Original Article

Evaluation of pharmacist's knowledge regarding chronic kidney disease

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Abstract

Background: Chronic Kidney Disease is a complex condition characterized by a decrease in kidney function. **Objective:** The objective of this study was to develop and validate a knowledge tool and assess the knowledge of pharmacists regarding Chronic Kidney Disease (CKD). **Methods:** The study consisted of 2 phases with phase-I involving the development and validation of a knowledge tool. The development phase encompassed a thorough review of the literature, focus-group discussion, and expert review. The validation phase consisted of pilot testing and involving content and face validity and reliability testing using Cronbach alpha. Phase-II involved an assessment of knowledge of pharmacists by administering the validated tool to 183 practicing pharmacists working in tertiary care hospitals in 3 big cities of Pakistan. The data obtained were statistically analyzed involving descriptive and inferential statistics including chi-square test, one way ANOVA, post hoc Tukey's test, and regression analysis. **Results:** The developed knowledge was found to be reliable with Cronbach alpha values above 0.7 during the pilot testing. A high response rate of 93.4% was observed during the study. 50.9% of the pharmacists in the study had good knowledge, the mean percent knowledge score was found to be 54.76. The knowledge score was found to be associated with the male gender, 30 – 39 years of age, >5 years of experience and clinical / hospital pharmacy certification during the post hoc analysis ($p<005$). Strong positive correlation and linear regression relationship were observed between percentage knowledge score and number of years of professional clinical experience. **Conclusions:** Pharmacists working in tertiary care hospitals in Pakistan exhibit a good knowledge of chronic kidney disease.

Keywords: Chronic kidney disease, Knowledge, Validation, reliability, Clinical pharmacy, Questionnaire

Introduction

Chronic kidney disease (CKD) represents a decreased kidney function, characterized by a glomerular filtration rate (GFR) of less than 60 mL/min/1.73m2, or markers of kidney damage, or both, for at least 3 months.[1] CKD is a major public health problem and a risk factor for the composite outcome of all-cause mortality and cardiovascular disease in the general population.[2] Worldwide, an estimated 200 million people have chronic kidney disease, and annually more than 500,000 individuals develop the end-stage renal disease in Sub-Saharan Africa alone and the majority of such patients undergo premature mortality. Chronic Kidney Disease (CKD) has been a worldwide health issue affecting millions of people.[3, 4] A significant increase in the global burden of CKD has been observed with more than 500,000 deaths since 1990. CKD is associated with expressively higher health care costs and economic burden and is thus not sustainable even in advanced countries having developed healthcare systems.[5-7] Regardless of higher associated medical costs and increased mortality rate, CKD has rather received fairly limited global attention and necessities effective public health interventions for its prevention and early management.[8, 9] The most frequent risk factors of CKD in the developing nations have been chronic glomerulonephritis and systemic hypertension.[10, 11] The early detection and management of CKD may help in the prevention or delaying the progress of the disease. The early detection of CKD can be achieved by the routine GFR reporting and by the education of primary health care professionals on the consequences of reduced GFR and its impact on patient safety as well as on cardiovascular and renal outcomes. [12] Pharmacists are among the important health care professionals and part of a multidisciplinary team to address areas requiring improvement along with unmet drug-related problems proactively and preventatively, thus contributing positively to CKD patients to reduce the gaps in

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How to cite this article: Syed Sulaiman, S. A., Haseeb Tariq, M. Evaluation of Pharmacist's Knowledge regarding chronic kidney disease. Arch Pharma Pract 2020;11(4):1-8.

inpatient care. Pharmacist interventions are associated with some positive impact, including improved patient care and reduced morbidity and all-cause mortality in CKD patients.[13]

A thorough review of the literature, studies focusing on pharmacist's knowledge could not be identified. This study was designed to fill this gap in the available literature and to develop a validated tool as well as to determine the knowledge of practicing pharmacists regarding chronic kidney disease, its detection, risk factors, complications, management, and dialysis.

Methods

Ethical approval:

Ethical approval was taken from Universiti Sains Malaysia (USM) and the study objective and design was explained and informed consent was taken from every respondent (pharmacist) during the validation as well as final data collection phase.

Study settings and design:

It was a prospective cross-sectional observational study including pharmacists working in a tertiary care public sector hospitals in three cities of Pakistan including Islamabad, Swat, and Lahore from March to November 2019.

