THE EPIDEMIOLOGY OF CHRONIC KIDNEY DISEASE

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CKD-AFRICA
CHRONIC KIDNEY DISEASE IN AFRICA COLLABORATION

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OUTLINE

1. Why knowing the burden of CKD matters
2. Definition and classification
3. Global and regional prevalence
4. Causes and CKD risk factors
5. Health disparities
6. Economic and social impact
7. Screening and detection
8. Epidemiological challenges
9. Overview of CKD-Africa and preliminary findings
10. Conclusion

WHY KNOWING THE BURDEN MATTERS

1. Identifies where the **need is greatest**
   - reveal geographic variation in CKD prevalence, risk factors, and outcomes
     - pinpoint hotspots — areas where CKD is more common, underdiagnosed, or poorly managed — allowing for targeted interventions rather than a one-size-fits-all approach
2. Guides **resource allocation** and policy
   - Accurate data help governments and donors decide where to invest in:
     - Dialysis and transplant facilities, screening and prevention programs, training for health workers, access to essential medicines
3. Improves understanding of **disparities**
   - visualize inequalities — by region, gender, income, or rural–urban divide
     - exposes how socioeconomic and environmental factors influence CKD risk, ensuring that prevention and care strategies address the most vulnerable populations
4. Supports **integration into NCD** agendas
   - CKD has often been neglected compared to other NCDs like diabetes or CVD
   - pivotal development recently has been the WHO's adoption of its first global resolution on kidney health
5. **Facilitates** regional and international **comparisons**
6. **Drives research and innovation**

DEFINITION AND CLASSIFICATION

- **Defining CKD:** CKD is defined as abnormalities of kidney structure or function, present for a minimum of 3 months, with implications for health

- **Classifying CKD:** CKD is classified based on Cause, GFR category (G1–G5), and Albuminuria category (A1–A3)

Table 2 | GFR categories in CKD

GFR category	GFR (ml/min per 1.73 m^2)	Terms
G1	≥90	Normal or high
G2	60–89	Mildly decreased[a]
G3a	45–59	Mildly to moderately decreased
G3b	30–44	Moderately to severely decreased
G4	15–29	Severely decreased
G5	<15	Kidney failure

CKD, chronic kidney disease; GFR, glomerular filtration rate.
[a]Relative to the young adult level. In the absence of evidence of kidney damage, neither G1 nor G2 fulfills the criteria for CKD.

Table 3 | Albuminuria categories in chronic kidney disease

Category	AER (mg/24 h)	ACR (approximately equivalent) (mg/mmol)	ACR (approximately equivalent) (mg/g)	Terms
A1	<30	<3	<30	Normal to mildly increased
A2	30–300	3–30	30–300	Moderately increased[a]
A3	>300	>30	>300	Severely increased

ACR, albumin-to-creatinine ratio; AER, albumin excretion rate.
[a]Relative to the young adult level.

KDIGO 2024

DEFINITION AND CLASSIFICATION

KDIGO: Prognosis of CKD by GFR and albuminuria categories

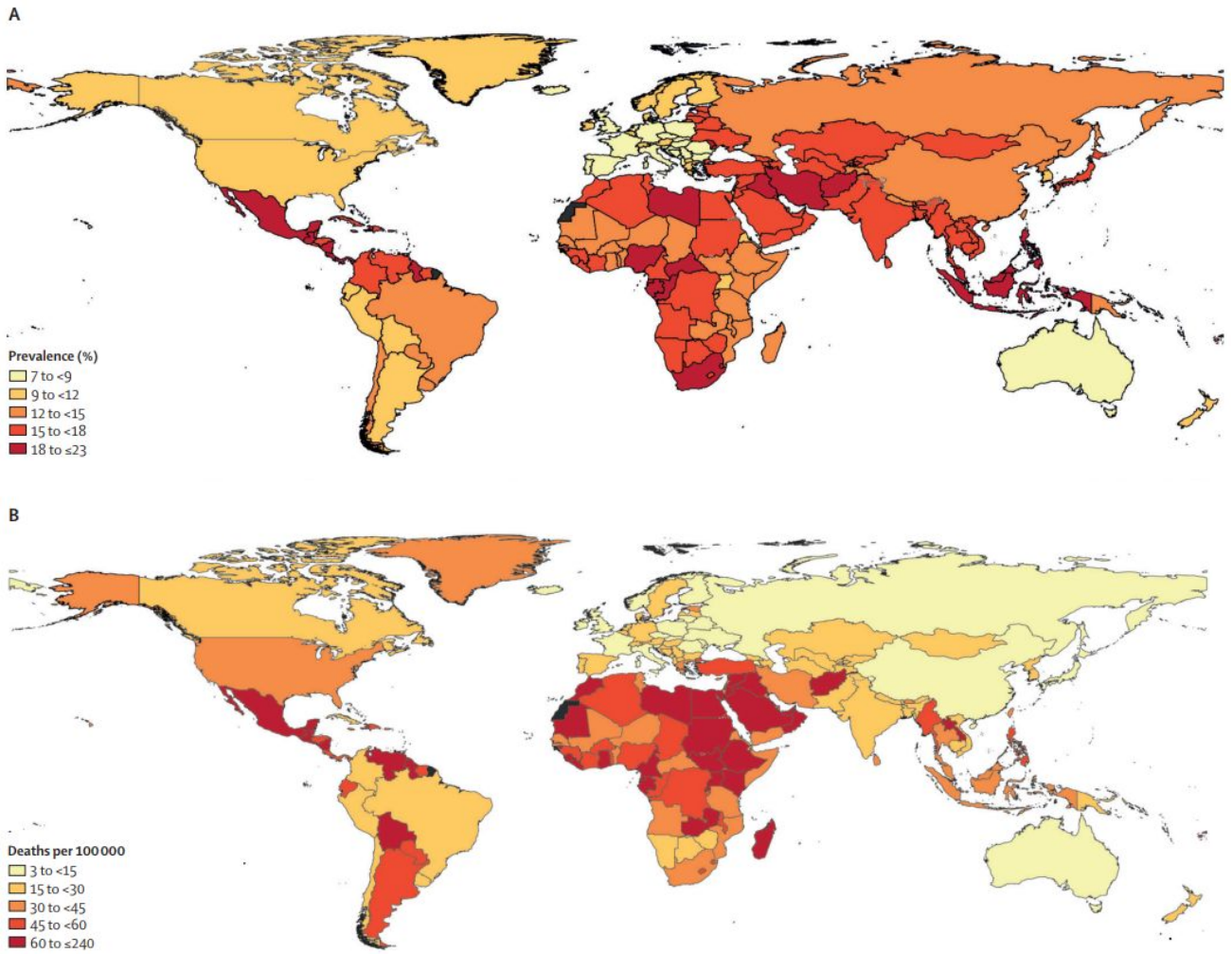
GFR categories (ml/min/1.73 m²) Description and range				Persistent albuminuria categories Description and range		
				A1	**A2**	**A3**
				Normal to mildly increased	Moderately increased	Severely increased
				<30 mg/g <3 mg/mmol	30–300 mg/g 3–30 mg/mmol	>300 mg/g >30 mg/mmol
	G1	Normal or high	≥90			
	G2	Mildly decreased	60–89			
	G3a	Mildly to moderately decreased	45–59			
	G3b	Moderately to severely decreased	30–44			
	G4	Severely decreased	15–29			
	G5	Kidney failure	<15			

Green: low risk (if no other markers of kidney disease, no CKD); Yellow: moderately increased risk; Orange: high risk; Red: very high risk. GFR, glomerular filtration rate.

