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Vaccine Hesitancy and Readiness Among University Students: A Cross-Sectional Study

Karthikeyan A[1], Kamalakumar Uthayanan[1], Prashanth M[1], Venkateswaramurthy Nallasamy[1], Sudha Muthusamy[2]*

[1]Department of Pharmacy Practice, JKKN College of Pharmacy, Kumarapalayam, Namakkal, Tamilnadu, India.

[2]Department of Pharmacology, Sri Shanmugha College of Pharmacy, Sankari, Salem, Tamilnadu - 637304, India.

***Corresponding Author:** Dr. Sudha Muthusamy, M.Pharm, Ph.D., Professor and Head, Department of Pharmacology, Sri Shanmugha College of Pharmacy, Sankari, Salem, Tamilnadu - 637304, India. **E-mail:** sudhacology@gmail.com

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ABSTRACT

Background: Vaccine hesitancy is a recognized barrier to optimal COVID-19 vaccination coverage, particularly among youth populations. This study examines COVID-19 vaccine acceptance, hesitancy, and associated factors among university students in Southern India, with emphasis on public health policy implications.

Methods: A cross-sectional survey was conducted between June and August 2022 among unvaccinated students at a pharmacy college in Tamil Nadu, India. A structured online questionnaire captured socio-demographic data, attitudes towards COVID-19 vaccination, perceived barriers, and information sources. Chi-square tests and multivariate analyses were applied using IBM SPSS v22, with $p<0.05$ considered statistically significant.

Results: Of 401 respondents, 346 (87.1%) were unvaccinated; 248 (71.7%) expressed willingness to vaccinate, while 98 (28.3%) were hesitant. Key predictors of hesitancy included inadequate perceived safety information ($p=0.047$), perception that vaccination is profit-driven ($p=0.034$), and concerns regarding long-term safety studies ($p=0.055$). Social media was the dominant information source for hesitant individuals (87.8%). Despite hesitancy, most participants acknowledged vaccination as essential for pandemic control

Conclusion: While in the study, the acceptance rates were high, persistent misconceptions and mistrust highlight the need for targeted information campaigns. Public health policy must address misinformation, strengthen safety communication, and leverage trusted channels to reach student populations.

INTRODUCTION

The COVID-19 pandemic, declared by the World Health Organization (WHO) in March 2020, has had far-reaching health, economic, and social impacts globally.[1] Vaccination remains the primary strategy to mitigate COVID-19 transmission, hospitalization, and mortality.[2] Despite the availability of multiple safe and effective vaccines, vaccine hesitancy—defined as the delay in acceptance or refusal of vaccination despite availability—has been recognized by WHO as one of the top ten threats to global health.[3]

The WHO Strategic Advisory Group of Experts (SAGE) "3Cs" model—Confidence (trust in vaccine safety and effectiveness), Complacency (low perceived risk of disease), and Convenience (accessibility)—provides a framework to understand the behavioral drivers of hesitancy.[4] In India, the COVID-19 vaccination program began in January 2021, prioritizing healthcare workers, the elderly, and high-risk populations, before expanding to all adults by May 2021.[5] Despite extensive public health campaigns, uptake among younger populations, including university students, has been uneven.[6]

University students play a pivotal role in pandemic control because of their high mobility, strong social influence, and ability to serve as key channels for disseminating health information within their communities.[7] However, this connectivity also increases exposure to misinformation, particularly on social media platforms such as WhatsApp, Facebook, and Instagram.[8,9] Misinformation has been shown to significantly affect vaccine decision-making and erode public trust.[10,11]

Studies in India and abroad have linked youth vaccine hesitancy to concerns over rapid vaccine development, side effects, distrust of pharmaceutical companies, and conspiracy theories.[12-14] Given their unique role and vulnerabilities, understanding student perspectives is essential for designing targeted interventions.