Study Sample:

The study sample included a hospital and clinical pharmacists working in a tertiary care public sector hospitals.

Sample size:

The study sample size included 183 hospital and clinical pharmacists working in a tertiary care public sector hospitals and the validated self-administered questionnaire were distributed among all of them.

Sampling technique:

A total population sampling technique was utilized for this study.

Study tool: Research questionnaire

After a thorough review of the literature, no pre-developed and validated tool was identified which could serve the objectives of this study, therefore a new questionnaire was developed. Items for assessment of knowledge were included based on information gathered after the literature review. The developed questionnaire contains 43 questions and was subjected to content validity by a panel of three experts including a researcher, an expert in the field of clinical pharmacy, and a consultant nephrologist. The questionnaire was modified based on the recommendations of the experts and was then spread among 40 respondents for face validity, internal reliability, and consistency. Cronbach alpha values were calculated and its value above 0.7 was considered to be acceptable. The final questionnaire containing overall 40 knowledge items were used to study the whole study population.

Statistical Analysis:

All the data collected through the questionnaire was recorded in SPSS version 24.0 after coding and carefully defining all the variables under study. Descriptive and inferential statistics were applied based on the characteristics of the study variables. Pearson's chi-squared test, ANOVA, and post hoc analysis were performed and the linear regression model was computed where the p-value <0.05 was considered statistically significant.

Results

Validation of the study tool was performed by administrating the developed tool to 40 respondents having similar characteristics like that of the study population. Among the respondents for a validation study, 55% were male while 45% were female having a mean age of 28 years and mean experience of 4.25 years.

The results for reliability analysis through the measure of Cronbach alpha provided in Table-1 shows acceptable results with alpha value 0.741. Hence the developed study tool was considered validated after performing content and face validity and measure of internal reliability.

The validated study tool was then administered to all the 183 hospital and clinical pharmacists working in public sector tertiary care hospitals in the three cities of Pakistan. Among them, 171 pharmacists returned the questionnaire after completing, and thus a response rate of 93.4% was observed. The demographic characteristics and descriptive statistics of all the study participants are provided in Table-2.

The mean age of the study participants was 28.13 ± 5.46 years and the mean of the experience was 4.02 ± 4.77 years. Kidney Disease Outcomes Quality Initiative (KDOQI) / Kidney Disease: Improving Global Outcomes (KDOGI) guidelines were read by 32.7% pharmacists, and 74.9% have studied chronic kidney disease in detail in their undergraduate curriculum.

Among the studied pharmacists, 50.9% had good knowledge, while 49.1% of pharmacists had poor knowledge. The mean knowledge of all the pharmacists regarding chronic kidney disease was found to be 54.76 ± 16.3 percent. The percentage knowledge score was found to be normally distributed with skewness value -0.043. Table-3 summarizes the sample response against knowledge items in the questionnaire.

Among the pharmacists' understudy, the male gender was found to have better knowledge ($p<0.05$) of CKD with 57.7% male having good knowledge. Pharmacists having more than 30 years of age were found to have good knowledge ($p<0.05$), with 73.2% pharmacists in the age group of 30 – 39 years having good knowledge. Practical experience after

graduation was found to be the most important variable which affects the knowledge score, it was observed that pharmacist having more than 5 years of post-graduation practical professional experience have good knowledge ($p<0.05$) with 95.8% of such population having good knowledge. Those pharmacist which have studied KDOQI/KDIGO guidelines have a better knowledge score ($p<0.05$), with 66.1% of such pharmacists having good knowledge. Pharmacists having clinical/community/hospital pharmacy training or certification were found to have a better knowledge score ($p<0.05$), with 88.9% of such pharmacists having good knowledge. The association of knowledge among various variables of the pharmacist and the comparison of mean knowledge score among them is provided in Table-4 and Figure-1.

It was observed that a statistically significant difference was observed in the knowledge score among various groups of pharmacists based on age, experience, and level of education. To further determine exactly which subgroup has a better knowledge score after ANOVA testing, post-hoc testing using Tukey's test was performed. From the post-hoc test, it was observed that pharmacists in the age group 30 – 39 years, having more than 5 years of experience, and having clinical/community/hospital pharmacy certification have the best knowledge score ($p<0.05$). The results of the post-hoc analysis are provided in Table-5.

