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Original Article

Impact of Structured Training on Community Pharmacists' Knowledge, Practice, and Competency in Immunization Services

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ABSTRACT

Background: Immunization is an essential tool of public health, but the coverage in the adult population is not optimal in low- and middle-income countries, such as India. The Community Pharmacists (CPs) are very accessible yet a poorly used resource in the immunization scene. **Objectives:** The purpose of the study was to develop organized immunization training programs and assess their effectiveness in the Knowledge, Attitude, and Willingness to Practice (KAwP). **Materials and Methods:** A three-phase, cross-sectional interventional study was done on 92 pharmacists. Phase I conducted and tested a 35-item KAwP questionnaire using expert review. Phase II included a pilot Train-the-Trainers program to perfect delivery. Phase III was dedicated to full-scale application which is the combination of self-directed modules and the intensive hands-on clinical training. An Objective Structured Practical Examination (OSPE) was used to measure competencies objectively. **Results:** The post-intervention data had statistically significant improvements in all domains. The proportion of "good knowledge" rose from 21.8% to 90.6%, with median scores increasing from 9.00 to 11.00 (Z=-4.107, $p< 0.05$). Negative and neutral attitudes were removed and this showed that 100% of the respondents had a positive professional outlook (Z=-4.500, $p<0.05$). The willingness scores increased significantly (Z=-4.170, $p<0.05$) and the participants showed a transition between theoretical intention and practice readiness. **Conclusion:** Competency-based instruction in a targeted manner is an essential stepping stone towards clinical practice preparedness in pharmacists. This finding justifies the inclusion of community pharmacists into national systems of public health to maximise the number of vaccines and improve the coverage of the population.

Keywords: Community Pharmacists, Immunization Training, Knowledge-Attitude-Willingness (KAwP), OSPE Assessment, Pharmacist-Led Vaccination Public Health Intervention, Vaccine Uptake.

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INTRODUCTION

Vaccination is widely accepted as one of the most critical strategies in the field of public health, and a significant decrease in mortality rates among different populations has been observed due to the use of vaccines (Michaud 2009). Yet, even though paediatric vaccination seems to be strong, the lack of vaccination against such diseases as tetanus, hepatitis, and pneumococcal diseases shows itself in adult population (Sendekie *et al*., 2025; Qamar *et al*., 2022). To bridge this gap, international healthcare strategies for 2025-2026 advocate for broadening the scope of where vaccines are administered, highlighting community pharmacists as vital, accessible, and trusted partners within the healthcare ecosystem (Qamar *et al*., 2022; Burson *et al*., 2016).

Although the roles of pharmacist have evolved since the days when the practitioner was a mere inventory controller, recent studies show that pharmacists in 2025 and beyond will continue to be significantly underexploited, especially in terms of protecting the community (Systematic Evidence, 2025; Tamiru, 2025; Elghanam and Kim, 2025a). In the Indian landscape, there is a notable absence of standardized educational pathways and policy frameworks to facilitate this professional transition (Elghanam and Kim, 2025a).

The urgency of the study is due to the ongoing burden on the health of people posed by vaccine-preventable diseases among adults. Despite the geographical locations of the pharmacies, which are well-positioned to enhance access, they are mostly inhibited through important practical levels of competency, i.e., despite the high motivation levels displayed by the pharmacists

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to contribute, there is a high level of lack of competency based education in administration methods and cold chain logistics (Bach and Goad, 2015). So, Key challenges include a deficit in hands-on clinical experience, limited professional confidence regarding injections, and a lack of structured systems for monitoring adverse events.

Moreover, the absence of validated and culturally suitable assessment tools makes it challenging to objective measure professional readiness and develop informed regulatory changes, as well as introduce specialized training modules and a scalable proof-of-concept (Elghanam and Kim, 2025b; Alsabbagh *et al.*, 2018). Accordingly, the current study is needed to develop and validate a Knowledge Attitude Willingness to Practice (KAwP) framework, introduce special training modules, and establish a scalable proof- This work will facilitate the formal inclusion of pharmacists in the national immunization program so that there is safe and equitable distribution of vaccines, by presenting rigorous evidence, which is provided by Belagavi.

MATERIALS AND METHODS

This research methodology was a structured, prospective interventional design that was divided into three sequential stages to sequentially develop, validate, and implement a training program on community pharmacists in Belagavi, India.

