

Understanding kidney care needs and implementation strategies in low- and middle-income countries: conclusions from a “Kidney Disease: Improving Global Outcomes” (KDIGO) Controversies Conference



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Evidence-based clinical practice guidelines improve delivery of uniform care to patients with and at risk of developing kidney disease, thereby reducing disease burden and improving outcomes. These guidelines are not well-integrated into care delivery systems in most low- and middle-income countries (LMICs). The KDIGO Controversies Conference on Implementation Strategies in LMIC reviewed the current state of knowledge in order to define a road map to improve the implementation of guideline-based kidney care in LMICs. An international group of multidisciplinary experts in nephrology, epidemiology, health economics, implementation science, health systems, policy, and research identified key issues related to guideline implementation. The issues examined included the current kidney disease burden in the context of health systems in LMIC, arguments for developing policies to implement guideline-based care, innovations to improve

kidney care, and the process of guideline adaptation to suit local needs. This executive summary serves as a resource to guide future work, including a pathway for adapting existing guidelines in different geographical regions.

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KEYWORDS: acute kidney injury; advocacy; chronic kidney disease; clinical practice guidelines; implementation; low and middle income countries

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Kidney diseases (KDs), both acute and chronic, are recognized as major public health issues worldwide. More than half of patients with advanced chronic kidney disease (CKD) do not receive any treatment, especially in the low and low middle income countries (LMICs).¹ Similarly, acute kidney injury (AKI) contributes to about 1.7 million preventable deaths every year worldwide.²

Implementation of existing knowledge can substantially reduce KD burden and improve outcomes. Kidney Disease: Improving Global Outcomes (KDIGO) has been at the forefront in developing evidence-based best practice guidelines to optimize the management of KD patients. Using rigorous methodology that represents the best global science, KDIGO has produced 9 guidelines and held 25 conferences on

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important issues in KDs and their treatment. The KDIGO guidelines have been adapted and/or adopted by several professional organizations, and disseminated through publications, seminars, webinars, symposia, and in digital format. Thus, KDIGO aims at providing the highest level of guideline-based care that can be adapted for local needs and models of care, including in the presence of resource limitations.

Over time, it has become apparent that these guidelines are not well-integrated into routine care in the LMICs. To achieve an international, multidisciplinary, transparent, and unbiased analysis, KDIGO brought together experts from around the world to a Controversies Conference in Bangkok, Thailand, in June 2015 to identify means to overcome the barriers to improved nephrology care in resource-constrained settings.

CONFERENCE METHODS AND PARTICIPANTS

Drs. Vivekanand Jha (George Institute for Global Health, New Delhi, India) and Goce Spasovski (University of Skopje, Skopje, Macedonia) co-chaired this conference. The objectives were to: (i) develop and deliver arguments for policies to implement guideline-based care; (ii) summarize the current state of knowledge on health systems and KD burden in LMICs; (iii) discuss the technological and manpower restructuring innovations needed to improve guideline-based delivery of kidney care; and (iv) assess requirements to develop resource-sensitive guidelines by understanding the barriers and facilitators of guideline implementation. The overall aim of this conference was to propose approaches to help facilitate implementation of evidence-based clinical practice guidelines for the care of patients with KD in LMICs. To this end, consensus was achieved on the recommended action plans based on plenary presentations and discussions at the meeting, narrative literature reviews, and deliberations on a series of questions defined in advance of the meeting.

The conference included experts in nephrology, epidemiology, health economics, implementation science, health systems, policy, and research. Participants worked in breakout groups to review strategies and develop recommendations for advancing models of care and research in the LMIC setting. Conference details can be found at <http://kdigo.org/home/conferences/implementation-strategies/>.

SETTING THE STAGE

Demographic and disease transitions in LMICs have produced a growing burden of KD. Persisting public health issues such as inadequate sanitation, lack of safe drinking water, suboptimal infection control and reproductive health, and environmental hazards continue to generate a large and preventable burden of AKI and CKD.³ Increasing urbanization, lifestyle and dietary changes have brought on an escalating burden of non-communicable diseases (NCDs), which increases the risk of CKD (Figure 1).⁴ Malnutrition affects serum creatinine, interfering with its role as a diagnostic marker. Maternal malnutrition may result in low-birth weight neonates, which imposes a lifetime risk of developing diabetes, hypertension, and CKD.⁵

Health care systems in LMICs often exhibit a lack of evidence-based policy, mismatch between disease burden and

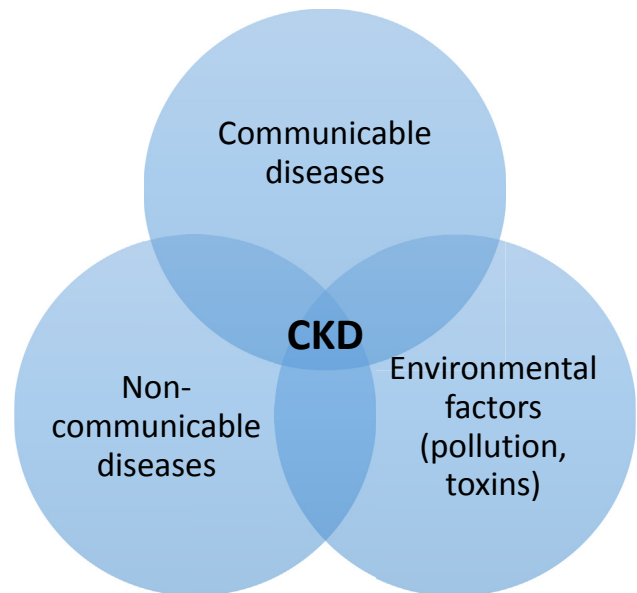


Figure 1 | Interaction of traditional and nontraditional risk factors in the epidemiology of CKD.

care provisions, shortage and maldistribution of care providers, absence of organized primary care, fragmentation and disparities in access and quality, and reliance on unproven therapies. The high cost of treatment, combined with lack of reliable social security, results in out-of-pocket payments, pushing families into poverty.