A strong positive correlation ($R = 0.714$) was observed between percentage knowledge and years of experience after graduation. The data were fitted to simple linear regression and a model was the best fit ($P<0.05$). The results of the regression model are provided in Table-6.

Based on the regression model a straight line equation was developed to determine the percentage knowledge among the pharmacist population from the number of years of experience after graduation. The developed equation is as follows:

Knowledge = 3.73 (Experience in years) + 37.84

This predictor model can be used to estimate the percentage of knowledge of pharmacists working in tertiary care hospitals.

Discussion:

The response rate to this study was relatively higher i.e. more than 90% unlike many previous studies assessing the knowledge of healthcare professionals.[14] Since it was a kind of new study in Pakistan and among pharmacists working in tertiary care hospitals, the majority of pharmacists expressed great interest in the study and carefully filled the questionnaire. Since no study with similar objectives was identified therefore a new tool was developed which was validated before use. The validation results were found to be in an acceptable range and following previous studies involving the validation of the tool to determine the knowledge of healthcare professionals.[15]

Pharmacist knowledge regarding chronic kidney disease was assessed and mean knowledge was found to be 54.76%. The pharmacists under this study were all working in tertiary care hospitals having a different level of professional experience. Since none of the previous studies on pharmacist's knowledge could be identified therefore comparison of our results with the reported literature is not possible. However, in one of a similar study on postgraduate medicine residents, the mean knowledge score was found to be 71.8%.[16]

It was further observed that the knowledge was dependent on age with the best knowledge results obtained in pharmacist from 30 – 39 years of age. This result is in accordance with one study conducted on healthcare professionals in Saudi Arabia where age below 40 years was found to be associated with better knowledge score.[17] The results of knowledge among pharmacist of different level of education was surprisingly different and may be of great concern. It was observed that pharmacists holding doctor of pharmacy (Pharm D) degree have better clinical knowledge as compared to those having higher postgraduate degree i.e. Master of Science (MS) or Master of Philosophy (M. Phil). One of a major reason behind this difference is the nature of postgraduate degrees, since they are only research based degrees. No institute in the whole country offers degree program to enhance the clinical competencies and knowledge or having a practice based degree. Another reason is the lack of clinical expertise among the faculty members of pharmacy institutes in Pakistan.[18-20]

The most important factor affecting the knowledge of pharmacists was post-graduation clinical professional experience. A significant positive correlation was observed between the clinical experience in years and the percentage knowledge of pharmacists, and the data were also fitted to linear regression model resulting in a predictor regression equation to determine percentage knowledge from clinical experience. The results obtained are in accordance with a similar study conducted to evaluate the impact of pharmacy work experience on the knowledge of pharmacists.[21] In another study on clinical pharmacists, no association was found between clinical experience and knowledge of pharmacists.[22]

Doctor of Pharmacy (Pharm D) curriculum was revised in 2013 in Pakistan, in which a more clinical oriented course was developed. The new curriculum also lacked various important clinical concepts and disease areas. Furthermore, no professional postgraduate degree, diploma, or certification system was incorporated by the pharmacy council of Pakistan.[23] More focus needs to be given on clinical pharmacy teaching and training in Pakistan since it does not have a well-developed clinical pharmacy training system. Improved pharmacy education and training system can produce pharmacists with improved knowledge and clinical

skills and thus leading to improved patient care and clinical outcomes.

Conclusion:

Pharmacists working in tertiary care hospitals in Pakistan exhibit a good knowledge of chronic kidney disease. The professional clinical experience holds more importance than the level of education of the pharmacist. The pharmacy teaching and training system should be improved to produce pharmacists with better clinical skills.

Author contribution

MHT:

1) Conception/design, analysis, and interpretation of data;
2) Drafting the article and revising it;

SASS:

1) Providing intellectual content of critical importance to the work described;
2) Final approval of the version to be published

Funding

The authors did not receive any funding for carrying out this study.

Conflict of interest:

The authors declare no conflict of interest.

