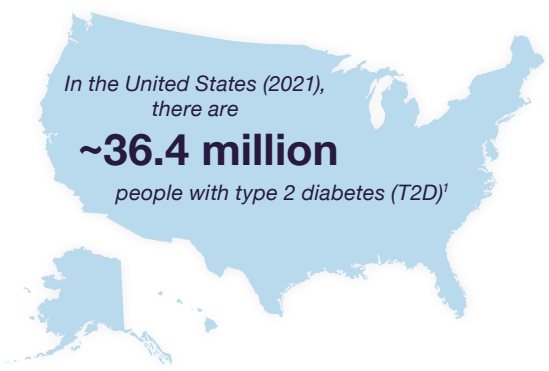
Discovering unmet needs in chronic kidney disease (CKD) and cardiovascular disease (CVD)

Reduce kidney and CV risk through appropriate testing, diagnosis, and treatment; *CKD associated with T2D is a major population health concern*



By 2060, the diabetes population is expected to double to over **60 million** people, which signals a rise in CKD cases[2]

Up to **40%** of patients with T2D have CKD[3]

Despite this high prevalence, **~90%** of patients with diabetes and CKD are unaware of their kidney disease[4,a]

According to the Centers for Disease Control and Prevention, **CKD is more common in non-Hispanic Blacks (16.3%)** and **Hispanics (13.6%)** than in non-Hispanic Whites (12.7%) or non-Hispanic Asians (12.9%)[5]

[a]Estimates of diabetes may not delineate between type 1 and type 2 diabetes. According to the American Diabetes Association, T2D accounts for 90%-95% of all diabetes cases. Therefore, statistics that describe diabetes may be more characteristic of T2D.[6]

References: 1. Statistics about diabetes. American Diabetes Association. Accessed March 18, 2024. https://diabetes.org/about-diabetes/statistics/about-diabetes. **2.** Lin J, et al. *Popul Health Metr.* 2018;16(1):9. **3.** Bailey RA, Wang Y, Zhu V, Rupnow MFT. Chronic kidney disease in US adults with type 2 diabetes: an updated national estimate of prevalence based on Kidney Disease: Improving Global Outcomes (KDIGO) staging. *BMC Res Notes*. 2014;7:415. **4.** United States Renal Data System. 2020 USRDS annual data report. National Institutes of Health, National Institute of Diabetes and Digestive and Kidney Diseases, Bethesda, MD, 2020. Accessed March 18, 2024. https://usrds-adr.niddk.nih.gov/2020/chronic-kidney-disease/1-ckd-in-the-general-population. **5.** Chronic kidney disease in the United States, 2021. Centers for Disease Control and Prevention. Accessed October 17, 2023. https://www.cdc.gov/kidneydisease/pdf/Chronic-Kidney-Disease-in-the-US-2021-h.pdf. **6.** American Diabetes Association. Standards of care in diabetes—2024. *Diabetes Care*. 2024;47(suppl 1):S1-S321.

Patient outcomes can be improved through appropriate testing, diagnosis, and Guideline-Directed Medical Therapy (GDMT)

INSUFFICIENT TESTING

>94% eGFR[7]

38.7% uACR[7]

According to the ADA, AACE, ESC, and KDIGO, **uACR and eGFR should be performed at least once per year** in members with T2D.[8-12] However, CKD screening rates remain too low[7,b]

LACK OF DIAGNOSIS

Patients may have lab-indicated CKD without corresponding diagnosis codes

Nearly 75% of Medicare Advantage patients with lab-indicated CKD did not have a corresponding diagnosis code[13]

REDUCED CARE QUALITY

The HEDIS® quality measure evaluates the performance of uACR and eGFR tests in patients with diabetes[14]
Performance on this measure is now included in Medicare and NCQA Star Ratings[14,15]

Low testing rates indicate **failure to achieve this HEDIS measure**[7,14]

