitating in numerous countries can impact the vaccination acceptance rate. The WHO registered vaccine hesitancy as one of the top ten threats to worldwide health in 2019 [8]. Decision-making around vaccine acceptability is likely heightened by better knowledge, positive attitude, understanding of how infections spread, and the benefits that vaccination could gain [9]. During the previous pandemic, the data shows that frontline healthcare workers performed a positive role by educating others about the significance of immunization [10]. Determining the acceptance of the COVID-19 vaccine by healthcare personnel will also guide future vaccination studies [11]. Healthcare students (future healthcare workers) must retain the fundamental knowledge about novel COVID-19 vaccinations and be able to clear the myths relating to COVID-19 and vaccination. The inadequate knowledge and the incorrect attitudes toward COVID-19 vaccination among healthcare students can directly affect their future infection-handling practice [12]. Therefore, addressing future generations of healthcare workers towards accepting COVID-19 vaccination in advance of their career is crucial in vaccine uptake strategy among prospective patients, especially parents of young children.

Although academic leadership performs a starring role among healthcare students regarding vaccination, other education-based interventions can be helpful to increase vaccination acceptance and must remain attempted and implemented. In the past, numerous studies urged the enhancement of modified interventions and strategies to improve vaccination uptake among healthcare personnel [13] [14]. One study in France regarding the influenza vaccine found improved vaccine acceptance. In India, in 2018, an intervention-based pilot cluster randomized trial study conducted in the rural Indian population to enhance primary health knowledge and empower beneficiaries aiming for elemental vaccination uptake demonstrated high implementation reliability (86.7%) [15].

However, even if some interventions have been shown to impact previous pandemic vaccination uptake, there is no assurance that they will affect a different environment. The most critical barriers to vaccination vary from one virus to another, differing on the epidemiology of each infection, the consequences and advantages of each vaccine, and the vaccination service delivery system [16]. Understanding the knowledge, attitude, perception, and positive factors influencing acceptance and barriers behind vaccine hesitancy would help promote vaccination more successfully. One of our recent surveys conducted in India among healthcare students demonstrated that most students had under-average knowledge regarding the COVID-19 vaccine [17]. The survey was conducted among 596 healthcare students, and 89.3% were willing to take a COVID-19 vaccine. The result highlighted that urban students were 2.5 times more willing to take vaccines than rural

students. The primary possible barrier factors in rural areas for not being willing to take vaccines were faster vaccine development, fears of the COVID-19 vaccine's reactions, and insufficient information regarding the COVID-19 vaccine's benefits [18]. Thus, these results highlighted the need to develop an intervention strategy to address vaccine hesitancy and improve COVID-19 vaccination acceptance to prevent and eliminate the disease.

The number of studies regarding intervention studies to improve COVID-19 vaccine acceptance among healthcare students in India is limited, although a number of other studies are being conducted worldwide. Taken together with all the rationales and to address this gap, this study evaluates the impact of an evidenced intervention among healthcare students to improve knowledge, attitude, and perception towards COVID-19 vaccinations, aiming to increase vaccine acceptance.

Methodology:

4.1 Study design: A randomized controlled trial was accomplished to measure the impact of an evidence-based



educational intervention by evaluating outcomes between the intervention and control group. No study has been conducted to analyze the interventional strategy to assess the COVID-19 vaccine acceptance in India; hence, this study was performed in a smaller sample size. The pre-test questionnaire survey was conducted among four healthcare colleges in Gwalior, Madhya Pradesh, India, who had not taken the vaccine, and then, based on the pre-study questionnaire survey, participants were selected ($n=330$) for the intervention study. The participants were randomized into control and international groups ($n=165$ each). All participants completed a post-anonymized questionnaire survey collecting data on socio-demographics, COVID-19 vaccine knowledge, attitude, perception, willingness to accept the vaccine, vaccine hesitancy, and its associated factors after completing their randomization assignments. The efficacy of the evidence-based intervention was studied by comparing the results of control and intervention groups.

