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World Kidney Day: Detecting Kidney Disease in Low- and Middle-Income Countries

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Chronic kidney disease (CKD) is a significant global health issue, with more than 700 million people accounting for 10% of the world population affected.[1] It is estimated that 78% of people with CKD reside in low- and middle-income countries (LMICs) where health systems struggle with limited resources and systemic inequities.[2] In LMICs, CKD is frequently associated with poverty, infections, and environmental factors. Compounding these risks are systemic challenges, including weak health care systems, insufficient government and private sector involvement, and a lack of public awareness of kidney health.[3] Furthermore, asymptomatic nature of CKD in its early stages makes it particularly challenging to detect, leading to late diagnosis and increased mortality.[4] In addition, patients with CKD in LMICs are at a higher risk of progressing to kidney failure, facing catastrophic health care expenses, especially for advanced therapies such as dialysis and transplantation.[2] Innovative solutions, including community-based interventions and digital health technologies, offer hope for improving detection and management of CKD in LMICs. World Kidney Day celebrated across the globe offers us an opportunity to increase awareness and improve access to CKD care services.

This article explores the challenges of CKD screening in LMICs and highlights novel models and real-world programs that provide a roadmap for improving early detection and management. It emphasizes the need for collaborative efforts among governments, health professionals, and communities to effectively address the growing public health crisis.

Challenges for CKD Screening in LMICs

CKD screening in LMICs faces multifaceted challenges stemming from policy gaps, inadequate resources, and unique pediatric considerations. We explore these aspects in detail.

Lack of Validated Tools for Screening

The Kidney Disease Improving Global Outcomes recommends the measurement of both estimated glomerular filtration rate and urine albumin-to-creatinine ratio for screening, risk stratification, and confirmation of CKD. However, most estimated glomerular filtration rate equations are derived from populations in high-income countries and have not been validated for individuals living in LMICs. Even the recently developed race-neutral CKD-Epidemiology Collaboration 2021 equation has been found to underestimate CKD in continental African populations.[5] Furthermore, CKD secondary to heat stress and environmental nephrotoxins commonly involves an underlying tubulointerstitial disease, which is typically nonproteinuric, making urine albumin-to-creatinine ratio a less sensitive test for diagnosis.

Lack of Applicability of Existing Risk Prediction Models

Population-based CKD screening targeting high-risk populations can detect more people at a lower cost, which is ideal for LMICs. However, the risk factors included in these models, such as presence of diabetes, hypertension, and cardiovascular disease, remain undiagnosed for most people living in LMICs because of poor access to health care. Furthermore, most existing risk scores and algorithms have been validated in high-income countries and do not include many high-risk but nontraditional causes relevant to LMICs, such as infections, use of traditional herbal remedies, exposure to heat stress, and other occupational and environmental risk factors. Sickle cell disease and APOL1 genetic predisposition are among the other factors missed.[4]

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Lack of Data on Cost-Effectiveness of CKD Screening in LMICs

Faced with competing medical priorities and limited funds, cost-effectiveness is a key factor to consider when implementing CKD screening programs in LMICs. Studies of high-income countries have shown that screening for CKD in high-risk populations is cost-effective. However, similar data are not available for LMICs, where per-person gross domestic product and cost-effectiveness thresholds are much lower.

Competing Medical Priorities

Governments in LMICs often prioritize infectious diseases and other known diseases, such as hypertension and diabetes. This has diverted attention and funding from CKD, leading to delayed diagnosis and treatment.[3]

Low Literacy and Awareness

Low health literacy prevalent in LMICs is a major barrier to the screening and management of CKD. A Thai study found that only 1.9% of patients with CKD were aware of their condition, underscoring the urgent need for public education and community-driven awareness campaigns.[6]

Limited Health System Capacity

LMICs often lack trained health care workers, universal health coverage, and adequate infrastructure for CKD screening and management. LMICs have just 0.6 nephrologists per 100,000 patients with CKD compared with 25.7 in high-income countries. Most screening programs rely on a single creatinine or proteinuria test, which can lead to diagnostic inaccuracies. Without repeat testing, the CKD prevalence may be overestimated or underestimated.

Political and Financial Challenges

Political will and funding for CKD programs are often limited. CKD is often excluded from national noncommunicable disease agendas, perpetuating its neglect in policy and funding priorities.

