PREVALENCE AND RISK FACTORS OF CHRONIC KIDNEY DISEASE IN SOUTH-KIVU, A LARGE SCALE POPULATION STUDY

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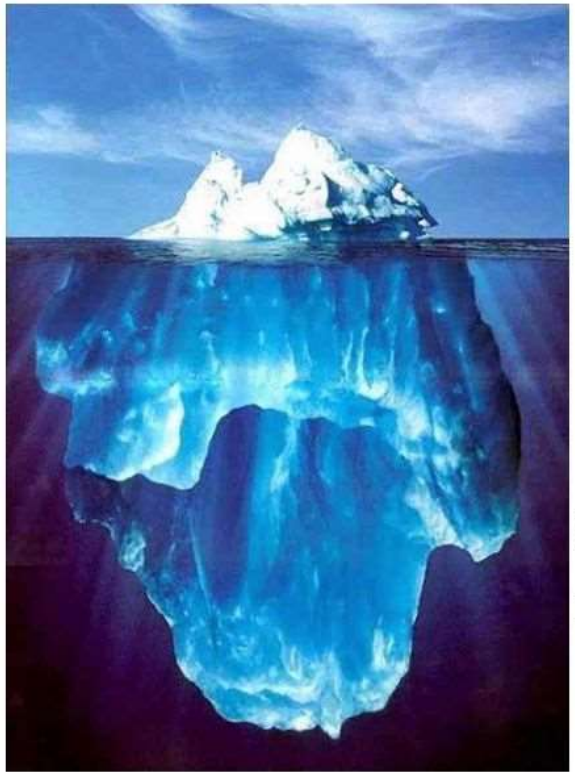
INTRODUCTION

- Chronic kidney disease (CKD) is a global public health problem :

  ↑ incidence and prevalence, high associated costs, poor outcomes

- Around 10% of the world's population had CKD in 2015. Kassebaum NJ et al. Lancet 2016
- In 2017, the Global Burden of Disease Study (GBD) ranked CKD as the 12th highest cause of death worldwide. Jager KJ et al. *Nephrol Dial Transplant* 2017



Known CKD

<1% of population

Unrecognised CKD

10% of population

CKD EPIDEMIOLOGY IN SSA

- The burden of CKD is raising in developing countries due to:
  - **Persistence of communicable (HIV infection, malaria, schistosomiasis, tuberculosis, etc.)**
  - **Growing burden of non-communicable disease (hypertension, diabetes and obesity).**
- Mortality from CKD stage 5 is high;
- Screening for CKD and its risk factors at the population level appears to be a good strategy.

Lozano, R. et al. Lancet 2013, Naicker, S. Kidney Int 2013

CKD EPIDEMIOLOGY IN SSA

- In Sub-saharan Africa (SSA), data of CKD epidemiology :

- are scarce

- Come from tertiary care hospitals in urban cities

- Meta-analysis of CKD in SSA:

- **CKD prev : 13.9 % without difference between urban/rural areas,++ in urban setting.**

