

Epidemiological characteristics of diabetic kidney disease in Chinese patients with type 2 diabetes visiting a tertiary care hospital: a retrospective analysis

Wenbin Tang¹, Yang Luo¹, Ting Zhang¹, Liang Tan², Zhixin Zhang², Fang Liu¹, Li Yan², Wendong Chen¹

¹Xiangya Hospital, Central South University, Changsha, China; ²Changsha Normin Health Technology Ltd, Changsha, China

BACKGROUND & OBJECTIVES

- Diabetes and its complication, diabetic kidney disease (DKD), represent a substantial and growing burden in China, with DKD being a leading cause of chronic kidney disease (CKD) and end-stage renal disease (ESRD).
- Current epidemiological evidence on DKD in China is limited and heterogeneous, highlighting the need for updated real-world data.
- Although metabolic control (glycaemia, blood pressure, lipids) can reduce disease progression, achievement of recommended targets remains suboptimal, and its real-world impact on DKD risk is unclear.
- This study aimed to quantify DKD burden (prevalence and incidence), identify key risk factors, and evaluate the association between metabolic target attainment and DKD risk in a tertiary hospital setting.

METHODS

Study Design & Data Source

- Retrospective cohort study using electronic medical records (EMR) from Xiangya Hospital (China), covering both outpatient and inpatient data from January 1, 2014, to December 31, 2024.

Study Selection

- Inclusion:** Patients with Type 2 Diabetes Mellitus (T2DM) aged ≥ 18 years.
- Exclusion:**
 - Pre-existing DKD at index date.
 - No follow-up data or follow-up < 1 year.
 - Non-Hunan Province residents.

- Acute T2DM complications, acute kidney injury, primary renal diseases, obstructive nephropathy, systemic diseases affecting renal function, malignancies, or hematologic disorders at baseline.

Study Data

- Baseline variables:** Demographics, comorbidities [e.g., atherosclerotic cardiovascular disease (ASCVD)], anthropometric measures (BMI), blood pressure (BP), and laboratory parameters [e.g., hemoglobin a1c (HbA1c), low-density lipoprotein cholesterol (LDL-C), uric acid].

- Metabolic targets (2024 Chinese Guidelines):** HbA1c $< 7.0\%$; BP $< 130/80$ mmHg; LDL-C < 2.6 mmol/L (or < 1.8 mmol/L in patients with ASCVD).

- Target attainment was assessed based on average values during follow-up.

Statistical Analysis

- Prevalence & Incidence:** Calculated annually (2014–2024) based on EMR documented DKD diagnoses.
- Comparison:** Continuous variables were compared using t-test or Wilcoxon rank-sum test, and categorical variables using chi-square or Fisher's exact test.
- Predictor Analysis:** Multivariable Cox Proportional Hazards Models to identify independent risk factors (HRs and 95% CIs).
- Subgroup Analysis:** Kaplan-Meier (KM) curves and Log-rank tests to compare DKD risk across different treatment target attainment groups.
- Statistical significance was set at two-sided $P < 0.05$.

RESULTS

DKD Prevalence in T2DM (2014-2024)

- A total of 87,801 patients with T2DM were included. In 2014, the prevalence of DKD was 16.9%. Over the 10-year period, the annual prevalence remained relatively stable, ranging from 14.1% to 18.2%, with no clear temporal trend observed (Figure 1).

