
# Practicing Nephrology with Massive Need and Minimal Resources



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# Disclosure of Interests

Employed by the US Department of Health and Human Services at the National Institutes of Health

# Definition

- Populations with massive (Nephrology) need = Disadvantaged Populations
- Most are in Low and Middle Income Countries and with low resources
- There are disadvantaged populations in communities in High Income Countries

# Outline

- Estimates of CKD and ESRD burden in selected Populations
- Nephrology Practice Challenges:
  - Politics/Infrastructure of LMICs
  - Prevention and Treatment strategies
  - Lack of Resources
  - Nephrology Workforce Shortage
    - Suggested Solutions
- Summary

# Selected Disadvantaged Populations

Low and Middle Income Countries in:

Asia

Africa

Middle East

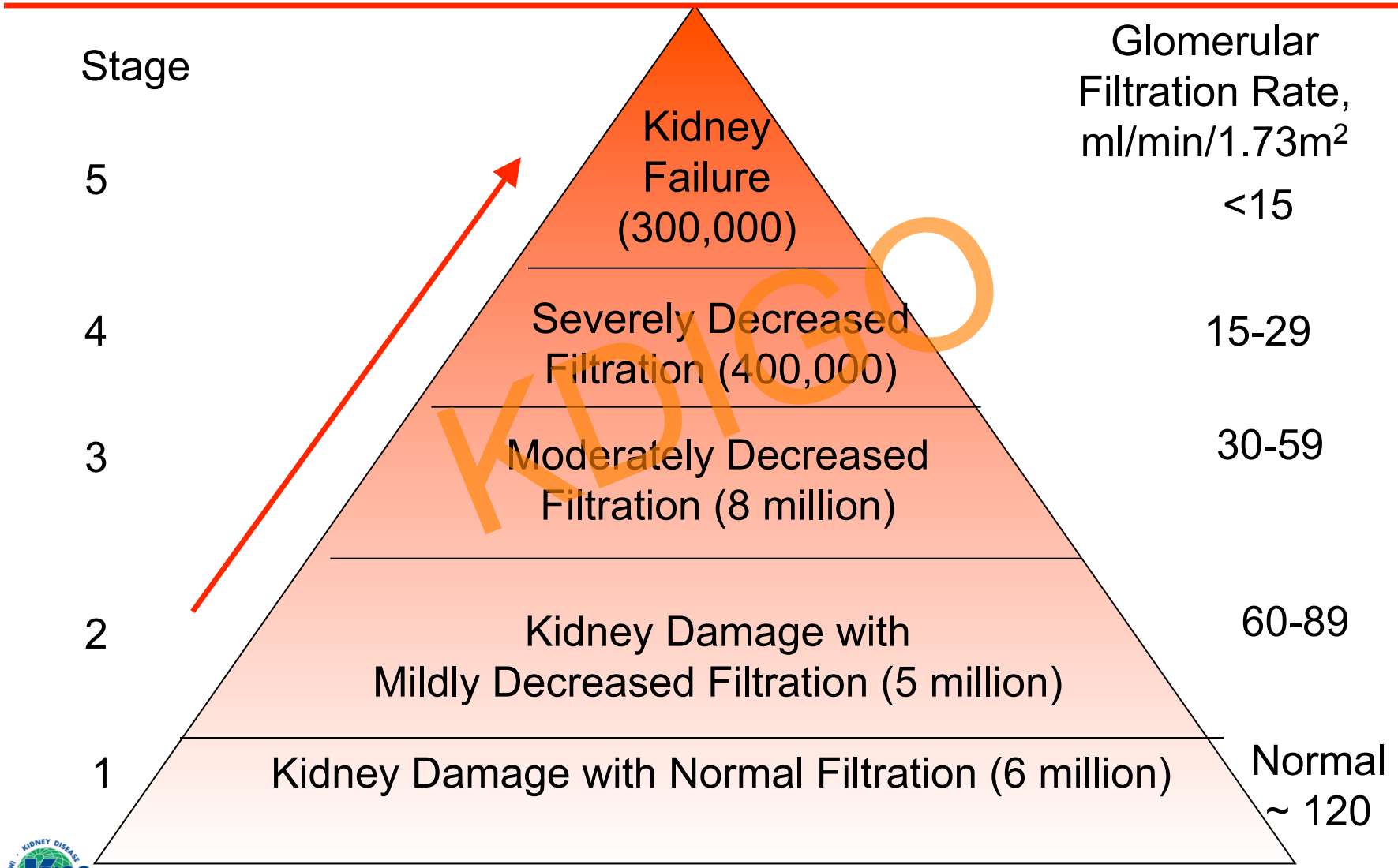
Latin America

High Income Countries

- Australia – New Zealand
  - Aborigine
  - Maori
  - Pacific Islander
- Canada
  - First Nation
- United Kingdom
  - Asians
  - Blacks
- United States
  - Native American
  - African American
  - Asians
  - Hispanics
    - Caribbean
    - Mexican American
    - Puerto Rican
- European Migrants

