

# Prevalence and Incidence of Chronic Kidney Disease in US Adults with Type 2 Diabetes Mellitus

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Poster no. 1370-P

## Abstract

**Background:** Diabetes mellitus (DM) is the most common cause of chronic kidney disease (CKD) in the US. Patients with diabetic CKD have worse medical outcomes, higher mortality rates, and higher healthcare costs than do diabetics without CKD. We used peer-reviewed literature to estimate the prevalence and incidence of diabetic CKD among US adults with type 2 DM (T2DM).

**Methods:** We searched PubMed using MeSH keywords and free text phrases for diabetic nephropathy, CKD, end-stage renal disease (ESRD), T2DM, prevalence, and incidence, limited to English-language reviews and original research from 2004 to 2013.

**Results:** Ten articles described CKD prevalence or incidence from 1988 to 2008 among US adult T2DM populations (Table). CKD prevalence did not vary with race/ethnicity. The incidence of stage 5 CKD (ESRD) was 108.2-236 per million T2DM adults. The incidence of stages 1-4 among this population was not identified.

**Conclusion:** Diabetic CKD is highly prevalent among T2DM patients, with mild CKD being the most common. Due to the potentially serious health and economic implications of the disease, physicians, payers, and other stakeholders should be cognizant of this information in their efforts to improve clinical practice, reduce disease burden, and facilitate effective policymaking. Given the aging US population, future studies examining CKD prevalence in Medicare patients are warranted.

Diabetic CKD Prevalence Among All US Adults and Veterans, by Age and Stage

	All T2DM Patients	Veterans with T2DM
<b>AGE</b>		
≥20 years	34.5%-42.3%	48%
20 to <65 years	24.6%-28.0%	-
≥65 years	49.5%-51.2%	-
<b>CKD STAGE</b>		
Mild (Stages 1-2)	19.7%-24.8%	18%
Moderate (Stage 3)	14.1%-19.4%	26%
Stage 3A	10.0%-11.9%	18%
Stage 3B	3.7%-4.1%	8%
Severe (Stage 4-5)	2.3%-2.7%	4%

CKD, chronic kidney disease; T2DM, type 2 diabetes mellitus.

## Background & Objectives

- Diabetes mellitus (DM) is the most common cause of chronic kidney disease (CKD) in the US.
- Patients with diabetic CKD have worse medical outcomes, higher mortality rates, and higher healthcare costs than diabetic patients without CKD.
- Objectives: among US adults with type 2 diabetes mellitus (T2DM):
  - Estimate the prevalence and incidence of diabetic CKD.
  - Identify whether CKD prevalence/incidence has been reported by CKD stage.
  - Determine the natural progression of CKD.

### KDOQI Staging of Kidney Disease

Stage	GFR <sup>a</sup>	Description
1	90+	Normal kidney function but other findings or characteristics that may point to kidney disease
2	60-89	Mild kidney disease
3A	45-59	Moderate kidney disease
3B	30-44	Moderate kidney disease
4	15-29	Severe kidney disease
5	<15 or on dialysis	End-stage kidney failure

GFR, glomerular filtration rate; KDOQI, Kidney Disease Outcomes Quality Initiative.

<sup>a</sup>All GFR values are normalized to an average surface area (size) of 1.73 m<sup>2</sup>

## Methods

- We conducted a PubMed literature search using Medical Subject Headings (MeSH) keywords and free text phrases.
- The search was executed on October 2, 2013.

## Search Strategy

Base search: “diabetic nephropathies”[mesh] OR (“kidney failure, chronic”[mesh] OR “renal insufficiency, chronic”[mesh] OR “end stage kidney disease” OR “end stage renal disease”) AND “diabetes mellitus, type 2”[mesh]

Sub-searches used varying combinations of MeSH keywords

Filters limited sources to English-language original research and reviews from 2004 to 2013

Manually screened abstracts and full text articles for data

## Results

- A total of **5,832** articles were screened
- 31** papers contained pertinent data
- Because a critical number of articles presented data for veteran populations, T2DM risk in veterans was reported separately
- Articles used various measures for defining CKD:
  - KDOQI staging
  - GFR <60 ml/min per 1.73 m<sup>2</sup>
  - Urine albumin-to-creatinine ratio (UACR) ≥30 mg/g & GFR <60 ml/min per 1.73 m<sup>2</sup>
  - UACR ≥30 mg/g & GFR ≤60 ml/min per 1.73 m<sup>2</sup>

## Reported CKD Prevalence & Incidence Among Adults with T2DM:

- Prevalence:
  - US adults: 34.5% - 42.3%
  - US veterans: 48%
  - By stage:
    - 1 and 2: 19.7% - 24.8%
    - 3A: 10.0% - 11.9%
    - 3B: 3.7% - 4.1%
    - 4 and 5: 2.3% - 2.7%
- Incidence:
  - Stages 1-4: not identified
  - Stage 5: 108.2-236 per million T2DM adults

## Diabetic CKD Prevalence Among All US Adults and Veterans, by Age and Stage

Age	All T2DM Patients		Veterans with T2DM	
	Range	Source	Value	Source
≥20 years	35% - 42%	Afkarian, De Boer	48%	Patel
20 to <65 years	24% - 28%	De Boer	--	--
≥65 years	50% - 51%	De Boer	--	--
CKD Stage				
Mild (Stages 1-2)	20% - 25%	Plantinga, Pyram, Koro	18%	
Moderate (Stage 3)	14% - 19%	Plantinga, Pyram, Koro	26%	Patel
Stage 3A	10% - 12%	Plantinga	18%	
Stage 3B	4%	Plantinga	8%	
Severe (Stage 4-5)	2% - 3%	Koro, Pyram	4%	

## Reported ESRD Risk:

### ESRD Incidence in T2DM Patients in the US, Overall and by Race/Ethnicity

Stage	Per million	Source
Overall	108 - 154	
White	72 - 104	
Black	316 - 413	Burrows
Native American	385 - 400	
Asian	142 - 161	
Hispanic	229 - 275	
Overall	236	Ward

ESRD, end-stage renal disease

## Reported CKD Risk:

- Older age, but not race/ethnicity, was a risk factor for CKD in T2DM patients in the US.
- Cigarette smoking also appears to be a risk factor, although most of the studies on smoking were not based on US cohorts.

## Reported CKD Progression:

- T2DM-related CKD develops within:
  - 5-10 years of T2DM diagnosis; or
  - 20-25 years of T2DM onset.
- CKD progression in T2DM patients:
  - increases with baseline severity of nephropathy.
  - is associated with smoking, hypoalbuminemia, proteinuria and anemia.
  - significantly decreases with prompt diagnosis of moderate or worse CKD in diabetic patients (odds ratio 0.20, 95% CI 0.19-0.21).

## Conclusions

- CKD prevalence in patients with T2DM is over 30% in US adults and reaches 50% in Medicare populations; mild CKD is most common.
- Among T2DM patients with CKD, the majority experienced CKD progression, the rate of which increases with CKD stage at diagnosis.
- Stage 1 CKD incidence among T2DM patients has not been reported; better descriptive models of the natural history and progression of T2DM are needed.
- Given the aging US population, future studies examining CKD prevalence in Medicare patients are warranted.

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