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Kidney Disease: Improving Global Outcomes Summit Recommendations on Implementation of Diabetes Management in CKD: From Primary to Data-Driven Collaborative Care

Philip Kam-Tao Li[1,2,3], Michael Cheung[4], Kai-Ming Chow[1,2], Maria Kwan Wa Leung[5], Lee-Ling Lim[1,6,7], Juliana N.M. Lui[1], Andrea O.Y. Luk[1,8], Jo-Anne Manski-Nankervis[9,10], Samuel Seidu[11,12], Nikhil Tandon[13], Adrian Liew[14], Peter Lin[15], Fei Chau Pang[16], Na Tian[17], Kohjiro Ueki[18,19], Martin C.S. Wong[20,21,22,23], Sophia Zoungas[24], Kit Man Loo[25], Kin Lai Chung[26], Victor Hin-Fai Hung[27], Huyen Thi Thanh Vu[28,29], Maggie Lee[30], Junne-Ming Sung[31], Cheuk Chun Szeto[1,2], Man Wo Tsang[32], Sunny Wong[32], Jack Kit Chung Ng[1,2,33], Harriet Chung[34], Sydney C.W. Tang[35], Kenny Kung[36], Sing Leung Lui[37], David V.K. Chao[38], Coral Cyzewski[4], Tanya Green[4] and Juliana C.N. Chan[1,6,8,33]

[1]Department of Medicine and Therapeutics, The Chinese University of Hong Kong, Prince of Wales Hospital, Hong Kong Special Administrative Region, China; [2]Carol and Richard Yu Peritoneal Dialysis Research Centre, Department of Medicine and Therapeutics, The Chinese University of Hong Kong, Prince of Wales Hospital, Hong Kong Special Administrative Region, China; [3]International Association of Chinese Nephrologists, Shatin, Hong Kong Special Administrative Region, China; [4]KDIGO, Brussels, Belgium; [5]Department of Family Medicine, New Territories East Cluster, Hospital Authority, Hong Kong Special Administrative Region, China; [6]Asia Diabetes Foundation, Hong Kong Special Administrative Region, China; [7]Department of Medicine, Faculty of Medicine, Universiti of Malaya, Kuala Lumpur, Malaysia; [8]Hong Kong Institute of Diabetes and Obesity, The Chinese University of Hong Kong, Prince of Wales Hospital, Hong Kong Special Administrative Region, China; [9]Department of General Practice and Primary Care, The University of Melbourne, Melbourne, Australia; [10]Primary Care and Family Medicine, Lee Kong Chian School of Medicine, Nanyang Technological University, Singapore, Singapore; [11]College of Medicine, Biological Sciences and Psychology, Diabetes Research Centre, University of Leicester, Leicester, UK; [12]NIHR Applied Research Collaboration - East Midlands, Leicester, UK; [13]Department of Endocrinology, All India Institute of Medical Sciences, Delhi, India; [14]The Kidney and Transplant Practice, Mount Elizabeth Novena Hospital, Singapore; [15]Canadian Heart Research Centre, Toronto, Ontario, Canada; [16]Primary Healthcare Office, Health Bureau, Hong Kong Special Administrative Region, China; [17]Department of Nephrology, General Hospital of Ningxia Medical University, Yinchuan, Ningxia, China; [18]Department of Molecular Diabetology, Graduate School of Medicine, The University of Tokyo, Tokyo, Japan; [19]Diabetes Research Center, Research Institute, National Center for Global Health and Medicine, Tokyo, Japan; [20]Centre for Health Education and Health Promotion, Jockey Club School of Public Health and Primary Care, The Chinese University of Hong Kong, Hong Kong Special Administrative Region, China; [21]School of Public Health, Peking University, Beijing, China; [22]The Chinese Academy of Medical Sciences and Peking Union Medical College, Beijing, China; [23]School of Public Health, Fudan University, Shanghai, China; [24]School of Public Health and Preventive Medicine, Monash University, Melbourne, Victoria, Australia; [25]Diabetes and Endocrine Centre, Day Treatment Block and Children Wards, Prince of Wales Hospital, Hong Kong Special Administrative Region, China; [26]CCE Office, Prince of Wales Hospital, New Territories East Cluster, Hong Kong Special Administrative Region, China; [27]Department of Medicine and Geriatrics, Princess Margaret Hospital, Hong Kong Special Administrative Region, China; [28]Department of Geriatrics, Hanoi Medical University, Hanoi, Vietnam; [29]Scientific Research Department, National Geriatric Hospital, Hanoi, Vietnam; [30]Department of Medicine and Geriatrics, New Territories West Cluster, Hospital Authority, Hong Kong Special Administrative Region, China; [31]Department of Internal Medicine, National Cheng Kung University Hospital, Taiwan; [32]Department of Medicine and Geriatrics, United Christian Hospital, Hong Kong Special Administrative Region, China; [33]Li Ka Shing Institute of Health Sciences, The Chinese University of Hong Kong, Prince of Wales Hospital, Hong Kong Special Administrative Region, China; [34]Shumshuipo District Health Centre, Hong Kong Special Administrative Region, China; [35]Division of Nephrology, Department of Medicine, School of Clinical Medicine, The University of Hong Kong, Hong Kong Special Administrative Region, China; [36]The GBA Healthcare Group, Hong Kong Special Administrative Region, China; [37]Department

Correspondence: Philip Kam-Tao Li, Department of Medicine and Therapeutics, Carol and Richard Yu PD Research Centre, The Chinese University of Hong Kong, Prince of Wales Hospital, 30–32 Ngan Shing St, Shatin, New Territories, Hong Kong SAR, China. E-mail: philipli@cuhk.edu.hk; or Juliana C. N. Chan, Department of Medicine and Therapeutics, Hong Kong Institute of Diabetes and Obesity, The Chinese University of Hong Kong, Prince of Wales Hospital, Shatin, New Territories, Hong Kong SAR, China. E-mail: jchan@cuhk.edu.hk

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of Medicine, Tung Wah Hospital, Hong Kong Special Administrative Region, China; and [38]Department of Family Medicine and Primary Health Care, United Christian Hospital, Hong Kong Special Administrative Region, China

