



## Knowledge, Attitude and Practices of Pharmacists towards the Use and Integration of E-Prescription Systems in Pakistan

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### ARTICLE INFO

#### Article History:

Received:	June	05, 2025
Revised:	July	10, 2025
Accepted:	July	16, 2025
Available Online:	July	19, 2025

#### Keywords:

e-prescription, pharmacists, digital health, IT infrastructure electronic health record

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### ABSTRACT

**Background:** E-prescription system is a step towards digitalization of health system. Since pharmacists play central role in management of medication system, they can play a vital role in implementation of the system.

**Objective:** The objective of this study is to assess the knowledge, attitude and practices (KAP) of pharmacists towards the use & integration of e-prescription systems in Pakistan & to identify barriers to adoption of e-prescription system and strategies to remove these barriers.

**Methodology:** The descriptive & cross-sectional study design was conducted among 426 pharmacists who are practicing in different health care setups & belong to different province of Pakistan. Data was collected through a structured questionnaire. Descriptive statistics, Spearman correlation & Kruskal-Wallis test was performed and data was analyzed using SPSS version 20.

**Results:** Out of 426 pharmacists, 279 (65.5%) were females, majority (268, 62.9%) were in the age group of 18-30 years. Majority of the pharmacists are at early level of their career with 1-5 years of experience (274, 64.3%). The mean scores for knowledge, attitude and practice were 4.4, 4 & 2.6. The results shows good knowledge level, positive attitude and poor practice levels of pharmacists across different provinces. Province & number of years of experience were significantly associated with practice levels whereas age & type of practice setting were significantly associated with both knowledge and practice levels. Weak significant & moderate significant correlation were found between knowledge-attitude ( $r=0.124$ ) and knowledge-practice ( $r=0.318$ ). Barriers to adopt e-prescription were also identified and strategies to overcome these barriers in implementation of e-prescription were also addressed.

**Conclusion:** The findings shows that there is poor practice levels of pharmacists towards e-prescription use, although they show willingness towards its use (positive attitude) and have good knowledge level. Improvement of infrastructure, training workshops & policy development are needed to bridge this gap.

## **Introduction**

E-prescriptions are defined as direct transmission of e-prescriptions electronically from physician to pharmacist (Almaghaslah et al., 2022; Mohamed Saad, 2016). In digital health, e-prescription systems is considered as one of the key component. It is helpful in ensuring patient safety and in enhancing quality of services (Smith, 2006). E-prescription is a digital tool to transfer the information on prescription with all the stakeholders involved including patients, pharmacists, physicians and insurance companies. Many European countries have been using this system for a decade now. It is part of their national strategy for e-health. Some of the European countries includes UK, Denmark, Sweden and Spain. North American countries includes Australia, Japan, USA and Canada.

In Canada, Prescribe IT government based system is used. It works by exchanging the prescription information between two parties; prescriber and pharmacists using secured pathway. USA uses Surescripts as an e-prescription tool. It is an advanced system which not only includes exchanging information between stakeholders but also includes other relevant information like medication history and information from insurance companies. Prescription exchange services (PES) is used in Australia. The two types of PES used in Australia are MediSecure and electronic medical prescription (eRx) Script Exchange.

UK uses NHS spine system as electronic prescription service. It helps in exchanging information between organizations. It is well secure and encrypted system for patient data security & helps in clinical decision support system (Ford et al., 2021). In Spain, e-prescription system is attached to electronic health record of patient to identify drug-drug interactions and allergies. Japan still uses paper system but they proposed new system in which patient have a choice between paper and e-prescription. In Sweden, smart cards were introduced in 1980's which contains past medication history as well and patient can access it through any physician office. Sweden and Denmark both are considered as leader in using digitalization in prescriptions. They use Electronic Data Interchange for Administration Commerce and Transport (EDIFACT) message format. Smart card is now replace by repository of e-prescription in Sweden (Aldughayfiq & Sampalli, 2021).

In Pakistan, e-prescription system is not developed and it is in early stages. Although ministry of National Health Services, Regulations, and Coordination has introduced e-health strategy, the system is yet not fully implemented (Majeed, n.d.)

Pharmacists can play an essential role in e-prescription by reducing medication errors, mainly due to its legibility. In a study conducted by Abramson et al, the prescription errors due to illegibility are very high and study emphasizes on development of e-prescription system to minimize such errors. (Lanham et al., 2016) In an e-prescription order, pharmacist has provided with the patient history which helps in understanding patient diagnosis, reduces confusion and improve workflow. (Warholak et al., 2014)

The challenges faced in Pakistan to adopt e-prescription includes poor network especially in rural areas, high cost, poor IT infrastructure and connectivity issues. Poor digital literacy is another challenge (Faryad et al., 2025). Since Pakistan is a developing country, there are concerns related to data security because of non-comprehensive data regulations related to data protection. Maintenance of IT system also requires continuous expense which might be an issue for some healthcare organizations who are deficient in resources. Resistance to change is also one of the contributing factors.

The adoption of e-prescription system not only helps in integrating patient data but it also helps in exchange of information between various stakeholders (Lestari et al., 2024). If adopted properly, it can help to secure patient data, medication optimization and minimize prescription errors. It can help in identifying patient's past medical/medication history and allergies, hence allowing the physicians to make clinical decisions considering all these factors. This study will help in identifying the existing barriers in implementation of e-prescription system in Pakistan and it will contribute in bridging the gap.

The objectives of current study is to assess the level of knowledge, current practices and attitude of pharmacists towards use of e-prescription system and integrating it with electronic health record (HER) of patient. It also identifies association between demographic features of pharmacists with their knowledge, attitude & current practices for digitalization of prescriptions.

## **Methodology**

A cross-sectional descriptive study design was conducted in the months of April & May, 2025 to evaluate the knowledge, attitudes and practices (KAP) of diversified groups of working pharmacists towards the use & integration of e-prescription systems in Pakistan. Both male & female pharmacists having different levels of working experience in terms of number of years and organization setup were eligible to participate. The recruitment of participants were performed via professional groups of pharmacists on Whatsapp and social media using personal and professional networks.