This study aimed to measure COVID-19 vaccine hesitancy and acceptance among unvaccinated university students in Southern India, identify key predictors, and provide policy-oriented recommendations. The manuscript can

discuss factors influencing vaccine acceptance and hesitancy, including social, psychological, and institutional drivers. It may also highlight communication strategies, accessibility issues, and the role of students as community influencers in vaccination efforts.

METHODS

Study Design and Setting

A cross-sectional, web-based survey was conducted from June to August 2022 at JKK Nattraja College of Pharmacy, Namakkal district, Tamil Nadu, India. This setting represents a higher education institution in a semi-urban region, where students have varying access to health information and vaccination services.[1,2]

Participants

Inclusion criteria were: (i) students aged ≥18 years, (ii) unvaccinated against COVID-19 at the time of data collection, and (iii) willingness to provide informed consent. Exclusion criteria were: students already vaccinated or declining to participate.

Questionnaire Development

A structured questionnaire was adapted from the WHO SAGE working group on vaccine hesitancy survey tool [3] and tailored to the COVID-19 context in India.[4] It comprised four sections

- Socio-demographic data (age, gender, academic program, residence type).
- Attitudes toward COVID-19 vaccination (perceived safety, efficacy, and trust)
- Perceived barriers (fear of side effects, cost, accessibility, religious/medical concerns)
- Sources of information (social media, news outlets, peers, healthcare providers)

The tool was pretested on 20 students for clarity and revised accordingly.

Ethical Considerations

The study was approved by the Institutional Ethics Committee (JKKNCP/ETHICS_PRACTICE/021PDS08). Electronic informed consent was obtained before participation, and anonymity was maintained.[5]

Data Collection

The survey was disseminated via email and WhatsApp groups using Google Forms. Multiple reminders were sent to maximize participation.

Statistical Analysis

Data were analyzed using IBM SPSS v22. Descriptive statistics summarized participant characteristics. Associations between hesitancy and explanatory variables were examined using chi-square tests. Variables with $p<0.1$ were included in a multivariate logistic regression model to identify independent predictors of hesitancy. A two-tailed $p<0.05$ was considered statistically significant.[6]

RESULTS

A total of 401 students participated, of which 346 (87.15%) were unvaccinated and included in the analysis; 55 respondents were excluded as per study criteria. Among the unvaccinated, 248 (71.67%) expressed willingness to receive COVID-19 vaccination, while 98 (28.32%) reported hesitancy as shown in Table 01. Of the vaccine acceptors, 135 (54.43%) were male and 113 (45.56%) were female; among hesitant respondents, 62 (63.26%) were male and 36 (36.73%) were female, indicating a higher male proportion in both groups.

Vaccination details	Gender	Profession	No. of respondents	Percentage (%)
Vaccine accepting people [n = 248]	Male	Healthcare	82	33.06
		Non-Healthcare	53	21.37
	Female	Healthcare	82	33.06
		Non-Healthcare	31	12.50
Vaccine hesitating people [n = 98]	Male	Healthcare	34	34.69
		Non-Healthcare	27	27.55
	Female	Healthcare	28	28.57
		Non-Healthcare	9	9.18

Table 1: Distribution of respondents

A greater proportion of healthcare students was noted among both acceptors and hesitants compared to non-healthcare respondents, as discussed in Table 02. Most hesitant participants reported obtaining information from social media (87.8%), friends (87.8%), internet sources (82.7%), and self-belief (90.8%). Only 14.3% believed adequate safety information was available, while 75.5% disagreed. Concerns included the possibility of contracting COVID-19 post-vaccination (9.2%) and fear of side effects (91.8%). Fear of needles was minimal (4.08%). Nearly one-quarter (23.5%) believed vaccination was a means for manufacturers to generate profit, and 86.7% perceived vaccines as widely available.[15]

Medical contraindications were reported by 5%, affordability was noted by 24.5%, and 94.9% stated willingness to vaccinate if adequate information was provided. Religious exemption was uncommon (5.1%). Over half (55.1%) expressed the need for long-term studies, 80% cited convenience as an influencing factor, and 59.2% reported pre-vaccination anxiety. None of the female participants was pregnant.