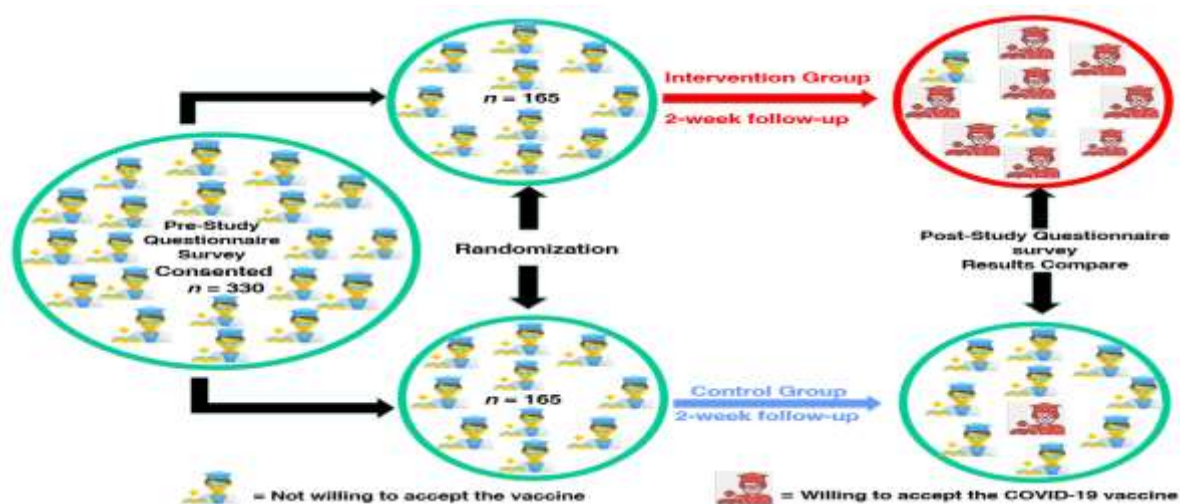


Figure 1. Randomized control study design of Phase

The Ho null hypothesis was “No significant difference between the control and intervention groups regarding knowledge and/or attitude and/or perception and/or acceptance concerning the COVID-19 vaccine among healthcare students.”

4.2. Educational Interventional Tool Development

"The COVID-19 Vaccination 100 Questions Resource Book: Protect Yourself and Community" was created utilizing graphical infographics including educational answers regarding the COVID-19 vaccine questions based on reliable and evidence-based information. The booklet discusses 100 questions about the COVID-19 vaccine, including knowledge, safety, effectiveness, propaganda, truths, advantages, etc. Illustrations are exhibited in Figure 2. The booklet was supplied to the interventional group as a part of a two-week learning course with regular reminders through lectures.