KDIGO 2024

GLOBAL AND REGIONAL PREVALENCE

- **Global Burden of Disease statistics:**
  - Prevalence of CKD in general population (≥20 years):
    - 1990: 378 million
    - 2023: 788 million (**14.2%**)
  - Majority of CKD burden is in LMICs: ~78% of all CKD cases
    - driven by accelerated epidemiologic transitions, high prevalence of risk factors (e.g., hypertension, diabetes), and limited access to early detection and management
  - Region with the highest age-standardised prevalence: North Africa and the Middle East (18.0%)
    - Most people had stage 1–3 CKD



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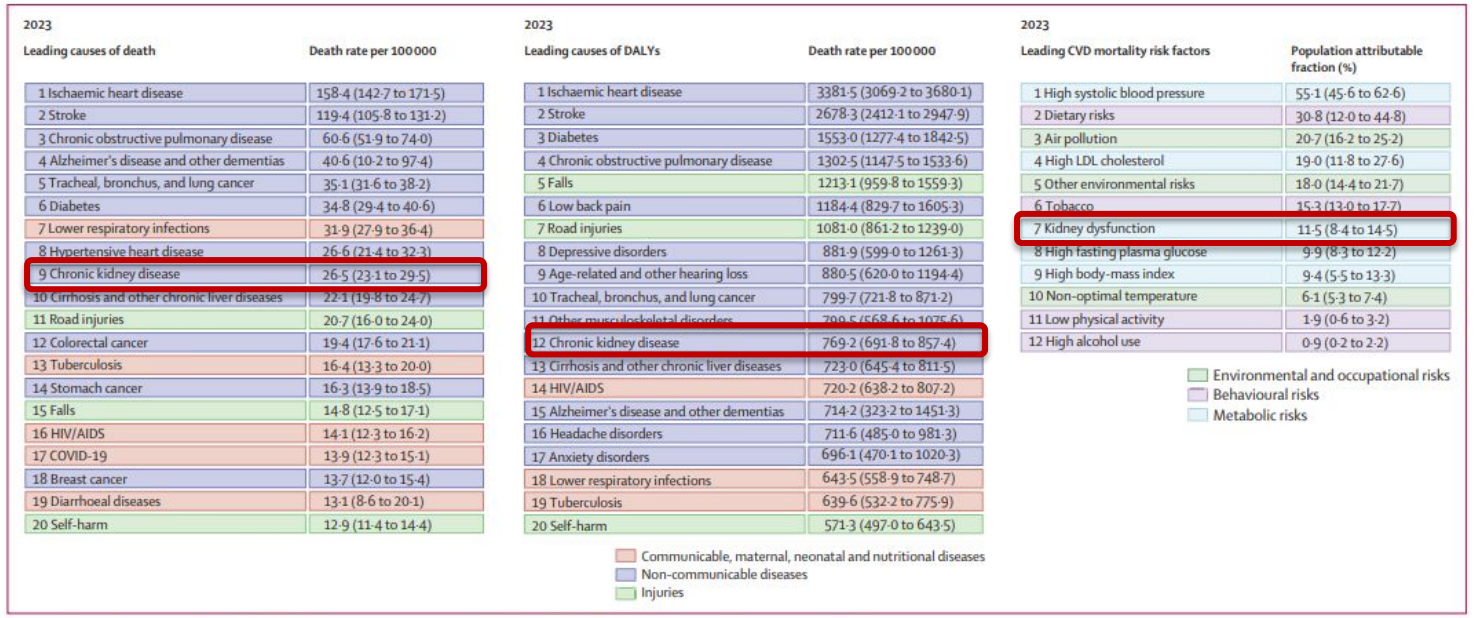
GLOBAL AND REGIONAL PREVALENCE

- **Global Burden of Disease statistics:**
  - 9th leading cause of death globally
    - accounting for 1.5 million deaths
  - 12th leading cause of DALYs
    - rate of 769.2 per 100 000
  - Impaired kidney function as a risk factor accounted for 11.5% of CVD deaths



2023 Leading causes of death	Death rate per 100 000
1 Ischaemic heart disease	158·4 (142·7 to 171·5)
2 Stroke	119·4 (105·8 to 131·2)
3 Chronic obstructive pulmonary disease	60·6 (51·9 to 74·0)
4 Alzheimer's disease and other dementias	40·6 (10·2 to 97·4)
5 Tracheal, bronchus, and lung cancer	35·1 (31·6 to 38·2)
6 Diabetes	34·8 (29·4 to 40·6)
7 Lower respiratory infections	31·9 (27·9 to 36·4)
8 Hypertensive heart disease	26·6 (21·4 to 32·3)
9 Chronic kidney disease	26·5 (23·1 to 29·5)
10 Cirrhosis and other chronic liver diseases	22·1 (19·8 to 24·7)
11 Road injuries	20·7 (16·0 to 24·0)
12 Colorectal cancer	19·4 (17·6 to 21·1)
13 Tuberculosis	16·4 (13·3 to 20·0)
14 Stomach cancer	16·3 (13·9 to 18·5)
15 Falls	14·8 (12·5 to 17·1)
16 HIV/AIDS	14·1 (12·3 to 16·2)
17 COVID-19	13·9 (12·3 to 15·1)
18 Breast cancer	13·7 (12·0 to 15·4)
19 Diarrhoeal diseases	13·1 (8·6 to 20·1)
20 Self-harm	12·9 (11·4 to 14·4)

2023 Leading causes of DALYs	Death rate per 100 000
1 Ischaemic heart disease	3381·5 (3069·2 to 3680·1)
2 Stroke	2678·3 (2412·1 to 2947·9)
3 Diabetes	1553·0 (1277·4 to 1842·5)
4 Chronic obstructive pulmonary disease	1302·5 (1147·5 to 1533·6)
5 Falls	1213·1 (959·8 to 1559·3)
6 Low back pain	1184·4 (829·7 to 1605·3)
7 Road injuries	1081·0 (861·2 to 1239·0)
8 Depressive disorders	881·9 (599·0 to 1261·3)
9 Age-related and other hearing loss	880·5 (620·0 to 1194·4)
10 Tracheal, bronchus, and lung cancer	799·7 (721·8 to 871·2)
11 Other musculoskeletal disorders	799·5 (568·6 to 1075·6)
12 Chronic kidney disease	769·2 (691·8 to 857·4)
13 Cirrhosis and other chronic liver diseases	723·0 (645·4 to 811·5)
14 HIV/AIDS	720·2 (638·2 to 807·2)
15 Alzheimer's disease and other dementias	714·2 (323·2 to 1451·3)
16 Headache disorders	711·6 (485·0 to 981·3)
17 Anxiety disorders	696·1 (470·1 to 1020·3)
18 Lower respiratory infections	643·5 (558·9 to 748·7)
19 Tuberculosis	639·6 (532·2 to 775·9)
20 Self-harm	571·3 (497·0 to 643·5)