Phase I: Framework Development and Validation

The research has begun with the formulation of a situation-specific evaluation tool: the Knowledge, Attitude, and Willingness to Practice (KAwP) questionnaire as shown in Figure 1. This 35-item instrument involved a 5-point Likert scale to measure factual knowledge, professional attitudes, and practice intentions. The questionnaire was content validated by an 11 subject expert panel to achieve scientific rigor with the measure of agreement being Cohens kappa. Products that had an almost perfect agreement (0.81-1.00) were retained. Internal consistency was then checked by alpha testing to guarantee reliability of the instrument to all the domains.

Phase II: Pilot Trainers-Trainers (TTT) Study

Before the full implementation, a pilot TTT program was carried out with a small group (n-8) to determine the feasibility, acceptability and preliminary effectiveness of the modules. This step adopted pre-post interventional design in order to streamline educational conveying plans and assessment rubric.

Phase III: Main Intervention and Implementation

92 community pharmacists were recruited using convenience sampling. The intervention involved two different learning modalities:

Theoretical Training

Two weeks of self-directed learning based on the standardized modules created by the Indian Pharmaceutical Association (IPA) on immunology, cold chain management, and Adverse Events Following Immunization (AEFI).

Practical Skill Development

A face-to-face, practical session aimed at live simulations of the preparation of vaccines, safe administration practices, and emergency response.

Assessment and Analysis

Effectiveness measured the difference between pre- and post-intervention KAwP scores. Also, the objective assessment of practical competencies was performed through an Objective Structured Practical Examination (OSPE), where standardized stations and checklists were used to make sure that the assessment of the skills was reproducible and consistent. The SPSS version 23.0. was used to statistically analyze data, with Wilcoxon signed-rank test to compare non-parametric data, setting the significance level at. Informed consent and ethical approval were obtained and all participants went through the process.

RESULTS

The organized training project led to a statistically significant increase in the professional skills of the participants in all the assessed areas.

Knowledge Enhancement

The learning program was very successful in enhancing background knowledge. Before the intervention, 57.4% of the participants were good in their knowledge with almost 43% in the moderate or poor categories. After the intervention, the good knowledge among pharmacists increased to 100% with no levels of poor or moderate knowledge at 0% as shown in Table 1. This improvement was statistically significant with the Wilcoxon signed-rank test indicating that the median knowledge score improved, 9.00 (IQR = 5.00) to 11.00 (IQR = 0.00) (p<0.05) as shown in Figure 2.

Attitudinal Transformation

The professional attitude of the participants toward their involvement in the immunization services significantly changed and it is evident in Table 2. The baseline data revealed that 10.4% had negative attitude and 17.4% was neutral towards these expanded roles. The post-intervention evaluation showed that positive attitudes rose to 93.0% whereas negative attitudes were annihilated (0.0%). This change is also supported by the increase in median attitude scores which increased to 53.00 (IQR=9.00) after the intervention (p<0.05) in comparison to the pre-intervention

score of 48.00 (IQR=11.00) in Figure 3 indicating that the training did indeed influence the attitude of the participants.

Practice Readiness and Willingness

The researchers noted a significant increase in the willingness of the pharmacists to take part in clinical vaccination practice. At first, 77.4% expressed a high level of willingness, but following the training, the level of high willingness increased to 96.5% as indicated in Table 3. The median practice readiness score improved from 63.00 (IQR=17.00) to 73.00 (IQR= 12.00) as shown in Figure 4. The Wilcoxon signed-rank test resulted in -5.384 (below 0.05), which indicates that the program was effective in changing the interest of pharmacists in theory to practical skills.

Demographic and Baseline Associations

Demographic variables analysis showed that the success of the intervention was equal across groups. There was no significant gender effect on the outcome of the knowledge test (Chi-square=1.392) and both male (71.4) and female (72.6) pharmacists had similar levels of competency. Likewise, gender did not play a crucial role in the attitudes (Chi-square =0.162) or the degree of willingness (Chi-square =0.522), which proves the universal applicability of the training. Lastly, pre-implementation education level baseline test assessments indicated that 72.2% of the community pharmacists had positive professional opinions prior to the full implementation of the modules.

DISCUSSION

The key finding of the study is that a competency-based educational intervention, which is structured, serves as a concrete trigger in facilitating the professional development of Community Pharmacists (CPs) in India. Through the application of a tested Knowledge-Attitude-Willingness to Practice (KAwP) model, we have been able to show that specific training is an effective way to overcome the fundamentally crucial gap between the willingness of a pharmacist to serve and the ability to practice. We find that the change between baseline motivation and actionable clinical capability, in fact, is not merely feasible but quantifiable with the help of significant statistical gains in all the domains considered.

Our findings are consistent with the two studies carried out in Nigeria by (Oseni *et al.*, 2025; Oladigbolu *et al.*, 2025), which determined that specialized vaccination training is the

Table 1: Distribution of participants by pre and post knowledge levels.