Type 2 diabetes and chronic kidney disease (CKD) are preventable and treatable. Their silent and progressive clinical course calls for structured assessment with timely feedback to patients and care providers for activating decision-making. Apart from CKD, patients with diabetes can have complications affecting multiple organs, notably the cardiovascular system, eyes, and feet. International practice guidelines recommend annual assessment of the eyes, feet, blood, and urine to detect silent complications and measure cardiovascular-kidney-metabolic (CKM) risk factors to ensure early intervention, including treatment to multiple targets and use of organ-protective drugs. In this report, we highlight the barriers and gaps in the implementation of practice guidelines in managing diabetes in CKD with proposed solutions to overcome such barriers. By improving the practice environment and workflow, nurses can be trained to perform protocol-guided evaluation under medical supervision. The systematic data collection enables physicians to make timely decisions, including drug prescriptions and referrals to other specialists to promote collaborative care, whereas nurses can use the personalized data to empower patient self-management and improve health literacy. This ongoing data collection will form a register to align payers, providers, and patients in delivering data-driven and value-based care with the creation of real-world evidence to verify treatment effectiveness and identify care gaps while providing on-the-job training. When accompanied by a biobank, the ongoing collection and analysis of this multidimensional data will refine diagnosis, classification, prognosis, and treatment in pursuit of precision medicine.

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Introduction

CKD affects 25% to 40% of patients with diabetes, predominantly type 2 diabetes mellitus (referred to hereafter as diabetes).[1,2] Both conditions are complex, progressive, and silent in early stages. To ensure timely intervention, CKM risk markers, including blood pressure (BP), body weight, glycated hemoglobin (HbA1c), low-density lipoprotein cholesterol, estimated glomerular filtration rate (eGFR) and urinary albumin-to-creatinine ratio (UACR), should be regularly measured, managed, and monitored. Self-management, regular medical review and treatment adherence require patient education, empowerment, and engagement. To achieve these multiple goals, a redesign of workflow, team structure, and clinic setting is needed to increase the efficiency and effectiveness of diabetes assessment, management, and education aimed at reducing hospitalization, morbidities, and premature mortality.[3]

The World Health Organization has included self-monitoring kits; laboratory assessments; and medications, notably statins, renin-angiotensin system inhibitors (RASi), and sodium-glucose cotransporter-2 inhibitor (SGLT2i) as essential management tools[4–6]; albeit enormous care gaps remain even in countries with medical coverage. On average, 17 years is needed to translate research into practice and policies in health care.[7] This might due to insufficient awareness, infrastructure, or alignment among all stakeholders, including but not limited to researchers, providers, and payors.[8]

In July 2023, medical experts and educators, administrators, and policymakers from around the world assembled in Hong Kong for a 2-day workshop to identify barriers and enablers in implementing the 2022 Kidney Disease: Improving Global Outcomes (KDIGO) Practice Guideline for Diabetes Management in CKD.[9] The meeting was conceptualized by the cochairs in February 2023 (PKTL and JCNC) with assistance from KDIGO. This was followed by invitation of experts divided into 4 groups and tasked to review the literature and provide recommendations on the following topics: (i) building optimal models of care in settings with different resources, (ii) enhancing the role of primary care providers (PCPs) in the management of patients with CKD and diabetes, (iii) fostering collaborative care among interdisciplinary specialists, and (iv) identifying factors that drive the success of care models. The 2-day meeting was attended by > 300 health care professionals, including officials with diabetes and kidney nurse specialists representing patients' voices. The meeting commenced with lectures delivered by additional experts, and it was followed by a 1-day workshop with deliberations among all faculty members. The lead of each group then submitted the consensus recommendations on the 4 topics to the cochairs, who finalized the report with the approval of all faculty members (https://kdigo.org/conferences/primary-care-implementation-summit/).

Premise for Using Data to Drive Actions and Implement Evidence-Based Guidelines

More than 3 decades of innovative research and best practices have confirmed that diabetes and kidney disease can be prevented, managed, and controlled, despite the enormous care gaps. Nevertheless, a patient with diabetes and CKD may encounter many care providers, including primary care doctors, internists, endocrinologists, nephrologists, cardiologists, traditional medicine practitioners, allied health workers, trained community workers, or peer supporters, with considerable variations in quality of care received. This may be because of variations in professional knowledge, health care systems, access to technologies, and medical coverage. These variations make regular and structured assessment imperative for quality assurance, benchmarking, and identifying care gaps.

Diabetes and its complications, notably CKD, are silent disease states whose risk factors and treatment targets are often characterized by numerical values, thus making regular measurements imperative in guiding medical decisions and empowering patient self-management. Here, doctors have the integrated knowledge and skills to diagnose and treat patients. At the same time, they are in a position to strengthen knowledge, skills, and attitudes of other health care providers to translate evidence to practice.[10] With increasing complexity of practice guidelines and prescribing rules, it has become even more important for doctors to design protocols and improve consistency of measuring these risk factors early for prescribing guideline-directed medical therapy. By changing workflow, these data can be gathered by nonmedical staff for quality improvement. This care reorganization will provide on-the-job training and align all stakeholders, including payors, patients, and providers to detect, treat, and control diabetes and CKD early.[11]

Barriers and Gaps in Implementing Evidence-Based Diabetes Management in CKD

In this "knowledge-attitude-behavior" framework,[12] lack of agreement and complexity of guidelines were respectively considered by 91%[13] and 61% of PCPs, as major barriers.[14] Promoting partnerships among stakeholders, including professional bodies, patient advocacy groups, and patient representatives may help align expectations, incentives, and practice to improve adherence to treatment guidelines.[9] Reform of undergraduate education and on-the-job training programs are crucial while a context-relevant health care financial system is needed to build competent workforce and ensure access to assessment, education, and treatment of diabetes and CKD.[15,16]

