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Inside CKD: Modeling the Clinical Impact of Targeted Urinary Albumin-to-creatinine Ratio Screening in People with Type 2 Diabetes Across the Globe: Results from the UK and the US

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Introduction

- Diabetes is the leading cause of kidney disease, and up to 40% of people with type 2 diabetes (T2D) have chronic kidney disease (CKD).[1]
- Together, these diseases constitute a major challenge for healthcare systems worldwide, which is worsened by the burden of undiagnosed CKD.
- Early CKD diagnosis followed by guideline-recommended interventions can prevent or delay the development of complications and progression to kidney failure and thus improve patient outcomes and reduce associated healthcare costs.[2]
- Albuminuria is a strong predictor of risk of progression, complications and death in people with CKD,[3,4] and the measurement of urinary albumin-to-creatinine ratio (UACR) is an important diagnostic and prognostic tool.
  - However, adherence to screening recommendations remains suboptimal in routine care.
- *Inside CKD* aims to model the global clinical and economic burden of CKD using country-specific, patient-level microsimulation-based modeling.
- We used the *Inside CKD* microsimulation to assess the potential impact of routine UACR measurement in primary care settings with initiation of a renin–angiotensin–aldosterone system (RAAS) inhibitor in eligible people on the overall prevalence of CKD and on the distribution of CKD stages 1–5 in people with T2D during the period 2021–2026.
- Here, we present preliminary results from the UK and the US; analyses of data from other countries are currently in progress (**Figure 1**).

Methods

- The *Inside CKD* microsimulation (**Figure 2**) uses validated software developed by HealthLumen (London, UK).[5–7]
- We used the *Inside CKD* microsimulation to model the impact of implementing routine UACR-based screening in individuals with T2D aged 45 years and older during routine primary care visits (during year 1 of the model) with initiation of a RAAS inhibitor in eligible people, versus current clinical screening practices.
- We constructed virtual populations representing the general populations of the UK and the US using data from country-specific national surveys and relevant published literature.[8–13]
  - When country-specific input data were unavailable, a predefined algorithm was used to identify suitable proxy data.

Figure 1. Countries included in the *Inside CKD* microsimulation model.

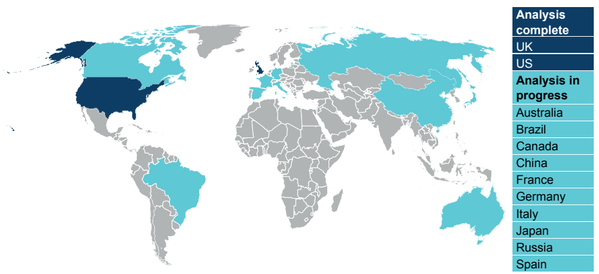
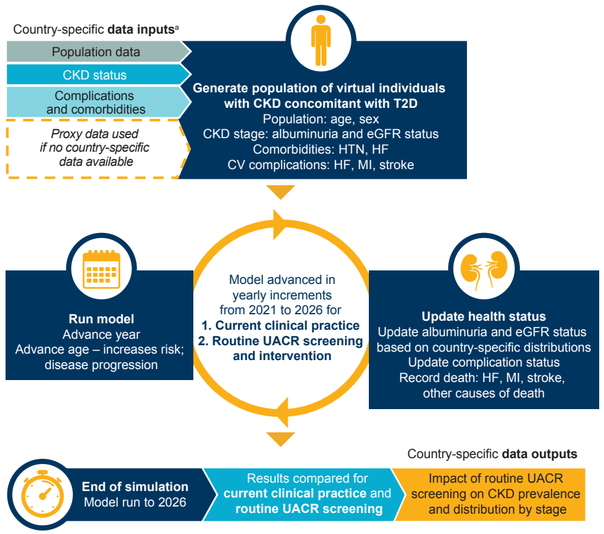


Figure 2. Overview of the *Inside CKD* microsimulation model.



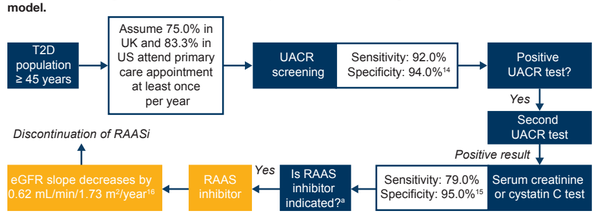
[a]Proxy data used if no country-specific data available.
CKD, chronic kidney disease; CV, cardiovascular; eGFR, estimated glomerular filtration rate; HF, heart failure; HTN, hypertension; MI, myocardial infarction; T2D, type 2 diabetes; UACR, urinary albumin-to-creatinine ratio.

