Original article

Factors associated with mortality and high treatment expense of adult patients hospitalized with chronic kidney disease in Thailand

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Background: Chronic kidney disease (CKD) is a global public health problem with a high risk of hospitalization and death. Few nationwide data have been reported regarding the outcomes of patients hospitalized with CKD in developing countries.
Objectives: To study the risk factors associated with mortality and high treatment costs of adult patients hospitalized with CKD in Thailand.
Methods: The medical data forms for adult inpatients with CKD collected in fiscal year 2010 were analyzed to determine the number of CKD admissions, associated comorbidities and complications, mortality rates, and hospital charges. Factors influencing mortality rates were evaluated by multiple logistic regression.
Results: The total number of CKD patients was 128,338. After adjustment, the major factors associated with high hospital charges were (a) comorbidities (e.g. pneumonia OR 3.18, 95% CI 3.03–3.34; sepsis OR 2.87, 95% CI 2.74–3.00; acute kidney injury (AKI) on preexisting CKD OR 2.83, 95% CI 2.69–2.98) and (b) dialysis treatment (i.e., hemodialysis OR 5.16, 95% CI 4.94–5.39; peritoneal dialysis OR 3.40, 95% CI 3.14–3.69). The risk factors for high mortality were: being male, elderly, having comorbidity (viz., sepsis, respiratory failure, stroke, pneumonia, ischemic heart disease, AKI in addition to CKD, heart failure, and diabetes), and CKD complications (viz., metabolic acidosis, hyperkalemia, volume overload, and anemia requiring blood transfusion).
Conclusions: Prevention and early treatment of any comorbidity and complications of CKD might reduce mortality and treatment costs of patients hospitalized with CKD.

Keywords: Chronic kidney disease, mortality, risk factors, predictors, high cost

Chronic kidney disease (CKD) is a global public health concern because of its prevalence and rising incidence, poor outcomes, and high treatment costs [1-3]. The prevalence of CKD in Thailand—both in the community and among outpatients—is high at between 4.6% and 17.5% [4-6]. Patients with CKD have an increased rate of hospitalization and a high respective risk for death [7, 8]. Cardiovascular diseases (CVD) are major comorbidities, causing high mortality and expense, as documented for western countries [7-9]. Because little information on the outcomes of patients hospitalized with CKD is available from developing countries, we analyzed the national data for Thai adult inpatients hospitalized with CKD in fiscal year 2010. We focused on identifying the epidemiological aspects of CKD and the factors affecting its mortality and treatment costs. The results of this study may provide essential information for improving care of patients with CKD.

Materials and methods

The study was approved followed an assessment by the Ethics Committee of the Faculty of Medicine, Khon Kaen University (certificate of approval No. HE541036), following the principles of the

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contemporary Declaration of Helsinki. The information to be analyzed was from the three main health scheme offices in Thailand: (a) the inpatient medical expense forms for fiscal year 2010 from the National Health Security Office; (b) the inpatient data from the CSMBS (Civil Servant Medical Benefit Scheme) from the Controller General's Department; and (c) the Social Security Office. The data collected from inpatients hospitalized with CKD included: sex, age, comorbidities, complications, treatment, clinical outcomes, and hospital charge. The data were first checked for accuracy by examining for (a) overlapping information, (b) visit dates, (c) missing items, (d) incorrect coding, and (e) the correct fiscal year. We conducted a statistical analysis of age, sex, admission rates, death rates, comorbidity, complications, and the average hospital charges. Patients with CKD were identified in both primary and secondary diagnoses as code N18 of the International Statistical Classification of Diseases and Related Health Problems, 10th revision (ICD-10) [10]. Hemodialysis and peritoneal dialysis were identified as codes 39.95 and 54.98 according to the ICD-9-CM 2010 classification of procedures [11].

Outcome measures

The outcome data of interest included (a) number, age, and sex of patients, (b) number of admissions, (c) length of stay, (d) hospital charges, and (e) mortality rates. The characteristics of patients with CKD and factors influencing their mortality and high treatment costs were analyzed.

Statistical analysis

The statistical analyses were conducted using SPSS Statistics for Windows, version 17 (SPSS Inc, Chicago, IL, USA). The respective continuous and categorical data were expressed as means ± SD or median (25th –75th percentiles), and percentage. Generalized estimating equation (GEE) and multiple logistic regression analysis (MLRA) were conducted to adjust the odds ratios for factors influencing a high cost accounting for multiple admissions within an individual and mortality rate, respectively.

