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Nurse-led intervention on knowledge and awareness regarding chronic kidney disease among hypertensive and/or diabetic patients: A quasi-experimental study

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ABSTRACT

Background: Diabetes and hypertension are the leading causes of chronic kidney disease (CKD) worldwide, and adequate awareness is crucial for its prevention and early detection among high-risk populations.

Objective: To evaluate the effectiveness of a nurse-led educational program through a booklet on the awareness and knowledge of CKD among hypertensive and/or diabetic patients.

Methods: A pre-test and post-test control group design was used with a convenient sample of 90 patients, equally divided into the experimental and control groups, i.e., 45 in each. Awareness-knowledge was assessed using a validated self-structured questionnaire. The pretest was conducted in both groups, and the experimental group received a 25–30-minute education intervention. Post-test assessment was conducted after one month in both groups.

Results: The mean pre-test knowledge scores of patients in the experimental and control groups were 18.04± 6.47 and 17.42± 6.37, respectively. In the post-test, there was a significant increase in the knowledge score of patients in the experimental group (33.96± 4.59) compared to the control group (18.80± 5.55; p=0.001). Awareness of CKD was significantly associated with religion (p =0.016), monthly income (p = 0.02) and duration of diabetes (p value= 0.04). In regression analysis, being widow/separated and earning under 10,000 INR per month were independently associated to lower knowledge scores, while education beyond high school was an independent positive predictor.

Conclusion: Nurse-led educational programs effectively enhance CKD knowledge, support self-management, and help prevent disease-related complications among Hypertensive and/or diabetic patients.

Keywords: Chronic kidney disease, Diabetes, Hypertension, Knowledge, Nurse-led educational program.

INTRODUCTION

Chronic kidney disease (CKD) is an irreversible, progressive condition and a major global health burden, affecting nearly 1 in 10 individuals [1,2]. In 2017, CKD caused 1.2 million deaths, ranking as the 12th leading cause of death worldwide, with projections indicating it may rise to the 5th position by 2040 [3]. Alarmingly, about 90% of adults with CKD and 1 in 3 adults with severe CKD remain unaware of their condition, leading to delayed diagnosis and treatment and also increasing the burden on caregivers with a decrease in the quality of life of patients [4,5]. A systematic review reported that the prevalence of poor kidney function varies widely from 2.9% to 56% and confirmed CKD varied from 4.4% to 17.1% [6]. Risk factors differ across regions. In developed countries, ageing, diabetes, hypertension, cardiovascular diseases and obesity predominates, whereas in developing countries, infections, glomerular and tubulointerstitial diseases, and exposure to drugs and toxins are common causes [7–9]. Diabetes Mellitus (DM) and Hypertension (HTN) are the main causes of CKD worldwide [10–13].

Hypertension acts both as a risk factor by accelerating CKD progression and as a comorbidity contributing to cardiovascular mortality in CKD patients [12,14,15]. In India, a pilot study reported 70% of patients having advanced CKD stage 4-5, and Diabetes being the most common CKD, out of which 97% of cases were having type 2 diabetes [13,16]. Low awareness among high-risk populations contributes significantly to delayed diagnosis and poor outcomes [17–19]. Therefore, early risk stratification, screening, awareness, and education are essential strategies to slow CKD progression [20–22]. The studies have reported low awareness and knowledge regarding CKD among the high-risk population [17,23,24]. Global initiatives such as the National Health and Nutrition Examination Surveys and Kidney Early Evaluation Program for CKD emphasize early detection [25,26]. Health education combined with early screening empowers high-risk individuals to adopt healthy behaviors and effective self-management practices [25,27,28].

Objective

The objective of the study was to assess the awareness and knowledge of CKD among hypertensive and/or diabetic patients and to assess the effectiveness of an education booklet on knowledge of CKD among hypertensive and/or diabetic patients.