Table 2: Statistics of Socio-demographical data

Characteristics	Profession	Gender	N	Mean	Std. Deviation
Age	Health care	Male	136	1.05	0.281
		Female	131	1.02	0.150
		Total	267	1.04	0.226
	Non-Health care	Male	83	1.08	0.280
		Female	47	1.11	0.312
		Total	130	1.09	0.291
	Total	Male	219	1.06	0.280
		Female	178	1.04	0.208
		Total	397	1.06	0.250

Educational qualification	Health care	Male	136	1.20	0.400
		Female	131	1.26	0.440
		Total	267	1.23	0.421
	Non-Health care	Male	83	1.18	0.387
		Female	47	1.11	0.312
		Total	130	1.15	0.362
	Total	Male	219	1.19	0.395
		Female	178	1.22	0.415
		Total	397	1.20	0.403
Living area	Health care	Male	136	1.54	0.500
		Female	131	1.50	0.502
		Total	267	1.52	0.501
	Non-Health care	Male	83	1.54	0.501
		Female	47	1.53	0.504
		Total	130	1.54	0.500
	Total	Male	219	1.54	0.500
		Female	178	1.51	0.501
		Total	397	1.53	0.500
No of people in household	Health care	Male	136	3.31	0.565
		Female	131	3.40	0.731
		Total	267	3.36	0.652
	Non-Health care	Male	83	3.40	0.492
		Female	47	3.30	0.548
		Total	130	3.36	0.513
	Total	Male	219	3.34	0.539
		Female	178	3.38	0.688
		Total	397	3.36	0.610
No of people in household vaccinated for COVID-	Health care	Male	136	2.40	1.078
		Female	131	2.53	1.198
		Total	267	2.46	1.138
	Non-Health care	Male	83	2.35	1.005
		Femal	47	2.49	1.159

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		Total	130	2.40	1.061
	Total	Male	219	2.38	1.049
		Female	178	2.52	1.185
		Total	397	2.44	1.112

Among acceptors, 96.8% believed vaccination was effective in controlling the pandemic, and 77.8% were likely or most likely to vaccinate if available. Perceived COVID-19 risk for South India was low for 50.8%, moderate for 26%, and high for 2.01%. Most (94.4%) believed normal life would resume only after mass vaccination, 98% believed vaccination protected self and others, and 97.6% supported continued preventive measures post-vaccination. Preference for a specific vaccine type was expressed by 45.2%, and 57.3% reported advising others to vaccinate.

The socio-demographic analysis showed that age was significantly associated with group differences (p = 0.034), with the majority of respondents aged 18–24 years, while older groups were underrepresented. Educational qualification approached significance (p = 0.054), as shown in Table 03, with postgraduates more common among healthcare professionals, reflecting higher academic requirements. In contrast, no significant differences were noted for living area, household size, or household vaccination status, which were evenly distributed across groups. These findings align with previous studies showing that age and education are strong predictors of vaccine attitudes, while factors such as residence or family size often play a minor role.[16-19]

Table 3: Findings of Socio-demographics data

Characteristics		**Health care**		**Non-healthcare**		**Value F**	**Value P**
		Male n (%)	**Female n (%)**	**Male n (%)**	**Female n (%)**		
Age	**Age (18-24 years)**	130	127	76	42	4.504	0.034

