REVEAL-CKD: Epidemiological characteristics of patients with undiagnosed stage 3 chronic kidney disease in China

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Background

- Early-stage chronic kidney disease (CKD) often lacks symptom manifestation and results in delayed diagnosis[1] which heightens the risks of disease progression, health-related complications and increased healthcare costs[2,3]
- Therefore, early diagnosis of CKD is crucial for timely intervention to delay disease progression and improve patient outcomes[1,4]
- Currently, there is limited evidence regarding the proportion of undiagnosed early-stage CKD in China, specifically the epidemiological and clinical characteristics of the undiagnosed patients
- REVEAL-CKD is a multinational, retrospective, observational study conducted across 11 countries. Aim is to address data gaps and inform strategies for enhancing early CKD diagnosis in clinical practice[5]
- China-specific results are presented here for the first time

Objectives

- To estimate the proportion of undiagnosed stage 3 CKD patients and time to CKD diagnosis
- To describe the epidemiological and clinical characteristics of the undiagnosed and diagnosed CKD patients

Methods

- This study assessed de-identified patient data from 20 hospitals in five regions in China forming the China Renal Data System (CRDS). The study timeline is presented in **Figure 1**
- Inclusion criteria: **1)** Two consecutive estimated glomerular filtration rate (eGFR) measurements indicating stage 3 CKD (eGFR ≥30 and <60 mL/min/1.73m^2) recorded >90 and ≤730 days apart between January 1, 2015 and December 31, 2020; **2)** ≥12 months of continuous presence in CRDS prior to the first qualifying eGFR measurement; and **3)** Aged ≥18 years at the index date (defined as the date of second qualifying eGFR measurement)
- The study estimated the proportion of undiagnosed stage 3 CKD (no CKD-related diagnostic code [ICD-10CN]) and time to CKD diagnosis among these undiagnosed patients. Additionally, we described the epidemiological and clinical characteristics of patients with undiagnosed and diagnosed CKD at baseline

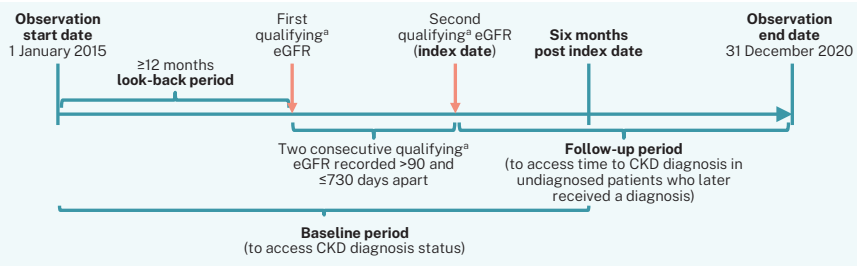
Results

- In total, 35,222 patients with two consecutive eGFR(s) indicating stage 3 CKD were included. The median age was 74.1 years and 56.1% were males (**Table 1**). Urine protein results were available in 24,235 (68.8%) patients, and urine albumin-creatinine ratio results were only available in 2,463 (7.0%) patients
- The overall undiagnosed proportion was 71.6% (n=25,214). Among them, 2,344 (9.3%) received a diagnosis during follow-up, and the median (95% CI) time to CKD diagnosis was 18.1 (17.6–18.8) months
- As shown in **Table 1**, the undiagnosed patients had baseline characteristics that differed from the diagnosed patients, such as having higher proportions of elderly and female patients, and lower proportions of patients with comorbidities. In addition, the undiagnosed patients had higher median eGFR compared with the diagnosed patients.
- When stratified by patient characteristic, the undiagnosed proportion of patients was higher among the elderly (≥65 years, vs. younger), females (vs. males), and stage 3A (vs. 3B) patients (**Figure 2**); and was lower in patients with (vs. without) any comorbidities at baseline (**Figure 3**)

Conclusions

- Consistent with data observed in other countries that were included in the REVEAL-CKD program, real-world data in China demonstrated a high level of undiagnosed CKD patients, and these patients had epidemiological and clinical characteristics that differed in comparison with the diagnosed patients
- These results indicate an urgent need to improve early CKD diagnosis so that more timely interventions are to be implemented to improve patient management and outcomes

FIGURE 1. Study timeline



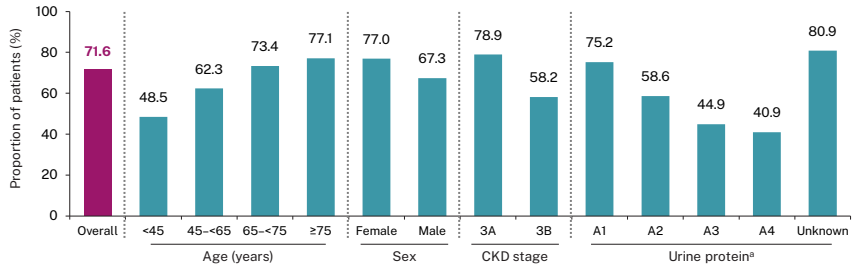
[a]eGFR ≥30 and <60 ml/min/1.73m^2 using the 2009 CKD-EPI creatinine equation. **Abbreviations: CKD:** chronic kidney disease; **CKD-EPI:** Chronic Kidney Disease Epidemiology Collaboration; **eGFR:** estimated glomerular filtration rate.

