ORIGINAL RESEARCH ARTICLE

Adult Vaccination Knowledge, Attitudes, and Behavior in Rural Tamil Nadu: A Cross-Sectional Study

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ABSTRACT

Background: Adult vaccination is a crucial yet underutilized component of public health, especially in rural areas where access to healthcare services is limited. Inadequate awareness regarding adult immunization adversely impacts individual health, healthcare systems, and economic productivity. **Objective**: To assess the knowledge, attitude, and behavior related to adult vaccination among rural population, Tamil Nadu.

Methods: A cross-sectional study conducted among 260 healthy adults (18 to 80 years) in rural Chengalpattu District, Tamil Nadu, used simple random sampling method. Data were collected using a pre-tested, structured, and validated self-administered questionnaire, focusing on adult vaccination knowledge, attitude, and behavior. Data analysis was performed using IBM SPSS version 25.

Results: Among 260 participants, 41.9% were aged 18-40 years. Covid-19 vaccine had the highest knowledge level (77%). Logistic Regression showed literacy (AOR:4.95) and socioeconomic status (AOR:2.43) significantly associated with knowledge. Likewise, literacy (AOR:3.65) and socioeconomic status (AOR:3.53) were significantly associated with attitude towards adult vaccination ($p < 0.05$).

Conclusion: The study findings underscore education, occupation, and socioeconomic status have a significant impact on adult vaccination acceptance. Addressing barriers to immunization through awareness campaigns and policy interventions is critical to improving adult vaccine uptake in rural populations.

Keywords: Adult Immunization, vaccine hesitancy, covid 19, rural health, attitude towards vaccination, healthy ageing

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Introduction

Vaccination is one of the most effective public health interventions globally, with the potential to prevent millions of deaths annually. It is the hallmark of preventive medicine that enhances protection by utilizing the body's natural defence. Currently, vaccines are available to prevent more than 20 deadly diseases, and enabling individuals of all ages to have healthier and, longer lives.[1] Low- and middle-income countries such as India is currently facing an epidemiological shift, with a growing proportion of the population entering older age groups. By 2050, global population over 65 years of age is expected to be higher than the number of children under 15.[2] As the population grows and life expectancy increases, it is important to use effective healthy aging strategies, such as vaccinations, to lower the number of illnesses that can be prevented by vaccines and improve quality of life.[3] The global agencies like WHO and UNICEF has successfully saved millions of children's in the past five decades.[4]

India, currently the most populated country with nearly 1.45 billion people accounting for approximately 18% of the world's population.[5] In India, the Universal Immunization Programme (UIP) has achieved considerable success in childhood immunization coverage; however, adult immunization remains an underprioritized and underutilized component of national health services.[6] Adult vaccination is among the most neglected areas of healthcare in India, despite the availability of vaccines for diseases.[7] Communicable illnesses are a major cause of morbidity, mortality and economic burden in developing nations like India.[8] While childhood vaccines are widely promoted through effective systems, adult vaccination in India lacks structured guidelines, coverage, infrastructure, accessibility or affordability, and policy-level focus, particularly in rural and underserved regions.[9]

With this context in mind, improving adult vaccination coverage in India is essential not only for individual protection but also for reducing healthcare costs and disease transmission at the community level.[9] Studies assessing knowledge, attitude, and behavior (KAB) are valuable in understanding the multifactorial dynamics influencing adult vaccination uptake, particularly in underserved settings. Such insights are essential for guiding public health interventions, designing targeted awareness campaigns, and informing policy decisions. There is limited literature on adult vaccination KAB in India, particularly in rural settings, highlighting the need for context-specific evidence. The present study undertakes a comparative analysis of adult vaccination-related KAB in a rural Indian population, highlighting the prevailing disparities, utilization trends, and behavioral patterns. Accordingly, this research was conducted to assess the knowledge, attitude, and behavior toward adult vaccination among adults residing in the rural field practice area of Chengalpattu District, Tamil Nadu.