		-32.74%	-31.98%	-19.14%	-10.57%		
	Age (25-29 years)	3 (0.75%)	3 -0.75%	7 -1.76%	5 -1.25%		
	Age (30 years & above)	3 (0.75%)	1 -0.25%	0	0		
Educational qualification	**Qualification (UG)**	109 -27.45%	97 -24.43%	68 -17.12%	42 -10.57%	3.74	0.054
	Qualification (PG)	27 -6.80%	34 -8.56%	15 -3.77%	5 -1.25%		
Living area	**Urban area**	63 -15.86%	65 -16.37%	38 -9.57%	22 -5.54%	0.092	0.761
	Rural area	73 -18.38%	66 -16.62%	45 -11.33%	25 -6.29%		
No. of household people	**Household people (1)**	1 (0.25%)	4 -1.00%	0 (%)	0 (%)	0.018	0.894
	Householdpeople (2)	4 (1.00%)	3 -0.75%	0 (%)	2 -0.50%		
	Household people (3-4)	83 -20.91%	63 -15.86%	50 -12.59%	29 -7.30%		
	Household people (5-6)	48 (%)	57 -14.35%	33 -8.31%	16 -4.03%		
	Household people (7 or More)	0	4 -1.00%	0	0		
No. of household people vaccinated	**Vaccinated household people (0)**	35 -8.81%	33 -8.31%	23 -5.79%	11 -2.77%	0.142	0.706
	Vaccinated household people (1)	37 -9.31%	29 -7.30%	17 -4.28%	13 -3.27%		
	Vaccinated household people (2)	39 -9.82%	46 -11.58%	35 -8.81%	14 -3.52%		
	Vaccinated household people (3-4)	24 -6.04%	14 -3.52%	8 -2.01%	8 -2.01%		

	Vaccinated household people (5-6)	1 (0.25%)	8 -2.05%	0	0		
	Vaccinated household people (7 or More)	0	1 -0.25%	0	1 -0.25%		

Vaccine Acceptance and Hesitancy Rates

Among the unvaccinated, 248 (71.7%) intended to vaccinate, while 98 (28.3%) were hesitant. Hesitant participants reported high reliance on: Social media (87.8%),[18] Friends (87.8%), General internet sources (82.7%), Self-belief (90.8%). Fear of needles was reported by only 6.1%,[21] but concern about side effects was high (91.8%). Religious and medical reasons were cited by 5.1% [24] and 7.1%, respectively.

Table 4: Distribution of respondents in Vaccination hesitancy

QUESTION & ANSWERS		**Healthcare**		**Non-healthcare**		**χ^2 value**	**P Value**
		Male n (%)	**Female n (%)**	**Male n (%)**	**Female n (%)**		
Q1	Yes	6(6.122%)	6(6.122%)	1(1.02%)	1(1.02%)	6.096	0.047
	No	22(22.44%)	19(19.38%)	25(25.51%)	8(8.16%)		
	Don't know	6(6.122%)	2(2.04%)	2(2.04%)	0		
Q2	Yes	5(5.10%)	3(3.06%)	1(1.02%)	0	3.066	0.216
	No	4(4.08%)	6(6.122%)	4(4.08%)	2(2.04%)		
	Don't know	25(25.51%)	18(18.36%)	23(23.46%)	7(7.14%)		
	Yes	29(29.59%)	25(25.51%)	27(27.55%)	9(9.18%)		