DEVELOPING AND DELIVERING ARGUMENTS FOR IMPROVED HEALTH POLICIES TO IMPLEMENT GUIDELINE-BASED CARE

Most LMICs have prioritized spending the limited funds available for health care to combat malnutrition, prevent infectious diseases, and improve reproductive health, as articulated in the Millennium Development Goals established by the United Nations (UN) (<https://www.un.org/millenniumgoals/>). Most countries made substantial progress, and earlier this year, the UN announced a new Sustainable Development agenda. In setting up the Sustainable Development Goal (SDG) targets, the UN panel took into account the rising global burden of premature deaths and disabilities due to NCDs. The new health-related SDG includes reducing by one-third premature mortality due to NCDs through prevention and treatment (<http://www.un.org/sustainabledevelopment/health/>). The SDG 3.8 calls for achievement of universal health coverage, including financial risk protection; access to quality essential health care services; and access to safe, effective, quality, and affordable essential medicines for all, making prevention/treatment of AKI and CKD progression a complementary goal rather than a competing one, while combating malnutrition and infections for overall health care improvement in LMICs.

NCDs are currently the driving force of CKD throughout the world, with regional nephropathies such as infection-related glomerulonephritides and Mesoamerican, Balkan, and Chinese herbal nephropathies being important causes of CKD

in certain LMICs.⁶ Lack of awareness, failure to recognize early signs, and improper management contribute to CKD burden.⁷

Between 1990 and 2013, the global years of life lost and years lived with disability due to CKD rose by 90%⁸ and 49.5%,⁹ respectively. A recent analysis revealed a higher age-standardized global prevalence of CKD in adults in LMICs (10.6% in men and 12.5% in women) than in high-income countries (8.6% in men and 9.6% in women).¹⁰ The total number of adults with CKD worldwide was estimated to be 497.5 million, with 387.5 million in LMICs (Supplemental Figure S1).¹⁰

Despite its importance, KD lacks visibility. Faced with a rising burden of premature death and disability due to NCDs, many countries are developing strategies for the prevention and control of NCDs as suggested in the SDGs. Most, however, do not specifically address KD in their programs.¹¹ Decision-makers worldwide are unaware that a large part of the burden of adverse outcomes secondary to diabetes, hypertension, and obesity is through the development of KD.¹² Expressing such burden and impact in terms of health care costs and disability (disability-adjusted life years) based on local or national statistics is important. If local information is not available, good-quality epidemiologic data, preferably from matched populations, should be used. Other stakeholders, including the target population that will benefit from intervention, governments, and potential allies should be defined. Any proposed initiative to target KD should be harmonized with existing or planned public health initiatives.¹¹ Unique forms of KD (e.g., CKD due to environmental factors or AKI secondary to herbs, toxins, or poor obstetric care) might require special initiatives. A health-economic analysis of the consequences of untreated disease is helpful. Countries that are implementing universal health care coverage stand to realize the most savings when CKD prevention programs are implemented early. Savings resulting from prevention can be used for more important public health needs rather than setting up expensive dialysis services. For example, a cost-benefit analysis of hypertensive patients at risk of CKD in Peru estimated the total cost savings from preventive interventions to be \$188 million over 5 years if dialysis is avoided.¹³ Prevention is the only recourse to save lives in countries where health care systems do not cover dialysis. The economic consequences of lost productivity, along with the recognition that better and earlier guideline-based care is a less expensive alternative to disease progression should be presented to policy makers as an argument for guideline implementation.

The benefits of early screening, detection, treatment, and cost-effectiveness should be presented in the form of numbers needed to treat and savings accrued to the health care system.¹⁴ Studies from developed countries have demonstrated that NCD mortality and disease incidence can be reduced by 75% and 58%, respectively, through appropriate interventions.^{15,16} Objectives of prevention programs should be clearly stated and prioritized, based on local resources (Table 1).

Table 1 | Possible targets for the advocacy initiative

- Recognize preventable deaths due to AKI in LMICs as a human rights issue
- Recognize CKD as an important cause of death and disability by national health authorities
- Include screening and management for AKI and CKD in existing or planned NCD and CD programs
- Reduce cardiovascular morbidity and mortality in those with CKD
- Retard progression of CKD and the need of RRT
- Increase government funding for CKD detection and prevention
- Increase access to RRT in an equitable and just manner
- Increase rates of organ donation and transplantation
- Establish a national ESRD registry

AKI, acute kidney injury; CD, communicable diseases; CKD, chronic kidney disease; ESRD, end-stage renal disease; LMICs, low- and middle-income countries; NCD, non-communicable diseases; RRT, renal replacement therapy.