References

1. Levin, A., Stevens, P.E., Bilous, R.W., Coresh, J., De Francisco, A.LM., De Jong, P.E., Griffith, K.E., Hemmelgarn, B.R., Iseki, K., Lamb, E.J., Kidney Disease: Improving Global Outcomes (KDIGO) CKD Work Group. KDIGO 2012 clinical practice guideline for the evaluation and management of chronic kidney disease. Kidney international supplements, 2013. 3(1): p. 1-150.
2. Weiner, D.E., Tighiouart, H., Amin, M.G., Stark, P.C., MacLeod, B., Griffith, J.L., Salem, D.N., Levey, A.S., Sarnak, M.J., Chronic kidney disease as a risk factor for cardiovascular disease and all-cause mortality: a pooled analysis of community-based studies. Journal of the American Society of Nephrology, 2004. 15(5): p. 1307-1315.
3. Saeed S, Islahudin F, Makmor-Bakry M, Redzuan AM. The practice of complementary and alternative medicine among chronic Kidney disease patients. J. Adv. Pharm. Educ. Res. 2018 Jan 1;8(3):30-36.
4. Turkistani YA, Alshami TM, Almatrafi SJ, Alahmadi AO, Edrisy A, Hashem SA, Bazuhair GY, Rajab FH, Alqawain AH, Jalawi BA, Hashem SA. Evaluation of Contrast-Induced Acute Kidney Injury (CI-AKI): A Literature Review. Int. J. Pharm. Res. Allied Sci. 2020 Jan 1;9(1):99-104.
5. Ojo, A., Addressing the global burden of chronic kidney disease through clinical and translational research. Transactions of the American Clinical and Climatological Association, 2014. 125: p. 229.
6. Naghavi, M., Wang, H., Lozano, R., Davis, S., Liang, X., Zhou, M., Vollset, S.E., Ozgoren, A.A., Abdalla, S., Abd-Elmotelib, F., Causes of Death C: Global, regional, and national age-sex specific all-cause and cause-specific mortality for 240 causes of death, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. 2015.
7. Vos, T., Barber, R.M., Bell, B., Bertozzi-Villa, A., Biryukov, S., Bolliger, I., Charlson, F., Davis, A., Degenhardt, L., Dicker, D., Global, regional, and national incidence, prevalence, and years lived with disability for 301 acute and chronic diseases and injuries in 188 countries, 1990–2013: a systematic analysis for the Global Burden of Disease Study 2013. The Lancet, 2015. 386(9995): p. 743-800.
8. Jha, V., Garcia-Garcia, G., Iseki, K., Li, Z., Naicker, S., Plattner, B., Saran, R., Wang, A., Yang, C., Chronic kidney disease: global dimension and perspectives. The Lancet, 2013. 382(9888): p. 260-272.
9. Nugent, R.A., Fathima, S.F., Feigl, A.B., Chyung, D., The burden of chronic kidney disease on developing nations: a 21st-century challenge in global health. Nephron Clinical Practice, 2011. 118(3): p. c269-c277.
10. AlSogair AA, Alharbi AA, Alharbi SH, Alateeq FA, Aloriney AM, Ahmed HG. Knowledge and Perceptions Toward Chronic Kidney Disease Prevention and Control in Saudi Arabia. International Int. J. Pharm. Res. Allied Sci. 2019;8(1):77-83.
11. Zayet GK. Serum Hepatocytes growth factor in acute and chronic Kidney diseasepatients and its relation to disease activity. J. Adv. Pharm. Educ. Res. 2018;8(3):74-80.
12. Levin, A., Stevens, P. E. Early detection of CKD: the benefits, limitations, and effects on prognosis. Nature Reviews Nephrology, 2011. 7(8): p. 446.
13. Stemer, G., Lemmens-Gruber, R. Clinical pharmacy activities in chronic kidney disease and end-stage renal disease patients: a systematic literature review. BMC nephrology, 2011. 12(1): p. 35.
14. Kharkar, M., Bowalekar, S., Knowledge, attitude, and perception/practices (KAP) of medical practitioners in India towards adverse drug reaction (ADR) reporting. Perspectives in clinical research, 2012. 3(3): p. 90.
15. Jadoo, S.A.A., Sulku, S.N., Aljunid, S.M., Dastan, I., Validity and reliability analysis of knowledge of, attitude toward, and practice of a case-mix questionnaire among Turkish healthcare providers. Journal of Health Economics and Outcomes Research, 2014. 2(1): p. 96-107.
16. Agrawal, V., Ghosh, A.K., Barnes, M.A., McCullough, P.A., Awareness, and knowledge of clinical practice guidelines for CKD among internal medicine residents: a national online survey. American journal of kidney diseases, 2008. 52(6): p. 1061-1069.
17. Alrabiah, A.M., Elsaid, T., Tourkmani, A. Determinants of family medicine physicians' knowledge and application of asthma management guidelines at primary healthcare centers in Riyadh, Saudi Arabia. Journal of Family Medicine and Primary Care, 2018. 7(5): p. 927.
18. Jamshed, S., Social pharmacy strengthening clinical pharmacy: why pharmaceutical policy research is needed in Pakistan? Pharmacy world & science, 2008. 30(5): p. 617-619.
19. Hadi, M.A., Hughes, J., Broader perspective needed on the PharmD degree in Pakistan. American journal of pharmaceutical education, 2009. 73(6).
20. Jamshed, S., Izham, M., Ibrahim, M. PharmD in Pakistan: a tag or a degree? American journal of pharmaceutical education, 2009. 73(1): p. 2.
21. Valdez, C., Namdar, R., Valuck, R., Impact of pharmacy experience, GPA, age, education, and therapeutic review on knowledge retention and clinical confidence. Currents in Pharmacy Teaching and Learning, 2013. 5(5): p. 358-364.
22. Fekadu, G., Gamachu, B., Mengie, T., Maqbool, M., Knowledge, attitude of health care professional's towards clinical pharmacy services in Nedjo General Hospital, Western Ethiopia. International Journal, 2019. 5(7): p. 172.
23. Madiha, M., Yang, C.-Q. Curriculum and Pharmacy practice experience offered for Pharm-D in Pakistan: needs and possibilities. International Current Pharmaceutical Journal, 2014. 3(8): p. 313-317.