MATERIAL AND METHODS

The research hypothesised that a nurse-led education program would bring significant change in the knowledge of CKD among hypertensive and/or diabetic patients. The non-equivalent control group pre-post-test quasi-experimental design was employed for participants. The non-random, time-based allocation was adopted as a part of a quasi-experimental study design to minimise contamination between groups. Participants attending the cardiology OPD on Monday and endocrinology OPD on Tuesday were assigned to the control group, whereas those attending the cardiology OPD on Friday and endocrinology OPD on Thursday were assigned in experimental group. The data was collected from July 2018 to December 2018. A sample size of 44 was calculated in each group, based on the pilot study results. 90 patients were enrolled (45 per group), assuming a 90 % power, 5% alpha error, and 10% attrition. The pre-test was administered to the participants in both the control and the experimental group which required approximately 10-15 minutes to complete. Data collection included demographic and clinical variables. The awareness regarding CKD was assessed by asking two questions of a yes/no type. First question (AQ1) enquired whether the patients were aware of their risk of developing CKD due to HTN and DM or not. Second question (AQ2) enquired whether they were informed by any health professional or not. There were 43 questions regarding knowledge of CKD, out of which 35 were yes/no type, and 8 were multiple choice questions. Each correct response was scored as ‘1’, and each incorrect response was scored as ‘0’. Knowledge level was categorized into poor knowledge (<18), average knowledge (18-26), good knowledge (26-35), and very good knowledge (>35). Content Validity

was established by three nursing experts and two nephrologists. Reliability of the tools was assessed using the test-retest method (r=0.79) during pilot study on similar population. The tool was translated into Hindi, and reverse translation was done in English.

Inclusion Criteria

The participants aged above 18 years, diagnosed with HTN and/or DM for ≥ 6 months and visiting the cardiology and endocrinology outpatient department (OPD) for regular follow-up at a tertiary care hospital.

Exclusion Criteria

The participants with cognitive impairment and renal disease were excluded from the study.

Intervention

A registered nurse pursuing her postgraduate degree in nursing developed the education booklet under the guidance of study guides and experts.

The education booklet included information regarding kidneys, its functions, about CKD, its risk factors, signs and symptoms, preventive measures for diabetic and/or hypertensive patients, diagnostic investigation for CKD, its complications and the management**.** The education was given once to the participants of experimental group visiting the cardiology OPD (Friday) and endocrinology OPD (Thursday) for 25-30 minutes.

The post-test was carried out one month after the intervention in both the control and the experimental group. There was no loss to follow up and the data of all 45 participants in both groups were analysed.

Figure 1 illustrates the data collection process, including participant enrolment, group allocation to final analysis.