According to the International Society of Nephrology Global Kidney Health Atlas, 64% of countries rated CKD awareness among PCPs to be low or below average or extremely low.[17] In a systematic review of qualitative research on the barriers and/or enablers to detection and/or management of CKD in adults within primary health care,[18] the most common barrier identified was a lack of time, followed by a fear of delivering a diagnosis of CKD, and dissatisfaction with CKD guidelines. Apart from time and resource constraints, the complexity of multiple guidelines produced by different organizations can, not unexpectedly, overwhelm primary care physicians from selecting the most appropriate guidelines for implementation. The most common enabler identified was the presence of supportive technology to identify and manage CKD, followed by the presence of a collaborative relationship among members of the health care team.[17]

Engage PCPs to Detect and Manage Diabetes and CKD Early

In well-developed health care systems, which adopt multidisciplinary care, PCPs are in a position to perform regular assessment of at-risk patients to diagnose CKD and prevent its progression. As the first contact point of patients, PCPs must be competent in detecting and managing CKD with timely referral to specialists for patients with complex and atypical presentations.[19] Given the silent nature of diabetes and CKD, patient education is important to enhance patients' willingness to undergo regular assessments, which are essential for implementation of practice guidelines.

Ensure Access to Adequate Coverage for Detection and Treatment

In low-resource settings, PCPs often lack access to laboratory services or guideline-directed medical therapy because of high costs, insufficient insurance coverage and reimbursement, uncoordinated care, and lack of incentives for quality improvement.[20,21] The use of "numbers needed-to-treat" and short-term savings because of reduced hospitalizations may help payors prioritize their investments.[20] Targeted screening of patients with risk factors such as diabetes, hypertension, cardiovascular disease, family history of CKD, or age $\geq$ 60 years will increase the cost-effectiveness of detection of CKD.[22-25]

Measure CKM Risk Factors to Change Disease Trajectory

Cardiometabolic risk factors (e.g., BP, HbA1c, lipids, and body weight) and microvascular complications,

notably kidney impairment (eGFR and UACR) and retinopathy (visual acuity and fundal changes) are silent. These risk factors and complications need to be detected, treated, and monitored to prevent their additive and causal impacts on cardiovascular-kidney disease.[26,27] High level evidence from randomized controlled trials[28] have confirmed that multifactorial management aimed at improving HbA1c, BP, and lipids, as well as the persistent use of statin and RASi reduced progression to kidney failure in patients with early[29] or advanced CKD.[30]

Random spot UACR and eGFR are the recommended screening methods for CKD. All laboratories should report both serum creatinine and eGFR values to facilitate decision-making.[9] The frequent clustering of CKM risk factors, including BP, body weight, lipid, glycemic indexes, UACR, and eGFR should be measured in the same setting and annually as a package[19,22,31,32] to evaluate their additive effects on complications.[9] If laboratory UACR is not available, point-of-care UACR with reliable accuracy may be considered.[24] Spot urine protein measurement, either by laboratory or point-of-care (with quantification) methods, is the minimum annual screening test (Figure 1).[9]

Engage Nonphysician Health Care Workers With Medical Supervision

Guided by protocols with medical supervision, trained nurses can be tasked to educate patients; perform assessments; help titrate insulin dosage; and provide liaison between patients and doctors to improve the efficiency, quality, and value of collaborative care. Regular interdisciplinary team meetings will promulgate evidence-based medical practice with open dialogues.[33] On average, at least 4 hours of education is needed to help patients learn how to self-manage with more time needed for patients with complex problems.[34,35]

Enhance Access to Strategies for Preventing CKD Progression

Complex practice guidelines, lack of training, resource constraints, insufficient skilled workers, and lack of financial incentives contribute to therapeutic inertia and low adherence to guidelines.[22,36,37] Among the US Veteran Affairs health care facilities, in 2013 to 2014, only 47% and 66% patients with diabetes and CKD, respectively, received BP-lowering drugs and RASi.[38] In the US CURE-CKD Registry, in 2006 to 2017, only 7% of patients with CKD and diabetes or prediabetes were treated with RASi and 25% of those with