2023 Leading CVD mortality risk factors	Population attributable fraction (%)
1 High systolic blood pressure	55·1 (45·6 to 62·6)
2 Dietary risks	30·8 (12·0 to 44·8)
3 Air pollution	20·7 (16·2 to 25·2)
4 High LDL cholesterol	19·0 (11·8 to 27·6)
5 Other environmental risks	18·0 (14·4 to 21·7)
6 Tobacco	15·3 (13·0 to 17·7)
7 Kidney dysfunction	11·5 (8·4 to 14·5)
8 High fasting plasma glucose	9·9 (8·3 to 12·2)
9 High body-mass index	9·4 (5·5 to 13·3)
10 Non-optimal temperature	6·1 (5·3 to 7·4)
11 Low physical activity	1·9 (0·6 to 3·2)
12 High alcohol use	0·9 (0·2 to 2·2)

Environmental and occupational risks
Behavioural risks
Metabolic risks

Communicable, maternal, neonatal and nutritional diseases
Non-communicable diseases
Injuries

Figure 3: **Leading causes of global deaths, DALYs, and leading CVD mortality risk factors in 2023, age-standardised for people aged 20 years and older**
The listed population attributable fractions do not take into account mediation between risk factors. Therefore, the sum of the population attributable fractions might exceed 100%. CVD=cardiovascular disease. DALY=disability-adjusted life-year.

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CAUSES AND CKD RISK FACTORS

- 589 million adults (20-79 years) are living with diabetes worldwide
- 43-45% of all people living with diabetes, are undiagnosed

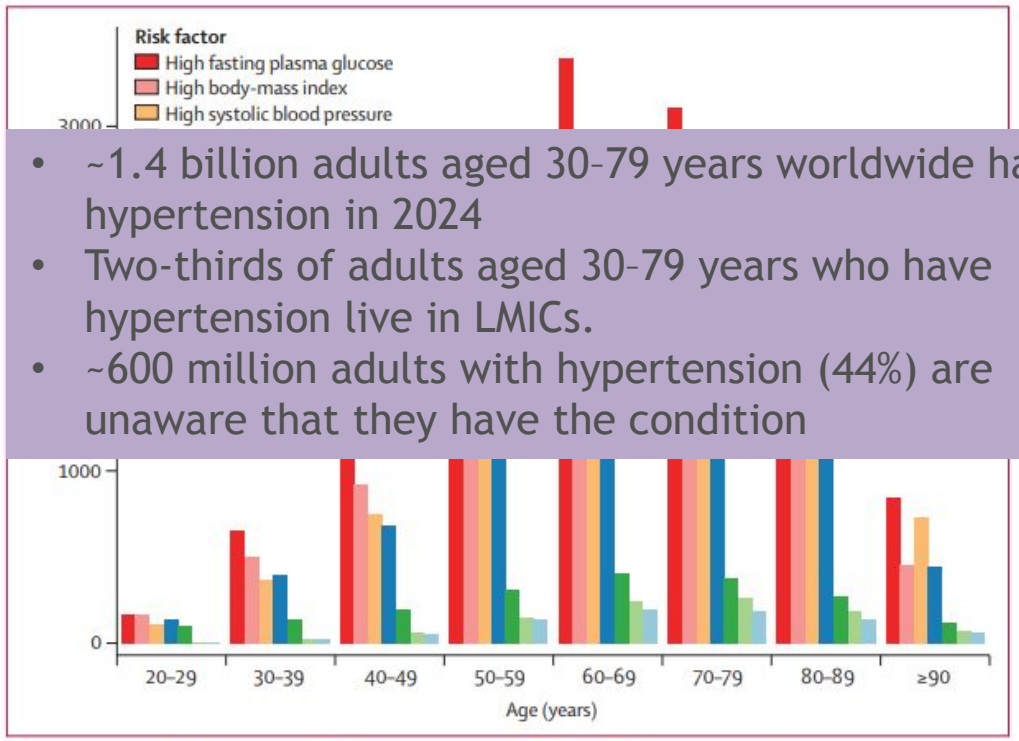

Figure 4: **Number of chronic kidney disease DALYs attributable to risk factors globally by age in 2023**
DALYs might be attributed to more than one risk factor or not be attributed to any risk factor. Therefore, the sum of the attributable DALYs might not be equal to the total chronic kidney disease DALYs. DALY=disability-adjusted life-year.

- ~1.4 billion adults aged 30-79 years worldwide had hypertension in 2024
- Two-thirds of adults aged 30-79 years who have hypertension live in LMICs.
- ~600 million adults with hypertension (44%) are unaware that they have the condition

