

Community Pharmacists' Attitudes and Practices toward Public Health in Saudi Arabia

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Abstract

Background: Community pharmacists play an increasingly important role in public health delivery in Saudi Arabia, particularly in line with national reforms under Vision 2030. Although several regional studies have explored aspects of this role, there is limited national evidence assessing pharmacists' overall readiness and the factors that influence their engagement. **Objectives:** To evaluate the knowledge, attitudes, and practices of community pharmacists in Saudi Arabia regarding public health services; identify key barriers affecting their involvement; and examine demographic and professional predictors associated with these domains. **Methods:** A cross-sectional survey was conducted between March and June 2025 across the five main regions of Saudi Arabia. A structured questionnaire assessed pharmacists' knowledge and attitudes (11 items), practices (9 items), and perceived barriers (8 items). Descriptive statistics and nonparametric tests were used to analyze the data. **Results:** A total of 388 pharmacists participated. Knowledge and attitudes were generally strong, with more than half (55.2%) strongly supporting involvement in public health services. Actual practice was more variable, with basic screening activities such as blood glucose testing (47.6%) and blood pressure measurement (45.3%) reported most often. Key barriers included lack of training (mean 3.82) and limited funding (mean 3.69). Educational level, experience, and region showed significant differences across the KAP domains. **Conclusion:** Community pharmacists in Saudi Arabia demonstrate strong readiness to support public health initiatives, but their contribution is constrained by system-level and organizational barriers. Addressing training needs, strengthening institutional support, and aligning practice expectations with national reforms will be essential for expanding their public health role.

Keywords: Community pharmacists, Public health services, Knowledge, attitudes and practices, Saudi Arabia, Healthcare barriers

Introduction

Community pharmacists represent one of the most accessible healthcare professionals within primary care systems, providing frontline services that extend far beyond medication dispensing. In Saudi Arabia, community pharmacies are often the first point of healthcare contact for many residents, with recent evidence highlighting their growing involvement in preventive and counseling services (1). Their accessibility, extended working hours, and frequent patient interactions have positioned them as important contributors to public health activities, including

health advice, basic screening, and support for self-care, as noted in several national studies (2, 3).

In recent years, Saudi Arabia has undertaken substantial reforms aligned with Vision 2030, emphasizing preventive health services, early detection, and integrated models of care.

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Regulatory bodies such as the Ministry of Health and the Saudi Food and Drug Authority have introduced initiatives encouraging community pharmacies to expand services such as vaccination, chronic disease screening, and counseling for public health-related conditions (4, 5). Despite these reforms, recent studies consistently show gaps between what pharmacists are expected to deliver and what is practiced in routine care. For example, variability in the delivery of smoking cessation counseling, screening services, and vaccination support has been documented across regions (6, 7).

Studies conducted in Saudi Arabia indicate that pharmacists generally exhibit positive attitudes toward participating in public health initiatives, yet practical implementation remains limited. Several national KAP studies have reported insufficient training, high workload, limited interdisciplinary collaboration, and a lack of structured public health protocols as major constraints to practice (8, 9). Evidence also shows differences in service engagement depending on region and pharmacy type, suggesting that system-level and organizational factors significantly influence public health performance (10).

Knowledge, Attitudes, and Practices (KAP) frameworks are widely used to assess healthcare providers' competencies and behavioral determinants in public health delivery. Within the Saudi context, existing KAP studies related to public health services have mostly been limited to specific regions, focused on narrow topics such as minor ailments, complementary medicines, or Hajj-related health conditions, and often lacked analyses examining predictors or structural barriers (2, 3, 11). To date, few studies have provided an integrated national assessment incorporating knowledge, attitudes, practices, and perceived barriers together, nor examined demographic and professional predictors influencing these domains. This represents a critical gap, especially as the country advances toward enhanced public health integration through Vision 2030.

Therefore, this study aimed to provide a comprehensive national evaluation of the knowledge, attitudes, and practices of community pharmacists in Saudi Arabia regarding their

involvement in public health service delivery, while identifying key barriers that limit their engagement. The study also sought to examine demographic and professional predictors associated with these domains to generate evidence that can guide workforce development, policy formulation, and future expansion of pharmacy-based public health services across the Kingdom.