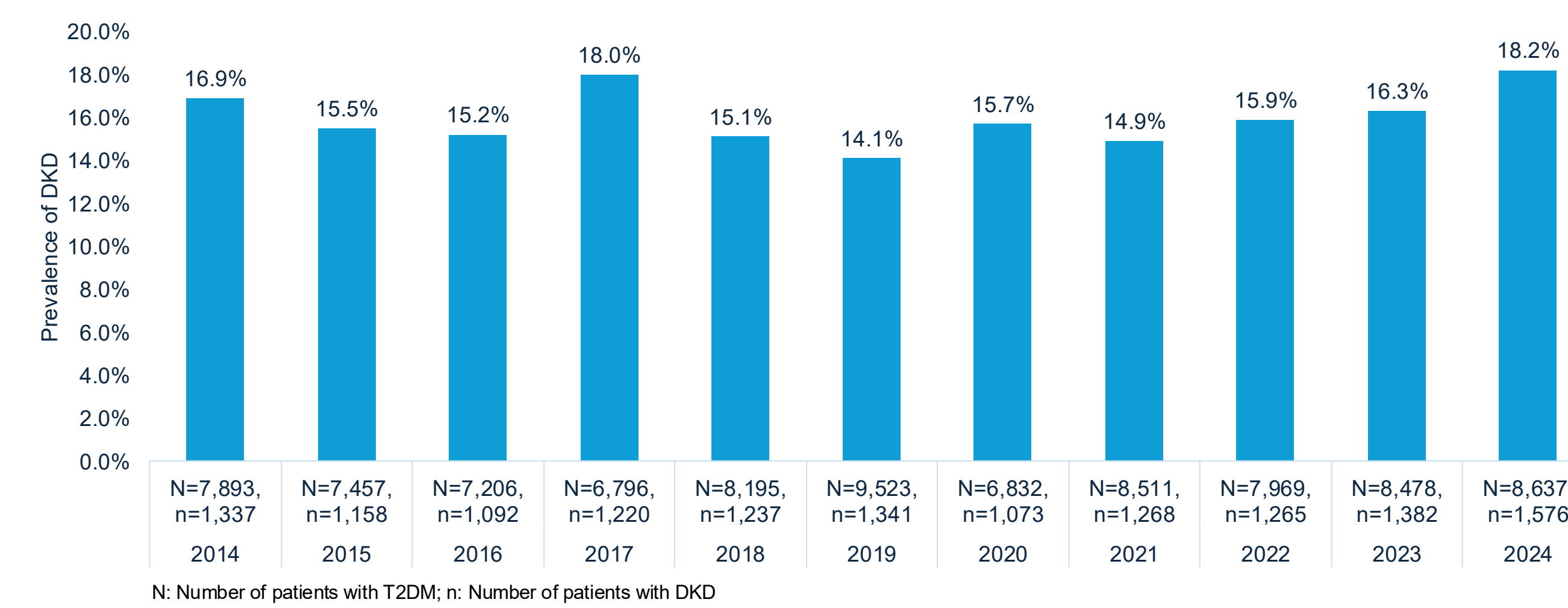


Figure 1. Annual prevalence of DKD among the patients with T2DM managed in the study hospital from 2014 to 2024

DKD Incidence in T2DM (2014-2024)

- From 87,801 patients with T2DM, 8,301 patients without DKD at baseline were included in the incidence analysis after applying exclusion criteria. During a mean follow-up of 3.8 years, 1,149 patients (13.8%) developed DKD.

Patient Characteristics

- Among the 8,301 patients included in the incidence analysis, the mean age was 61.0 years, with 62.6% males. Overall, metabolic control was suboptimal, with elevated blood pressure and HbA1c levels. Comorbidities were common, particularly hypertension (55.1%) and coronary heart disease (32.1%) (Table 1, Figure 2 and Figure 3).
- Compared with patients without DKD, those who developed DKD had higher blood pressure [systolic blood pressure (SBP)/diastolic blood pressure (DBP): 148.3/88.7 vs 154.3/90.5 mmHg], poorer glycaemic control (HbA1c: 7.1% vs 7.8%), and higher uric acid levels (332.1 vs 367.6 $\mu\text{mol/L}$). Lipid profiles and most comorbidities were largely comparable between groups, while eGFR differed significantly (Table 1 and Figure 3).