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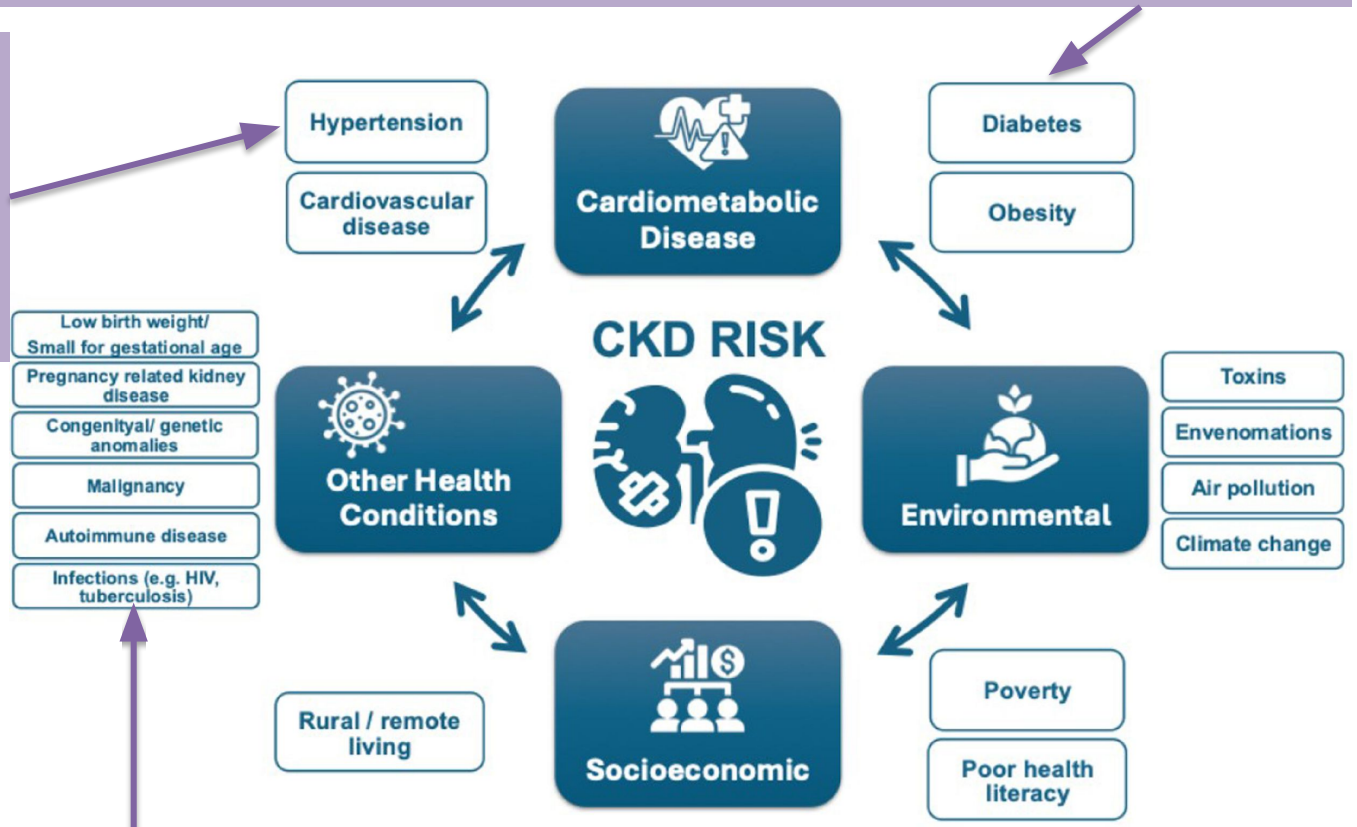
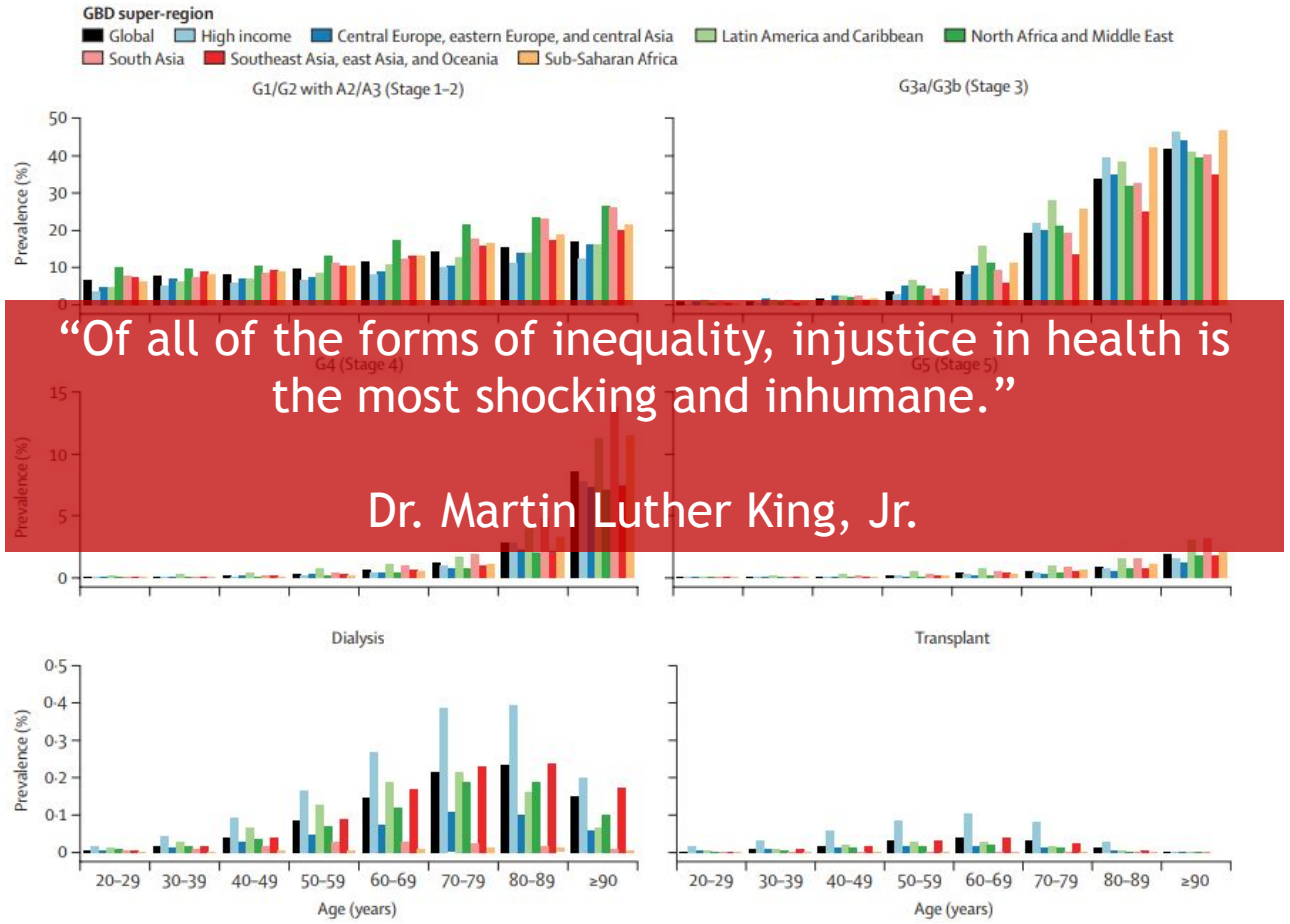


- Globally: 40.8 million individuals have HIV, SSA accounting for close to 70% of the global burden of infection
- HIV-associated nephropathy (HIVAN) fast becoming an important cause of morbidity and mortality related to kidney disease

HEALTH DISPARITIES

- Disproportionate burden in LMICs
- Inequities in access to screening and treatment
  - driven by socioeconomic, geographic, and structural factors that result in significantly poorer outcomes for vulnerable populations
    - ~1.2 billion people live in extreme poverty worldwide
    - Poverty negatively influences healthy behaviors, health care access, and environmental exposure, all of which contribute to health care disparities
- Genetic predispositions: e.g., APOL1 variants in African ancestry populations



"Of all of the forms of inequality, injustice in health is the most shocking and inhumane."

Dr. Martin Luther King, Jr.