NATIONAL FOCUS
Executive order on advancing kidney health

[b]As evidenced by a retrospective analysis of 101,057 patients with CKD associated with T2D across the US who had data in the Optum® Clinformatics® database. Investigators sought to evaluate eGFR and uACR testing rates over a 1-year period.[7]

References: 7. Betts KA, Song J, Elliott J, et al. Geographical variation in kidney function testing and associations with health care costs among patients with chronic kidney disease and type 2 diabetes. *Am J Manag Care.* 2022;28(6 suppl):S112-S119. **8.** de Boer IH, Khunti K, Sadusky T, et al. Diabetes management in chronic kidney disease: a consensus report by the American Diabetes Association (ADA) and Kidney Disease: Improving Global Outcomes (KDIGO). *Diabetes Care.* 2022;45(12):3075-3090. **9.** American Diabetes Association. Standards of care in diabetes—2024. *Diabetes Care.* 2024;47(suppl 1):S1-S321. **10.** Marx N, Federici M, Schütt K, et al; for the ESC Scientific Document Group. 2023 ESC Guidelines for the management of cardiovascular disease in patients with diabetes. *Eur Heart J.* 2023;44(39):4043-4140. **11.** Kidney Disease Improving Global Outcomes. KDIGO 2022 clinical practice guideline for diabetes management in chronic kidney disease. *Kidney Int.* 2022;102(5S):S1-S127. **12.** Blonde L, Umpierrez GE, Reddy SS, et al. American Association of Clinical Endocrinology clinical practice guideline: developing a diabetes mellitus comprehensive care plan–2022 update. *Endocr Pract.* 2022;28(10):923-1049. **13.** Chronic kidney disease often undiagnosed in Medicare beneficiaries. Centers for Medicare & Medicaid Services. Updated September 2021. Accessed March 18, 2024. https://www.cms.gov/files/document/ckd-data-highlight102020-2.pdf. **14.** Kidney health evaluation for patients with diabetes (KED). National Committee for Quality Assurance. Accessed March 18, 2024. https://www.ncqa.org/hedis/measures/kidney-health-evaluation-for-patients-with-diabetes. **15.** Medicare 2024 Part C & D Star Ratings Technical Notes. Centers for Medicare & Medicaid Services. Accessed March 18, 2024. https://www.cms.gov/files/document/2024technotes20230930.pdf.

High costs of care for patients with CKD associated with T2D emphasize the need to accurately diagnose and code conditions[16,17]

Risk-adjusted scoring represents a plan or health system population's burden of illness (as defined by diagnosis code/code/stage). In the illustrative examples below, the risk-adjusted scores are based on diagnosis of CKD stage 3 or 4 in noninstitutional, non-dual, nondisabled female patients 67 years with other common comorbidities.[17]

		Patient A **(Undiagnosed CKD)**	Patient B **(Diagnosed CKD Stage 3)**	Patient C **(Diagnosed CKD Stage 4)**
Gender, Age	Female, 67	0.330	0.330	0.330
Conditions	Diabetes with Chronic Complications	0.166	0.166	0.166
	Congestive Heart Failure (CHF)	0.360	0.360	0.360
	CKD Stage	N/A	0.127	0.514
	Diabetes with CHF	0.112	0.112	0.112
	CHF Renal	N/A	0.176	0.176
	Total Raw Risk Score	**0.968**	**1.271**	**1.658**
Parameters	Normalization Factor	1.015	1.015	1.015
	Coding Pattern Differences	0.941	0.941	0.941
	Final Risk Score	**0.897**	**1.178**	**1.537**

References: 16. Golestaneh L et al. *Am J Manag Care.* 2017;23(suppl 10):S163-S172. **17.** Centers for Medicare & Medicaid Services. Accessed August 7, 2023. https://www.cms.gov/files/document/2024-announcement-pdf.pdf.