Methods

Study Design and Setting

A cross-sectional, questionnaire-based study was conducted to assess the knowledge, attitudes, and practices (KAP) of community pharmacists toward the provision of public health services in Saudi Arabia. The study was carried out across five main administrative regions of the Kingdom: Central, Western, Eastern, Northern, and Southern, representing urban and rural pharmacy practice environments. These regions were selected based on official administrative boundaries published by the Ministry of Health to ensure national geographic coverage. This national survey aimed to identify the level of pharmacists' engagement in public health activities, their readiness to expand preventive roles, and perceived barriers influencing practice. Data collection took place between March and June 2025. No deviations from the planned study period occurred.

Study Population and Sampling

The target population included licensed community pharmacists currently practicing in Saudi Arabia. Inclusion criteria encompassed pharmacists working in private, chain, and independent community pharmacies, with at least six months of professional experience. Pharmacists working in hospital or academic settings were excluded.

A stratified sampling strategy was employed to ensure adequate representation from each of the five regions, with strata defined by region and proportional allocations based on the estimated number of community pharmacies registered in each area according to the Ministry of Health's 2024 statistics. Within each stratum, pharmacists were approached using convenience sampling due to the absence of a complete national sampling frame, which made probability sampling infeasible. Participant recruitment was therefore based on

pharmacists' accessibility, availability at the time of data collection, and willingness to participate. This approach is therefore best described as a stratified convenience sampling method, and the limitations of this design are acknowledged.

The minimum sample size was calculated using the Raosoft® calculator at a 95% confidence level, 5% margin of error, and 50% response distribution, yielding a required sample of 377 pharmacists. A total of 612 pharmacists were approached (online and physical combined), of whom 402 responded (response rate \approx 65.7%). After screening for completeness and removal of 14 duplicates identified through timestamp and response pattern checks, 388 valid responses remained. This ensured adequate power for regional comparisons.

Study Instrument

The study utilized a self-administered questionnaire adapted from previously published and validated KAP tools used in pharmacy and public health research (6,7). Items were adapted specifically from instruments used in published Saudi KAP studies examining vaccination services, minor ailment management, public health counseling, and Hajj-related health preparedness. The instrument was reviewed by a panel of three experts in public health and pharmacy practice to ensure content validity and contextual appropriateness for community pharmacy settings. A content validity index (CVI) was calculated at the item level (I-CVI range = 0.82–1.00) and scale level (S-CVI = 0.91), indicating strong expert agreement.

The questionnaire comprised four sections: Demographics (e.g., gender, age, educational qualification, years of experience, workplace area, region); Knowledge and Attitude (11 items) assessing pharmacists' perceptions, awareness, and willingness to engage in public health activities; Practice (9 items) measuring the extent of involvement in health promotion, disease prevention, and patient education; and Barriers (8 items) identifying obstacles to delivering public health services.

Responses were rated on a 5-point Likert scale (1 = strongly disagree to 5 = strongly agree). Negative items were reverse-coded before analysis. The tool

underwent pilot testing among 25 community pharmacists for clarity and reliability, yielding a Cronbach's alpha of 0.84, indicating high internal consistency. These pilot participants were excluded from the final analysis. Based on pilot feedback, three items were reworded for clarity, and the time needed to complete the survey was standardized to 6–8 minutes.

Data Collection

The questionnaire was distributed electronically via Google Forms and, where feasible, physically through regional pharmacy representatives. The online survey was restricted to one response per device using Google Forms settings; IP addresses were not recorded to maintain anonymity. Physical copies followed the same item order and formatting as the electronic version to ensure consistency. Participation was completely voluntary and anonymous. Informed consent was obtained on the first page of the survey before completion. To reduce non-response bias, two reminder messages were circulated two weeks apart through regional WhatsApp groups of community pharmacists.