Dependence on Donor-Driven Programs

CKD initiatives in LMICs often rely on donor funding, which compromises their long-term sustainability. Programs frequently dissolve without national government support, leaving vulnerable populations underserved.[4]

Lack of Point-of-Care Diagnostics

The lack of affordable diagnostic tools such as urine dipsticks, cystatin C tests, and lateral flow biomarkers limits comprehensive CKD screening in underserved areas. Effective point-of-care (POC) tools can transform kidney disease detection in LMICs.[2]

Diagnostic Complexity in Children

The diagnosis and management of kidney disease in children living in LMICs face numerous challenges, including developmental changes in kidney function and serum creatinine levels, compounded by the absence of age-specific norms and limited adoption of advanced equations, such as the under-25 equation. Moreover, health care workers often lack training in applying the Kidney Disease Improving Global Outcomes guidelines to pediatric populations, a gap worsened by insufficient resources and institutional support. Limited access to diagnostic tools, including prenatal ultrasound, hinders the early detection of congenital anomalies of the kidney and urinary tract.

Solutions and Models for CKD Screening in LMICs

Improving CKD screening in LMICs requires innovative and resource-sensitive approaches that integrate local health care systems, community participation, and digital technologies. Several successful programs and strategies have illustrated these solutions (Figure 1).

Use of Risk Prediction Models for Targeted CKD Screening

Several risk prediction models, using simple clinical parameters such as age, gender, body mass index, waist circumference, blood pressure, and urine dipstick, have been developed in India[7] and Thailand.[8] Because these models do not require laboratory tests, they are ideal for LMICs where laboratory investigations are not freely available.

Community Health Worker Programs

Community health workers have demonstrated remarkable potential in bridging the gap between underserved populations and health care systems. A recent scoping review revealed that community health workers were successfully involved in CKD diagnosis and related physical screening, delivering health education and patient navigation into the health care system.[9]

Integration With Existing Public Health Initiatives

Integrating CKD screening into established public health programs can reduce costs and maximize resources. Classic examples include the Thai Screening and Early Evaluation of Kidney Disease program[6] that effectively embedded CKD awareness into broader health care campaigns and the HIV treatment program in South Africa[S1] that added protocolized serum creatinine testing to the program.

Digital and Mobile Health Solutions

Digital tools and mobile health platforms offer scalable solutions to the CKD screening challenges in LMICs. In rural India, telehealth programs and mobile applications using POC for creatinine and urine albumin have facilitated CKD risk assessment, screening, and

