Global trends in chronic kidney diseases
Towards Sustainable Development Goals

Vivekanand Jha
Is CKD a public health problem?

- Disease burden is high (i.e., it affects many people, has increased recently, and will likely increase in the future)
- Problem is distributed unfairly (i.e., it does not affect all people the same but affects disadvantaged individuals to a greater extent)
- Preventive strategies could substantially reduce the burden of the condition
- Such preventive strategies are not yet in place.

Schoolwerth AC et al, 2005
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Schoolwerth AC et al, 2005
Prevalence of treated ESRD per million population, by country, 2015

Data source: Special analyses, USRDS ESRD Database. Data presented only for countries from which relevant information was available. United Kingdom: England, Wales, Northern Ireland (Scotland data reported separately). The prevalence is unadjusted and reflects prevalence at the end of 2015. Switzerland includes dialysis patients only. Data for Indonesia represent the West Java region. Data for France exclude Martinique. Data for Italy includes five regions. Data for Canada excludes Quebec. Data for Latvia represents 80% of country’s population. Abbreviations: ESRD, end-stage renal disease; sp., speaking.

NOTE: Data collection methods vary across countries, suggesting caution in making direct comparisons.
CKD as a cause of years of life lost moved from #24 in 1990 to #18 in 2007 to #16 in 2017
International estimates of CKD are consistent ~ 10-16% of adults

James, Hemmelgarn and Tonelli, Lancet 2010

850 MILLION PEOPLE WORLDWIDE are now estimated to have some form of kidney disease\(^3\).
Increasing prevalence of diabetes worldwide

- **WORLD 592 million people living with diabetes**
- **WORLD 387 million**

<table>
<thead>
<tr>
<th>Region</th>
<th>Prevalence</th>
</tr>
</thead>
<tbody>
<tr>
<td>Africa</td>
<td>93%</td>
</tr>
<tr>
<td>Middle East and North Africa</td>
<td>85%</td>
</tr>
<tr>
<td>South East Asia</td>
<td>64%</td>
</tr>
<tr>
<td>South and Central America</td>
<td>55%</td>
</tr>
<tr>
<td>Western Pacific</td>
<td>46%</td>
</tr>
<tr>
<td>Europe</td>
<td>33%</td>
</tr>
<tr>
<td>North America and Caribbean</td>
<td>30%</td>
</tr>
</tbody>
</table>

