



BARRIERS AND OPPORTUNITIES IN IMPLEMENTING ADULT VACCINATION: AN ASSESSMENT OF KNOWLEDGE, ATTITUDES, AND PRACTICES IN INDIA

Clinical Research

Dr. Mohammed Shakeel Sillat*	Assistant Professor, Department Of Infectious Diseases, Christian Medical College, Vellore, Tamil Nadu. *Corresponding Author
Dr. Priscilla Rupali	Professor & Head, Department Of Infectious Diseases, Christian Medical College, Vellore, Tamil Nadu.
Dr. J. Vignesh Kumar	Social Scientist, Department Of Infectious Diseases, Christian Medical College, Vellore, Tamil Nadu.
Ms. Maya P G	Sr. Demonstrator, Department Of Biostatistics, Christian Medical College, Vellore, Tamil Nadu.

ABSTRACT

Background: Despite the effectiveness of childhood immunization initiatives, the adoption of adult vaccination remains limited in developing nations such as India, resulting in a considerable burden of vaccine preventable diseases. Factors associated with the inadequate coverage have not been thoroughly studies within our demographic. **Materials and Methods:** A cross-sectional survey was conducted among Indian adults to evaluate their awareness of recommended vaccines, attitudes towards vaccination, and current vaccination practices. Statistical analysis was performed to identify correlations between demographic factors and vaccination status. **Results:** The survey revealed a significant deficiency in vaccine knowledge, with only 4.9% of respondents aware of all recommended vaccines. While 70.9% were familiar with at least one vaccine, only 54.3% knew of two or more. Awareness was highest for the tetanus, diphtheria, and pertussis vaccine (63.5%), but considerably lower for hepatitis B, pneumococcal, and influenza vaccines. Awareness of HPV, herpes zoster, meningococcal meningitis, and H. influenzae type b vaccines was around 10%. The primary source of vaccination information was healthcare providers (70.2%), yet only 35.6% had received vaccination advice from their physicians. Barriers to vaccination included lack of awareness (67.8%), cost concerns, and safety fears. Only 43.8% had received at least one recommended vaccine, with tetanus being the most common, while uptake for vaccines like herpes zoster, MMR, and HPV was very low. However, most unvaccinated individuals expressed a willingness to get vaccinated if recommended by a physician. **Conclusion:** There is a critical need to enhance adult vaccination awareness and coverage in India. While healthcare providers play a crucial role in influencing vaccination decisions, their potential is underutilized. Comprehensive strategies, including public awareness campaigns, cost reduction, and healthcare provider education, are essential to improve adult vaccination rates. Addressing these gaps can mitigate the burden of communicable diseases, contributing to better public health outcomes.

KEYWORDS

Adult Vaccine – Knowledge – Attitude – Practice

INTRODUCTION

Infectious diseases significantly contribute to morbidity and mortality, impacting both developed and, more severely, developing countries like India. The rise in antibiotic resistance, population migration, and frequent epidemic outbreaks underscores the ongoing threat posed by infectious diseases in the present era. These diseases not only affect human health but also impose significant financial burdens, particularly on low to middle-income countries [1].

Despite a notable decline in mortality rates, the absolute burden of communicable diseases remains substantial. The increasing prevalence of non-communicable diseases further strains India's public health system, presenting the dual challenges of managing both infectious and non-infectious diseases [2, 3]. While epidemiological trends signal a shift towards non-communicable diseases, recent reports indicate a re-emergence of infectious diseases [4]. Globally, the number of outbreaks has been on the rise since 1980 [5].

Childhood immunization has proven to be a cost-effective strategy for addressing these challenges [6, 7]. Widespread adult immunization holds promise for achieving similar success in the adult population. Vaccination alleviates the burden of disease, reduces empirical antibiotic overuse, and helps curb the development of resistance, thereby enhancing the fight against antimicrobial resistance (AMR) [8].

Numerous studies have underscored the lower uptake of recommended vaccines among adults in India compared to higher-income countries [9, 10]. For example, a study conducted in western India revealed that uptake rates for influenza and pneumococcal vaccines were only 22% and 6%, respectively, despite 70% of the study population being eligible for adult vaccination [11].