Knowledge		*n*	%
Pre test	Poor Knowledge	14	12.2
	Moderate knowledge	35	30.4
	Good Knowledge	66	57.4
Post test	Poor knowledge	0	0
	Moderate knowledge	0	0
	Good Knowledge	106	92.2

Table 2: Distribution of participants by pre and post Attitude levels.

Attitude		Count	Column *N* %
Pre test	Negative	12	10.4
	Neutral	20	17.4
	Positive	83	72.2
Post test	Negative	0	0.0
	Neutral	8	7.0
	Positive	107	93.0

Table 3: Distribution of participants by pre and post Willingness levels.

Willingness		*n*	%
Pre test	Low	10	8.7
	Moderate	16	13.9
	High	89	77.4
Post test	Low	1	.9
	Moderate	3	2.6
	High	111	96.5

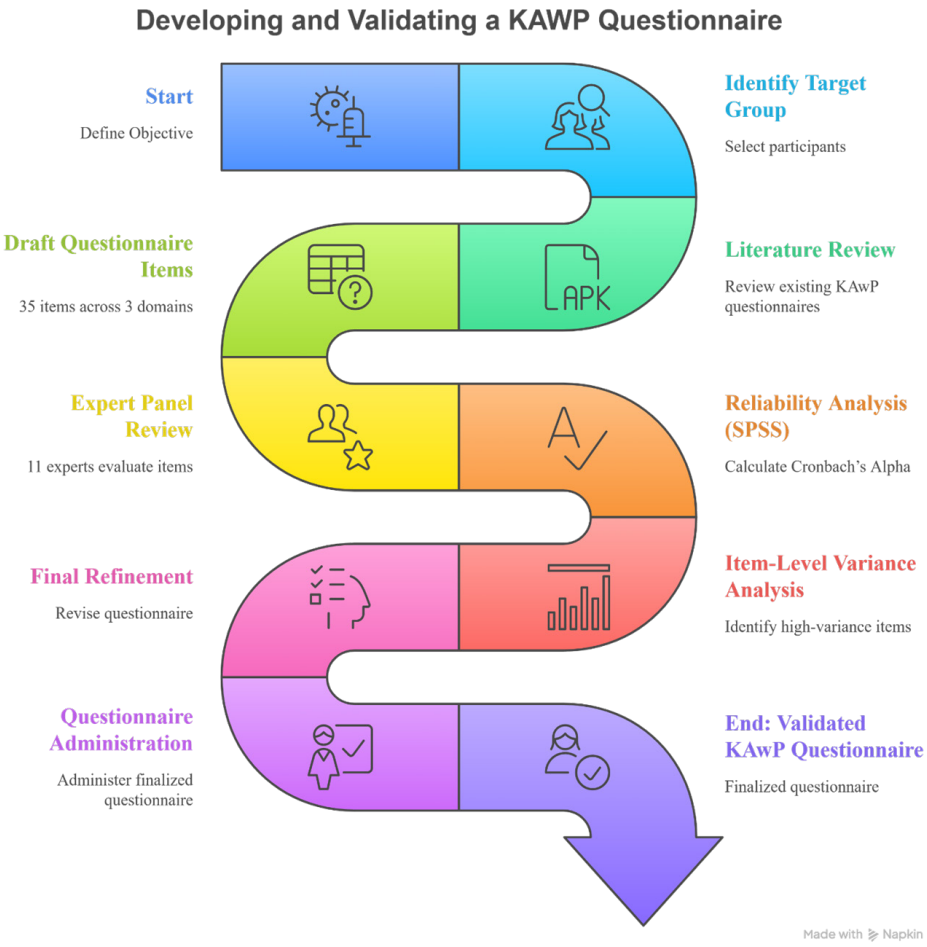

Figure 1: Flow diagram illustrating the development, validation, and finalization of the Knowledge, Attitude, and Willingness to Practice (KAwP) questionnaire.

most powerful predictor of an active role of a pharmacist in immunization delivery. As in Belagavi, where high willingness shot up to 96.5% after intervention as indicated by Oseni *et al.* Table 3 discovered that the intention to provide clinical service was increased by 80% with a structured educational event to become actual clinical service (Oseni *et al.*, 2025).

Moreover, our results are consistent with the research conducted by (Qamar *et al.*, 2022) in Malaysia that found that a poor level of training was one of the main perceived obstacles among most pharmacists. Both reports conclude that the current pharmacist willingness in the Asian LMICs has a solid baseline level, but it has to be formalized with a structured certification and clinical development. The dramatic increase of our median knowledge scores between 9.00 and 11.00 directly responds to the barrier mentioned in (Ayenew *et al.*, 2024) the necessity to develop professional confidence through specialized training.

