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ORIGINAL ARTICLE

Prevalence of chronic kidney disease and related factors among diabetic patients in primary care, Bangkok, Thailand

Suthee Saritsiri[1,2*] Aroonsri Mongkolchati[1] Thunwadee Suksaroj[1]

[1] ASEAN Institute for Health Development, Mahidol University , Nakhon Pathom, Thailand
[2]The 67th Public Health Center, Health Department, Bangkok Metropolitan Administration, Bangkok, Thailand

Corresponding author: *Suthee Saritsiri* ***E-mail****: big_bossboom@hotmail.com*

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ABSTRACT

The purpose of this study was to define the prevalence and related factors of chronic kidney disease (CKD) among diabetes patients who received service from 1 October, 2017 to 30 September, 2018, at the 67th Public Health Center, Bangkok, Thailand, in order to understand the current situation in primary care, and to lead the development of service policy to slow CKD progression in the future. The data were collected by questionnaires and by reviewing medical records, including the urine albumin-creatinine ratio (UACR) and estimated glomerular filtration rate (eGFR) to evaluate renal function. The diagnosis of CKD followed the 2012 KDIGO Clinical Practice Guideline. The data were analysed using number, percentage, mean $\pm$ S.D., chi-square test and multiple logistic regression. The results indicated that out of 442 diabetic patients, 418 were enrolled. The mean age was 62.7$\pm$10.1 years. The prevalence of stage 1, 2, 3a, 3b, 4 and 5 (non-dialysis) CKD were 14.8%, 11.2%, 9.3%, 6.7%, 0.5% and 0.2%, respectively. About 32.3% of cases had UACR > 30 mg/g creatinine (26.1% microalbuminuria and 6.2% macroalbuminuria). Factors related with CKD significantly ($p < 0.05$) included age > 70 years, financial support by the civil servant medical beneficiary scheme, duration with diabetes > 5 years, smoking, haemoglobin < 13 g/dl, serum triglyceride > 150 mg/dl, HDL $\leq$ 40 mg/dl in male or $\leq$ 50 mg/dl in female), and receiving antihypertensive drugs. However, diabetes patients who received angiotensin-converting enzyme inhibitors (ACEI) or angiotensin-receptor blockers (ARBs) decreased their risk of CKD. This study showed high prevalence of CKD among diabetes patients. Early identification and proper management in primary care are mandatory to delay kidney disease progression.

Key words: chronic kidney disease, diabetes, prevalence, related factors

INTRODUCTION

Chronic Kidney Disease (CKD) is an important non-communicable health problem.[1] There are more than 8 million Thai who had CKD. The estimated incidence rate of end-stage renal disease in the Thai population is 300 per million; meanwhile, there were about 14,060 new cases in 2005.[2] In 2008, the Thai SEEK study found that the prevalence of CKD among people aged 18 or older was 17.5%.[3] The prevalence of renal replacement therapy has been rising rapidly from 30 per million population in 1997 to 1,200 per million population in 2014[4]; diabetes and hypertension are the most common causes.[5-7] In 2006, data from the Thailand Diabetes Registry (TDR) Project in tertiary care medical indicated that 44% of people with diabetes mellitus (DM) who received care suffered from kidney disease.[8] In 2011, DM was the leading cause of kidney failure, accounting for 44% of new cases in the United States.[9] In addition to the progression to end-stage renal disease (ESRD), DM also poses a risk factor of cardiovascular complication.[10] Moreover, when patients with CKD have a progressive decline of kidney function to ESRD, the cost of renal replacement therapy is a significant burden on global healthcare resources, and only a tiny proportion of nations have sufficiently robust economies to challenge this disease.[11] The Ministry of Public Health has pronounced a national mandate requiring all public hospitals in Thailand to screen Thai citizens above 35 years of age for diabetes and hypertension; moreover, those who have DM should also be screened for CKD. Treatment to prevent diabetic kidney disease should begin early before kidney damage develops. Systematic screening for CKD among patients with DM appears to be a necessary practice in primary healthcare service.

In Bangkok, there are primary care services such as Public Health Centres (PHCs) set up across 50 districts. There are 68 PHCs scattered around the city, providing primary healthcare services to low and middle-income residents. Most doctors work as general practitioners. The screening of CKD by estimated glomerular filtration rate (eGFR) was used only to refer patients to see the nephrologist at the hospital but not staged in primary care. The overall prevalence of CKD in Public Health Centres is unknown and is still not staged for CKD following the Kidney Disease Outcomes Quality Initiative (KDOQI) 2012. Therefore, the treatment for diabetes patients may not be sufficient to prevent or slow the progression of CKD. The purpose of this study was to define the prevalence and related factors of chronic kidney disease (CKD) among diabetes patients receiving care at the 67th PHC in Bangkok, in order to lead the development of service policy to slow CKD progression in the future.

