ORIGINAL ARTICLE

Impact of the Chronic Kidney Disease Clinic Policy on eGFR Decline among CKD Patients in a Province of Northeast Thailand: An Interrupted Time Series Analysis

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Background: Chronic kidney disease (CKD) poses a growing global health concern, particularly in low- and middle-income countries. In Thailand, CKD affects 4.6% to 17.5% of the population, with diabetic nephropathy and hypertension being the primary causes of end-stage renal disease (ESRD). To mitigate this, the Ministry of Public Health introduced CKD clinic policies in 2016 to slow progression in stages 1 to 4. The ESCORT-2 study demonstrated the effectiveness of integrated care, prompting nationwide adoption. The present study assessed the policy impact using 12 clinical performance indicators.

Materials and Methods: Data from CKD stage 3 to 4 patients were retrieved from Roi Et Province's Health Data Center between January 2014 and December 2021. Interrupted time series (ITS) analysis evaluated performance trends before and after policy implementation, stratified by hospital level.

Results: Following policy implementation, significant improvements were observed in four key indicators, 1) the proportion of CKD patients receiving angiotensin converting enzyme inhibitors (ACEi) or angiotensin receptor blockers (ARBs) increased from 43.46% by 7.95% (95% CI 4.41 to 11.49), 2) statin use rose from 39.78% by 3.51% (95% CI 0.063 to 6.95), 3) the percentage of patients with estimated glomerular filtration rate (eGFR) decline to less than 5 mL/minute/1.73 m^2/year improved from 55.31% by 13.93% (95% CI 0.19 to 27.67), 4) urine protein to creatinine ratio (UPCR) testing increased from 2.10% by 9.64% (95% CI 0.31 to 18.98). Post-policy linear trend analysis also showed modest increases in ACEi/ARB use, potassium monitoring, statin prescription, and intact parathyroid hormone (iPTH) testing.

Conclusion: The implementation of the kidney disease clinic policy has positively influenced the care of patients with chronic kidney disease. Continuing of this policy would benefit patients with chronic kidney disease.

Keywords: Chronic kidney disease; CKD clinic; Interrupted time series

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One of the biggest issues with worldwide public health is chronic kidney disease (CKD). Stage 1 to 5 of CKD are less common in high-income nations affecting 8.6% of men and 9.6% of women than in low- and middle-income countries, where the incidence is 10.6% of men and 12.5% of women. There are 11.2% of people in Asia who have CKD stages 3 to 5(1,2). In Thailand, the prevalence of CKD ranged from 4.6% to 17.5%(3). The Thai Screening and Early Evaluation of Kidney Disease (SEEK) study conducted by the Nephrology Society of Thailand investigated CKD prevalence in the general population. The present study was a comprehensive study, encompassing individuals meeting the criteria for all five CKD stages, revealed a CKD prevalence of 17.5% among the Thai population(4). CKD in Thailand has been steadily increasing, posing a significant health concern in the country. According to the Thailand Renal Replacement Therapy Registry for 2021 to 2022, the leading cause of end-stage renal disease among patients undergoing renal replacement therapy in Thailand was diabetic nephropathy, accounting for 32.2%. Hypertension was the second most common cause, contributing to 29.2%.

A systematic review of CKD care models in

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low- and middle-income countries, found the National efforts focused on the prevention of end-stage renal disease through enhanced screening[5], public awareness campaigns, and education for primary care providers. Of the 12 clinical care models, nine focused on people with CKD and the remaining on people at risk for CKD. A majority in the first category implemented a multidisciplinary clinic with allied health professionals or primary care providers, rather than nephrologists, in leading roles.

To address these challenges, the Thai Ministry of Public Health has undertaken various initiatives aimed at preventing and delaying renal impairment in CKD stage 1 to 4 as evidenced by studies. In the initial phase, a multidisciplinary model of delayed renal degeneration in patient care, and the prospective cohort study to evaluate the effectiveness of an integrated care model on delaying CKD progression in routine clinic (ESCORT-2), were established. The study revealed a mean estimated glomerular filtration rate (eGFR) decline rate of -0.92 mL/minute/1.73 m^2/year, with patients having diabetic kidney disease (DKD) experiencing a rate three times faster than those without DKD[6,7].