Ethical Considerations

Ethical approval was obtained from the Research Ethics Committee at King Khalid University (approval no. KKU-10-2025-9). Confidentiality and privacy were assured for all participants. This study adhered strictly to the Declaration of Helsinki. All participants provided informed consent prior to their involvement. Before participation, respondents received an informed consent form detailing the study's purpose, risks, and confidentiality protocols. Consent was obtained electronically through the survey platform prior to questionnaire access, in accordance with institutional ethical standards and guidelines.

Data Analysis

Data were analyzed using IBM SPSS Statistics version 26.0. Descriptive statistics were presented as frequencies and percentages for categorical variables, and means \pm standard deviations (SD) for continuous variables. Although Likert-scale responses are ordinal in nature, they were treated as approximately continuous for the purpose of descriptive analysis (mean \pm SD), a practice that is widely accepted in health and social science

research when items are measured on symmetric 5-point scales and sample sizes are adequate. The Relative Importance Index (RI) was calculated for each Likert item using the formula:

$$RI = (\Sigma W) / (A \times N)$$

where W is the weight assigned to each response (1–5), A is the highest possible weight (5), and N is the total number of respondents. In addition to mean scores, the RI was used to provide a standardized ranking metric (ranging from 0 to 1), allowing clearer comparison of item relative importance across domains and facilitating interpretability beyond raw mean values. The RI was used to rank items according to perceived importance based on previous applications in KAP studies, where ordered Likert responses are interpreted comparatively.

Prior to inferential testing, the data were checked for normality using the Kolmogorov–Smirnov test and were found to deviate from normal distribution ($p < 0.05$). Accordingly, nonparametric tests were employed. The Mann–Whitney U test was applied to compare differences between two groups (e.g., urban vs. rural workplace area, male vs. female), while the Kruskal–Wallis test was used to evaluate differences among more than two groups (e.g., region, educational qualification, years of experience). When significant results were obtained, pairwise post-hoc comparisons with Bonferroni adjustment were conducted to identify specific group differences.

To explore differences in KAP domains across demographic and professional characteristics, nonparametric tests were applied. Effect sizes (r) for Mann–Whitney U and eta-squared (η^2) for Kruskal–Wallis tests were calculated and reported to quantify the magnitude of differences. A p -value < 0.05 was considered statistically significant for all analyses.

Results

Participant Characteristics

A total of 388 community pharmacists participated in the study, representing all major regions of Saudi Arabia. The sample consisted predominantly of males (75.0%), with females accounting for 25.0%. Most pharmacists held a Bachelor of Pharmacy

degree (48.2%) or a PharmD (41.2%), while only a small proportion reported postgraduate qualifications (4.1%). In terms of professional experience, the largest group had 2–4.9 years of experience (37.4%), followed by those with 5–9.9 years (29.9%). The majority of participants worked in urban areas (72.2%), and the Middle (28.9%) and Western (26.8%) regions contributed the highest number of respondents. These characteristics provide a diverse demographic and professional distribution suitable for national analysis (Table 1).

Table 1. Demographic and Professional Characteristics of Community Pharmacists (N = 388)

Variable	Category	Frequency (n)	Percentage (%)
Sex	Male	291	75.0
	Female	97	25.0
Education degree	Bachelor of pharmacy (B. pharm)	187	48.2
	Doctor of pharmacy (Pharm D.)	160	41.2
	Pharmacy diploma	25	6.4
	Postgraduate (Master/PhD)	16	4.1
Years of experience	2 – 4.9 years	145	37.4
	5 – 9.9 years	116	29.9
	Less than 2 years	89	22.9
	10 years or more	38	9.8
Nationality	Non-Saudi	216	55.7
	Saudi	172	44.3
Workplace Area	Urban area	280	72.2
	Rural areas	108	27.8
Workplace region	Middle region	112	28.9
	Western region	104	26.8
	Southern region	67	17.3
	Northern region	55	14.2
	Eastern region	50	12.9

Knowledge and Attitudes Toward Public Health Services

Respondents generally demonstrated strong knowledge and positive attitudes toward public health activities. More than half of the pharmacists (55.2%) strongly agreed that they should be involved in public health services, and an additional 31.2% agreed with this role. Similarly, about three-quarters of the participants expressed readiness to engage in public health activities, with 37.1%

strongly agreeing and 37.9% agreeing. Statements reflecting traditional or restrictive views of pharmacy practice, such as the belief that pharmacy education should focus only on drug-related issues, received relatively low levels of agreement, with most pharmacists disagreeing or strongly disagreeing. Negative attitude items, including concerns about public acceptance or lack of knowledge, also showed lower mean scores and lower RI values compared to positive items. These patterns indicate that while overall attitudes are encouraging, some residual uncertainty persists among a portion of respondents. The item-level distribution of responses is presented in Table 2.