Q3	No	4(4.08%)	2(2.04%)	0	0	3.960	0.138
	Don't know	1(1.02%)	0	1(1.02%)	0		
Q4	Yes	2(2.04%)	2(2.04%)	0	0	2.628	0.269
	No	31(31.63%)	25(25.51%)	27(27.55%)	9(9.18%)		
	Don't know	1(1.02%)	0	1(1.02%)	0		
Q5	Yes	8(8.16%)	5(5.10%)	7(7.14%)	3(3.06%)	6.782	0.034
	No	4(4.08%)	6(6.122%)	0	0		
	Don't know	22(22.44%)	16(16.32%)	21(21.42%)	6(6.122%)		
Q6	Yes	27(27.55%)	22(22.44%)	27(27.55%)	9(9.18%)	6.288	0.043
	No	4(4.08%)	4(4.08%)	0	0		
	Don't know	0	1(1.02%)	1(1.02%)	0		
Q7	Yes	27(27.55%)	25(25.51%)	27(27.55%)	9(9.18%)	4.289	0.117
	No	4(4.08%)	2(2.04%)	0	0		
	Don't know	3(3.06%)	0	1(1.02%)	0		
Q8	Yes	17(17.34%)	11(11.22%)	19(19.38%)	7(7.14%)	5.818	0.055
	No	5(5.10%)	4(4.08%)	2(2.04%)	0		
	Don't know	12(12.24%)	12(12.24%)	7(7.14%)	2(2.04%)		
Q9	Yes	0	0	0	0	0	0
	No	27(27.55%)	28(28.57%)	9(9.18%)	0		
Q10	Yes	15(15.30%)	20(20.40%)	14(14.28%)	9(9.18%)	0.218	0.640
	No	19(19.38%)	7(7.14%)	14(14.28%)	0		
	Yes	3(3.06%)	2(2.04%)	0	0	3.196	0.074

Q11	No	31(31.63%)	25(25.51%)	28(28.57%)	9(9.18%)		
Q12	Yes	29(29.59%)	24(24.48%)	28(28.57%)	9(9.18%)	5.284	0.022
	No	5(5.10%)	3(3.06%)	0	0		
Q13	Yes	4(4.08%)	2(2.04%)	1(1.02%)	0	1.767	0.184
	No	30(30.61%)	25(25.51%)	27(27.55%)	9(9.18%)		
Q14	Yes	30(30.61%)	26(26.53%)	28(28.57%)	9(9.18%)	3.196	0.074
	No	4(4.08%)	1(1.02%)	0	0		

Acceptance-related findings showed stronger positive responses among healthcare respondents, with several significant associations. Most participants across all groups agreed that vaccination is an effective way to control the pandemic (Q15: $\chi^2 = 4.234$, $p = 0.040$). A significant difference was observed regarding belief that life would not return to normal until mass vaccination occurred (Q17: $\chi^2 = 7.600$, $p = 0.006$), which was more strongly endorsed by healthcare respondents. Willingness to advise others to vaccinate (Q23) also differed significantly ($\chi^2 = 7.494$, $p = 0.006$), with healthcare professionals more likely to encourage vaccination. For other items, such as convenience of vaccination (Q16), perception of personal and community protection (Q19), and continued adherence to preventive measures post-vaccination (Q21), no statistically significant differences were noted, although trends favored healthcare groups. These results suggest that acceptance of COVID-19 vaccines was generally high, especially among healthcare professionals, with their role extending beyond personal uptake to advocacy for vaccination in the community.

Table 5: Distribution of respondents in Vaccination Acceptance

QUESTION	Healthcare	Non-healthcare		

& ANSWERS		Male n (%)	Female n (%)	Male n (%)	Female n (%)	χ^2 value	P Value
Q15	Yes	78(31.45%)	78(31.45%)	53(21.37%)	31(12.50%)	4.234	0.040
	No	4(1.61%)	4(1.61%)	0	0		
	Don't know	0	0	0	0		
Q16	Yes	80(32.26%)	76(30.65%)	53(21.37%)	30(12.10%)	2.160	0.142
	No	2(0.81%)	7(2.82%)	0	0		
	Don't know	0	0	0	0		
Q17	Yes	59(23.79%)	67(27.02%)	36(14.52%)	28(11.29%)	7.600	0.006
	No	7(2.82%)	7(2.82%)	0	0		
	Don't know	0	0	0	0		
Q18	Yes	78(31.45%)	78(31.45%)	53(21.37%)	31(12.50%)	4.234	0.040
	No	4(1.61%)	4(1.61%)	0	0		
Q19	Yes	81(32.66%)	78(31.45%)	53(21.37%)	31(12.50%)	2.614	0.106
	No	1(0.40%)	4(1.61%)	0	0		
Q20	Yes	81(32.66%)	76(30.65%)	53(21.37%)	30(12.10%)	1.686	0.194
	No	1(0.40%)	7(2.82%)	0	0		
Q21	Yes	80(32.26%)	78(31.45%)	53(21.37%)	31(12.50%)	3.149	0.076
	No	2(0.81%)	4(1.61%)	0	0		
Q22	Yes	40(16.13%)	39(15.73%)	23(9.27%)	10(4.03%)	1.771	0.183
	No	42(16.94%)	43(17.34%)	30(12.10%)	31(12.50%)		
Q23	Yes	54(21.77%)	50(20.16%)	23(9.27%)	15(6.05%)	7.494	0.006
	No	28(11.29%)	32(12.90%)	30(12.10%)	16(6.45%)		