These findings led to the establishment of CKD clinic policies in 2016, initially piloted across 15 provinces. The evaluation of CKD clinic outcomes was based on 12 indicators, 1) blood pressure (BP), 2) hemoglobin (Hb) or hematocrit (Hct), 3) hemoglobin A1C (HbA1C), 4) urine protein, 5) potassium, 6) statin drugs use, 7) angiotensin converting enzyme inhibitors or angiotensin receptor blockers (ACEi/ARB) drugs use, 8) bicarbonate (HCO_3), 9) eGFR, 10) urine protein to creatinine ratio (UPCR), 11) intact parathyroid hormone (iPTH), and 12) phosphorus (PO_4). Subsequently, these policies were disseminated nationwide. Historically, the evaluation of CKD clinic performance has focused on policy compliance and certain clinical outcomes such as eGFR results, with limited studies on performance indicators specific to CKD clinics.

To the authors' knowledge, there was a few studies using the interrupted time series (ITS) method to evaluate the public health policy in CKD[8]. The present study is the first study to assess the public health policy intervention in Thailand using ITS method for CKD. The objectives of the present study were to utilize an ITS analysis to compare the performance indicator rates in CKD clinics within a province in Northeast Thailand before and after the policy implementation in January 2016.

Materials and Methods

Data sources

In the present study, a secondary data analysis approach was adopted. Initially, data retrieved between January 1, 2014, and December 31, 2021, was obtained from the Health Data Center (HDC) in Roi Et Province. HDC serves as a comprehensive health database system that has been collecting monthly health data since 2014 from all healthcare services under the purview of the Ministry of Public Health, Thailand. These health data encompass various aspects, including community-related information such as village and activities, health facilities within the community, outpatient department records comprising diagnostic dates, prescribed medications, laboratory results, and inpatient department records covering admission dates, diagnostic information, medications administered, and laboratory findings.

It was important to note that the data extracted from HDC did not contain any identifying information and could not be linked to personal data. Inclusion criteria for the study were individuals aged 18 years or older, eGFR of less than 90 mL/minute/1.73 m^2, and receipt of CKD-related care at a hospital between 2014 and 2021 under Thailand's Universal Health Coverage scheme. CKD was defined and staged according to the National Kidney Foundation Kidney Disease Outcomes Quality Initiative (NKF-KDOQI) guidelines[9]. Participants were categorized based on the most recent eGFR value recorded during the study period. In cases where multiple values were available, the latest measurement within the defined period was used for classification. Exclusion criteria included individuals with incomplete or missing laboratory data relevant to CKD diagnosis such as missing serum creatinine levels, those with acute kidney injury (AKI) diagnoses, and patients with a documented history of renal transplantation at the time of data collection.

Measures

Outcome variable: The outcome variables are 12 indicators of CKD clinic performance, which include BP, Hb or Hct, HbA1C, urine protein, potassium, statin drug use, ACEi/ARB drug use, HCO_3, eGFR, UPCR, iPTH, and PO_4.

The indicators for the care of CKD patients can be categorized as follows:

1. Assessment of kidney function with eGFR, UPCR and urine protein. These indicators are used to assess kidney function, the severity of proteinuria, and monitor kidney deterioration,

2. Management of associated medical conditions with BP, monitoring BP to prevent kidney deterioration and complications arising from high BP. Potassium, monitoring blood potassium levels to prevent hyperkalemia, which can affect heart rhythm. HCO_3, used to assess acid-base balance in the body, which can indicate metabolic acidosis in CKD patients,

3. Monitoring anemia and blood sugar levels with Hb or Hct, used to detect anemia, which is common in CKD patients. HbA1C, used to monitor long-term blood sugar control in diabetic patients at risk of kidney disease,

4. Monitoring bone and calcium-related conditions with iPTH, used to assess calcium deficiency or kidney deterioration that affects parathyroid hormone levels. PO_4, monitoring phosphorus levels in the blood to reduce the risk of bone abnormalities in CKD patients, and

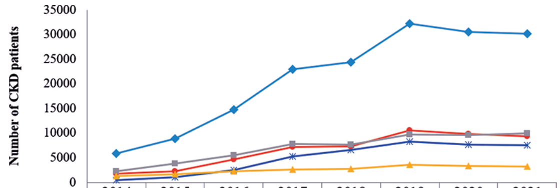
5. Management and prevention of cardiovascular complications with statin drugs use to control cholesterol levels and reduce the risk of cardiovascular diseases in CKD patients, and ACEi/ARB drugs use to lower BP and prevent kidney deterioration, particularly in patients with proteinuria.

