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Original Research Article

Effectiveness and cost of Bailing capsules for patients with chronic kidney disease stage 3: a real-world cohort study

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ABSTRACT

Introduction Due to the high rates of mortality and morbidity, chronic kidney disease (CKD) has become a significant public health concern. Evidence shows that Chinese patent medicine Bailing capsules may help protect kidney function by reducing proteinuria and having potential antioxidative and antiinflammatory effects. In this study, we aimed to investigate the real-world effectiveness and cost of Bailing capsules in the treatment of patients with CKD stage 3. **Methods** A retrospective study was conducted using data from patients newly diagnosed with CKD stage 3 who visited secondary and tertiary hospitals covered by the Tianjin Healthcare and Medical Big Data Platform in China between 2016 and 2021. Incidence rates and incidence densities were analyzed. Cox regression survival analysis was performed to estimate the hazard ratios of disease progression. Data on patient costs were extracted from electronic medical records, including outpatient, emergency, and hospitalization expenses. **Results** A total of 3370 patients were included, with 1337 retained after propensity score matching. The incidence rates for progression from CKD stage 3 to first dialysis and to CKD stage 5 were significantly lower in the exposed group than in the control group (11.79% *vs.* 18.44%, $P = 0.01$; 19.39% *vs.* 27.56%, $P = 0.007$, respectively). The corresponding incidence density ratios were 0.54 (0.52–0.55) and 0.57 (0.56–0.59), respectively. Cox regression analysis revealed a significantly lower risk of disease progression in the exposed group. The average annual cost was CNY 16 685 (USD 2336) for the exposed group and CNY 29 819 (USD 4175) for the control group. **Conclusion** Bailing capsules were associated with lower medical costs and slower disease progression, indicating their possible role as adjunct therapy. The results also reveal current gaps in evidence quality, emphasizing the need for well-designed prospective studies to confirm effectiveness, minimize confounding, and inform future clinical and policy decision-making.

KEYWORDS

Bailing capsule, chronic kidney disease, cost, incidence density, incidence rate, real-world cohort study

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1. Introduction

Chronic kidney disease (CKD) is defined as a persistent reduction in estimated glomerular filtration rate (GFR) to <60 mL · min^{-1} · 1.73 m^{-2} for ≥3 months, indicative of sustained kidney damage or dysfunction. According to the Kidney Disease: Improving Global Outcomes 2012 Clinical Practice Guideline, CKD is classified into five stages based on GFR levels.[1] Owing to population aging and shifts in disease spectrum, CKD incidence continues to rise. Its gradual progression and high rates of mortality and morbidity make it a significant public health concern.[2] A study in 2023 reported a CKD prevalence of 8.2% in China.[3] Patients with CKD stages 3–5, hypertension, diabetes, and related conditions are at a high risk for rapid disease progression.[4]

Conventional treatment methods include controlling the primary cause, maintaining a healthy lifestyle (e.g., low salt, low fat, and high-quality low-protein diet), avoiding risk factors of hypertension and hyperglycemia, inhibiting excessive activation of the renin-angiotensin system, and preventing and managing the relevant complications.[5] However, these methods have limited ability to delay renal decline, particularly in patients with CKD stages 3–5,[6] and effective drugs for slowing the deterioration of renal function remain insufficient.[7]

In traditional Chinese medicine (TCM), CKD is described/ or defined as "edema," "consumptive disease," and "blockage and repulsion" ("Guan-Ge").[8,9] Currently, TCM physicians attribute CKD pathogenesis to a root deficiency and superficial excess.[10,11] The qi and yin deficiency of the spleen and kidney is the most common pathogeny, while the symptomatic deficiency of blood stasis and dampness-heat are the most common symptoms.[12] TCM treatment can improve clinical symptoms of CKD, reduce serum creatinine levels, and offer benefits in preventing and controlling CKD progression.[13]

In China, TCM has long been used to treat kidney diseases. Since the 1980s, Chinese researchers have been committed to the clinical applications of TCM in treating CKD.[14] Commonly used Chinese materia medica include *Cordyceps sinensis* (BerK.) Sacc. (*C. sinensis*, Dong Chong Xia Cao) and *Salvia miltiorrhiza* Bge. (Dan Shen). Patients with CKD treated with Chinese materia medica show improved long-term survival.[15] However, evidence-based