Modified from Tonelli M *et al.*¹¹

The importance of acute kidney injury recognition and prevention in LMICs

The public health narrative of KD is usually centered on CKD. Policy makers should be made aware that preventable community-acquired AKI poses added burden in many LMICs. In contrast, AKI in high-income countries is largely in hospitalized patients. A meta-analysis of 13 cohort studies confirmed that AKI is an important independent risk factor for CKD and end-stage renal disease (ESRD), death, and other important nonrenal outcomes.¹⁷ Repeated episodes of AKI accelerate CKD progression.¹⁸ The 0by25 initiative of the International Society of Nephrology has recognized reducing preventable deaths due to AKI a “human rights” issue and called for stakeholder engagement, public awareness, and education of general practitioners and nonphysician health workers on causes of AKI (e.g., infections, herbs, contaminated water, over-the-counter medicines, and obstetric care) and the importance of its prevention. The 0by25 group found that about 20% of all patients with AKI in LMICs did not receive dialysis despite indications, largely due to absence of resources and inability to afford cost of therapy.³ According to Olowu *et al.*,¹⁹ about 80% of undialyzed patients with AKI in sub-Saharan Africa die. The next set of studies by the 0by25 group will investigate whether AKI can be prevented by providing guideline-based care to these patients (<http://www.0by25.org>).

Table 2 describes the information that can help policy makers understand the need to develop a KD-specific health program.

Developing public policy for kidney disease

The public policy cycle is a 3-step process: formulation, implementation, and monitoring and evaluation.^{20,21} Formulation begins with estimation of disease burden, analysis of public policy alternatives, and evaluation of cost-benefit leading to an action plan (Figure 2).¹¹

Clearly defined objectives, a guideline-based action plan, attention to potential administrative conflicts, leveraging available resources, and positive engagement of all parties are key to successful implementation. Transparent qualitative and

Table 2 | What data do policy makers need?

- What are the data on intensity of AKI and CKD burden and intersection with other diseases/risk factors?
- What is the impact of kidney disease on population health and economics (in terms of DALYs and cost of care)?
- What is the cost-effectiveness of interventions at different stages of CKD?
- What target populations might benefit from kidney disease interventions (e.g., age, groups at increased risk, geographic location, or occupations)?
- Are there local factors that exacerbate or mitigate disease risk or implementation strategies?
- Who are the stakeholders and allies?
- Are there local evidence-based best practice management guidelines, or can global guidelines be adapted to suit local needs?
- What innovations can improve the delivery of care for kidney disease in an affordable and scalable manner in the context of local health system?
- How can we evaluate effectiveness of health care intervention (i.e., components, process and outcome)?
- Is there a need to set up kidney disease registries?
- What is the research agenda for improving locally appropriate implementation?
- What are the metrics for measuring successful implementation and progress of kidney disease prevention efforts?

AKI, acute kidney injury; CKD, chronic kidney disease; DALYs, disability-adjusted life years.

quantitative indicators help measure short- and long-term outcomes.

The role of KDIGO, national societies and other global or regional health organizations. Local adaptation starts with the identification of stakeholders interested in providing guideline-based care, such as professional societies, governments, insurance providers, or other interested groups. The availability of local champions fosters implementation.^{22,23}

Engagement of national or regional nephrology societies with global organizations can play a significant advocacy role. The successful collaboration between Pan American Health Organization and the Latin American Society of Nephrology and Hypertension that started with the participation of a Pan American Health Organization speaker at an International Society of Nephrology / Latin American Society of

Nephrology and Hypertension regional meeting in Guatemala in 2008²⁴ resulted in the inclusion of KD within the strategies for prevention of cardiovascular disease in the Americas and the creation of a task force for the study of the CKD epidemic in Central America.^{25,26}

Patient support groups, foundations, and nongovernmental organizations that are already advocating for NCD prevention and are engaged with policy makers can be powerful allies. In addition to educational and fundraising activities, these bodies can support advocacy to include KD in the public health agenda by organizing and advising patients to demand the care they need, collaborating with governments to replicate successful programs developed by nongovernmental organizations, and facilitating implementation of public health policies.²⁷ The steps involved in developing an advocacy project with these organizations are summarized in Figure 3.

Understanding barriers to implementation of guidelines in LMICs. Implementation of guideline-based care can be thwarted at several levels (Table 3). Resource constraints, perceived complexity of guidelines, physician attitude, and lack of training promote nonadherence to guidelines.²⁸ The National Institute for Health and Care Excellence (NICE), UK, has suggested steps to understand, identify, and overcome these barriers (Table 4).²⁹ Publishing simplified guidelines in local languages, customized educational slide decks, flow charts, algorithms, and flyers can facilitate implementation.