The authors extracted the data from the database, secondary data. Therefore, the measurement of outcomes variable was based on the guideline of diagnosis in laboratory in each health facility. The data were meticulously aggregated for each month of the study period, which was between January 1, 2014, and December 31, 2021. Quarterly rates were constructed from the data, resulting in 28 quarterly study points. Therefore, the study provided a comprehensive analysis of the performance indicators for each patient CKD stage 1 to 4.

The data were also categorized for comparison according to three hospital levels. 1) Advanced level, including regional hospitals, which are advanced referral centers, and large general hospitals. 2) Standard level, including small general hospitals and community hospitals with 120 beds or more. And 3) first level, including large community hospitals with 60 to 120 beds, medium community hospitals with 30 to 90 beds, and small community hospitals with 10 beds.

Ethical approval

The present study was approved by the Khon Kaen University Ethics Committee for Human Research, under certificate No. HE642084, on February 11, 2022.



	2014	2015	2016	2017	2018	2019	2020	2021
stage 1	415	1127	2460	5320	6597	8250	7708	7569
stage 2	1839	2285	4648	7192	7321	10557	9861	9325
stage 3	2290	3825	5462	7741	7674	9764	9613	10013
stage 4	1359	1674	2228	2641	2761	3611	3362	3246
Total	5903	8911	14798	22894	24353	32182	30544	30153

Figure 1. The yearly count of patients with chronic kidney disease (CKD).

Statistical analysis

The present study used the ITS[10-12] for evaluating trends by observing changes in slopes before and after implementing an intervention. The present analysis involved building a sequence of quarterly treatment rates in CKD clinics spanning between January 2014 and December 2021. The pre-intervention period extended for 24 months, between January 2014 and December 2016, while the post-intervention period covered 60 months, running between January 2017 and December 2021. Data aggregation occurred at 3-month intervals, resulting in eight time points during the pre-intervention period and 20 time points in the post-intervention period.

The equation for the ITS analysis[13,14] was as follows: $Y = \beta_0 + \beta_1 \times$ time before intervention(x_1) + $\beta_2 \times$ intervention$(x_2) + \beta_3 \times$ time after intervention $+ e_t$

In the equation, Y represents the rate of access to renal replacement therapy treatment, β_0 is a constant term, while β_1 is the coefficient of the time before the intervention, reflecting the trend of access to the clinic before policy implementation, β_2 is the coefficient of the intervention immediately, indicating the level change. β_3 stands for the coefficient of time after the intervention, capturing the effects of the intervention over time, leading to a different slope before and after intervention. To address autocorrelation, the authors ensured robustness in fitting the model. All analyses were conducted using Stata Statistical Software, version 17 (StataCorp LLC, College Station, TX, USA).

Results

Chronic kidney disease data

In Figure 1, the yearly count of CKD patients across stages 1 to 4 steadily increased from 2014 to 2021. Especially, the growth observed between 2015 and 2016, with numbers rising from 8,911 to 14,798, representing an increase of approximately 40%. It was

Table 1. Changes in performance indicators of the CKD clinic before and after policy implementation