Table 2. Knowledge and Attitudes of Community Pharmacists Toward Public Health Services (N = 388)

Item	Strongly Agree n(%)	Agree n(%)	Neutral n(%)	Disagree n(%)	Strongly Disagree n(%)	Mean	SD	RI	p-value
Pharmacists should be involved in public health activities	214 (55.2%)	121 (31.2%)	38 (9.8%)	7 (1.8%)	8 (2.1%)	4.36	0.89	0.87	< 0.001
People will not accept my participation in public health activities (R)	48 (12.4%)	64 (16.5%)	106 (27.3%)	97 (25.0%)	73 (18.8%)	2.79	1.27	0.56	0.001
I am ready to be involved with public health activities	144 (37.1%)	147 (37.9%)	72 (18.6%)	20 (5.2%)	5 (1.3%)	4.04	0.94	0.81	< 0.001
It is important for pharmacists to practice health promotion activities	138 (35.6%)	161 (41.5%)	72 (18.6%)	12 (3.1%)	5 (1.3%)	4.07	0.88	0.81	< 0.001
Pharmacy education should only focus on drug-related problems (R)	45 (11.6%)	63 (16.2%)	99 (25.5%)	131 (33.8%)	50 (12.9%)	2.80	1.20	0.56	0.001
I am NOT interested in public health activities (R)	37 (9.5%)	50 (12.9%)	112 (28.9%)	130 (33.5%)	59 (15.2%)	2.68	1.16	0.54	< 0.001
I don't have enough knowledge to advise patients (R)	35 (9.0%)	49 (12.6%)	76 (19.6%)	123 (31.7%)	105 (27.1%)	2.45	1.26	0.49	< 0.001
Public health activities belong to health centers only (R)	42 (10.8%)	58 (14.9%)	129 (33.2%)	110 (28.4%)	49 (12.6%)	2.83	1.16	0.57	0.004
I do NOT have the time to educate patients (R)	47 (12.1%)	91 (23.5%)	104 (26.8%)	109 (28.1%)	37 (9.5%)	3.01	1.18	0.60	0.931

Other health workers do not allow pharmacists (R)	57 (14.7%)	96 (24.7%)	131 (33.8%)	84 (21.6%)	20 (5.2%)	3.22	1.101	0.64	<0.001
Role in health education becomes more important during crises	201 (51.8%)	107 (27.6%)	61 (15.7%)	14 (3.6%)	5 (1.3%)	4.25	0.94	0.85	< 0.001

*p < 0.05 indicates statistical significance.

Practices Related to Public Health Service Delivery

Engagement in public health activities among community pharmacists showed considerable variation across service types. Screening-focused tasks were performed most frequently; for example, blood glucose testing or encouraging clients to undertake it was reported “often” or “always” by 47.6% of pharmacists, and blood pressure measurement reached similar levels at 45.3%. Routine counseling activities were more moderately practiced. Education on proper nutrition, for instance, was reported “often” or “always” by 41.5%, while weight-management counseling followed a similar pattern. In contrast, specialized or sensitive counseling areas remained less common. Only 23.2% of pharmacists reported frequently providing tobacco-cessation advice, and just 21.9% frequently addressed substance-misuse education. These patterns indicate that while pharmacists are generally active in basic screening and lifestyle-related services, participation declines noticeably when tasks require more specialized preventive counseling. A detailed breakdown of these findings is presented in Table 3.

