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Knowledge, Attitude and Practices Regarding Tetanus Toxoid Vaccination among Medical and Non-Medical Female Students of Childbearing Age in Sindh, Pakistan: A Comparative Cross-Sectional Study

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Abstract

Background: *Tetanus remains a preventable cause of maternal and neonatal mortality in Pakistan, where coverage of tetanus toxoid (TT) vaccination among women of reproductive age remains below the elimination threshold. This study assessed and compared the knowledge, attitude and practices (KAP) regarding TT vaccination between medical and non-medical female students of childbearing age in Sindh.*

Methods: *A comparative cross-sectional study was conducted among 400 female students (200 medical and 200 non-medical) aged 15–49 years at two public universities in Jamshoro, Sindh. Data were collected through a self-administered questionnaire developed using the Health Belief Model. The chi-square test compared categorical variables, composite domain scores were compared between groups, crude odds ratios and adjusted prevalence ratios identified determinants of uptake, and Pearson correlation examined inter-domain relationships. A p-value < 0.05 was considered significant.*

Results: *Medical students demonstrated significantly higher knowledge (mean 7.57 ± 1.42 vs 4.33 ± 3.20), attitude (29.08 ± 2.92 vs 26.59 ± 4.10) and practice (1.96 ± 1.45 vs 0.70 ± 1.03) scores than non-medical students (all p < 0.001). No non-medical student had ever received a TT vaccine (0.0%) compared with 45.0% of medical students, yet reported refusal was uncommon and similar between groups (p = 0.628). Rural residence (adjusted PR 0.38, 95% CI 0.21–0.67) and married status (adjusted PR 0.08, 95% CI 0.01–0.43) were significant barriers to uptake. Knowledge correlated more strongly with practice (r = 0.515) than attitude did (r = 0.324).*

Conclusion: *TT vaccination coverage was critically low among young women of childbearing age, driven by inadequate awareness and access rather than refusal. Strengthening practical, vaccine-specific knowledge and providing accessible, university-based vaccination, particularly for non-medical and rural students, is recommended to advance maternal and neonatal tetanus elimination.*

Keywords: Tetanus Toxoid; Vaccination; Knowledge Attitude Practice; Women of Childbearing Age; Pakistan; Health Belief Model.

Introduction

Tetanus is a serious, vaccine-preventable bacterial infection caused by Clostridium tetani, an organism found in soil, dust and animal faeces that enters the body through broken skin, wounds or the cutting of the umbilical cord at delivery. The disease causes painful muscle stiffness and spasms and carries an extremely high case-fatality rate, approaching 100% in untreated cases and remaining between 10% and 60% even under hospital care. Maternal and neonatal tetanus (MNT) is of particular concern in resource-limited settings, where poor hygiene during delivery and limited access to health services place mothers and newborns at heightened risk. Crucially, no natural immunity to tetanus exists, so that vaccination of women of childbearing age is the principal means of protecting both mothers and their infants.

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Although global MNT mortality fell substantially in the early years of this century, Pakistan remains among the small group of countries in which MNT continues to constitute a public-health problem and where the World Health Organization elimination standard has not yet been achieved. National survey data have indicated that coverage of TT vaccination among pregnant women in Pakistan remains inadequate, with only a little over half of recent live births in Sindh protected against neonatal tetanus. Low coverage has been linked not only to poor antenatal care-seeking but also to inadequate vaccination-related knowledge, family structure and local decision-making dynamics, and low coverage has been observed even among literate and relatively affluent populations, indicating that education and income alone do not guarantee protection.

It is commonly assumed that students enrolled in medical programmes possess greater knowledge of, and adherence to, vaccination than their non-medical counterparts; however, empirical evidence supporting this assumption in the Pakistani context is scarce. Few studies have directly compared the knowledge, attitude and practices (KAP) of medical and non-medical students with respect to TT vaccination, and fewer still have focused on female students of childbearing age, the priority population for the vaccine. The present study was therefore designed to assess and compare the KAP regarding TT vaccination between medical and non-medical female students aged 15–49 years in Sindh, to identify the socio-demographic determinants of vaccination uptake, and to examine the interrelationships among the three KAP domains. The study was framed by the Health Belief Model, which seeks to explain health behaviour through perceptions of susceptibility, severity, benefits, barriers and cues to action.

Materials and Methods

Study design and setting

A comparative cross-sectional study was conducted among female students at two public-sector universities located in Jamshoro, Sindh — the Liaquat University of Medical and Health Sciences (representing the medical stream) and the University of Sindh (representing the non-medical stream). Data were collected over the study period using a structured, self-administered questionnaire.