KIDNEY DISEASE IN THE CONTEXT OF LOCAL HEALTH SYSTEMS AND DISEASE BURDEN

Kidney disease registries play a vital role in public policy as public health surveillance tools. Registries provides a standardized method to collect data on disease burden, treatment, and outcomes, and monitor evolution over time.³⁰ In a recent review, no renal registries were identified in many LMICs, including India, Indonesia, the Philippines, and almost all African countries.^{30,31} Establishing and maintaining a registry requires initial investment from public funds but provides

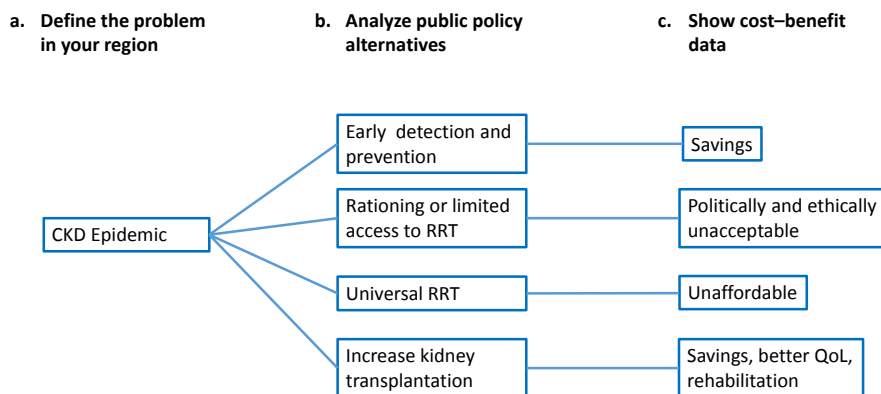


Figure 2 | Steps involved in the formulation of a public health policy on CKD. Modified from Manual de incidencias en Políticas Publicas. Tapia-Alvarez M, Campillo-Carrete B, Cruickshank-Soria S, Morales-Sotomayor G, eds. *Alternativas y Capacidades AC*; Mexico, DF. 2010. Available at: <http://www.alternativasycapacidades.org/>.²⁷ CKD, chronic kidney disease; QoL, quality of life; RRT, renal replacement therapy.

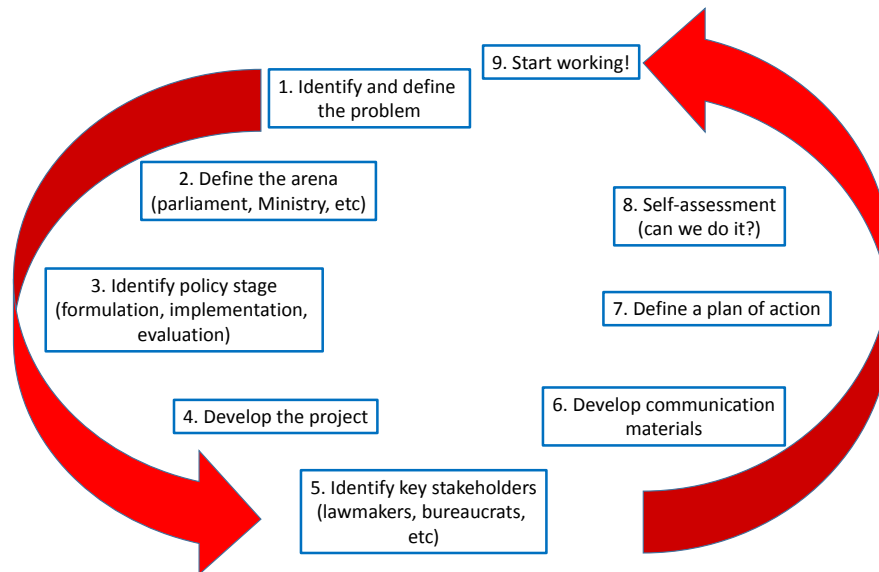


Figure 3 | How nongovernmental organizations can influence public health policies. Modified from Manual de incidencias en Políticas Publicas. Available at: <http://www.alternativasycapacidades.org/>.²⁷

immense value in informing development of CKD prevention and renal replacement therapy programs.³⁰ It also requires the ability to identify KD using appropriate tests and availability of dialysis and/or transplant (for ESRD registries). Countries that are planning to develop renal replacement therapy programs should incorporate a registry as a component.

Table 3 | Current barriers to kidney disease care in LMICs

- **System-level barriers**
 - Lack of access to health insurance
 - Lack of trained manpower and resources
 - Lack of education around standardized, guideline-based uniformity of care
 - Lack of coordinated efforts by stakeholders in development of a comprehensive health care response to emerging threats
 - Focus on curative rather than preventive medicine
 - Unregulated health care systems—no incentives for quality improvement
 - Lack of incentives for disease prevention
- **Kidney disease-specific issues**
 - Inadequate health systems response to kidney care delivery
 - Omission of kidney disease screening and management in course curricula
 - Lack of data on AKI and CKD burden and its consequences
 - Inadequate understanding of risk factors for CKD development and/or progression
 - Inadequate understanding of the consequences of missed opportunities for kidney disease care
 - Delayed diagnosis and late presentation with advanced disease and complications
 - Fragmentation of information and communication on kidney disease care
 - Lack of locally appropriate or adapted guidelines for kidney disease (e.g., language, complexity, implementation tools)
 - Lack of standardized care tools for physicians and educational tools for patients

AKI, acute kidney injury; CKD, chronic kidney disease; LMICs, low- and middle-income countries.

Health care policies and financing by the government are the key determinants of access, availability, and coverage in each country. Many countries exhibit internal heterogeneities in health care delivery, financing, and reimbursement policies.^{32,33} LMICs with limited or poor access to dialysis also lack primary and secondary prevention programs for NCDs such as hypertension, diabetes, and obesity, all known CKD risk factors.

Are there common characteristics of kidney care in countries with high kidney disease prevalence and limited resources?