A common barrier to vaccine uptake is the lack of knowledge and perceived need for vaccination [12]. Additionally, physicians often recommend vaccines based on their own hesitations and perceived biases, contributing to variations in vaccine uptake rates. There is currently no concerted effort to ensure that every adult receives age-

appropriate vaccinations. Although various Indian societies and associations have published guidelines on adult immunization, there exists heterogeneity in recommendations, often targeting specific patient populations, which complicates generalization. Unfortunately, there is currently no government-endorsed guideline for adult vaccination in our country [13-15].

This study aims to explore gaps in knowledge, attitudes, and practices regarding recommended vaccines among adults, offering insight into factors influencing vaccine acceptance and hesitancy. By addressing these factors, the study seeks to enhance awareness and implementation of adult vaccination. Findings from this research will guide the development of interventions focused on improving information dissemination, fostering effective communication, and providing appropriate training for healthcare providers to promote adult vaccination uptake.

METHODS

This cross-sectional study was conducted within multiple outpatient departments at a single teaching hospital between December 2022 and September 2023. The research was carried out by the Department of Infectious Diseases, Christian Medical College, Vellore, India. The study population consisted of individuals, either patients or their relatives aged 18 years or older, attending various specialty OPDs in a tertiary care hospital in Vellore, who provided consent for participation in interview. Based on a previous report [11] which suggested a minimum prevalence of 10% for knowledge regarding adult vaccination and 6% for vaccination coverage, and aiming for a precision of 2% with a 95% confidence interval, the effective sample size was estimated to be 550 individuals.

Survey Instrument

A self-administered questionnaire, divided into four sections, was utilized for data collection. The questionnaire was developed based on a comprehensive literature review of earlier studies [11, 16-18]. Originally crafted in English, it was subsequently translated to accommodate the regional languages. The first page included study

information along with an informed consent agreement. The first section of the questionnaire focused on gathering socio-demographic characteristics and health status information from participants. This encompassed inquiries related to age, gender, occupation, geographical residency region, monthly income, educational level, and any existing co-morbid conditions.

The knowledge section aimed to assess participants' awareness of vaccinations and the primary sources of information. The third section delved into respondents' attitudes toward vaccination, exploring preconceptions regarding adult vaccination, perceived usefulness of vaccines for healthy adults, willingness to receive vaccinations upon doctor recommendation, concerns regarding cost and side effects. Questions also addressed potential barriers to vaccination, such as lack of awareness about routine adult vaccination, skepticism regarding vaccine effectiveness in preventing infections, and apprehensions regarding adverse events associated with vaccination.

The concluding segment of the questionnaire explored the prevailing practices regarding vaccinations recommended for adults. This involved assessing whether participants had received advice from physicians, participated in conversations regarding the importance of vaccination, and their past administrations of recommended vaccinations, including those for COVID-19.

Statistical Analysis

Sociodemographic variables, such as age and gender, along with other categorical variables, are presented using frequencies and percentages. Associations between knowledge, practice, and other categorical variables are assessed using the Pearson chi-square test. Differences in attitude scores among dichotomous variables are analyzed using the independent sample t-test or Mann-Whitney U test, while one-way ANOVA or Kruskal-Wallis test is employed for variables with more than two levels. Predictors of knowledge and practice are identified through logistic regression, with results expressed as adjusted odds ratios and 95% confidence intervals. Linear regression is used to identify predictors of attitude, with regression coefficients and 95% confidence intervals reported. Statistical significance is set at $p < 0.05$. All analyses are conducted using SPSS version 29.0.

Ethical Approval

The study protocol and questionnaire received approval from the Ethics Committee of the Christian Medical College and Hospital, Vellore (IRB approval number 14976 dt: 02-11-2022). Prior to participation, all participants provided informed consent.

RESULTS

The main socio-demographic characteristics of the study population are presented in **Table 1**. A total of 550 participants responded to the survey, comprising 311 (56.5%) males and 239 (43.5%) females. The majority of participants fell within the age group of 27-49 years (55.1%), and over half possessed a college degree or diploma (54.5%). Additionally, 7.3% were employed in a healthcare facility. Regarding underlying co-morbidity, 43.8% of participants reported having at least one condition. The most prevalent comorbidities were hypertension (20.4%) and diabetes (18.7%). Moreover, 8.7% of subjects had underlying HIV, 2% had a hematological disorder, and 1.3% had malignancy.

Table 1. Key socio-demographic characteristics of the study population.