- **97 % of studies were medium or low quality;**

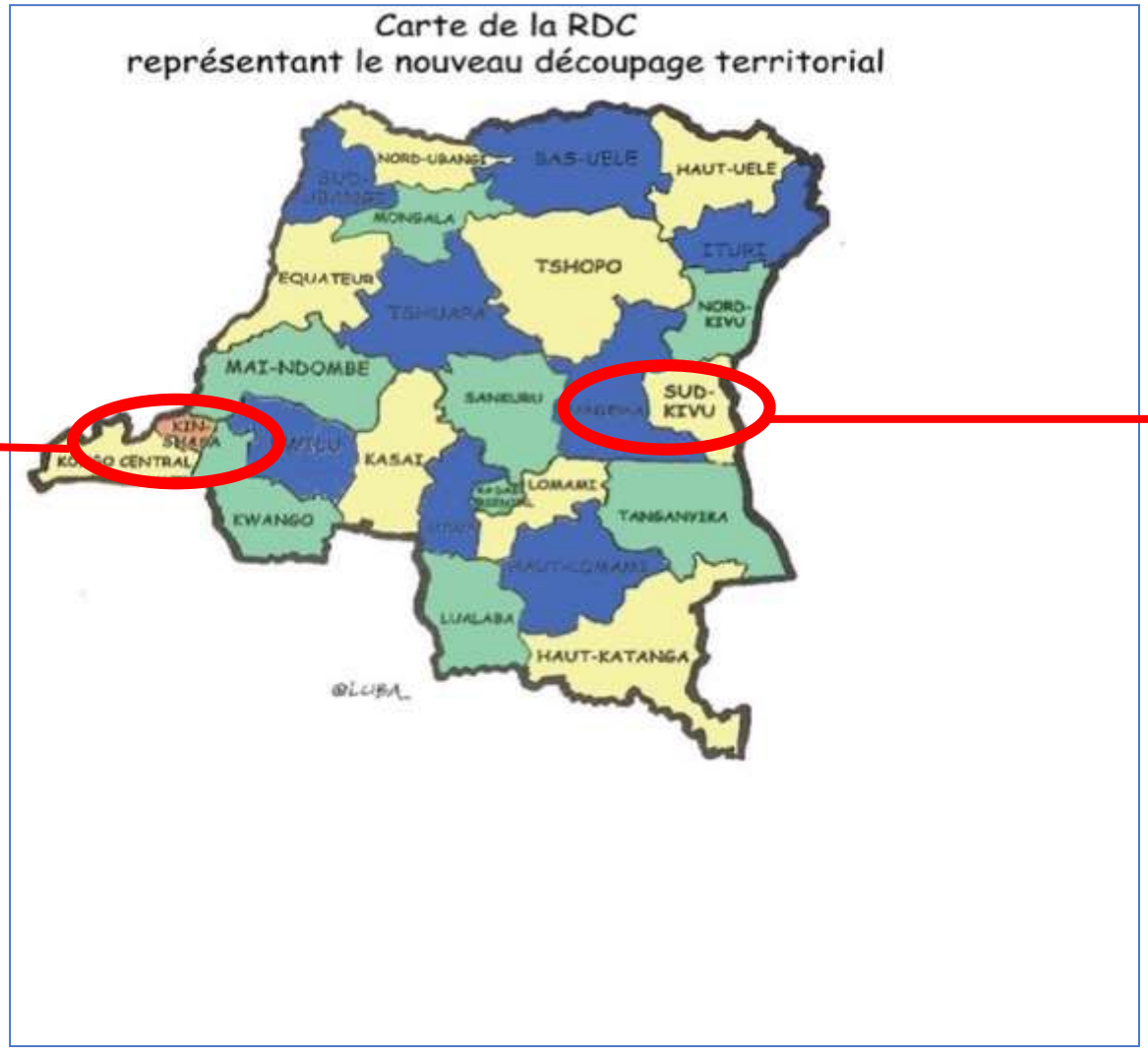
Stanifer, JW et al. Lancet Global Health 2014

PREVALENCE OF CKD IN DRCONGO

*CKD Prevalence
Stages 1-5 :12 %
Stages 3-5 : 8 %
N= 503 , 52 yo, randomly selected

**APOL1 (in 412 children):
G1: 12.4%
G2: 10.4 %
HR: 7.0 %

***SCT : 19 % (n=359 Adults)



- **No data on CKD in general pop.**
- +CKD Risk factors (++urban vs.rural)

HTN: (41.4 vs 38.1%)

Diabetes: (4.9 vs 3.2%)

Overweight/Obesity: (30.9% vs 12.9%),)