Methodology

A Community-based cross-sectional study was conducted from October 2023 and March 2024 among the rural population of Chengalpattu District, Tamil Nadu.

Inclusion and Exclusion Criteria: The study included healthy individuals aged 18-80 years, with no gender specificity. Participants who could understand and communicate in Tamil or English were included, as the questionnaire was administered in these languages. The exclusion criteria included adults diagnosed with psychiatric disorders and undergoing treatment, adults with terminal illnesses, healthcare professionals, and pregnant women.

Sample Size calculation: A sample size of 260 was calculated with Dobson's formula, considering the lowest awareness prevalence of adult vaccination at 33.6% from a previous study.[7] A desired precision (margin of error) of 6% and a 95% confidence level (Z = 1.96) were applied. Accounting for an anticipated 10% non-response rate, the final sample size was estimated as 260.

Sampling Technique: Participants were selected using a simple random sampling technique. The study was conducted in the rural field practice area of Sree Balaji Medical College and Hospital located in Sarapanancheri, which is divided into five wards with a total adult population of 5,298. Eligibility was determined using population registers maintained at the Rural Health Training Centre. A sampling frame was prepared by assigning unique numbers to all eligible individuals, and 260 participants were selected using computer-generated random numbers.

Data Collection Tool: After obtaining Informed Consent from the study participants, Data collection was carried out using a pre-tested, structured questionnaire. Although the tool was designed as a self-administered instrument, interviewer assistance was provided to illiterate participants (59.6%) to ensure comprehension and accurate responses. Trained Postgraduates from our department fluent in Tamil administered the questions in a neutral tone without introducing bias, maintaining the integrity of participant responses. Literate participants completed the form independently.

Questionnaire Description:

The questionnaire comprised 35 items across four sections.

Section A- socio-demographics details (5 items): Age, gender, occupation, education and socioeconomic status, designed to describe the background characteristics of participants and analyse their association with KAB outcomes.

Section B- Knowledge (10 items), designed for general understanding of vaccine-preventable diseases, awareness of recommended adult vaccines, misconceptions and beliefs.

Section C- Attitude (10 items), focusing on perceived importance, trust in vaccine safety and efficacy, and the perceived necessity of vaccination-related information.

Section D- Behaviour (10 items), designed to measure both observed and intended vaccination practices.

Each of the KAB domains was measured using a 5-point Likert scale (Strongly Agree to Strongly Disagree). The cumulative scores for each domain were computed and categorized knowledge, attitude, and behavior regarding adult vaccination. Cronbach's alpha was used to assess internal consistency and reliability: 0.80 for knowledge, 0.79 for attitude, and 0.80 for behavior sections.

Scoring and Categorization: Knowledge, attitude, and behaviour scoring were calculated based on the response given by the study participants. 1(Strongly Disagree) to 5 (Strongly Agree), and the cumulative mean scores were obtained. The mean scores for knowledge, attitude, and behavior were 32, 34, and 29. Based on these mean scores the outcomes were categorized (Adequate/Inadequate knowledge, Favourable/unfavourable attitude and Good/poor behaviour).

Vaccines Assessed: The instrument included items covering ten adult vaccines: Tetanus and Diphtheria (Td), Hepatitis B, Rabies, Typhoid, Human Papillomavirus (HPV), COVID-19, Herpes Zoster, Influenza, Pneumococcal, and Meningococcal vaccines. Knowledge, attitude, and behavior were measured using a 5-point Likert scale.

Data Analysis: Data were analyzed using IBM SPSS Software, Version 25. Descriptive statistics (frequencies, percentages & means) were used to summarize socio-demographic variables and outcome measures. Bivariate analysis was conducted using Chi-square test to determine associations between socio-demographic variables and KAB domains. Variables with $p < 0.05$ in bivariate analysis were considered for inclusion in the multivariate regression analysis.

Logistic regression was performed to identify independent predictors of knowledge, attitude, and behavior outcomes. Results were expressed as odds ratios (ORs) and adjusted odds ratios (AORs) with 95% confidence intervals (CI). Model fitness was assessed using the Hosmer-Lemeshow goodness-of-fit test (>0.05).