METHODS

Study design and population

The descriptive study was used to define the prevalence of CKD and related factors among diabetes patients. The target population was patients with type 2 diabetes mellitus (T2DM) who attended to the DM clinic at the 67th PHC for more than one year and were registered as a diabetes patient on 1 October, 2017. In the fiscal year 2018, a total of 442 patients had received screening for CKD, followed by KDOQI 2012. The study protocol was approved by the BMA Human Resource Community and Research Ethics Committee (Approval No.2018/01), and Committee for Research Ethics (Social Services), Faculty of Social Sciences and Humanities, Mahidol University, Bangkok, Thailand (Approval No.2018/269.2011). This study was conducted at the 67th PHC from 1 November, 2018 to 30 April, 2019. The data were collected from the medical

records of patients who had type 2 diabetes mellitus (T2DM) receiving care at the 67th PHC from 1 October, 2017 to 30 September, 2018, and had received screening for CKD followed by KDOQI 2012, after receiving the permission and consent form from participants. The exclusion criteria were those whose required information could not be retrieved from the medical records.

Variables and procedure

The variables collected included sociodemographic factors (age, gender, marital status, occupation, educational level, income per month, and medical rights), patient factors (comorbidity, duration of having T2DM, body mass index, waist circumference, cigarette smoking, and alcohol consumption), the medication used (antidiabetic drug, antihypertensive drug and non-steroid anti-inflammatory (NSAIDs). For laboratory factors (fasting blood sugar, haemoglobin, glycosylated haemoglobin, triglyceride, HDL cholesterol, LDL cholesterol, uric acid, creatinine, eGFR and urine albumin-creatinine ratio from first-morning urine. Blood and urine samples were analysed standardised at Central Clinical Laboratory Centre, Department of Health, Bangkok Metropolitan Administration. Creatinine in blood and urine was analysed with the enzymatic method (Roche). Urine albumin was assayed with the immunoturbidimetric method using ALBT reagent. Microalbuminuria and macroalbuminuria were defined as UACR of $\geq$ 30 mg/g and > 300mg/g creatinine, respectively. The eGFR was calculated using the chronic kidney disease epidemiology collaboration (CKD-EPI) equation. The stages of CKD followed by the KDOQI 2012 criteria[12] were defined as follows: stage 1 (eGFR $\geq$ 90 ml/min/1.73m^2 and UACR $\geq$ 30 mg/g), stage 2 (eGFR 60-89 ml/min/1.73m^2 and UACR $\geq$ 30 mg/g), stage 3A (eGFR 45-59 ml/min/1.73m^2 regardless of UACR), stage 3B (eGFR 30-44 ml/min/1.73m^2 regardless of UACR), stage 4 (eGFR 15-29 ml/min/1.73m^2 regardless of UACR) and stage 5 (eGFR < 15 ml/min/1.73m^2 regardless of UACR).

Statistical analysis

Numerical and categorical data were expressed as mean $\pm$ standard deviation and frequency or percentage, respectively. Descriptive analysis of quantitative variables was made with measurement of central tendency and dispersion. The relationship between CKD and individual risk factors were analysed by using chi-square statistics and multiple logistic regression calculated adjusted odds ratio and 95% confidence interval. The *p*-value < 0.05 was considered statistically significant. Data analysis and processing were performed using the SPSS 24.0 statistical program for Windows.

RESULTS

Among the 442 cases eligible for enrollment, 24 were excluded because of incomplete information. The clinical characteristics of the remaining 418 cases are illustrated in **Table 1**. The mean age was 62.7$\pm$10.1 years; about 60% were older than 60 years. Female cases were more common than male. Hypertension and dyslipidemia were common comorbid diseases. The duration of diabetes was more than 5 years in the majority of cases. About 60% earned their livings as labourers, street vendors, small business owners, farmers or agricultural cookers. It is noticeable that about 20% of cases were housewives or unemployed. Having education at the primary school level and direct monthly income of less than 5,000 Baht (about 150 USD) was each found in 70% of cases. The

majority of cases were financially supported under the universal health coverage scheme of the National Health Security Office, which provided a reimbursement package for costs of annual blood check-up medications and hospitalisation .The BMI was 26.7±4.5 Kg/m^2. About 60% of cases had BMI higher than the normal limit, and about a quarter of the cases were obese. Similarly, about 80% of cases had a waist circumference more than normal limits Current smoking and drinking were found in 6% and 12%, respectively. The average numbers of anti-diabetic and anti-hypertensive drugs were 1.5±0.9 both. Drugs in the biguanides group and the renin-angiotensin blockage were most commonly prescribed for treatment of diabetes and hypertension, respectively. Up to 84% of cases did not regularly take nonsteroidal anti-inflammatory drugs (NSAIDs). Microalbuminuria and macroalbuminuria were detected in 26.1% and 6.2%, respectively. CKD at various stages was found in 42.8% of cases. This could be classified into stage 1 (14.8%), stage 2 (11.2%), stage 3A (9.3%), stage 3B (6.7%), stage 4 (0.5%) and stage 5 (0.2%). The cases were stratified by eGFR and albuminuria criteria as shown in **Table 2**. Clinical characteristics of diabetic patients with any degree of CKD, compared with diabetics with no CKD, are shown in **Table 3** significant difference ($p < 0.05$) in age, duration with diabetes, systolic blood pressure, haemoglobin, triglyceride, HDL cholesterol, uric acid, creatinine, eGFR, UACR, and the number of antihypertensive drugs. **Table 4** shows the significant factors related with CKD ($p < 0.05$) from the multiple logistic regression results included age ≥ 70 years, history of smoking, financial support by the civil servant medical beneficiary scheme, comorbidity with hypertension and received antihypertensive drugs, poor control HDL cholesterol (female ≤ 50 mg/dl or male ≤ 40 g/dl), poor control triglyceride ≥ 150 mg/dl, haemoglobin < 13 g/dl. The protective factors were duration with DM 5-10 years and receiving angiotensin-converting enzyme inhibitors (ACEI) or angiotensin receptor blockades (ARB).