Results
Epidemiology

In fiscal year 2010, the population over 19 years of age numbered 47,966,734 74% of the total population of 64.7 million. Approximately 96% of the adult population (46,208,964 individuals) was covered by one of the three health insurance systems (viz., the Medical Welfare Scheme, the Civil Servant Medical Benefit Scheme, and the Social Security Scheme). The total number of adult inpatients was 3,876,792 (admitted 4,863,935 times), accounting for 71% of all inpatients. According to the 23 major disease groups specified in the ICD 10, diseases of the genitourinary system ranked 7th among causes of hospitalization (298,258 individuals, 7.7% of all adult inpatients, and 392,498 admissions) and 7th among causes of mortality in Thailand [12]. CKD was the most common diagnosis of genitourinary system disorders. The total number of patients with CKD was 128,338 (generating 236,439 admissions), accounting for 4.9% of all adult inpatient admissions (268 individuals or 493 visits per 100,000 adult population).

Table 1 presents the characteristics of admitted CKD patients. There were 65.5% aged >60 years, 29.1% between 40-60 years, and 5.4% <40 years. Admissions of female patients were slightly greater than of males.

Associated comorbidities

The two most frequently associated comorbidities were hypertension and diabetes mellitus (DM). In rank order, the less frequently associated comorbidities associated with CKD were: hyperlipidemia, ischemic heart disease, heart failure, gout, sepsis, pneumonia, acute kidney injury (AKI) in addition to preexisting CKD, diarrhea, stroke, and respiratory failure.

Complications

Complications for all CKD admissions included anemia (requiring blood transfusion), hyperkalemia, volume overload, and metabolic acidosis.

Dialysis treatment

CKD patients needing dialysis numbered 21,727 admissions. Mode of dialysis included: hemodialysis (n = 17,143 admissions or 78.9% admissions for CKD) and peritoneal dialysis (n = 4,584 admissions or 21.1% admissions for CKD).

Length of hospital stay

The median length of hospital stay was 3 days with minimum to maximum: 1-1,078 days. The longest median hospital stay was for patients with CKD requiring renal replacement therapy. The comorbidities associated with a longer admission duration were pneumonia, AKI in addition to preexisting CKD, sepsis, stroke and respiratory failure (**Table 2**).

Table 1. Characteristics of patients hospitalized with chronic kidney disease

	Characteristics of admitted CKD patients
Number of adult patients (individuals)	128,338
Number of admissions (times)	236,439
Age (mean ± SD) years	65.5 ± 13.9
Sex (male/female)	1/1.14
Common comorbidities (% of admissions)	
Hypertension	53.1
Diabetes mellitus	43.0
Hyperlipidemia	13.2
Ischemic heart disease	12.4
Heart failure	10.5
Gout	8.3
Sepsis	7.8
Pneumonia	6.2
AKI on preexisting CKD	5.1
Diarrhea	5.1
Stroke	5.0
Respiratory failure	4.8
Complications (% of admissions)	
Anemia requiring blood transfusion	24.4
Hyperkalemia	9.9
Volume overload	9.3
Metabolic acidosis	5.0
Dialysis treatment (% of admissions)	
Hemodialysis	7.3
Peritoneal dialysis	1.9
Length of stay (days)	
Median (25th–75th percentile)	3.0 (2.0–6.0)
Hospital charge (baht)	
Mean ± SD	20,980 ± 126,985
Median (25th–75th percentile)	7,360 (3,866–16,599)
Mortality (%)	10.7

CKD, chronic kidney disease; AKI, acute kidney injury; SD, standard deviation

Hospital charges

The median hospital charge was 7,360 (3,866–16,599) baht. Hospital charge was correlated with length of stay ($r = 0.39$, $P < 0.001$). The most frequent comorbidities associated with high daily hospital expense were ischemic heart disease, respiratory failure, sepsis, and AKI in addition to preexisting CKD (**Table 2**).

Crude and adjusted odds ratios of factors related with high expense are presented in **Table 3**. After adjustment, the factors affecting high hospital charges (>50,000 baht or >US$1,500 per admission) were: (a) male sex, (b) comorbidities (e.g., pneumonia, sepsis, AKI in addition to preexisting CKD, (c) complications (i.e., anemia requiring blood transfusion, hyperkalemia), and (e) dialysis treatment (i.e., hemodialysis or peritoneal dialysis).