In general, LMICs allocate insufficient resources to health care and have an unstructured model of care, resulting in late presentation and referrals. Recent analysis of the Monitoring Dialysis Outcomes (MONDO) database including data of 84,796 hemodialysis patients from 27 countries demonstrated a significant association between socio-economic factors, dialysis variables, and health quality indicators.³⁴ Low resource allocation bears close correlation with the prevalence of ESRD (Supplemental Figure S2).¹ Late referral adversely impacts morbidity and mortality,¹ leading to urgent start dialysis and high prevalence of temporary vascular access usage. The renal replacement therapy choice is also affected by the availability and cost of treatment, rather than by patient preference and clinical outcomes.³⁵

LMICs are plagued by shortage of health care professionals including kidney specialists, leading to nonstandard delivery of care and poor outcomes. Kidney care, including that for advanced CKD, is frequently provided by non-nephrologists in LMICs.^{36,37} A cultural component of denial adds to sub-optimal management and loss to follow-up. By way of example, irregular hemodialysis frequency and nonstandard reuse of dialyzers,^{36,37} variable access to drugs, and poorly

Table 4 | Understanding, identifying and overcoming barriers to guideline implementation

Understanding the barriers to change	Identifying the barriers to change	Overcoming the barriers to change
<ul style="list-style-type: none"> • Awareness and knowledge • Motivation • Practicalities • Acceptance and beliefs • Skills • The external environment 	<ul style="list-style-type: none"> • Talk to key individuals • Observe clinical practice in action • Use a questionnaire • Brainstorm • Run a focus group 	<ul style="list-style-type: none"> • Educational materials^a • Educational meetings, interactive workshops • Educational outreach visits^b • Opinion leaders • Clinical audit and feedback^c • Reminder systems^d • Patient-mediated strategies (e.g., mass media campaigns)

^aFormats and layout can affect the influence of materials in changing behavior. They are low cost but need follow up.

^bAttention to the visitor, frequency, tailor to barriers.

^cClinically rich data and buy-in needed.

^dEspecially at decision-making points, more for in-training staff.

regulated use of generics and biosimilars are frequent in LMICs.

If universal ESRD therapy is not available in a country, what type of care should be available to patients and the community?

Lack of financial resources forces patients in many LMICs to either reduce dialysis frequency, withdraw from dialysis, or use alternative treatments that are untested or of dubious value. Supportive or palliative care for patients with advanced CKD is nonexistent in LMICs. A recent KDIGO Controversies Conference addressed the issue of supportive care in CKD.³⁸ This is best achieved through a multidisciplinary team including nephrologists, nurses, psychosocial workers/counselors, dietitians, allied health professionals, and community leaders, many of whom may not be available in LMICs. Research is needed on the modality and impact of supportive care provision in LMICs on patients who cannot access dialysis due to financial reasons.³⁸

Even when dialysis is available, policies for its delivery can be arbitrary and not clearly stated, as provision is driven by market forces. Since dialysis cannot be provided to all individuals, guidelines based on a transparent decision making, taking into account the individual patient's circumstances, should be developed to optimize use of this limited resource. Countries must set their own priorities and establish transparent protocols. For example, in South African state hospitals, dialysis is only offered to those who consent to receiving a transplant when offered.³⁹ In Thailand, an ESRD patient can be treated for free by peritoneal dialysis, whereas those who decline the offer and choose hemodialysis will not get any financial support.⁴⁰

INNOVATIONS IN HEALTH CARE DELIVERY: MANPOWER RESTRUCTURING AND USE OF TECHNOLOGY

Manpower and technology have an important impact on the ability to implement guideline-based kidney care. Although care by nephrologists generally results in better outcomes,^{41,42} shortage of nephrologists makes this impractical in LMICs.⁴³ Because interventions to reduce KD burden are likely to be implemented at primary care settings, it is logical to involve general physicians and nurses.⁴⁴ Non-physician health care

workers (NPHWs) have been trained successfully in delivering interventions for communicable diseases and reproductive health.⁴⁵ Both physician and non-physician primary care providers should be trained in the entire spectrum of guideline-driven prevention, detection, and management of KD.⁴⁶

Increase manpower: train more nephrologists and task shift other providers in kidney care

Increasing the number of nephrologists through expanded, supported, and strengthened nephrology training programs is an important goal. This may require international cooperation facilitated by global nephrology organizations. The increased training can be counteracted by a continuing brain drain from LMICs to high-income countries.⁴⁷

Training NPHWs in early diagnosis and referral and community management for kidney care can reduce manpower requirements and improve outcomes. For optimal results, such a system should be developed in the overall context of management of chronic diseases, such as diabetes, hypertension, and cardiovascular disease.⁴⁸

Standardized algorithms/pathways should be based on evidence-based guidelines after appropriate adaptation for CKD prevention and management with clear decision points, checklists, and levels of referral according to the local health care infrastructure.⁴² The algorithms should include management action plans in a user-friendly format for the local providers (including diabetologists and cardiologists).⁴⁹

This effort should be complemented by development of a master curriculum with a toolkit for local adaptation. A trainer's guide with instructions on standardized training, competency, and skills assessment with requirements for certification and mandatory recertification will be helpful. Institution of quality parameters and performance incentives have been shown to work in improving outcomes. The quality and structure of incentives, however, may be different for public providers and private practitioners. Education of patients and practitioners has been shown to reduce the risk of decline in kidney function and/or death.^{50,51}