Guideline-Directed Medical Therapies for CKD associated with T2D are underutilized

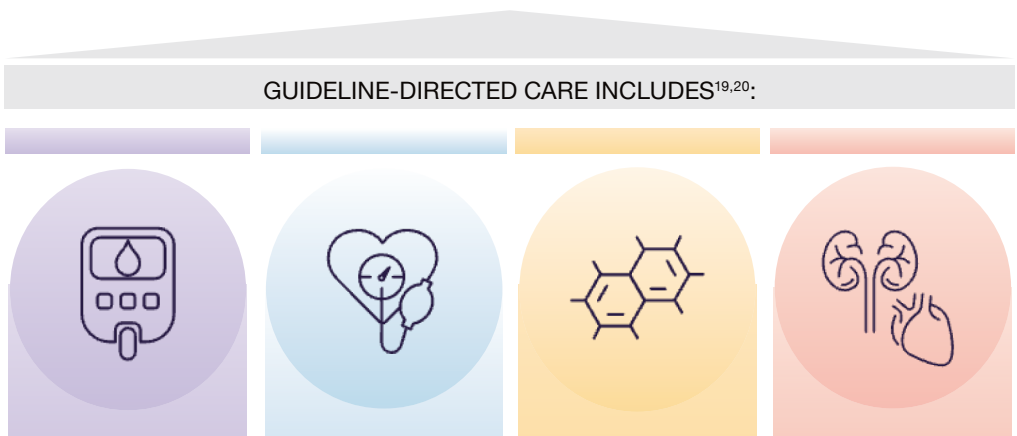
Real-World Utilization of Guideline-Directed Medical Therapies

For patients with a diagnosis of CKD associated with T2D:

41% ACEi/ARB only[18]

19% ACEi/ARB + additional GDMT (nsMRA, SGLT2i, GLP-1 RA)[18]

30% No GDMT[18]

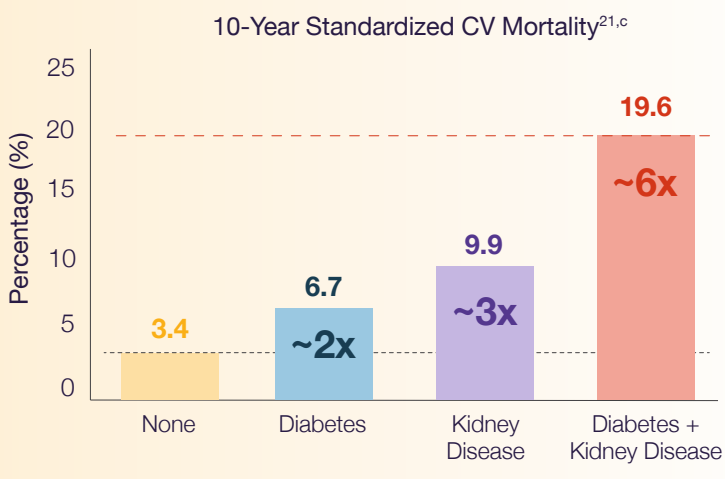


Clinical practice guidance from the ADA and KDIGO recommends the use of pharmacotherapies to reduce risk in patients with CKD associated with T2D, though real-world data show that use is insufficient.[19]

References: 18. Data on file. Bayer. **19.** de Boer IH, Khunti K, Sadusky T, et al. Diabetes management in chronic kidney disease: a consensus report by the American Diabetes Association (ADA) and Kidney Disease: Improving Global Outcomes (KDIGO). *Diabetes Care.* 2022;45(12):3075-3090. **20.** American Diabetes Association. Standards of care in diabetes–2023. *Diabetes Care.* 2023;46(suppl 1):S1-S291.

Kidney disease approximately triples the risk of CV mortality in patients with diabetes

NHANES III was conducted between 1988 and 1994; this study used data from NHANES III participants aged ≥20 years who had follow-up mortality data through 2006.[21]



In adult patients with CKD associated with T2D, CV risk increases at early signs of eGFR decline or albuminuria.