Table 1. Baseline characteristics of the included patients for the DKD incidence analysis

Variable	All patients	Patients without developed DKD	Patients with developed DKD	p value
Demographic characteristics				
Age (years) *	8,301 61.0 \pm 11.3	7,152 61.1 \pm 11.3	1,149 60.3 \pm 11.4	0.024
Male (%) [†]	8,301 5,193 (62.6%)	7,152 4,446 (62.2%)	1,149 747 (65.0%)	0.064
BMI (kg/m ²) *	2,432 24.6 \pm 3.4	260 24.6 \pm 3.5	2,172 24.5 \pm 3.2	0.710
Clinical measurements*				
SBP (mmHg)	4,098 148.9 \pm 20.0	3,667 148.3 \pm 19.8	431 154.3 \pm 21.1	<0.001
DBP (mmHg)	4,094 88.9 \pm 11.3	3,665 88.7 \pm 11.3	429 90.5 \pm 11.1	0.002
Laboratory tests[†]				
FPG (mmol/L)	1,495 6.8 (5.8, 8.3)	1,330 6.7 (5.7, 8.1)	165 7.5 (6.2, 9.5)	<0.001
HbA1c (%)	2,466 7.2 (6.4, 8.3)	2,180 7.1 (6.4, 8.2)	286 7.8 (7.0, 9.4)	<0.001
Uric acid ($\mu\text{mol/L}$)	2,236 335.0 (274.5, 403.1)	2,002 332.1 (272.0, 398.5)	234 367.6 (297.4, 440.2)	<0.001
eGFR (mL/min/1.73m ²)	2,237 77.3 (65.6, 94.5)	2,002 76.1 (65.0, 91.7)	235 93.0 (72.2, 116.0)	<0.001
TG (mmol/L)	1,488 1.5 (1.1, 2.3)	1,357 1.5 (1.1, 2.3)	131 1.5 (1.2, 2.6)	0.466
TC (mmol/L)	1,524 4.4 (3.6, 5.2)	1,382 4.4 (3.6, 5.2)	142 4.5 (3.6, 5.3)	0.368
HDL-C (mmol/L)	1,472 1.0 (0.9, 1.2)	1,332 1.0 (0.9, 1.2)	140 1.0 (0.8, 1.2)	0.664
LDL-C (mmol/L)	1,472 2.8 (2.2, 3.5)	1,332 2.8 (2.2, 3.5)	140 2.9 (2.3, 3.6)	0.502

BMI = body mass index; SBP = systolic blood pressure; DBP = diastolic blood pressure; FPG = fasting plasma glucose; HbA1c = glycated hemoglobin; eGFR = estimated glomerular filtration rate; TG = triglycerides; TC = total cholesterol; HDL-C = high-density lipoprotein cholesterol; LDL-C = low-density lipoprotein cholesterol.
* Mean \pm SD; [†] n (%); \pm : Median (Q1, Q3).

Risk Factors for DKD in T2DM

- After adjustment for demographic, socioeconomic, clinical, and laboratory covariates, HbA1c, DBP, and LDL-C were identified as independent and modifiable risk factors for DKD (Figure 4).
- Each 1% increase in HbA1c was associated with a 15.3% higher risk of DKD (HR 1.153), while each 1 mmHg increase in DBP increased risk by 3.0% (HR 1.030). Similarly, each 1 mmol/L increase in LDL-C was associated with a 17.1% higher risk of DKD (HR 1.171).