The sample size was calculated with Raosoft calculator at confidence interval of 95%. The total number of sample size should be not less than 384 as per the calculator however, additional sample size was included leading to total sample size to 426. The target population was working pharmacists and pharmacy students who have exposure to the working environment. The pharmacists belong to different provinces of Pakistan. They are selected on the basis of non-probability convenience sampling.

The questionnaire consists of demographics, knowledge (n=5), attitude (n=5) & practice (n=6) questions. Face validity of questionnaire was performed by experts in the field of Pharmacy practice. Cronbach's alpha was used to test the internal consistency of instrument. The attitude scale has excellent reliability and strong internal consistency with  $\alpha = 0.889$ . Practice scale reliability was found to be moderate with  $\alpha = 0.738$  after revising the scale from 6 items to 5 items (question 6 was removed). For knowledge scale,  $\alpha = 0.415$  after revising the scale items from 5 items to 3 items (question 1 and 2 was removed). This suggests items in knowledge scale shows poor reliability (acceptable is 0.5).

Demographic characteristics are analyzed using descriptive statistics. To check the response distribution, Kolmogorov Smirnov test was performed. Kruskal-Wallis test with  $p < 0.05$  was used to analyze the association among study variables. Association between KAP levels were evaluated by Spearman's rank order correlation ( $p < 0.01$ ). All tests were performed and analyzed using SPSS v.20.

## **Results**

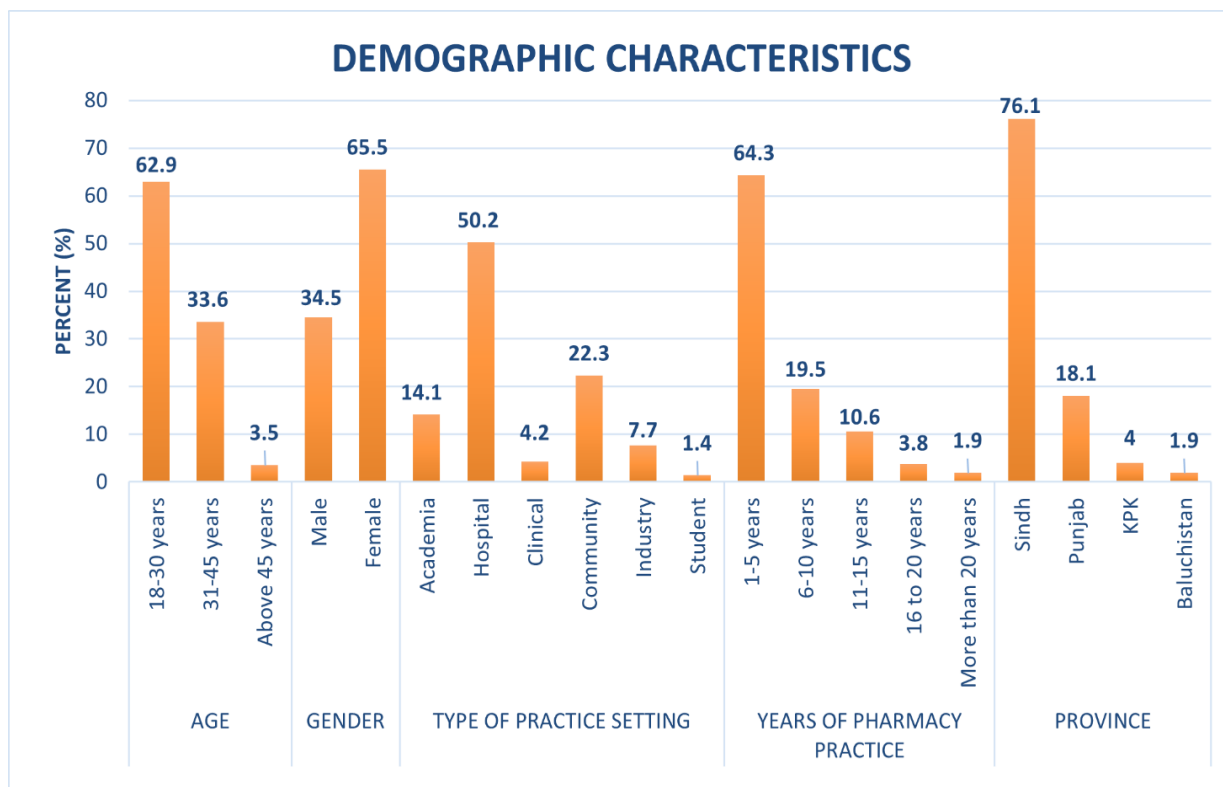
### **Demographic characteristics**

The demographic characteristics are summarized in Table 1. Out of 426 pharmacists participated in the study, 268 (62.9%) were between 18-30 years, followed by 143 (33.6%) who were aged between 31-45 years and rest of 15 (3.5%) were aged above 45 years. With regards to gender

characteristics, female respondents were 65.5% compared to male participants (34.5%). In terms of type of practice setting, majority of the pharmacists were from hospital setup (50.2%), followed by those pharmacists working in community setup (22.3%), academia (14.1%) industrial pharmacists (7.7%), clinical pharmacists (4.2%) and students who have completed internship in any setup (1.4%). With respect to experience, 64.3% pharmacists have 1-5 years of experience, 19.5% have 6-20 years, 10.6 % have 11-15 years, 3.8 % have 16-20 years and 1.9% have more than 20 years of experience. Most of the pharmacists belong to Sindh province (76.1%), followed by Punjab (18.1%), KPK (4%) and Baluchistan (1.9%). Figure 1 presents the visual summary of participant's demographics in chart form.