Predictors of mortality

The mortality rate for inpatients with CKD was 10.7%. Multiple logistic regression analysis revealed the factors influencing the mortality rate were: male sex, age >80 years, comorbidity (sepsis, respiratory failure, stroke, pneumonia, ischemic heart disease, AKI on preexisting CKD, heart failure, and DM) and complications (metabolic acidosis, hyperkalemia, volume overload, and anemia requiring blood transfusion) (**Table 4**).

Table 2. Length of hospital stay and hospital charges for hospitalized patients with chronic kidney disease and comorbidities, complications, and dialysis

		Length of stay (days)	Total hospital charge (baht)		Hospital charge per day (baht)	
		Median (25th–75th percentile)	Mean ± SD	Median (25th–75th percentile)	Mean ± SD	Median (25th–75th percentile)
Comorbidities	Hypertension	4 (2–7)	23,333±151,929	7,759 (4,028–17,866)	3,564±11,486	2,182 (1,465–3,543)
	Diabetes mellitus	4 (2–7)	23,072±165,634	7,836 (4,151–17,566)	3,479±12,217	2,127 (1,444–3,482)
	Hyperlipidemia	4 (2–7)	27,754±79,165	8,767 (4,471–20,767)	4,283±11,570	2,232 (1,493–3,700)
	Ischemic heart disease	4 (2–8)	37,732±106,752	11,478 (5,510–27,252)	5,924±15,359	2,729 (1,782–4,597)
	Heart failure	4 (2–8)	28,369±107,870	9,920 (5,310–21,368)	3,503±6,035	2,392 (1,642–3,787)
	Gout	4 (2–7)	19,727±54,788	7,061 (3,709–15,541)	2,989±5,738	1,930 (1,323–3,095)
	Sepsis	6 (3–13)	54,187±140,151	19,293 (8,684–49,433)	4,789±4,888	3,412 (2,054–5,756)
	Pneumonia	7 (4–14)	63,327±163,420	19,308 (8,470–55,465)	4,170±3,747	3,118 (1,901–5,143)
	AKI on pre–existing CKD	7 (4–14)	57,789±127,685	22,363 (9,794–55,169)	4,678±6,166	3,182 (1,995–5,286)
	Diarrhea	3 (2–6)	17,199±55,461	5,557 (3,086–11,968)	2,390±2,751	1,684 (1,223–2,602)
	Stroke	5 (3–11)	44,983±116,448	13,962 (6,644–37,092)	4,112±6,066	2,860 (1,826–4,686)
	Respiratory failure	5 (2–11)	55,515±121,600	23,262 (10,459–54,127)	5,923±5,509	4,691 (3,260–6,917)
Complications	Anemia requiring blood transfusion	4 (2–8)	29,857±97,687	9,234 (4,591–23,990)	3,569±4,830	2,600 (1,828–3,950)
	Hyperkalemia	4 (2–7)	25,446±65,694	9,324 (5,151–21,005)	3,775±4,978	2,696 (1,850–4,246)
	Volume overload	4 (2–7)	24,277±315,227	8,960 (4,955–19,631)	3,391±21,033	2,372 (1,635–3,770)
	Metallic acidosis	4 (2–8)	27,833±63,349	11,010 (5,679–25,701)	4,432±5,591	2,942 (1,866–5,215)
Mode of dialysis	Hemodialysis	8 (4–15)	66,302±245,694	27,847 (13,424–61,410)	5,864±92,303	3,470 (2,301–5,473)
	Peritoneal dialysis	8 (4–15)	56,072±369,690	21,850 (10,218–51,175)	6,711±177,788	2,904 (1,900–4,815)

CKD, chronic kidney disease; AKI, acute kidney injury

Table 3. Factors influencing high hospital charges (>50,000 baht) among Thai adult patients hospitalized with CKD