Study population and sampling

The study population comprised female students of childbearing age (15–49 years), irrespective of marital status, enrolled in undergraduate programmes at the two universities. A stratified sampling approach was used, with separate samples drawn from the medical and non-medical strata so that findings could be compared. The required sample size was calculated using the formula $n = z^2pq/d^2$, taking $z = 1.96$ for a 95% confidence level, an estimated awareness proportion (p) of 0.5, $q = 1 - p$, and a margin of error (d) of 0.05, yielding 384; this was inflated by 10% to allow for non-response, giving a target of approximately 422. A balanced analytic sample of 400 participants (200 medical and 200 non-medical) was achieved.

Participants were currently enrolled undergraduates aged 18 years or older who provided written informed consent. Students who could not recall their vaccination history, who had a history of allergy or adverse reaction to the TT vaccine, who had a contraindication to the vaccine, or who declined consent were excluded.

Data collection instrument

The questionnaire was developed on the basis of previously published studies and the constructs of the Health Belief Model, and comprised sections on demographic information, knowledge of tetanus and TT vaccination, attitudes towards vaccination, and vaccination practices. It was prepared in English, translated into Urdu and back-translated to eliminate translation errors, and pretested before formal administration. The survey was delivered electronically using online forms accessed on tablets and Android devices, with required fields to minimise missing data and contact details of the surveyors provided for clarification.

Statistical analysis

Data were analysed using statistical software. Categorical variables were summarised as frequencies and percentages and compared between groups using the Pearson chi-square test; continuous variables were summarised as median (interquartile range) or mean (standard deviation) and compared between the two independent groups. Composite scores were computed for each KAP domain and dichotomised into poor and good categories using predefined cut-offs. Crude odds ratios (OR) and mutually adjusted prevalence ratios (PR) with 95% confidence intervals (CI) were estimated to identify determinants of ever having received the TT vaccine. Pearson correlation coefficients

quantified relationships among the KAP domains, overall and stratified by stream. A p-value < 0.05 was considered statistically significant.

Ethical considerations

Ethical approval was obtained from the Ethics Review Committee of the Department of Sociology, University of Sindh. Online informed consent was obtained from each participant before completion of the questionnaire. Participants' personal information was kept confidential and accessible only to the principal investigator.

Results

Socio-demographic characteristics

Of the 400 participants, the median age was 22 years in both groups. Medical students were significantly more likely to be of urban residence (69.0% vs 41.0%), single (98.0% vs 80.5%) and from households earning more than PKR 100,000 per month (40.5% vs 11.5%) than non-medical students (all p < 0.001). The socio-demographic profile of the two groups is presented in Table 1.

Table 1. *Socio-demographic characteristics of participants (N = 400).*

Variable	Medical n (%)	Non-Medical n (%)	p-value
Age, years — median (IQR)	22 (21–23)	22 (21–29)	0.021
Residence			
Urban	138 (69.0)	82 (41.0)	<0.001
Rural	62 (31.0)	118 (59.0)	
Marital status			
Single	196 (98.0)	161 (80.5)	<0.001
Married	4 (2.0)	39 (19.5)	
Monthly household income (PKR)			
< 25,000	35 (17.5)	23 (11.5)	<0.001
25,000–50,000	43 (21.5)	98 (49.0)	
50,001–100,000	41 (20.5)	56 (28.0)	
> 100,000	81 (40.5)	23 (11.5)	

Chi-square test; p < 0.05 significant.

Knowledge, attitude and practice

Medical students scored significantly higher than non-medical students on every knowledge and attitude item (all p < 0.001). Notably, 76.0% of non-medical students had never heard of the TT vaccine, and no non-medical student knew the number of doses required for lifelong protection. The composite domain scores confirmed the medical advantage across all three domains (Figure 1), and the categorical classification showed that 100.0% of non-medical and 94.0% of medical students had poor practice. Domain scores and categorical levels are shown in Table 2.

Table 2. *Composite KAP scores and categorical levels by educational stream (N = 400).*

Domain	Medical	Non-Medical	p-value
Mean score (mean ± SD)			
Knowledge	7.57 ± 1.42	4.33 ± 3.20	<0.001
Attitude	29.08 ± 2.92	26.59 ± 4.10	<0.001
Practice	1.96 ± 1.45	0.70 ± 1.03	<0.001
Good level — n (%)			
Knowledge	163 (81.5)	71 (35.5)	<0.001
Attitude	187 (93.5)	111 (55.5)	<0.001
Practice	12 (6.0)	0 (0.0)	<0.001

SD, standard deviation. Levels dichotomised by predefined cut-off; chi-square / group comparison, p < 0.05 significant.