Table 1 Demographic characteristics (N=418)

Characteristics	Number (%)
Age, years mean 62.7 ± 10.1	
< 60	156 (37%)
≥ 60	262 (63%)
Gender	
Female	272 (65%)
Male	146 (35%)
Occupation	
Labourer	116 (28%)
Unemployed	83 (20%)
Small business owner	79 (19%)
Farmers/ agriculture	70 (17%)
Civil servant	24 (6%)
Other	46 (11%)
Educational level	
Illiterate	25 (6%)
Primary school	284 (68%)

Characteristics	Number (%)
Secondary school	77 (18%)
Higher education	32 (8%)
Income (baht) per month	
≤ 5,000	290 (69%)
> 5,000	128 (31%)
Medical right	
Universal Coverage the 67th PHC	333 (80%)
Non-Universal Coverage	44 (11%)
Government or State Enterprise	20 (5%)
Social Security	10 (2%)
Other	11 (3%)
Comorbidity	
Hypertension	367 (88%)
Dyslipidemia	361 (86%)
Cardiovascular disease	7 (2%)
Duration of T2DM, years	
< 5	92 (22%)
5-10	214 (51%)
> 10	112 (27%)
Body Mass Index, kg/m² mean 26.7±4.5	
≤ 22.9	94 (22%)
23-24.9	67 (16%)
25-29.9	161 (39%)
Body Mass Index, kg/m² cont.	
≥ 30	96 (23%)
Waist circumference, cm	
F < 80, M < 90	77 (18%)
F ≥ 80, M ≥ 90	341 (82%)
Smoking habit	
Non-smoker	360 (86%)
Ex-smoker	32 (8%)
Current smoker	26 (6%)
Alcohol consumption	
Non-consumer	350 (84%)
Ex-consumer	20 (5%)
Current consumer	48 (11%)
Number of antidiabetic drug mean 1.5±0.9	
0	48 (12%)
1	169 (40%)
2	142 (34%)
≥ 3	59 (14%)
Insulin	25 (6%)
Sulfonylurea	186 (45%)
Biguanide	322 (77%)
Thiazolididione	42 (10%)

Characteristics	Number (%)
Number of antihypertensive drug mean 1.5±0.9	
0	59 (14%)
1	149 (36%)
2	146 (35%)
≥ 3	64 (15%)
Diuretic	23 (6%)
ACEI/ARB	318 (76%)
Calcium channel blocker	187 (45%)
Beta blocker	61 (15%)
Alpha blocker	9 (2%)
Use of Non steroidal anti-inflammatory drug	66 (16%)

Table 2 Distribution of patients with chronic kidney disease among diabetes patients. (N=418)

Stage	eGFR	Total			
	ml/min/1.73	N (%)	ACR < 30 mg/g	ACR 30-300	ACR > 300 mg/g
stage 1	≥ 90	62 (14.8%)	140	52	10
stage 2	60-89.9	47 (11.2%)	99	39	8
stage 3A	45-59.9	39 (9.3%)	24	13	2
stage 3B	30-44.9	28 (6.7%)	15	9	4
stage 4	15-29.9	2 (0.5%)	0	1	1
stage 5	<15	1 (0.2%)	0	0	1

eGFR = estimated glomerular filtration rate (ml/min/1.73 m^2). ACR = albumin-creatinine ratio (mg/g).