CKD clinic indicator	Baseline; % (95% CI)	Change after policy implementation 2014-2016		Change in trends after policy implementation 2017-2021	
		Relative change; % (95% CI)	p-value	Relative change; % (95% CI)	p-value
Stage 1-4					
BP <140/90 mmHg	64.34 (61.47 to 67.20)	–2.51 (–6.68 to1.66)	0.23	0.14 (–0.09 to0.38)	0.23
Hb >10 g/dL, Hct (>30%)	8.47 (5.80 to 11.13)	–0.42 (–6.99 to 6.15)	0.89	0.29 (–0.19 to 0.79)	0.22
HbA1C 6.5% to 7.5%	11.91 (9.04 to 14.78)	4.21 (–5.17 to13.59)	0.36	0.17 (–0.31 to0.66)	0.46
Urine protein	28.95 (19.37 to 38.53)	8.73 (–12.81 to 30.27)	0.41	0.047 (–1.43 to 1.54)	0.95
ACEi/ARB drugs use	43.46 (40.57 to 46.34)	7.95 (4.41 to 11.49)	<0.001*	0.56 (0.32 to 0.79)	0.0001*
Potassium <5.5 mEq/L	95.72 (94.94 to 96.51)	–1.32 (–2.33 to –0.32)	0.012*	0.09 (0.05 to 0.13)	<0.001*
Statin drugs use	39.78 (37.91 to 41.68)	3.51 (0.063 to 6.95)	0.046*	0.64 (0.10 to 1.17)	0.02*
Stage 3-4					
HCO_3 >22 mEq/L	62.71 (60.58 to 64.84)	–3.13 (–6.90 to 0.64)	0.10	–0.07 (–0.30 to 0.16)	0.55
eGFR decline <5mL/min/1.73 m²/year	55.31 (54.21 to 56.41)	12.24 (1.11 to 23.38)	0.03*	–2.10 (–3.21 to –1.00)	0.004*
UPCR[a]	2.10 (–0.69 to 4.89)	9.64 (0.31 to 18.98)	0.043*	–0.32 (–0.84 to 0.21)	0.22
iPTH[a]	36.90 (3.1 to 69.89)	–26.97 (–90.14 to 36.20)	0.69	4.57 (1.41 to 7.74)	0.006*
PO_4[a]	3.27 (0.64 to 5.8)	–37.12 (122.5 to 4834)	0.38	–0.43 (–30.82 to 2.95)	0.97

BP=blood presser; Hb=hemoglobin; HCT=hematocrit; ACEi=angiotensin converting enzyme Inhibitor(s); ARB=angiotensin II receptor blocker(s); UPCR=urine protein to creatinine ratio; HCO_3=bicarbonate or hydrogencarbonate ion; iPTH=serum intact parathyroid hormone; PO_4=serum phosphorus; HbA1C=hemoglobin A1C; CI=confidence interval

(a) The Screening was conducted only at advance and standard level hospitals

* Significant (p<0.05)

important to highlight that the CKD clinic policy was implemented in 2016.