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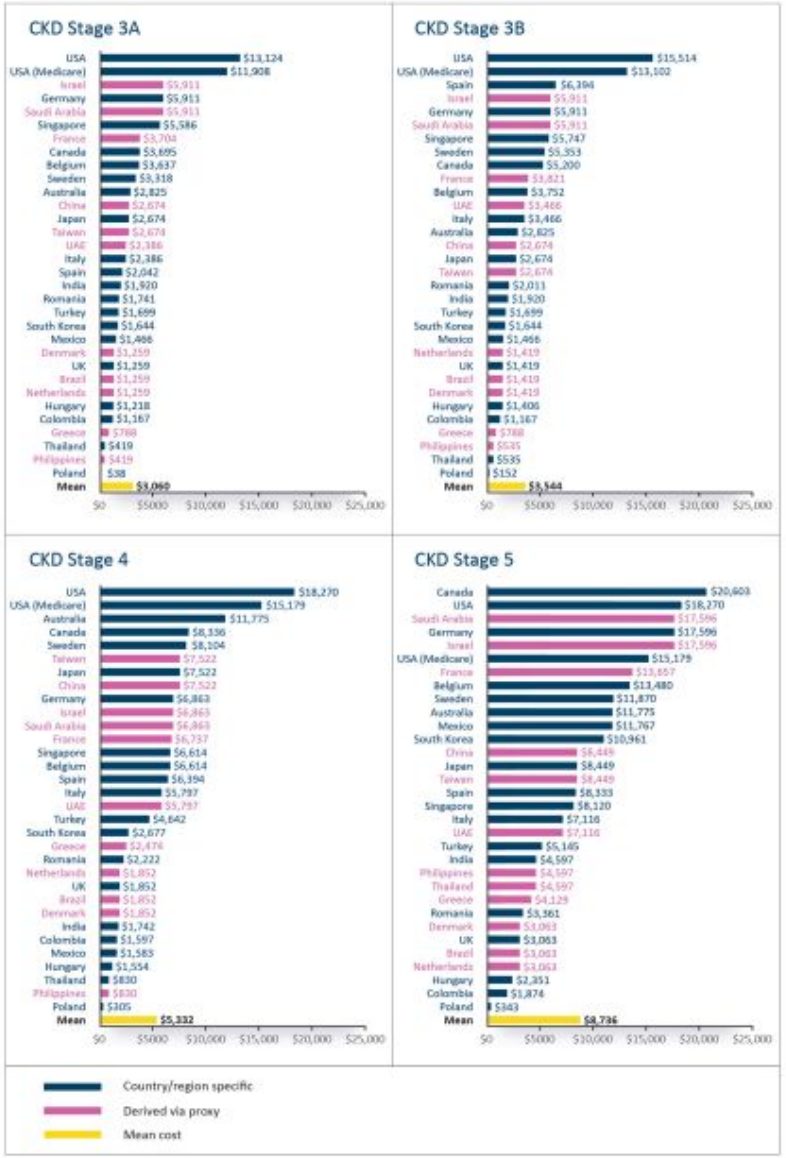
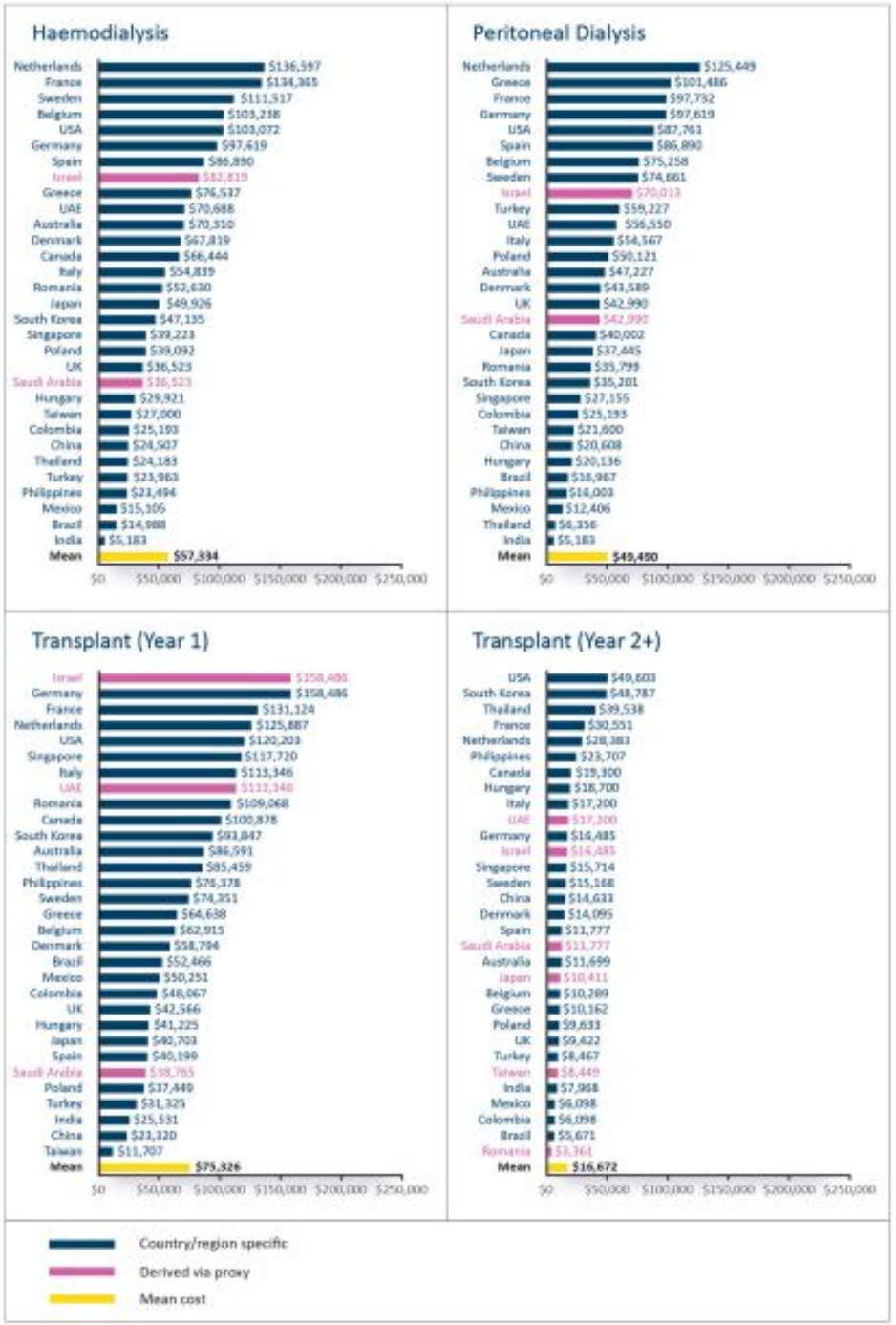
ECONOMIC AND SOCIAL IMPACT

- High cost of dialysis and transplantation
  - Annual direct costs associated with CKD management rose by an average factor of 4 in each country/region upon progression from stage G3a to G5
  - Costs of transplant substantially higher
  - The mean annual per patient costs of complications were $18,294 for myocardial infarction, $8463 for heart failure, $10,168 for stroke and $5975 for acute kidney injury