Nevertheless, the results provided by the study by (Bwire *et al.*, 2025) are slightly contradictory to our results that we did not observe in our study. Acceptability towards a pharmacy-based vaccination model was found to be comparatively low in their qualitative review of community drug outlets in Tanzania (35.0%) because of structural and regulatory fears (Oladigbolu *et al.*, 2025). In our study, we have reported 100% positive attitudes and 96.5% high willingness post-intervention. Such a difference is probably due to the fact that our study involved hands-on clinical simulations (OSPE) that bridged and overcame the underlying technical fears, and the Tanzanian study measured the baseline perceptions without an interventional element (Elghanam and Kim, 2025b; Oladigbolu *et al.*, 2025).

Our results are also consistent with the data provided by (Marcum *et al.*, 2010), who tested an immunization certificate program in the USA and found that they increased professional confidence significantly. This is in line with our results where professional confidence items were significantly improved. It indicates that the cross-culturally effective model of certificate-based training, as popularized by the American Pharmacists Association (APhA), can be successfully applied to local contexts whether it is applied in a high-income environment or a middle-income environment (Bach and Goad, 2015; Marcum *et al.*, 2010).

Methodologically speaking, our research is consistent with the high-level competency framework confirmed by (Sakr *et al.*, 2023) in Lebanon. With a validated 35-item KAwP questionnaire and

Objective Structured Practical Examinations (OSPE), our study is rigorous enough to ensure that the reported improvements are not simply self-reported but are measurable, objective, and reproducible (Sakr *et al.*, 2023; Pelly *et al.*, 2010). By doing this, our study will overcome the barriers to standardization of benchmarks of professional practice across various pharmacy environments (Sakr *et al.*, 2023).

The positive results of the OSPE implementation in our research also correspond to the educational strategies that were promoted by the scholars (Sil *et al.*, 2024), who have described the OSPE as a formative assessment instrument that successfully promotes learning in the psychomotor domain. By making sure that 100% of our participants would successfully pass through vaccine preparation and administration stations, we have demonstrated evidence of a paternalistic opposition commonly observed in the literature, as we demonstrated that pharmacists are able to meet the highest standards of quality and safety (Tamiru, 2025; Sakr *et al.*, 2023).

Regarding the policy of the public health, our findings are in line with those of (Elghanam and Kim, 2025a, 2025b), whose meta-analyses revealed that pharmacist-led interventions are effective in raising vaccination rates in all types of vaccines. We recommend the compromise roadmap, allowing Indian policymakers to implement pharmacists into the National Immunization Strategy, which can be standardized through standardized curricula and mandatory certification, as an effective means of dramatically increasing vaccine access. The successes of having pharmacists empowered as immunizers can be seen in the successes of populations where this has been done (Isenor *et al.*, 2016).

LIMITATIONS

Despite these robust outcomes, the use of convenience sampling in a single region may limit the generalizability of our findings to all of India. Furthermore, our assessment focused on short-term readiness and did not evaluate long-term knowledge retention - a limitation also cited in (Ayenew *et al.*, 2024). Future research should utilize multi-centre, longitudinal designs to evaluate the direct impact of pharmacist-led services on community-wide vaccine uptake rates.

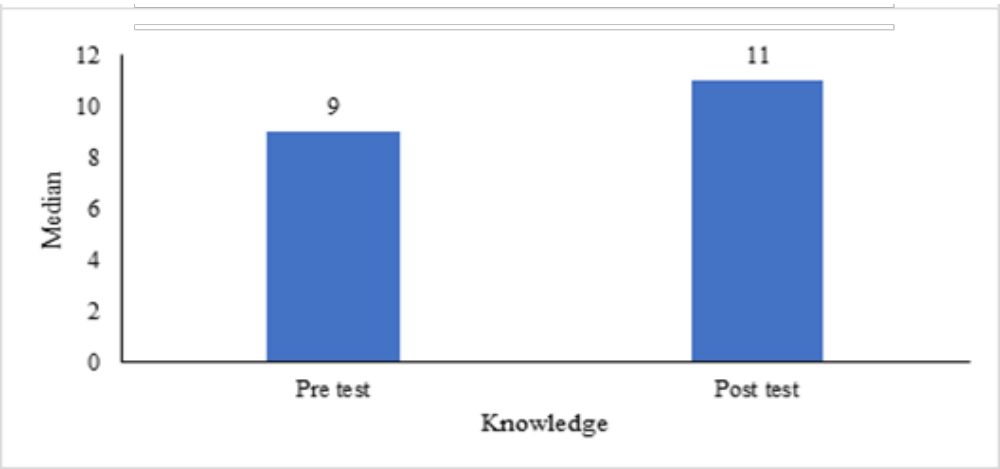

Figure 2: Comparison of Knowledge Scores Before and After Educational Intervention.