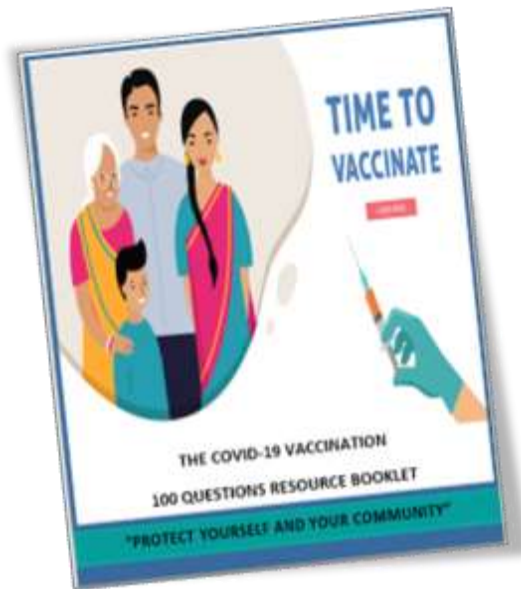
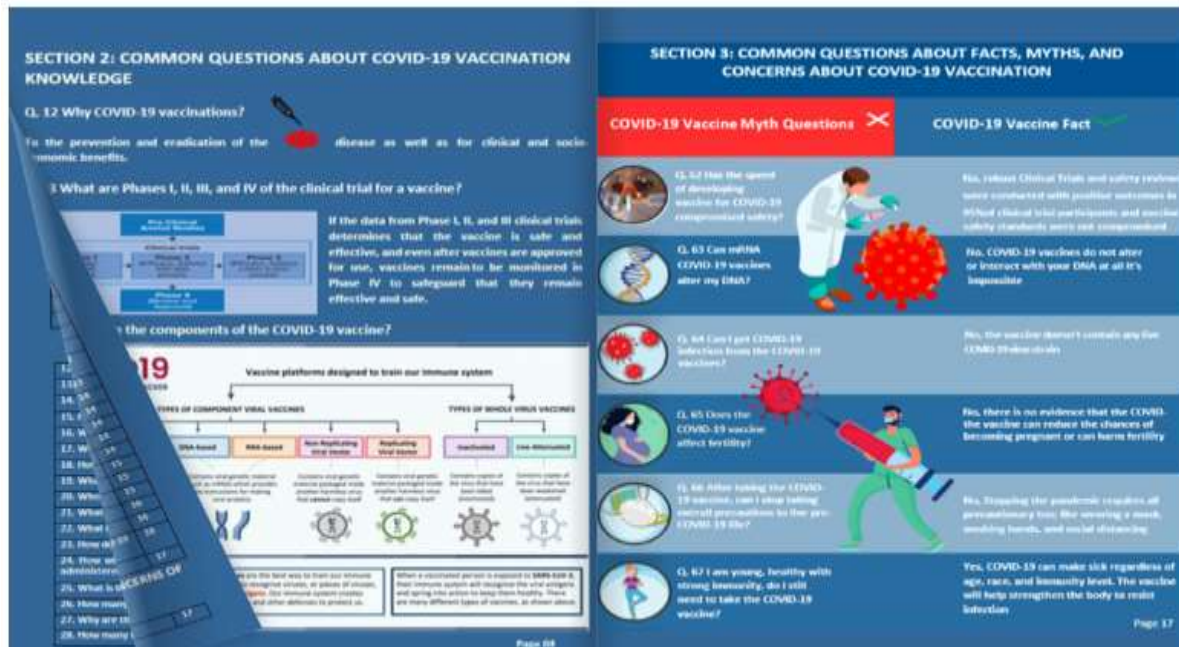


Figure 2. Evidence-based educational booklet cover page and inside layout page



4.3. Questionnaire Tool Development:

The ethical committee-approved pre-verified authenticated questionnaire was framed using a wide-ranging literature review and by integrating the subject specialists' opinions, evidence leaflets on COVID-19 considered by the CDC, WHO, and Indian Health Ministry, models like the SAGE Working Group "Model of Determinants of Vaccine Hesitancy" and the Health Belief Model [19] [20], etc. The survey comprised an informed consent form and a questionnaire form (Figure 8). The question form was divided into six sections, including 36 questions: socio-demographic characteristics, knowledge, perception,

attitude, motivators, and hesitancy factors regarding COVID-19 vaccine uptake. The survey was secret, and the data will be private.

4.4. Data collection and Data analysis pre-study and post-study:

Data was collected through a web-based (anonymous) and a manual questionnaire using a snowballing sample technique. All information collected by the survey was transcribed in Microsoft Excel or an equivalent tool as actual or coded for data analysis. To interpret the results, statistical analysis constant variables were converted into categorical variables, like COVID-19 vaccination acceptance, hesitance, resistance, and other relevant factors. Descriptive statistics were applied to determine frequencies and proportions. ANOVA tests and Multivariable logistic regression were performed to examine the level of correlation among study variables and assess the association outcomes between co-variables and intervention. The statistical P-value lower than 0.05 was considered significant.