Although dialysis ideally should be prescribed by nephrologists, training primary care physicians and nurse practitioners to work in dialysis units under nephrologist

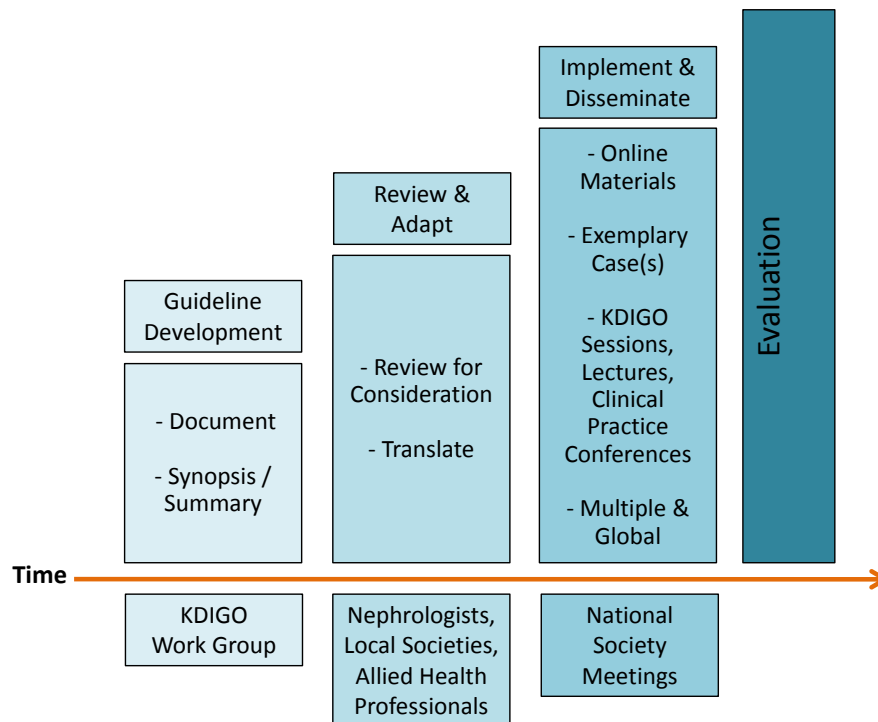


Figure 4 | Pathway to guideline implementation.

supervision is advisable to meet the rising workload demands of dialysis in LMICs.¹ Appropriate utilization of such personnel will require development of standard operating procedures and continuous quality monitoring.

Innovation for CKD screening, awareness, and management

Population-wide screening for undiagnosed diabetes and high blood pressure has been advocated by most professional societies and is increasingly being integrated into NCD management policies throughout the world. Large universal CKD screening programs have taken place in the Netherlands, the United States, Japan, and China.^{52,53} This strategy is of particular importance in LMICs, where approximately half of people affected with these conditions are undiagnosed.⁵⁴ Current recommendations suggest limiting screening for CKD to those with known risk factors such as hypertension, diabetes, older age, family history of kidney disease, and certain ethnicities.⁵⁵ Use of point-of-care tests is important to improve uptake, as it can provide real-time feedback to the participants on the measured parameters.

The conference participants recognized the limitations of current CKD screening recommendations in geographic areas where abnormally high prevalence of CKD of nontraditional etiology is reported.⁵⁶ The scope of screening might need to be expanded to other populations, such as to those with exposure to novel risk factors. Geographically targeted screening of unique at-risk populations, such as Canadian First Nations people, has yielded increased rates of CKD detection over nontargeted universal screening.⁵⁷ Appropriately designed studies are needed to define the magnitude of disease and risk factors in different geographies. Practical point-of-care systems

for glomerular filtration rate estimation will need to be developed and validated because most of these patients do not exhibit proteinuria.⁵⁸ More data are required on the cost effectiveness of screening followed by interventions (e.g., hydration through “water breaks” and shade for those who work outdoors in hot and humid ambient conditions).^{58–60}

Clinical decision support systems can boost the ability of NPHWs and primary care physicians to deliver uniform high-quality, guideline-based care in the community. The efficiency of this approach can be improved by using information technology through mobile applications that can provide decision support and management plans in real time, integrated tracking and monitoring, reminder and recall service via voice or text messaging, drug inventory management and education materials. These tools have been shown to increase long-term adherence to treatment and thereby delay development and/or progression of cardiovascular disease.⁶¹ Telemedicine has been used to prescribe and monitor dialysis in the United States and other developed countries, though its role in providing nephrologist oversight to dialysis units managed by non-nephrologists in remote areas in LMICs deserves further evaluation.^{62,63}

DEVELOPING AND IMPLEMENTING RESOURCE SENSITIVE GUIDELINES

KDIGO is committed to ensuring the utility of its clinical practice recommendations that have been developed based on the best evidence. High-quality clinical trials, outcome studies, and registries are nonexistent in LMICs presently, with little hope of obtaining local data to inform and adapt guideline recommendations to local context.^{64,65}