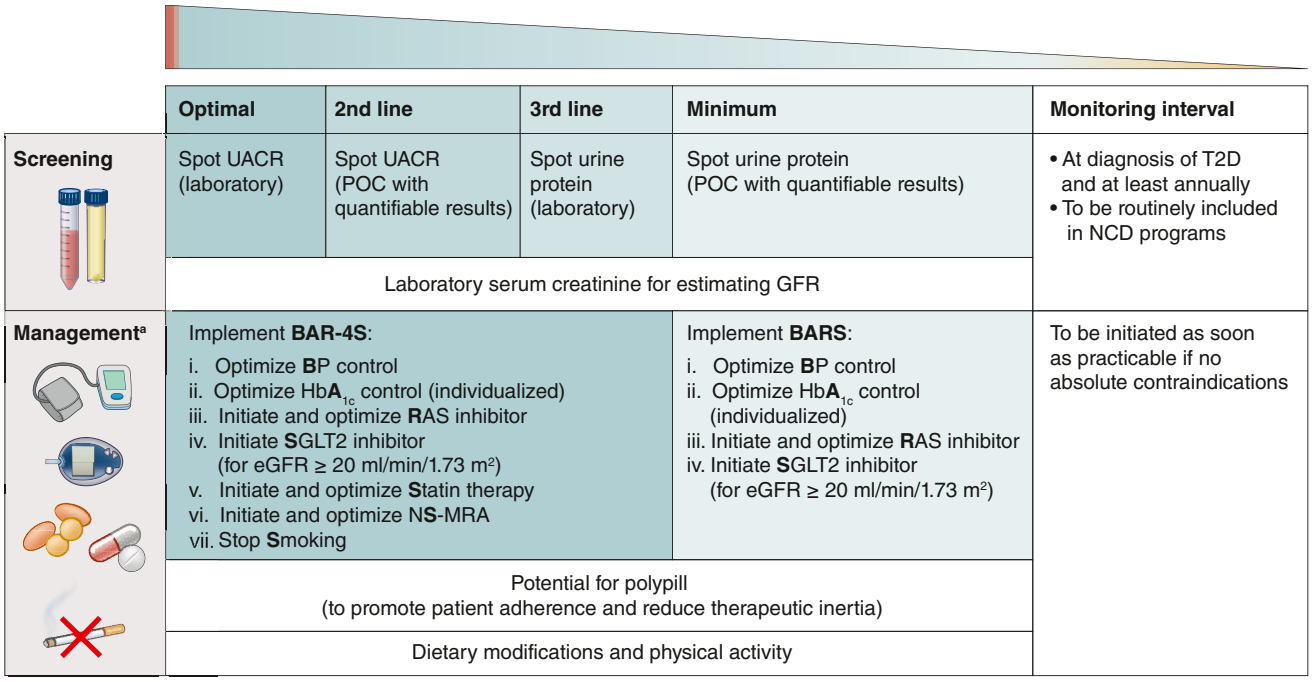

Figure 1. A concise action framework to enhance early detection of chronic kidney disease (CKD) in T2D in the primary care setting, with considerations given to availability and scalability of resources. A diagnosis of CKD can be made in the presence of either eGFR $<$ 60 ml/min per 1.73 m^2 or albuminuria $>$ 3 mg/mmol (or 30 mg/g) for at least 3 consecutive months.[9] [a]Management of CKD and type 2 diabetes is based on the KDIGO 2022 Clinical Practice Diabetes Guideline.[9] BP, blood pressure; eGFR, estimated glomerular filtration rate; HbA_{1c}, glycated hemoglobin; KDIGO, Kidney Disease: Improving Global Outcomes; NCD, non-communicable disease; NS-MRA, nonsteroidal mineralocorticoid receptor antagonist; POC, point-of-care; RAS, renin-angiotensin system; SGLT2, sodium–glucose cotransporter-2; T2D, type 2 diabetes; UACR, urinary albumin-to-creatinine ratio.

coexistent hypertension.[39] The corresponding proportions for statin therapy were 17% and 42%,[39] with < 1% of patients being on SGLT2i.[39] In India, only 15% of patients with diabetes were treated with RASi,[40] albeit with considerable variations across settings and care providers.[41,42]

A recent study indicated low treatment initiation and high discontinuation rates, respectively, of 17.8% and 56.0% for angiotensin-converting enzyme inhibitors or angiotensin receptor blockers, 1.3% and 66.0% for nonsteroidal mineralocorticoid receptor antagonists (ns-MRAs), 2.5% and 65.0% for SGLT2is, 3.7% and 66.8% for dipeptidyl-peptidase 4 inhibitors, 2.31% and 69.0% for glucagon-like peptide 1 receptor agonist (GLP-1 RAs), 4% and 75.7% for insulin, and 5.5% and 56.9% for sulfonylureas.[43] These real-world evidence highlight the importance of patient education on treatment persistence for silent diseases such as diabetes and CKD. In another study including 7199 patients with CKD and diabetes, 80.3% experienced care gap in SGLT2i prescription and 42.0%, in RASi prescription.[44]

Among other reasons, the high costs of many recently developed organ-protective medications have rendered reduced access not only in low-and-middle income countries and low-income countries but also high-income countries. These financial barriers have made it even more urgent to perform regular structured assessments using simple tools to facilitate early control of multiple risk factors using conventional medications and patient empowerment. With care reorganization to facilitate regular review, it is possible to prevent silent progression and development of cardiovascular-kidney complications, which are expensive and difficult to treat.[3]

Implementation of KDIGO Practice Guidelines

The KDIGO staging and risk stratification by eGFR and UACR should be widely disseminated in different languages for risk communication.[9] Control of BP and HbA1c as well as use of RASi and SGLT2i (i.e., BARS) are paramount for organ protection.[9,45] The use of nS-MRA, Statin therapy and Smoking cessation will confer additional benefits (BAR-4S) (Figures 1[9] and 2[26]). Following the summit, a landmark trial had been published showing the benefits of semaglutide, a GLP-1 RA, in patients with type 2 diabetes and CKD. Among the 3533 randomized patients (1767 in the semaglutide group and 1766 in the placebo group), semaglutide reduced the primary end point of major kidney events or death from kidney-related or cardiovascular causes by 23%,[46] providing an additional armamentarium in the management of diabetes in CKD.

The Kidney Protection Plan provides a guide to implement these recommendations, focusing on early intervention, patient empowerment, and open communication (Figure 3).[9,26,47–50] Local champions can design context-relevant care models to engage payors to scale the program, especially if these models are cost-effective.[51,52] Other decision support tools include periodic prompts, computerized reminders, and personalized reports.[53–55] In the primary care setting, the majority of patients do not have cardiovascular-kidney complications. In these patients, EARLY control of multiple risk factors using conventional glucose-; BP-; and lipid-lowering drugs, including metformin, RASi, and statins will translate to long-term organ protection. In overweight patients with suboptimal glycemic control, SGLT2i and GLP-1 RA can be used to further lower body weight and blood glucose while conferring independent organ-protective effects. In patients with established cardiovascular-kidney complications, SGLT2i and GLP-1 RA should be prioritized for organ protection with the use of other glucose-lowering drugs, including insulin, to achieve optimal glycemic control. In patients with optimal BP control treated with RASi who have residual albuminuria, ns-MRA should be considered for additional organ protection. In patients who are intolerant of RASi or SGLT2i, ns-MRA may be considered as an option. Currently, there are no clear guidelines on the sequence of introducing these organ-protective drugs, including SGLT2i, GLP-1 RA, and ns-MRA. The choices should be individualized based on the risk profiles of the patients and their control of blood glucose, BP, and albuminuria.[26]

Develop 1-Stop Service Package for Quality Assurance, Risk Stratification, and Care Triage

To operationalize these recommendations, a 1-stop yearly package, including blood and urine tests can be provided with additional eye and feet assessment every 2 years. A territory-wide risk assessment and management program in Hong Kong which evolved from a research-driven quality improvement program since 1995 had the largest decline in annual diabetes-related death rate from 3% in 2000 to 1.3% in 2016.[47,52] This 1-stop service enables regular assessments of risk factors and complications which frequently cluster, and allows the use of personalized data to empower patients for self-management. Databases from these structured assessments provide key performance indexes, including attainment of HbA1c, BP, low-density lipoprotein cholesterol goals, number of treatment goals attained, proportions of patients with CKD and other complications, and use of organ-protective drugs. These benchmarking strategies, especially if adequately funded, have been proven to improve quality of care.[52,56–58]