**53%** increasing prevalence of diabetes worldwide.
**Breaking news: CKD set to rise to to 5 causes of YLL by 2040**

<table>
<thead>
<tr>
<th>Leading causes 2016</th>
<th>Leading causes 2040</th>
<th>Mean % change number of YLLs</th>
<th>Mean % change all-age YLL rate</th>
<th>Mean % change age-standardised YLL rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>1 Ischaemic heart disease</td>
<td>1 Ischaemic heart disease</td>
<td>-3.6 (-43.1 to 40.9)</td>
<td>-18.3 (-52.3 to 19.9)</td>
<td>-44.8 (-66.7 to -18.6)</td>
</tr>
<tr>
<td>2 Stroke</td>
<td>2 Stroke</td>
<td>-10.7 (-40.1 to 31.9)</td>
<td>-24.4 (-49.3 to 12.3)</td>
<td>-49.0 (-65.7 to -25.0)</td>
</tr>
<tr>
<td>3 Lower respiratory infections</td>
<td>3 Lower respiratory infections</td>
<td>-24.8 (-47.9 to 3.4)</td>
<td>-36.3 (-56.5 to -12.3)</td>
<td>-39.1 (-60.6 to -8.9)</td>
</tr>
<tr>
<td>4 Diarrhoeal disease</td>
<td>4 Diarrhoeal disease</td>
<td>-24.8 (-47.9 to 3.4)</td>
<td>-36.3 (-56.5 to -12.3)</td>
<td>-39.1 (-60.6 to -8.9)</td>
</tr>
<tr>
<td>5 Road injuries</td>
<td>5 Chronic kidney disease</td>
<td>100.3 (8.3 to 302.1)</td>
<td>69.8 (-8.5 to 244.6)</td>
<td>23.9 (-32.1 to 153.2)</td>
</tr>
<tr>
<td>6 Malaria</td>
<td>6 Alzheimers disease</td>
<td>131.2 (90.9 to 196.0)</td>
<td>95.8 (60.1 to 151.8)</td>
<td>1.8 (-22.3 to 41.5)</td>
</tr>
<tr>
<td>7 Neonatal preterm birth</td>
<td>7 Diabetes</td>
<td>76.7 (10.3 to 228.8)</td>
<td>49.8 (-6.8 to 184.1)</td>
<td>4.6 (-35.4 to 106.8)</td>
</tr>
<tr>
<td>8 HIV/AIDS</td>
<td>8 Road injuries</td>
<td>-18.3 (-31.7 to 8.5)</td>
<td>-30.8 (-42.3 to -8.6)</td>
<td>-29.9 (-41.4 to -6.1)</td>
</tr>
<tr>
<td>9 COPD</td>
<td>9 Lung cancer</td>
<td>20.7 (-9.0 to 60.5)</td>
<td>2.2 (-23.1 to 35.6)</td>
<td>-28.7 (-46.8 to -6.6)</td>
</tr>
<tr>
<td>10 Neonatal encephalopathy</td>
<td>10 Diarrhoeal diseases</td>
<td>-39.7 (-76.5 to 47.0)</td>
<td>-48.9 (-79.8 to 23.9)</td>
<td>-49.6 (-77.9 to 10.4)</td>
</tr>
<tr>
<td>11 Tuberculosis</td>
<td>11 Self-harm</td>
<td>7.8 (-15.2 to 41.9)</td>
<td>-8.7 (-28.4 to 20.0)</td>
<td>-11.5 (-30.6 to 17.1)</td>
</tr>
<tr>
<td>12 Congenital defects</td>
<td>12 HIV/AIDS</td>
<td>-30.4 (-41.8 to -20.3)</td>
<td>-41.1 (-50.9 to -32.6)</td>
<td>-36.9 (-48.0 to -27.2)</td>
</tr>
<tr>
<td>13 Lung cancer</td>
<td>13 Liver cancer</td>
<td>69.6 (30.7 to 135.2)</td>
<td>43.8 (9.9 to 102.9)</td>
<td>8.8 (-18.5 to 53.6)</td>
</tr>
<tr>
<td>14 Self-harm</td>
<td>14 Hypertensive heart disease</td>
<td>89.9 (6.3 to 358.7)</td>
<td>61.1 (-10.3 to 285.2)</td>
<td>6.0 (-42.4 to 158.9)</td>
</tr>
<tr>
<td>15 Colorectal cancer</td>
<td>15 Colorectal cancer</td>
<td>59.1 (18.3 to 123.9)</td>
<td>34.8 (-0.3 to 88.4)</td>
<td>-5.8 (-31.6 to 33.4)</td>
</tr>
<tr>
<td>16 Tuberculosis</td>
<td>16 Tuberculosis</td>
<td>-40.0 (-52.8 to -19.7)</td>
<td>-49.1 (-60.4 to -31.8)</td>
<td>-54.9 (-64.9 to -38.6)</td>
</tr>
<tr>
<td>17 Congenital defects</td>
<td>17 Congenital defects</td>
<td>-41.0 (-50.6 to -30.5)</td>
<td>-50.0 (-58.1 to -41.3)</td>
<td>-33.3 (-43.9 to -21.9)</td>
</tr>
<tr>
<td>18 Neonatal preterm birth</td>
<td>18 Neonatal preterm birth</td>
<td>-57.0 (-66.4 to -48.9)</td>
<td>-63.6 (-71.4 to -57.0)</td>
<td>-48.9 (-59.3 to -39.9)</td>
</tr>
<tr>
<td>19 Breast cancer</td>
<td>19 Breast cancer</td>
<td>46.2 (13.0 to 89.0)</td>
<td>23.9 (-5.3 to 61.0)</td>
<td>-1.6 (-24.9 to 29.1)</td>
</tr>
<tr>
<td>20 Falls</td>
<td>20 Falls</td>
<td>24.1 (16.0 to 33.2)</td>
<td>5.1 (-2.6 to 13.5)</td>
<td>-18.8 (-26.8 to -10.3)</td>
</tr>
</tbody>
</table>

Foreman et al Lancet 2018
What defines a public health problem?