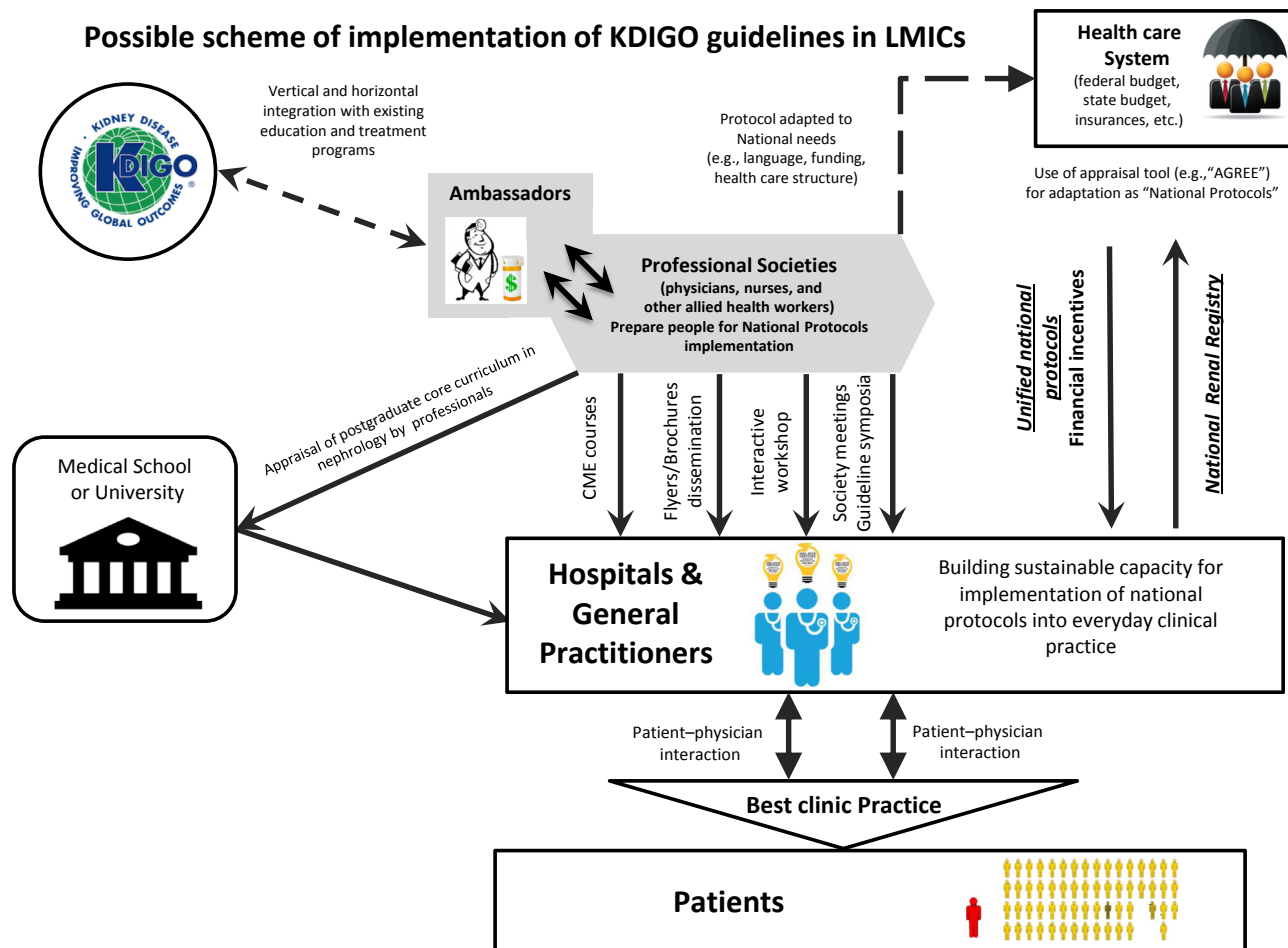


Figure 5 | Key players in the implementation of KDIGO guidelines in LMICs. LMIC, low- and middle-income countries.

While all guideline-rating recommendations should be considered when using available clinical practice guidelines, it is suggested that grade 1 recommendations should be prioritized for adaptation because they are usually based on the highest quality of evidence. Adaptation should be under the jurisdiction of the local renal societies.

Country-based dissemination of the adapted guideline version is best achieved through local publications, participation in local conferences/symposia or workshops. Case presentations that illustrate how the guidelines are used to optimize care are particularly well-received. Such collections can be used as teaching tools for a recommended course of action. “Train the trainers” could be an important focus of such an initiative and as an implementation tool. A “bank” consisting of easily understood algorithms to guide management of patients under specific circumstances could be kept for presentations at congresses and symposia. Continuing medical education credits could increase the participation of young doctors and thereby ensure wider dissemination of guidelines. Special sessions at local congresses or webinars are other methods of dissemination that could help caregivers better understand the KDIGO process of guideline development and implementation.

Novel methods for guideline implementation include public-private partnerships. Local pharmaceutical companies can assist guideline dissemination as part of “detailing”. Where possible, guideline recommendations should be harmonized with those produced by other organizations with overlapping interests (e.g., diabetology, hypertension, infectious diseases, and public health etc.). Avoiding discordance is essential to minimize confusion, assist uptake and facilitate the educational process on KD to local caregivers.

Any adaptation must carry a reference to the original guideline source. The diverse nature of diseases and health systems in different LMICs may require different implementation approaches. However, a certain degree of uniformity in adaptation is desirable, such as the requirement for an auditing system.

A uniform and well-recognized simple adaptation formula is the ADAPTE framework (Supplemental Figure S3).⁶⁶ However, if other validated methods exist in a particular country, these should be used for the adaptation and audit.