**Table 1: Demographics characteristics of participant pharmacists (N= 426)**

DEMOGRAPHICS	FEATURES	FREQUENCY	PERCENT (%)
<b>AGE</b>	18-30 years	268	62.9
	31-45 years	143	33.6
	Above 45 years	15	3.5
<b>GENDER</b>	Male	147	34.5
	Female	279	65.5
<b>TYPE OF PRACTICE SETTING</b>	Academia	60	14.1
	Hospital	214	50.2
	Clinical	18	4.2
	Community	95	22.3
	Industry	33	7.7
	Student	6	1.4
<b>YEARS OF PHARMACY PRACTICE</b>	1-5 years	274	64.3
	6-10 years	83	19.5
	11-15 years	45	10.6
	16 to 20 years	16	3.8
	More than 20 years	8	1.9
<b>PROVINCE</b>	Sindh	324	76.1
	Punjab	77	18.1
	KPK	17	4
	Baluchistan	8	1.9



**Figure 1: Demographics**

**Assessment of knowledge level**

Table 2 describes the assessment of knowledge of pharmacists related to use & integration of e-prescription. The responses were either Yes/No/Not sure & True/False/Not sure. It was evaluated by scoring 1 to Yes/True responses, 0.5 to not sure responses and 0 to No/False responses. Majority of pharmacists (93.2%) have knowledge about e-prescription, its uses (89%) and benefits (87.8%), however, lacking was observed regarding its implementation policies as 42.7% pharmacists are not sure about legal recognition of e-prescription in Pakistan.

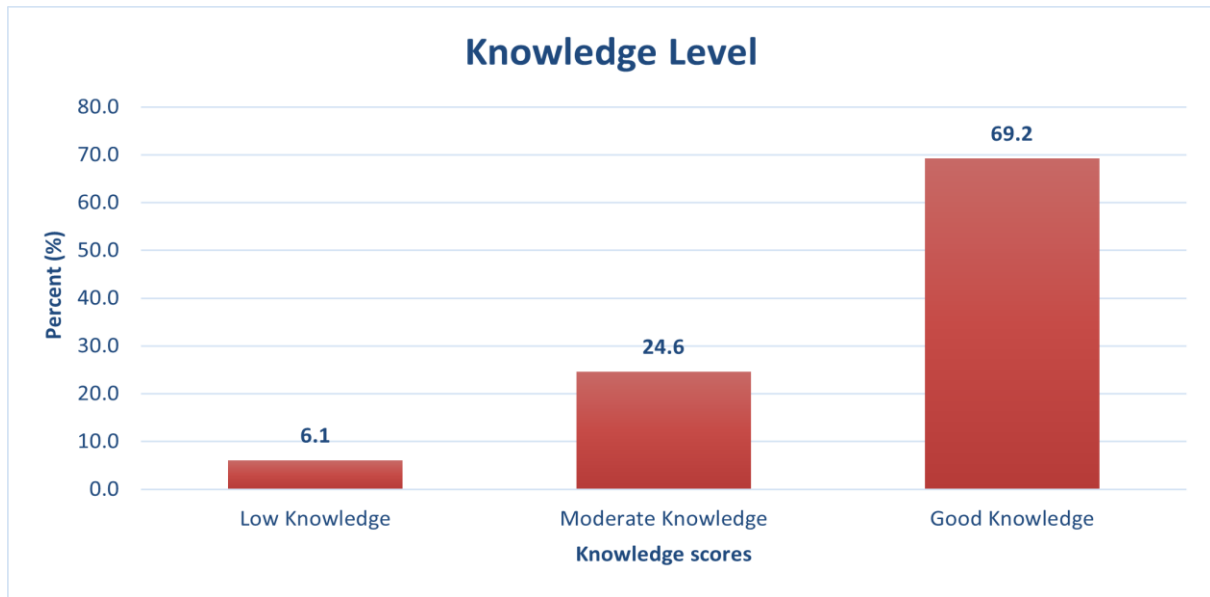
Following are the score range to assess knowledge level:

**Low knowledge level= 1-3**

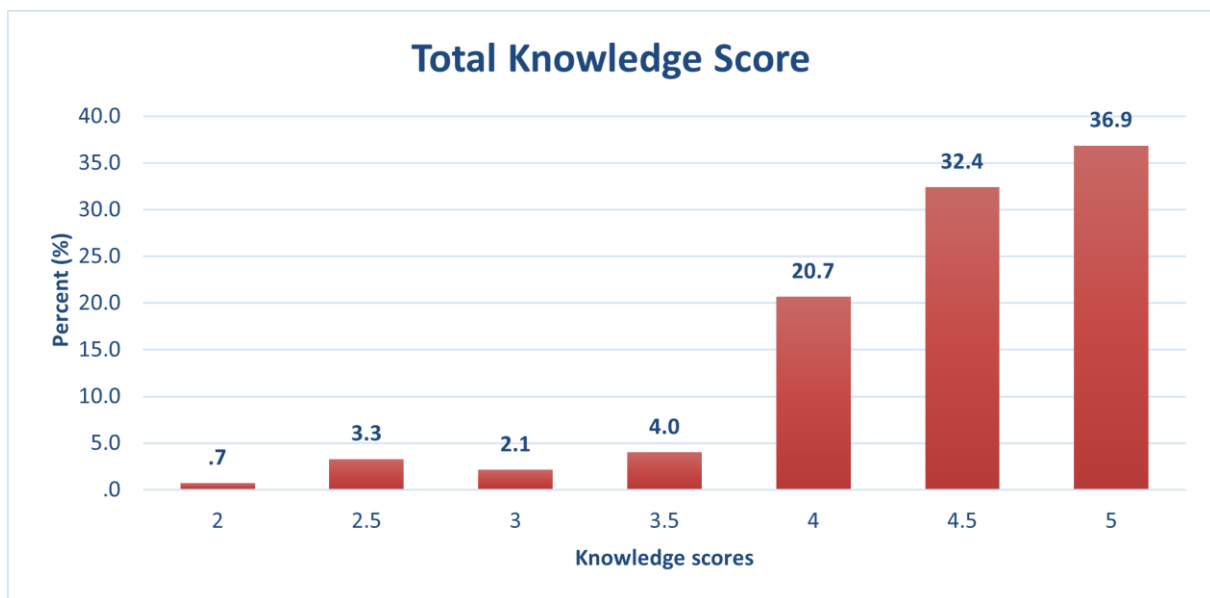
**Moderate knowledge level= 3.5-4**

**High knowledge level= 4.5-5**

69.2 % of pharmacists have good knowledge about e-prescription use & integration, followed by 24.6 % of the pharmacists have moderate knowledge and 6.1% pharmacists fall under low knowledge levels, with mean knowledge score of 4.4 as shown in Fig 2 & 3 .