Table 1: Results of reliability analysis of the questionnaire

Knowledge items	Cronbach Alpha
1. CKD is defined as abnormalities of kidney structure or function, present for >3 months, with implications for health	
2. The KDOQI guidelines have classified CKD based on GFR values in 5 classes (G1 to G5)	
3. The KDOQI guidelines have classified CKD based on albuminuria value in 3 classes (A1 to A3)	
4. According to the 2017 ACC/AHA guidelines, the target blood pressure in CKD patients should be <130/80 mmHg and those with blood pressure >130 mmHg will be classified as hypertensive	
5. Is eGFR a better way of assessing a decline in kidney function than elevated serum creatinine alone?	
6. Can an age-related reduction in eGFR without kidney disease lead to low eGFR with normal serum creatinine, normal urine analysis, and normal USG?	
7. The Cockroft-gault equation is a better tool to estimate GFR than by MDRD equation*	
8. The KDIGO 2012 guidelines recommended classifying CKD based on cause, GFR category and albuminuria category	
9. Following are the risk factors which should be considered while predicting the CKD prognosis	
a) Elevated blood pressure	
b) Hyperglycemia	
c) Dyslipidemia	
d) History of cardiovascular disease	
e) Chronic use of NSAIDs, lithium, cyclosporine	
f) Glomerulonephritis	
10. Following are the complications for which every CKD patient should be continuously monitored	
a) Anemia	
b) Metabolic bone disease	
c) Hyperkalemia	
d) Acidosis	
e) Edema	
f) Acute Kidney Injury	
11. ACE inhibitors are the first-line drugs in the management of CKD in both diabetic and non-diabetic patients	0.741
12. All patients of CKD should be considered at high risk for developing Acute Kidney Injury (AKI)	
13. High protein diet should be administered to all CKD patients at risk of Acute Kidney Injury (AKI)*	
14. Guidelines recommend the use of isotonic crystalloids fluids in CKD patients with AKI to keep the hydration status	
15. Dialysis should be initiated in CKD patients with AKI with abrupt changes in electrolytes and fluid	
16. Diuretics are recommended to improve kidney function in CKD patients with AKI*	
17. Anticoagulation therapy with enoxaparin or unfractionated heparin is recommended in AKI patients on dialysis (not at risk of bleeding)	
18. Iron therapy is recommended in CKD patients with anemia	
19. Erythropoietin therapy is not recommended at Hb > 10 g/dl	
20. IV Iron dextran should be continued in CKD patients with anemia having systemic infection*	
21. Phosphate lowering therapy with phosphate binders is recommended in CKD patients at risk of mineral and bone disorders	
22. The dose of calcium-based phosphate binders should be restricted in G3a-G5 stage CKD patients	
23. In CKD G5 stage patients with hyperparathyroidism, calcitriol is not recommended*	
24. KDOQI guidelines for dialysis have recommended that initiating dialysis on stage 4 patients with GFR <30ml/min may yield better clinical outcomes and low mortality rate	
25. Anticonvulsant drugs valproic acid is dialyzable and thus require additional dose after dialysis*	
26. Loading doses do not need adjustments in CKD patients	
27. Reduction in dose without changing the dosing interval may be associated with a LOWER risk of toxicities*	
28. Lengthening the dosing interval without changing the dose is associated with a higher risk of subtherapeutic drug concentrations	
29. ACE inhibitors should be discontinued if the serum creatinine rise by more than 30%	
30. Metformin can be administered to stage 5 CKD patients with GFR < 15ml/min*	
* Reverse scoring was used for items 7, 13, 16, 20, 23, 25, 27, and 30.	