- Disease burden is high (i.e., it affects many people, has increased recently, and will likely increase in the future)
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Schoolwerth AC et al, 2005
2.6 MILLION received dialysis or transplantation worldwide

2.3 MILLION premature deaths for lack of access to dialysis and transplantation
The gap between the need and availability of RRT is greatest in Africa and Asia......
<table>
<thead>
<tr>
<th>Access to dialysis</th>
<th>Adult studies</th>
<th>Paediatric studies</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Overall</td>
<td>Incident</td>
</tr>
<tr>
<td>Pooled</td>
<td>4221/8253 (51%; 15)</td>
<td>4221/8253 (51%; 15)</td>
</tr>
<tr>
<td>Individual studies</td>
<td>39-1% (25-7; 16)</td>
<td>39-1% (25-7; 16)</td>
</tr>
<tr>
<td><strong>Not dialysed although indicated</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pooled</td>
<td>3277/6797 (48%; 11)</td>
<td>3277/6797 (48%; 11)</td>
</tr>
<tr>
<td>Individual studies</td>
<td>56-6% (19-5; 11)</td>
<td>56-6% (19-5; 11)</td>
</tr>
<tr>
<td><strong>Known to stop dialysis although needed</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pooled</td>
<td>2572/4535 (59%; 23)</td>
<td>2508/2990 (84%; 13)</td>
</tr>
<tr>
<td>Individual studies</td>
<td>51-4% (41-4; 23)</td>
<td>79-7% (27-5; 13)</td>
</tr>
<tr>
<td><strong>Continued dialysis ≤3 months</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pooled</td>
<td>3324/6589 (50%; 26)</td>
<td>295/3014 (10%; 16)</td>
</tr>
<tr>
<td>Individual studies</td>
<td>33-1% (32-9; 26)</td>
<td>14-1% (21-6; 16)</td>
</tr>
<tr>
<td><strong>Continued dialysis ≤12 months†</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pooled</td>
<td>1598/3560 (45%; 13)</td>
<td>19/1472 (16%; 16)</td>
</tr>
<tr>
<td>Individual studies</td>
<td>36-4% (38-3; 13)</td>
<td>15-5% (2-3; 6)</td>
</tr>
<tr>
<td><strong>Recovery of enough renal function to come off dialysis</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pooled</td>
<td>34/1765 (2%; 9)</td>
<td>5/64 (8%; 3)</td>
</tr>
<tr>
<td>Individual studies</td>
<td>4-9% (7-1; 9)</td>
<td>7-3% (12-6; 3)</td>
</tr>
<tr>
<td><strong>Transplant received</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Pooled</td>
<td>2321/16 608 (14%; 24)</td>
<td>41/4483 (1%; 11)</td>
</tr>
<tr>
<td>Individual studies</td>
<td>6-3% (8-4; 24)</td>
<td>17% (13; 11)</td>
</tr>
</tbody>
</table>

Data are n/N (% number of studies) or mean (SD; number of studies). NA = not applicable. * Countries reporting dialysis duration ≤3 months: Burkina Faso, Cameroon, Democratic Republic of the Congo, Ethiopia, Ghana, Malawi, Nigeria, Senegal, South Africa, and Sudan. † Countries reporting dialysis duration ≤12 months: Cameroon, Ethiopia, Ghana, Nigeria, Senegal, South Africa, Sudan.
Kidney disease burden is highest in less developed countries

Xie et al. Kidney Int 2018
Change in CKD DALYs 1990 - 2016

Xie et al Kidney Int 2018
Upcoming challenges will make the distribution even more unfair
Uddanam Nephropathy: What is Andhra's mysterious kidney disease?

Though it has been close to twenty years since the first cases were reported, the cause of Uddanam Nephropathy is yet to be established.
Climate Change and the Emergent Epidemic of CKD from Heat Stress in Rural Communities: The Case for Heat Stress Nephropathy

Geographic distribution of populations with eGFR<60
Air pollution and CKD in USA

Bragg-Gresham et al, PLOS One 2018
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Schoolwerth AC et al, 2005
ESRD incidence in Taiwan

A Case Study

Yang, NDT 2008; 23:3977; Hwang, Nephrology 2010; Suppl 2; 3-9
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Schoolwerth AC et al, 2005
LMIC kidney disease treatment gaps

• Large undiagnosed and untreated population
• Inadequate workforce
  - Dependence on physician-centric model
• Disproportionate focus on dialysis
• Lack of effective, organized community programs for detection and treatment
• Lack of guideline-based care
Most high-risk people live in resource-poor regions

Spending on cardiovascular & diabetes disease drugs

- $100 billion
- 80 million
- 250 million
- <$20 billion

*20% ten-year risk of myocardial infarction or death from CVD
Most high-risk people live in resource-poor regions

*Doctors per 10,000 population*

World Health Organization, 2009; World Bank, 2016
Healthcare services for identification and management of CKD are deficient in low-income countries

Developing sustainable solutions

⇒ Where do we start?
  - Re-engineer the workforce
    ⇒ Larger and less expensive
    ⇒ Less variation in quality

- Develop low-cost technologies
  ⇒ Electronic decision support
  ⇒ Point-of-care diagnostics

- Develop low-cost drugs
  ⇒ Fixed-dose once-a-day combinations
Task Shifting the Management of Non-Communicable Diseases to Nurses in Kibera, Kenya: Does It Work?