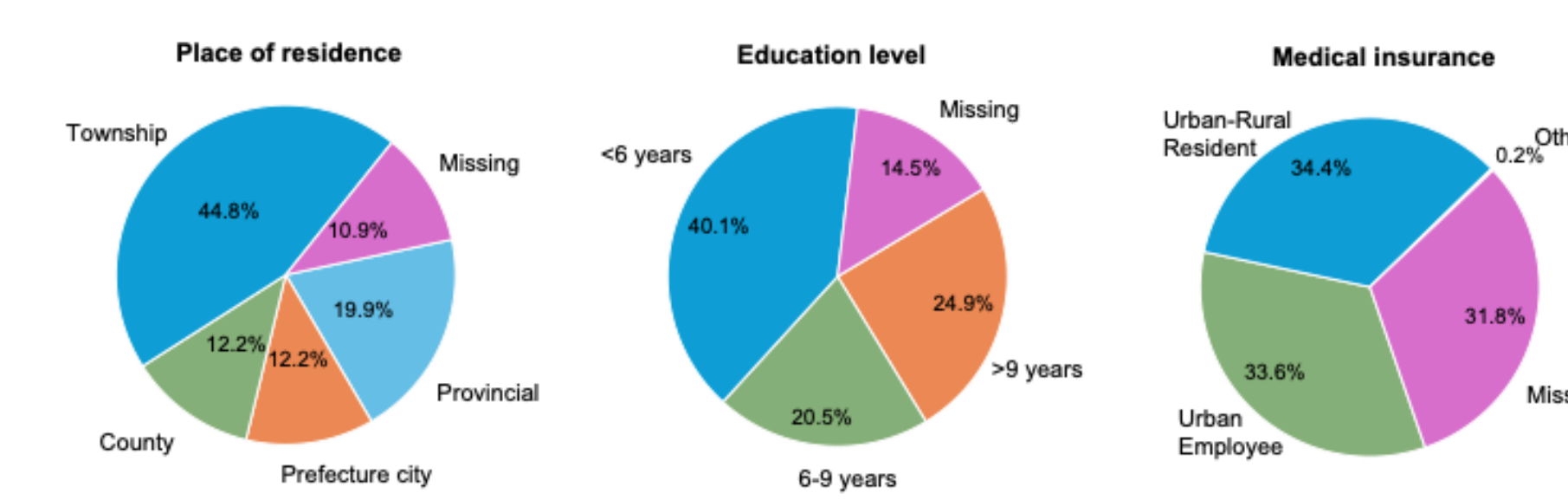


Figure 2. Socioeconomic characteristics of the overall study population for DKD incidence analysis