# Stages of CKD NHANES III Estimates (1988-94)

Am J Kid Dis 39:S1-S266, 2002



# Percentage of NHANES participants within the KDIGO 2012 prognosis of CKD by GFR and albuminuria categories

**NHANES (2007-2012)**

| | |
|---|---|
| *Low risk =* | *86.2%* |
| *Moderately increased risk =* | *9.8%* |
| *High risk =* | *2.3%* |
| *Very high risk =* | *1.7%* |

| | | | | ALBUMINURIA CATEGORIES | | | |
|---|---|---|---|---|---|---|---|
| | | | | 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 | Total |
| GFR categories (ml/min/1.73 m²) | G1 | Normal to high | ≥ 90 | 57.4 | 3.8 | 0.2 | 61.4 |
| | G2 | Mildly decreased | 60-89 | 28.8 | 2.5 | 0.5 | 31.8 |
| | G3a | Mildly to moderately decreased | 45-59 | 3.5 | 0.8 | 0.2 | 4.5 |
| | G3b | Moderately to severely decreased | 30-44 | 0.8 | 0.6 | 0.1 | 1.5 |
| | G4 | Severely decreased | 15-29 | 0.2 | 0.2 | 0.1 | 0.5 |
| | G5 | Kidney failure | < 15 | 0.02 | 0.05 | 0.07 | 0.1 |
| | | Total | | 90.7 | 8.0 | 1.2 | 100 |



*Data source: National Health and Nutrition Examination Survey (NHANES), 1988-1994, 1999-2004 & 2007-2012 participants age 20 and older. Single-sample estimates of eGFR and ACR; eGFR calculated using the CKD-EPI equation. Abbreviations: ACR, urine albumin/creatinine ratio; CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; GFR, glomerular filtration rate; KDIGO, Kidney Disease: Improving Global Outcomes CKD Work Group.*

# The contribution of chronic kidney disease to the global burden of major non-communicable diseases

*Couser et al: Kidney Int; 2011 Dec;80(12):1258-70*

- CKD is increasingly common in developed and developing
- CKD is harmful and expensive.
- CKD is treatable.
- CKD disproportionately affects the poor
- Awareness of CKD is low.
- The presence of CKD dramatically increases the risk of adverse outcomes among people with other NCDs
- CKD is also linked to acute kidney injury
- CKD is a significant public-health problem:
  - imposes tremendous burden of death and disability
  - inequitable distribution among the poor
  - the existence of effective and affordable treatments are not available to a large proportion of those affected.

# CKD Causes and Impact

- The burden of CKD is not limited to its impact on demands for RRT but it also has major impacts on overall population health
- The prognosis and the cardiovascular morbidity and mortality of patients with diabetes mellitus and those with systemic hypertension depend on renal involvement
- CKD, through its impact on cardiovascular risk in patients, impacts directly on the global burden of death due to cardiovascular diseases
- Early detection and prevention of progressive CKD may not only alleviate the future burden of ESRD but also reduce the cardiovascular morbidity and mortality associated with highly prevalent conditions such as diabetes and hypertension

# The burden of chronic kidney disease (CKD) globally

- There are no reliable national or regional registries of CKD (in developed or developing countries); therefore, it is difficult to provide reliable estimates of its prevalence.
- Local registries provide rough estimates of the burden of CKD; but even so, the prevalence estimates vary widely in the same locale, depending on the study or the methodology used to provide the estimates.

# Burden of CKD in Disadvantaged Populations

- Development of ESRD is a death sentence for most people in developing countries because of their meager resources.
- Therefore, Prevention and Early Detection of kidney disease is the best option
- Availability of good (relatively simple) biomarkers for detection and early treatment of kidney injury is essential.

# The global Burden of CKD

*Sub-sahara africa (ssa)*

- SSA, comprising 48 countries, occupies over 80% of the African landmass, with a population of 800 million (2007) and annual population growth rate of 2.3%.
- CKD estimates are in the range of 200-300 pmp. In Nigeria, it accounts for 8-12% of hospital admissions.
- Causes include
  - **Hypertension:** 25% in Senegal, 29.8% in Nigeria, 45.6% in South Africa, 48.7% in Ghana.
  - **Glomerulonephritis:** prevalent estimates are difficult to assess. However, available data suggest that the nephrotic syndrome is higher in SSA than other parts of the world.
  - **HIV-associated kidney disease**: available reports of CKD in HIV-infected patients range from 6% to 48.5%.
  - **Diabetic Nephropathy**: Approximately 9.4 million people in Africa have diabetes; it is estimated to increase to 12.7 million by 2025. Currently, it is not a major cause of CKD; prevalence of diabetic nephropathy is estimated to be 6-16% in the region.



*Naicker – Clin Nephr, 74 (Suppl): S13-16*

# The Global Burden of CKD

*India*

- Published studies estimate the prevalence of CKD in India at 0.79%-1.4%.
- Southern India:
  - Population based, 21,062 were screened, renal disease, short of chronic renal failure (CRF) was present in 0.68% and chronic renal failure was present in 0.16% of the population.
- North India
  - Community based epidemiological study. Of the 4,712 cases that were available for analysis, CRF was detected in 37 patients (0.785%).
- Indian CKD Registry
  - Over 154 centers across India reporting their data on approx. 38,193 patients. Males constitute nearly 69.6%; the mean age is 47.90 ± 16.8 years in the adult population. The majority of patients reporting to nephrologists were in CKD stage 4 – 5 groups (73%). Diabetes mellitus as the cause of CKD was found in 31.2% of the patients, Type 2 being responsible in 96.9% of the cases, with the duration of diabetes being < 10 years in 44.7%.
- SEEK
  - Screening and Early Valuation of Kidney Disease" (SEEK) study was started in 2006; 6,120 adult subjects from 21 centers from 53 community camps have been screened. This study reported a very high prevalence of 17.4% of CKD among 5,623 participants; 1.6% out of these being in CKD Stage 4 and 5.