TABLE 1. Baseline characteristics

Baseline[a] characteristics	Overall (N=35,222)	Undiagnosed (n=25,214)	Diagnosed (n=10,008)	P value[b]
Median age (IQR), years	74.1 (64.2–81.6)	75.3 (66.3–82.1)	70.2 (58.5–79.7)	
Age group, years				<0.001
<45	1,566 (4.4)	759 (3.0)	807 (8.1)	
45–<65	7,797 (22.1)	4,857 (19.3)	2,940 (29.4)	
65–<75	9,202 (26.1)	6,752 (26.8)	2,450 (24.5)	
≥75	16,657 (47.3)	12,846 (50.9)	3,811 (38.1)	
Male	19,770 (56.1)	13,310 (52.8)	6,460 (64.5)	<0.001
Median eGFR (IQR), mL/min/1.73m^2	49.0 (41.6–54.8)	50.5 (43.8–55.5)	44.4 (37.1–51.7)	<0.001
Urine protein[c]				<0.001
A1	16,732 (47.5)	12,583 (49.9)	4,149 (41.5)	
A2	3,212 (9.1)	1,883 (7.5)	1,329 (13.3)	
A3	2,697 (7.7)	1,211 (4.8)	1,486 (14.8)	
A4	1,594 (4.5)	652 (2.6)	942 (9.4)	
Unknown	10,987 (31.2)	8,885 (35.2)	2,102 (21.0)	
Median serum uric acid (IQR), µmol/L	425.0 (350.4–509.0)	419.0 (346.0–501.0)	439.0 (362.0–526.0)	<0.001
Median total cholesterol (IQR), mmol/L	4.6 (3.7–5.5)	4.6 (3.8–5.5)	4.4 (3.6–5.4)	<0.001
Established CVD[d,e]	13,770 (39.1)	9,485 (37.6)	4,285 (42.8)	<0.001
Heart failure[d]	8,200 (23.3)	5,239 (20.8)	2,961 (29.6)	<0.001
Hypertension[d]	21,055 (59.8)	13,948 (55.3)	7,107 (71.0)	<0.001
Type 2 diabetes[d]	8,684 (24.7)	4,803 (19.0)	3,881 (38.8)	<0.001

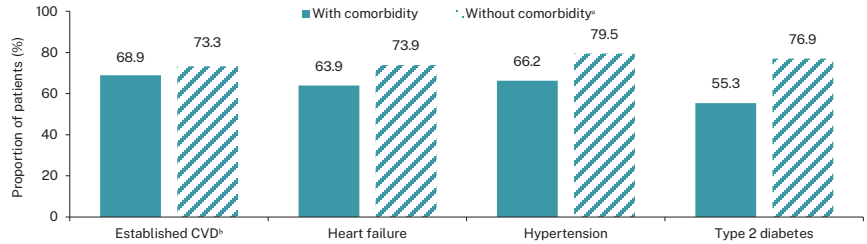
[a]Baseline period was defined as from ≥12 months prior to the first qualifying eGFR to 6 months post index date; [b]Undiagnosed vs. diagnosed. Wilcoxon rank sum tests for continuous variables and chi-square tests for categorical variables; [c]Combination of urine albumin-creatinine ratio, 24-hour urine protein excretion, 24-hour urine albumin excretion, and semi-quantitative urine protein measurement and categorized into A1, A2, A3 and A4 using specialized clinical nephrology center standard based on KDIGO guideline[4]; [d]Patients with missing comorbidity information were considered not having the comorbidity; [e]Included history of myocardial infarction, stroke, coronary artery bypass graft, percutaneous coronary intervention, or unstable angina. **Abbreviations: CVD:** cardiovascular disease; **eGFR:** estimated glomerular filtration rate; **IQR:** interquartile range; **KDIGO:** Kidney Disease: Improving Global Outcomes.

FIGURE 2. Proportion of undiagnosed stage 3 CKD overall and by key characteristic



[a]Combination of urine albumin-creatinine ratio, 24-hour urine protein excretion, 24-hour urine albumin excretion, and semi-quantitative urine protein measurement and categorized into A1, A2, A3 and A4 using specialized clinical nephrology center standard based on KDIGO guideline.[4] **Abbreviations: CKD:** chronic kidney disease; **KDIGO:** Kidney Disease: Improving Global Outcomes.

FIGURE 3. Proportion of undiagnosed stage 3 CKD by baseline comorbidity



[a]Patients with missing comorbidity information were considered not having the comorbidity; [b]Included history of myocardial infarction, stroke, coronary artery bypass graft, percutaneous coronary intervention, or unstable angina. **Abbreviations: CKD:** chronic kidney disease; **CVD:** cardiovascular disease.

References: [1]Shlipak MG, *et al.* Kidney Int 2021;99:34–47; [2]Eckardt KU, *et al.* Kidney Int 2018;93:1281–1292; [3]Wang V, *et al.* Seminars in Nephrology 2016;36:319–330; [4]Levin A, *et al.* Kidney International Supplements 2013;3:1–150; [5]Kushner P, *et al.* Clin Kidney J 2022;15:738–746. **Author Contributions:** Substantial contributions to study conception/design or acquisition/analysis/interpretation of data, drafting of the publication or revising it critically for important intellectual content, and final approval of the publication: SZ, CC, MYJ, SYZ, LCS, QG, SN. **Author Disclosures:** CC, MYJ, SYZ are employees of AstraZeneca. All other authors have declared no conflicts of interest. **Acknowledgements:** This study was sponsored by AstraZeneca China. The authors acknowledge Xiaowei Ning and Ruilin Chen from Costello Medical, Singapore, for medical writing and editorial assistance. All costs associated with development of this poster were funded by AstraZeneca China.