*Sumaili, Nephr Dialysis Transpl. 2010,

**Ekulu et al. *Kidney Int Rep* 2019 , ***Mukendi et al, *Cardiovasc J Afr* 2015

+Katchunga *et al Presse Med* 2011

AIMS OF THE THESIS

- To assess the prevalence of CKD and its risk factors in South Kivu

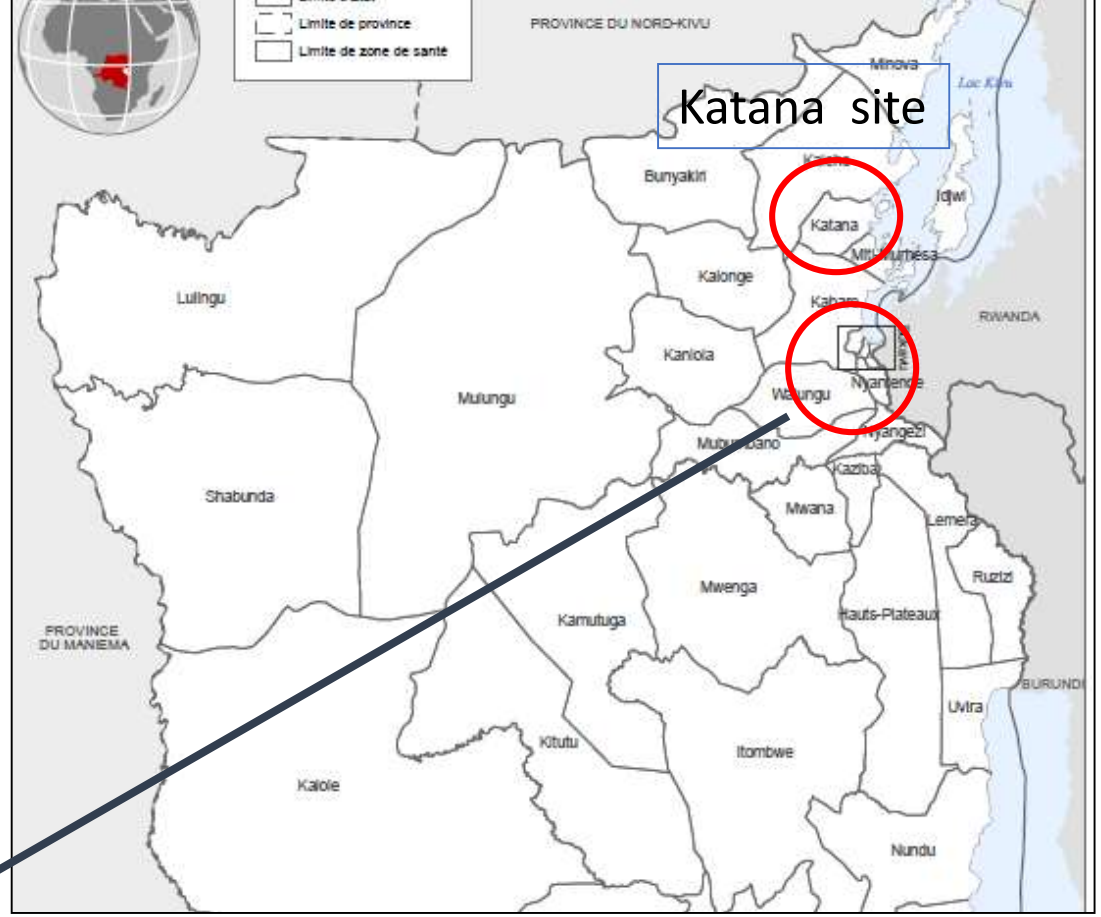
- To assess the prevalence of *APOL1* and *GSTM1* risk variants and of SCT and their association with albuminuria, eGFR ‹ 60 and CKD in the same population.

METHODS

Population-based cross-sectional study in urban and rural site (October 2016 – April 2017**)**

Using a multi-stage cluster sampling

Ibanda site/Bukavu



METHODS

- **Sample selection**
  - inclusion criteria: all subjects aged ≥ 18 years ,
- Exclusion criteria: pregnant women, subjects who refused to participate

- **Data collection**
- Data collected during house-to-house visit
- By trained General Physicians and Nurses