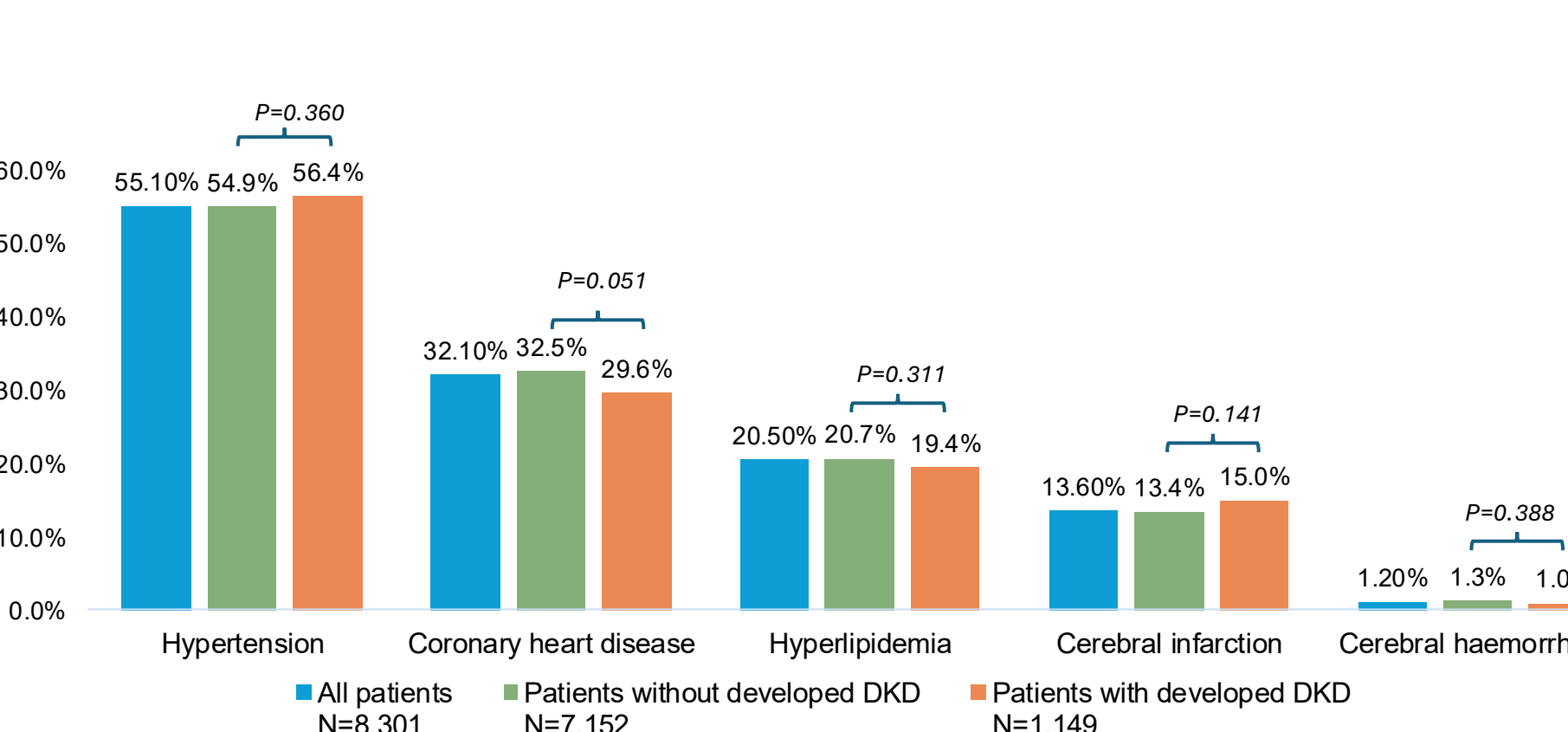


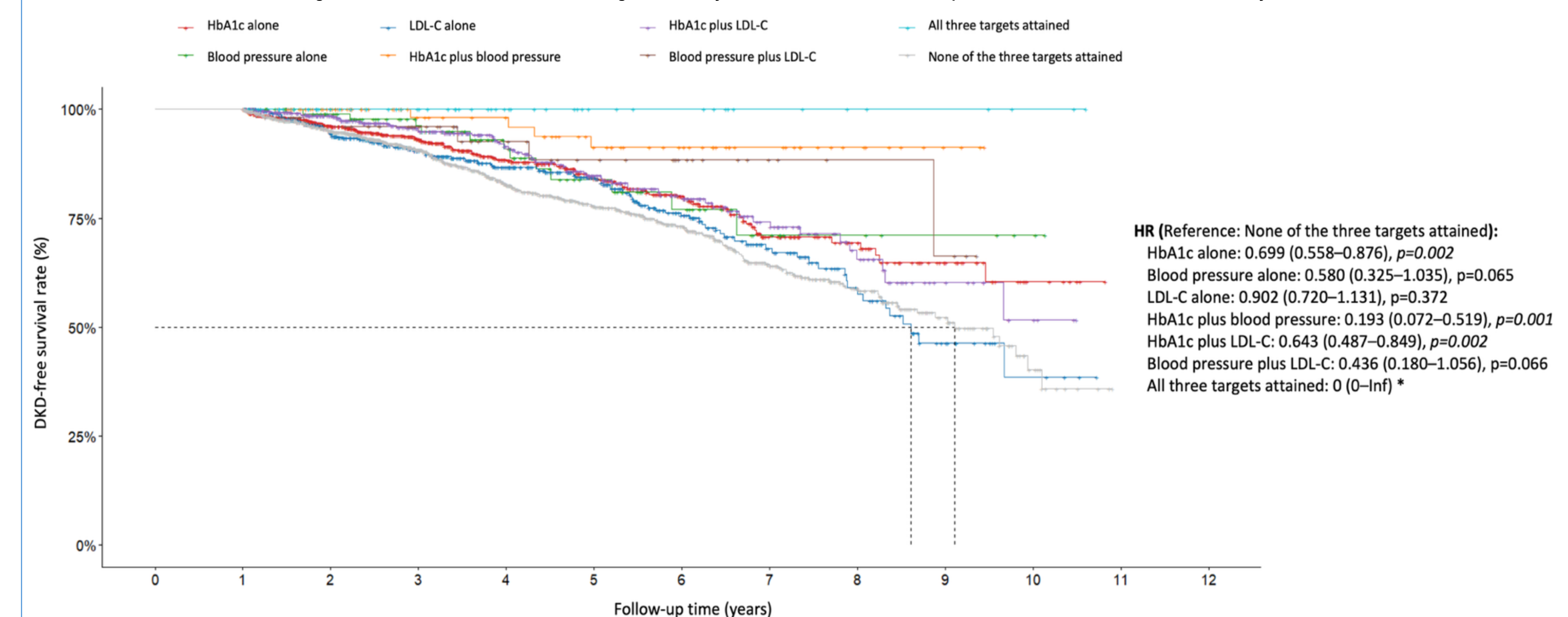
Figure 3. Comorbidities of the included patients for the DKD incidence analysis