Institutional Ethics Committee of the Sree Balaji Medical College and Hospital issued approval 002/SBMCH/IHEC/2023/2096, before data collection.

Results

A total of 260 adults participated in the study. Males constituted 60% of the participants. The largest age group was 18–40 years (41.9%), followed by 41–60 years (31.2%) and 61 years and above (27%). Illiteracy was noted in 59.6%, and 52.3% were unemployed. Socioeconomic classification using the 2024 B.G. Prasad Scale[10], showed that 31.2% of the participants belonged to the middle class (Table 1).

Table 1: Sociodemographic characteristics of the participants [n = 260]

Variables	Participants (%)
Age (Years)	
18-40	109 (41.9)
41-60	81 (31.2)
61-80+	70 (27)
Gender	
Female	104 (40)
Male	156 (60)
Education	
Illiterate	155 (59.6)
Literate	105 (40.4)
Occupation	
Employed	124 (47.7)
Unemployed	136 (52.3)
Socio Economic status	
Lower	32 (12.3)
Lower middle	71(27.3)
Middle class	81(31.2)
Upper middle class	47 (18.1)
Upper class	29 (11.2)

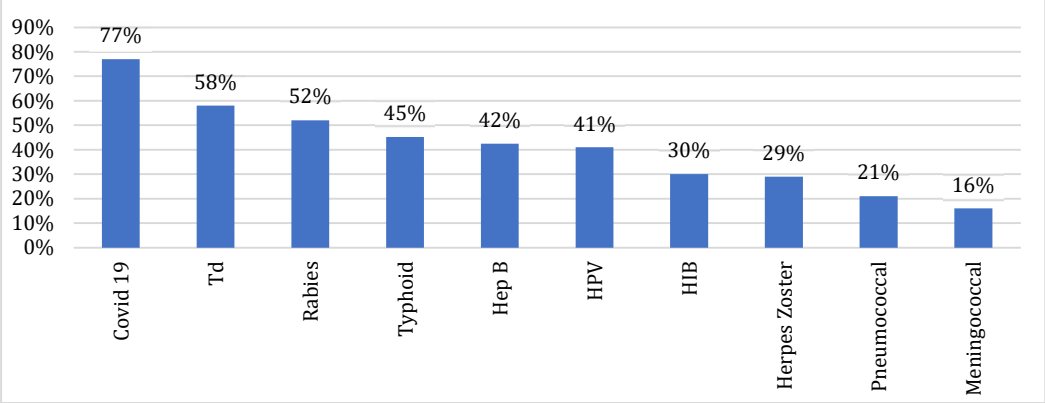

Fig 1: Participant's knowledge about the recommended adult vaccinations (%)

Table 2: Association between knowledge regarding adult vaccination and related variables

Variables	Inadequate Knowledge (%)	Adequate Knowledge (%)	p value	OR (95% CI) †	p value	AOR (95% CI)
Age						
61-80	44 (62.9)	26 (37.1)	0.02*	4.07 (2.15-7.69)	0.9	0.95 (0.46-1.95)
41-60	32 (39.5)	49 (60.5)		1.57 (0.85-2.88)	0.24	1.56 (0.73-3.33)
18-40	32 (29.4)	77 (70.6)		ref	ref	ref
Sex						
Male	61 (39.1)	95 (60.9)	0.32	0.77 (0.47-1.28)	-	-
Female	47 (45.2)	57 (54.8)				
Literacy						
Illiterate	93 (60)	62 (40)	0.00*	9.00(4.77-16.96)	0.00**	4.95 (2.38-10.27)
Literate	15 (14.3)	90 (85.7)				
Occupation						
Unemployed	74 (54.4)	62 (45.6)	0.03*	3.15 (1.88-5.31)	0.18	1.52 (0.82-2.83)
Employed	34 (27.4)	90 (72.6)				
Socio-economic status						
Class IV &V	66 (64.1)	37 (35.9)	0.00*	4.88 (2.85-8.34)	0.05**	2.43 (1.31-4.48)
Class I-III	42 (26.8)	115 (73.2)				