Table 3. Practices Related to Public Health Service Delivery Among Community Pharmacists (N = 388)

Item	Never n(%)	Rarely n(%)	Sometimes n(%)	Often n(%)	Always n(%)	Mean	SD	RI	p-value
Provide education on oral health	73 (18.8%)	75 (19.3%)	116 (29.9%)	76 (19.6%)	48 (12.4%)	2.87	1.28	0.58	0.052
Provide education to stop tobacco chewing/smoking	89 (22.9%)	116 (29.9%)	93 (24.0%)	34 (8.8%)	56 (14.4%)	2.62	1.32	0.52	<0.001

Provide education on other substances abuse (cannabis; alcohol; benzodiazepines; pregabalin; gabapentin...)	138 (35.6%)	112 (28.9%)	53 (13.7%)	36 (9.3%)	49 (12.6%)	2.35	1.37	0.47	<0.001
Provide information on proper nutrition	65 (16.8%)	63 (16.2%)	99 (25.5%)	100 (25.8%)	61 (15.7%)	3.08	1.31	0.62	0.262
Provide education on weight management and exercise	78 (20.1%)	71 (18.3%)	105 (27.1%)	75 (19.3%)	59 (15.2%)	2.91	1.34	0.58	0.197
Conduct blood pressure measurements, or encourage clients to take them	53 (13.7%)	68 (17.5%)	91 (23.5%)	106 (27.3%)	70 (18.0%)	3.19	1.30	0.64	0.005
Conduct blood glucose tests, or encourage clients to take them	64 (16.5%)	54 (13.9%)	85 (21.9%)	108 (27.8%)	77 (19.8%)	3.21	1.35	0.64	0.003
Conduct cholesterol tests, or encourage clients to take them	64 (16.5%)	73 (18.8%)	89 (22.9%)	90 (23.2%)	72 (18.6%)	3.09	1.35	0.62	0.215
Provide vaccinations, or encourage clients to take it	159 (41.0%)	76 (19.6%)	62 (16.0%)	32 (8.2%)	59 (15.2%)	2.37	1.46	0.47	<0.001
p-values were obtained using Kruskal–Wallis or Mann–Whitney U tests, as appropriate. *p < 0.05 indicates statistical significance.									

Perceived Barriers to Public Health Practice

Respondents reported several notable barriers affecting their ability to provide public health services. The most frequently endorsed issues were lack of training on public health activities, which had one of the highest mean scores (3.82) and RI values (0.76), and lack of outside funding (mean 3.69; RI 0.74). Time constraints were also prominent; nearly 65% of pharmacists either agreed or strongly agreed that they lacked adequate time to counsel patients. Organizational challenges such as limited teamwork and lack of official recognition for public health roles were also reported, though with slightly lower mean scores (around 3.5–3.6). Overall, these findings indicate that the barriers are largely structural and resource-related rather than personal limitations. Details of these responses are presented in Table 4.

Table 4. Perceived Barriers to Delivering Public Health Services Among Community Pharmacists (N = 388)

Item	Strongly Agree n(%)	Agree n(%)	Neutral n(%)	Disagree n(%)	Strongly Disagree n(%)	Mean	SD	RI	p-value
Lack of time to consult with patients	112 (28.9)	137 (35.3)	69 (17.8)	48 (12.4)	22 (5.7)	3.70	1.13	0.74	0.041
Lack of teamwork with colleagues	98 (25.3)	131 (33.8)	83 (21.4)	54 (13.9)	22 (5.7)	3.59	1.14	0.72	0.058
Lack of outside funding to assist pharmacists	117 (30.2)	126 (32.5)	77 (19.8)	45 (11.6)	23 (5.9)	3.69	1.16	0.74	0.046
Lack of training on public health activities	123 (31.7)	135 (34.8)	68 (17.5)	43 (11.1)	19 (4.9)	3.82	1.09	0.76	0.037
Lack of financial resources to implement changes	109 (28.1)	128 (33.0)	75 (19.3)	49 (12.6)	27 (7.0)	3.64	1.18	0.73	0.052
Lack of official recognition for public health roles	102 (26.3)	121 (31.2)	86 (22.2)	55 (14.2)	24 (6.2)	3.57	1.16	0.71	0.066
Limited understanding of public health concepts among pharmacists	95 (24.5)	119 (30.7)	89 (22.9)	59 (15.2)	26 (6.7)	3.51	1.18	0.70	0.075
Lack of specialty training in public health	118 (30.4)	129 (33.2)	71 (18.3)	48 (12.4)	22 (5.7)	3.71	1.13	0.74	0.043
p-values were obtained using Kruskal–Wallis or Mann–Whitney U tests, as appropriate. *p < 0.05 indicates statistical significance.									