Jha et al. Adv Ther (2023) 40:4405–4420

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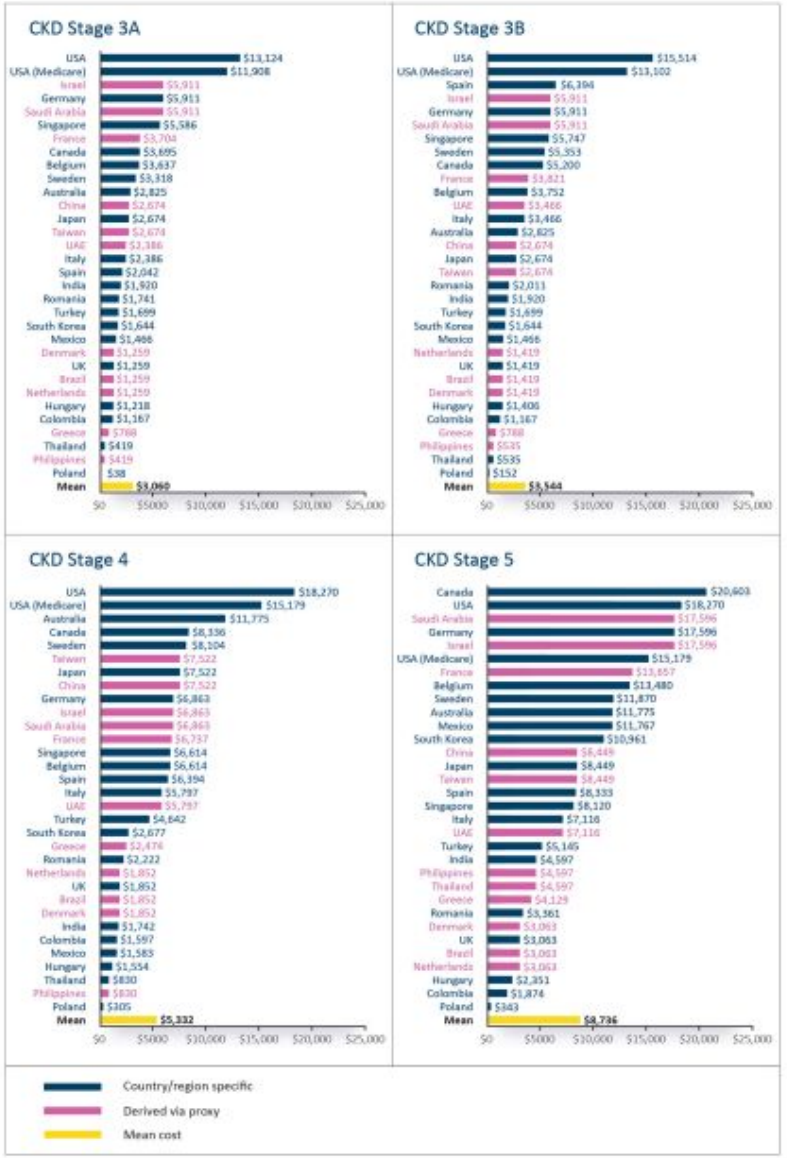
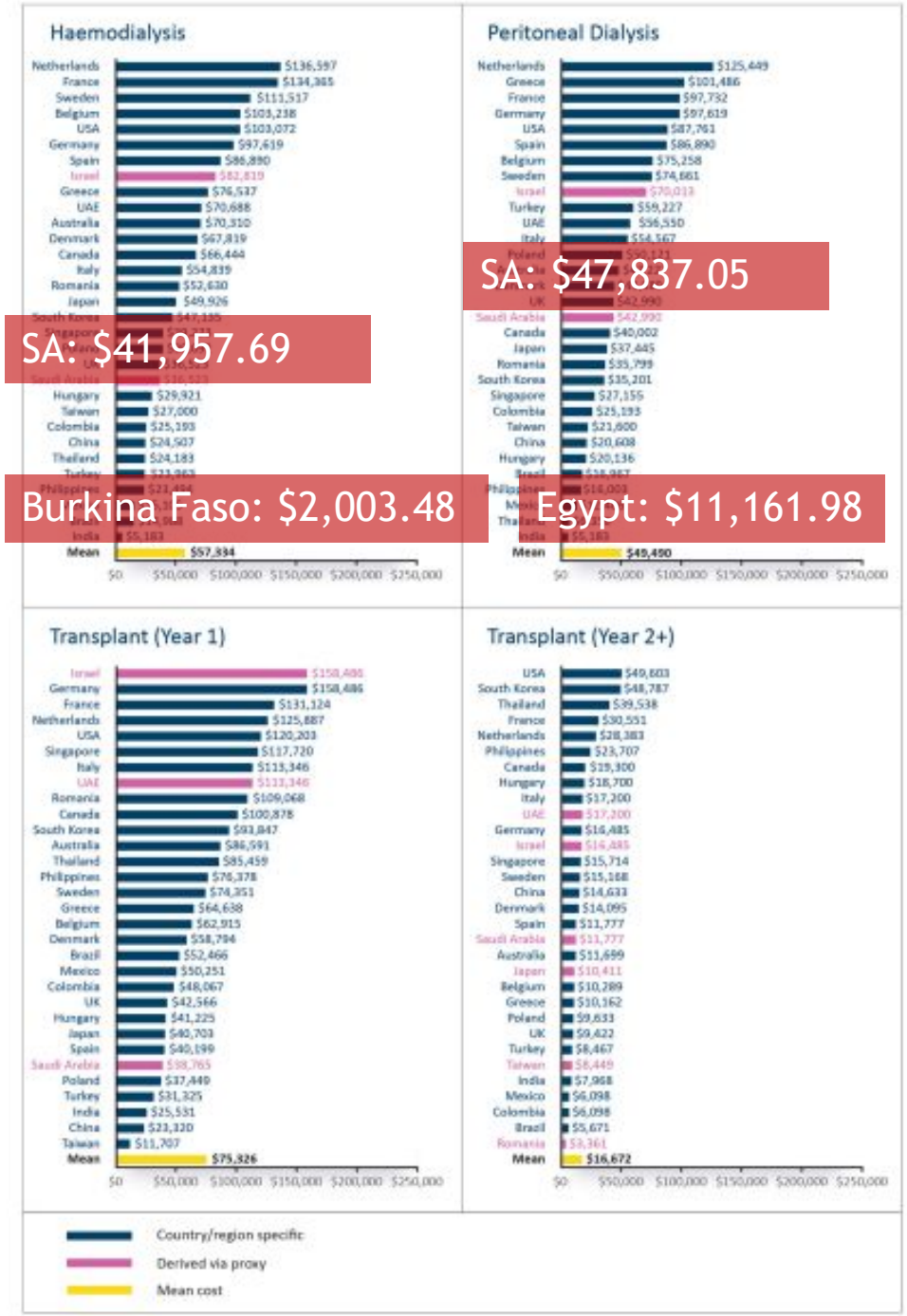




Jha et al. Adv Ther (2023) 40:4405–4420
Yakubu et al. BMC Nephrology (2025) 26:551

ECONOMIC AND SOCIAL IMPACT

- Treatment options:
  - Dialysis: limited public sector capacity, urban-centered
  - South Africa: <10% of patients needing dialysis have access
  - Kidney transplantation largely unavailable
  - High out-of-pocket costs and geographic barriers
- The burden is uneven — higher in some regions
  - mirroring the distribution of hypertension, diabetes, and HIV
  - genetic predisposition, CKDu, environmental exposures/heat stress, limited access to early screening/treatment
- Alarming gaps remain — whole regions with little of no data