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studies on the effectiveness of Chinese materia medica in treating CKD remain limited and are not yet accepted worldwide, highlighting the need for further research.[16]

Bailing capsules are refined via low-temperature fermentation of *Cordyceps* strains and contain multiple active components, such as adenosine, D-mannitol, cordycepic acid, carrier alkaloids, multiple amino acids, vitamins, and trace elements. They exhibit antioxidative, anti-inflammatory, and proteinuria-reducing effects.[17] Bailing capsules have been widely utilized in the treatment of CKD-related conditions, such as glomerulonephritis, diabetic nephropathy (DN), and nephrotic syndrome. From the TCM perspective, they tonify the lung and kidney, improve vital qi, relieve cough, and resolve phlegm.[18] Meta-analyses have shown that Bailing capsules, combined with Western medicine, have better efficacy than Western medicine alone by reducing proteinuria and protecting kidney function.[19] However, evidence on their real-world effectiveness and cost in CKD treatment remains scarce.[20]

Therefore, in this study, we aimed to assess the effectiveness and cost of Bailing capsules in patients with CKD stage 3 using a large-scale retrospective cohort.

2. Methods

2.1. Ethical approval

This study was approved by the Medical Ethics Committee of Wuqing People's Hospital (approval no.: 2022-01-01).

2.2. Study design

A retrospective cohort study was conducted using data from patients newly diagnosed with CKD stage 3 who visited secondary and tertiary hospitals covered by the Tianjin Healthcare and Medical Big Data Platform in China between 2016 and 2021.

2.3. Setting

The Tianjin Healthcare and Medical Big Data Platform includes 43 tertiary, 39 secondary, and 295 primary hospitals in Tianjin, with a patient population of approximately 15 million. The platform provides more than 5 years of follow-up data, with records dating back to 2001. Patient data were retrieved from electronic medical records, the Hospital Information System (HIS), the Laboratory Information System, and the medical record home pages, including date of birth, sex, body mass index, diagnostic codes, disease course, medications, and laboratory indices.

2.4. Participants

Inclusion criteria were as follows: (Ⅰ) first consultation between 2016 and 2021; (Ⅱ) initial diagnosis as CKD stage 3; (Ⅲ) at least three medical visits.

Exclusion criteria included: (Ⅰ) patients using Chinese patent drugs containing *C. sinensis* except Bailing capsules (such as Jin Shui Bao tablets or capsules, Ning Xin Bao capsules, Zhi Ling capsules, Xin Gan Bao capsules, Yong Chong Cao Jun Fen capsules, and Chong Cao Jiao Lei Jun oral liquid, and (Ⅱ) patients undergoing dialysis within 1 month after the first diagnosis of CKD stage 3.

Demographic, clinical, and cost-related data were collected. The time to first dialysis and disease progression (from CKD stage 3 to stages 4 and 5) were also recorded.

2.5. Exposure and grouping

Patients were divided into exposed and control groups. The exposed group received Bailing capsules in addition to conventional therapy. In contrast, the control group received conventional therapy alone, regardless of whether other Chinese patent drugs were used (provided they did not contain *C. sinensis*).

2.6. Outcome measures

2.6.1. Clinical outcome measures

Median time to progression (mTTP) was defined as the median duration from CKD stage 3 diagnosis to first dialysis, stage 4, or stage 5. When fewer than 50% of patients experienced disease progression by the end of the observation period, incidence rates and incidence densities were used to describe disease progression.

Incidence density was calculated as the number of patients who experienced progression from CKD stage 3 during the observation period divided by the person-months. Person-months were defined as the total duration of disease progression for each patient who experienced progression. The densities of the two groups were compared by calculating incidence density ratios with 95% confidence intervals (95% CIs).