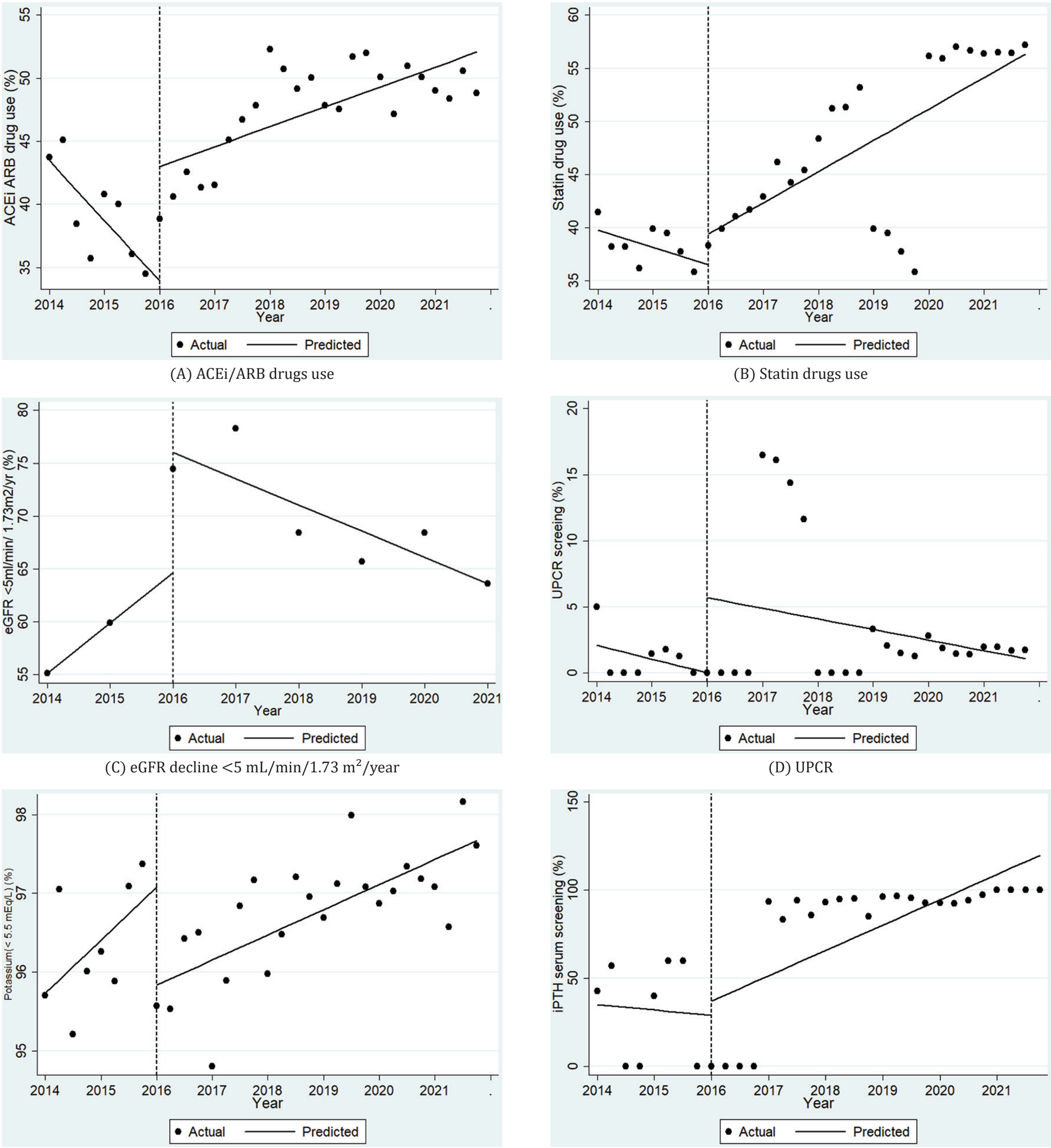
Evaluation of interrupted time series

In Table 1, ITS analysis shows improvements in CKD clinic performance indicators following the implementation of the Ministry of Public Health policy. Notably, four indicators demonstrated sharp increases. 1) The proportion of CKD patients receiving ACEi/ARB drugs increased from a baseline of 43.46% by 7.95% (95% CI 4.41 to 11.49), as shown in Figure 2A; 2) Statin use rose from 39.78% by 3.51% (95% CI 0.063 to 6.95), as shown in Figure 2B; 3) The percentage of patients with an eGFR decline of less than 5 mL/minute/1.73 m²/year increased from 55.31% by 13.93% (95% CI 0.19 to 27.67), as shown in Figure 2C; 4) UPCR screening increased from 2.10% by 9.64% (95% CI 0.31 to 18.98), as shown in Figure 2D. However, the proportion of CKD patients with potassium test results of less than 5.5 mEq/L decreased from a baseline of 95.72% by –1.32% (95% CI –2.33 to –0.32), as shown in Figure 2E.

Regarding linear trends in post-policy implementation, there was a slight but consistent increase in four indicators. 1) ACEi/ARB drug use rose to 51.4%, with a linear trend increase of 0.56% (95% CI 0.32 to 0.79). 2) Potassium test results of less than 5.5 mEq/L reached 94.41%, with a linear trend increase of 0.09% (95% CI 0.05 to 0.13). 3) Statin use reached 43.29%, with a linear trend increase of 0.64% (95% CI 0.10 to 1.17). And 4) iPTH testing reached 36.9%, with a linear trend increase of 4.57% (95% CI 1.15 to 60.2), as shown in Figure 2F.

In Table 2, the analysis was stratified by hospital level into two groups, advanced and standard-level hospitals, and first-level hospitals. The results from the ITS analysis for advanced and standard-level hospitals reveal a significant improvement in comprehensive care indicators following the implementation of the Ministry of Public Health's policy. Specifically, 1) the proportion of CKD patients receiving ACEi/ARB drugs increased from a baseline of 51.77% by 13.66% (95% CI 7.69 to 19.63), 2) the use of statin drugs rose from 43.85% by 6.93% (95% CI 3.27 to 10.50), 3) screening for serum HCO_3 increased from 63.38% by 10.38% (95% CI 6.75 to 14.01). However, the percentage of CKD patients with potassium levels of less than 5.5 mEq/L showed a slight decline, decreasing from a baseline of 96.04% by –1.61% (95% CI –2.50 to –0.71).