ECONOMIC AND SOCIAL IMPACT

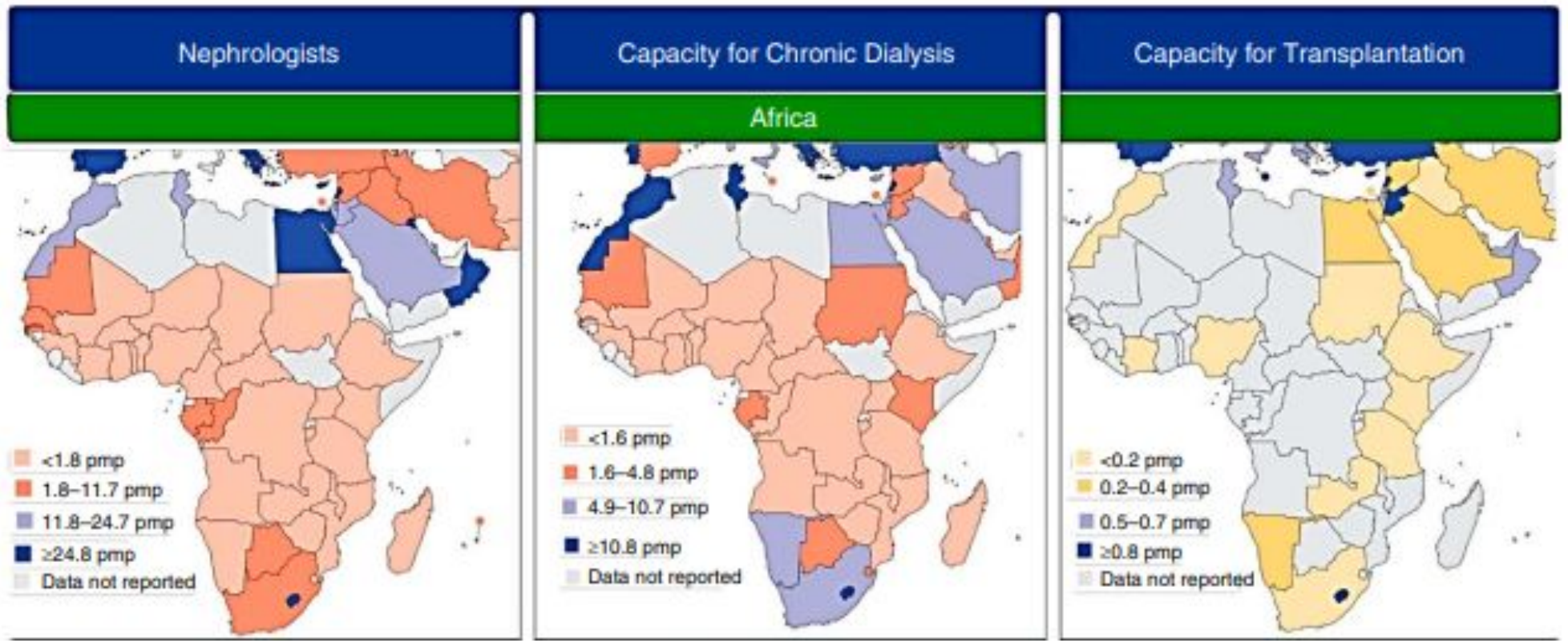
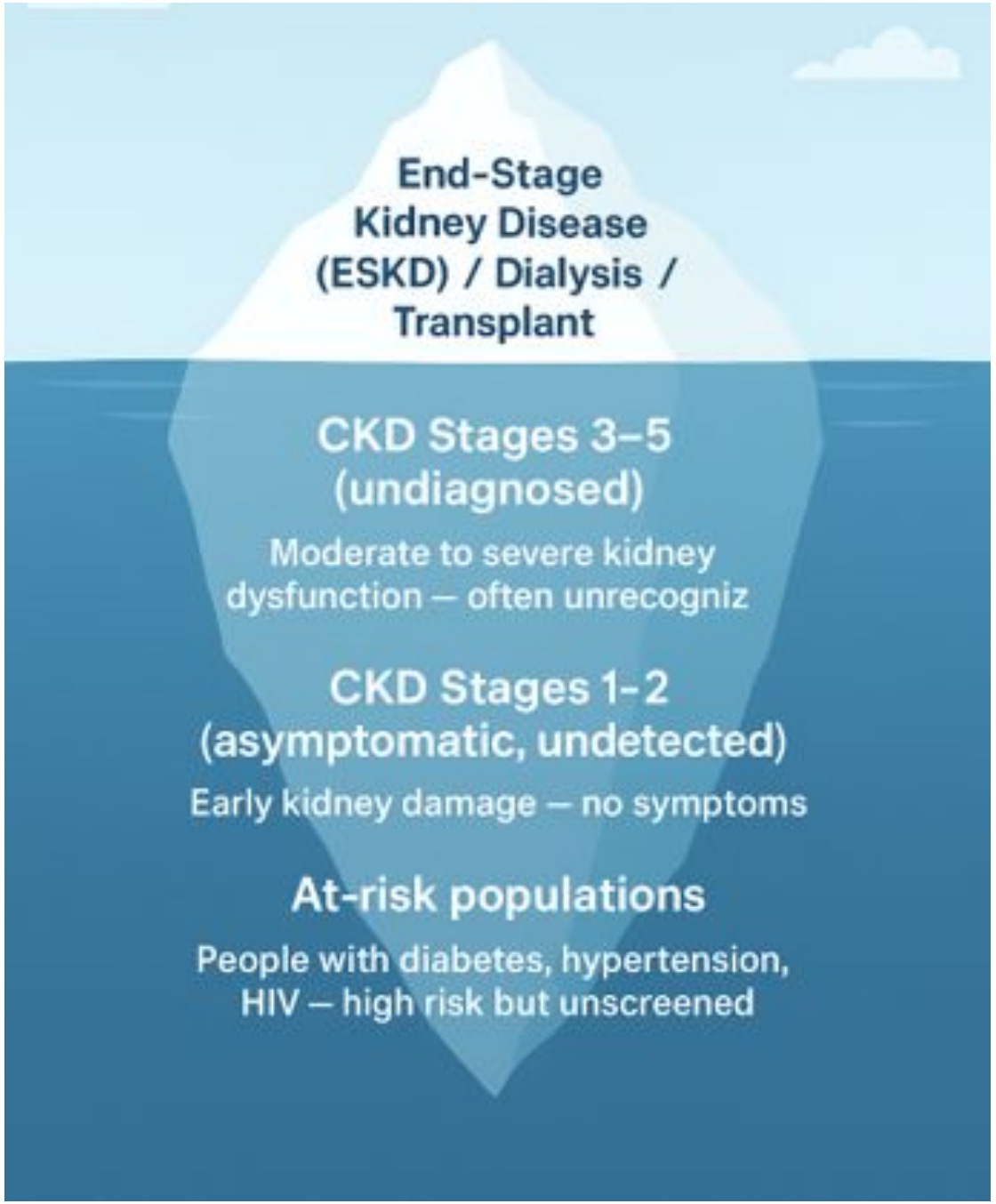


Figure. Current work force and kidney care capacity in three LMIC regions. Adapted from the 2023 ISN-GKHA. ISN-GKHA, International Society of Nephrology Global Kidney Health Atlas; LMIC, low- and middle-income country

Kalyesubula et al. Kidney360. 2024;5(7):1047-1061

SCREENING AND DETECTION

- Early detection is a key strategy to prevent kidney disease, its progression and related complications
  - awareness of kidney disease at the population level is low
    - >90% of people with CKD are unaware of their status
- Guidelines: Screening for high-risk groups (diabetes, hypertension)
- Increasing knowledge and implementing sustainable solutions for early detection of kidney disease are public health priorities



EPIDEMIOLOGICAL CHALLENGES

Measurement matters

- Different eGFR equations (MDRD, CKD-EPI, CG)
- MDRD and CKD-EPI including/excluding race correction factor
- Non-standardized creatinine calibration
- Albuminuria rarely measured in community-based studies
- Lack of 3-month chronicity
- Inconsistent CKD definitions across studies

	MDRD (with correction)	MDRD (without correction)	CKD-EPI 2009 (with correction)	CKD-EPI 2009 (without correction)	CG
eGFR (ml/min/1.73 m^2	58	48	63	54	66
CKD stage	3a	3a	2	3a	2
Female, age 40, serum creatinine 110 µmol/L					

