

Cardiovascular and Chronic Kidney Disease-Related Healthcare Costs for Patients with Type 2 Diabetes and Chronic Kidney Disease

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BACKGROUND

- Several emerging treatments, including finerenone and SGLT-2 inhibitors, have progression of kidney disease, and reducing the risk of death in patients with CKD associated with T2D⁴⁻⁸
- and its complications

major CKD complications among patients with CKD associated with T2D

- as the 1 year prior to the index date
- renal replacement therapy [RRT]) were summarized for 4-month periods
- subsequent three months (four months total)
- in 4-month cycles

The majority of patients were covered by Medicare Advantage (80%). The majority of • Patients with chronic kidney disease (CKD) associated with type 2 diabetes (T2D) incur patients were CKD stage III (68%) and comorbidities including hypertension (92%) and high medical costs related to CKD management and cardiovascular (CV) complications¹⁻³ hyperlipidemia (84%) were common (**Table 1**)
 Table 1. Baseline characteristics
demonstrated clinical benefits in terms of preventing CV disease, slowing down the Patients with CKD associated with T2D N = 52,599• To evaluate whether these clinical benefits translate to real-world economic benefits, it is **Demographic information at index date** essential to quantify the key cost components associated with the management of CKD Age (years), mean (SD) 71.38 (9.78) Female, N (%) 25,533 (48.54%) **OBJECTIVE Race, N (%)** This study aimed to provide the most up-to-date cost estimates of CKD management and 31,332 (59.57%) White METHODS Black 8,173 (15.54%) • This study utilized the Optum Clinformatics[®] claims database (2014 – 2019), which Hispanic 6,291 (11.96%) comprised patients from commercial health plans and Medicare Advantage plans 1,645 (3.13%) Asian • Patients with CKD associated with T2D were included. The *index date* was defined as the first date the patient had both CKD and T2D, and the baseline period was defined 5,158 (9.81%) Unknown Insurance type, N (%) • A generalized estimating equation (GEE) regression was used to model the monthly medical costs (in 2020 USD) associated with each cost component, adjusting for age at index date, sex, 42,249 (80.32%) Medicare Advantage baseline complications, and baseline medical costs. Cost components included the following: - CKD management by stage (including stage I-II, stage III, stage IV, and stage V without 10,369 (19.71%) Commercial CKD stages, N (%) – RRT and major CKD complications were estimated for two phases: - The acute costs included the costs during the month of the event onset and the CKD stage I 2,796 (5.32%) CKD stage II 10,955 (20.83%) - The post-acute costs included costs during subsequent follow-up and were reported 35,696 (67.86%) CKD stage III – Mortality costs were assessed in the month prior to death CKD stage IV 2,420 (4.60%) RESULTS CKD stage V & ESRD 732 (1.39%) Patient characteristics **Comorbidities**, N (%) • The study sample included 52,599 adult patients with CKD associated with T2D (Figure 1) Hypertension 48,639 (92.47%) Hyperlipidemia 44,364 (84.34%) Step 1b: Patients with chronic kidney Step 1a: Patients with type 2 diabetes mellitus (T2D) disease (CKD) Diabetes-related microvascular complications 16,695 (31.74%) N = 2,012,394N = 1,195,41915,720 (29.89%) Ischemic heart diseases Step 2: Patients with CKD associated with T2D 3,687 (7.01%) Myocardial infarction Definition: The index date was defined as the first available claim date where patients had both CKD and T2D. Index dates were restricted to 01/01/2015-08/31/2019. 14,420 (27.41%) Anemia N = 269,3628,157 (15.51%) Heart failure **Step 3: Patients aged 18 or older on their index date** N = 269,353Atrial fibrillation 6,893 (13.10%) Hyperkalemia 3,181 (6.05%) Step 4: Patients with continuous enrollment for 1 year before and ≥4 months after the index date N = 97,220Stroke 2,443 (4.64%)

Figure 1. Sample selection



Medical costs (USD 2020), mean (SD)

\$16,995 (\$45,670)

Abbreviations: CKD, chronic kidney disease; ESRD, end-stage renal disease; IQR, interquartile range; SD, standard deviation; T2D, type 2 diabetes; USD, United States dollar.