Table 3 Clinical characteristics of diabetic patients with any degree of CKD compared with diabetics with no CKD. (N=418)

	Total	No CKD eGFR > 60 ACR < 30	CKD 1[a] eGFR > 90 ACR ≥ 30	CKD 2 eGFR 89-60 ACR ≥ 30	CKD 3A eGFR 59-45	CKD 3B eGFR 44-30	CKD 4-5 eGFR < 30	
	N=418	**239 (57.2%)**	**62 (14.8%)**	**47 (11.2%)**	**39 (9.3%)**	**28 (6.7%)**	**3 (0.7%)**	
Age (yr)	62.7±10.1	60.6±8.8	58.3±9.2	66.9±8.7	71.3±9.8	69.6±11.3	72.3±10.1	**0.000**
Duration with DM (yr)	8.7±6.1	8.2±5.1	7.0±4.6	10.2±8.0	10.4±7.1	11.9±9.4	9.3±2.8	**0.013**
Body Mass Index (kg/m^2)	26.7±4.5	26.7± 4.5	28.0±5.1	26.6±4.6	25.4±3.6	25.4±4.7	26.6±1.3	0.163
Waist circumference (cm)	92.3±9.9	91.8±9.9	94.8±10.4	92.6±10.7	92.0±8.6	90.1±8.9	91.7±6.8	0.403
Systolic BP (mmHg)	130.1±8.5	128.8±8.7	130.2±7.1	131.5±6.9	132.8±9.7	134.2±7.6	138.1±3.6	**0.003**
Diastolic BP (mmHg)	73.2±6.7	73.2±7.0	74.6±7.3	72.7±5.7	72.9±5.3	71.0±5.7	68.4±7.2	0.190
FBS (mg/dl)	136.8±32.5	135.1±26.8	149.4±44.0	132.1±22.2	137.2±48.4	131.5±30.0	129.7±38.2	0.185
HbA1C (%)	7.2±1.2	7.1±1.1	7.5±1.5	7.2±1.0	7.1±1.3	7.0+1.3	6.9±0.7	0.582
Hb (g/dl)	13.0±1.6	13.2±1.50	13.0±1.6	13.0±1.7	13.0±1.8	11.9±1.5	10.4±0.8	**0.000**
Total cholesterol (mg/dl)	187.9±36.9	187.8±35.4	197.9±45.2	180.8±34.9	191.0±33.3	175.5±35.1	167.3±24.1	0.078
Triglyceride (mg/dl)	157.5±99.3	144.4±72.9	208.7±15.7	158.8±77.0	150.1±99.3	163.0±13.3	172.0±63.8	**0.043**
HDL cholesterol (mg/dl)	51.0±14.3	52.7±14.8	48.7±12.9	46.5±12.3	52.8±13.9	47.8±14.1	41.7±5.7	**0.014**
LDL cholesterol (	105.8±32.9	106.2±33.2	108.1±35.3	102.5±33.1	108.9±28.8	100.3±31.8	91.7±31.0	0.748
Uric acid (mg/dl)	5.5±1.4	5.2±1.3	5.3±1.4	5.7±1.3	6.2±1.2	6.7±1.4	8.8±0.9	**0.000**
Creatinine (mg/dl)	0.9±0.3	0.8±0.2	0.7±0.1	0.9±0.2	1.2±0.2	1.5±0.3	2.4±0.7	**0.000**
eGFR (ml/min/1.73m^2)	83.7±22.1	91.5±14.7	101.6±9.3	76.1±19.2	52.9±4.4	39.3±4.3	22.5±6.8	**0.000**
UACR (mg/g)	60.0±13.3	10.4±6.8	16.2±2.3	13.6±13.8	6.4±12.6	10.3±18.8	25.7±13.6	**0.000**
Number of antidiabetic drug	1.5±0.9	1.5±0.9	1.6±1.0	1.6±0.8	1.3±0.9	1.2±0.7	0.7±0.6	0.055
Number of antihypertensive drug	1.5±0.9	1.3±1.0	1.6±0.8	1.9±0.8	1.8±0.9	1.9±0.8	2.7±0.6	**0.000**

[a] CKD (1, 2, 3A, 3B, 4-5) different stages of CKD [b] P (ANOVA test). eGFR = estimated glomerular filtration rate. ACR = albumin - creatinine ratio. CKD = Chronic Kidney Disease. BMI = Body Mass Index. Hb = hemoglobin HbA1C = glycosylated hemoglobin. FBS = fasting blood sugar BP = Blood Pressure LDL cholesterol = Low Density Lipoprotein cholesterol. HDL cholesterol = High Density Lipoprotein cholesterol

Table 4 Assessing factors associated with CKD (N=418)