Table 2: Demographic characteristics of the study participants

Variable		Number	%
Gender	Male	97	56.7
	Female	74	43.3
Age	< 29 Years	119	69.6

	30 – 39 Years	41	24.0
	> 40 Years	11	6.4
Level of education	Pharm D	95	55.6
	B Pharm	9	5.3
	Masters (M Phil / MS)	49	28.7
	Clinical/community/hospital pharmacy certification	18	10.5
Working experience	< 1 year	22	12.9
	1 – 5 years	101	59.1
	> 5 years	48	28.1
Source of information	Books and guidelines	93	54.4
	Internet	86	50.3
	Coursebooks	62	36.3
	Practical experience / training	35	20.5

Table 3: Response of pharmacists against each knowledge item

Knowledge items	Response N (%)	
	Correct	wrong
CKD is defined as abnormalities of kidney structure or function, present for >3 months, with implications for health	156 (91.2)	15 (8.8)
The KDOQI guidelines have classified CKD based on GFR values in 5 classes (G1 to G5)	131 (76.6)	40 (23.4)
The KDOQI guidelines have classified CKD based on albuminuria value in 3 classes (A1 to A3)	89 (52.0)	82 (48.0)
According to the 2017 ACC/AHA guidelines, the target blood pressure in CKD patients should be <130/80 mmHg and those with blood pressure >130 mmHg will be classified as hypertensive	131 (76.6)	40 (23.4)
Is eGFR a better way of assessing a decline in kidney function than elevated serum creatinine alone?	106 (62.0)	65 (38.0)
Can an age-related reduction in eGFR without kidney disease lead to low eGFR with normal serum creatinine, normal urine analysis, and normal USG?	114 (66.7)	57 (33.3)
The Cockroft-gault equation is a better tool to estimate GFR than by MDRD equation	47 (27.5)	124 (72.5)
The KDIGO 2012 guidelines recommended classifying CKD based on cause, GFR category and albuminuria category	94 (55.0)	77 (45.0)
Following are the risk factors which should be considered while predicting the CKD prognosis		
a) Elevated blood pressure	111 (64.9)	60 (35.1)
b) Hyperglycemia	97 (56.7)	74 (43.3)
c) Dyslipidemia	53 (31.0)	118 (69.0)
d) History of cardiovascular disease	88 (51.5)	83 (48.5)
e) Chronic use of NSAIDs, lithium, cyclosporine	101 (59.1)	70 (40.9)
f) Glomerulonephritis	114 (66.7)	57 (33.3)
Following are the complications for which every CKD patient should be continuously monitored		
a) Anemia	77 (45.0)	94 (55.0)
b) Metabolic bone disease	51 (29.8)	120 (70.2)
c) Hyperkalemia	118 (69.0)	53 (31.0)
d) Acidosis	85 (49.7)	86 (50.3)
e) Edema	106 (62.0)	65 (38.0)
f) Acute Kidney Injury	108 (63.2)	63 (36.8)
ACE inhibitors are the first-line drugs in the management of CKD in both diabetic and non-diabetic patients	110 (64.3)	61 (35.7)
All patients of CKD should be considered at high risk for developing Acute Kidney Injury (AKI)	134 (78.4)	37 (21.6)
High protein diet should be administered to all CKD patients at risk of Acute Kidney Injury (AKI)	112 (65.5)	59 (34.5)
Guidelines recommend the use of isotonic crystalloids fluids in CKD patients with AKI to keep the hydration status	89 (52.0)	82 (48.0)
Dialysis should be initiated in CKD patients with AKI with abrupt changes in electrolytes and fluid	106 (62.0)	65 (38.0)
Diuretics are recommended to improve kidney function in CKD patients with AKI	44 (25.7)	127 (74.3)
Anticoagulation therapy with enoxaparin or unfractionated heparin is recommended in AKI patients on dialysis (not at risk of bleeding)	107 (62.6)	64 (37.4)
Iron therapy is recommended in CKD patients with anemia	111 (64.9)	60 (35.1)
Erythropoietin therapy is not recommended at Hb > 10 g/dl	111 (64.9)	60 (35.1)
IV Iron dextran should be continued in CKD patients with anemia having a systemic infection	41 (24.0)	130 (76.0)
Phosphate lowering therapy with phosphate binders is recommended in CKD patients at risk of mineral and bone disorders	107 (62.6)	64 (37.4)