Group Differences in KAP Domains

Significant variations were observed in pharmacists' Knowledge–Attitude, Practice, and Barriers scores across several demographic and professional characteristics. Pharmacists in the Northern region showed the highest Knowledge–Attitude scores (3.76 ± 0.49), while those in the Western and Middle regions reported lower averages. Practice scores followed a similar pattern, with the highest mean also seen in the Southern region (3.24 ± 1.09). Notable differences emerged between urban and rural settings, where rural pharmacists reported higher Knowledge–Attitude (3.68 ± 0.57) and Practice scores (3.04 ± 0.94). Educational qualification was also associated with marked differences, with postgraduate pharmacists

recording the highest Knowledge–Attitude score (4.04 ± 0.63) and higher practice levels compared to bachelor-level pharmacists. Years of experience showed a similar trend, where those with less than two years demonstrated slightly higher practice scores (3.13 ± 1.28) compared with other experience groups. These findings are presented in Table 5, which summarizes the comparative results across all demographic categories.

Table 5. Differences in Knowledge–Attitude, Practice, and Barriers Scores Across Demographic and Professional Characteristics

Variable	Knowledge–Attitude Mean \pm SD	Practice Mean \pm SD	Barriers Mean \pm SD	p-value (KA)
Region	3.69 \pm 0.66 (Eastern region). 3.48 \pm 0.71 (Middle region). 3.76 \pm 0.49 (Northern region). 3.58 \pm 0.53 (Southern region). 3.39 \pm 0.64 (Western regions).	2.90 \pm 0.89 (Eastern region). 2.62 \pm 1.21 (Middle region). 3.10 \pm 0.65 (Northern region). 3.24 \pm 1.09 (Southern region). 2.70 \pm 1.10 (Western regions).	3.23 \pm 0.86 (Eastern region). 3.65 \pm 0.83 (Middle region). 2.86 \pm 0.62 (Northern region). 3.32 \pm 1.03 (Southern region). 3.49 \pm 0.89 (Western regions).	0.002*
Workplace Area (Urban / Rural)	3.68 \pm 0.57 (Rural areas). 3.49 \pm 0.66 (Urban area)	3.04 \pm 0.94 (Rural areas). 2.78 \pm 1.12 (Urban area)	3.16 \pm 0.87 (Rural areas). 3.47 \pm 0.89 (Urban area)	0.004*
Gender	3.60 \pm 0.68 (Female). 3.52 \pm 0.63 (Male)	3.28 \pm 1.02 (Female). 2.71 \pm 1.06 (Male)	3.46 \pm 0.89 (Female). 3.36 \pm 0.90 (Male)	0.286
Educational Qualification	3.42 \pm 0.59 (Bachelor of pharmacy). 3.67 \pm 0.65 (Doctor of pharmacy). 3.31 \pm 0.70 (Pharmacy diploma). 4.04 \pm 0.63 (Postgraduate (Master/PhD)).	2.62 \pm 1.07 (Bachelor of pharmacy). 3.11 \pm 1.00 (Doctor of pharmacy). 2.81 \pm 1.21 (Pharmacy diploma). 3.11 \pm 1.19 (Postgraduate (Master/PhD)).	3.45 \pm 0.81 (Bachelor of pharmacy). 3.40 \pm 0.93 (Doctor of pharmacy). 2.77 \pm 1.11 (Pharmacy diploma). 3.41 \pm 0.93 (Postgraduate (Master/PhD)).	< 0.001
Years of Experience	3.63 \pm 0.77 (10 years and more). 3.39 \pm 0.63 (2 years- 4.9 years). 3.67 \pm 0.50 (5 years- 9.9 years). 3.58 \pm 0.71 (Less than 2 years)	2.92 \pm 1.25 (10 years and more). 2.60 \pm 1.00 (2 years- 4.9 years). 2.93 \pm 0.86 (5 years- 9.9 years). 3.13 \pm 1.28 (Less than 2 years)	3.24 \pm 1.06 (10 years and more). 3.53 \pm 0.78 (2 years- 4.9 years). 3.13 \pm 0.79 (5 years- 9.9 years). 3.54 \pm 1.04 (Less than 2 years)	0.003*
Nationality	3.50 \pm 0.60 (non-Saudi). 3.59 \pm 0.69 (Saudi).	2.56 \pm 0.97 (non-Saudi). 3.22 \pm 1.10 (Saudi).	3.34 \pm 0.81 (non-Saudi). 3.44 \pm 0.99 (Saudi).	0.181