2.6.2. Cost measures

We assessed only direct medical costs from the perspective of the healthcare system. Cost data were obtained from the HIS, including outpatient, emergency, and inpatient expenses. Specifically, outpatient medical costs comprised expenses of medical service, consultation, treatment, laboratory and imaging examinations, and medications, whereas inpatient costs included bed, treatment, examination, medication, and material expenses. The annual average cost was defined as the total medical expenses incurred by patients from enrollment to the occurrence of events or the end of follow-up, divided by the total observation time.

2.7. Statistical analysis

Propensity score matching (PSM) was used to control for confounding factors and reduce bias in estimating the intervention effect, with a 1:5 matching ratio implemented via the greedy matching approach. A logistic regression model was constructed to calculate each patient's baseline probability of receiving Bailing capsules, using age, sex, hospitalization at the first visit, hospital level, medical history (such as hypertension and diabetes), year of first visit, and the use of other non-*C. sinensis* Chinese patent drugs during follow-up. After successful matching, Cox regression survival analysis was then performed to estimate the hazard ratios (HRs) for disease progression between the two groups.

For descriptive analysis, continuous variables were presented as mean (standard deviation, SD) or median (first and third quartiles, Q1–Q3), and categorical variables were described as frequency and percentage. Between-group comparisons used the *t*-test or Wilcoxon rank-sum test for continuous variables, and the chi-square test or exact probability method for categorical variables.

Because this study utilized data from multiple hospitals with varying data management protocols, some variables had missing values. Therefore, we excluded patients with missing data and analyzed only cases with complete data.

For the Cox regression survival analysis, the log-rank test was used to compare and assess the difference in survival between groups. HRs with 95% CIs were reported.

All statistical tests were two-sided, with $P < 0.05$ considered statistically significant (unless otherwise specified). Analyses were performed using SAS 9.4 (SAS Institute, Cary, NC).

3. Results

3.1. Characteristics of patients

The process and results of patient screening are shown in Figure 1.