**Figure 2: Knowledge level**



**Figure 3: Knowledge score  
Assessment of attitude level**

Table 2 describes the assessment of attitude of pharmacists towards use & integration of e-prescription. The attitude was scored as 0 for negative attitude (1 & 2 ratings), 1 for neutral attitude (3 ratings) and 2 for positive attitude (4 & 5 ratings). Majority of pharmacists exhibits positive attitude with average rating of 4.

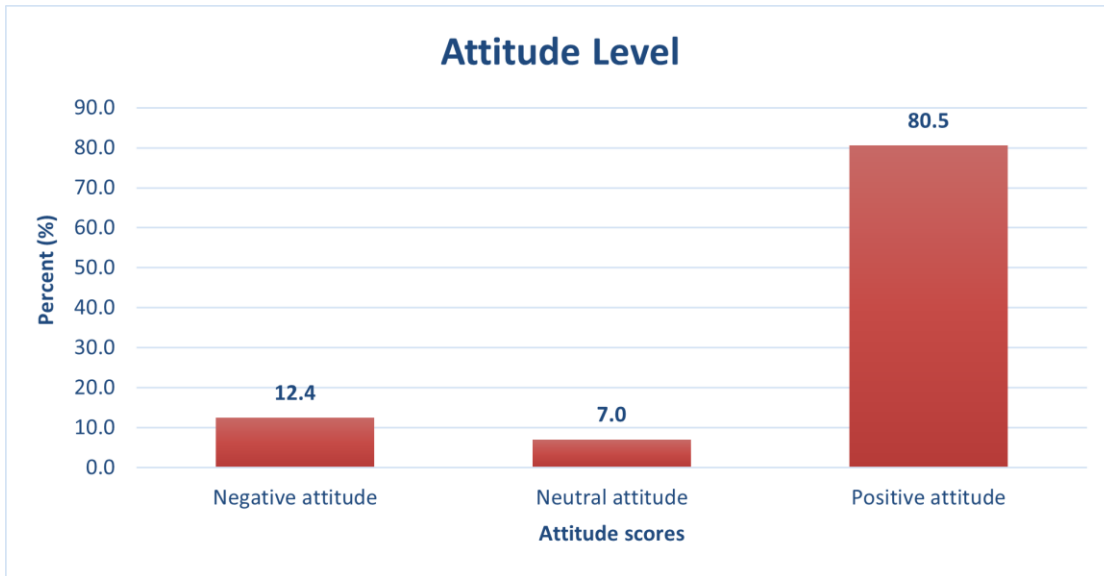
Following are the score range to assess attitude level:

**Negative attitude:** 0-3

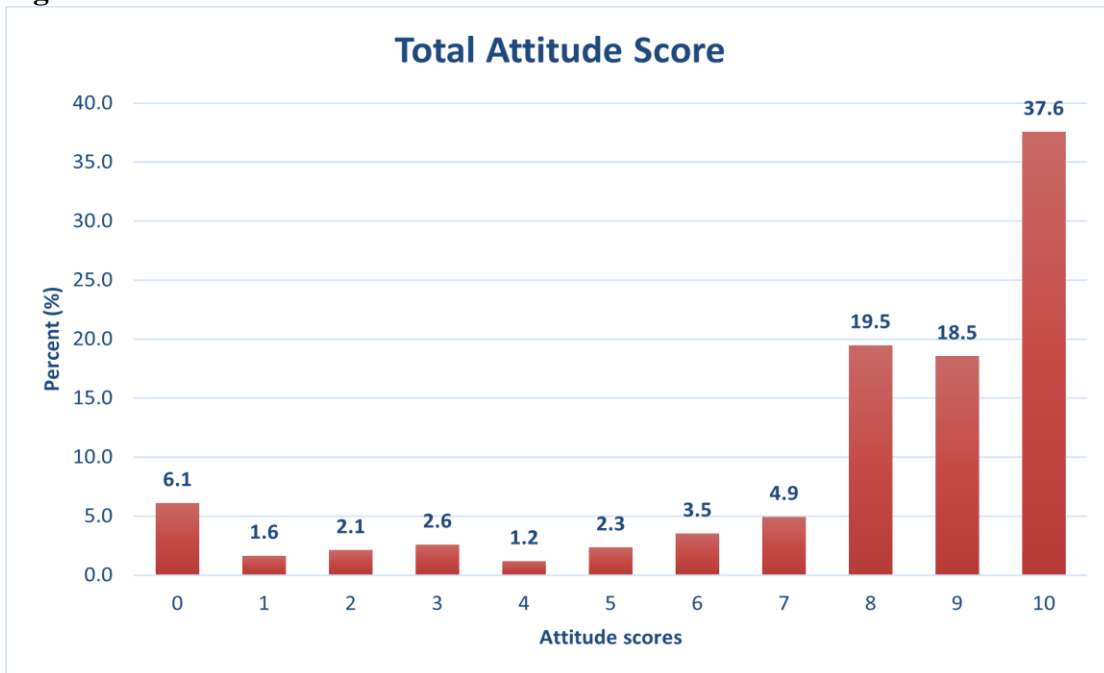
**Neutral Attitude:** 4-6

**Positive Attitude:** 7-10

As indicated by the bar graph below, it is clear that majority of the pharmacists (80.5%) shows positive attitude towards use & integration of e-prescriptions, followed by negative attitude (12.4%) and neutral attitude (7%), having mean attitude scores of 7.8 as shown in Fig 4 and 5.



**Figure 4: Attitude Level**



**Figure 5: Attitude score**

**Assessment of practice level**

Table 2 shows assessment of practice of pharmacists regarding use & integration of e-prescription. The practice was assessed by scoring Yes responses as 1, No responses as 0 and Sometimes/not applicable responses as 0.5. Majority of the pharmacists (64.3%) have no access to e-prescription, they do not receive e-prescriptions (51.6%), they do not filled any e-prescription (52.1%) and they are not trained to use e-prescription (64.6%).