Factors	Total N (%) 418	No CKD 239 (57.2%)	CKD 179 (42.8%)	Crude OR OR (95% CI)	*p* value	Adjust OR OR (95% CI)	*p* value
Age (yr)							
< 60	156 (37.3%)	107 (68.6%)	49 (31.4%)	1.00	**0.000**	1.00	**0.028**
60-70	174 (41.6%)	104 (59.8%)	70 (40.2%)	1.47 (0.93 - 2.31)	0.096	1.15 (0.55 - 2.41)	0.716
> 70	88 (21.1%)	28 (31.8%)	60 (68.2%)	**4.68 (2.67 - 8.21)**	**0.000**	**2.86 (1.11 - 7.40)**	**0.030**
Gender							
Female	272 (65.1%)	167 (61.4%)	105 (38.6%)	1.00		1.00	
Male	146 (34.9%)	72 (49.3%)	74 (50.7%)	**1.64 (1.09 - 2.45)**	**0.018**	1.92 (0.97 - 3.80)	0.059
Income per month							
0-5,000 Baht	290 (69.4%)	158 (54.5%)	132 (45.5%)	1.00		1.00	
> 5,000 Baht	128 (30.6%)	81 (63.3%)	47 (36.7%)	0.70 (0.45 - 1.07)	0.095	0.89 (0.49 - 1.60)	0.686
Medical right							
UC 67	333 (79.7%)	187 (56.2%)	146 (43.8%)	1.00	0.168	1.00	**0.028**
Non UC	44 (10.5%)	30 (68.2%)	14 (31.8%)	0.60 (0.31 - 1.17)	0.132	0.42 (0.17 - 1.01)	0.053
Government	20 (4.8%)	10 (50%)	10 (50%)	1.28 (0.52 - 3.16)	0.591	**3.33 (1.02 - 10.89)**	**0.046**
Social Security	10 (2.4%)	8 (80%)	2 (20%)	0.32 (0.07 - 1.53)	0.154	0.61 (0.09 - 3.84)	0.602
Other	11 (2.6%)	4 (36.4%)	7 (63.6%)	2.24 (0.64 - 7.80)	0.205	3.59 (0.74 - 17.51)	0.114
Hypertension							
no	51 (12.2%)	38 (74.5%)	13 (25.5%)	1.00		1.00	
yes	367 (87.8%)	201 (54.8%)	166 (45.2%)	**2.41 (1.25 - 4.68)**	**0.009**	1.48 (0.59 - 3.71)	0.401
Cardiovascular							
no	411 (98.3%)	238 (57.9%)	173 (42.1%)	1.00		1.00	
yes	7 (1.7%)	1 (14.3%)	6 (85.7%)	8.25 (0.99 -69.19)	0.052	8.24 (0.52 - 130.22)	0.134
Duration with DM (yr)							
< 5	92 (22%)	46 (50%)	46 (50%)	1.00	**0.002**	1.00	**0.005**
5-10	214 (51.2%)	140 (65.4%)	74 (34.6%)	**0.53 (0.32 - 0.87)**	**0.012**	**0.44 (0.23 - 0.82)**	**0.010**
> 10	112 (26.8%)	53 (47.3%)	59 (52.7%)	1.11 (0.64 - 1.93)	0.703	0.97 (0.46 - 2.05)	0.928

Table 4 Assessing factors associated with CKD (N=418) (cont.)

Factors	Total N (%) 418	No CKD 239 (57.2%)	CKD 179 (42.8%)	Crude OR OR (95% CI)	*p* value	Adjust OR OR (95% CI)	*p* value
Smoking							
non-smoker	360 (86.1%)	215 (59.7%)	145 (40.3%)	1.00	**0.005**	1.00	**0.032**
ex-smoker	32 (7.7%)	9 (28.1%)	23 (71.9%)	**3.79 (1.70-8.42)**	**0.001**	**6.24 (1.59 - 24.45)**	**0.009**
current smoker	26 (6.2%)	15 (57.7%)	11 (42.3%)	1.09 (0.49-2.44)	0.839	1.41 (0.48 - 4.11)	0.533
Alcohol consumption							
non-consumer	350 (83.7%)	204 (58.3%)	146 (41.7%)	1.00	0.139	1.00	0.896
ex-consumer	20 (4.8%)	7 (35.0%)	13 (65.5%)	**2.60 (1.01 - 6.66)**	**0.048**	0.87 (0.18 - 4.29)	0.862
current consumer	48 (11.5%)	28 (58.3%)	20 (41.7%)	1.00 (0.54 - 1.84)	0.995	0.80 (0.32 - 2.01)	0.640
Fasting Blood Sugar (mg/dl)							
≤ 130	214 (51.2%)	117 (54.7%)	97 (45.3%)	1.00	**0.037**	1.00	0.241
131-180	174 (41.6%)	110 (63.2%)	64 (36.8%)	0.70 (0.47 - 1.06)	0.090	1.01 (0.57 - 1.77)	0.985
>180	30 (7.2%)	12 (40.0%)	18 (60.0%)	1.81 (0.83 - 3.94)	0.135	2.47 (0.81 - 7.53)	0.113
HbA1c (%)							
< 7	208 (49.8%)	118 (56.7%)	90 (43.3%)	1.00	0.351	1.00	0.111
7-7.5	90 (21.5%)	53 (58.9%)	37 (41.1%)	0.92 (0.55 - 1.51)	0.729	0.94 (0.48 - 1.83)	0.855
>7.5-8	43 (10.3%)	29 (67.4%)	14 (32.6%)	0.63 (0.32 - 1.27)	0.197	0.62 (0.24 -1.65)	0.341
> 8	77 (18.4%)	39 (50.6%)	38 (49.4%)	1.28 (0.76 - 2.16)	0.360	2.17 (0.95 - 4.96)	0.067
Hb (g/dl)							
≥ 13	212 (50.7%)	132 (62.3%)	80 (37.7%)	1.00		1.00	
< 13	206 (49.3%)	107 (51.9%)	99 (48.1%)	**1.53 (1.03 - 2.25)**	**0.033**	**2.27 (1.28 - 4.02)**	**0.005**
Triglyceride (mg/dl)							
< 150	247 (59.1%)	149 (60.3%)	98 (39.7%)	1.00		1.00	
≥ 150	171 (40.9%)	90 (52.6%)	81 (47.4%)	1.37 (0.92 - 2.03)	0.119	**1.75 (1.00 - 3.04)**	**0.049**