Variables	Frequency	Percent
Total	550	100
Age Group, years		
18-26	131	23.8
27-49	303	55.1
50-64	97	17.6
65 and above	19	3.5
Gender		
Male	311	56.5
Female	239	43.5
Educational level		
Up to primary	65	11.8
High school	185	33.6
Degree / Diploma	300	54.5
Occupation		
Health Care Workers	40	7.3

Others	510	92.7
Comorbidities		
None	309	56.2
At least one	241	43.8

Knowledge

Table 2 depicts the findings pertaining to the knowledge towards vaccinations recommended to adults.

Table 2. Participant's knowledge about the recommended vaccines.

Have you heard about the following vaccines?	Yes	Percent
Tetanus (Tdap or Td)	349	63.5
Pneumococcal (PCV13 or PPSV23)	83	15.1
Influenza or Flu	169	30.7
Varicella or Chicken pox	187	34
Hepatitis B	257	46.7
Measles, Mumps, & Rubella (MMR)	156	28.4
Human Papillomavirus (HPV)	49	8.9
Meningococcal (Men ACWY)	63	11.5
Herpes Zoster or Shingles	53	9.6
Haemophilus Influenzae type b (Hib)	50	9.1

Out of the 550 participants, 390 (70.9%) were familiar with at least one vaccine recommended for adults (excluding the COVID-19 vaccine). The most recognized vaccine was for tetanus (63.5%), followed by hepatitis B (46.7%), varicella (34%), and influenza (30.7%). Conversely, Human papillomavirus vaccine had the lowest recognition rate (8.9%), followed by Haemophilus influenzae type b vaccine (9.1%). In total, only 4.9% correctly identified all vaccines recommended for adults, regardless of their underlying conditions. Among these 390 participants, healthcare providers remained the primary source of information (70.2%). Other sources included mass media (36.6%), internet and social media platforms (17.9%), and friends and family members (17.6%).

Multivariate logistic and linear regression analyses were used to test whether key variables significantly predicted higher vaccination knowledge, practice and positive attitudes, and the results are showed in **Table 3**. The logistic regression analysis for knowledge reveals several significant predictors. Individuals with diabetes are less likely to have higher knowledge levels (OR: 0.39, $p = 0.010$), while those with HIV are more likely to have higher knowledge (OR: 4.12, $p = 0.048$). Participants who received vaccination advice from their doctor (OR: 5.78, $p < 0.001$), consumed news from newspapers and media (OR: 5.80, $p = 0.006$), and used the internet (OR: 8.38, $p = 0.044$) were also more knowledgeable.

Table 3. Multivariate logistic and linear regression analyses estimating the associations between various outcomes of interest.

Knowledge	OR	SE	95% CI	p value
Diabetes	0.39	0.14	0.19-0.79	0.010
HIV	4.12	2.95	1.01-16.79	0.048
Advise on vaccination by doctor	5.78	2.45	2.51-13.27	<0.001
Newspaper & Media	5.80	3.70	1.65-20.29	0.006
Internet	8.38	8.85	1.05-66.39	0.044
Attitude	Coef.	SE	t	p value
News and Media	0.53	0.19	2.75	0.006
Working as healthcare professional	0.43	0.16	2.59	0.010
New vaccines carry more risks than older vaccines	-1.74	0.20	-8.39	<0.001
Practice	OR	SE	95% CI	p value
Female	0.56	0.13	0.36-0.89	0.014
Working as healthcare professional	3.90	0.88	2.50-6.09	<0.001
Not a healthcare professional	0.18	0.09	0.06-0.49	<0.001
HIV	4.38	2.26	1.59-12.06	0.004
Advise on vaccination	6.53	1.55	4.09-10.43	<0.001

by doctor				
Newspaper & Media	1.82	0.45	1.12-2.96	0.016

Attitudes

Regarding attitudes, nearly one-third of participants believed that vaccines are exclusively recommended for children (34.9%) and deemed unnecessary for healthy adults (34.5%). Additionally, 26% of respondents expressed concerns regarding adverse effects associated with newer vaccines. A significant proportion of participants (87.8%) stated they would consider receiving recommended vaccinations if recommended by their treating physician. While the majority of participants (86.5%) believed that vaccines are effective and provide protection from infections, lack of awareness among the general population (67.8%) on this subject appears to be the primary hindrance. This is followed by concerns about cost (43.8%) and apprehension regarding safety and adverse effects (24.7%), as illustrated in **Table 4**.

Table 4. Reasons for not taking the vaccines.