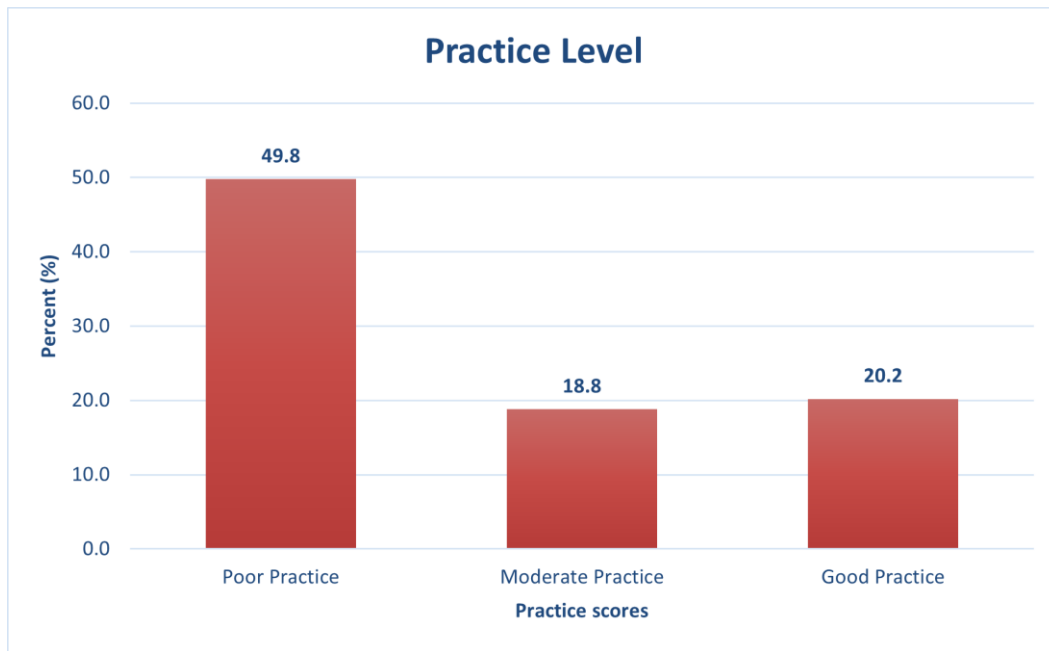
Following are the score range to assess practice level:

**Poor Practice= 0-2**

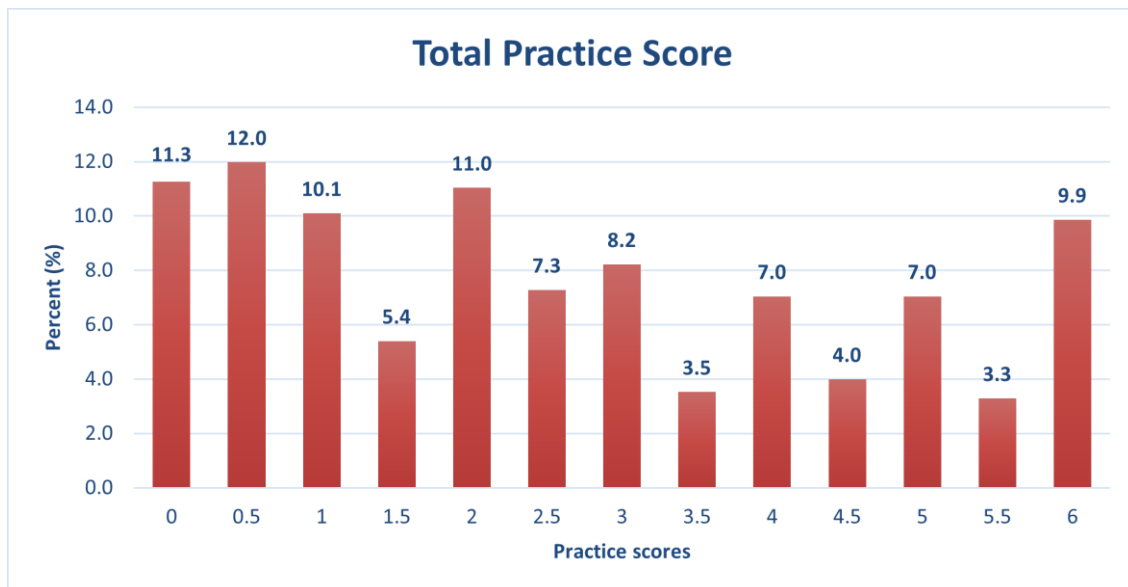
**Moderate Practice= 3-4**

**Good Practice=5-6**

As indicated by the bar graph below, it is clear that majority of the pharmacists (49.8%) have poor practice level towards use & integration of e-prescription, followed by 20.2 % showing good practice level and 18.8% pharmacists showing moderate practice levels having mean practice scores of 2.6 as shown in Fig 6 & 7.



**Figure 6: Practice level**



**Figure 7: Practice scores**

**Table 2: Assessment of KAP**

<b>Assessment of KAP</b>			
<b>Assessment of knowledge</b>	<b>Questions</b>	<b>Options/ Ratings</b>	<b>Percent (%)</b>
	E-prescription is the electronic generation and transmission of a prescription.	TRUE	93
		FALSE	0.7
		Not sure	6.1
	E-prescribing helps reduce medication errors.	TRUE	88
		FALSE	2.8
		Not sure	9.4
	E-prescription systems can be integrated with patient health records.	Yes	91
		No	2.1
		Not sure	6.6
	The use of e-prescriptions is legally recognized in Pakistan.	Yes	45
		No	13
		Not sure	43
	E-prescription allows pharmacists to track prescribing patterns and potential misuse.	Yes	89
		No	2.3
		Not sure	8.7
<b>Assessment of attitude</b>	The implementation of e-prescriptions is a necessary step for healthcare modernization in Pakistan.	1	7.5
		2	5.4
		3	12
		4	16
		5	59
	I am concerned about patient data privacy in e-prescription platforms.	1	17
		2	12
		3	24
		4	16
		5	31
	E-prescriptions may reduce workload and improve pharmacy efficiency.	1	7.3
		2	4.7
		3	10
		4	20
		5	57
	I believe e-prescription systems can improve patient safety and care quality.	1	8
		2	3.8
		3	9.9
		4	21
		5	57
	Pharmacists should be trained to interpret and process e-prescriptions.	1	7
		2	3.5
		3	7.7
		4	16
		5	66
<b>Assessment of practice</b>	Do you currently use or have access to any e-prescription platform?	Yes	36
		No	64