#Chi square test and Odds Ratio was used to test the association at 95% CI
*P value obtained from Bivariate analysis significant at p<0.05, † 95% CI= 95% Confidence Interval
**P value obtained from Logistic regression analysis, statistically significant at p<0.05

Table 3: Association between Attitude regarding adult vaccination and related variables

Variables	Unfavourable Attitude (%)	Favourable Attitude (%)	P value	OR (95% CI) †	P value	AOR (95% CI)
Age						
61-80	49 (70)	21 (30)	0.01*	4.93 (2.57-9.45)	0.67	1.16 (0.58-2.30)
41-60	38 (46.9)	43 (53.1)		1.86 (1.03-3.38)	0.07	1.99 (0.93-4.25)
18-40	35 (32.1)	74 (67.9)		ref	ref	ref
Sex						
Male	69 (44.2)	87 (55.8)	0.28	0.76 (0.46-1.25)	-	-
Female	53 (51)	51 (49)		ref		
Literacy						
Illiterate	100 (64.5)	55 (35.5)	0.00*	6.86(3.86-12.17)	0.00**	3.65 (1.81-7.14)
Literate	22 (21)	83 (79)		ref		ref
Occupation						
Unemployed	77 (56.6)	59 (43.4)	0.001*	2.29 (1.39-3.77)	0.88	1.04 (0.55-1.96)
Employed	45 (36.3)	79 (63.7)		ref		ref
Socio-economic status						
Class IV &V	75 (72.8)	28 (27.2)	0.00*	6.26 (3.60-10.89)	0.00**	3.53 (1.91-6.50)
Class I-III	47 (29.9)	110 (70.1)		ref		ref

#Chi square test and Odds Ratio was used to test the association at 95% CI
*P value obtained from Bivariate analysis significant at p<0.05, † 95% CI= 95% Confidence Interval
**P value obtained from Logistic regression analysis, statistically significant at p<0.05

Table 4: Association between Behavior regarding adult vaccination and related variables

Variables	Poor Behaviour (%)	Good Behaviour (%)	P value	OR (95% CI) †	p value	AOR (95% CI
Age						
61-80	39 (55.7)	31 (44.3)	0.02*	3.82 (2.01-7.25)	0.18	1.64 (0.79-3.42)
41-60	35 (43.2)	46 (56.8)		2.31 (1.24- 4.28)	0.29	1.50 (0.70-3.21)
18-40	27 (24.8)	82 (75.2)		ref	ref	ref
Sex						
Male	58 (37.2)	98 (62.8)	0.49	0.84 (0.50-1.39)	-	-
Female	43 (41.3)	61 (58.7)		Ref		
Literacy						
Illiterate	89 (57.4)	66 (42.6)	0.00*	10.45(5.29-20.63)	0.00**	5.25 (2.43-11.34)
Literate	12 (11.4)	93 (88.6)		Ref		Ref
Occupation						
Unemployed	73 (53.7)	63 (46.3)	0.01*	3.97 (2.31-6.81)	0.01**	2.16 (1.15-4.07)
Employed	28 (22.6)	96 (77.4)		Ref		Ref
Socio-economic status						
Class IV &V	62 (60.2)	41 (39.8)	0.00*	4.57 (2.67-7.81)	0.01**	2.11 (1.13-3.93)
Class I-III	39 (24.8)	118 (75.2)		Ref		Ref

#Chi square test and Odds Ratio was used to test the association at 95% CI
*P value obtained from Bivariate analysis significant at p<0.05, † 95% CI= 95% Confidence Interval
**P value obtained from Logistic regression analysis, statistically significant at p<0.05

Figure 1 displays the percentage awareness of each adult vaccine assessed. COVID-19 vaccine had the highest awareness (77%), followed by Td (58%), Rabies (52%), and Typhoid (45%). The lowest awareness was noted for Pneumococcal (21%) and Meningococcal (16%) vaccines. Vaccine-specific awareness was assessed through individual binary questions, where each correctly identified vaccine contributed one point to the total knowledge domain score (maximum score = 10). Participants who correctly identified ≥6 vaccines were categorized as having adequate knowledge; those scoring <6 were categorized as having inadequate knowledge.