Reasons for not taking the vaccines	Yes (%)	No (%)
I was unaware that routine vaccination is also recommended for adults	373(67.8)	177(32.2)
I think the vaccines are not effective and do not protect from infections	74(13.5)	476(86.5)
I think the vaccines are not safe and they have many side effects	136(24.7)	414(75.3)
The cost of vaccines is very high	241(43.8)	309(56.2)

The linear regression analysis identified significant predictors of attitude (**Table 3**). Participants exposed to news and media had a more positive attitude (Coef. = 0.53, $p = 0.006$). Additionally, those in healthcare profession had a significantly more positive attitude (Coef. = 0.43, $p = 0.010$). The perception that new vaccines carry more risks than older ones was associated with a significantly lower attitude toward the usefulness of vaccines (Coef. = -1.74, $p < 0.001$).

Practice

Only 35.6% of participants had ever received advice on immunization practice from a doctor, and 30.7% had ever discussed their vaccination needs with any healthcare professionals. Among the 550 participants, only 243 (43.8%) self-reported having received at least one vaccination recommended for adults, excluding COVID-19 vaccination. The highest rate of coverage was for tetanus (36%), followed by hepatitis B (14.7%), whereas only 6.5% had been immunized against influenza, and 4.3% of the eligible population had been vaccinated against varicella (**Table 5**). Additionally, 95.5% of subjects had received at least one dose of the COVID-19 vaccine, with the majority of participants (90%) having completed two or more doses.

Among the 307 unvaccinated respondents, 269 (87.6) reported a positive attitude toward willingness to receive a recommended vaccination based on a physician's recommendation. Participants who received immunization advice are statistically more likely to be vaccinated compared to those who did not receive such advice.

Table 5. Prevalence of vaccination in the study population.

Have You Received Any Of The Following Vaccines?	Eligible Population*	Yes (%)
Tetanus (Tdap or Td) vaccination	550	198 (36)
Pneumococcal (PCV13 or PPSV23) vaccination	242	22 (9)
Influenza vaccination	550	36 (6.5)
Varicella vaccination	524	23 (4.3)
Hepatitis B vaccination	550	81 (14.7)
Measles, Mumps, Rubella (MMR) vaccination	549	14 (2.5)
Human Papillomavirus (HPV) vaccination	434	8 (1.8)
Herpes Zoster (HZ) vaccination	158	1 (0.6)

* Refers to individuals for whom a particular vaccine is recommended due to either their age or existing health conditions.

Gender, occupation, HIV status, physicians' advice, and media consumption were significant predictors of vaccination practice (**Table 3**). Females exhibited lower odds of engagement in vaccination practices (OR: 0.56, $p = 0.014$). Individuals in non-healthcare

occupations showed significantly lower engagement (OR: 0.18, $p < 0.001$) compared to healthcare professionals, who demonstrated nearly four times higher odds of vaccination practice (OR: 3.90, $p < 0.001$). HIV-positive individuals were more likely to engage in recommended practices (OR: 4.38, $p = 0.004$). Participants who received advice from doctors demonstrated over six times higher odds of vaccination practice (OR: 6.53, $p < 0.001$), and those exposed to news media (OR: 1.82, $p = 0.016$) also showed higher engagement in practices.

DISCUSSION

The success story of public health and preventive medicine is often exemplified by childhood immunization. However, the same level of achievement has not been attained in adult vaccination programs, leading to significant morbidity and mortality from vaccine-preventable diseases among adults [19]. This study aims to investigate the knowledge and attitudes of the adult population regarding vaccination. It seeks to explore the factors that influence vaccine acceptance as well as hesitancy. Furthermore, the study intends to illuminate prevailing vaccination practices among adults and ascertain the prevalence of individuals vaccinated with age-appropriate vaccines.

The survey findings underscore a notable deficiency in knowledge among respondents, with only 4.9% reporting awareness of all recommended vaccines. While a considerable portion (70.9%) displayed familiarity with at least one vaccine, merely 54.3% were acquainted with two or more vaccines. Approximately two-thirds of the participants were aware of the tetanus, diphtheria, and pertussis vaccine, but awareness levels were considerably lower for other vaccines such as hepatitis B, pneumococcal, and influenza compared to Western cohorts [16, 17]. Awareness of vaccines targeting HPV, HZ, and H. influenzae type b was around 10%. This aligns with findings from other community-based survey on HPV vaccine awareness [20]. As the Government of India prepares to integrate HPV vaccines into the universal immunization program, extensive awareness campaigns are imperative to foster a favorable attitude and strengthen vaccination programs, ultimately enhancing immunization coverage [21].