	Do you currently receive e-prescriptions in your pharmacy setting?	Yes	33
		No	52
		Sometimes	16
	Have you ever processed or filled a prescription through an electronic system?	Yes	48
		No	52
	Do you think your workplace is ready for full e-prescription integration?	Yes	54
		No	46
	Have you received training related to e-prescription systems?	Yes	35
		No	65
Do you educate patients about how e-prescriptions work?	Yes	30	
	No	37	
	Not applicable	33	

**Association between knowledge, attitude & practice**

To evaluate the association between KAP scores of pharmacists regarding the use of e-prescription, Spearman’s rank correlation was used. There was a significant but weak positive correlation ( $r=0.124$ ,  $p = 0.010$ ) between knowledge and attitude scores. This indicates higher knowledge levels are associated with positive attitude. There was moderately positive correlation ( $r=0.318$ ,  $p < 0.001$ ) between knowledge and practice scores. This suggests that having higher knowledge scores was related to having better practices in pharmacists related to e-prescription use. However, there was non-significant relation between attitude & practice ( $r=-0.004$ ,  $p = 0.936$ ) which suggests having positive attitude is not linked with practical implication of e-prescription as demonstrated in table 3.

**Table 3: Correlation between knowledge, attitude, and practice scores**

<b>Correlation</b>	<b>Coefficient (<math>\rho</math>)</b>	<b>Significance</b>	<b>Strength</b>
Knowledge ↔ Attitude	0.124	$p = 0.010$	Weak (significant)
Knowledge ↔ Practice	0.318	$p < 0.001$	Moderate (significant)
Attitude ↔ Practice	-0.004	$p = 0.936$	None (not significant)

**Association between groups**

**KAP level & age**

Kruskal Wallis test was performed to determine any significant association between KAP levels and different age groups. The results reveals that there was no significant association between attitude level & age groups of pharmacists towards e-prescription use ( $p = 0.724$ ). However, there was significant association between different age groups, practice level & knowledge level. This shows that age may play a role regarding pharmacists practices regarding use of e-prescription systems ( $p = 0.001$ ). Similarly, different age groups play a role in impacting pharmacists knowledge regarding e-prescription use since there is significant relation between age groups and

knowledge level ( $p = 0.014$ ). Table 4 demonstrates association between KAP level and different age groups.

**KAP level & provinces**

Table 4 demonstrates the results of Kruskal Wallis test to assess the relation between KAP levels and provinces. Pharmacists from different provinces were similar in terms of their knowledge & attitude levels in terms of e- prescription use ( $p = 0.555$  for knowledge level and  $p = 0.411$  for attitude level). However, there was significant relation between practice levels of provinces ( $p=0.045$ ) with Punjab demonstrating highest mean rank (209.43) followed by Sindh (mean rank=186.96), KPK (mean rank=186.65) and Baluchistan (mean rank=106.50). Thus it suggests Pharmacists working in Punjab province are more actively practicing e-prescriptions system compared to other provinces.

**KAP levels & experience in pharmacy practice**

Table 4 demonstrates the results of Kruskal Wallis test to assess the relation between KAP levels and experience in pharmacy practice. There was no significant relation between knowledge levels ( $p=0.189$ ), attitude levels ( $p=0.881$ ) and years of pharmacy experience regarding e-prescription use, however, pharmacists with advancing years in experience shows higher level of good practice ( $p<0.001$ ) regarding e-prescription use. The pharmacists with more than 20 years of experience shows highest mean rank (225) suggesting that practice levels increases with increase in experience.

**KAP levels & type of practice setting**

Table 4 demonstrates the results of Kruskal Wallis test to assess the relation between KAP levels and types of practice setting. There was statistically significant association between knowledge levels across different type of practice settings ( $p=0.037$ ) with pharmacists working in community setups having higher practice levels (mean rank: 225) of e-prescription followed by hospital pharmacists. Attitude towards e-prescription appears consistent through different type of practice settings, hence there was no significant relation between KAP levels and type of practice setting ( $p=0.087$ ). There was highly significant association between practice levels and types of practice setting ( $p < 0.001$ ) with clinical pharmacists (mean rank: 258) followed by hospital pharmacists appears to be more active in the use of e-prescription.