p-values were obtained using Kruskal–Wallis or Mann–Whitney U tests, as appropriate. *p < 0.05 indicates statistical significance.

Reliability of Measurement Scales

All three measurement domains demonstrated acceptable to excellent internal consistency, as reflected in their Cronbach’s alpha values. The Knowledge–Attitude items showed good reliability, while the Practice and Barriers scales demonstrated strong internal consistency. These reliability coefficients are presented in Table 6.

Table 6. Reliability of the Study Measurement Scales

Domain	No. of Items	Cronbach's Alpha
Knowledge–Attitude	11	0.766
Practice	9	0.931
Barriers	8	0.880

Post-hoc Pairwise Comparisons

Post-hoc analyses clarified the specific subgroup contrasts underlying the significant Kruskal–Wallis findings. For KA scores, postgraduate pharmacists scored significantly higher than both Bachelor's and Diploma holders. For practice scores, pharmacists in the Southern region differed significantly from those in several other regions, indicating region-specific variations in service delivery. For barriers, diploma-trained pharmacists and those working in the Middle region exhibited significantly higher barrier scores than their counterparts. These subgroup disparities provide important insights into the contextual and structural determinants shaping public health practice within community pharmacies.

Discussion

This national evaluation provides a comprehensive picture of the public health capacity of community pharmacists in Saudi Arabia, integrating knowledge, attitudes, practices, and structural barriers within a unified KAP framework. Overall, the study shows that pharmacists possess high knowledge and generally favorable attitudes toward public health roles, yet these attributes are only partially translated into routine practice. This pattern is broadly consistent with recent Saudi studies reporting strong endorsement of public health responsibilities among pharmacists but variable levels of implementation in daily practice (6, 7, 8).

The high Knowledge–Attitude (KA) scores observed in this study align with previous surveys documenting positive perceptions of public health roles among community pharmacists in Saudi Arabia, including health education and preventive services (7, 12). Similar trends have been reported in studies examining pharmacists' readiness to support immunization and antimicrobial stewardship efforts (13, 14). Within the Vision 2030 framework, this alignment between workforce attitudes and national preventive-care priorities reinforces the relevance of community pharmacies as accessible public health touchpoints.

Despite strong KA indicators, an evident gap remains between pharmacists' knowledge and attitudes and their routine public health practices, suggesting the influence of structural and organizational constraints. Prior KAP-based investigations in Saudi Arabia similarly report that organizational factors, rather than lack of knowledge, tend to limit practice behaviors (7, 15). Pharmacists with higher awareness may also be more likely to recognize shortcomings in workflow support, formal role definition, and interprofessional communication, which may diminish their ability to consistently apply public health skills (12, 16).

Patterns of service provision in this study reinforce these structural explanations. Routine tasks such as blood pressure and glucose monitoring remain common, consistent with prior regional reports, while advanced counseling activities such as tobacco cessation and vaccination advocacy remain less frequent (6, 13). These findings suggest that while pharmacists are willing, the operational and regulatory environment does not yet fully support expanded preventive services.