The style and language of the KDIGO guideline recommendations is standardized and based on a Grading of Recommendations Assessment, Development and Evaluation (GRADE) approach. Locally adapted versions should be user

friendly and rendered practical for application in local geographies. Allied health professionals must also be taken into account in the translation and adaptation to ensure a wider distribution and greater acceptance of the guidelines.

Comparisons of KDIGO guidelines with locally adapted guidelines would serve to educate and improve the adaptation process and is an ideal that all adapted guidelines should aspire to. Online training from KDIGO with input and advice from local caregivers can help this process, especially if variance exists between KDIGO recommendations and local practice.

A suggested guideline adaptation and implementation process for LMICs is shown in [Figure 4](#).

Simplify communication and engage other professional societies

The most commonly used guidelines need to penetrate primary care and cross-cutting specialties such as endocrinology and cardiology, as these providers are more likely to encounter individuals in earlier stages of CKD. Joint meetings can help promote the provision of scalable and affordable models of guideline-based care in their areas of influence. This approach requires identification of local champions who can work with local societies. The messaging should be developed such that the other specialists feel empowered rather than threatened, especially while discussing referrals. Adaptation should take into account both global science and local resources.

CONCLUSION

The rising burden of NCDs has been recognized as a threat to the global community that calls for urgent steps, as articulated in the SDG 3.8. Because KDs are important contributors to this burden, there is a critical requirement for the development of an implementation framework tailored to the local needs of health systems and to optimize the quality of care for patients at risk for developing KD in limited-resource settings. All health system stakeholders should be engaged in the development and implementation of guideline-based care, using a framework consistent with local policies. A multi-pronged approach is required to align the kidney care delivery model to the health care system. This includes leveraging existing frameworks for care of communicable diseases and NCDs and customizing them for the challenges of AKI and CKD. Existing policies, payment systems, and care delivery models should be utilized. The health care work force should be empowered with technology to develop affordable, scalable, and acceptable models of care delivery. Support from national, regional, and global professional societies is needed for training and continuing professional development of nephrologists, physicians, and NPHWs in implementation science and understanding of health systems; developing capacity to adapt guidelines; and integration of these principles in medical, paramedical, and nursing school curricula. [Figure 5](#) shows a suggested scheme of implementation for guideline-based care in LMICs.

Major gaps remain in the development and implementation of a “health systems” approach to overcome the barriers and facilitate delivery of optimal guideline-based care for patients with and at risk of developing KD. A robust international and culturally sensitive research agenda in this area is essential. It is anticipated that this conference and future planned work will provide the impetus to develop, evaluate, and implement care frameworks in limited-resource settings.

The participants recognized the uniquely influential position of KDIGO as an international collaboration in designing, implementing, and testing effective and efficient models of guideline implementation to reduce KD burden, in collaboration with like-minded organizations such as the International Society of Nephrology, national and regional nephrology and physician societies, kidney foundations, and multilateral organizations such as the World Health Organization.

DISCLOSURE

VJ declared having received research support from Baxter and GlaxoSmithKline. AJC declared having received consultancy fees from AstraZeneca, Bayer, Gilead, and Relypsy. GG-G declared having received consultancy fees from Pisa Farmaceutica and speaker honoraria from Abbvie. THJ declared having received research support from Wellcome Trust UK, Medical Research Council, Department for International Development, and Singapore Ministry of Health. RP-F declared having received consultancy fees from Akebia and Janssen; speaker honoraria from AstraZeneca, Janssen, and Novartis; and research support from Fresenius. CRS declared having received consultancy fees from Fresenius. AYMW declared having received speaker honoraria from Sanofi. DCW declared having received consultancy fees from Akebia, Amgen, Boehringer Ingelheim, Bristol Myers Squibb, GlaxoSmithKline, Janssen, Otsuka, UCB Celltech, and Vifor; speaker honoraria from Amgen, Fresenius, Janssen, Vifor, and ZS Pharma; and research support from British Heart Foundation, Healthcare Quality Improvement Partnership, Kidney Research UK, National Institute for Health Research, and Australian National Health & Medical Research Council. All the other authors declared no competing interests.

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SUPPLEMENTARY MATERIAL

Figure S1. Age-specific prevalence estimates and absolute numbers of men and women with chronic kidney disease worldwide. (A) Stages 1–5. (B) Stages 3–5. Reproduced with permission from Mills KT, Xu Y, Zhang W, et al. A systematic analysis of worldwide population-based data on the global burden of chronic kidney disease in 2010. *Kidney Int.* 2015;88:950–957.¹⁰

Figure S2. Global prevalence of end-stage kidney disease for 2012 with estimated numbers of patients receiving and requiring renal replacement therapy by region. Reproduced with permission from Romanowski K, Clark EG, Levin A, et al. Tuberculosis and chronic kidney disease: an emerging global syndemic. *Kidney Int.* 2016;90:34–40.⁶⁷

Figure S3. Overview of the ADAPTE process. Reproduced with permission from The ADAPTE Collaboration (2009). The ADAPTE

Process: Resource Toolkit for Guideline Adaptation. Version 2.0.

Available at: <http://www.g-i-n.net>.⁶⁶

Supplementary material is linked to the online version of the paper at www.kidney-international.org.

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APPENDIX

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