Knowledge scores were significantly associated with literacy status (AOR = 4.95; 95% CI: 2.38–10.27) and socioeconomic status (AOR = 2.43; 95% CI: 1.31–4.48). Although older age groups (61-80 years) initially showed a higher likelihood of inadequate knowledge in bivariate analysis (OR = 4.07), this association did not remain significant in multivariate regression. Gender and occupation did not retain statistical significance in the adjusted model (Table 2).

Unfavorable attitudes were more likely among illiterate participants (AOR = 3.65; 95% CI: 1.81–7.14) and those from lower socioeconomic strata (AOR = 3.53; 95% CI: 1.91–6.50). While elderly participants (61-80 years) showed higher odds of Unfavorable attitudes in bivariate analysis (OR = 4.93), the association was not significant after adjustment (AOR = 1.16; p = 0.67). Gender and occupation showed no significant independent association (Table 3).

The behavioral results aligned with the knowledge and attitude trends. Illiteracy (AOR = 5.25; 95% CI: 2.43–11.34), unemployment (AOR = 2.16; 95% CI: 1.15–4.07), and lower socioeconomic status (AOR = 2.11; 95% CI: 1.13–3.93) were significantly associated with poor vaccination behavior. Increasing age was associated with poorer behavior in bivariate analysis but was not retained as a significant factor in multivariate regression (Table 4).

Discussion

The present study assessed knowledge, attitude, and behavior regarding adult vaccines among adults residing in the rural field practice area of Chengalpattu District, Tamil Nadu and identified significant gaps in all three domains.

In the present study, the highest level of awareness was observed for the COVID-19 vaccine (77.6%), which can be attributed to extensive initiatives by the government campaigns and nationwide media coverage during the pandemic. Lowest level of awareness was observed for pneumococcal (21%) and meningococcal (16%) vaccines in the present study, both of which are critical for elderly and immunocompromised individuals. The inadequate knowledge is likely due to exclusion from national immunization programs and high cost in private sectors, making them less accessible in rural settings. Similar findings were obtained in a study conducted in rural Karnataka, which found that the 81.71% of the study participants had adequate knowledge about the COVID-19 vaccine (p-<0.001).[11] Similar findings were obtained in a study conducted in China, which found that the covid 19 vaccine had the highest awareness among the study participants.[12] In contrast, study conducted in Turkey showed that higher awareness was found in the tetanus vaccine (84.6%).[13]

Education was a major determinant of knowledge and behavior. In the present study, literacy status was strongly associated with knowledge (p < 0.001). Similar study found that knowledge about vaccines was significantly associated with education level (p = 0.03).[13] In the present study, illiteracy was significantly related to poor behavior (OR = 10.45; 95% CI: 5.29–20.63). Similarly, study conducted by Gatewood et al., found that the likelihood of adhering to vaccination was greater in regions with higher health literacy (OR = 1.036; 95% CI = 1.036-1.037).[14] The relationship between knowledge and intention to vaccinate was affected by education; those with lower education had a weaker association.[15] The poor knowledge observed in our study most probably due to low literacy, particularly among the rural and illiterate segments of the population, impeding their ability to seek, understand, and process vaccine-related information.