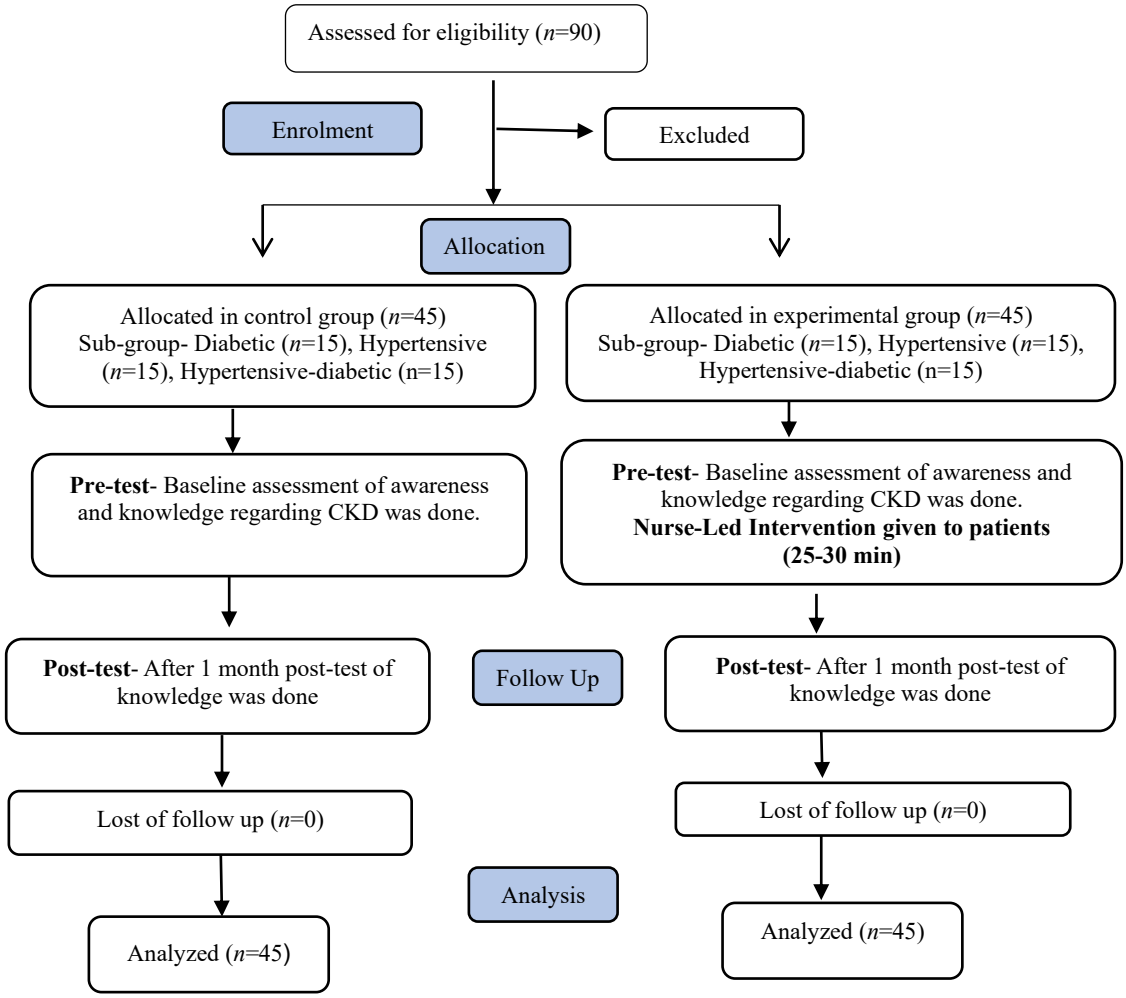

Figure 1. *Flowchart of participants.*

Local Ethics Committee approval and consent to participate

The study was approved by the institute's ethics committee for postgraduate research, AIIMS, New Delhi, Ref. No. IECPG-98/21.03.2018, and the study was approved on March 21, 2018. Eligible patients were informed, and written informed consent was taken; they were reassured of their confidentiality and autonomy. This study was conducted in accordance with the Declaration of Helsinki.

Statistical Analysis

STATA 14.0 was used for statistical analysis. The normal distribution of data was assessed using the

Shapiro-Wilk Test. The reliability of the tool was assessed using the test-retest method. The degree of stability over time was evaluated using Pearson's correlation coefficient (r), r > 0.7 was considered as a good correlation. Categorical variables were analysed using the Chi-square test and Fisher's exact test. Continuous variables following a normal distribution were analysed by the *t*-test; an unpaired t-test was used to compare the data between the control and experimental group, while a paired t-test was used to compare pre-test vs post-test data within the groups. The Wilcoxon rank-sum test was used to analyse data which was not distributed normally. Anova and Kruskal-Walli's rank test was used to assess the relationship of pre-test knowledge score with categorical variables, and Spearman's correlation coefficient was used to investigate the potential relationship between pre-test knowledge score with clinical variables. Univariable and stepwise multiple linear regression for calculating unadjusted and adjusted beta coefficients with 95% class interval were performed to find the independent association factors of knowledge. Categorical variables were included using dummy coding where one category serving as the reference group and assigned a value 0 like marital status (reference: unmarried), geographical region (reference: rural), educational level (reference: no formal education) and monthly income (reference: ≥40,000 INR) while the other categories converted into binary dummy variable (1 if present, 0 if absent). The level of significance was at *p*-value < 0.05.

RESULTS

The data were checked for homogeneity and were found comparable ($p>0.05$). Table 1 reports the demographic and clinical variable distribution of patients among the experimental and control groups. More than half (64 %) of patients in the experimental group and (67%) patients in the control group, were aware about the risk of developing kidney disease due to HTN and/or DM (AQ1) and only 42% in experimental group and 36 % in the control group got informed by any health care professional about their risk of developing CKD (AQ2).