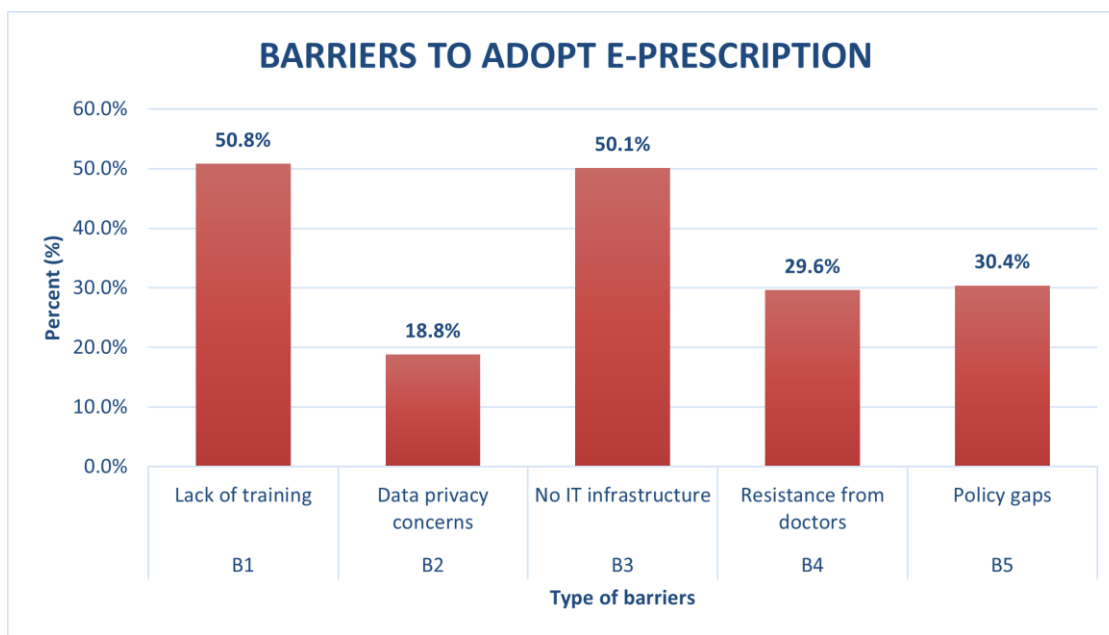
**Table 4: Association between groups**

Association between groups	KAP Domain	Chi-Square ( $\chi^2$ )	Sig. (p-value)	Significance
<b>KAP levels &amp; age</b>	Knowledge Level	8.586	0.014	✓ Significant
	Attitude Level	0.645	0.724	✗ Not Significant
	Practice Level	14.727	0.001	✓ Highly Significant
<b>KAP levels &amp; provinces</b>	Knowledge Level	2.086	0.555	✗ Not Significant
	Attitude	2.877	0.411	✗ Not

	Level			Significant
	Practice Level	8.06	0.045	✓ <b>Significant</b>
<b>KAP levels &amp; experience in pharmacy practice</b>	Knowledge Level	6.146	0.189	✗ Not Significant
	Attitude Level	1.182	0.881	✗ Not Significant
	Practice Level	20.976	<b>0</b>	✓ <b>Highly Significant</b>
<b>KAP levels &amp; type of practice setting</b>	Knowledge Level	11.878	0.037	✓ Significant
	Attitude Level	9.627	0.087	✗ Not Significant
	Practice Level	40.916	<b>0</b>	✓ <b>Highly Significant</b>

### Barriers to e-prescription adoption

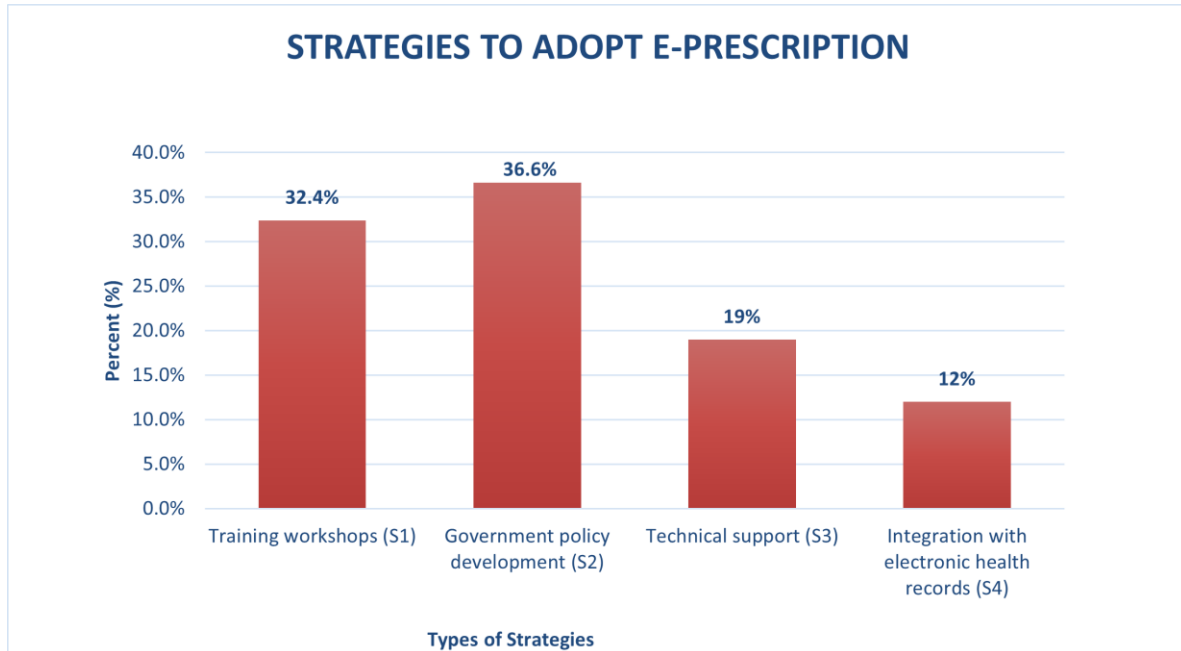
Key findings are demonstrated in table 5 which shows most commonly reported barriers are lack of training (50.8%) & no IT infrastructure (50.10%), followed by other barriers like policy gaps (30.4%), resistance from doctors (29.6%) & data privacy concerns (18.8%). It was an open ended questions and participants also addresses other barriers like insufficient HR system and facilities, lack of awareness regarding technology, lack of maintenance budget including HIMS, network issues, electricity issues, lack of resources and high cost. This indicates there are both technical and educational barriers. Figure 8 shows visual representation of barriers.



**Figure 8: Barriers to adopt e-prescription**

**Strategies to improve e-prescription adoption**

Key findings are demonstrated in table 5 which reports most frequently suggested strategy of the pharmacists were development of government policy (36.6%), followed by training workshops (32.4%), technical support (19%) and integration with health records (12%). This indicates most important strategies to adopt e-prescription are policy development and capacity building through practical training. Figure 9 shows visual representation of strategies.