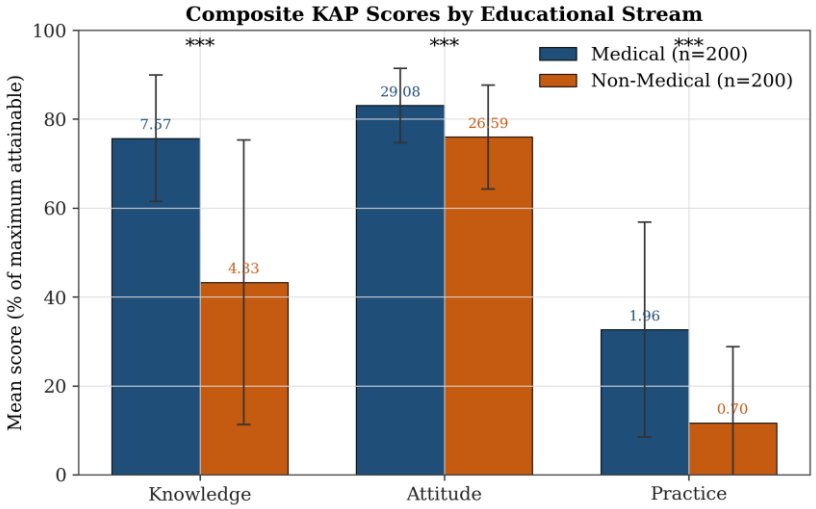

Figure 1. Composite knowledge, attitude and practice (KAP) scores, expressed as a percentage of the maximum attainable score, by educational stream. Error bars represent the standard deviation; raw means are annotated. All between-group differences were significant (*** $p < 0.001$).

Vaccination practices

Vaccination uptake was strikingly low. None of the non-medical students (0.0%) had ever received a TT vaccine, compared with 45.0% of medical students ($p < 0.001$), and only 14.0% of medical students had completed the five-dose schedule. However, reported refusal of vaccination was uncommon and statistically similar between the groups (10.0% vs 11.5%; $p = 0.628$), indicating that low uptake was not driven by deliberate rejection. Key practice indicators are shown in Table 3 and Figure 2.

Table 3. *Selected TT vaccination practices by educational stream (N = 400).*

Practice (Yes responses)	Medical n (%)	Non-Medical n (%)	p-value
Ever received a TT vaccine	90 (45.0)	0 (0.0)	<0.001
Completed 5-dose schedule	28 (14.0)	0 (0.0)	<0.001
Encouraged others to vaccinate	125 (62.5)	78 (39.0)	<0.001
Would consent for daughter*	86 (74.1)	16 (25.8)	<0.001
Ever refused TT vaccination	20 (10.0)	23 (11.5)	0.628
Possesses vaccination card	42 (21.0)	23 (11.5)	0.010

**Among eligible respondents. Chi-square test; $p < 0.05$ significant.*

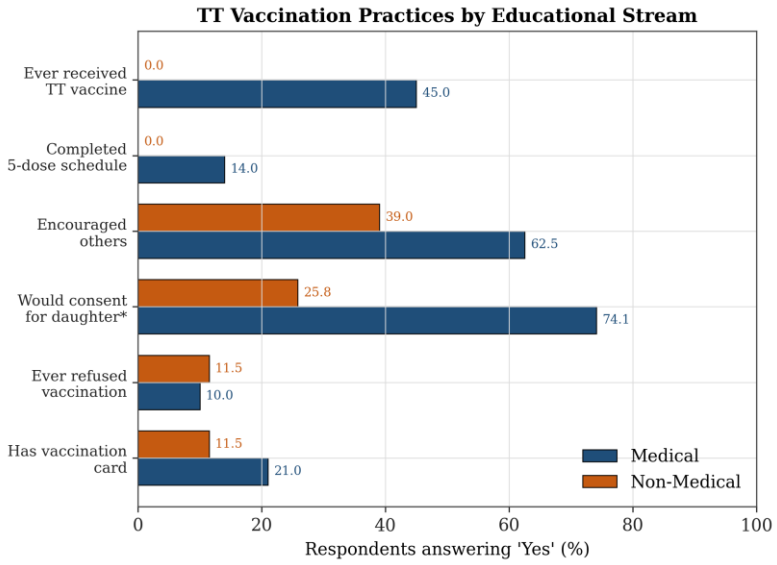

Figure 2. Tetanus toxoid (TT) vaccination practices by educational stream, showing the percentage answering 'Yes' to each item. No non-medical student had ever been vaccinated, yet reported refusal was uncommon and similar between groups, indicating that low uptake reflects limited awareness and access rather than refusal.

