

# Inside CKD: projecting the population level clinical burden of chronic kidney disease according to urine albumin-to-creatinine ratio categories

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## Introduction

- CKD affects over 850 million individuals globally.<sup>1</sup>
- Albuminuria (measured as uACR) is a critical marker of CKD.<sup>2</sup>
- Patients with normo- (A1) to micro-albuminuria (A2) represent most of the CKD population and are expected to account for the majority of the clinical burden.<sup>3,4</sup>
- Patients with macro-albuminuria (A3) are at a higher risk of cardio-renal events but represent a small proportion of the CKD population.
- However, albuminuria is not routinely tested, with limited data translating the burden of CKD at the population level according to albuminuria categories.

## Study objective

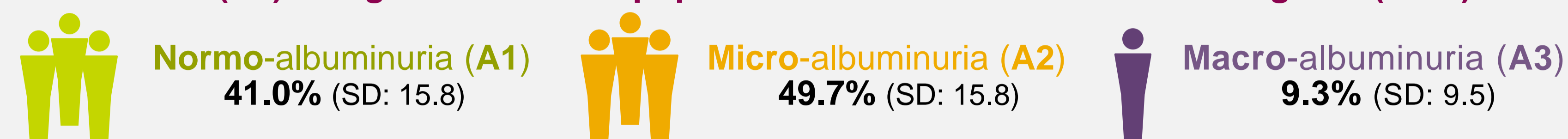
This study aimed to assess the future epidemiological burden of CKD at a total population level according to albuminuria categories using the Inside CKD microsimulation for 31 countries and regions<sup>†</sup>.

## Methods

- The *Inside CKD* microsimulation simulated virtual individuals from 31 countries and regions.<sup>5</sup>
- Inputs: national demographics, eGFR and albuminuria distributions defining the CKD population, and disease statistics from relevant databases and peer-review publications.
- Outputs: annual total population level estimates according to albuminuria categories for 31 countries and regions.

## Results

The CKD populations are projected to be predominantly within normo- (A1) and micro-albuminuria (A2) categories at a total population level in all countries and regions (2023):



Projected cumulative (2022-2027) cardio-renal incidence events and transitions from CKD stage G3 to G4 and G4 to G5 (ESKD) predominantly occurred in the normo- (A1) and micro-albuminuria (A2) categories at a total population level in all countries and regions (Figures 1 and 2):

	Normo (A1) + Micro (A2)	vs	Macro (A3)
Heart failure	98.1% (SD: 2.2)	vs	1.9% (SD: 2.2)
MI	98.0% (SD: 2.3)	vs	2.0% (SD: 2.3)
Stroke	96.7% (SD: 3.9)	vs	3.3% (SD: 3.9)
All-cause mortality	95.8% (SD: 4.7)	vs	4.2% (SD: 4.7)
Transition from CKD stage G3 to G4	94.9% (SD: 6.2)	vs	5.1% (SD: 6.2)
Transition from stage G4 to G5 (ESKD)	97.6% (SD: 2.6)	vs	2.4% (SD: 2.6)

Figure 1. Projected cumulative incidence events (2022-2027) for normo- (A1), micro- (A2), and macro-albuminuria (A3) categories at a total population level (CKD stages G3-5), in 31 countries and regions.