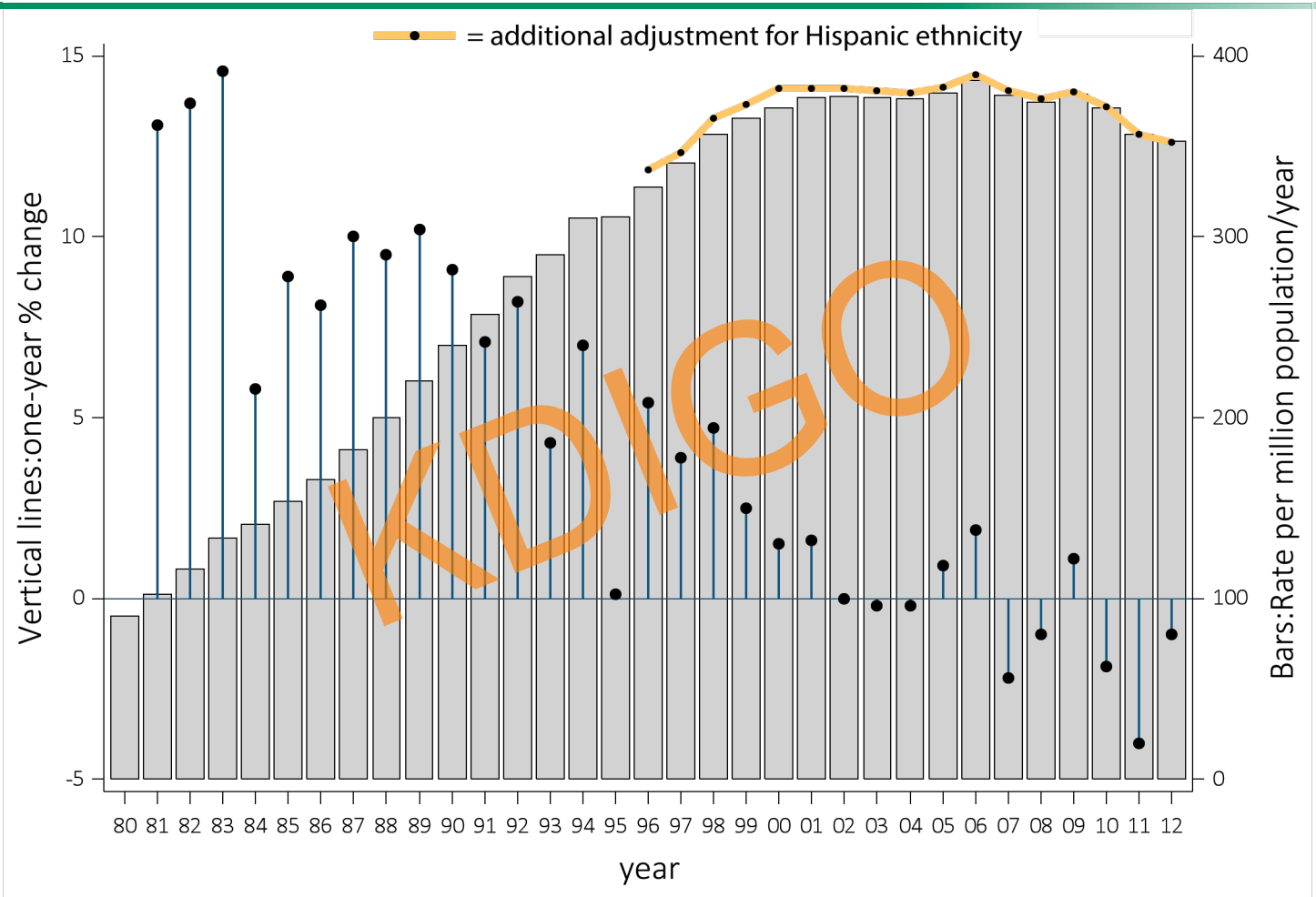
# CKD Estimates in Nigeria

| | location | proteinuria | CKD/Reduced GFR /creatinine. |
|---|---|---|---|
| Abioye et al | RURAL. 1995 | 50% | 30% |
| Mabayoje et al | HOSPITAL-BASED 1992 | | 10% |
| Oviasu et al | URBAN. 1993 | 4.7% | |
| Alebiosu et al | HOSPITAL-BASED 2006 | | 3.6% |
| Amira et al | URBAN 2007 | 23.9% | |
| Nwankwo et al | HOSPITAL-BASED (HYPERTENSIVES) 2007 | | 45.5% |
| Asinobi et al | URBAN 2009 | 2.3% | |
| Afolabi et al | HOSPITAL-BASED 2009 | 0.8% | 10.4% |
| Ulasi et al | RURAL 2009 | | 23.7% |

# ESRD Worldwide

- Incidence increasing - 8 % every year.
- Population growth rate - 1.2%.
- Prevalence worldwide approx. 2,900,000.
- Estimate 100-1500/million population.
- 89% on hemodialysis.
- 11% on CAPD.
- >445,000 post transplants.