Variables	Experimental Group (n=45)	Control Group (n=45)	*p*-value (test)
Age (years)			
Mean ± SD (Range)	51.71±13.71 (24-78)	51.84±11.51 (18-66)	0.96 (U)
	n (%)		
Gender			
Male	26 (58)	26 (58)	0.99 (C)
Female	19 (42)	19 (42)	
Marital status			
Unmarried	3 (7)	2 (4)	0.99 (F)
Married	42 (93)	39 (95.5)	
Occupation			
Government Job	10 (22)	7 (16)	
Private Job	20 (45)	21 (47)	0.7 (F)
Health Professional	1 (2)	0 (0)	
Unemployed	14 (31)	17 (38)	
Residence			
Rural	12 (27)	9 (20)	0.46 (C)
Urban	33 (73)	36 (80)	
Education			
Informal	10 (22)	10 (22)	
Primary	10 (22)	12 (27)	0.50 (C)
High school	12 (27)	16 (36)	
Above High school	13 (29)	7 (16)	
Source of health education			
Hospital	23 (51)	24 (53)	
Health Education	4 (9)	2 (4)	0.80 (F)
Program	18 (40)	19 (42)	
Other			
Monthly income (Rs.)			
>40,000	4 (9)	2 (4)	
30,000-40,000	10 (22)	8 (18)	
20,000-30,000	17 (38)	17 (38)	0.80 (F)
10,000-20,000	10 (22)	14 (31)	
<10,000	4 (9)	4 (9)	
Albuminuria §			
Nil	14(66.7)	15(65.2)	
Trace	3(14.3)	7(30.4)	0.22 (F)
>1	4(19.1)	1(4.4)	
Clinical Variables	**Median (Range)**		
Duration of diabetes	6.5(1-25)	7(1-30)	0.72 (W)
Duration of hypertension	6(1-25)	5.5(1-35)	0.74 (W)
Serum Creatinine(mg/dl)	0.9 (0.5-2)	0.8 (0.4-1.3)	0.02 (U)
GFR (1.73ml/min/m2)	86 (32-208)	94 (41-218)	0.12 (U)

Note: § Albuminuria report of only 21 patients in the experimental group and 23 patients in the control group was available. U (Unpaired T-test), C (Chi-Square Test), F (Fisher's Exact Test), W (Wilcoxon rank-sum Test)

Table 1. *Distribution of demographic and clinical variables of patients of the experimental and control groups*.

The knowledge level assessed at baseline showed that 44.4% patients in the experimental and 51.1% in control group had poor knowledge, 44.4% in the experimental and 37.7% in the control

group had average knowledge, 9% patients in the experimental and 11% in the control group had good knowledge; however, only 2.2% patients in the experimental group had very good knowledge, and none in the control group had very good knowledge. Table 2 showed that at baseline, both groups were similar in knowledge level and the nurse-led education program was effective in improving knowledge of CKD among hypertensive and/or diabetic patients.

Groups	**Pre-test Score Mean± SD (Min-Max)**	**Post-test Score Mean± SD (Min-Max)**	***p*-value (test)**
Experimental group (n=45)	18.04 ± 6.47 (4-35)	33.96 ± 4.59 (21-43)	0.001* (P)
Control group (n=45)	17.42 ± 6.37 (3-27)	18.80 ± 5.55 (9-30)	0.0018* (P)
p-value	0.65 (U)	0.001* (U)	

Note*:* * (significant test), U (Unpaired T-test), P (Paired T-test).

Table 2. *Comparison between the knowledge score of the experimental and control groups*

Table 3 shows that after the nurse-led educational program, in the post-test, the experimental groups showed a greater improvement in knowledge scores (diabetics p = 0.001, hypertensives p = 0.001, and hypertensive-diabetics p = 0.001) compared to the control group (diabetics p = 0.17, hypertensives p = 0.12, and hypertensive-diabetics p = 0.10), further emphasizing the effectiveness of the intervention even at the subgroup level.

Knowledge score		**Experimental group (n=45)**	**Control group (n=45)**
Diabetic (n=15)	Pre-test score	17.40±4.50	16.66±5.99
	Post-test score	33.80±2.95	18.13±4.43
p-value (test)		0.001* (P)	0.17 (P)
Hypertensive (n=15)	Pre-test score	18.66±6.87	16.93±7.45
	Post-test score	34.20±5.64	17.93±6.09
p-value (test)		0.001* (P)	0.12 (P)
Diabetic and hypertensive (n=15)	Pre-test score	18.06±7.95	18.66±5.77
	Post-test score	33.86±5.06	20.33±5.99
p-value (test)		0.001* (P)	0.10 (P)

Note*:* * (significant test), P (Paired T-test).