Data on HZ vaccine awareness in India is scarce. Nevertheless, our study suggests that awareness levels are substantially lower compared to other countries, where rates exceed 50% [16, 22]. Published experiences with COVID-19 vaccination indicate that high levels of knowledge coupled with positive attitudes correlate with robust immunization practices. Such attributes not only enhance accessibility to preventive services like vaccination but also significantly contribute to containing vaccine-preventable infectious diseases [23].

Multiple studies have consistently demonstrated that healthcare providers serve as the primary source of information. This trend is evident in our study as well, where healthcare providers were identified as the primary information source for 70% of participants, underscoring their pivotal role in disseminating accurate and reliable information [24, 25]. Research indicates that adults who trust health authorities as a source of information are more likely to possess a high level of knowledge, leading to increased vaccination rates. These findings emphasize the vital role healthcare providers play in driving successful vaccination campaigns [26, 27]. However, a notable segment of the population believes vaccines are primarily intended for children and harbors negative attitudes towards their use in healthy adults. This perception may stem from extensive awareness campaigns led by national and international agencies that predominantly target pediatric immunization services, while similar emphasis on adult segment is lacking.

Approximately one-fourth of the population expressed concerns regarding potential adverse effects associated with newer vaccines. The COVID-19 pandemic and ensuing vaccination debates may have influenced changes in attitudes toward vaccination. Social media platforms are governed by algorithms that often lack mechanisms to suppress controversial and scientifically unsupported content, making it imperative to ensure the dissemination of accurate and evidence-based information in an understandable manner for individuals with diverse education levels [28]. A study examining changes in vaccination attitudes and behavior among older adults revealed a shift towards decreased complacency about the importance of vaccines and increased concerns about potential risks associated with vaccination [29].

Our study unveils a robust confidence in vaccines, with 86.5% participants expressing belief in their efficacy. However, this confidence encounters several barriers before translating into widespread coverage. One major obstacle reported by 67.8% of respondents was, "I was unaware that routine vaccination is also recommended for adults." This lack of awareness was followed by concerns related to cost and safety. Increasing awareness alone may not be sufficient to address these barriers, as surveys conducted among populations with relatively high levels of awareness also reported similar obstacles to vaccination [30]. A multi-pronged approach is necessary, including strategies such as sending reminder text messages, reducing costs, educating healthcare providers, utilizing clinical decision support tools, and addressing needle phobia. Such comprehensive measures may help overcome barriers to vaccination uptake [12, 31].

Our findings suggest that doctors are not only the most trusted source of information but also significantly influence a patient's decision to receive a vaccine. A large majority of participants (87.8%) stated they would consider vaccination if their treating physician recommends it. This aligns with a previous study exploring factors influencing adult immunization practices, where "doctor's recommendation" (80.6%) and "knowing why I should get a vaccine" (78.2%) were reported as the top factors affecting the decision to receive an immunization [32]. Despite their significant role, only 35.6% of participants had ever received advice on immunization from a physician. This discrepancy is alarming, considering that within the unvaccinated cohort of this study, 87.6% expressed willingness to get vaccinated based on their physician's advice, but 86% did not receive any advice on vaccination from their doctor.

Vaccine hesitancy (VH) is a concerning aspect in any immunization program. In 2019, the World Health Organization (WHO) named VH as one of the top ten threats to global health [33]. Defined as reluctance or refusal to vaccinate despite the availability of vaccines, VH may influence the recommendation behaviors of physicians. A recently published systematic review proposed defining vaccine hesitancy as "a psychological state of indecisiveness regarding a vaccination decision" [34]. Another recent study conducted among healthcare providers affiliated with a medical college and tertiary care hospital in Delhi highlighted that the most common reasons for vaccine hesitancy among physicians were fear of side effects (51.41%) and lack of awareness (49.46%). This hesitancy was particularly pronounced for the zoster vaccine (97.80%), while it was least evident for tetanus toxoid (57.62%) [35]. VH has also been documented in developed nations. In a survey, 42.2% of French hospital staff physicians showed moderate vaccine hesitancy despite 94% expressing strong favorability towards vaccination [36].