**Figure 9: Strategies to adopt e-prescription**

**Table 5: Barriers & Strategies to e-prescription adoption**

Barriers/ Strategies	Features	Percent (%)
<b>Barriers</b>	Lack of training (B1)	50.8
	Data privacy concerns (B2)	18.8
	No IT infrastructure (B3)	50.1
	Resistance from doctors (B4)	29.6
	Policy gaps (B5)	30.4
<b>Strategies</b>	Training workshops (S1)	32.4
	Government policy development (S2)	36.6
	Technical support (S3)	19
	Integration with electronic health records (S4)	12

**Discussion**

The results of the current study shows that the pharmacists are aware about e-prescription, its use in reducing medication errors & its role in helping pharmacists in medication review. This is consistent with the study in Saudi Arabia that shows that the community pharmacists used e-prescription and they were aware about its benefits in reducing medication errors by decreasing misinterpretation in prescription which is common in hand written prescriptions & enhances

medication safety (Alsahali et al., 2023). The level of knowledge was satisfactory with 69.2% pharmacists exhibits good knowledge levels towards use & integration of e-prescription systems although they lack awareness regarding its legislatives and policy development. This is consistent with the study in Ukraine where 59.8% pharmacists shows good awareness level regarding e-prescription system (Maksymovych et al., 2020). The importance of regulation can be manifested by the study in India which shows that the regulations are not well defined regarding e-prescription implementation (Apte et al., 2023). Pakistan government launch a digital healthcare system by providing software solution leading to modification of healthcare system (Muhammad Mahtab Mahboob et al., 2021).

The attitude of pharmacists regarding use & integration of e-prescription system was positive (80.5%). They believed that implementation of e-prescription is necessary step in digital health initiative by Pakistan. They believed that it can improve patient safety and reduces medication errors. The concerns related to data privacy remains an important issue regarding this matter and majority of the pharmacists emphasize on the importance of training of software to avoid any delay in smooth workflow of pharmacy. The positive attitude of some of the pharmacists was also observed in another study in Saudi Arabia in which there is implementation of digital system (Wasfaty services) in community pharmacies (Khardali et al., 2023). They encouraged other pharmacies to digitalize their services. They noticed fewer medication errors and more time for patient counselling after introduction of e-prescription system in their pharmacies. Some of pharmacists also exhibits negative attitude towards this system. The contradictory results in terms of attitude might be related to the staff shortage leading to increase pressure on shift pharmacist, impeding the workflow as described by one of the pharmacist. Lack of communication with the prescribing physician to confirm about any medication related query is another reason causing delays in the process.

Regarding practice, majority of pharmacists have no access to e-prescription system (64.3%) and they have no proper training to use this system (64.6%). Poor practice levels were revealed by participating pharmacists (49.8%). The survey conducted in Nigeria shows that the practical implementation of e-prescription might not be technically feasible due to inadequate government funding (Omotosho et al., 2018).

The current study suggests that pharmacists with higher knowledge levels tends to have positive attitudes and better practices towards use of e-prescription. However, positive attitude is not necessarily associated with implementation & good practice levels. This is consistent with the study which shows that healthcare professionals are ready for implementing e-prescription but due to lack of resources, they are unable to practice it. (*A Survey of E-Prescription Readiness in Selected Nigeria Hospitals - Adebayo Omotosho - Google Books, n.d.*)

Gender has no influence on KAP scores. Years in pharmacy experience and age has significant relation to higher practice levels revealing that pharmacists with more experience in the field tends to have better practice levels towards e-prescription use. Comparing different provinces, Punjab is found to be highly active in practicing e-prescription system. This may be credited to digital infrastructure and IT policies in Punjab province.

The most commonly barriers to adopt e-prescription as per current study are lack of training & IT infrastructure. The barriers towards e-prescription adoption in Libyan hospitals are financial, technical and organizational which is consistent with the current study (Maatuk et al., 2022). Another study demonstrates uneven development of infrastructure, lack of skilled man power, lack of integrating and symmetrical practices and work standards & organizational support are one of

the top barriers in adopting digitalization and implementing e-health system in Pakistan. (Qureshi et al., 2014)

For successful implementation of e-prescription, the key strategies are to develop policies at government level, conduct trainings, technical infrastructure & integrating the health records.

The future studies should focus on legislative mandates and technology use to support e-prescription as the studies shows that community pharmacists software issues and lack of proper training leads to delays in their workflow (Odukoya & Chui, 2012).

Based on these findings, it is recommended to develop training programs, improve IT infrastructure and develop strong policies to standardize the practices. Mentorship to early level pharmacists should be provided since the current study reveals there is impact of number of years of pharmacy experience to the practice levels. There should be equal use and access of e-prescription use across different provinces of Pakistan.

## **Conclusion**

The findings of the current study reveals that pharmacists have good level of knowledge and they have positive attitude towards the use of e-prescription system and digitalization of pharmacy services. However, poor practice levels of majority of the pharmacists shows that implementation of e-prescription system is still in infancy. There is a need of training, investment in IT infrastructure, development of policies at government and institutional levels and integration of health records to reduce medication errors and enhance medication safety. The differences in access to e-prescription systems at provincial level should be reduced to ensure standardized practices throughout the country.

## **Limitations & future research**

The current study is cross-sectional & generalizability is limited due to unequal sample size from different provinces with majority of the participants are of Sindh, followed by Punjab and very limited from KPK and Baluchistan. Future research is required to include equal samples from all provinces, use of more reliable scale for knowledge since it has low internal consistency and longitudinal studies need to be conduct before & after implementation of the system. In addition, the future studies could also explore the impact of KAP scores on improving healthcare services like reducing medication errors, improved adherence and smooth workflow.

## **Declarations**

### **Author's contribution:**

Conceptualization, data acquisition, data analysis, results interpretation, writing & manuscript:

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Data collection: Masood Ahmed Khan

Data collection: Abdul Razzaque Nohri

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### **Availability of data & materials**

The data will be available upon request to the corresponding author.

### **Financial support & sponsorship:**

None.

### **Conflicts of interest**

The authors declare that they have no conflicts of interest related to this study. The study was -conducted independently, with no external influence on data collection, analysis, or interpretation.

### **Consent to participate**

Consent is taken from participants.

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