Q24	Yes	23(9.27%)	15(6.05%)	17(6.85%)	3(1.21%)	0.013	0.910
	No	59(23.79%)	67(27.02%)	36(14.52%)	28(11.29%)		

Analysis of hesitancy-related questions revealed several statistically significant findings. Concern about vaccine safety information (Q1) differed significantly across groups ($\chi^2 = 6.096$, $p = 0.047$), with healthcare respondents reporting fewer safety-related worries compared to non-healthcare participants as depicted in Table 05. Similarly, suspicion that vaccination was primarily profit-driven (Q5) showed significant variation ($\chi^2 = 6.782$, $p = 0.034$), being more common among non-healthcare respondents. Awareness of vaccine availability (Q6) also differed significantly ($\chi^2 = 6.288$, $p = 0.043$), with healthcare professionals demonstrating better knowledge. Belief in vaccine effectiveness (Q12) was significantly higher among healthcare respondents ($\chi^2 = 5.284$, $p = 0.022$). Other domains—such as fear of side effects (Q3), religious concerns (Q11), or medical reasons for refusal (Q13)—did not show significant differences. Overall, hesitancy appeared to be shaped more by **misconceptions and trust issues** in non-healthcare respondents, while healthcare workers demonstrated greater confidence in vaccine efficacy and availability.

Predictors of Hesitancy

Chi-square tests identified significant associations between hesitancy and:

- Inadequate perceived safety information (p=0.047)[24]
- Belief that vaccination is profit-driven (p=0.034)[26]
- Perception that vaccination reduces the chance of infection (p=0.022)
- Concern over absence of long-term safety studies (p=0.055)

Discussion

In this study, 71.67% of unvaccinated respondents expressed willingness to receive COVID-19 vaccination, comparable to findings from similar surveys in which acceptance ranged from 68–79.5%.[20,21] Hesitancy (28.32%) was slightly higher than some reports from developed countries, possibly due to greater reliance on non-formal

information sources and lower trust in vaccine safety in the setting.

Males outnumbered females among both acceptors and hesitants, consistent with studies indicating that men may perceive lower risk from vaccination side effects or be more willing to participate in preventive measures.[20] Healthcare students showed higher representation in both groups, reflecting increased exposure to vaccination discourse but also susceptibility to misinformation.

A notable finding was the heavy reliance on social media (87.8%) for vaccine-related information, similar to global reports of misinformation influencing hesitancy.[22,23] Unlike studies in which over half of respondents cited official sources,[22] our results underscore the urgent need for targeted, credible communication strategies. Transparency in efficacy and safety data, particularly regarding rapid vaccine development, could mitigate concerns; 75.5% in our study felt safety information was inadequate, aligning with findings that accelerated vaccine production during the pandemic created skepticism.[24]

Side effect concerns were the leading hesitancy driver (91.8%), higher than the ~50% reported in other populations.[24] This may reflect heightened media focus on adverse events in India during early vaccine rollout. Fear of needles, however, was rare, contrasting with systematic reviews showing 20–50% prevalence in adolescents.[25]

Perceptions that vaccines are profit-driven (23.5%) were lower than in some Middle Eastern studies but remain a barrier. Interestingly, 86.7% of hesitant participants acknowledged wide vaccine availability, paralleling WHO's 2021 statement on global supply of multiple approved vaccines.[26] Medical contraindications accounted for only 5% of hesitancy, much lower than in Jordan,[27] suggesting that misinformation outweighs clinical barriers in our cohort.