• Patients were 71 years of age on average; 49% were female and 60% were white.

Cost estimates

- The estimated 4-month CKD management costs increased from \$7,725 for stage I-II to \$11,879 for stage V (without RRT), with the largest increase (+\$1,881) from stage II to IV (Table 2)
- The estimated acute event costs for dialysis and kidney transplantation were \$87,538 and \$124,271, respectively. The costs decreased to \$49,573 and \$7,079 in subsequent 4-month cycles, respectively
- For the major CKD complications, the estimates of acute costs in the first 4 months after the incident event were \$21,016 for myocardial infarction, \$21,087 for stroke, and \$31,063 for heart failure. In subsequent 4-month cycles, these decreased to \$1,941 for myocardial infarction, \$2,327 for stroke, and \$4,931 for heart failure
- For patients who experienced a hospitalization with atrial fibrillation, their acute costs were nearly 6 times higher than those without a hospitalization (\$30,500 vs. \$5,162). Similarly, the acute cost of hyperkalemia was \$31,212 with hospitalization and \$1,782 without
- In the month before death, the costs associated with CV-related death were the highest (\$17,031), followed by renal-related death (\$12,605) and death from other causes (\$9,900)

Unit Costs (USD 2020)	All Patient N=52,599	
	4-month acute (S.E.)	4-r pc
CKD management and RRT		
CKD stage I and II	N/A	
CKD stage III	N/A	
CKD stage IV	N/A	
CKD stage V (without RRT)	N/A	
Dialysis	\$87,538 (\$6,691)	\$
Kidney transplantation	\$124,271 (\$37,052)	
Major CKD complications		
Myocardial infarction	\$21,016 (\$811)	
Heart failure	\$31,063 (\$823)	
Stroke	\$21,087 (\$975)	
Hyperkalemia		
Hyperkalemia with hospitalization	\$31,212 (\$2,135)	
Hyperkalemia without hospitalization	\$1,782 (\$378)	
Atrial fibrillation		
Atrial fibrillation with hospitalization	\$30,500 (\$1,388)	
Atrial fibrillation without hospitalization	\$5,162 (\$666)	
Death costs	1-month (S.E.)	
CV-related	\$17,031 (\$1,782)	
Renal-related	\$12,605 (\$2,380)	
Other causes	\$9,900 (\$504)	

Table 2. Cost estimates for CKD management, RRT, major CKD complications, and death

Abbreviations: CKD, chronic kidney disease; CV, cardiovascular; S.E., standard error; N/A, not applicable; RRT, renal replacement therapies; USD, United States dollar.

onth ongoing/ t-acute (S.E.)

\$7,725 (\$597)
\$8,928 (\$640)
\$10,809 (\$668)
\$11,879 (\$937)
\$49,573 (\$2,476)
\$7,079 (\$1,422)
\$1,941 (\$367)
\$4,931 (\$347)
\$2,327 (\$505)
N/A
N/A
N/A
N/A
N/A

N/A N/A

LIMITATIONS

- Given that the cause of death cannot be evaluated directly in claims data, CV-related or renal-related death was identified based on the primary diagnosis or procedure codes during hospitalization in the month of death
- The Optum Clinformatics[®] claims data used in this study were from a single payer source which may not be generalizable to other payers

CONCLUSIONS

- CV events and CKD management incur high healthcare costs in adult patients with CKD associated with T2D, and the costs increase with more severe disease stages
- The results demonstrate the need for appropriate monitoring and treatment to avoid downstream costs in this patient population
- The cost estimates may also support the parametrization of economic models and help clinicians determine the costeffectiveness of interventions

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Conflict of Interest:

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