The dose of calcium-based phosphate binders should be restricted in G3a-G5 stage CKD patients	103 (60.2)	68 (39.8)
In CKD G5 stage patients with hyperparathyroidism, calcitriol is not recommended	38 (22.2)	133 (77.8)
KDOQI guidelines for dialysis have recommended that initiating dialysis on stage 4 patients with GFR <30ml/min may yield better clinical outcomes and low mortality rate	110 (64.3)	61 (35.7)
Anticonvulsant drugs valproic acid is dialyzable and thus require additional dose after dialysis	42 (24.6)	129 (75.4)
Loading doses do not need adjustments in CKD patients	58 (33.9)	113 (66.1)
Reduction in dose without changing the dosing interval may be associated with a LOWER risk of toxicities	42 (24.6)	129 (75.4)
Lengthening the dosing interval without changing the dose is associated with a higher risk of subtherapeutic drug concentrations	118 (69.0)	53 (31.0)
ACE inhibitors should be discontinued if the serum creatinine rise by more than 30%	119 (69.6)	52 (30.4)
Metformin can be administered to stage 5 CKD patients with GFR < 15ml/min	67 (39.2)	104 (60.8)

Table 4: Cross-tabulation of various factors affecting Pharmacist's knowledge

Variables affecting knowledge		Knowledge		P-value
		Poor n (%)	Good n (%)	
Gender	Male	41 (42.3)	56 (57.7)	0.046*
	Female	43 (58.1)	31 (41.9)	0.022**
Age	< 29 Years	70 (58.8)	49 (41.2)	0.001*
	30 – 39 Years	11 (26.8)	30 (73.2)	0.000***
	> 40 Years	3 (27.3)	8 (72.7)	
Experience	< 1 year	20 (90.9)	2 (9.1)	0.000*
	1 – 5 years	62 (61.4)	39 (38.6)	0.000***
	> 5 years	2 (4.2)	46 (95.8)	
Read KDOQI guidelines	Yes	19 (33.9)	37 (66.1)	0.006*
	No	65 (56.5)	50 (43.5)	0.001**
Level of education	Pharm. D	57 (60.0)	38 (40.0)	0.001* 0.000***
	B. Pharm	2 (22.2)	7 (77.8)	
	Masters (M. Phil / MS)	23 (46.9)	26 (53.1)	
	Clinical / community / hospital pharmacy certification	2 (11.1)	16 (88.9)	

***Chi-square test; **Independent sample t-test; ***One way ANOVA**

Table 5: Post hoc analysis of multiple comparisons among various variables

Study variable	Independent variable comparison group		Sig.	95% Confidence Interval	
	Sub set-1	Other subsets		Lower Bound	Upper Bound
Age	< 29 Years	30 - 39 Years	.000	-19.9700	-6.9320
		> 40 Years	.032	-23.5428	-.8536
	30 - 39 Years	< 29 Years	.000	6.9320	19.9700
		> 40 Years	.968	-10.9709	13.4764
	> 40 Years	< 29 Years	.032	.8536	23.5428
		30 - 39 Years	.968	-13.4764	10.9709
Experience	< 1 Year	1 - 5 Years	.000	-26.5557	-14.4209
		> 5 Years	.000	-46.0903	-32.8112
	1 - 5 Years	< 1 Year	.000	14.4209	26.5557
		> 5 Years	.000	-23.4834	-14.4415
	> 5 Years	< 1 Year	.000	32.8112	46.0903
		1 - 5 Years	.000	14.4415	23.4834
Level of education	Pharm. D.	B. Pharm	.201	-23.0692	3.1219
		Masters (M. Phil / M.S)	.166	-11.8839	1.3243
		Clinical / community / hospital pharmacy certification	.000	-35.3204	-16.0158
	B. Pharm	Pharm. D.	.201	-3.1219	23.0692
		Masters (M. Phil / M.S)	.808	-8.9232	18.3110
		Clinical / community / hospital pharmacy certification	.043	-31.0235	-.3654
	Masters (M. Phil / M.S)	Pharm. D.	.166	-1.3243	11.8839
		B. Pharm	.808	-18.3110	8.9232