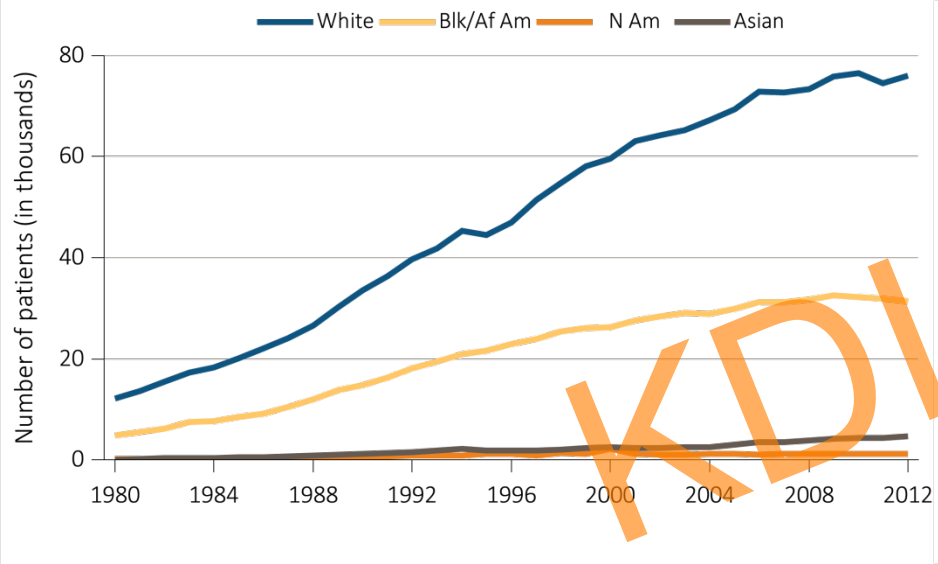
# Trends in the adjusted* incidence rate of ESRD, per million/year (bars; scale on right), and annual percent change in the adjusted* incidence rate of ESRD (lines; scale on left) in the U.S. population, 1980-2012



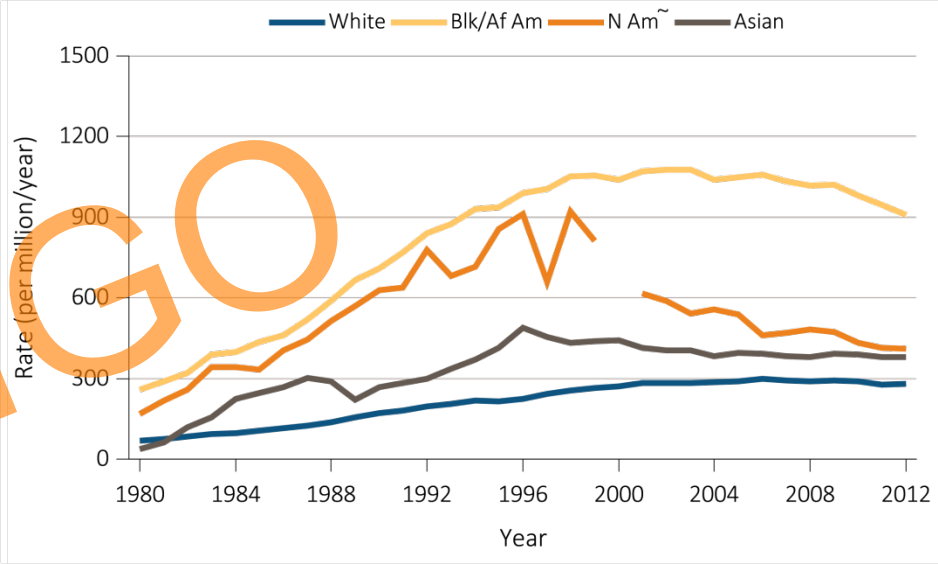

*Adjusted for age, sex, and race. The standard population was the U.S. population in 2011. Abbreviation: ESRD, end-stage renal disease.

# Trends in (a) ESRD incident cases, in thousands, and (b) adjusted* ESRD incidence rate, per million/year, by *race*, in the U.S. population, 1980-2012