Determinants of vaccination uptake

In the adjusted analysis, rural residence (PR 0.38, 95% CI 0.21–0.67) and married status (PR 0.08, 95% CI 0.01–0.43) were significant independent barriers to ever having received the TT vaccine, as were the middle household-income bands relative to the lowest. Vaccination uptake was entirely confined to medical students and to those already aware of tetanus, precluding ratio estimation for these variables. Determinants are presented in Table 4 and Figure 3.

Table 4. *Determinants of ever-receiving the TT vaccine (N = 400).*

Variable	Received Yes n (%)	Crude OR (95% CI)	Adjusted PR (95% CI)
Marital status			
Single	88 (97.8)	Ref	Ref
Married	2 (2.2)	0.14 (0.03–0.62)*	0.08 (0.01–0.43)*
Residence			
Urban	64 (71.1)	Ref	Ref
Rural	26 (28.9)	0.41 (0.24–0.68)*	0.38 (0.21–0.67)*
Monthly household income (PKR)			
< 25,000	15 (16.7)	Ref	Ref
25,000–50,000	22 (24.4)	0.53 (0.25–1.11)	0.30 (0.12–0.70)*
50,001–100,000	15 (16.7)	0.52 (0.23–1.17)	0.38 (0.16–0.92)*
> 100,000	38 (42.2)	1.65 (0.81–3.35)	1.11 (0.47–2.60)

*OR, odds ratio; PR, prevalence ratio; CI, confidence interval; Ref, reference. *p < 0.05.*

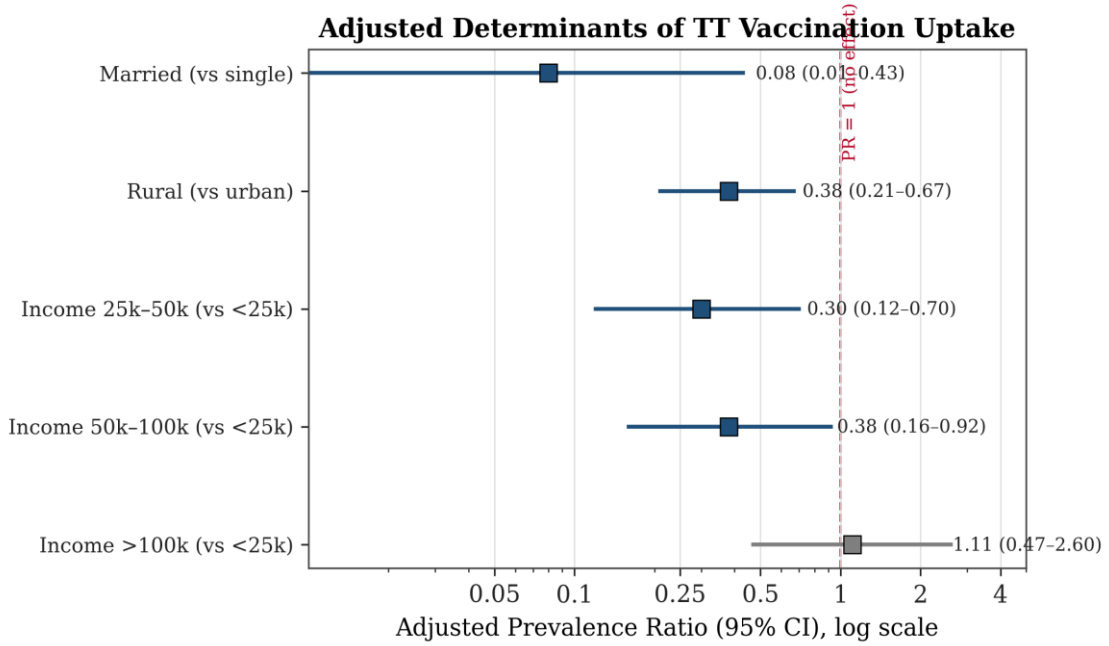

Figure 3. Forest plot of adjusted prevalence ratios (PR) with 95% confidence intervals for determinants of ever having received the TT vaccine. Squares represent the adjusted PR and lines the 95% CI. Estimates whose interval excludes 1.0 (dashed line) are significant (blue); non-significant estimates are grey. The axis is on a logarithmic scale.