Table 3. *Comparison of knowledge score between sub-groups of experimental and control group.*

Table 4 reported the relationship between awareness and demographic variables. Patients with a higher monthly income (p = 0.02), hindu by religion (p = 0.01), showed greater awareness of the risk of chronic kidney disease.

Variables		AQ1			AQ2		
		NO n(%)	YES n(%)	p-value (test)	NO n(%)	YES n(%)	p-value (test)
Age(years)	Mean ± SD	55.35±12.38	49.89±12.39	0.05(U)	53.40±12.56	49.22±12.39	0.12(U)
Gender	Male	20 (64.5)	32 (54.2)	0.37(F)	32 (58.2)	20 (57.1)	0.96 (F)
	Female	11 (35.5)	27 (45.8)		23 (41.8)	15 (42.9)	
Religion	Hindu	29(93.6)	46 (78)	0.01* (F)	47 (85.5)	28 (80)	0.39(F)
	Muslim	0 (0)	10 (17)		4 (7.3)	6 (17.1)	
	Sikh	2 (6.4)	1(1.7)		2 (3.6)	1 (33.3)	
	Christian	0 (0)	2(3.4)		2 (3.6)	0 (0)	
Marital status	Unmarried	1 (3.2)	4 (12.9)	0.40(F)	3 (5.4)	2 (5.7)	0.99(F)
	Married	25 (80.6)	51 (86.4)		46 (83.6)	30 (85.7)	
	Widow/widowed	1 (3.2)	0 (0)		1 (1.8)	0 (0)	
	Separated	4 (12.9)	4 (12.9)		5 (9.1)	3 (8.6)	
Occupation	Government Job	6 (19.4)	11(18.6)	0.80(F)	12 (21.8)	5 (14.3)	0.42(F)
	Private Job	16(51.6)	25 (42.4)		26 (47.3)	15 (42.9)	
	Health Professional	0 (0)	1 (1.7)		0 (0)	1 (2.9)	
	Unemployed	9 (29.0)	22 (37.3)		17 (30.9)	14 (40)	
Geographical region	Urban	8 (25.8)	13 (22)	0.68(C)	14 (25.5)	7 (20)	0.55(C)
	Rural	23 (74.2)	46 (78)		41 (74.5)	28 (80)	
Education	Informal Education	9 (29.0)	11 (35.5)	0.07(F)	12 (21.8)	8 (22.9)	0.52(F)
	Primary Education	11(35.5)	11(35.5)		13 (23.6)	9 (25.7)	
	High school	5 (16.1)	23 (39)		15(27.27)	13 (37.1)	
	>High school	6 (19.4)	14 (23.7)		15(27.27)	5 (14.3)	
Source of health education	Hospital	17 (54.8)	30 (50.9)	0.93(F)	26(47.27)	21 (60)	0.31(F)
	Health Edu. Prog.	2 (6.5)	4 (6.8)		3(5.45)	3 (8.6)	
	Other (specify)	12 (38.7)	25 (42.4)		26(47.27)	11(31.4)	
Monthly income(Rs.)	>40,000	1 (3.2)	5 (8.5)	0.02*(F)	1(1.82)	5 (14.3)	0.05(F)
	30,000-40,000	5 (16.1)	13 (22.0)		12(21.82)	6 (17.1)	
	20,000-30,000	10 (32.3)	24 (40.7)		18(32.73)	16 (45.7)	
	10,000-20,000	8 (25.8)	16 (27.1)		17(30.91)	7 (20)	
	<10,000	7 (22.6)	1 (1.7)		7(12.73)	1 (2.9)	

Note: * (significant test), (U) t-test, (C) Chi square, (F) generalised Fisher's Exact Test, (W) Wilcoxon test.

Table 4. *Relationship between Awareness and Demographic Variables*.

Table 5 reported the relationship between awareness and clinical variables and found that patients

having diabetes for a longer period of time had higher awareness of CKD risk (p=0.04).