## (a) Incident Cases



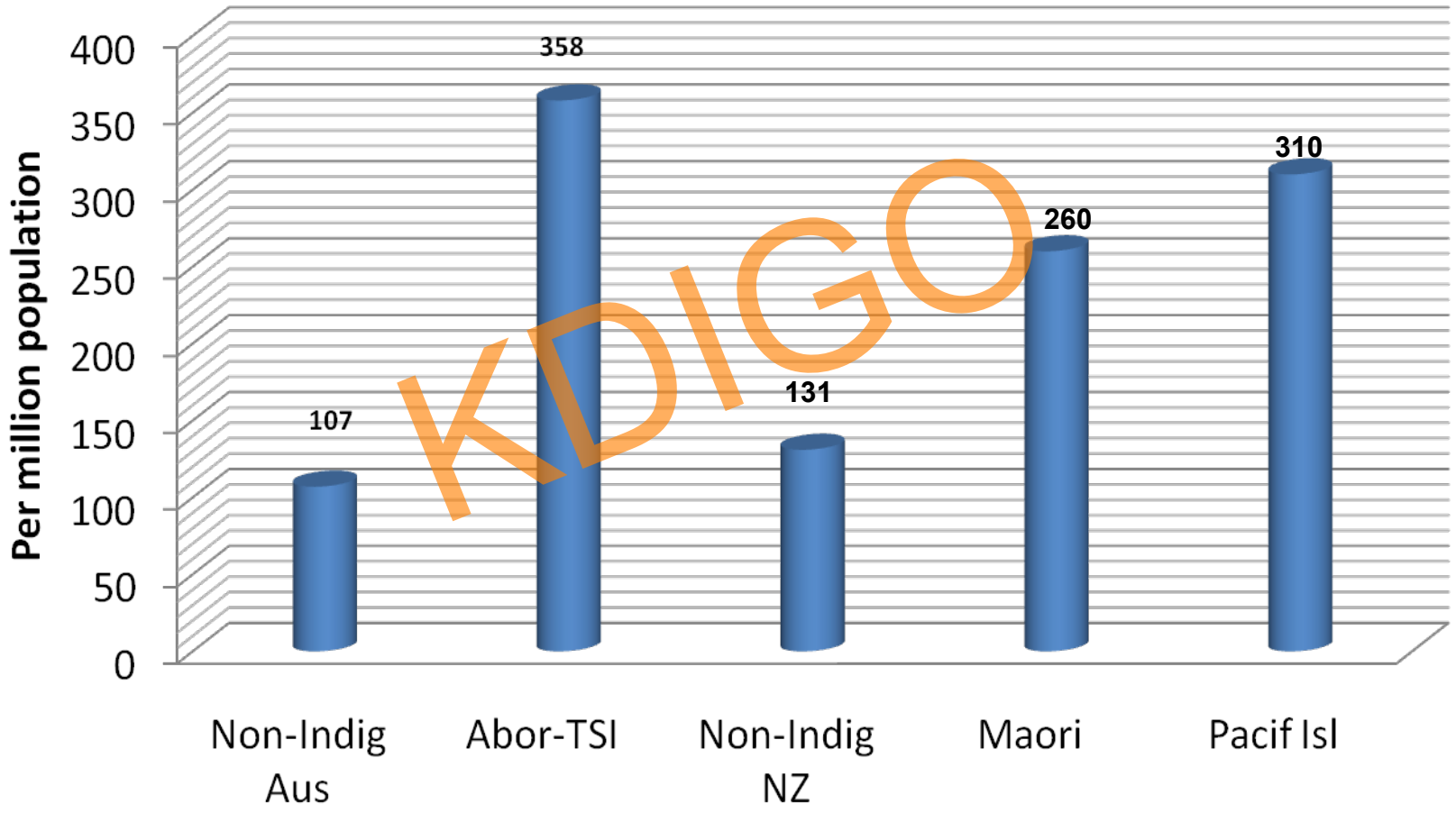

## (b) Incidence Rates






**Adjusted for age and sex; the standard population was the U.S. population in 2011. Panel b: ~Estimate shown is imprecise due to small sample size and may be unstable over time. The line for Native Americans has a discontinuity because of unreliable data for that year. Abbreviations: Af Am, African American; ESRD, end-stage renal disease; N Am, Native American.*

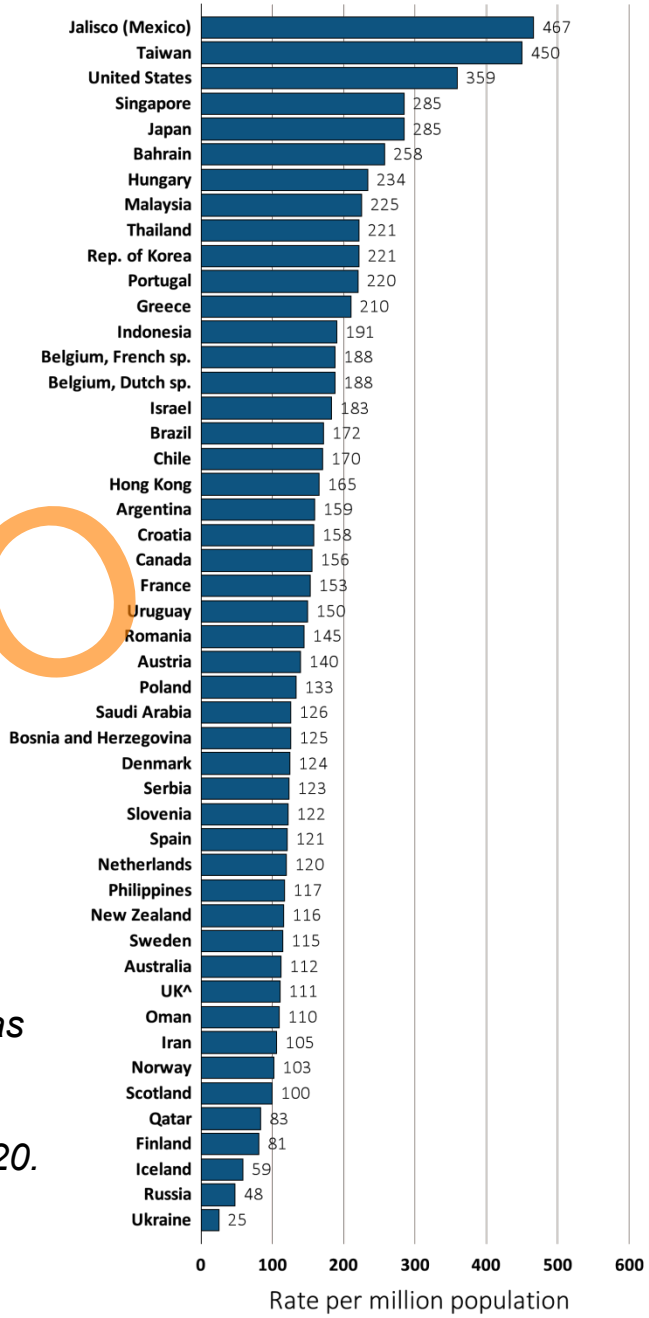
# ESRD Incidence Rate, per million population, in Australia and New Zealand by ethnicity, 2010






ANZDATA Report 2010

# Incidence rate of ESRD, per million population, by country, in 2012






*Data presented only for countries from which relevant information was available. All rates are unadjusted. ^UK: England, Wales, & Northern Ireland (Scotland data reported separately). Japan and Taiwan are dialysis only. Data for Belgium do not include patients younger than 20. Data for Indonesia represent the West Java region. Data for France include 22 regions. Data for Spain include 18 of 19 regions.*

# Manage Risk Factors

| Risk Factor | Management |
|---|---|
| Hypertension | Lifestyle modification, pharmacologic (AASK, etc) |
| Diabetes | Lifestyle modification, pharmacologic (DCCT – type 1; IDNT-type 2, UKPDS |
| Infection<br>HIV, Hepatitis C, Malaria, schistosomiasis tuberculosis | Treat Infection<br>Prevent Infection |
| Age | Not modifiable |
| Race / ethnicity | Not modifiable |
| Obesity | Lifestyle modification |
| Smoking | Cessation of smoking |
| Hyperlipidemia | Diet, pharmacologic (statins) |

# CKD DETECTION AND PREVENTION PROGRAMS

A number of screening strategies have been implemented for the detection of CKD, some have focused on the entire population, whereas others have targeted a specific group(s) within the population.