3.2. Pre-PSM and post-PSM

Before PSM, 376 cases were in the exposed group treated with Bailing cap-

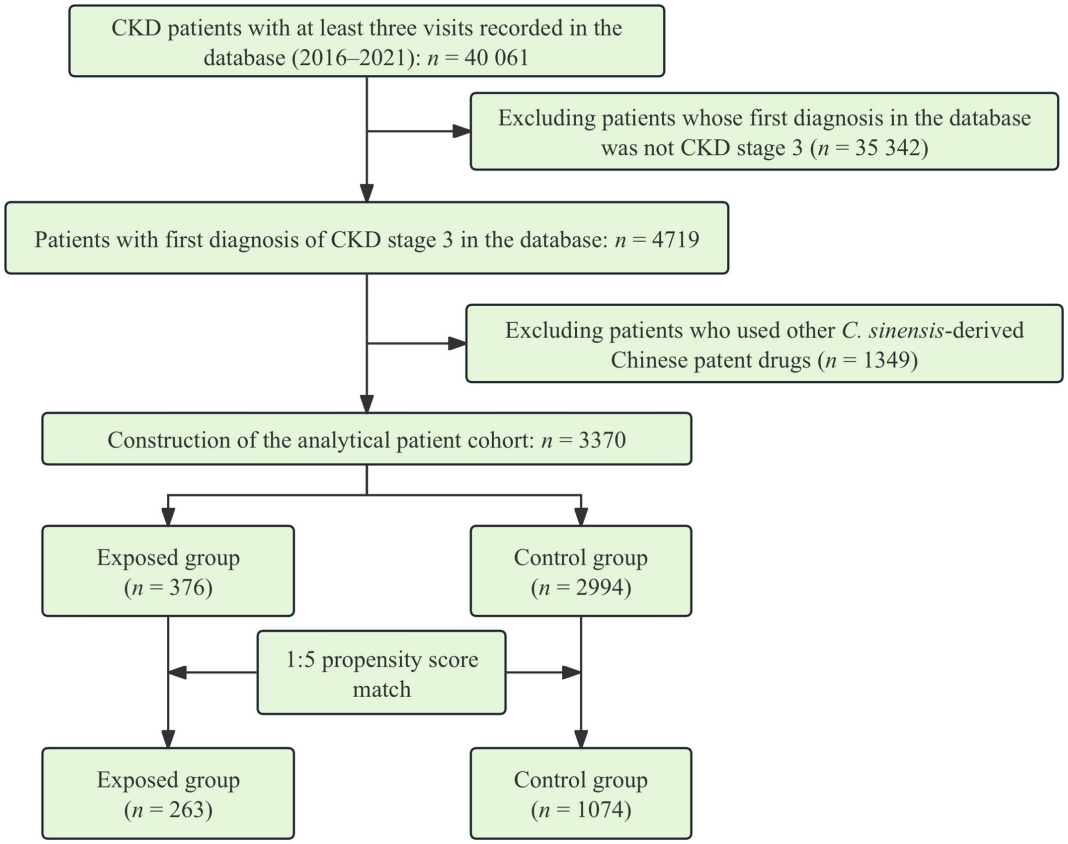

Figure 1 Process and result of patient screening

Notes: CKD: chronic kidney disease; *C. sinensis*: *Cordyceps sinensis* (BerK.) Sacc. (Dong Chong Xia Cao).

sules, and 2994 were in the control group. Significant differences between the two groups were observed in sex, hospitalization at first visit, hospital level, year of first visit, presence of diabetes, and use of other Chinese patent drugs. In contrast, age and underlying hypertension did not differ significantly (Table 1).

We used a matching ratio of 1:5 for PSM. After matching, 263 cases remained in the exposed group and 1074 in the control group, with no significant differences observed in any of the distributions ($P > 0.05$) (Table 1).

3.3. Clinical outcomes

By the end of the observation period, fewer than 50% of patients experienced endpoint events (progression from CKD stage 3 to first dialysis, stage 4, or stage 5); therefore, incidence rates and incidence densities, rather than mTTP, were used for analysis (Table 2). The results showed that the incidence rates of progression from CKD stage 3 to first dialysis and to CKD stage 5 were significantly lower in the exposed group than in the control group (11.79% *vs.* 18.44%, $P = 0.01$; 19.39% *vs.* 27.56%, $P = 0.007$, respectively), whereas progression to stage 4 did not differ significantly (11.79% *vs.* 14.25%). Incidence density ratios (incidence density of exposed group/incidence density of control group) for progression from CKD stage 3 to first dialysis, stage 4, and stage 5 were 0.54 (0.52–0.55), 0.73 (0.71–0.75), and 0.57 (0.56–0.59), respectively.

3.4. Cox regression survival analysis

3.4.1. Survival analysis of all-cause patients after PSM in two groups

Cox regression analysis revealed a significantly lower risk of progression from CKD stage 3 to first dialysis, stage 4, and stage 5 in the exposed group, without changes in other factors. Compared with the exposed group, HRs in the control group were 2.32 (95% CI: 1.71–3.16), 1.42 (95% CI: 1.00–2.02), and 2.08 (95% CI: 1.61–2.68), respectively, indicating significant differences (higher HRs indicate greater benefit in the exposed group). Detailed results are presented in Appendices 1-3.

3.4.2. Survival analysis of the prognosis

As shown in Figure 2A–C, survival analysis of the prognosis revealed a superior long-term survival in the exposed group, comprising patients requiring dialysis and those at CKD stages 4 and 5. These findings support the effectiveness of Bailing capsules in improving the long-term survival of patients.

3.5. Cost analysis

As shown in Table 3, the average annual medical cost in the exposed group was CNY 16 685 (USD 2336), compared with CNY 29 819 (USD 4175) in the control group, indicating lower average annual medical costs in the exposed group than in the control group. Major contributors to this difference included bed, laboratory test, examination, treatment, and Western medication fees. The lower costs in the exposed group may be attributed to the use of Bailing capsules, which exerted a superior therapeutic effect on patients' conditions compared with the control group. Bailing capsules likely delayed disease progression, reduced hospital stay and the corresponding costs of examinations and laboratory tests, and decreased reliance on Western medications.