Clinical Variables		AQ1			AQ2		
		NO	YES	p-value	NO	YES	p-value (test)
Duration of diabetes (Median)		4	8.5	0.04*(W)	5.5	9.5	0.06(W)
Duration of hypertension (Median)		6	6	0.38(W)	6	5	0.74(W)
Albuminuria	Nil	12	17	0.18 (F)	19	10	0.46 (F)
	Trace	1	9		5	5	
	>1	1	4		2	3	
Serum Creatinine(mg/dl)		0.9	0.8	0.13(W)	0.87	0.9	0.64(W)
GFR (1.73ml/min/m2)		86	95	0.18(U)			0.90(U)

Note: * (significant test), U (Unpaired t-test), C (Chi-square), F (generalised Fisher's Exact Test), W (Wilcoxon test).

Table 5. *Relationship between Awareness and Clinical Variables*

Table 6 showed the relationships between demographic variables and knowledge score. Patients living in urban areas (p=0.03), unmarried (p=0.008), with more than high school education (p=0.0008), and a monthly income of 30-40 thousand rupees (p=0.01) had higher knowledge than others.

Demographic Variables	Knowledge Score (Mean ± SD)	p-value (test)
Gender		
Male	17.76 ± 6.83	0.95 (U)
Female	17.68 ± 5.82	
Religion		
Hindu	17.45 ± 6.65	0.35 (U)
Muslim	19.13 ± 4.82	
Marital status		
Unmarried	24.60 ± 3.20	
Married	17.76 ± 6.15	0.008* (K)
Widow/widowed/Separated	13.66 ± 6.83	
Occupation		
Government Job/Health Professional	19.44 ± 8.51	
Private Job	17.68 ± 6.02	0.38 (A)
Unemployed	16.80 ± 5.39	
Geographical region		
Rural	15.09 ± 6.96	0.03* (U)
Urban	18.53 ± 6.03	
Education		
Informal Education	13.90 ± 4.96	
Primary Education	16.18 ± 5.43	0.0008* (A)
High school	19.32 ± 5.35	

>High school	21.05 ± 7.74	
Source of health education		
Hospital	17.10 ± 6.68	
Health Edu. Prog.	21.66 ± 5.04	0.23 (K)
Other (specify)	17.89 ± 6.10	
Monthly income (INR)		
>40,000	19.67 ± 9.69	
30,000-40,000	20.77 ± 6.50	
20,000-30,000	17.20 ± 5.79	0.01* (K)
10,000-20,000	17.79 ± 5.04	
<10,000	11.50 ± 5.90	
Albuminuria		
Nil	17.10 ± 4.95	
Trace	19.50 ± 4.57	0.47 (K)
> +1	19.20 ± 9.17	

Note: * (significant test), U (Unpaired T-test), A (Anova), K (Kruskal-Wallis rank test).

Table 6. *Relationship of pre-test knowledge score with selected variables.*

In Table 7, no correlation was found between knowledge and clinical variables (age, duration of diabetes, duration of hypertension, serum creatinine(mg/dl), and GFR (1.73ml/min/m2).

Clinical Variables	**Spearman's Coefficient (rho)**	**p-value (test)**
knowledge / Age	-0.165	0.12 (S)
knowledge / Duration of diabetes	0.049	0.70 (S)
knowledge / Duration of hypertension	0.002	0.99 (S)
knowledge / Serum Creatinine(mg/dl)	-0.067	0.52 (S)
knowledge / GFR (1.73ml/min/m2)	0.08	0.41 (S)

Table 7. *Correlation analysis between Knowledge score and Clinical Variables.*

In Table 8, the variables that were statistically significant in bivariate analysis (Table 6) were included in univariable and multiple linear regression analysis. In the adjusted stepwise multiple linear regression model, being widowed/separated and having a monthly income of less than 10,000 INR remained independently associated with lower knowledge scores, while education beyond high school emerged as an independent positive predictor. Other variables did not retain statistical significance after adjustment. The results were interpreted as the knowledge among widowed/separated patients was less as compared to unmarried patients.