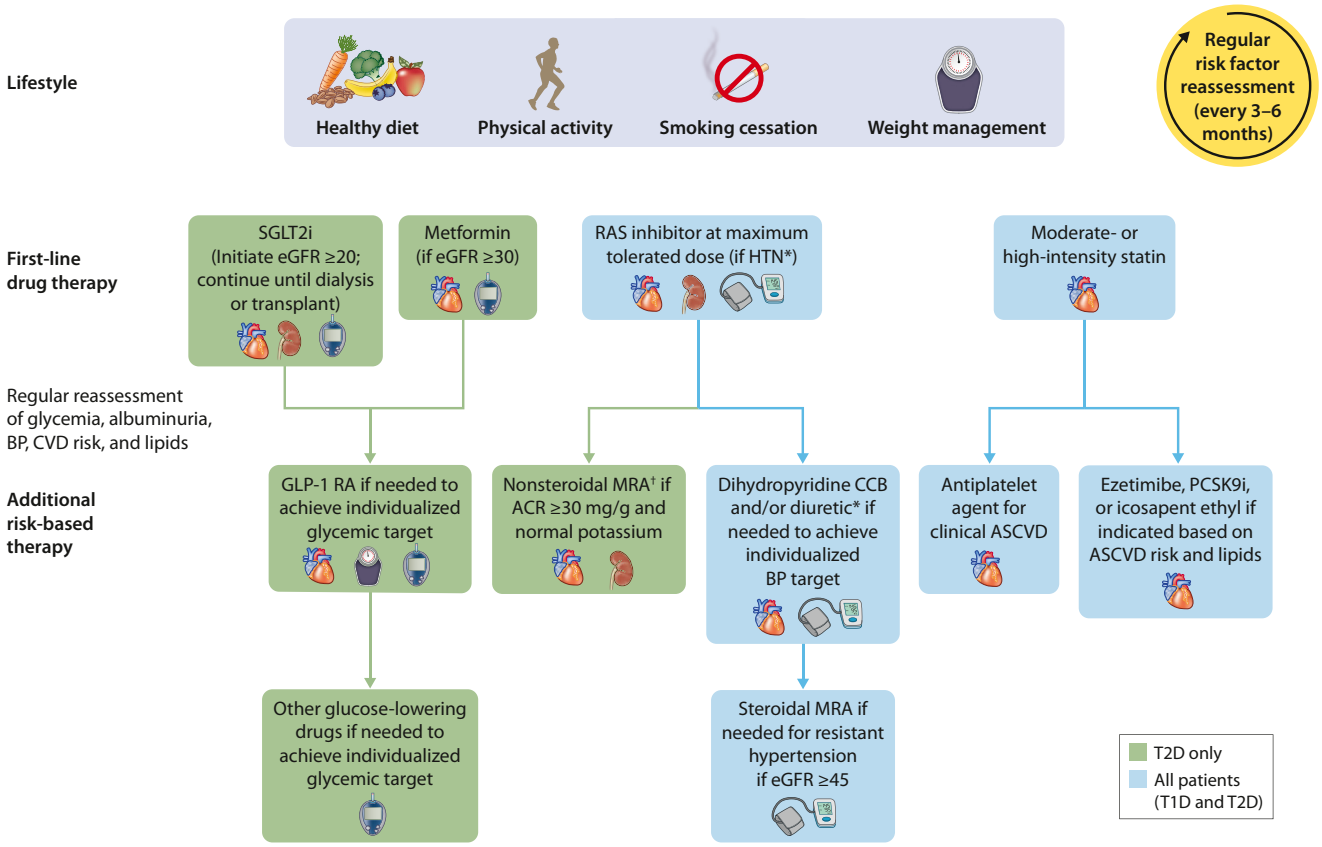

Figure 2. A joint consensus statement[26] by the American Diabetes Association and KDIGO on the medical treatment of patients with T2D in CKD in line with the proposed BARS or BAR-4S concepts (Figure 1). In patients with CKD defined by persistent eGFR $<$ 60 ml/min per 1.73 m^2 or persistent uACR $>$ 30 mg/g (or 3 mg/mmol) or evidence of kidney damage, metformin and SGLT2i are the preferred organ protective drugs and can be prescribed at eGFR 30 and 20 ml/min per 1.73 m^2 or higher, respectively for cardiovascular-kidney protections. GLP-1 RA can be considered as an additional risk-based therapy, especially in the presence of obesity and suboptimal control of glycemia. Patients with CKD should be protected by a RASi at the maximally tolerated dose* followed by ns-MRA if there is persistent uACR $>$ 30 mg/g (or 3 mg/mmol) despite being on SGLT2i or RASi (provided eGFR $>$ 20 ml/min per 1.73 m^2 with normal serum potassium level). †Finerenone is currently the only ns-MRA with proven clinical kidney and cardiovascular benefits. Given the heterogeneity of risk factors and treatment responses, treatment should be individualized to achieve the dual goals of optimal control of multiple risk factors (i.e., blood pressure, blood lipids, blood glucose, and obesity) and organ protection. Icons presented indicate the following benefits: blood pressure cuff = blood pressure–lowering; glucometer = glucose-lowering; heart = heart protection; kidney = kidney protection; scale = weight management. ASCVD, atherosclerotic cardiovascular disease; CCB, calcium channel blocker; CKD, chronic kidney disease; CVD, cardiovascular disease; eGFR, estimated glomerular filtration rate; GLP-1 RA, glucagon-like peptide-1 receptor agonist; HTN, hypertension; KDIGO, Kidney Disease: Improving Global Outcomes; ns-MRA, nonsteroidal mineralocorticoid receptor antagonist; PCSK9i, proprotein convertase subtilisin/kexin type 9 inhibitor; RASi, renin-angiotensin system inhibitor; SGLT2i, sodium-glucose cotransporter-2 inhibitor; T1D, type 1 diabetes; T2D, type 2 diabetes; uACR, urinary albumin-to-creatinine ratio.