Variables	No. of admissions (times)	No. of high cost admission (%)	Crude odds ratio (95% CI)	P	Adjusted odds ratio (95% CI)	P
Sex						
Female	126,027	8,490 (6.7)	1		1	<0.001
Male	110,412	9,662 (8.8)	1.31 (1.27–1.36)		1.29 (1.25–1.34)	
Age (years)						
19–30	4,376	405 (9.3)	1		1	
31–40	8,392	715 (8.5)	0.92 (0.80–1.06)	0.24	1.03 (0.88–1.20)	0.72
41–50	22,172	1,682 (7.6)	0.81 (0.72–0.92)	0.001	0.90 (0.78–1.03)	0.13
51–60	46,571	3,408 (7.3)	0.77 (0.68–0.86)	<0.001	0.81 (0.71–0.92)	0.002
61–70	62,672	4,324 (6.9)	0.72 (0.64–0.81)	<0.001	0.75 (0.66–0.85)	<0.001
71–80	64,288	5,065 (7.9)	0.82 (0.72–0.92)	0.001	0.84 (0.74–0.96)	0.01
>80	27,968	2,553 (9.1)	0.95 (0.84–1.07)	0.40	0.95 (0.83–1.09)	0.48
Comorbidities						
Hypertension (yes/no)	125,565/110,874	11,037 (8.8)/7,115 (6.4)	1.38 (1.34–1.42)	<0.001	1.21 (1.17–1.26)	<0.001
Diabetes mellitus (yes/no)	101,664/134,775	8,775 (8.6)/9,377 (7.0)	1.27 (1.23–1.31)	<0.001	1.20 (1.16–1.25)	<0.001
Hyperlipidemia (yes/no)	31,229/205,210	3,449 (11.0)/14,703 (7.2)	1.51 (1.45–1.57)	<0.001	1.38 (1.32–1.45)	<0.001
Ischemic heart disease (yes/no)	29,272/207,167	4,406 (15.1)/13,746 (6.6)	2.42 (2.33–2.51)	<0.001	2.35 (2.24–2.45)	<0.001
Heart failure (yes/no)	24,915/211,524	2,679 (10.8)/15,473 (7.3)	1.53 (1.46–1.60)	<0.001	1.13 (1.07–1.19)	<0.001
Sepsis (yes/no)	18,528/217,911	4,586 (24.8)/13,566 (6.2)	4.62 (4.44–4.79)	<0.001	2.87 (2.74–3.00)	<0.001
Pneumonia (yes/no)	14,732/221,707	4,004 (27.2)/14,148 (6.4)	5.18 (4.98–5.40)	<0.001	3.18 (3.03–3.34)	<0.001
AKI plus preexisting CKD (yes/no)	12,133/224,306	3,351 (27.6)/14,801(6.6)	5.09 (4.88–5.31)	<0.001	2.83 (2.69–2.98)	<0.001
Stroke (yes/no)	11,886/224,553	2,313 (19.5)/15,839 (7.1)	2.97 (2.83–3.12)	<0.001	2.41 (2.27–2.55)	<0.001
Respiratory failure (yes/no)	11,347/225,092	3,080 (27.1)/15,072 (6.7)	5.02 (4.80–5.25)	<0.001	2.10 (1.99–2.22)	<0.001
Complications						
Anemia requiring blood Transfusion (yes/no)	57,727/178,712	7,442 (12.9)/10,710 (6.0)	2.38 (2.31–2.46)	<0.001	2.13 (2.06–2.21)	<0.001
Hyperkalemia (yes/no)	23,505/212,934	2,532 (10.8)/15,620 (7.3)	1.57 (1.51–1.64)	<0.001	1.09 (1.03–1.14)	0.002
Metabolic acidosis (yes/no)	11,897/224,542	1,549 (13.0)/16,603 (7.4)	1.90 (1.80–2.00)	<0.001	1.03 (0.96–1.10)	0.42
Mode of dialysis						
Hemodialysis	17,143/219,296	5,239 (30.6)/12,913(5.9)	6.45 (6.22–6.70)	<0.001	5.16 (4.94–5.39)	<0.001
Peritoneal dialysis	4,584/231,855	1,170 (25.5)/16,982 (7.3)	4.16 (3.89–4.46)	<0.001	3.40 (3.14–3.69)	<0.001

AKI; acute kidney injury

Table 4. Prognostic factors influencing mortality rates of adult Thai patients hospitalized with chronic kidney disease