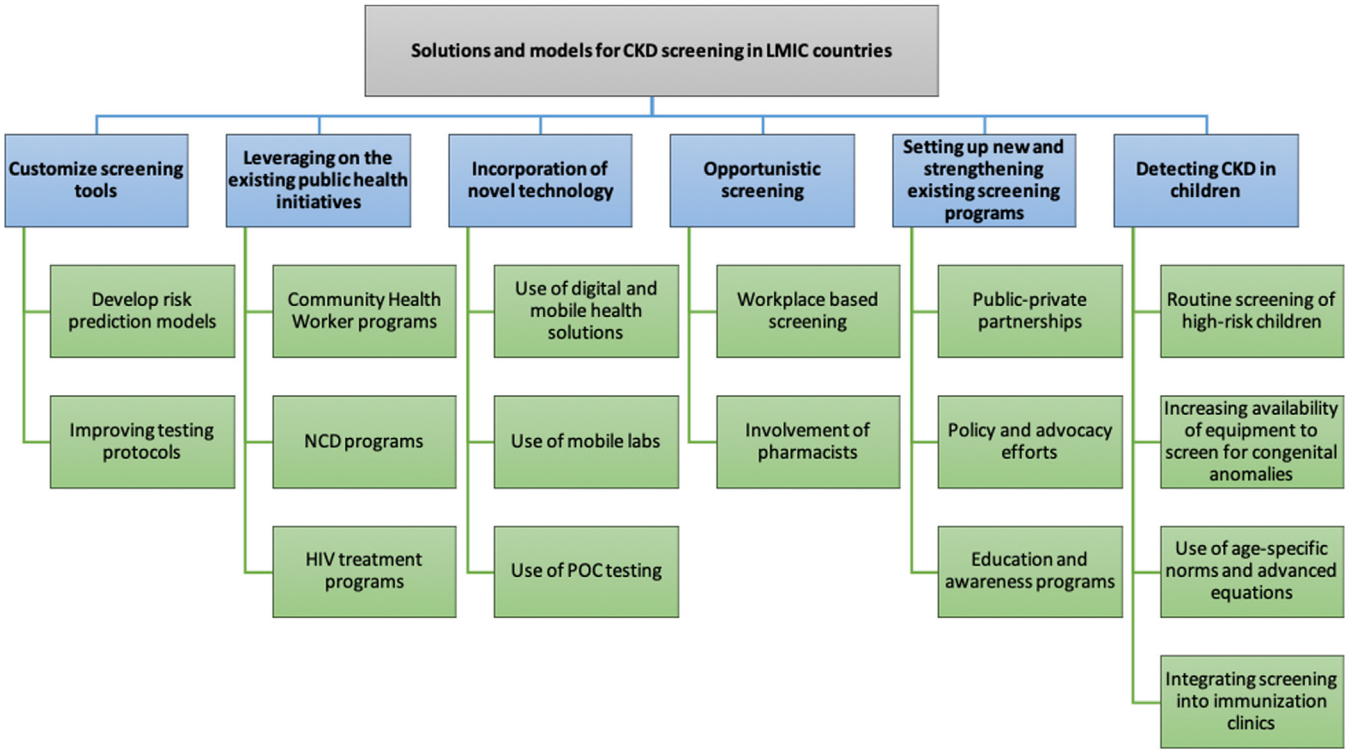

Figure 1. Solutions and models for CKD screening in LMICs. CKD, chronic kidney disease; LMIC, low- and middle-income country; NCD, noncommunicable disease; POC, point-of-care.

education, thereby improving diagnostic accuracy and decision-making at the primary care level.

Improved Testing Protocols

Reliable diagnosis depends on rigorous testing protocols. Studies have stressed the importance of confirmatory testing within 3 months to avoid diagnostic errors. For example, a study conducted in Morocco found that confirmatory creatinine and albuminuria measurements reduced CKD prevalence estimates by nearly 50% while minimizing false negatives.[S2]

Performing Tests to Diagnose CKD in the Community

CKD screening programs are more effective when conducted within the community than in health care settings because they ensure better accessibility and reach populations that may not otherwise seek medical care. Utilizing POC testing and mobile laboratories are effective methods for community-based screening. In Sri Lanka, the National CKD Screening Program employs buses equipped with mobile laboratories to reach communities with a high prevalence of CKD of unknown etiology. These mobile units facilitate the on-site testing of serum creatinine and urine albumin levels, enabling timely referral for further evaluation and management.

Workplace-Based Screening

Certain occupations carry a higher risk of developing CKD owing to factors such as heat stress, dehydration, and exposure to agrochemicals and other toxic substances. Instituting CKD screening programs at such workplaces offer a valuable opportunity to detect CKD early. Such initiatives have been successfully implemented among agricultural workers in Central America, miners in Australia, construction workers in the Middle East, and textile and garment workers in Bangladesh and Cambodia.

Involvement of Pharmacists

Pharmacists, with their expertise and role, are well placed to be involved at different steps in the CKD care pathway, including screening. Clinical trials conducted in Australia[S3] and Canada[S4] have shown that it is feasible to involve pharmacists in CKD screening. The National Kidney Foundation in the USA[S5] has developed a Continuous Education Program and a toolkit to facilitate the involvement of pharmacists and pharmacy technicians in CKD care. Considering that pharmacies are an integral part of any health care system, this is an ideal model to be tested in LMICs.

Public-Private Partnerships

Collaborations between governments and private entities have proven to be effective in enhancing CKD screening. Initiatives such as Kidney Disease Improving Global Outcomes bring together diverse stakeholders to subsidize diagnostic tools and fund public education campaigns,

improving local capacities. Similar partnerships could help implement affordable testing modalities, such as cystatin C, and improve access to POC diagnostics.

Policy and Advocacy Efforts

Political commitment to and advocacy of CKD-specific policies are crucial for achieving universal health coverage. Brazil serves as an example where sustained advocacy efforts has led to enhanced funding for noncommunicable disease management and CKD care. Policy frameworks that integrate CKD screening into broader health initiatives can significantly reduce disease burden.[4]

Detecting CKD in Children

Early identification through routine screening of high-risk children and the use of POC diagnostic tools, such as lateral flow saliva urea nitrogen tests adapted for pediatric populations, can enable timely diagnosis and better outcomes. The adoption of age-specific norms and advanced equations to assess kidney function in children and integrating kidney assessments into childhood immunization clinics are useful strategies to improve screening.[2]

Conclusion

Detecting CKD in LMICs is challenging but not insurmountable. Systemic issues, such as low health care capacity and limited political commitment, exacerbate delays in diagnosis and poor outcomes. However, leveraging community health worker programs, digital innovations, and public-private collaborations offers actionable solutions. Success depends on sustained political will, universal health coverage, and community-focused awareness campaigns. Collaborative efforts across stakeholders are critical to reduce burden of CKD in LMICs.

SUPPLEMENTARY MATERIAL

Supplementary File (PDF)

Supplementary References

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