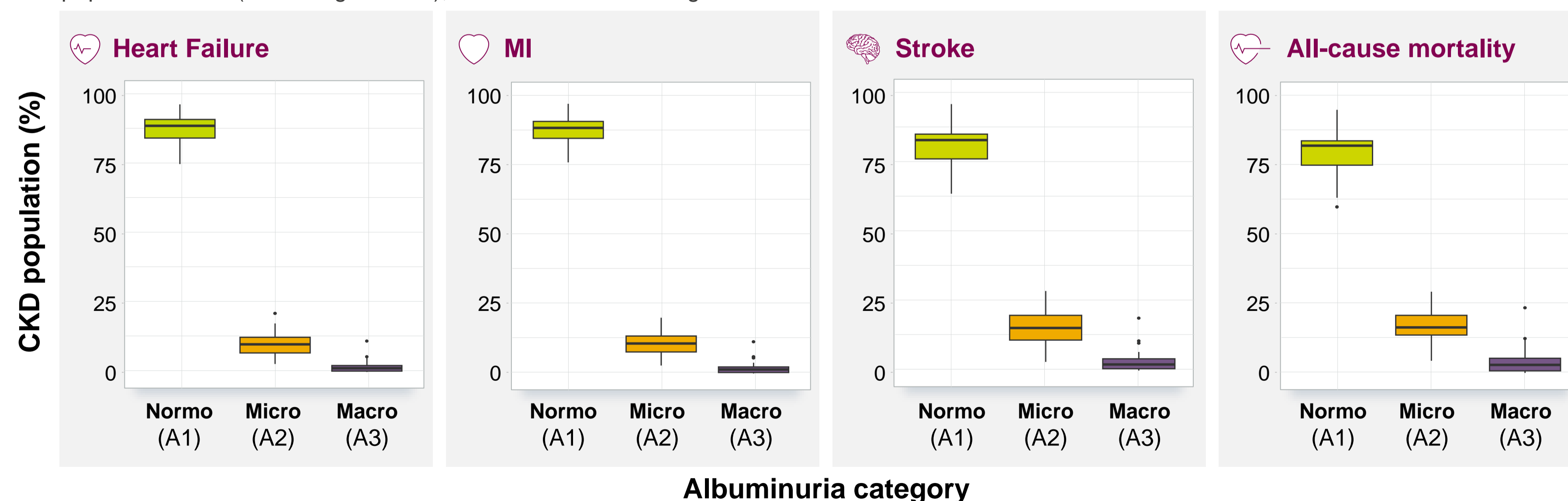
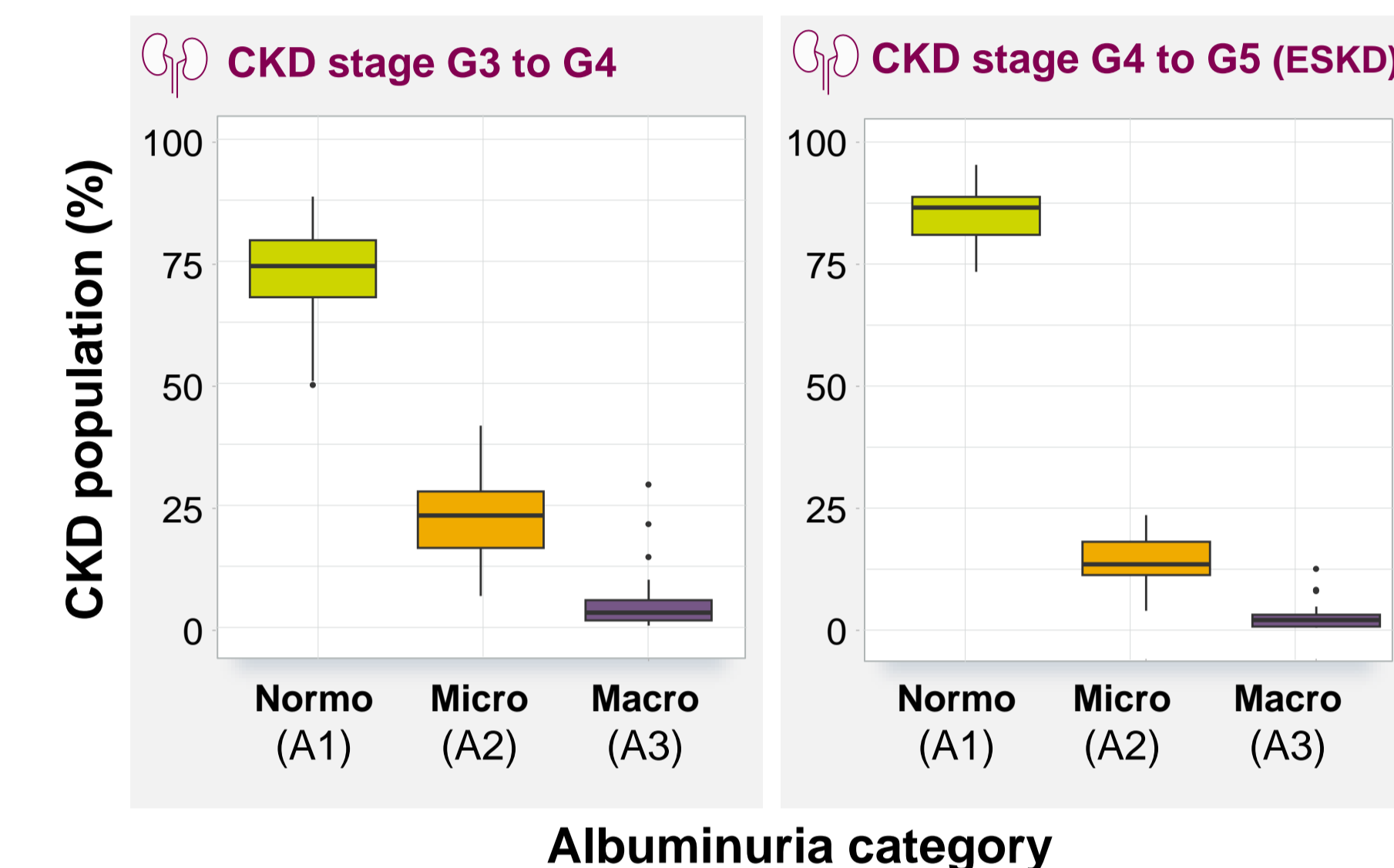


Figure 2. Projected cumulative transitions<sup>‡</sup> from CKD stage G3 to G4 and G4 to G5 (ESKD) (2022-2027) for normo- (A1), micro- (A2), and macro-albuminuria (A3) categories at a total population level, in 31 countries and regions. <sup>‡</sup>Transitions defined as a change in either eGFR or albuminuria category



## Conclusions

- This study provides evidence that the clinical burden of CKD is predominantly within the normo- (A1) and micro-albuminuria (A2) categories at a total population level.
- Evidence based policy interventions should aim to target the CKD population as a whole, including the normo- (A1) and micro-albuminuria (A2) categories.

## 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.<sup>6</sup> 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.

## References

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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  
**Europe** – Belgium, Denmark, France, Germany, Greece, Hungary, Italy, Netherlands, Poland, Romania, Spain, Sweden, UK

## Abbreviations

CKD: chronic kidney disease; eGFR: estimated glomerular filtration rate; ESKD: end stage kidney disease; MI: myocardial infarction; SD: standard deviation; uACR: urine albumin-to-creatinine ratio