Examples of current general population (nationally) screening approaches include:

- United States (NHANES III)
- Australia [Australian Diabetes, Obesity and Lifestyle study (AusDiab Study)]
- Japan (Okinawa Screening Program)
- The Netherlands [Prevention of Renal and Vascular End-stage Disease (PREVEND) Study]
- Iceland
- India, and
- Singapore

# CKD DETECTION AND PREVENTION PROGRAMS:
## Specific population-targeted approaches

- Australian Aborigines of the Tiwi Islands have a high death rate attributable to ESRD. The annual incidence of ESRD (2760 per million) in Tiwi Islanders is among the highest in the world (15 times that of the general Australian population).
- The Zuni Kidney Project targeted Zuni Indians in the United States, where most of the population is affected by CKD due to glomerulonephritis and diabetic nephropathy, and 2% have ESRD (prevalence rate of 17,400 per million population)
- The National Kidney Foundation (USA) launched the Kidney Early Evaluation Program (KEEP) to identify individuals at risk of CKD and the prevalence of CKD among those at risk (patients with diabetes, patients with hypertension, as well as first-degree relatives of patients with CKD)

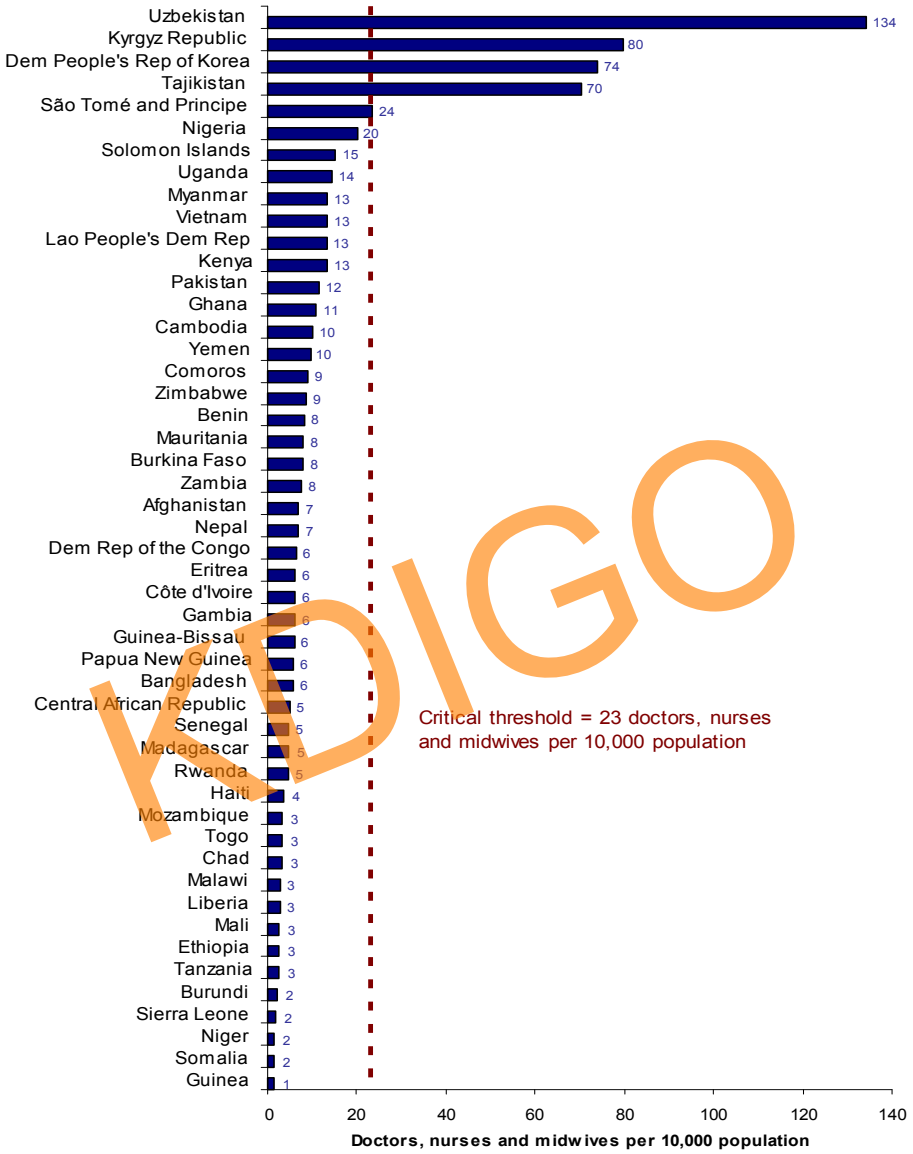
# Prevention Programs

- Lifestyle modification - weight reduction, exercise, smoking cessation, and dietary manipulations can be effective and protective
  - diabetes-DPP, DPPOS
  - hypertension-dietary salt restriction, diets rich in fruit and vegetables and low in saturated fat; etc)
- Pharmacologic approaches –
  - control of hypertension; treat pre-hypertension
  - control hyperglycemia (DPP, DPPOS)
  - treat/control albuminuria, proteinuria (ACEi, ARBs, etc)
  - treatment of dyslipidemia -HMG CoA reductase inhibitors (statins)
- Improvement of cardiovascular health