This 1-stop multisystem assessment service with adequate reimbursement can be set up within a medical clinic run by family doctors or specialists or in a "standalone unit" run by trained nurses as part of an interdisciplinary network. These "service units" should be medically supervised with trained staff providing services, including teaching patients how to use continuous glucose monitoring devices, give injections, and perform self-monitoring of blood glucose. These service units facilitate on-the-job training for allied health workers in pursuit of interdisciplinary care.[59] Using Hong Kong as an example, with the full implementation of the territory-wide risk assessment and management program, the use of RASi and/or statins in patients with diabetes has increased to 70% to 80% by 2019.[60] These real-world databases, especially if accompanied by a biobank, are powerful tools to identify unmet needs, verify clinical trial data and make discoveries in pursuit of precision medicine.[61]

Foster Collaborative Care With Data Transparency

Patients with diabetes and CKD encounter various health care providers. Driven by a common goal to maintain patients' well-being, all relevant stakeholders should be aligned in terms of knowledge, attitudes, and skills with

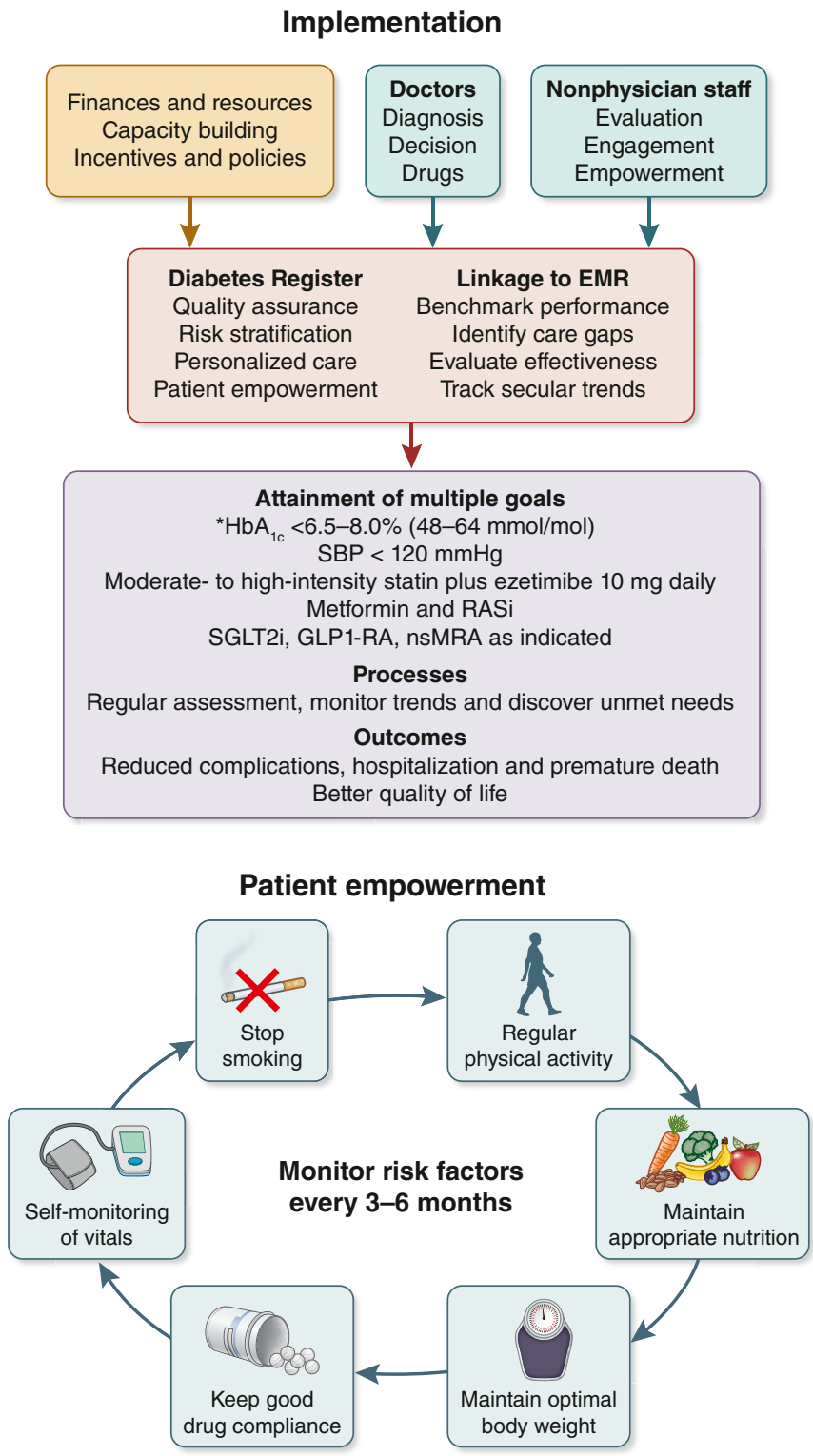

Figure 3. Implementation of data-driven Kidney Protection Plan (KPP) targeting the system, patients, and providers with the aim of providing regular structured assessment. A multidisciplinary approach with feedback to patients and providers for promoting early control of multiple risk factors (i.e., hyperglycemia, high blood pressure, dyslipidemia, and overweight), use of organ-protective drugs, and patient empowerment with ongoing data collection is proposed to align decision making by patients, providers, and payors. Guidance above was adapted from KDIGO 2022,[9] de Boer *et al.*,[26] Chan *et al.*,[47] KDIGO 2021,[48] Baigent *et al.*,[49] Bi et al.[50] *HbA1c goal should be individualized taking into consideration age at diagnosis, expected disease duration, risk of hypoglycemia, comorbidities, frailty, life expectancy, cognitive function and social support. EMR, electronic medical record; GLP-1 RA, glucagon-like peptide-1 receptor agonist; HbA_{1c}, glycated hemoglobin; nsMRA, nonsteroidal mineralocorticoid receptor antagonist; RASi, renin-angiotensin system inhibitor; SBP, systolic blood pressure; SGLT2i, sodium-glucose cotransporter-2 inhibitor.