In developing countries, healthcare providers are frequently overburdened due to a mismatched doctor-patient ratio and a lack of adequately trained paramedic staff. This results in a scarcity of time to discuss and guide patients, consequently impeding efforts to promote vaccination. Additionally, the deficiency in effective communication skills among healthcare providers may exacerbate this challenge. A study exploring adult vaccination attitudes and practices by physicians in the UAE revealed a lack of a pro-vaccine stance, with 74.4% of physicians reporting insufficient time to advise about vaccines [37].

In our cohort, only 43.8% had received at least one vaccine in addition to the COVID-19 vaccine. The highest coverage was noted for the tetanus vaccine (36%), possibly due to its other indications, such as during pregnancy and for patients with injuries. However, the uptake of other vaccines such as hepatitis B (14.7%), pneumococcal (9%), and influenza (6.5%) was very low. This was especially pronounced for vaccines targeting varicella, MMR, HPV, and HZ, with less than 5% of the eligible population reporting receiving them. A similar study conducted among adults visiting outpatient departments found that among individuals warranting vaccination, only 22% were vaccinated for influenza, 77% for tetanus, and 6% for pneumococcal pneumonia. The differing rates of vaccine uptake may be attributed to the fact that in their study, more than 50% of the population was over the age of 65 years [11]. An observational analysis of data from the Longitudinal Ageing Study in India conducted during 2017–2018 on 64,714 adults aged 45 years or older, reported extremely low coverage of hepatitis B (1.9%), influenza (1.5%), and pneumococcal (0.6%) vaccines among the study population [38].

Data on the coverage of the MMR vaccine among Indian adults is

scarce. Our study showed that only 2.5% of eligible participants had received the MMR vaccine in adulthood. This is especially concerning given the provisional surveillance data reported to the WHO, indicating that India ranked fourth among the top countries with measles outbreaks, reporting 15,183 cases between September 2023 and February 2024 [39]. A study exploring gaps in measles vaccination in India analyzed data on 43,864 children aged 24–35 months, derived from the National Family Health Survey 2019–21 (NFHS-5). It highlighted significant disparities in coverage: 11.5% of eligible children in India have not received any dose of the measles-containing vaccine, 29.8% have received only one dose, and 58.6% have been vaccinated with both doses [40]. Implementing measles/rubella vaccination campaigns, especially among young college students, might be an effective strategy to enhance seroprevalence and reduce outbreaks. Other community-based studies from India have also shown a low prevalence of vaccinated individuals for HPV (0.6%), comparable to our study [20]. Our study further highlights very low coverage for the HZ vaccine (0.6%) compared to Western countries, where the coverage among adults aged ≥ 50 and ≥ 60 years is 24.1% and 34.5%, respectively [41].

The findings in this study are subject to several limitations. Firstly, the survey data is self-reported and was not verified by medical records, which may introduce recall bias and affect the accuracy of the respondents' knowledge and vaccination status. Additionally, the sample may not be representative of the entire adult population in India, as the representation of the elderly was very low, making the generalizability of the findings difficult. The cross-sectional nature of the study also limits the ability to infer causality between knowledge, attitudes, and vaccination practices. Another limitation is the potential influence of social desirability bias, where participants might over-report positive attitudes towards vaccination or underreport hesitancy due to perceived societal expectations. To reduce the potential for social desirability bias, the survey was anonymous with no identifying data collected. Furthermore, the study did not extensively explore the reasons behind healthcare providers' hesitancy to recommend vaccines, which could provide deeper insights into improving vaccination rates.

The findings from this study demonstrate low levels of awareness and vaccination coverage among Indian adults. Future research should aim to include a more diverse and representative sample, longitudinal data to assess changes over time, and a more detailed exploration of healthcare providers' perspectives and practices. Learning's from the childhood immunization experience can be used to improve adult immunization, such as setting up public health clinics that provide vaccines to adults and establishing public-private partnerships to reduce costs.

CONCLUSION

This study reveals significant gaps in knowledge, attitudes, and practices regarding adult vaccination in India, with low awareness and uptake of recommended vaccines. Key barriers include a lack of awareness, safety concerns, and misconceptions about the necessity of vaccines for healthy adults. Healthcare providers play a crucial role in influencing vaccination decisions, yet often lack the resources to effectively educate patients. Addressing these issues requires comprehensive strategies, including public education campaigns, integration of vaccination into routine healthcare, and government-endorsed guidelines. By enhancing awareness and addressing vaccine hesitancy, we can reduce the burden of vaccine-preventable diseases and improve public health outcomes.

Conflict Of Interest Statement:

All authors have no conflicts of interest to be stated.

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