# Global Health Workforce by World Health Organization Region

| 2000 – 2006 | Doctors | | Nursing and midwifery personnel | |
|---|---|---|---|---|
| | n | per 10,000 population | n | per 10,000 population |
| WHO region | | | | |
| Africa | 150,714 | 2 | 792,853 | 11 |
| Americas | 1,620,329 | 19 | 4,095,757 | 49 |
| SE Asia | 849,324 | 5 | 1,955,190 | 12 |
| Europe | 2,825,271 | 32 | 6,941,698 | 78 |
| Eastern Med | 532,486 | 10 | 777,077 | 15 |
| Western Pa- cific region | 2,435,023 | 14 | 3,466,342 | 20 |
| Global total | 8,413,147 | | 18,028,917 | |
| Income group | | | | |
| Low | 1,163,269 | 5 | 2,606,367 | 11 |
| Lower middle | 2,894,455 | 13 | 3,768,603 | 17 |
| Upper middle | 1,673,117 | 21 | 3,225,671 | 41 |
| High | 2,682,262 | 28 | 8,426,061 | 87 |
| Global total | 8,413,103 | 13 | 18,026,702 | 28 |

# Density of doctors, nurses and midwives in the 49 priority countries






Source: WHO Global Atlas of the Health Workforce

August 2010

# Global shortage of nephrologists

- The challenge of shortage of nephrologists is different in developed vs. developing countries.
- In developed countries the shortage may be attributed to:
  - Trainee physicians who are often reluctant to pursue a career in nephrology because the field is scientifically and clinically demanding.
  - Patients with kidney disease present challenging and sometimes intractable long-term problems
  - Remuneration rates are less than those of some other subspecialties

# Shortage of nephrologists in developing countries

- Shortage of Nephrologists in developing countries may be attributable to:
  - Lack of resources (both human and financial)
  - Poor quality of education
  - Limited experience of trainees in these countries
- But the greatest hindrance to development of a healthy nephrology workforce in developing countries may be the result of forces of globalization increasing the movement of healthcare professionals from their home countries to work in developed countries.

# Percentage of foreign-born doctors in 2000

| Country | % |
|---|---|
| New Zealand | 34.5 |
| United Kingdom | 30.4 |
| United States | 26.4 |
| Australia | 21.4 |
| Canada | 20.6 |
| Norway | 13.3 |



Adapted from *Forcier et al; Human Res Health 2:1-11, 2004*

# International medical graduates (IMGs) in the medical workforces of the US, UK, Canada and Australia.

| Country | Doctors per 10,000 population | Total No of IMGs | % IMGs in workforce | No from India | No from South Africa | No from Egypt |
|---|---|---|---|---|---|---|
| US | 29.3 | 208,733 | 25.0 | 40,838 | 1,943 | 4,593 |
| UK | 23.1 | 39,266 | 28.3 | 15,093 | 1,980 | 1,592 |
| Canada | 22 | 15,701 | 23.1 | 1,449 | 1,754 | 558 |
| Australia | 27.1 | 14,345 | 26.5 | 2,143 | 1,253 | 545 |



Adapted from *Mullan; NEJM 33: 1810-1818, 2005*

- **Reversing the "brain drain"**
  - UK – Changes to the UK migration policy in 2006, where medicine, nursing, and other health professionals are no longer classed as "shortage" professions have begun to have an effect on international recruitment.
  - US – Signs that the US will become self-sufficient in either the doctor or nurse workforce in the foreseeable future are not encouraging.
  - Australia – Australia continues to benefit from migration from S. Africa, Asia and the UK; 2.4% of its medical workforce was born in sub-Sahara Africa and 6% in Asia. There is no policy in place to curtail migration
  - New Zealand – It has the highest proportion of migrant doctors and one of the highest for nurses. There is no specific policy to curtail immigration of health professionals.
  - Canada – Overall, over 20% of doctors practicing in Canada are foreign born. There is no policy in place to curtail immigration.

# SHORTAGE OF NEPHROLOGY WORKFORCE IN DEVELOPING COUNTRIES

"*The shortage of [nephrology] healthcare workers will not be easily corrected in the near future. Elective periods spent by workers from developed countries in developing regions have assisted to a certain extent in some regions. Various initiatives, such as increasing medical and nursing school intakes, training mid-level workers to deliver specific care, involving communities in finding solutions are mid- to long-term solutions. Therefore, a massive investment in educating and retaining healthcare professionals requires the commitment of governments globally*."

Naicker 2010

•Two examples of challenges in Low Income countries:

# The Need for Dialysis in Haiti: Dream or Reality?

*J. Exantus, F. Desrosiers, A. Ternier, A. Métayer, G. Abel, J-H. Buteau; State University Hospital, Port-au-Prince , Haïti.* **Blood Purif** 2015;39:145–150

- In addition to the increasing burden of non-communicable diseases, the communities are plagued with other public health issues such as acute diarrheal infections, malaria, tuberculosis, cholera, and acquired immunodeficiency syndrome (AIDS), which can contribute to and accelerate progression of kidney disease.
- In Haiti, few patients have access to health insurance or disability financial support.
- Considering that seventy-two percent (72%) of Haitians live with less than USD 2 per day, survival with CKD can be quite stressful for them.
- FHADIMAC (Haitian Foundation of Diabetes and Cardio-vascular diseases) documented that diabetes mellitus and hypertension have a prevalence of 12 and 47%, respectively. Other causes of renal failure include acute renal failure due to diethyleneglycol poisoning, crush syndrome related to earthquake and leptospirosis.