RESULT:

Table 1. Demographics of the respondents of the study Control and Intervention group

Variables		Control Group Frequency (%)	Intervention Frequency (%)	Group
Gender	Male	58.2	62.2	
	Female	41.8	37.8	
Age Group	18-24	97.0	90.3	
	25-34	2.4	8.5	
	35-44	.6	1.2	
Locality	Rural	78.2	76.4	
	Sub-urban	13.3	15.2	
	Urban	8.5	8.5	
Income	Above 500,000 INR	3.0	9.1	
	300,000 to 500,000 INR	4.2	4.2	
	100,000 to 300,000 INR	9.7	7.9	
	51,000-100,000 INR	17.0	18.8	
	Below 50,000 INR	66.1	60.0	
Academic Stream	Medical	13.0	14.0	
	Nursing	84.0	85.0	
	Other allied science	3.0	1.0	
Current Academic Study	Master's degree/ Postgraduate	2.0	7.0	
	Bachelor's degree/ Undergraduate	98.0	93.0	

The demographic result data (Table 1) shows that participants comprised males (58.2%) and females (41.8%), with more than 90% of the standard age range being 18-24. More than 75% of participants identified their locality as rural areas, followed by suburban and urban areas. Additionally, most participants (> 60%) reported their income as below 50,000 INR per year (66.1%), followed by 51-000-100 000 INR. Regarding the academic stream, the majority of participants were from the nursing stream (>80%) and were pursuing an undergraduate bachelor's degree (>98%). After demographic differences were assessed between participants, mean values were calculated to indicate the participant knowledge, attitude, and perception between the control and intervention groups after the post-questionnaire survey.

Out of the top five major knowledge-based questions, the intervention group's knowledge regarding COVID-19 vaccine areas increased (df=76.7%). After completing the intervention, participants demonstrated an increased understanding of questions like "Mass COVID-19 vaccination plays a considerable role in herd immunity". Also, compared to the control group, the Intervention group strongly agreed that "COVID-19 vaccines will not cause you to test COVID-19 positive on COVID-19 viral tests". The intervention group, compared to the control group, exhibited a significant improvement in the knowledge question that "the COVID-19 vaccine can prevent COVID-19 infection and control its complications." There was also some average significance found between these two groups for knowledge questionnaire parameters such as identification of COVID-19 vaccine's side effect, wait periods to receive optimum strength from COVID-19 vaccine as well scheduling number of COVID-19 vaccine. However, there was no noticeable significance between these two groups regarding knowledge of the identification of ineligible groups to take the COVID-19 vaccine.

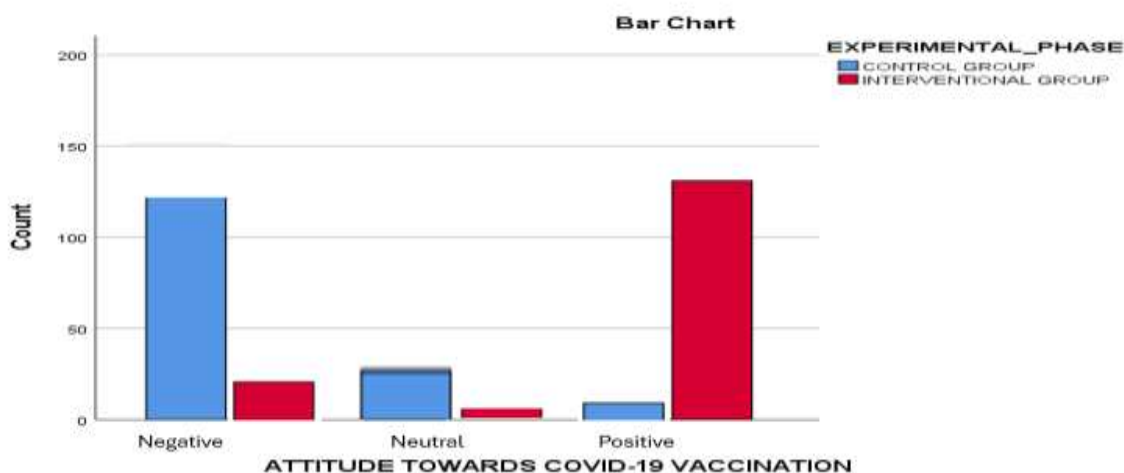
There was a growth in positive attitude (df=73.94%) in Interventional groups in comparison to the control group in the following variables: Own responsibility as a future healthcare worker to understand the COVID-19 vaccine for own and for prospective patients making compulsory COVID-19 vaccine for general trust in the