Variables	No. of patients (individuals)	Dead individuals and mortality rate (%)	Crude odds ratio (95% CI)	P	Adjusted odds ratio* (95% CI)	P
Sex						
Female	66,134	6,814 (10.3)	1		1	
Male	62,204	6,941 (11.2)	1.10 (1.05–1.14)	<0.001	1.07 (1.03–1.11)	0.001
Age (years)						
19–30	1,869	189 (10.1)	1		1	
31–40	4,135	400 (9.7)	0.95 (0.79–1.14)	0.60	1.13 (0.92–1.39)	0.23
41–50	10,556	1,127 (10.7)	1.06 (0.90–1.25)	0.47	1.20 (1.00–1.45)	0.049
51–60	23,073	2,318 (10.0)	0.99 (0.85–1.16)	0.93	1.09 (0.91–1.30)	0.36
61–70	32,837	3,277 (10.0)	0.98 (0.84–1.15)	0.85	1.08 (0.91–1.29)	0.38
71–80	37,727	4,039 (10.7)	1.07 (0.91–1.24)	0.42	1.19 (0.99–1.41)	0.06
>80	18,141	2,405 (13.3)	1.36 (1.16–1.59)	<0.001	1.52 (1.27–1.81)	<0.001
Comorbidities						
Diabetes mellitus (yes/no)	58,427/69,911	6,795 (11.6)/6,960 (10.0)	1.19 (1.15–1.23)	<0.001	1.13 (1.08–1.19)	<0.001
Ischemic heart disease (yes/no)	19,264/109,074	3,178 (16.5)/10,577 (9.7)	1.84 (1.76–1.92)	<0.001	1.64 (1.55–1.73)	<0.001
Heart failure (yes/no)	18,174/110,164	3,277 (18.0)/10,478 (9.5)	2.09 (2.01–2.18)	<0.001	1.42 (1.35–1.50)	<0.001
Sepsis (yes/no)	16,792/111,546	6,146 (36.6)/7,609 (6.8)	7.89 (7.58–8.20)	<0.001	4.96 (4.75–5.19)	<0.001
Pneumonia (yes/no)	13,247/115,091	3,860 (29.1)/9,895 (8.6)	4.37 (4.19–4.56)	<0.001	1.81 (1.72–1.91)	<0.001
AKI plus preexisting CKD (yes/no)	11,367/116,971	2,972 (26.1)/10,783 (9.2)	3.49 (3.33–3.65)	<0.001	1.63 (1.54–1.72)	<0.001
Stroke (yes/no)	9,527/118,811	2,071 (21.7)/11,684 (9.8)	2.55 (2.42–2.68)	<0.001	2.16 (2.03–2.30)	<0.001
Respiratory failure (yes/no)	10,596/117,742	4,707 (44.4)/9,048 (7.7)	9.60 (9.19–10.03)	<0.001	4.14 (3.94–4.36)	<0.001
Complications						
Anemia requiring blood Transfusion (yes/no)	38,730/89,608	5,916 (15.3)/7,839 (8.7)	1.88 (1.81–1.95)	<0.001	1.21 (1.16–1.27)	<0.001
Hyperkalemia (yes/no)	19,165/109,173	3,728 (19.5)/10,027 (9.2)	2.39 (2.29–2.49)	<0.001	1.51 (1.44–1.59)	<0.001
Volume overload (yes/no)	15,213/113,125	2,831 (18.6)/10,924 (9.7)	2.14 (2.04–2.24)	<0.001	1.25 (1.18–1.32)	<0.001
Metabolic acidosis (yes/no)	10,561/117,777	2,799 (26.5)/10,956 (9.3)	3.52 (3.35–3.69)	<0.001	1.74 (1.64–1.84)	<0.001