DKD Risk by Treatment Target Attainment

- Among 8,301 patients, attainment of metabolic targets was suboptimal, with 43.1% achieving HbA1c control, 9.7% blood pressure control, and 32.5% LDL-C control, while only 1.7% achieved all three targets.
- A clear gradient in DKD-free survival was observed according to the level of target attainment, with patients achieving none of the targets as the reference (Figure 5). Achieving HbA1c control alone was associated with a significantly lower risk of DKD (HR 0.699), whereas blood pressure or LDL-C control alone showed no significant benefit.
- Greater risk reduction was observed with combined target attainment, particularly HbA1c plus blood pressure control, which was associated with the largest reduction in DKD risk (HR 0.193), followed by HbA1c plus LDL-C control (HR 0.643).

Variables	Reference	HR (95% CI)	P value
Age (years)		1.007 (0.999, 1.016)	0.088
Male	Female	1.058 (0.872, 1.284)	0.568
Place of residence			
Provincial capital	Non-provincial capital	0.853 (0.664, 1.096)	0.213
Prefecture city	Non-prefecture city	1.073 (0.802, 1.435)	0.636
Education level			
> 9 years	≤ 9 years	0.874 (0.700, 1.090)	0.231
Medical insurance			
Urban Employee	Non-urban employee	0.831 (0.674, 1.024)	0.083
BMI (kg/m ²)		1.012 (0.983, 1.042)	0.413
DBP (mmHg)		1.030 (1.021, 1.039)	<0.001
HbA1c (%)		1.153 (1.094, 1.215)	<0.001
LDL-C (mmol/L)		1.171 (1.073, 1.279)	<0.001

Figure 4. The results of multivariable Cox regression analysis for DKD risk in the included patients with T2DM for DKD incidence analysis



*. The HR for the "All three targets attained" group was estimated as 0 because no incident DKD events occurred during follow-up in this subgroup. This result should be interpreted with caution, as the sample size of this group was relatively small, leading to an unbounded upper confidence interval (0 to ∞).

Figure 5. Kaplan-Meier curves for DKD-free survival in patients with T2DM stratified by target control attainment status over follow-up

CONCLUSIONS

- DKD remains a substantial and persistent burden among patients with T2DM, with stable prevalence and considerable incidence in routine clinical practice.
- Suboptimal metabolic control is common and strongly associated with increased DKD risk.
- HbA1c, diastolic blood pressure, and LDL-C are key modifiable risk factors for DKD.
- Integrated metabolic management, particularly combined glycaemic and blood pressure control, provides greater risk reduction than single-target strategies.
- This study provides robust real-world evidence from a tertiary hospital setting, supporting the external validity of DKD epidemiological patterns and risk factors in Chinese patients with T2DM.