Moreover, the linear trend following policy implementation demonstrated an increase in seven key indicators. 1) CKD patients screened with Hb levels of greater than 10 g/dL or Hct greater than 30% increased from a baseline of 13.04% by 0.77% (95% CI 0.08 to 1.45). 2) The proportion of patients receiving ACEi/ARBs rose from 51.77% by 0.37% (95% CI 0.07 to 0.68). 3) Screening for potassium



(A) ACEi/ARB drugs use

(B) Statin drugs use

(C) eGFR decline <5 mL/min/1.73 m^2/year

(D) UPCR

(E) Potassium <5.5 mEq/L

(F) iPTH screening

Figure 2. The rates of performance indicators in the CKD clinic. The graphs display percentages across of performance indicators of CKD clinic, (A) ACEi/ARB drugs use, (B) Statin drugs use, (C) eGFR, (D) UPCR, (E) Potassium levels serum, (F) iPTH. Over 28 quarterly periods, this analysis offers an examination of performance indicators for patients diagnosed with CKD stage 1-4.

levels of less than 5.5 mEq/L increased from 96.04% by 0.07% (95% CI 0.03 to 0.11). 4) Statin use increased from 43.85% by 0.72% (95% CI 0.47 to 0.97). 5) UPCR screening increased from 2.1% by 0.91% (95% CI 0.49 to 1.33). 6) iPTH screening rose from 36.9% by 3.94% (95% CI 1.93 to 5.94). And 7) PO_4 screening increased from 3.26% by 3.01% (95% CI 0.37 to 5.65).

Table 3 presents the performance indicators of the CKD clinic policy at the first-level hospital setting. Following the policy implementation, a sharp upward trend was observed in three indicators. 1) Urine protein screening increased from 28.62% by 25.15% (95% CI 8.59 to 41.71). 2) ACEi/ARB drug administration rose from 35.18% by 6.12% (95% CI 1.74 to 10.50). And 3) The rate of eGFR decline to

Table 2. Changes in performance indicators of the CKD clinic policy in advance and standard level hospital

CKD clinic indicator	Baseline; % (95% CI)	Change after policy implementation 2014-2016		Change in trends after policy implementation 2017-2021	
		Relative change; % (95% CI)	p-value	Relative change; % (95% CI)	p-value
Stage 1-4					
BP <140/90 mmHg	66.91 (62.00 to 71.82	2.04 (–2.43 to 6.52)	0.357	0.29 (–0.01 to 0.59)	0.06
Hb >10 g/dL, Hct >30%	13.04 (10.49 to 15.59)	2.55 (–4.07 to.18)	0.436	0.77 (0.08 to 1.45)	<0.001*
HbA1C 6.5% to 7.5%	11.95 (8.80 to 15.10)	4.71 (–5.9 to 15.43)	0.375	0.03 (–0.37 to 0.44)	0.86
Urine protein	31.34 (19.46 to 43.21)	–0.83 (–24.5 to 22.4)	0.944	0.36 (–1.04 to 1.76)	0.60
ACEi/ARB drugs use	51.77 (48.25 to 55.29)	13.66 (7.69 to 19.63)	<0.001*	0.37 (0.07 to 0.68)	0.02*
Stage 3-4					
Potassium <5.5 mEq/L	96.04 (95.42 to 96.64)	–1.61 (–2.50 to –0.71)	0.001*	0.07 (0.03 to 0.11)	0.002*
Statin drugs use	43.85 (42.13 to 45.57)	6.93 (3.27 to 10.5)	0.001*	0.72 (0.47 to 0.97)	<0.001*
HCO_3 >22 mEq/L	62.38 (61.35 to 63.42)	10.38 (6.75 to 14.01)	<0.001*	–0.19 (–0.45 to 0.06)	0.13
eGFR decline <5 mL/min/1.73 m^2/year	54.29 (51.11 to 57.48)	12.51 (–1.48 to26.52)	0.07	–1.04 (–2.37 to 0.28)	0.09
UPCR[a]	2.1 (–0.69 to 4.89)	4.98 (–1.42 to 11.39)	0.123	0.91 (0.49 to 1.33)	0.0001*
iPTH[a]	36.90 (3.91 to 69.89)	–27.07 (–90.22 to 36.09)	0.57	3.94 (1.93 to 5.94)	0.0004*
PO_4[a]	3.26 (0.64 to 5.88)	–2.69 (–73.90 to 68.51)	0.94	3.01 (0.37 to 5.65)	0.03*