4. Discussion

Clinical outcomes based on the incidence rates and incidence densities were superior in the exposed group compared to those in the control group. Additionally, the average annual medical cost was lower in the exposed group (CNY 16 685 [USD 2336]) than in the control group (CNY 29 818 [USD

Table 1 Demographic characteristics and baseline comparison of the two groups before and after PSM

Variable	Before PSM matched		*P*	After PSM matched		*P*
	Exposed group (*n* = 376)	Control group (*n* = 2994)		Exposed group (*n* = 263)	Control group (*n* = 1074)	
Age, y, mean (SD)	64.03 (12.81)	64.06 (14.01)	0.653	63.86 (13.39)	64.75 (13.55)	0.342
Younger age (0–40), *n* (%)	37 (9.84)	348 (11.62)		31 (11.79)	99 (9.22)	
Middle-aged (41–65), *n* (%)	214 (56.91)	1537 (51.34)		141 (53.61)	571 (53.17)	
Old age (≥66), *n* (%)	125 (33.24)	1109 (37.04)		91 (34.60)	404 (37.62)	
Sex			0.012*			0.430
Male, *n* (%)	204 (54.26)	1824 (60.92)		146 (55.51)	625 (58.19)	
Female, *n* (%)	172 (45.74)	1170 (39.08)		117 (44.49)	449 (41.81)	
Hospitalization at the first visit			<0.001*			0.830
No, *n* (%)	347 (92.29)	1950 (65.13)		237 (90.11)	963 (89.66)	
Yes, *n* (%)	29 (7.71)	1044 (34.87)		26 (9.89)	111 (10.34)	
Hospital level			0.011*			0.544
Secondary, *n* (%)	48 (12.77)	244 (8.15)		20 (7.60)	105 (9.78)	
Tertiary, *n* (%)	327 (86.97)	2740 (91.52)		242 (92.02)	964 (89.76)	
Unclear, *n* (%)	1 (0.27)	10 (0.33)		1 (0.38)	5 (0.47)	
Year of first diagnosis			<0.001*			0.443
2016, *n* (%)	61 (16.22)	337 (11.26)		54 (20.53)	182 (16.95)	
2017, *n* (%)	71 (18.88)	468 (15.63)		50 (19.01)	222 (20.67)	
2018, *n* (%)	58 (15.43)	604 (20.17)		53 (20.15)	227 (21.14)	
2019, *n* (%)	79 (21.01)	563 (18.80)		46 (17.49)	183 (17.04)	
2020, *n* (%)	85 (22.61)	674 (22.51)		45 (17.11)	197 (18.34)	
2021, *n* (%)	22 (5.85)	348 (11.62)		15 (5.70)	63 (5.87)	
Use of other Chinese patent drugs			<0.001*			0.660
No, *n* (%)	128 (34.04)	1354 (45.22)		83 (31.56)	324 (30.17)	
Yes, *n* (%)	248 (65.96)	1640 (54.78)		180 (68.44)	750 (69.83)	
Hypertension			0.108			0.818
No, *n* (%)	44 (11.70)	443 (14.80)		30 (11.41)	128 (11.92)	
Yes, *n* (%)	332 (88.30)	2551 (85.20)		233 (88.59)	946 (88.08)	
Diabetes			<0.001*			0.392
No, *n* (%)	105 (27.93)	1458 (48.70)		90 (34.22)	398 (37.06)	
Yes, *n* (%)	271 (72.07)	1536 (51.30)		173 (65.78)	676 (62.94)	

Notes: PSM: propensity score matching; SD: standard deviation. *$P < 0.05$ indicates statistical significance.

Table 2 Clinical outcomes of the two groups after PSM

Variable	Exposed group	Control group	*P*
To dialysis			
Total, *n*	263	1074	
Progression, *n*	31	198	
Person-months	7499	25 763	
Incidence rate, %	11.79	18.44	0.01*
Incidence density	0.0041	0.0077	
To CKD stage 4			
Total, *n*	263	1074	
Progression, *n*	31	153	
Person-months	7452	26 720	
Incidence rate, %	11.79	14.25	0.30

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Variable	Exposed group	Control group	*P*
Incidence density	0.0042	0.0057	
To CKD stage 5			
Total, *n*	263	1074	
Progression, *n*	51	296	
Person-months	7071	23 590	
Incidence rate, %	19.39	27.56	0.007*
Incidence density	0.0072	0.0125	

Notes: CKD: chronic kidney disease; PSM: propensity score matching. *$P < 0.05$ indicates statistical significance.