Table 4 Assessing factors associated with CKD (N=418) (cont.)

Factors	Total N (%) 418	No CKD 239 (57.2%)	CKD 179 (42.8%)	Crude OR OR (95% CI)	*p* value	Adjust OR OR (95% CI)	*p* value
HDL cholesterol (mg/dl)							
F > 50, M > 40	247 (59.1%)	154 (62.3%)	93 (37.7%)	1.00		1.00	
F ≤ 50, M ≤ 40	171 (40.9%)	85 (49.7%)	86 (50.3%)	**1.68 (1.13 - 2.49)**	**0.010**	**1.82 (1.06 - 3.14)**	**0.031**
Number of type of antidiabetic drug							
0	48 (11.5%)	22 (45.8%)	26 (54.2%)	1.00	0.240	1.00	0.351
1	169 (40.4%)	102 (60.4%)	67 (39.6%)	0.56 (0.29 - 1.06)	0.750	0.62 (0.27 - 1.41)	0.255
2	142 (34%)	78 (54.9%)	64 (45.1%)	0.69 (0.36 - 1.34)	0.276	0.69 (0.28 - 1.71)	0.424
≥ 3	59 (14.1%)	37 (62.7%)	22 (37.3%)	0.50 (0.23 - 1.09)	0.082	0.38 (0.12 - 1.20)	0.098
Number of type of antihypertensive drug							
0	59 (14.1%)	49 (83.1%)	10 (16.9%)	1.00	**0.000**	1 .00	**0.000**
1	149 (35.6%)	93 (62.4%)	56 (37.6%)	**2.95 (1.39 - 6.29)**	**0.005**	**9.30 (2.94 - 29.34)**	**0.000**
2	146 (34.9%)	66 (45.2%)	80 (54.8%)	**5.94 (2.79 -12.63)**	**0.000**	**21.18 (5.99 - 74.93)**	**0.000**
≥ 3	64 (15.3%)	31 (48.4%)	33 (51.6%)	**5.22 (2.26 -12.06)**	**0.000**	**18.66 (4.77 - 72.99)**	**0.000**
ACEI/ARB							
No	100 (23.9%)	65 (65%)	35 (35%)	1.00		1.00	
Yes	318 (76.1%)	174 (54.7%)	144 (45.3%)	1.54 (0.96 - 2.45)	0.071	**0.37 (0.16 - 0.83)**	**0.016**
Waist circumference (cm)							
F < 80, M < 90	77 (18.42%)	38 (49.4%)	39 (50.6%)	1.00		1.00	
F ≥ 80, M ≥ 90	341 (81.58%)	201 (58.9%)	140 (41.1%)	0.68 (0.41 - 1.12)	0.126	1.10 (0.56 - 2.17)	0.785

Table 4 Assessing factors associated with CKD (N=418) (cont.)

Factors	Total N (%) 418	No CKD 239 (57.2%)	CKD 179 (42.8%)	Crude OR OR (95% CI)	*p* value	Adjust OR OR (95% CI)	*p* value
Systolic BP (mmHg)							
< 130	202 (48.3%)	130 (64.4%)	72 (35.6%)	1.00	**0.039**	1.00	0.999
130-139	173 (41.4%)	88 (50.9%)	85 (49.1%)	**1.74 (1.14 - 2.61)**	**0.009**	0.96 (0.55 - 1.66)	0.881
140-149	38 (9.1%)	19 (50.0%)	19 (50.0%)	1.81 (0.90 - 3.63)	0.097	0.99 (0.37 - 2.63)	0.982
≥ 150	5 (1.2%)	2 (40.0%)	3 (60.0%)	2.71 (0.44 - 16.59)	0.281	0.96 (0.09 - 10.75)	0.974
Diastolic BP (mmHg)							
< 80	356 (85.2%)	199 (55.9%)	157 (44.1%)	1.00		1.00	
≥80	62 (14.8%)	40 (64.5%)	22 (35.5%)	0.70 (0.39 - 1.22)	0.207	0.84 (0.40 - 1.76)	0.637
Uric acid (mg/dl)							
≤ 7	358 (85.6%)	214 (59.8%)	144 (40.2%)	1.00		1.00	
> 7	60 (14.4%)	25 (41.7%)	35 (58.3%)	**2.08 (1.19 - 3.62)**	**0.010**	1.05 (0.51 - 2.13)	0.903
Educational level							
Illiterate	25 (6%)	16 (64%)	9 (36%)	1.00	0.580		
Primary school	284 (67.9%)	165 (58.1%)	119 (41.9%)	1.28 (0.55 - 3.00)	0.567		
Secondary school	77 (18.4%)	39 (50.6%)	38 (49.4%)	1.73 (0.68 - 4.39)	0.247		
Higher	32 (7.7%)	19 (59.4%)	13 (40.6%)	1.22 (0.41 - 3.58)	0.722		
Occupation							
Civil servant	24 (5.7%)	12 (50%)	12 (50%)	1.00	0.383		
Farmer/agriculture	70 (16.7%)	42 (60%)	28 (40%)	0.67 (0.26 - 1.69)	0.394		
Labourer	116 (27.8%)	66 (56.9%)	50 (43.1%)	0.76 (0.31 - 1.83)	0.537		