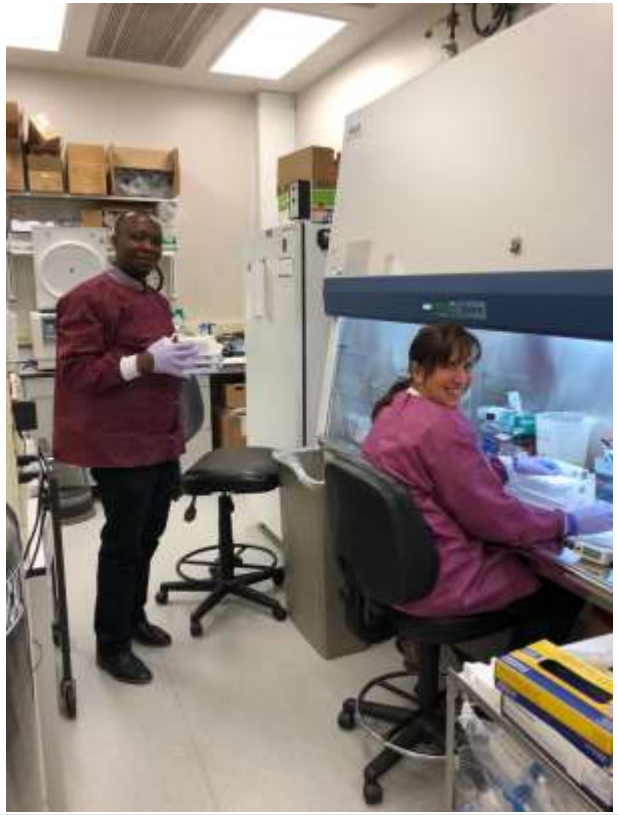
METHODS

- Socio-demographic information, personal and family health history were recorded from each participant
- Anthropometric data were obtained using standard methods and calibrated devices
- **Urine dipstick and glycemia on site by the study team.**
- **Creatinine measured with Compensated Jaffe IDMS Roche (Lab Saint Luc)**
- **Cystatin C measured** using a PETIA method on the SPA PLUS® analyzer **(Lab Saint Luc)**
- **albumin-to-creatinine ratio (ACR) : (Lab Saint Luc)**

Definition of CKD : ACR ≥ 30 mg/g and/or eGFR< 60 ml/min/1.73m²

(CKD EPI equation without AA)

METHODS



Frederick National Laboratory
for Cancer Research
sponsored by the National Cancer Institute

DNA extraction and genotyping (Frederick National Laboratory, NIH, USA)

- **For APOL1**: we used the recessive model of inheritance
  - ✓ *APOL1* high-risk genotypes (G1G1, G2G2 and G1G2) vs. Low risk (G0G0, G0G1 and G0G2)
- **For SCT** :
  - ✓ SCT carriers were considered as the high-risk group vs. SCT non-carriers, the low risk group.
- **For *GSTM1***, the dominant model of inheritance was considered for analyses:
  - ✓ 0 or 1 copy (1/0 or 1/1) vs. 2 copies of the *GSTM1* null allele (0/0).

RESULTS

Prevalence and Risk Factors of Chronic Kidney Disease in the Democratic Republic of Congo

PATIENTS & METHODS

1317 patients, South-Kivu
- 55% in rural site
- 45% in urban site
- mean age 41 years
- 61% Female

- Samples obtained for Cr, Cys, and urine albumin
- eGFR calculated by Cr, Cys, and Cr-cys methods

CKD PREVALENCE

eGFR< 60 (ml/min/BSA)	
Cr	5.4 %
Cys	6.7 %
Cr-cys	4.7 %
uACR ≥ 30	6.6 %
Overall CKD (eGFR<60 or uACR ≥ 30)	
Cr	12.2 %
Cys	13.8 %
Cr-cys	11.5 %

RISK FACTORS

Older age
Urban residence
Female
Hypertension
Diabetes
HIV infection

all $p < 0.05$

CONCLUSION:

The burden of CKD is substantial (>11%), predominantly in the urban area, and largely driven by ageing, female gender, hypertension, diabetes and HIV infection.