David Some¹ *, Jeffrey K. Edwards¹,², Tony Reid³, Rafael Van den Bergh³, Rose J. Kosgei³, Ewan Wilkinson⁴, Bienvenu Baruani³, Walter Kizito¹,², Kelly Khabala¹, Safieh Shah⁵, Joseph Kibachio⁶, Phylles Musembi⁶

¹ Médecins Sans Frontières, Nairobi, Kenya, 2 Médecins Sans Frontières, Operational Research Unit, Brussels, Belgium, 3 College of Health Sciences, Department of Obstetrics and Gynaecology, University of Nairobi, Kenya, 4 Chester University, Chester, United Kingdom, 5 Ministry of Health, Non Communicable Diseases Control Unit, Nairobi, Kenya, 6 Ministry of Health, Sub County Medical Officer of Health, Nairobi, Kenya

* kdsome@yahoo.com

Conclusion

Nurses are able to adhere to protocols for managing stable NCD patients based on clear and standardized protocols and guidelines, thus paving the way towards task shifting of NCD care to nurses to help relieve the significant healthcare gap in developing countries.
A village-based healthcare “ecosystem” utilizing digital health technologies

- Community healthcare workers
- Regional medical supervision
- Smartphone-guided, personalized care
- Wireless POC diagnostics
- Evidence-based algorithms: clinical and operational
- Continuous quality control
Develop low-cost technologies

Clinical decision support

Patient-facing application

- Personal risk monitoring
- Early warning signs & symptoms
- Medication adherence prompts
- Smoking cessation tools
- Weight loss & food choice tools
- Data upload (e.g. BP)
- Appointment scheduling
Multimedia resources
Risk communication
Recall & reminder system
Interactive Voice Response
Decision support
Workshop training
Virtual training platform
Remuneration incentives
Government support
PHC medication supply
Strategies for reducing disparities (and research directions)

- Use manpower from within communities
- Promote evidence-based coordinated care
- Develop and measure quality metrics
- Outcome reporting
- Reform reimbursement
- Effective communication
  - Leadership in health promotion
  - Actionable skill sets
  - Cultural competency
- Medical advocacy for improved healthcare systems
Does this approach work?
Agreement between health workers and physicians regarding treatment of patients with coronary heart disease

Percent agreement

<table>
<thead>
<tr>
<th>Drug</th>
<th>Agreement (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>ACE-inhibitor</td>
<td>92</td>
</tr>
<tr>
<td>Beta-blocker</td>
<td>90</td>
</tr>
<tr>
<td>Statin</td>
<td>94</td>
</tr>
<tr>
<td>Aspirin</td>
<td>95</td>
</tr>
</tbody>
</table>

JACC 2012; 59:1188–96
Identification of high-risk individuals by community health worker

Percent identified

+12

51
Physician

63
Healthworker

JACC 2012;59:1188–96
Experience with a program for prevention of chronic renal failure in India

Muthu Krishna Mani

Apollo Hospital, Chennai, Tamil Nadu, India

Developing nephrology programs in very low-resource settings: challenges in sustainability

Karen Yeates¹, Sudakshina Ghosh² and Kajiru Kilonzo²

¹Department of Medicine, Queen's University, Kingston, Ontario, Canada and ²Kilimanjaro Christian Medical Centre, Moshi, Tanzania
<table>
<thead>
<tr>
<th><strong>STRENGTHS</strong></th>
<th><strong>WEAKNESSES</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Wide recognition of the importance of timely detection of CKD</td>
<td>- No single strategy can address all contexts</td>
</tr>
<tr>
<td>- International collaboration to strengthen kidney health systems</td>
<td>- Cultural diversity limits generalizability of some strategies</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th><strong>OPPORTUNITIES</strong></th>
<th><strong>THREATS</strong></th>
</tr>
</thead>
<tbody>
<tr>
<td>- Centralization of training to minimize duplication</td>
<td>- Financial sustainability</td>
</tr>
<tr>
<td>- Knowledge transfer and sharing of lessons learned across countries</td>
<td>- If growth in risk factors for CKD/ESKD outstrips the ability of countries to mitigate them</td>
</tr>
</tbody>
</table>

CKD/ESKD strategies
Responding to a challenging global health environment

RESOURCES & POLITICAL WILL
Informed by experts and communities who understand the needs

Medical advances and innovation
Improved guidelines, standards of care
Research and data collection

Achieving better global kidney health

Courtesy Adeera Levin