Table 4 Assessing factors associated with CKD (N=418) (cont.)

Factors	Total N (%) 418	No CKD 239 (57.2%)	CKD 179 (42.8%)	Crude OR OR (95% CI)	*p* value	Adjust OR OR (95% CI)	*p* value
Occupation							
Small business owners	79 (18.9%)	50 (63.3%)	29 (36.7%)	0.58 (0.23 - 1.46)	0.247		
Unemployed	83 (19.9%)	40 (48.2%)	43 (51.8%)	1.08 (0.43 - 2.67)	0.876		
Other	46 (11.0%)	29 (63.0%)	17 (37.0%)	0.59 (0.22 - 1.59)	0.295		
Dyslipidemia							
No	57 (13.6%)	32 (56.1%)	25 (43.9%)	1.00			
Yes	361 (86.4%)	207 (57.3%)	154 (42.7%)	0.95 (0.54 - 1.67)	0.865		
Body Mass Index (kg/m^2)							
≤ 22.9	94 (22.5%)	52 (55.3%)	42 (44.7%)	1.00	0.795		
23-24.9	69 (16.5%)	43 (62.3%)	26 (37.7%)	0.75 (0.40 - 1.41)	0.371		
25-29.9	159 (38.0%)	91 (57.2%)	68 (42.8%)	0.93 (0.55 - 1.55)	0.767		
≥ 30	96 (23.0%)	53 (55.2%)	43 (44.8%)	1.00 (0.57 - 1.78)	0.988		
Total cholesterol (mg/dl)							
< 200	279 (66.7%)	161 (57.7%)	118 (42.3%)	1.00			
≥ 200	139 (33.3%)	78 (56.1%)	61 (43.9%)	1.07 (0.71 - 1.61)	0.757		
LDL cholesterol (mg/dl)							
< 100	204 (48.8%)	117 (57.4%)	87 (42.6%)	1.00			
≥ 100	214 (51.2%)	122 (57.0%)	92 (43.0%)	1.01 (0.69 - 1.49)	0.943		
NSAIDs							
No	352 (84.2%)	204 (58.0%)	148 (42.0%)	1.00			
Yes	66 (15.8%)	35 (53.0%)	31 (47.0%)	1.22 (0.72 - 2.07)	0.459		

DISCUSSION

This study was the first to explore the prevalence of CKD among diabetic patients receiving care at a PHC in Bangkok. About 32.3 % of cases had UACR ≥ 30 mg/g creatinine and 42.8% of cases could be classified as having CKD at any stage. The result corresponded to the report from the US, and the Third National Health and Nutrition Examination Survey (NHANES III) which was 43.5%[13] and 42.3%[14] respectively higher than previous reports from similar setting; 27.9% and 34.6% from Spain[15,16], 20.8% and 26% from Ethiopia[17], but lower than the prevalence from Japan at 46%[18]. In 2006 in Thailand, approximately 67% of T2DM patients were affected by CKD stage 1 (23.2%), stage 2 (28.7%), stage 3 (37.3%), stages 4 (8.2%), and stage 5 (2.7%).[19] In 2008, the study of Surapong and Aphaphan[20] found that the prevalence of CKD stages 3–5 in T2DM patients at primary care units of Udon Thani province were 27.09% and 25.28%. In this study the prevalence of albuminuria was high; the reason that explained this, in this study, was that the CKD patients receiving angiotensin-converting enzyme (ACE) inhibitors or angiotensin receptor blockers (ARB) were only 45.3%. The researcher found that doctors did not adjust the medication appropriately and most prescribed a low dose and did not follow up UACR examination results were similar to Australia[21],which found that 34.6% of DM patients had albuminuria (27.3% microalbuminuria and 7.3% macroalbuminuria). Some studies have the prevalence of albuminuria lower than this study (microalbuminuria 14.3 - 30.8% and macroalbuminuria 1.8 - 3.4% in China[22] and Europe.[23] Thailand reported that T2DM patients in primary care consultations had 37.2% albuminuria (26% microalbuminuria and 11.2% macroalbuminuria).[24]