vaccine, as well belief that most of the students at their university will have a COVID-19 vaccine if it is suggested for them. However, there was still no noticeable difference between these two groups in attitude parameters, such as whether COVID-19 vaccination should be compulsory for children under 18 and whether they would like to participate in the COVID-19 vaccine clinical trial.

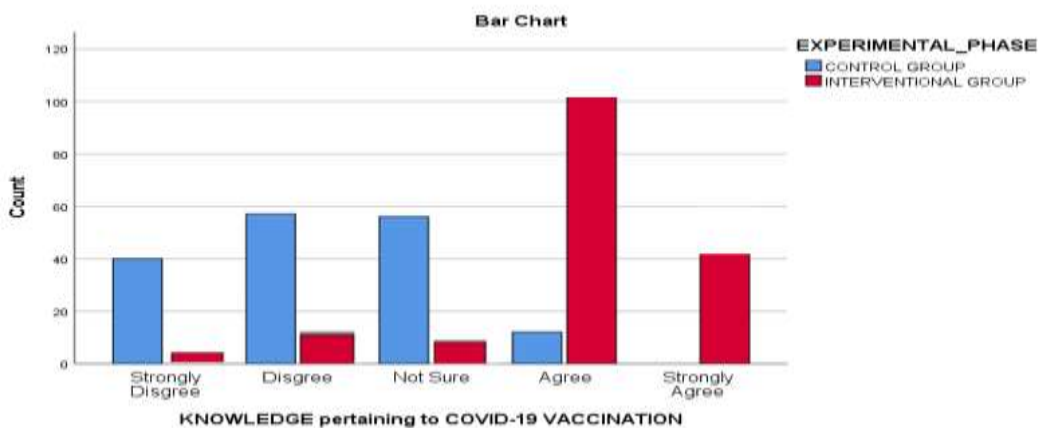
Table 2. Overall analysis of Intervention impact: Comparison of study Control and Intervention Group 'knowledge, attitude, perception, and acceptance parameters

Parameters	Class	Control Group N (%)	Intervention Group N (%)	Difference (%)	Sig. P Value
Knowledge about COVID-19 vaccination	High	17 (10.30)	142 (86%)	76.7	<0.005
	Neutral	59 (35.75)	9 (5.45)	30.3	
	Poor	89 (53.93)	14 (8.48)	45.45	
Attitude towards COVID-19 vaccination	Positive	12 (7.27)	134 (81.21)	73.94	<0.005
	Neutral	31 (18.78)	5 (3.03)	15.75	
	Negative	122 (73.93)	26 (15.75)	58.18	
Perception towards COVID-19 vaccination	Good	25 (15.15)	144 (87.27)	72.12	<0.005
	Neutral	41 (24.84)	11 (6.66)	18.18	
	Poor	98 (59.39)	10 (6.06)	53.33	
Acceptance of COVID-19 vaccination	High	19 (11.51)	151 (91.51)	80.0	<0.005
	Not sure	30 (18.18)	6 (3.63)	14.55	
	Low	114 (69.09)	8 (4.84)	64.25	