Religious exemption was uncommon (5.1%), supporting evidence that religious belief is not a major hesitancy factor in some regions.[28,29] The desire for long-term studies (55.1%) mirrors other reports of concern over rapid development timelines.[22] Convenience influenced decisions for 80% of hesitant respondents, higher than the 38% noted elsewhere,[27] indicating logistical barriers may play a greater role in our context.

Among acceptors, high confidence in vaccine efficacy (96.8%) and belief in the necessity of mass vaccination for normalcy (94.4%) align with prior findings.[21,30] Availability concerns were far higher than reported elsewhere,[21] potentially reflecting early regional shortages. Continued adherence to preventive measures post-vaccination (97.6%) was encouraging and consistent with CDC guidance.[23]

Overall, our results highlight that vaccine hesitancy in this population is primarily driven by misinformation, safety concerns, and demand for long-term safety data, rather than religious or medical barriers. Addressing these through transparent communication, engagement with trusted sources, and ensuring convenient access could substantially improve uptake. Building sustainable vaccine trust requires transparent communication, community engagement, and ongoing post-marketing safety monitoring.[26] Addressing profit-driven perception concerns may involve highlighting non-commercial partnerships and public sector involvement in vaccine development.[26]

Policy Implications

- Integrate digital literacy and health communication modules into higher education curricula.
- Establish permanent campus vaccination centers to improve convenience.
- Implement social media monitoring and response systems in partnership with platforms.
- Engage student leaders as health ambassadors to build peer-level trust.

Conclusion

This study demonstrates that although a majority of university students in Southern India expressed willingness to receive COVID-19 vaccination, nearly one-third still showed hesitancy driven by misinformation, safety concerns, and distrust regarding vaccine motives. The reliance on social media as a primary information source among hesitant individuals underscores the urgent need for targeted digital communication strategies. Addressing vaccine hesitancy in this demographic is particularly important, given their role as future healthcare providers, influencers within peer groups, and active participants in online discourse.

These findings highlight that policy responses should not rely solely on mass media campaigns, but instead integrate institution-based health promotion, peer-led advocacy, and digital literacy training. Universities can serve as strategic hubs for vaccine education and delivery by organizing on-campus vaccination drives, embedding vaccine science in curricula, and facilitating open forums to address concerns directly.[19]

In the long term, building vaccine confidence requires sustained investment in transparent public health communication, inclusive stakeholder engagement, and continued post-marketing safety surveillance. This multifaceted approach can mitigate misinformation, rebuild trust, and improve vaccine coverage. By targeting young adults early in their professional and civic life, public health policy can lay the foundation for a generation that is informed, health-conscious, and resilient against future public health threats.

Author Contributions

Conceptualization: Sudha Muthusamy
Methodology: Sudha Muthusamy, Karthikeyan A
Investigation & Data Collection: Karthikeyan A, Kamalakumar Uthayanan, Prashanth M
Data Curation: Karthikeyan A, Prashanth M
Formal Analysis & Visualization: Karthikeyan A, Venkateswaramurthy Nallasamy
Resources & Project Administration: Prashanth M, Kamalakumar Uthayanan
Writing – Original Draft: Karthikeyan A, Kamalakumar Uthayanan
Writing – Review & Editing: Venkateswaramurthy Nallasamy, Sudha Muthusamy
Supervision: Sudha Muthusamy
All authors read and approved the final manuscript. *Corresponding author:* Sudha Muthusamy.

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Conflicts of Interest

The authors declare no conflicts of interest.

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