access to shared data for informed decision-making. This data transparency will empower patients and benchmark performance to ensure seamless care.[62] The coordinator of multidisciplinary care is determined by local context.[9] If the PCP is the care coordinator, they should stay abreast on the evolution of practice guidelines and develop a communication and referral mechanism to other disciplines, depending on the clinical need and competency in the primary care setting.[63]

Use Technology to Facilitate Implementation of Data-Driven, Patient-Centered Care

Given the "numerical" nature of diabetes and CKD, digital health has particular relevance in the management of these conditions. This has become widely available because of the popularity of mobile phones and wearables, often referred to as mobile health. These digital interventions and mobile devices use information and communication technology to inform timely decision-making.[64] Before the popularity of these mobile devices, telephone calls[65] and short text messages[66] have been shown to prevent diabetes in individuals with prediabetes[66] or death in patients receiving multiple chronic medications.[65] Increasingly, applications are designed to incorporate algorithms from clinical data, including those from wearables (e.g., continuous glucose monitoring) to empower patients and providers.[64]

However, given the heterogeneity, uncertainty, and diversity of clinical course, digital tools enable but cannot fully replace personalized health care.[51,55] In some patients, digital intervention may enhance health literacy and increase physical activity.[67,68] However, in patients with diabetes and complex needs, a hybrid model including in-person consultation as well as digital education and monitoring was superior in improving glycemia than digital care alone.[69]

Use Information and Communication Technology to Facilitate Referral and Benchmarking

The numerical definitions of risk factors and treatment targets in diabetes and CKD can be used to generate algorithms with data visualization to promote shared decision-making, data tracking, and evaluation. Digitalizing care protocols for different stages of disease can streamline the division of labor among different specialties and care providers.[52,70] For example, patients with diabetes and early CKD can be managed by PCPs, internists, or diabetologists, whereas patients with advanced CKD or heart failure can be managed by a multidisciplinary team (diabetologist, nephrologist, and cardiologist). Involvement of industry partners, payors, patient groups, and health economists can facilitate open dialogues on reimbursement policy for value-based and patient-centered care.

The interoperability of different electronic medical record (EMR) systems with standardized coding will improve data transparency, communication, and coordination efficiency across disciplines. This will ensure accountability of prescriptions and clinical assessment practices, and avoid duplication or omission of medications and laboratory tests.[71] These data-driven quality improvement programs based on evidence-based clinical care pathways with regular monitoring will promote the consistent delivery of high-quality care.[47,72] Clear decision-making processes for care transitions between primary and secondary care are essential for seamless patient management.[73] A referral system embedded within the EMR system can increase the efficiency, communication, and responsiveness across health care providers.[74]

In areas where EMR systems are less well-developed or where integration of data within the same or among different EMR systems are not feasible, the use of structured forms for data collection and design of databases using commercial programs such as Microsoft or other programming languages, for example, JAVA can be used to digitalize the data for storage, analysis, communication, and evaluation.[52,75] In developing countries, philanthropies or seed funds can be used to set up sentinel sites to establish the workflow and build capacity including workforce, information technology system, and biobanks.[76] These multistakeholder efforts will help create powerful data to improve the classification and treatment of complex diseases such as diabetes and CKD with precision, value, and quality.[77]

Use Processes and Indicators to Benchmark Successful Models of Care

The success of care models in patients with diabetes and CKD hinges on multiple interconnected factors (Table 1).[78] The documentation of patient demographic and risk profiles linked to process indicators and clinical outcomes, notably hospitalization data, serves as benchmarks of success.[61] The process indicators include the efficiency of diagnosis of CKD, that is, measurement of UACR and eGFR, frequency of monitoring of CKM risk factors, frequency of visits to doctors and educators, persistent use of organ-protective drugs (e.g., metformin, RASi, SGLT2i, statin, ns-MRA, and GLP-1 RA) and self-management practice (e.g., self-monitoring of BP, body weight, blood glucose) (Table 2).[79-84] Intermediate outcomes include control of BP, body weight, HbA1c, low-density lipoprotein cholesterol, eGFR, and UACR. These markers of disease progression are minimum measures in all regions, including low-resource

Table 1. Key messages for successful care models and recommendations

- Successful care models rely on ongoing data collection and analysis to document goal achievements and identify areas for improvement aimed at informing health care providers, planners, payors, policymakers, and patients to develop sustainable solutions.
- A key feature of a successful multidisciplinary care model is having access to an affordable or paid-for regular 1-stop multisystem risk assessment (eye, feet, blood, and urine) for quality assurance, with benchmarking of key performance indexes. The personalized data are used to stratify risk, empower self-management, promote patient-provider communication and ensure continuity of care.
- The 1-stop multisystem assessment allows detection of atypical features (e.g., severe albuminuria or rapid decline of eGFR; young age of diagnosis, especially with body leanness, rapid increase in HbA1c, features of endocrinopathies or severe complications despite short disease duration, strong family history of young-onset diabetes or CKD) for timely referral to specialists for detailed assessments.
- The provider-patient communication needs to be strengthened by promoting organizational health literacy and training health care workers to promote patients' health literacy and self-management (e.g., healthy diet; regular exercise; adequate sleep; stress management; smoking cessation; weight control; and regular self-monitoring of blood glucose, blood pressure, and body weight) with ongoing support.
- In countries where a primary care system has the necessary expertise and capacity, PCPs are able to coordinate the collaborative management of patients with diabetes and CKD, involving the appropriate specialists, when clinically indicated.
- In more sophisticated health care systems, data digitalization may add value to patient-centered, integrated, and multidisciplinary care.
- In remote or underserved areas, the use of trained nonmedical health care workers and point-of-care testing can improve access to a structured care protocol.
- Good record keeping accompanied by a database or register for evaluation will help policymakers and practitioners continue to improve the system toward expected standards.