BP=blood presser; Hb=hemoglobin; HCT=hematocrit; ACEi=angiotensin converting enzyme Inhibitor(s); ARB=angiotensin II receptor blocker(s); UPCR=urine protein to creatinine ratio; HCO_3=bicarbonate or hydrogencarbonate ion; iPTH=serum intact parathyroid hormone; PO_4=serum phosphorus; HbA1C=hemoglobin A1C; CI=confidence interval

(a) The Screening was conducted only at advance and standard level hospitals

* Significant (p<0.05)

Table 3. Changes in performance indicators of the CKD clinic policy in first level hospital

CKD clinic indicator	Baseline; % (95% CI)	Change after policy implementation 2014-2016		Change in trends after policy implementation 2017-2021	
		Relative change; % (95% CI)	p-value	Relative change; % (95% CI)	p-value
Stage 1-4					
BP <140/90 mmHg	70.86 (68.39 to 73.31)	–6.73 (–14.68 to 1.23)	0.094	0.01 (–0.22 to 0.26)	0.87
Hb >10gm/dl, Hct >30%	1.42 (–1.64 to 4.47)	–4.39 (–12.85 to 4.05)	0.296	0.04 (–0.16 to 0.24)	0.68
HbA1C 6.5% to 7.5%	12.55 (10.31 to 14.79)	5.62 (–1.75 to 13.01)	0.129	0.10 (–0.29 to 0.50)	0.60
Urine protein	28.62 (22.55 to 34.68)	25.15 (8.59 to 41.71)	0.004*	–0.38 (–1.31 to 0.54)	0.40
ACEi/ARB drugs use	35.18 (33.0 to 37.37)	6.12 (1.74 to 10.50)	0.008*	0.40 (0.23 to 0.57)	<0.001*
Stage 3-4					
Potassium <5.5 mEq/L	95.12 (94.05 to 96.18)	–0.64 (–2.16 to 0.87)	0.39	0.01 (0.05 to 0.16)	<0.001*
Statin drugs use	32.79 (30.92 to 34.67)	–2.59 (–6.20 to 1.02)	0.15	0.77 (0.58 to 0.95)	<0.001*
HCO_3 >22 mEq/L	71.37 (66.41 to 76.33)	–16.61 (–20.83 to –11.32)	0.002*	0.33 (–0.02 to 0.69)	0.06
eGFR decline <5 mL/min/1.73 m^2/year	54.41 (54.39 to 54.42)	8.78 (0.38 to 17.93)	0.05*	–2.63 (–4.71 to –0.56)	0.02*
UPCR[a]	-	-	-	-	-
iPTH[a]	-	-	-	-	-
PO_4[a]	-	-	-	-	-

BP=blood presser; Hb=hemoglobin; HCT=hematocrit; ACEi=angiotensin converting enzyme Inhibitor(s); ARB=angiotensin II receptor blocker(s); UPCR=urine protein to creatinine ratio; HCO_3=bicarbonate or hydrogencarbonate ion; iPTH=serum intact parathyroid hormone; PO_4=serum phosphorus; HbA1C=hemoglobin A1C; CI=confidence interval

(a) The Screening was conducted only at advance and standard level hospitals

* Significant (p<0.05)

less than 5 mL/minute/1.73 m²/year improved from 54.41% by 8.78% (95% CI 0.38 to 17.93).

Additionally, overall linear trend analysis after policy implementation showed an increase in three indicators, 1) ACEi/ARB drug use rose from 35.18% by 0.40% (95% CI 0.23 to 0.57), 2) potassium test results of less than 5.5 mEq/L increased from 95.12% by 0.01% (95% CI 0.05 to 0.16), and 3) statin use increased from 32.79% by 0.77% (95% CI 0.58 to 0.95).