Risk of CV death rises:

- As eGFR falls below 75 mL min/1.73 m^2, risk of CV death rises[22,d]
- As uACR increases above 30 mg/g, risk of CV death rises[22,d]

CV, cardiovascular; NHANES III, Third National Health and Nutritional Examination Survey.
[c]N=15,046.
[d]Adjusted for age, sex, race or ethnic origin, smoking, SBP, antihypertensive drugs, diabetes, total and high-density lipoprotein cholesterol concentrations, and albuminuria (UACR or dipstick) or eGFR, as appropriate.

References: 21. Afkarian M, Sachs MC, Kestenbaum B, et al. Kidney disease and increased mortality risk in type 2 diabetes. *J Am Soc Nephrol.* 2013;24(2):302-308. **22.** Matsushita K, et al. *Lancet Diabetes Endocrinol.* 2015;3(7):514-525. doi:10.1016/S2213-8587(15)00040-6.

Progression of CKD in patients with T2D is associated with an increase in costly cardiovascular and kidney events

Incidence of CV Events in Patients With CKD Associated With T2D Alone

~2x more Myocardial infarction (MI) cases[23,e]

~3-6x greater risk of Hospitalization due to heart failure (HHF)[24,f]

~3x more Cardiovascular (CV) deaths[25,g]

Cost of CV Events in Patients With CKD Associated With T2D (2023 USD)[24,26,27,h]

ANNUALIZED MI: **$26,193**

ANNUALIZED HHF: **$43,053**

1-MONTH COST CV-related death **$17,917**

[e]As evidenced by a cross-sectional analysis of self-reported patient data collected between 2007 and 2012 from 2,006 patients with type 2 diabetes who completed NHANES.[23]
[f]Randomized, double-blind, placebo-controlled SAVOR TIMI 53 trial conducted from 2010-2013 in 16,492 patients with T2D and a glycated hemoglobin (HbA1c) of 6.5%-12.0% within 6 months of randomization and either a history of atherosclerotic cardiovascular disease (ASCVD) or multiple cardiovascular disease (CVD) risk factors. Baseline UACR was available in 15,760 patients.[24]
[g]This study used data from NHANES III participants aged ≥20 years, who participated in a health examination and had available data on medications used, serum creatinine, and urine albumin and creatinine concentrations. Of these, the only participants who were included were those who had follow-up mortality data through 2006 (15,046 of 15,762 of NHANES III participants, 95.5%); 1,430 (9.5%) of the 15,046 participants had T2D.[25]
[h]Costs inflated to 2023 USD using MCPI from the US Bureau of Labor Statistics. MCPI from Half 2 of relevant years used in calculations. Difference of MCPI 2023 (Half 1) and originating MCPI was taken and divided by originating MCPI, and then multiplied by 100 to generate inflation factor percentage. Inflation factor percentage was multiplied by originating cost to generate inflated cost in 2023 USD. Values rounded to nearest dollar.[27]

References: 23. Wu B, Bell K, Stanford A, et al. Understanding CKD among patients with T2DM: prevalence, temporal trends, and treatment patterns–NHANES 2007-2012. *BMJ Open Diabetes Res Care.* 2016;4(1):e000154. **24.** Scirica BM, Mosenzon O, Bhatt DL, et al. Cardiovascular outcomes according to urinary albumin and kidney disease in patients with type 2 diabetes at high cardiovascular risk: observations from the SAVOR-TIMI 53 trial. *JAMA Cardiol.* 2018;3(2):155-163. **25.** Afkarian M, Sachs MC, Kestenbaum B, et al. Kidney disease and increased mortality risk in type 2 diabetes. *J Am Soc Nephrol.* 2013;24(2):302-308. **26.** Betts KA, Song J, Faust E, et al. Medical costs for managing chronic kidney disease and related complications in patients with chronic kidney disease and type 2 diabetes. *Am J Manag Care.* 2021;27(20 suppl):S369-S374. **27.** U.S. Bureau of Labor Statistics. Databases, tables and calculators by subject. Accessed March 18, 2024. https://data.bls.gov/timeseries/CUUR0000SAM?output_view=data.

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