KI REPORTS
KIReports.org

Masimango I. M et al, 2020

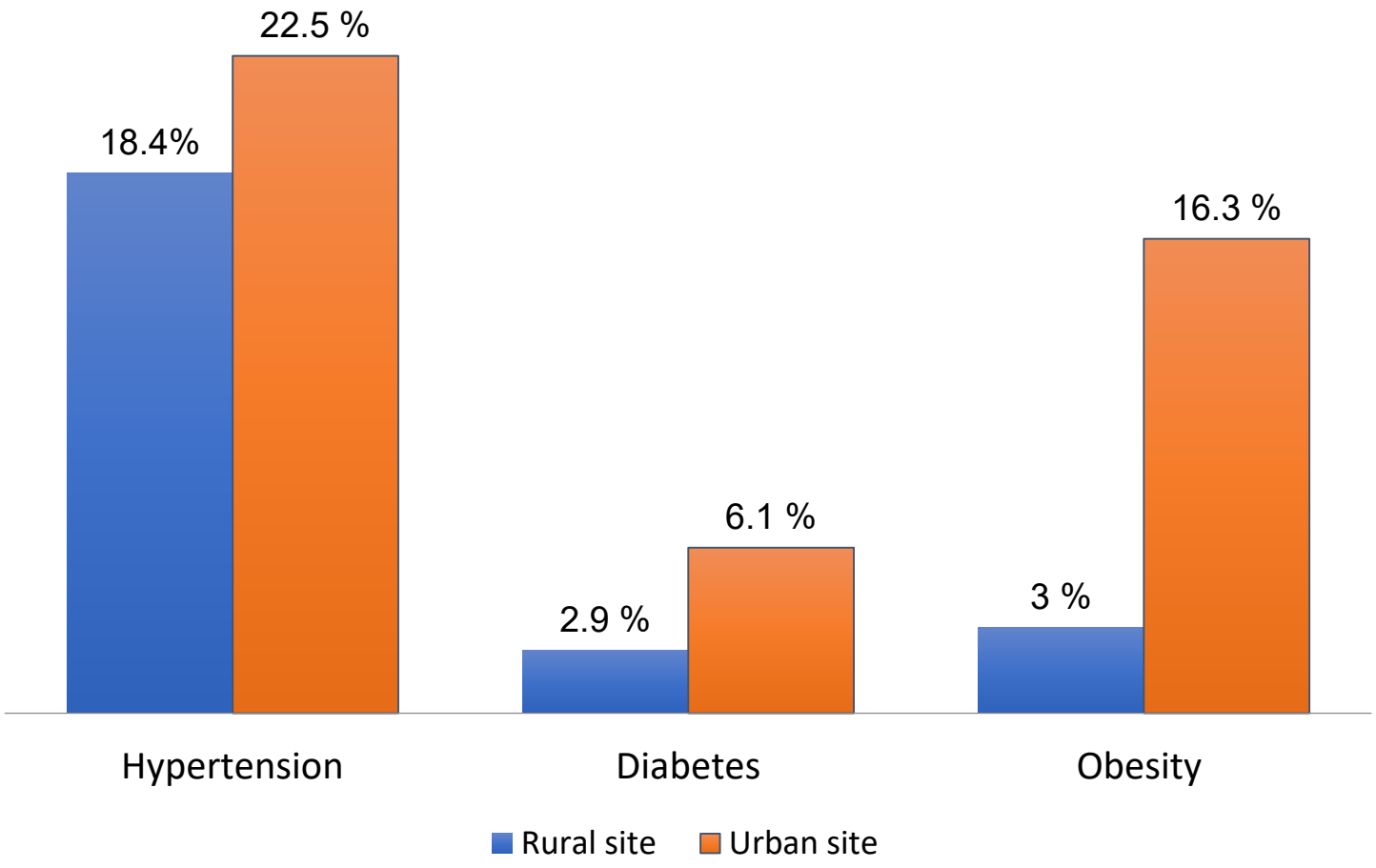
Clinical characteristics of the study population

Hypertension 20.2 %

Diabetes 4.4 %

Obesity 8.9 %

HIV 0.4 %



KI REPORTS
Kidney International Reports

APOL1 Renal Risk Variants and Sickle Cell Trait Associations with Reduced Kidney Function in a Large Congolese Population-Based Study

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APOL1 Renal Risk Variants and Sickle Cell Trait Associations with Reduced Kidney Function in a Large Congolese Population-Based Study

ISN INTERNATIONAL SOCIETY OF NEPHROLOGY

Methods and Cohort

Democratic Republic of Congo

Cross-sectional
n=1317 , Adults

Urban (n=587)
Rural (n=730)

APOL1
SCT
GSTMI
} Gene variants

Apolipoprotein-L1 (APOL1)
Sickle cell trait (SCT)
Glutathione S-transferase mu1 (GSTM1)

Outcomes

↓ eGFR
↑ CKD risk

↑ Albuminuria

Risk allele frequency

APOL1 G1 allele- 8.7%
APOL1 G2 allele- 9.1%
APOL1 High Risk- 3.2%
SCT- 3.8%
GSTM1 *null*- 51.1%

APOL1 High Risk

↓ eGFR P=0.047

SCT

↓ eGFR P=0.018
↑ CKD risk P=0.031

↑ Albuminuria P=0.032

GSTM1 *null*

No association with renal outcomes

KI REPORTS
Kidney International Reports

Mannix Masimango et al, 2021
Visual abstract by:
Mythri Shankar, MD, DNB

@nephromythri

Conclusion: This study highlighted the impact of *APOL1* variants and SCT on poorer renal outcomes in Democratic Republic of Congo and advocates for further genetic studies in Sub Saharan Africa settings.

TAKE HOME MESSAGE

- This high CKD prevalence (>11%) represents a substantial health burden in young adults from South-Kivu, DRC.
- It is largely driven by classical risk factors (age, gender, HIV, diabetes and hypertension).
- Our observations suggest a major impact of the epidemiological transition in the DRC
- APOL1 renal HR and SCT are additional CKD risk factors in the same population

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