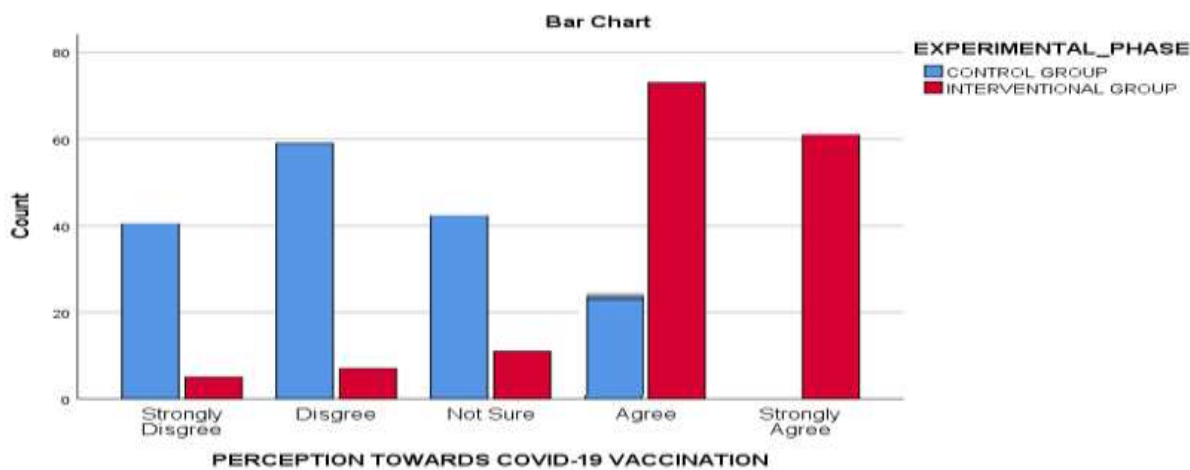
A significant positive improvement was found in the intervention group compared to the control group for perception with approx. 50% of the difference of the average Mean. The Intervention group agreed that COVID-19 vaccines strengthen the immune system and are essential to staying healthy as a future healthcare worker. The Interventional group strongly agreed that getting the COVID-19 vaccine is necessary for the overall public health of our communities, trusted that the COVID-19 vaccine will be effective if it is permitted by the FDA or WHO as well as the benefits of the COVID-19 vaccine overshadow the risks.



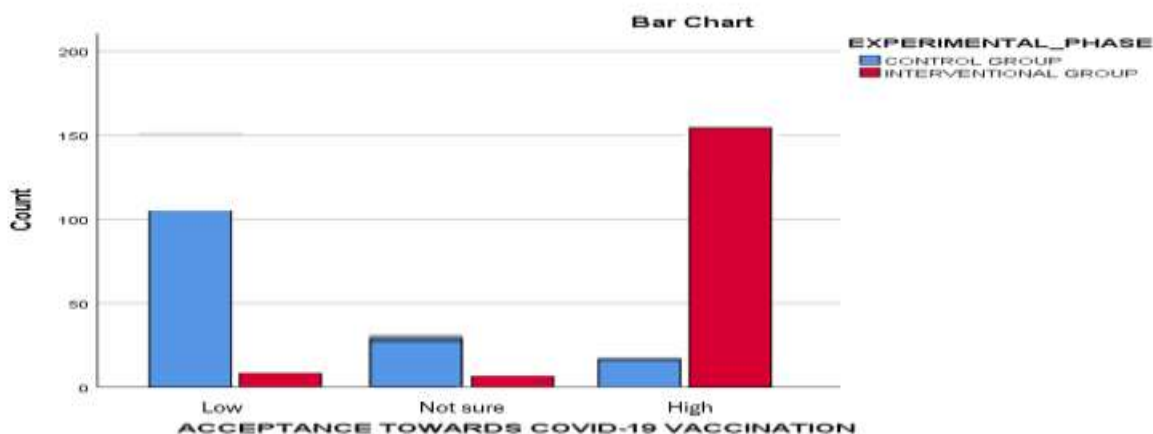
Bar Graph 1. Comparison of Knowledge regarding COVID-19 vaccination between control and Intervention group.