EPIDEMIOLOGICAL CHALLENGES

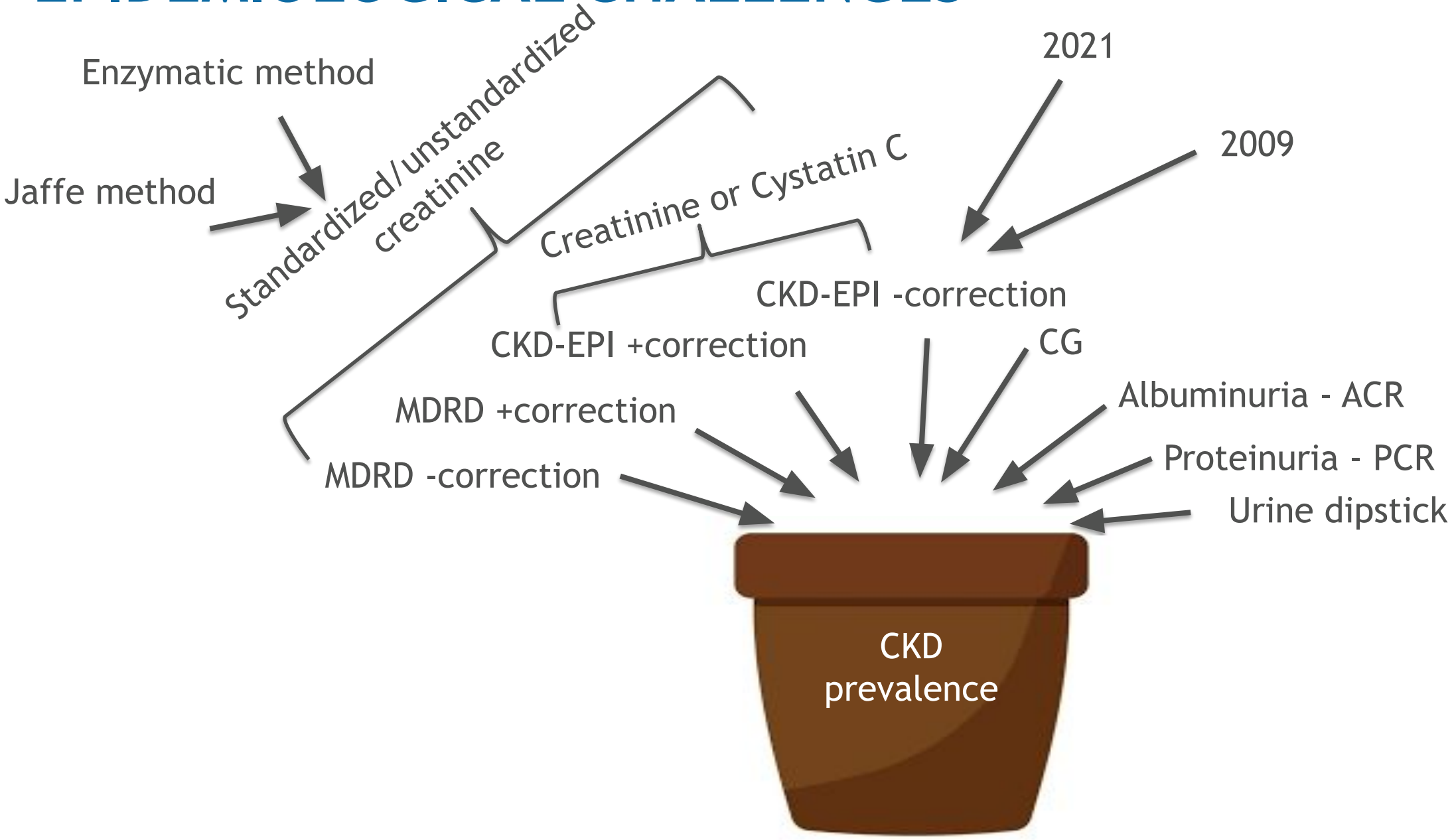
Measurement matters

Measurement of kidney function in Malawi, South Africa, and Uganda: a multicentre cohort study

June Fabian, Robert Kalyesubula*, Joseph Mkandawire, Christian Holm Hansen, Dorothea Nitsch, Eustasius Musenge, Wisdom P Nakanga, Josephine E Prynn, Gavin Dreyer, Tracy Snyman, Billy Ssebunnya, Michele Ramsay, Liam Smeeth, Stephen Tollman, Saraladevi Naicker, Amelia Crampin, Robert Newton, Jaya A George, Laurie Tomlinson, on behalf of the African Research on Kidney Disease Consortium†*

Findings Of 3025 people who underwent measured GFR testing (Malawi n=1020, South Africa n=986, and Uganda n=1019), we analysed data for 2578 participants who had complete data and adequate quality measurements. Among 2578 included participants, creatinine-based equations overestimated kidney function compared with mGFR, worsened by use of ethnicity coefficients. The greatest bias occurred at low kidney function, such that the proportion with GFR of less than 60 mL/min per 1·73 m² either directly measured or estimated by cystatin C was more than double that estimated from creatinine. A new creatinine-based equation did not outperform existing equations, and no equation, including the Chronic Kidney Disease Epidemiology Collaboration (CKD-EPI) 2021 race-neutral equation, estimated GFR within plus or minus 30% of mGFR for 75% or more of the participants. Using a model to impute kidney function based on mGFR, the estimated prevalence of impaired kidney function was more than two-times higher than creatinine-based estimates in populations across six countries in Africa.

EPIDEMIOLOGICAL CHALLENGES



PRELIMINARY FINDINGS: CKD-AFRICA COLLABORATION

Prevalence of CKD in the general adult population of Africa

- 67 studies totaling 91,723 participants
- 45% reported using standardized creatinine assays
- Creatinine determination:
  - 92.5% used Jaffe method (IDMS traceable calibration)
  - 7.5% used enzymatic methods
- Albuminuria/Proteinuria determination:
  - 33% used urinary albumin-to-creatinine ratio
  - 28% used the qualitative urine dipstick test
  - 1.5% (1 study) used the 24-h urine collection method
- 13% satisfied the 3-month chronicity criterion for diagnosing CKD

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PRELIMINARY FINDINGS: CKD-AFRICA COLLABORATION

- eGFR estimation:
  - 57% used the creatinine-based CKD-EPI equation
  - 52% used the MDRD equation
  - 22% used the Cockcroft-Gault equation
  - 4% used the cystatin C-based CKD-EPI equation
  - Of the 33 studies reporting GFR estimates using the creatinine-based CKD-EPI equation, 36% did not report on whether the African-American race correction factor was included or not
  - Of the 30 studies reporting on estimates for the creatinine-based MDRD equation, 57% did not report on the inclusion or exclusion of the African-American race correction factor
  - 41% applied only one equation
  - 11% estimates for three equations

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CONCLUSION

- CKD is a growing global health challenge globally with LMICs being disproportionately affected
- We face large health disparities with social and economical impact
- We do not have the capacity to treat - future directions should be geared at improved screening, early detection, equitable access to care, and stronger public health policies.

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