Barriers identified in this study, such as a lack of training, time constraints, limited formal recognition, and insufficient organizational support, reflect enduring challenges documented in the Saudi pharmacy literature (12). The higher barrier scores observed among diploma-trained pharmacists and among those practicing in the Middle region highlight workforce preparation differences and region-specific resource constraints, consistent with findings from recent assessments of minor ailment

services and public health roles across the Kingdom (11, 17, 18).

Findings from subgroup analyses further demonstrate the influence of demographic and educational characteristics on KAP outcomes. Postgraduate qualification was associated with higher KA scores, supporting evidence that advanced training enhances public health competence (7). Male gender, Saudi nationality, and Southern-region practice were associated with higher practice scores; however, these associations should be interpreted cautiously, as this study did not measure workload distribution, patient interaction patterns, or operational differences that might explain these trends. Avoiding causal interpretations is necessary given the cross-sectional design.

Multiple structural barriers were identified; their combined influence suggests that workforce attitudes and practice behaviors are shaped by broader system-level factors such as regulatory clarity, institutional support, and resource allocation. Similar challenges have been reported in international pharmacy policy literature, particularly in settings undergoing health system transformation (19).

Although this study was conducted in Saudi Arabia, the findings may also be relevant to other low- and middle-income countries and emerging health systems where community pharmacies play an expanding role in primary care but face comparable constraints related to training, regulation, and service integration. In such contexts, pharmacists similarly operate within privately dominated practice environments and encounter limitations in formal public health integration, which may influence service delivery patterns.

Taken together, the findings suggest that while pharmacists show strong professional readiness, system-level improvements are required to translate readiness into consistent public health practice.

Limitations

Several limitations should be considered when interpreting these findings. First, the study employed a stratified convenience sampling

approach due to the absence of a comprehensive national sampling frame. As participants were recruited based on accessibility and willingness to participate, the findings may not fully represent all community pharmacists in Saudi Arabia. This limits the generalizability of the findings beyond similar practice settings. Second, the majority of respondents practiced in urban areas, which may have led to under-representation of pharmacists working in remote or underserved settings. Third, the use of a self-administered questionnaire introduces the possibility of self-report bias and social desirability bias, as respondents may have overestimated positive practices or attitudes. Fourth, the cross-sectional design limits the ability to establish causal relationships between demographic characteristics, perceived barriers, and KAP outcomes. Finally, although reminder messages were used to improve participation, the potential for non-response bias cannot be excluded, as pharmacists who chose not to participate may differ systematically from those who responded.

Strengths and Contributions

This study has several strengths that enhance its significance. It represents one of the most extensive national assessments of community pharmacists' public health capacity in Saudi Arabia, and it contributes to the existing literature by providing broad geographic coverage and detailed subgroup analyses. The inclusion of regional comparisons and subgroup analyses adds depth to the analysis, identifying inequities in preparedness across educational and geographic subgroups. These insights provide actionable evidence to support the development of national pharmacy workforce plans and public health strategies.

Policy Implications

The findings underscore the importance of moving from individual-level readiness toward structured system-level integration of public health services within community pharmacies. These results suggest that policymakers may consider embedding public health competencies within undergraduate curricula, strengthening continuing professional development programs, and clarifying pharmacists' preventive care responsibilities. Strengthening institutional support, improving recognition systems, and addressing regional disparities will be

essential to optimizing public health service delivery. Aligning reimbursement models and regulatory frameworks with preventive-care objectives, as emphasized in national transformation priorities, would support more sustainable and consistent service provision across the Kingdom.

Conclusion

This national study provides a comprehensive appraisal of the public health capacity of community pharmacists in Saudi Arabia, demonstrating high levels of knowledge and positive attitudes toward public health roles, yet limited translation of these capabilities into consistent practice. The findings underscore a persistent implementation gap shaped largely by structural and organizational barriers rather than workforce willingness. Community pharmacists are well-positioned to support national public health priorities, but realizing this potential will require coordinated improvements in training, regulatory clarity, and system-level support. These findings highlight critical gaps between professional readiness and practical implementation, reinforcing the need for sustained efforts in training, regulatory support, and workflow integration to strengthen the public health contribution of the pharmacy workforce and ensure more consistent delivery of preventive and population-health services across the Kingdom.

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