Chronic kidney disease, CKD; AKI, acute kidney injury

Discussion

CKD is defined as abnormalities in the kidney structure or function or a decreased glomerular filtration rate (GFR <60 mL/min/1.73 m^2) for more than three months, or both [13]. Code N18 in the ICD-10 represents an older nomenclature for chronic renal failure—a decreased GFR comparable to patients with stage 3a–5 CKD (GFR <60 mL/min/1.73 m^2). Our study found the major diseases associated with CKD were hypertension and DM. The less prevalent comorbidities, albeit causing long duration of admission, high treatment cost, and mortality were pneumonia, sepsis, respiratory failure, AKI in addition to CKD, stroke and ischemic heart disease. CKD with complications are also associated with higher mortality. The degree of CKD severity increased in-hospital mortality of patients with acute coronary syndrome [14-17], heart failure [18-20], cardiac surgery [21], and stroke [22-24]. The reasons for the poor outcome specifically among these patients are: (a) CKD is itself an independent factor, (b) CKD is usually associated with multiple comorbidities, (c) the associated diseases precipitate serious complications, and (d) standard care for comorbidities are underutilized [15, 17, 19, 20]. Moreover, in-hospital costs and length of hospitalization of CKD patients represent a substantial economic burden, which is associated with comorbidity—especially of cardiovascular diseases, DM, and infections [14, 19, 20, 25]. Optimum therapeutic interventions made early, and appropriate medication, might improve clinical outcomes and reduce the cost of hospitalization.

The present study revealed that patients with CKD aged between 70 and 80 years, and older had significantly increased mortality compared with younger patients. Prognosis of elderly CKD patients depended on several factors including functional, psychosocial, and cognitive status, occurrence of malnutrition, associated comorbidities and treatments. These patients should receive comprehensive geriatric assessment and multidimensional management for improving of prognosis [26].

An important finding was that severe infection, especially pneumonia, was a leading cause of associated disease resulting in the highest hospital charges and mortality. This supports a previous finding that pneumonia is a serious complication in older patients with CKD, who are more likely to have comorbidities—especially CVD, higher pneumonia severity index, and greater mortality than patients with pneumonia, but without CKD [27]. In addition, patients with CKD are susceptible to infection because of an impaired innate immune system including impaired neutrophil and macrophage function [28]. Further study is needed to identify risk factors and organism causing pneumonia in Thai patients with CKD to determine a strategy for preventing pneumonia and reducing mortality.

The prevalence of CVD—including coronary heart disease, congestive heart failure, left ventricular hypertrophy, and stroke—are increased in patients with CKD, and progress with the severity of CKD, leading to morbidity and mortality [14, 19, 22, 24, 29]. Occurrence of CKD in patients with CVD increased related hospital cost and mortality [15, 16, 18]. The interaction of cardiac and renal functions has been established and designated as cardio–renal syndrome [30]. The relationship between the heart and kidneys is bidirectional and mediated by several mechanisms: namely, hemodynamic change, hormonal effects, activation of the sympathetic nervous system and renin–angiotensin–aldosterone system, metabolic derangement, malnutrition, and inflammation [31,32]. Moreover, common risk factors and complications of CKD (i.e., hypertension, diabetes mellitus, dyslipidemia, albuminuria, anemia, hyperkalemia, and volume overload) aggravate CVD. Therefore, treatment of these factors will improve CVD outcomes.

Data presented in the Tables presents the characteristics of patients with CKD with and without AKI, demonstrating that patients with CKD patients with AKI had significantly more comorbidity, CKD complications, dialysis treatment, length of hospital stay, hospital charges, and mortality. These findings confirm those found in other studies [33-35]. AKI and CKD have a bidirectional relationship; such that AKI is associated with progression to CKD and preexisting CKD increases the risk of AKI [36-38]. Therefore, more effort should be made to prevent AKI in patients with CKD.

Early and appropriate treatment of complications of CKD among outpatients may reduce the chance of admission. For example, receiving an adequate dose of erythropoiesis-stimulating agent and iron supplement decreases the need for blood transfusion and hospitalization [39, 40]. Patient education regarding limiting high potassium and salt intake and proper adherence to medication might reduce the occurrence of hyperkalemia and volume overload requiring hospital admission.

A strength of this study is that almost all Thai adult patients hospitalized with CKD were included. Therefore, the results should provide an overview of the situation. Notwithstanding, the lack of a registered nationwide laboratory system means that there is no defined staging of CKD in patients in the present study. However, because of the retrospective nature of the study design, some data might not be complete. The record of hospital charges for each group represents an average, which might not wholly characterize the severity of individual patients, nor include details of the procedures and medical instruments needed for each patient.

Conclusions

Pneumonia, sepsis, respiratory failure, AKI in addition to preexisting CKD, stroke, and ischemic heart disease were the major diseases associated with high hospital charges and mortality of CKD patients. Prevention and early treatment of these comorbidities and CKD complications should reduce the poor outcome of, and treatment costs for, patients hospitalized with CKD.

Conflict of interest statement

The authors have no conflicts of interest to declare.

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