	Clinical / community / hospital pharmacy certification	.000	-30.7372	-10.0395
Clinical / community / hospital pharmacy certification	Pharm. D.	.000	16.0158	35.3204
	B. Pharm	.043	.3654	31.0235
	Masters (M. Phil / M.S)	.000	10.0395	30.7372

Table 6: Regression model fit between years of experience after graduation and percentage knowledge of the pharmacist

Regression Model	Unstandardized Coefficients		Standardized Coefficients	t	Sig.
	B	Std. Error	Beta		
(Constant)	37.844	1.550		24.423	.000
Experience	3.773	.285	.714	13.243	.000

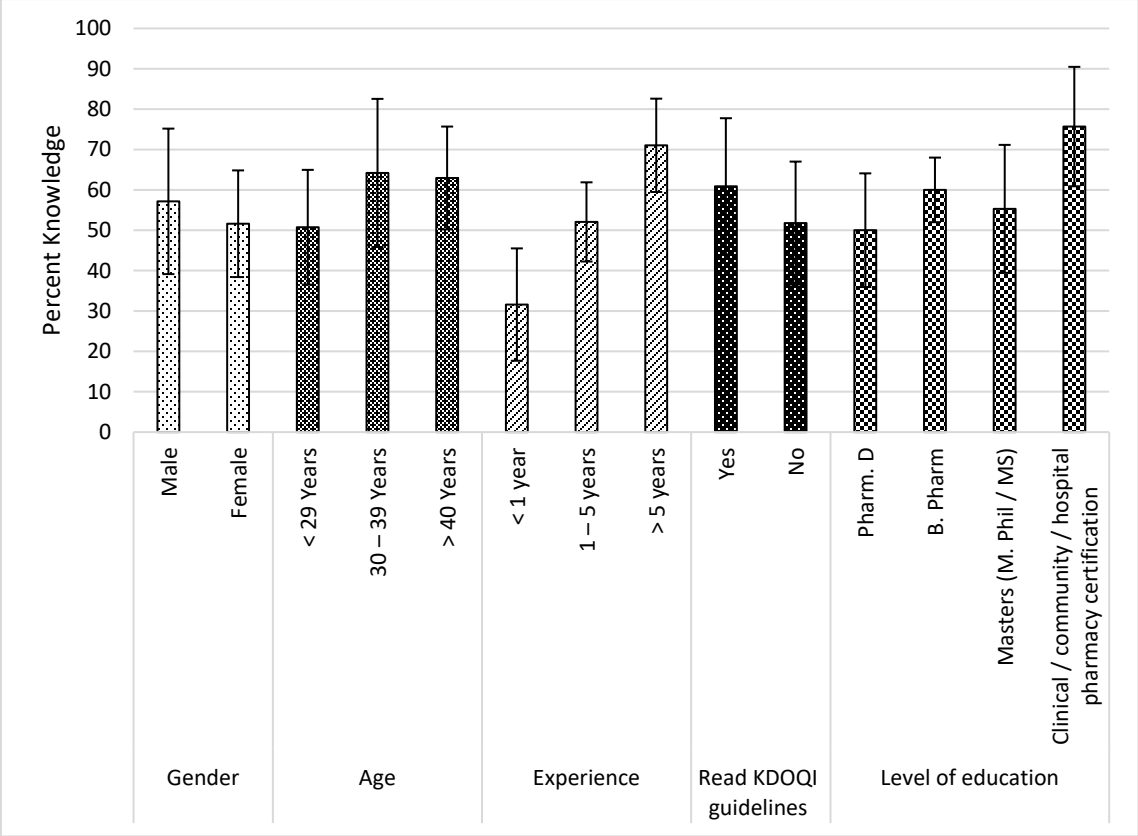

Figure 1: Comparison of mean knowledge of pharmacist among various variables