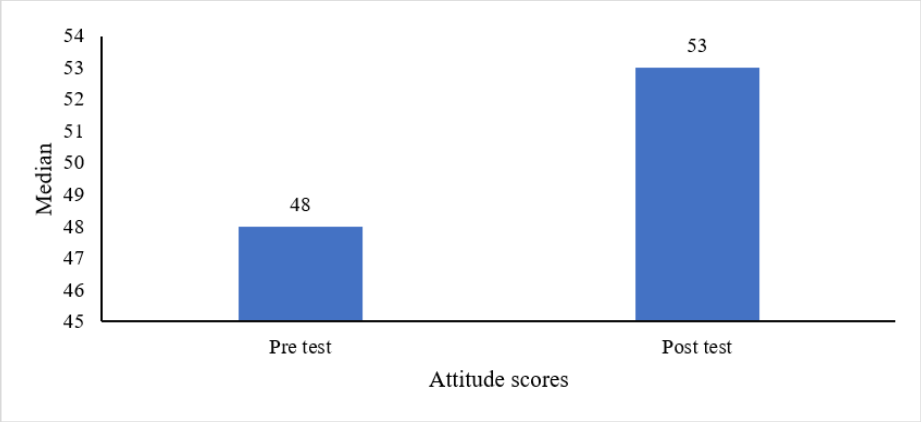

Figure 3: Pre- and Post-Intervention Attitude Scores Toward Pharmacist-Led Immunization Services Assessed Using Wilcoxon Signed-Rank Test.

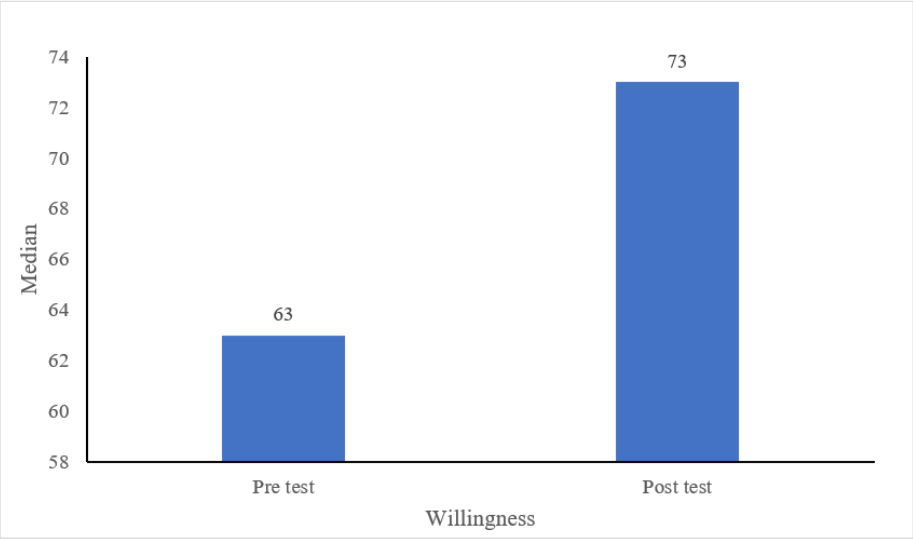

Figure 4: Comparison of Practice Readiness Scores Before and After Intervention Using Wilcoxon Signed-Rank Test.

CONCLUSION

Structured immunization training modules significantly enhance CP knowledge, positively influence attitudes, and translate willingness into clinical readiness. This study provides a comprehensive model for assessing and enhancing pharmacist competency, and Integrating community pharmacists as an accessible and scalable workforce into the national immunization strategy offers a promising and pragmatic approach to strengthening public health infrastructure and advancing vaccine coverage in India.

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ABBREVIATIONS

KAwP: Knowledge, Attitude, and Willingness to Practice; **CPs:** Community Pharmacists; **TTT:** Train-the-Trainer; **IPA:** Indian Pharmaceutical Association; **AEFI:** Adverse Events Following Immunization; **OSPE:** Objective Structured Practical Examination; **SPSS:** Statistical Package for the Social Sciences; **IQR:** Interquartile Range; **LMICs:** Low- and Middle-Income Countries; **APhA:** American Pharmacists Association; ***n*:** Number of Participants; ***p*:** Probability Value; **χ^2:** Chi-square Value.

CONFLICT OF INTEREST

The authors declare that there is no conflict of interest.

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