This study found that factors related with CKD included age ≥ 70 year, history of smoking, hypertension that was treated with antihypertensive drugs, poor control HDL cholesterol (female ≤ 50 mg/dl or male ≤ 40 g/dl), poor control Triglyceride ≥ 150 mg/dl, haemoglobin < 13 g/dl. The factor of age in this research was significantly associated with increase into old age, which is similar to the previous study. In Turkey[25], the odds ratios of CKD ranged from 1.45 to 2.18 for every 10-year increase in age among subjects older than 30 years of age. In Singapore[26], older age ≥ 65 years AOR 2.54, 95% CI (2.44-2.64) vs. ≤ 65 years. There is a progressive loss of nephrons and decreased renal blood flow when age increases, which leads to CKD[27]. In Mexico[28], age > 60 years (OR 2.16, 95% CI 1.56-2.98) was associated with CKD. In Ethiopia, a study demonstrated that ≤ 5 years, OR 0.48, 95% CI (0.21-1.12) compared with > 10 years duration of DM.[29] This study found that financial support by the civil servant medical beneficiary scheme was related to CKD because the patients were followed up every 3 months, but other schemes followed up every month. In this study, it was found that those who had a history as a smoker, AOR 6.24, 95% CI (1.59-24.45) compared with nonsmokers, similar to the US study, AOR 1.6, 95% CI (1.12-2.29) p 0.009.[30] In comparison, the China study showed, AOR 1.34, 95% CI (1.23-1.47) for current smokers and AOR 1.15, 95% CI (1.08-1.23) for former smokers.[31] In this study, it was found that Hb < 13 g/dL, AOR 2.27, 95% CI (1.28-4.02) compared with Hb ≥ 13 g/dL. Similar to a study in Korea[32] that found that low normal Hb levels and anaemia were risk factors for ESRD incidence in person without CKD, and for CKD progression to ESRD. For poor controlled HDL cholesterol and triglyceride, similar to the Indonesian study[33], found low HDL cholesterol AOR

2.54, 95% CI (1.24-5.19). In Italy, the study found that TG ≥150 mg/dL increased the risk of low eGFR by 26% and albuminuria by 19%[34]. This study found that receiving antihypertensive drugs related to CKD, similar to the Ethiopian study.[28] The KDIGO 2012 Clinical Practice Guideline explained that long-term, uncontrolled blood pressure was found to be an initiating factor for high intra-glomerular pressure, leading to impairing glomerular filtration, microalbuminuria, or proteinuria.[35] In this study, it was found that user ACEI/ ARB AOR 0.37, 95% CI (0.16-0.83) compared with nonusers which was similar to the Ethiopian study[24], which demonstrated that nonuser ACEI/ ARB OR 4.35, 95%CI (1.96-10.0). Blockers of the RAAS interfere with the kidney's response to intravascular volume contraction, the ability of angiotensin II to contract the efferent arteriole to support glomerular filtration during these periods.[36]

The key finding obtained from this study is the prevalence of CKD among diabetes patients who have been receiving the primary care service especially the progression from stages 1 to 3B was found. It is the first report that reflects the gap of primary care system related the criteria for referring a patient to the hospital, CKD stage 4 diagnosed which has advanced kidney damage with a severe decrease in the glomerular filtration rate (GFR). This could be the latent condition that could make the loading of severe case of CKD who already reach the need of dialysis or a kidney transplant at hospital whereas it may be preventable or reduced. Therefore, the effective prevention CKD program, early diagnosis and treatment paradigms in order to reduce the risk to end stage renal disease should be developed and implemented as a pilot for possible future policy in primary care level.

However, this study had limitations. Firstly, this research was limited by the cross-sectional study and the first epidemiologic research on the incidence of CKD. Therefore, the CKD shift stage was not comparable. The diabetes patients with severe complications or CKD stage 4 -5 were treated at the hospital because the Public Health Centre was primary health care. Therefore the prevalence estimate of CKD stage 4-5 might be an underestimation. Secondly, due to time and budget limitations, the research was conducted within two months for data collection. There is no information available about the cause of CKD.

CONCLUSION

This study found that the prevalence of CKD among diabetes patients was highs therefore, healthcare providers should increase awareness for CKD detection, identify risk factors of CKD, and establish proper management of the condition, including achieving the target of diabetes control, blood pressure control, albuminuria control and avoiding NSAIDs.

RECOMMENDATIONS

The researcher recommends that PHCs should report the situation of CKD in primary care to the National Health Security Office (NHSO) to obtain financial support. The budgets of CKD screening programs are opportunistic and are faced with challenges. PHCs should have appropriate guidelines for CKD to help primary healthcare providers (physicians, pharmacists, OPD nurses and laboratory nurses) detect, and manage CKD among diabetes patients, as well as criteria for appropriate referral to nephrology. Further studies should be conducted in the community setting or other PHCs.

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