Inside CKD: projecting the population level economic burden of chronic kidney disease according to urine albumin-to-creatinine ratio (uACR) categories

Juan Jose Garcia Sanchez[1], Luca De Nicola[2], Ricardo Correa-Rotter[3], Juan F. Navarro-González[4], Albert Power[5], Michal Nowicki[6], Istvan Wittmann[7], Claudia Cabrera[8], Salvatore Barone[9], Timothy Coker[10], Lise Retat[10]

[1]AstraZeneca, Cambridge, UK; [2]University Luigi, Vanvitelli, Naples, Italy; [3]Instituto Nacional de Ciencias Medicas y Nutricion Salvador Zubiran, Ciudad de Mexico, Mexico; [4]University Hospital Nuestra Señora de Candelaria, Santa Cruz de Tenerife, Spain; [5]North Bristol NHS Trust, Bristol, UK; [6]Medical University of Lodz, Poland; [7]2nd Department of Internal Medicine and Nephrology Centre, University of Pécs, Hungary; [8]AstraZeneca, Gothenburg, Sweden; [9]AstraZeneca, Gaithersburg, US; [10]HealthLumen Limited, London, UK

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KEY FINDINGS

The total CKD population (diagnosed and undiagnosed) in 31 countries and regions was projected to be predominantly within the urine albumin to creatinine ratio (uACR) categories **A1**: **44.8%** (SD: 14.9) and **A2**: **46.4%** (SD: 14.7).

97.3% ($216.42 BILLION USD)
of the **CKD management costs**
were estimated to be in categories A1 and A2 for the diagnosed CKD population (prevalence).

90.2% ($1112.45 BILLION USD)
of the **cardio-renal complication costs**
were estimated to be in categories A1 and A2 for the diagnosed CKD population (prevalence).

CONCLUSIONS

This study estimates the epidemiological and economic burden of CKD to arise **primarily from patients within the diagnosed uACR categories A1 and A2 at the population level.**

Our analysis provides healthcare decision makers with insights **allowing them to intervene in individuals with categories A1 or A2; by screening patients earlier.**

Earlier intervention in this larger population by primary care doctors, **could delay disease progression and alleviate clinical and economic pressure on healthcare systems.**

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Introduction

- CKD affects over 850 million individuals worldwide, a prevalence of 11%.[1]
- Albuminuria, measured as uACR, is an independent predictor of CKD progression as well as cardiovascular (CV) events and death.[2]
- Patients within uACR category A3 (severely increased albuminuria) have the highest risk of cardio-renal complications at an individual level but only account for a small proportion of the CKD population.
- Patients within uACR categories A1 and A2 (normal to moderately increased albuminuria) represent the majority of the CKD population and are expected to account for most of the clinical burden.[3,4]
- Currently uACR is not routinely tested so there is limited data on the clinical and economic burden by uACR category at a population level.

Objective

This study aimed to assess the future economic burden of CKD at a total population level according to uACR categories using the validated *Inside* CKD microsimulation across 31 countries and regions.[†]

Methods

- The Inside CKD microsimulation simulated 620 (20 million per country or region) virtual individuals from 31 countries and regions.[5]
- Demographic and epidemiological characteristics including age, diagnosis status based on CKD stage (estimated glomerular filtration rate (eGFR) and uACR), and disease status were based on data from published national health/epidemiological surveys.
- Country-specific direct costs were applied annually based on diagnosed CKD stage. The model projected population size, incidence of complications and associated costs according to uACR category.
- The costs were applied to prevalence (total number of diagnosed cases) in 2027 to calculate totals for CKD management (stages 3, 4 and 5 (pre-kidney replacement therapy (KRT)) and cardio-renal complications (heart failure, myocardial infarction (MI) and stroke).
- All unit costs were adjusted to 2022 prices and standardised to US dollars (USD) according to implied purchasing power parity rates from the International Monetary Fund data

Results

The microsimulation projected the average total CKD population (diagnosed and undiagnosed) to be predominantly within uACR categories A1 and A2 in all countries and regions in 2027.