# Some determinants of health in Haiti

*J. Exantus, et al:* **Blood Purif** 2015;39:145–150

| Determinants | Values |
|---|---|
| Total population | 10,413,211 |
| Children less than 15 years | 3,675,863 |
| Population 15 years and older | 6,737,347 |
| Number of doctors or nurses/10,000 people | 5.9 |
| Number of nephrologists available in Haiti (2014) | 4 adult nephrologists; 2 pediatric nephrologists |
| Hemodialysis centers in the country | 2 private; 1 public |
| Location | Port-au-Prince (West) |
| Health insurance coverage | 3.1% of population |
| Percentage of population living under poverty line (less than USD 2) in 2009 | 72% |

# Status of Dialysis is Haiti – 2014

*J. Exantus, et al:* **Blood Purif** 2015;39:145–150

- In a private center, the weekly average cost of three hemodialysis sessions is USD 600.
- In the public setting, the cost varies from USD 66 to 460.
- Considering the number of stations compared to the number of patients in the public setting hospital, usually patients are under-dialyzed with one to two sessions.
- During last year, the average number of hemodialyzed patients per month in the 3 centers was 56; hypertension and diabetes mellitus are the first and second leading causes, respectively.
- The main vascular access for the patients is jugular or femoral vein catheterization.
- The mean patient age is 44 (range 4–85 years) and less than 10% of patients have an arteriovenous fistula.
- Peritoneal dialysis is not available.

# Renal Replacement Therapy in Ghana

*Sampson Antwi,* **Blood Purif** 2015;39:137–140


- Ghana is a country of approximately 27 million people. There are five adult nephrologists and two pediatric nephrologists.
- The exact burden of kidney disease in the community is not known. However, among hypertensive adults in four polyclinics in Accra, Ghana, Osafo et al. found a chronic kidney disease (CKD) prevalence of 46.9%.
- Among all pediatric patients admitted to a Teaching Hospital in Kumasi, Ghana over a three-year period, Antwi found the overall prevalence of kidney disease to be 4.3% (664 out of 15,371 admissions).



- Dialysis services are available only in three health institutions: Korle-Bu Teaching Hospital-Accra, Komfo Anokye Teaching Hospital-Kumasi, and Cape Coast Teaching Hospital. Accra, the capital town and Cape Coast are both located on the coastal lands, while Kumasi, the second largest city, is situated in the central part of the country some 300 kilometers from the capital and 600 kilometers away from the far most city in the north. This leaves over half of the land space in Ghana uncovered with dialysis service.

# DIALYSIS SERVICES IN GHANA

*Sampson Antwi,* **Blood Purif** 2015;39:137–140

- Korle-Bu Teaching Hospital (KBTH) in Accra has the largest facility and has up to 200 patients undergoing chronic haemodialysis.
- Both Cape Coast and Komfo Anokye Teaching Hospitals have an average each of 20 clients undergoing chronic haemodialysis.
- Besides these public institutions, there are also limited dialysis services in three private health institutions in the country.
- Peritoneal dialysis is not done among the adult population.
- The cost per session of haemodialysis service is GHC 200 ( $ USD 65). Dialysis for acute kidney injury is covered by the National Health Insurance Scheme (NHIS) with a flat fee of GHC 850 ( $ USD 265) for the full cost of acute dialysis. Clients whose cumulative bill for dialysis sessions exceeds this amount have to top up the difference from their pockets. The NHIS does not cover for chronic dialysis services and patients pay from their pocket or from other sources. The country's minimum wage for workers is GHC 6.00 ( $ USD 2.00)

# Renal Replacement Therapy in Ghana

*Sampson Antwi,* **Blood Purif** 2015;39:137–140

- Kidney transplantation services began in 2008 and are carried out on a limited basis at the Korle-Bu Teaching Hospital in Accra.
- Like chronic dialysis, the cost of transplant services is privately borne.

*Children*:

- Peritoneal dialysis services are now available in two centers in Ghana for children with acute kidney injury in failure.
- No chronic dialysis services are offered for children though there is a huge burden of chronic kidney diseases among them

*Affordability*:

- The biggest challenge facing dialysis services in Ghana is affordability. The NHIS does not cover chronic dialysis services. As a result, the accessibility of these services is pocket driven. The cost per session excluding laboratory investigations and medicines is GHC 200 ( $ USD 65), this translates into GHC 2,400 ( $ USD 780) per month ( $ USD 9,360/year) far in excess of what the average Ghanaian can afford.

# Summary Healthcare Challenges in LMICs

- They comprise 80% of world population but access to 15% of resources.
- GDP less than $9075 (World Bank).
- Total Health Expenditure (THE) as % GDP often less than 5% as compared to over 10% in the developed world.
- Corruption, unstable governments, inconsistent health policies, civil unrest and rapid population growth.
- Competing priorities make it impossible for these countries to make resources available to combat kidney diseases, thus contributing significant challenges to kidney health globally.
- They have inadequate trained human resources

# Summary

Practicing Nephrology in LMICs is a monumental task -

- Huge disease burden with non-communicable diseases, including CKD/ESRD.
- Abundance of predisposing factors: obesity, diabetes, hypertension, infections, genetics.
- Limited resources to handle the increasing load of non-communicable diseases
- Severe shortage of healthcare workers and adequately trained nephrologists and nurses.
- Prevention, and early detection and treatment of kidney disease are the best alternatives.

# THANK YOU