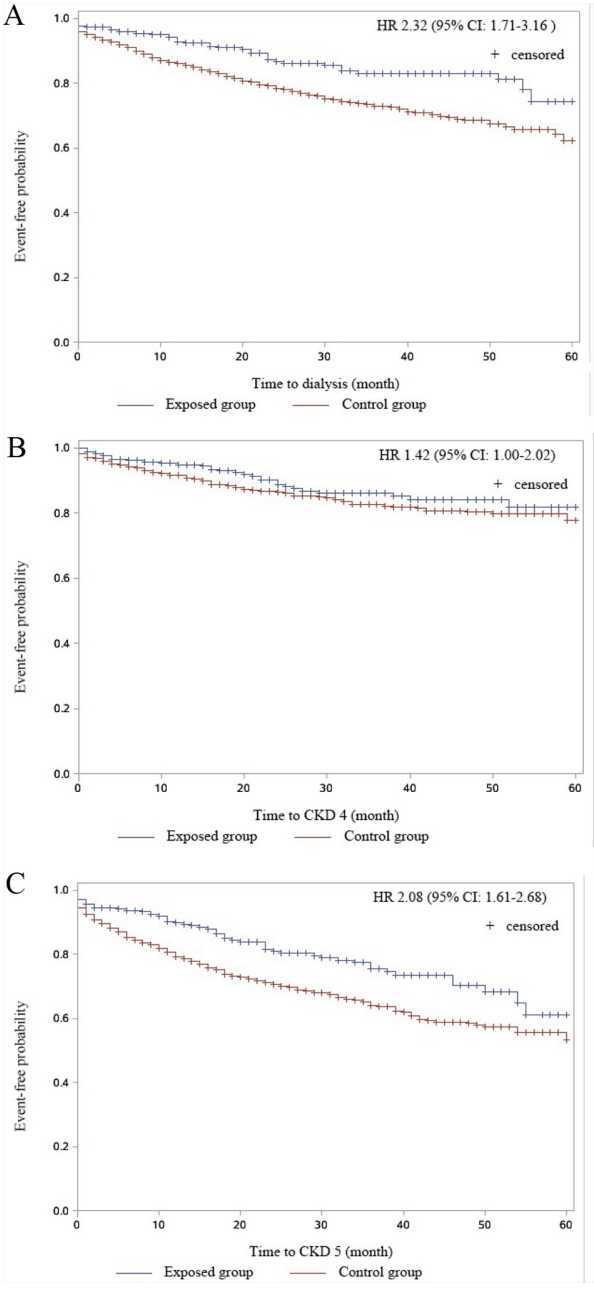

Figure 2 Survival analysis curve of progression from CKD stage 3 diagnosis to dialysis, CKD stages 4 and 5 (A–C)

Notes: CI: confidence interval; CKD: chronic kidney disease; HR: hazard ratio.

4175]). These findings suggest that Bailing capsule use in patients with CKD stage 3 is associated with greater cost-effectiveness and may contribute to slower disease progression.

Bailing capsules, containing fermentation products of *C. sinensis*, have been commonly used to treat renal dysfunction, such as DN. However, research on their mechanism of action of Bailing capsules in treating kidney disease remains limited. Recent pharmacological studies indicate that *C. sinensis* exhibits antioxidative, immunomodulatory, anti-mutagenic, and antitumor effects.[21,22] *C. sinensis* may also protect against CKD progression by modulating the TLR4/NF-κB lipid and redox signaling pathway.[23] Changes in several biomarkers after treatment with Bailing capsules indicate that the therapy might help restore dysregulated metabolism pathways, thereby contributing to its clinical effects in practical application. The mechanism of action related to the treatment involves many metabolic profiles, particularly amino acid metabolism. We found a distinct tryptophan metabolism in patients with DN, with six metabolites significantly altered. After Bailing Capsule treatment, five of these metabolites, along with glucuronides, were restored to normal levels, indicating that Bailing capsules may play a protective role in DN by restoring tryptophan metabolism and reducing glucuronides.[24] Additionally, levels of cresols were significantly decreased and tended to return to normal, suggesting that Bailing capsules may alleviate DN by modulating gut microbiota and restoring abnormal tyrosine metabolism. These findings further indicate that reducing the accumulation of uremic toxins may improve the therapeutic effect of Bailing capsules.[24]