A1 (NORMAL TO MILDLY INCREASED)
44.8%[‡] (SD: 14.9)

A2 (MODERATELY INCREASED)
46.4%[‡] (SD: 14.7)

A3 (SEVERELY INCREASED)
8.8%[‡] (SD: 9.1)

[‡]Calculated as unweighted averages

Results

The average costs associated with CKD management (stages G3a–G5) and cardio-renal complications in the diagnosed population (prevalence) were predominantly in uACR categories A1 and A2 in all countries and regions in 2027 (Table 1, and Figure 1-2).
The costs for the individual countries and regions are available in the supplementary data, accessed via the QR code.

Table 1. Projected costs associated with CKD management and cardio-renal complications in the diagnosed population CKD stages G3–G5) (prevalence – 2027)

		A1	A2	A3
Total CKD management costs (billion USD)		**$183.30 (82.4%)**	**$33.13 (14.9%)**	**$5.95 (2.7%)**
Average cost per CKD stage (billion USD)	CKD stage G3	$5.02	$0.82	$0.15
	CKD stage G4	$0.52	$0.18	$0.03
	CKD stage G5 (pre-KRT)	$0.19	$0.04	$0.01
Total complication costs (billion USD)		**$573.03 (46.4%)**	**$539.43 (43.7%)**	**$121.33 (9.8%)**
Average cost per complication (billion USD)	Heart failure	$5.67	$5.55	$1.08
	MI	$8.49	$6.99	$1.81
	Stroke	$4.33	$4.86	$1.02

Figure 1. Projected costs associated with CKD management in the diagnosed population (CKD stages G3–G5) (prevalence – 2027)