CKD, chronic kidney disease; eGFR, estimated glomerular filtration rate; HbA1c, glycated hemoglobin; PCP, primary care physician.

settings. Whenever feasible, hospitalizations due to cardiovascular-renal-cancer events, hyperglycemic and hypoglycemic crisis and mortality should be captured to evaluate the impacts and cost-effectiveness of interventions and care strategies.[85,86]

Health Literacy of Patients and Organizations and Patient-Reported Outcome Measures

In the Chronic Renal Insufficiency Cohort Study, health illiteracy was associated with a heightened risk for CKD progression and all-cause mortality.[79] The perspectives, values, and behavior of a patient may change during his/her journey of living with a chronic condition. These factors will influence the social, mental, and behavioral determinants of clinical outcomes.[87,88] To understand these complex relationships, organizational health literacy with a work culture of promoting patient education, empowerment, and engagement is crucial (Table 2).[89]

Patient-reported outcome measures (PROMS) such as Diabetes Distress Scale, Visual Analog Scale for pain assessment, EQ-5D index for quality of life, and Kidney Disease Quality of Life have been used although the choice of a disease-specific PROM or frequency of PROMs collection are subjects of ongoing research. Practical issues such as burden on participants (e.g., time needed to comprehend and complete PROM questionnaire) and feasibility of incorporating PROMs into technology (e.g., linkage to EMR) during routine care are considerations.[85] The importance of these PROMs further supports the need to develop a 1-stop multisystem risk assessment and empowerment package by trained nonmedical personnel to maximize efficiency and create impacts.[89]

Align Incentives of Care Providers, Policymakers and Payors to Promote Value-Based Care

Instead of focusing on treating life-threatening and advanced disease (save now and pay later), the paradigm should shift to adopting a proactive and preventive strategy (pay now and save later) to prevent the preventable.[90–95] Patients with diabetes have 2- to 6-fold increased risk of hospitalizations due to traditional (e.g., cardiovascular-kidney or cancer events) and nontraditional causes (e.g., infections, liver diseases, and mental illnesses).[96] An economic model that confirms the money- and life-saving impacts of early guideline-directed care by reducing hospitalizations and societal costs (loss of productivity and poor quality of life), should incentivize payors to pay for, providers to deliver, and patients to adhere to quality and value-based care.

In low-and-middle income countries, policymakers should focus on clinical outcomes and social returns on investments, including productivity gains and community well-being. Team-based structured care with regular assessment, patient education, and early attainment of multiple targets will prevent organ damage and premature death.[29,30,97,98] This is especially relevant to low-and-middle income countries with limited resources to treat advanced diseases.[99] These emerging economies can take reference from primary, specialist, and collaborative care models in advanced economies, which provide both acute episodic care and quality chronic care.[100–102]

The burden of diabetes and CKD is now recognized by global agencies including the World Health Organization, which has held the government accountable for ensuring access to medications and monitoring tools to prevent and properly manage diabetes and noncommunicable diseases such as CKD. Nevertheless, the challenges lie in the adherence of guideline-directed care in which care providers must contextualize the guidance for local practice with the goal to facilitate ongoing evaluation and informed decision-making at all levels, including patients, providers, and payors.[3,5]

Table 2. Definition and various attributes of health literacy in the care of people with diabetes and CKD

Health literacy types	Definition	Attributes	Relevance and application in low- and middle-income countries
Personal health literacy	• The degree to which individuals have the ability to find, understand, and use information and services to inform health-related decisions and actions for themselves and others.	• The ability to use health information rather than just understanding it. • The ability to make "well-informed" decisions rather than "appropriate" ones.	• Recognize the significant effect of social determinants on health disparities and CKD outcomes.[79,80]
Organizational health literacy[81]	• The capacity to which organizations equitably enable individuals to navigate, understand, and use information and services to inform health-related decisions and actions for themselves and others.	• Identify gaps in effective delivery of health information that is easy to understand and act on.	• Design and distribute print, audiovisual, and social media content according to local, social, cultural context.
Distributed health literacy[82]	• Health literacy abilities, skills and practices of others that contribute to an individual's level of health literacy.	• Explore and enhance support system for patients (especially those with low personal health literacy) such as family, friends, neighbors, peer supporters, and community groups. • Compensate for low individual health literacy skills by drawing on people within their social network(s) and in their cultural contexts.	• Encourage patients to bring their "health literacy mediators" (such as household members, close social network) to the clinic to reinforce the message of self-management.[83] • Prioritize resources to enable community or peer support group for patients with low individual health literacy and relatively limited contact time with health care workers.
Digital health literacy[84]	• The skills and ability to use information and communication technologies to find, evaluate, create, and communicate information for health.	• Functional: the ability to successfully read and write about health using technological devices. • Communicative: the ability to control, adapt, and collaborate through communication about health with others in online social environments. • Critical: the ability to evaluate the relevance, trustworthiness, and risks of sharing and receiving health-related information through the digital ecosystem (such as the Internet and ChatGPT). • Translational: the ability to apply health-related information from the digital ecosystem in different contexts.	• Explore the benefits of digital health intervention in vulnerable groups such as patients residing in remote areas. • Allocate resources to enhance access to digital technology. • Education to equip patients with knowledge to verify source and reliability of health information on digital platform.

CKD, chronic kidney disease.

Conclusion

More than 3 decades of innovative research and best practices have confirmed that diabetes and CKD can be prevented, managed, and controlled; yet, considerable care gaps persist. On average, 17 years is needed to translate research into practice and policies in health care.[7] To this end, patients, providers, and payors need to be incentivized to deliver data-driven, value-based care. This care transformation is a matter of urgency against a backdrop of aging and ecological transition, and changing lifestyles accompanied by a rising trend of young-onset obesity and diabetes. These young individuals are at high risk of developing CKD while still being economically productive.[96,103,104] However, these challenges can be turned into opportunities to make a real difference. Through systematic data collection to better engage patients, promote interdisciplinary care, and provide quality assurance to benefit the patient and society, we envision that this 1-stop multisystem assessment package will narrow the care gap through effective implementation of evidence-based practice guideline with precision, affordability, and value.

DISCLOSURE

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