- These data included demographics, prevalence of CKD and comorbidities (uncontrolled hypertension and heart failure), incidence of complications (heart failure, myocardial infarction and stroke) and direct and indirect costs associated with CKD (e.g. cost of renal replacement therapy [RRT]).
- The model also included parameters relating to the proportion of patients who visit a primary care physician at least once a year, the proportion of patients who agree to UACR measurements, the proportion of patients eligible for RAAS inhibitor treatment, the rate of RAAS inhibitor discontinuation and the diagnostic sensitivity and specificity of UACR measurements (**Figure 3**).[14–17]
- CKD stages were defined as discrete health states, in line with Kidney Disease: Improving Global Outcomes (KDIGO) 2012 recommendations.[18]

Results

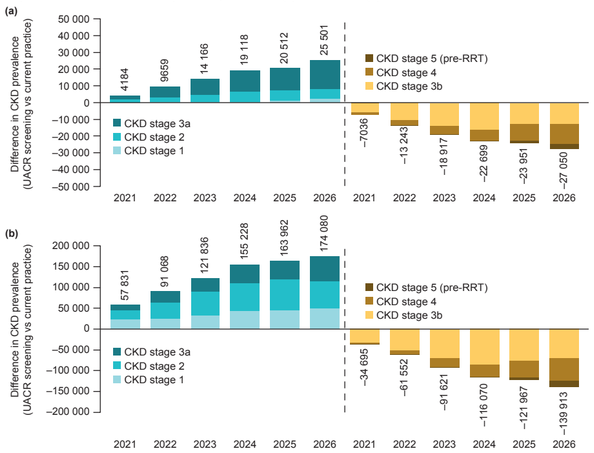
- The potential effect of routine UACR screening and initiation of a RAAS inhibitor in eligible people (versus current practice) on the distribution of the different stages of CKD is shown in **Figure 4**.
- In 2026, the numbers of cases of CKD stages 1–3a identified through routine UACR screening and initiation of a RAAS inhibitor in eligible people (versus current practice) are expected to have increased:
  - UK: + 25 501 cases
  - US: + 174 080 cases.

Figure 3. Screening scenario modeled for the period 2021–2026 using the *Inside CKD* microsimulation model.



[a]ACEi or ARB, as recommended by KDIGO 2012 recommendations.[18]
ACEi,, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; RAAS, renin–angiotensin–aldosterone system; T2D, type 2 diabetes; UACR, urinary albumin-to-creatinine ratio.

Figure 4. Differences in the distribution of cases of CKD stages 1–5 (pre-RRT) from 2021 to 2026 in people with T2D with routine UACR screening with initiation of a RAAS inhibitor in eligible people compared with current clinical practice, in the UK (a) and the US (b).



CKD, chronic kidney disease; RAAS, renin–angiotensin–aldosterone system; RRT, renal replacement therapy; T2D, type 2 diabetes; UACR, urinary albumin-to-creatinine ratio.

- Conversely, routine UACR screening and initiation of a RAAS inhibitor in eligible people (versus current practice) is expected to result in decreases in the numbers of cases of CKD stages 3b–5 (without RRT) in 2026 due to delayed disease progression:
  - UK: – 27 050 cases
  - US: – 139 913 cases.
- The overall prevalence (diagnosed and undiagnosed) of CKD of all stages did not change substantially with routine UACR screening and initiation of a RAAS inhibitor in eligible people (versus current practice) in either country (**Table 1**).

Table 1. Overall national prevalence (diagnosed and undiagnosed) of CKD stages 1–5 in people with T2D with routine UACR screening with initiation of a RAAS inhibitor in eligible people, compared with current clinical practice, in the UK and the US.

Country	Scenario	Prevalence					
		2021	2022	2023	2024	2025	2026
UK	Current practice	1 764 716	1 788 497	1 810 280	1 830 459	1 850 624	1 866 945
	UACR screening	1 761 864	1 784 913	1 805 529	1 826 878	1 847 185	1 865 396
US	Current practice	14 438 368	14 616 654	14 795 727	14 966 831	15 129 016	15 268 921
	UACR screening	14 415 501	14 587 138	14 765 511	14 927 672	15 087 021	15 234 754

RAAS, renin–angiotensin–aldosterone system; T2D, type 2 diabetes; UACR, urinary albumin-to-creatinine ratio.

Limitations

- Model inputs, outputs and assumptions are subject to additional review and update as part of a global model standardization; model outputs presented here should therefore be considered preliminary in nature.
- The model assumes that there will be no shifts in standard clinical practice or policy over the period 2021–2026.

Conclusions

- Here we present the results of the *Inside CKD* microsimulation model of the potential effects on people with T2D in the UK and the US of routine measurement of UACR during primary care visits followed by intervention with a RAAS inhibitor in eligible people, compared with current clinical practice.
- The results show that the modeled scenario may not lead to substantial changes in the overall prevalence (diagnosed and undiagnosed) of CKD of all stages in people with T2D.
- However, the scenario may lead to a change in the distribution of the different stages of CKD in people with T2D, with an increase in CKD stages 1–3a and a decrease in CKD stages 3b–5.
- Early CKD diagnosis and intervention can delay disease progression.
- Thus, the modeled scenario may lead to a decrease in the number of people with T2D and early-stage CKD who progress to CKD stages 3b–5.
- As a consequence, there may also be an increase in the number of people with T2D who remain in the early stages of CKD.
- By reducing the number of cases of CKD stages 3b–5 in people with T2D, the modeled intervention could reduce the global burden and associated healthcare costs caused by advanced-stage CKD.
- Analyses in other countries are ongoing to assess the generalizability of these preliminary results.

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Disclosures

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SN, CC and JJGS are employees of AstraZeneca. AAS is a former employee of AstraZeneca. JC-G, LR, LW and MX are employees of HealthLumen, which has received funding from AstraZeneca. JA, MCB, SC, GMC, LDN J-MH, EK, GL, FSM, JFN-G, AP, NT and JW are members of the *Inside CKD* Scientific Committee and have received financial support from AstraZeneca to attend *Inside CKD* committee meetings.

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