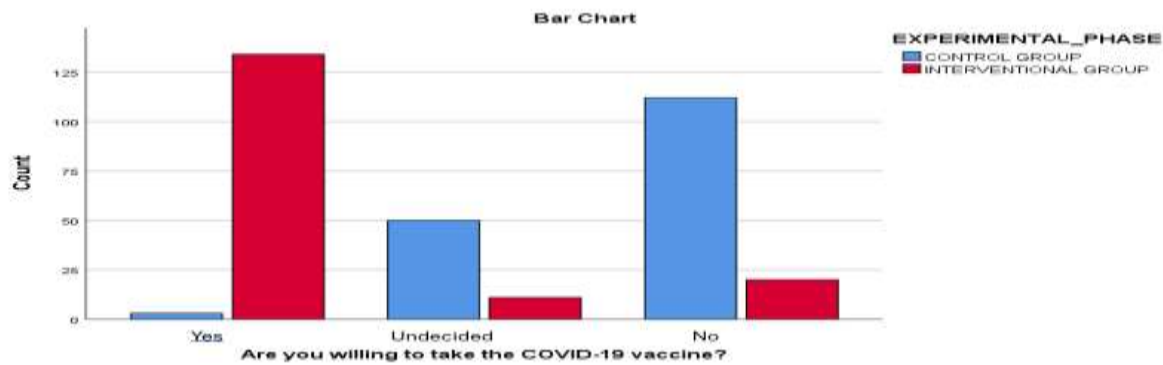
Bar Graph 2. Comparison of Attitude regarding COVID-19 vaccination between control and Intervention group vaccination



Bar Graph 3. Comparison of perception regarding COVID-19 vaccination between control and Intervention group vaccination.



Bar Graph 4. Comparison of Acceptance regarding COVID-19 vaccination between control and Intervention group vaccination



Bar Graph 5. Comparison of Willingness to accept COVID-19 vaccination between control and Interventional group vaccination.

Table 2 and Bar Graphs (1-5) show that after providing an adequate educational intervention program, the intervention group strongly agreed with all the parameters as the mean score for all the parameters, i.e., knowledge, attitude, perception, and acceptance. As per the above Bar Graph 1, 86% of respondents from the Interventional Group strongly agreed with the understanding of COVID-19 vaccination, whereas 53.93% of respondents from the Control Group were unwilling to gain an understanding of COVID-19 vaccination. The overall attitude was improved in the intervention group (81.21%), while 73.93% of the control group still had a poor attitude (Bar Graph 2). The perception was drastically enhanced in the Intervention group (87.27%), while most of the control group (59.39%) still had a low perception (Bar Graph 3). As per Bar Graph 4, 91.51% of respondents from the Interventional Group strongly agreed with accepting the COVID-19 vaccination, whereas 69.09% of respondents from the control group were reluctant to get the vaccine.

The main question to assess the willingness to the COVID-19 vaccine has shown a significant difference between both the groups (Graph 5), where after getting the proper factual education intervention, participants in the intervention group showed acceptance towards the COVID-19 vaccine compared to the control group. Approx 85% of participants in the Intervention group Responded "Yes" to the question "Are you willing to take the COVID-19 vaccine?". Only 4.8% of participants in the Intervention group still have not decided on their willingness to accept the COVID-19 vaccine. However, most participants in the Control Group (69%) were not willing to take the COVID-19 vaccine. Only 2% of participants in the Control group were ready to take the COVID-19 vaccine. The remaining participants (29%) in the control group were undecided on their willingness to accept the COVID-19 vaccine.

