

The Potential Impact of Public Health Interventions in Preventing Kidney Disease

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Summary: The years of life lost and years lived with disability resulting from chronic kidney disease (CKD) increased globally by 90% and 49.5%, respectively, between 1990 and 2013. In addition to the traditional factors, infections, low birthweight, environmental factors, and low socioeconomic status contribute to the CKD burden in low- and middle-income countries. System-level challenges such as poor appreciation of the burden, insufficient human resources, high health care costs, poor referral pathways, unreliable health information systems, and inadequate medicine supply pose barriers to CKD control. In this article, we present evidence that the CKD burden in low- and middle-income countries is related to system-wide issues, which could be reduced effectively using innovative, affordable, and scalable interventions. A multipronged approach is required including improving socioeconomic determinants of health, enabling the environment for healthy decision making, and sustainable interventions. Innovative approaches include promoting healthy behaviors, counseling, and education in primary care, task-sharing between physicians and nonphysicians, using technology to train nonphysicians to screen, diagnose, refer, follow-up, and educate patients, and ensuring quality. Stronger political will and system-level change are needed to prevent and manage CKD if the sustainable development goals of reducing premature mortality from noncommunicable diseases by 2030 are to be attained.

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Demographic, population, and disease transitions have led to a large increase in the kidney disease burden globally. In high-income countries (HICs), chronic kidney disease (CKD) is linked to the prevalent noncommunicable diseases (NCD) such as diabetes and hypertension, whereas acute kidney injury (AKI) is encountered largely among hospitalized patients, usually in intensive care units. In contrast, in low- and low-middle-income countries (LMICs), the pattern of kidney disease is reflective of a dual disease burden with contributions both from persisting and emerging infections and oncoming lifestyle-related diseases. Preventable AKI caused by inadequate sanitation, lack of safe drinking water, inadequately treated infections, and suboptimal care during pregnancy and delivery continue to be encountered. At the same time, rapid changes in lifestyle and diet, and an

aging population, are fueling the burgeoning CKD epidemic. Infections also contribute to the CKD burden, either through direct chronic renal injury as with human immunodeficiency virus, and hepatitis B and C infections; or by causing AKI (eg, malaria, hemorrhagic fever, dengue, leptospirosis, and so forth), which may increase the future risk of CKD or worsen outcomes in patients with pre-existing CKD.

Health systems in LMICs also show several deficiencies, such as a mismatch between the disease burden and care provision, particularly at the primary care level, manifested as shortage and maldistribution of physicians, lack of systematic prevention and control programs, and reliance on unproven therapies including indigenous medical systems. All of these contribute to the development and/or progression of kidney disease. Insufficient allocation of health care funds and unstructured care models create additional fault lines. People do not seek care until late in the disease process, by which time expensive curative treatment becomes necessary, as opposed to cost-effective primary and secondary preventive measures. A large proportion present with advanced kidney failure and need hospitalization and urgent dialysis. Other factors that increase morbidity, mortality, and cost of care are nonstandard care delivery, for example, irregular hemodialysis frequency, unregulated dialysis re-use, and reliance on poor-quality generics and biosimilars.

Schoolwerth et al¹ suggested that a health condition should be recognized as a public health problem when it places a large and increasing burden on society, disproportionately affects disadvantaged segments of the population, and is amenable to preventive

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strategies, which are not yet in place. In this article, we present evidence that the kidney disease burden in LMICs is related substantially to system-wide issues and can be reduced effectively using public health interventions (PHIs). We describe the levels of PHIs with implications for kidney health, the use of innovations in public health delivery to develop affordable and scalable models to reduce disease burden and improve outcomes, and discuss examples of such interventions.

THE BURDEN OF CHRONIC KIDNEY DISEASE

Kidney diseases, both acute and chronic, are important causes of morbidity and premature mortality. Population-based surveys suggest an approximately 8% to 10% community-wide prevalence of CKD. A recent analysis showed a higher age-standardized prevalence of CKD among adults in LMICs (men, 10.6%; women, 12.5%) than in HICs (men, 8.6%; women, 9.6%).² Similar to other NCDs, CKD increases with age, increasing to 20% in individuals in their 60s to 35% among patients older than 70 years.³ Between 1990 and 2013, the global years of life lost and years lived with disability as a result of CKD increased by 90% and by 49.5%, respectively.⁴ In some countries in Central and South America, CKD is now one of the top 10 causes of death and disability.⁵ It has been suggested that the contribution of CKD to the overall disease burden is underestimated because of insufficient diagnosis and inaccurate cause of death reporting in patients with CKD risk factors such as diabetes.⁶

In 2010, approximately 2.3 million people with end-stage kidney disease died prematurely because they did not have access to renal replacement therapy.⁷ A majority of these deaths took place in LMICs. In the next 15 years, the total number of people undergoing renal replacement therapy will increase to 5.4 million, mostly in the emerging countries of Asia and Africa.⁷ Similarly, yearly, approximately 13 million people worldwide develop AKI, more than 85% of whom are in LMICs. Most of these cases are not identified in a timely manner and patients fail to receive appropriate treatment.⁸ Children and young adults develop AKI in association with diarrheal diseases, tropical infections, snake bites, poor obstetric care, and consumption of toxic traditional medicines, suggesting an absence of PHIs that could have prevented AKI.⁹

BARRIERS TO PROVISION OF CARE FOR KIDNEY DISEASE IN LMICS

Cost of Care

Kidney disease has a bidirectional relationship with poverty, implying that poverty predisposes to the

development of disease, and worsens the outcome of individuals with kidney disease. Care of patients with kidney disease has significant economic consequences on health systems and households. Approximately 2% to 6% of the health care expenditure in HICs is used to provide treatment for patients with end-stage kidney disease even though they account for only 0.1% to 0.2% of the total population. Dialysis treatment costs accounted for 6.3% of the Medicare budget in the United States in 2010, 4.1% of the total health care budget in Japan in 1996, and approximately 1.3% of all health spending in the United Kingdom.¹⁰ In LMICs, the annual per-patient cost for hemodialysis and peritoneal dialysis ranged from Int\$3,424 to Int\$42,785 and from Int\$7,974 to Int\$47,971, respectively.¹¹

In LMICs, health care costs often are met with out-of-pocket expenditure, leading to loss of household income. Each year approximately 100 million individuals spiral into poverty as a result of out-of-pocket costs for health care.¹² A recent study from India showed that spending for dialysis while awaiting kidney transplantation led to severe, moderate, and some financial crisis in 54%, 8%, and 10% of families, respectively.¹³ According to the Global Snapshot study of AKI conducted by the International Society of Nephrology, lack of resources and an inability to afford therapy were common reasons for forgoing dialysis for AKI despite indication in several LMICs.⁸

Lack of Trained Human Resources

According to the World Health Organization (WHO) Global Health Observatory, 44% of all member states have fewer than one physician per 1,000 population, and countries with the highest disease burden have the lowest number of health care workers.¹⁴ This is reflected in the nephrology health workforce. There are fewer than one nephrologist per million population in African and Southeast Asian countries, in contrast to 22 and 31 per million population in North America and Western Europe.¹⁵ Even within individual LMICs, there are disparities in the health workforce availability between rural and urban regions.

System-Level Issues With CKD Management

CKD screening is suboptimal globally, with 50% of people with CKD remaining undiagnosed in the community.¹⁶ Management is compounded by delayed referrals, fragmented care, poor follow-up evaluation and referral pathways, and inadequate focus on patient engagement and education.¹⁷ These challenges are magnified several fold in LMICs. Health systems at primary care levels in most LMICs have been designed to focus on maternal and child health services and

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