This retrospective, real-world study utilized a regional medical big data platform. Its core strength lies in leveraging large-scale data and long-term follow-up, which not only enhances statistical power and population representativeness but also aligns with the chronic nature of CKD management. Compared with randomized controlled trials, it significantly reduces research time and costs, with study conclusions more consistent with real clinical scenarios and higher efficiency in evidence translation.

In terms of innovative contributions, to the best of our knowledge, this study is the first to systematically evaluate the long-term efficacy and costs of Bailing capsules in the treatment of CKD stage 3 in a real-world setting. The economic analysis provides a new research direction for subsequent studies and offers evidence-based guidance for rational clinical use and decision-making.

Since the effect indicators in this study were derived from real-world data and patients with CKD stage 3 were representative of the broader CKD population, the findings are informative for the treatment of this disease.

However, this study had a few limitations. First, the inclusion of patients with CKD stage 3 was confirmed via diagnostic records, eGFR parameters documented in medical records, or eGFR values calculated using serum creatinine conversion formulas. Additionally, comorbidities, such as hypertension and diabetes, were considered and adjusted for disease severity between the two groups. However, unobserved confounders remain despite the PSM balancing of measurable characteristics, which restricts causal inferences. Second, Bailing capsules were initiated at any time after baseline diagnosis of CKD stage 3 (cohort entry); the period from diagnosis to first prescription constitutes "immortal time." During this period, patients must remain event-

Table 3 Cost of CKD stage 3 patients post-PSM

Cost	Exposed group	Control group	*P*
Total†			0.054
Total (missing), *n*	260 (3)	1034 (40)	
CNY, mean (SD)	16 685 (32 933)	29 819 (84 846)	
USD, mean (SD)	2336 (4611)	4175 (11 878)	
Material†			0.128
Total (missing), *n*	164 (99)	747 (327)	
CNY, mean (SD)	1502 (5081)	2408 (9736)	
USD, mean (SD)	210 (711)	337 (1363)	
Bed†			0.017*
Total (missing), *n*	58 (205)	361 (713)	
CNY, mean (SD)	1010 (2383)	1748 (7053)	
USD, mean (SD)	141 (334)	245 (987)	
Radiation†			0.264
Total (missing), *n*	30 (233)	196 (878)	
CNY, mean (SD)	470 (808)	832 (1673)	
USD, mean (SD)	66 (113)	116 (234)	
Registration†			0.054
Total (missing), *n*	23 (240)	152 (922)	
CNY, mean (SD)	42 (71)	96 (188)	
USD, mean (SD)	6 (10)	13 (26)	
Nursing†			0.055
Total (missing), *n*	50 (213)	249 (825)	
CNY, mean (SD)	408 (801)	592 (1312)	
USD, mean (SD)	57 (112)	83 (184)	
Test†			<0.001*
Total (missing), *n*	181 (82)	780 (294)	
CNY, mean (SD)	1986 (8462)	3729 (13 560)	
USD, mean (SD)	278 (1184)	522 (1898)	
Supervision‡			0.059
Total (missing), *n*	12 (251)	125 (949)	
CNY, mean (SD)	386 (484)	4038 (18 970)	
USD, mean (SD)	54 (68)	565 (2656)	
Inspection†			<0.001*
Total (missing), *n*	104 (159)	479 (595)	
CNY, mean (SD)	986 (2304)	1535 (3599)	
USD, mean (SD)	138 (323)	215 (504)	
Anesthesia‡			0.067
Total (missing), *n*	20 (243)	73 (1001)	
CNY, mean (SD)	56 (95)	96 (231)	
USD, mean (SD)	8 (13)	13 (32)	
Operation†			0.462
Total (missing), *n*	39 (224)	163 (911)	
CNY, mean (SD)	1650 (3058)	1446 (4316)	
USD, mean (SD)	231 (428)	202 (604)	
Blood utilization†			0.029*
Total (missing), *n*	17 (246)	131 (943)	