Discussion:

These results emphasize the need for a distinctive curriculum to enhance student knowledge, attitude, and perception regarding the COVID-19 vaccines and teach them with vaccine advising. To support this study result, supplementary studies have explained the significance of school-located vaccination clinics in improving influenza vaccination and human papillomavirus coverage among school students [21].

The socio-demographics of the lower acceptant in the control group participants displayed they were more likely to belong to rural areas and have junior healthcare education and household salary than those with vaccine uptake; this may probably be due to mistrust and misrepresentation, helplessness to understand the commendations of public health agencies or a lack of digital knowledge. Our findings suggest increasing vaccine acceptance and dismissing vaccine myths and propaganda. Regardless of insignificant socio-demographic modification, results improved perception and knowledge of measured variables soon after the intervention. While these outcomes are hopeful for reducing vaccine hesitancy in the short term, one of the previous studies found that instant information about influenza did not reduce vaccine hesitancy in the long term [22]. The findings of this study demonstrate an overall significant improvement in knowledge, attitude, and perception toward COVID-19 vaccine acceptance immediately following the educational interventional program. This study's findings connect with prior research engaging educational interventional programs in which brief videotapes have been displayed to improve knowledge, attitudes, and health behavior [23] [24]. Another previous study revealed that video education ultimately enhanced the health perspective about immunization against influenza [23], while supplementary research showed that video education is powerful in improving the definite HPV vaccine uptake [24]. These variations in acceptance and hesitancy align with prior outcomes, which agree that better knowledge, belief, and worry about infection [25] [26] are fundamental determinants for vaccine uptake. To form an agreement on defensive performance such as vaccination, experts must reflect on making health announcement policies within the setting of brief and cost-effective interventional tools (implemented in this study) to advance knowledge, perception, and attitude regarding COVID-19 vaccine acceptance.

The summary of this study displays some demographic concerns related to the variables considered. For instance, males and those with improved household income levels reported more considerable vaccine consequences. These outcomes encourage conclusions from earlier studies that view gender and socio-economic factors as correlating with willingness to get the COVID-19 vaccine [27]. Likewise, as expected regarding socioeconomic class, vaccination rates are frequently more remarkable among those who are more affluent, live in urban areas, and have higher levels of education [28]. These conclusions deliver constructive understanding into recognizing numerous focus groups needing targeted additional education to this demographic cluster, which may help.

It was proved that education about vaccines' correct information could play a significant role in vaccine uptake. Since vaccine education has been proven to be one of the most vital interventions that can be applied at the beginning of healthcare education, this education needs to be incorporated into the school/college curriculum throughout the study.

Conclusion:

In conclusion, during an international study, a strong relationship was discovered between the level of education, educational stream, and residence locality. The key barriers were fear of COVID-19 side effects, incomplete and incorrect information regarding the vaccine's efficacy and safety, sufficient recommendations from the healthcare provider, and mistrust of health safety authorities. Developing strategies and educational interventions that can address and focus on the motivator and barrier factors identified is essential. Developing such evidence-based tailored intervention to address concerns discovered in the study to reduce vaccine reluctance and improve vaccine acceptance will be the key to success in controlling the pandemic. Healthcare students, with their improved understanding of the COVID-19 vaccination and raised vaccination acceptance rate, will play an essential role in making their community more aware of the significance of this vaccination.

Limitation and Future recommendation:

Considering the limitation of a small sample size, future extensive research in a larger scale setting is needed to generalize this outcome. The outcome regarding the effectiveness of evidence-based intervention can assist governments to improve vaccine uptake and modify pandemic vaccine strategies in high-risk populations, lowering ill health burdens on the healthcare sector. Eventually, this research will enhance the healthcare sector's future position by improving decision-making around the use of vaccines by the upcoming generation of healthcare workers.

Ethical perspective

The survey was conducted under the Declaration of Helsinki's ethics and with the Sangini ethics committee's approval.

Conflict of Interests: No relevant disclosures.

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