Discussion

The implementation of the policy led to a significant increase in comprehensive care for patients with CKD. Notably, there was an uptick in the administration of ACEi, ARBs, and statins, as well as in the monitoring and management of potassium levels below 5.5 mEq/L. This improvement is attributed to the impact of medication dosages on kidney filtration, influencing the rate of decline in eGFR to less than 5 mL/minute/1.73 m^2/year post-policy implementation. In alignment with the national evaluation of CKD clinics under the Ministry of Public Health, clinical outcomes demonstrated a more than 20% increase in the proportion of patients achieving an eGFR decline rate of less than 5 mL/minute/1.73 m^2/year. Among the most notable improvements was the increased use of ACEi/ARB and statin medications. ACEi/ARB drugs, widely used for BP control, have proven effective in slowing renal function decline in both diabetic and non-diabetic CKD patients presenting with hypertension and albuminuria or proteinuria. Moreover, these medications play a critical role in delaying the progression of diabetic nephropathy[15].

However, certain indicators such as BP control, with a BP of less than 140/90 mmHg, maintenance of Hb levels above 10 g/dL or Hct above 30%, and screening for urine protein and UPCR did not show significant improvement following the policy rollout. While there was a slight increase in the proportion of patients with potassium levels below 5.5 mEq/L, from the baseline of 95.72%, these indicators were already standard components of monitoring in non-communicable disease (NCD) clinics before the CKD policy was introduced[16,17]. Consequently, the policy did not significantly affect these measures.

The evaluation of CKD clinic performance metrics indicated that clinical indicators either remained stable or showed limited improvement. One contributing factor may be that some hospitals do not have dedicated CKD clinics and instead manage CKD patients through existing NCD clinics due to staffing limitations. This observation aligns with findings by Taptagaporn et al.[18], who reported that while 76.42% of hospitals had established CKD clinics, many faced budgetary constraints, relying heavily on operational funds and support from the National Health Security Office. When stratified by hospital level, improvements in specific indicators namely UPCR, iPTH, and PO_4 testing were observed only at standard and advanced-level hospitals, with no increase noted at first-level hospitals. This suggests the need for a referral system to ensure broader access to these essential tests.

The objective of slowing CKD progression aimed to ensure that at least 50% of patients experienced an eGFR decline of less than 5 mL/minute/1.73 m^2/year. Prior to 2014, this target was achieved in 55.34% of cases. Following the implementation of the policy, the rate increased by 12.24%. Although a linear trend analysis from 2015 to 2021 revealed a slight decline of 2.1%, the overall rate remained consistently above 65%, exceeding the Ministry of Public Health's performance goals. Furthermore, follow-up data from the HDC indicated an increase in the number of patients whose CKD regressed from stage 3 to stage 2 and from stage 4 to stage 3. In contrast, there was a decrease in the number of patients progressing from stage 2 to stage 3 and from stage 3 to stage 4. For patients in stage 4, the final stage before kidney failure, the policy implementation has contributed to delaying kidney damage and facilitating early planning for potential kidney failure treatments. This outcome can be considered a key success of the policy implementation[19,20]. Despite the global burden of CKD, access to specialized care and kidney replacement therapies remains limited, particularly in low- and middle-income countries. The variability in eGFR decline, especially among diabetic and rapidly progressing CKD patients, highlights the urgent need for expanded early detection, multidisciplinary care, and resource allocation to improve outcomes worldwide[21].

The key success of this policy may be due to the patients' behavior influence[22,23], medication adherence[24,25] leading to more effective control of eGFR and CKD progression. Moreover, patients with CKD at an early stage would likely benefit from the policy from the early access to the CKD clinic[26].

Conclusion

The implementation of the kidney disease clinic policy has positively influenced the care of patients with CKD. Continuing of this policy would benefit patients with CKD.

What is already known about this topic?

CKD has a high prevalence in Thailand, and its significant burden on both health and the economy led to the implementation of CKD clinic policy. However, there is still a lack of evaluation regarding the effectiveness of this policy implementation.

What does this study add?

This study found that follow-up for cardiovascular and kidney disease prevention and control, particularly through the use of statin drugs and ACEi/ARB medications, was effective. Additionally, renal function assessment with eGFR and UPCR, improved after the policy implementation, although it gradually declined over the long term. However, follow-up for anemia, blood sugar levels, and BP remained inadequate.

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Conflicts of interest

The authors declare no conflict of interest.

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