Socioeconomic status was another strong predictor. In the present study, people belonging to the lower socioeconomic class had significant association with inadequate knowledge [AOR:2.43 (1.31-4.48)], unfavourable attitude [AOR: 3.53 (1.91-6.50)], and poor behavior [AOR: 2.11 (1.13-3.93)] towards adult vaccination in comparison with higher socioeconomic people. Similarly, study conducted in India, found that higher socioeconomic status group are more likely to get vaccinated [AOR: 3.32 (95% CI: 2.52–4.39)].[16] The association between lower socioeconomic status and poor adult vaccination-related KAB likely due to a combination of financial constraints, restricted access to accurate information, and infrequent interactions with healthcare providers. In contrast, a study conducted in Asian-Americans found that increased vaccination reluctance is frequently associated with a higher socioeconomic class (SES), especially in high-income nations where people may believe that vaccine-preventable illnesses pose less of a threat.[17,18]

In the present study, illiteracy (AOR:3.65) and lower socioeconomic status (AOR:3.53) were significantly associated with unfavourable attitude (p-<0.05). Similarly, study conducted in Puducherry, had association between educational status, socioeconomic status, and attitude towards vaccination (p-<0.05).[19]

Gender-based analysis in this study showed that males had slightly better knowledge and behavior, though not statistically significant. Similar findings were obtained in a study conducted in South India,

which found that males had adequate awareness and good behavior towards adult vaccination.[20] In contrast, some studies have found that women have more awareness (AOR: 3.25; 95% CI: 2.60– 4.07) of certain vaccines, specifically HPV vaccines, than men.[21,22]

In the present study 64.6% of the study participants agreed that they would like to gain information regarding vaccinations recommended during adulthood from health care providers, and more than half of the participants expressed that they needed more public awareness to understand the significance of adult vaccination. Similar findings were obtained in a study conducted in Italy, where a large majority (53.4%) reported that they needed more education on adult vaccination.[23] In accordance with previous studies, health care professionals were the most reliable source of health-related information.[24–27]

In the present study, 66.9% agreed that any form of vaccine has its own adverse side effects; nevertheless, 70.7% encouraged their family members, friends, and relatives to get immunized to the recommended vaccines. A similar study found that more than half of the participants 53.45% believed that the side effect of vaccination would stop individuals from getting vaccinated; however, 78.5% of study participants would advise family and friends to be vaccinated.[28] Misinformation and rumors about adverse effects, together with a lack of awareness of the safety, availability, and effectiveness of vaccines, are the main causes of adult vaccine hesitancy in India.[29,30]

Limitations

This study has a few limitations that must be acknowledged. Firstly, the use of self-reported data introduces the possibility of recall bias, where participants may not accurately remember past vaccination events, and social desirability bias, where participants may provide responses, they perceive as acceptable rather than truthful. Despite these limitations, the study provides valuable insights into the prevailing gaps in adult immunization awareness in rural settings.

Conclusion

This study highlights significant disparities in knowledge, attitude, and behavior related to adult vaccination among rural populations, particularly among those who are illiterate and socioeconomically disadvantaged. These findings underscore the urgent need to strengthen adult immunization strategies through targeted community education, capacity-building of healthcare providers, and integration of adult vaccines into existing national health programs such as Ayushman Bharath or the National Health Mission (NHM) in India. Promoting adult immunization not only supports healthy ageing but also contributes to the broader goals of reducing vaccine-preventable diseases and enhancing community-level herd immunity.

Recommendations

The health system needs to emphasize the value of adult vaccination. This problem must be addressed by several stakeholders, including practitioners, policymakers, and the media. Integration of adult immunization into existing national health programs such as NHM and Ayushman Bharat could be taken for consideration. Development of IEC strategies using community health workers. By conducting regular CMEs for primary healthcare providers on adult vaccine will be a greater impact. Additionally, as the benefits and drawbacks (cost, side effects, vaccination need, etc.) of each adult vaccine type vary greatly, it is prudent to discuss each vaccine separately.

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Author contribution: KN: played a key role in every stage, from conception of the study to manuscript preparation, data collection and analysis. SE: Worked on Study conception, Study design and Manuscript preparation. KP: Worked on Study design, manuscript preparation and analysis.

Availability of Data: Data available on request to the corresponding author.

No use of generative AI tool: This article was prepared without the use of generative AI tools for content creation, analysis, or data generation. All findings and interpretations are based solely on the authors' independent work and expertise.

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