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Cost	Exposed group	Control group	*P*
CNY, mean (SD)	264 (503)	2014 (6691)	
USD, mean (SD)	37 (70)	282 (937)	
Oxygen†			0.007*
Total (missing), *n*	32 (231)	247 (827)	
CNY, mean (SD)	292 (846)	1076 (3588)	
USD, mean (SD)	41 (118)	151 (502)	
Examination†			0.07
Total (missing), *n*	150 (113)	634 (440)	
CNY, mean (SD)	275 (588)	372 (793)	
USD, mean (SD)	39 (82)	52 (111)	
Treatment†			<0.001*
Total (missing), *n*	168 (95)	753 (321)	
CNY, mean (SD)	3493 (10 745)	7131 (19 942)	
USD, mean (SD)	489 (1504)	998 (2792)	
Western medications†			0.043*
Total (missing), *n*	244 (19)	971 (103)	
CNY, mean (SD)	7324 (13 380)	10 822 (32 260)	
USD, mean (SD)	1025 (1873)	1515 (4516)	
Chinese patent drugs†			<0.001*
Total (missing), *n*	211 (52)	624 (450)	
CNY, mean (SD)	3358 (4883)	2346 (3552)	
USD, mean (SD)	470 (684)	328 (497)	
Others†			0.504
Total (missing), *n*	176 (87)	701 (373)	
CNY, mean (SD)	1866 (4000)	7959 (45 442)	
USD, mean (SD)	261 (560)	1114 (6362)	

Notes: CKD: chronic kidney disease; CNY: Chinese Yuan; PSM: propensity score matching; SD: standard deviation; USD: United States Dollar. †Wilcoxon rank-sum test; ‡*t*-test. *$P < 0.05$ indicates statistical significance.

free to be classified as "exposed," creating an artificial survival advantage in the exposed group, which may bias results. Third, data were collected from multiple hospitals with inconsistencies in data management protocols, resulting in missing data; therefore, analyses were restricted to cases with complete data, potentially introducing selection bias. Finally, the dataset was primarily from Tianjin, which may limit the generalizability of the results. Prospective studies are required to confirm these findings, incorporating additional potential confounders, accounting for immortal time, and strengthening the reliability and credibility of the evidence.

5. Conclusions

In this retrospective cohort study, we explored the clinical benefits of Bailing capsules in treating patients with CKD stage 3 using real-world data. The findings suggest that Bailing capsule use is associated with potential advantages in clinical application and cost-effectiveness for patients with CKD stage 3. However, given the inherent limitations of retrospective data and unaddressed confounding factors, future prospective studies are needed to validate these findings and address the constraints.

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Author Contribution Statement

Yu-si Suo: Data curation, formal analysis, validation, visualization, writing – original draft, and writing – review & editing. **Li-ning Zhang:** Data curation, formal analysis, validation, visualization, writing – original draft, and writing – review & editing. **Shi-huan Cao:** Data curation, investigation, formal analysis, validation, and writing – review & editing. **Tie-zhuang Jia:** Data curation, formal analysis, and writing – original draft. **Yun-ting Chen:** Methodology and software. **Fan Wang:** Methodology and validation. **Chun-hui Liu:** Software and investigation. **Yin Zhang:** Formal analysis and supervision. **Cheng-ying Zhang:** Conceptualization, methodology, supervision, and writing – review & editing. **Xue-jing Jin:** Conceptualization, project administration, funding acquisition, methodology, supervision, and writing – review & editing.

Declaration of Competing Interest

Prof. Xue-jing Jin, who serves as the section editor of *Evidence-Based Chinese Medicine and Technology Assessment*, was not involved in the peer review of this manuscript. The other authors declare no conflicts of interest regarding this work.

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Electronic Supplementary Material

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