Correlation among KAP domains

For the total sample, all three domains were positively and significantly correlated ($p < 0.001$); knowledge correlated more strongly with practice ($r = 0.515$) than attitude did ($r = 0.324$), and knowledge correlated with attitude at $r = 0.572$. On stratified analysis, the correlations were

considerably stronger among non-medical students (knowledge–practice r = 0.528) than among medical students (knowledge–practice r = 0.242; attitude–practice r = 0.058, non-significant), indicating a ceiling effect in the medical group and a greater potential behavioural return from educating non-medical students.

Discussion

This comparative study demonstrated that medical female students possessed significantly greater knowledge, more favourable attitudes and better practices regarding TT vaccination than their non-medical counterparts, yet revealed that the prevalence of adequate vaccination was critically low across the entire sample. The findings provide direct comparative evidence in a context where such evidence has been scarce, and they confirm the common but previously under-tested assumption that health-professional education is associated with superior vaccine knowledge and behaviour.

The most important finding is the profound gap between generally favourable attitudes and negligible practice, especially among non-medical students, none of whom had ever been vaccinated despite a measurable level of positive attitude. This knowledge-attitude-practice gap is well recognised in health-behaviour research, and the present correlation analysis localised its source: attitude was only weakly associated with practice, whereas knowledge was more strongly associated with it. The finding is consistent with regional evidence that inadequate knowledge and lack of awareness lead to demand failure in seeking care and to elevated risk of tetanus infection, and with reports that the majority of women have poor knowledge of tetanus and the importance of TT vaccination.

The observation that reported refusal was uncommon and similar across the two groups is particularly important, because it reframes the problem as one of awareness and access rather than of vaccine hesitancy. This interpretation is reinforced by the very high proportion of non-medical students unaware of the vaccine, the low rate of vaccination-card possession, and international evidence attributing most non-vaccination to misconception and to the vaccine being unavailable at nearby centres rather than to active rejection. Through the lens of the Health Belief Model, the favourable perceptions of benefit and the high trust in health authorities were not translated into action because the necessary cues to action and the basic awareness of the vaccine were absent.

The determinant analysis identified rural residence and married status as significant barriers to uptake. Lower vaccination among rural residents reflects the persistent urban-rural inequity in immunisation access in Pakistan and accords with evidence that socio-economic status and residence affect adequate antenatal tetanus vaccination. The markedly lower uptake among married women is counter-intuitive, given that they are the conventional priority target for TT immunisation, and most plausibly reflects missed opportunities at antenatal and reproductive-health contacts — a programmatic failure to capture a priority group. The complete confinement of vaccination to the medically educated and to those already aware of tetanus underscores health literacy as the most direct lever for improving coverage.

These findings should be interpreted in light of the study's limitations. The cross-sectional design permits the identification of association but not causation. Practice data were self-reported and subject to recall and social-desirability bias, which could not always be verified given the low rate of card possession. The study was confined to two universities in Jamshoro, which may limit generalisability to other settings and to non-student populations. The complete separation observed for educational stream and prior awareness, while substantively informative, precluded adjusted ratio estimation for those variables. Strengths include the balanced comparative design, the theory-based and pretested instrument, the use of multivariable adjustment, and the focus on the priority population for TT vaccination.

Conclusion

TT vaccination coverage was critically low among female students of childbearing age in Sindh, particularly among non-medical and rural students, and was driven by inadequate awareness and access rather than by refusal. Because attitudes were largely favourable and refusal was rare, relatively low-cost interventions — targeted, vaccine-specific health education and accessible, university-based vaccination drives, with particular attention to non-medical and rural women and to the integration of TT vaccination into reproductive-health services — are likely to yield substantial gains in coverage and to advance the national and global goal of maternal and neonatal tetanus elimination.

Declarations

Conflict of interest: The authors declare no conflict of interest.

Funding: This research received no specific grant from any funding agency.

Ethical approval: Obtained from the Ethics Review Committee, Department of Sociology, University of Sindh, Jamshoro.

Authors' contributions: SR conceived and designed the study, collected and analysed the data, and drafted the manuscript. PAK and HK supervised the study, contributed to design and interpretation, and critically revised the manuscript. BM contributed to data collection, literature review and manuscript revision. All authors approved the final version.

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