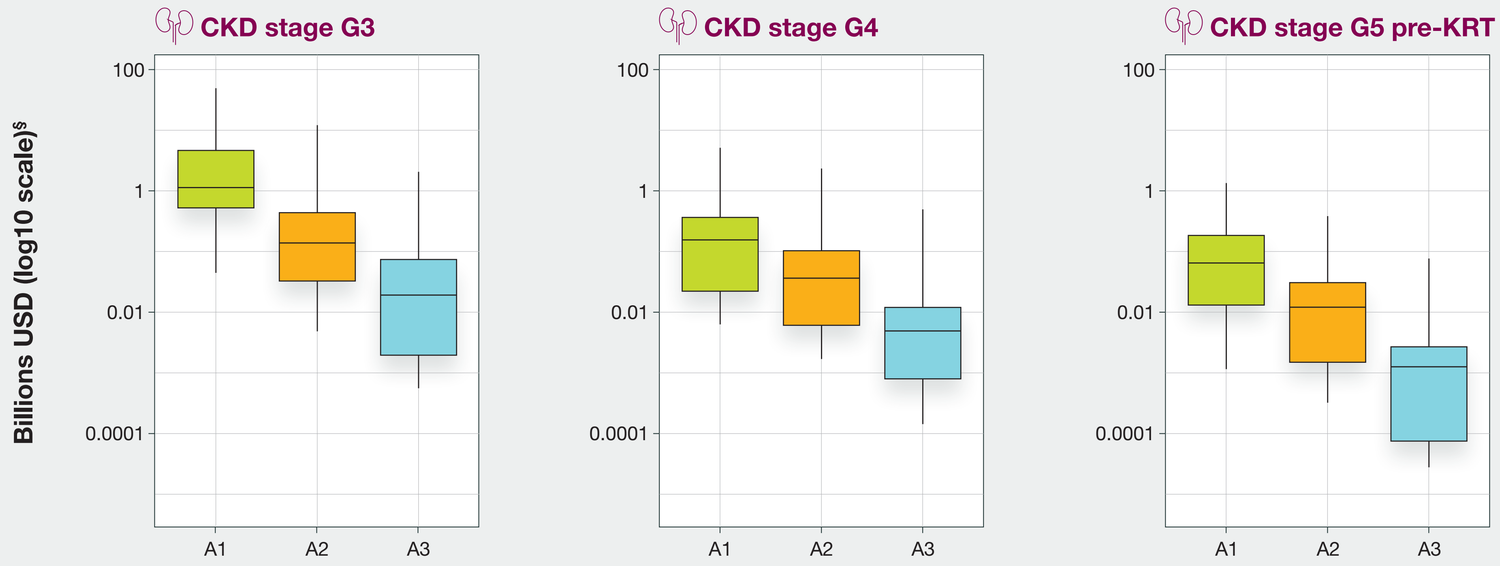
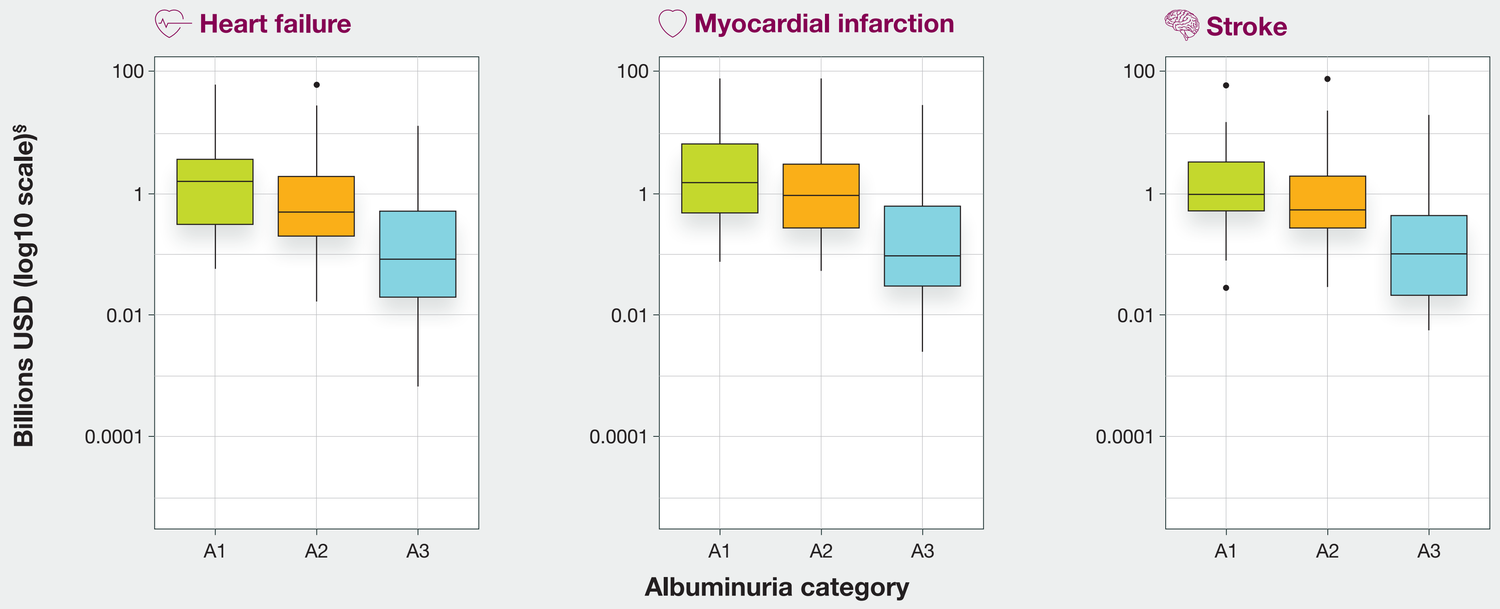


Figure 2. Projected costs associated with cardio-renal complications in the diagnosed population (CKD stages G3–G5) (prevalence – 2027)



§A log10 scale was used to enable graphical represent of the wide-ranging costs across the 31 countries and regions

Limitations

To the authors' knowledge, the best epidemiological data for each country or region were used in the microsimulation.
It is important to note that due to limited epidemiological data, some of the country-specific inputs for the microsimulation may not be representative of the total population. For example, a cross sectional study by Cueto-Manzano et al.[6] was used for Mexico. This study population is not representative of the total population with 73% female, age 51 ± 14 years, with more than 50% of subjects reporting family antecedents of diabetes mellitus, hypertension, and obesity, and 30% of CKD.
This highlights the need for future research to determine high-quality epidemiological data.

Acknowledgements

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[†]Countries and regions

Americas – Brazil, Canada, Colombia, Mexico, USA
East Asia and Pacific – Australia, China, Japan, Philippines, Singapore, South Korea, Taiwan, Thailand
South & Central Asia – India, Israel, Saudi Arabia, Turkey, UAE (Emirati)
Europe – Belgium, Demark, France, Germany, Greece, Hungary, Italy, Netherlands, Poland, Romania, Spain, Sweden, UK

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