Variables	Unadjusted beta coefficient with 95% CI	*p*-value	Step-wise linear regression	*p*-value
Marital status				
Married	-6.83 (-12.4, -1.2)	0.018	-5.11 (-10.2, 0.04)	0.05
Widow/widowed/Separated	-10.93 (-17.7, -4.2)	0.002	-7.90 (-14.2, -1.6)	0.015
Residence			_____	_____
Urban	3.44 (0.3, 6.5)	0.03		
Education				
Primary	2.28 (-1.3, 5.9)	0.21	1.93 (-1.5, 5.4)	0.26
High school	5.42 (1.9, 8.8)	0.002	4.48 (1.2, 7.8)	0.008
>High school	7.15 (3.4, 10.8)	0.001	6.06 (2.5, 9.6)	0.001
Monthly income				
30,000-40,000	1.11 (-4.5, 6.7)	0.69	-0.44 (-5.6, 4.7)	0.86
20,000-30,000	-2.46 (-7.8, 2.8)	0.36	-3.06 (-7.9, 1.8)	0.21
10,000-20,000	-1.87 (-7.3, 3.6)	0.50	-2.20 (-7.2, 2.8)	0.38
<10,000	-8.16 (-14.6, -1.6)	0.01	-7.79 (-13.7, -1.8)	0.011

Table 8. *Regression analysis of knowledge with selected variables.*

A significant increase in knowledge was found in patients who had education up to high school and beyond high school, respectively, as compared to patients who had informal education. There was a significant decrease in knowledge score in patients who had a monthly income of less than 10,000 rupees compared to patients who had monthly income more than 40,000 rupees.

DISCUSSION

In the present study, 65.5% were aware of the risk of kidney disease in hypertensive and/or diabetic patients. Similarly, 60.6% respondents recognised diabetes as a risk factor for renal disease [29]. In the present study, 44.4% in the experimental and 51.1% in the control group had poor knowledge, 44.4% in the experimental and 37.7 in the control had average knowledge, 9% in experimental and 11.1% in control group had good knowledge, 2.2% in experimental and none in control had very good knowledge. Nearly the same, 55% of participants had average knowledge regarding renal disease [30]. In our study the knowledge score was significantly improved pre-test 18.04 ± 6.47 to post-test 33.96±4.59 at p=0.001in the experimental group similarly there was significant increase in knowledge of CKD was reported ($p < 0.05$) [31,32]. Knowledge was higher in unmarried subjects, living in an urban region, having an education up to or more than high school, and having a monthly

income of more than 30,000 rupees. Similarly, patients with higher education had more knowledge of renal disease than those patients who had lower education (p=0.001) [10,24,34]. Patients having lower income <$ 2000 [Odds ratio (*OR*) 0.41, 95% class interval (CI)] and lower education (*OR* 0.33. 95% CI) had poor knowledge score of CKD [30,35].

The post-test was taken after one month of the intervention, rather than immediately, which could affect the novelty effect, causing a threat to external validity and no attrition at follow-up was a strength of the study.

Limitations

Awareness was assessed using two questions and most items in the knowledge questionnaire were closed-ended in nature and may overestimate the knowledge or limit the critical ability of critical reasoning related to kidney health.

The study didn't evaluate the gain translated into sustained behavioural changes, treatment adherence, or improved clinical outcome. Additionally, the single-centre, quasi-experimental design with convenient sampling and lack of randomization may impact the external validity, limit the causal inference and generalizability

CONCLUSION

In conclusion, the nurse-led intervention significantly improved the CKD knowledge score among hypertensive and/or diabetic patients. Appropriate information empowers hypertensive and/or diabetic patients to manage better blood pressure, blood sugar, and lifestyle changes, potentially reducing the risk and progression of kidney disease. Multicentric studies are needed, along with structured nurse-led education and counselling programs for these patients, and longitudinal research to comprehensively evaluate kidney health maintenance.

List of abbreviations

CKD: Chronic Kidney Disease

HTN: Hypertension

DM: Diabetes Mellitus

OPD: Outpatient Department

AQ1: Awareness Question 1

AQ2: Awareness Question 2

AIIMS: All India Institute of Medical Sciences

IECPG: Institute Ethics Committee for Postgraduate

STATA: Statistics and Data Analysis software

GFR: Glomerular Filtration Rate

OR: Odds Ratio

CI: Class Interval

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Conflicts of interest

The authors declare that there is no conflict of interest.

Author contributions

Conceptualisation: JJ, MAKR, RN, VPJ, methodology: JJ, MAKR, RN, VPJ, Software: JJ, Data Collection: JJ, MAKR, RN, VPJ, Data analysis and interpretation: JJ, MAKR, writing- original draft preparation: JJ, MAKR, writing-review and editing: JJ, MAKR, supervision: MAKR, RN, VPN

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