Global access of patients with kidney disease to health technologies and medications: findings from the Global Kidney Health Atlas project

Htay Htay[1,2], Mona Alrukhaimi[3], Gloria E. Ashuntantang[4], Aminu K. Bello[5,39], Ezequiel Bellorin-Font[6], Mohammed Benghanem Gharbi[7], Branko Braam[5], John Feehally[8], David C. Harris[9], Vivekanand Jha[10,11], Kailash Jindal[5], Kamyar Kalantar-Zadeh[12], Rumeyza Kazancioglu[13], Peter G. Kerr[14,15], Adeera Levin[16], Meaghan Lunney[17], Ikechi G. Okpechi[18,19], Michelle E. Olah[5], Timothy Olusegun Olanrewaju[20], Mohamed A. Osman[5], Yasin Parpia[5], Jeffrey Perl[21,22], Bilal Qarni[5], Harun Ur Rashid[23], Ahmed Rateb[5], Eric Rondeau[24,25], Babatunde Lawal Salako[26], Laura Sola[27], Irma Tchokhonelidze[28], Marcello Tonelli[29], Natasha Wiebe[5], Isaac Wirzba[5], Chih-Wei Yang[30], Feng Ye[5], Alexander Zemchenkov[31,32], Ming-hui Zhao[33,34,35,36] and David W. Johnson[1,37,38,39]

[1]Department of Nephrology, Metro South and Ipswich Nephrology and Transplant Services (MINTS), Princess Alexandra Hospital, Brisbane, Australia; [2]Department of Renal Medicine, Singapore General Hospital, Singapore; [3]Department of Medicine, Dubai Medical College, Dubai, United Arab Emirates; [4]Faculty of Medicine and Biomedical Sciences, Yaounde General Hospital, University of Yaounde I, Yaounde, Cameroon; [5]Department of Medicine, Division of Nephrology, University of Alberta, Edmonton, Alberta, Canada; [6]Division of Nephrology and Kidney Transplantation, Hospital Universitario de Caracas, Universidad Central de Venezuela, Caracas, Venezuela; [7]Urinary Tract Diseases Department, Faculty of Medicine and Pharmacy of Casablanca, University Hassan II of Casablanca, Casablanca, Morocco; [8]Department of Infection, Inflammation and Immunity, University Hospitals of Leicester, University of Leicester, Leicester, UK; [9]Centre for Transplantation and Renal Research, Westmead Institute for Medical Research, University of Sydney, Sydney, New South Wales, Australia; [10]George Institute for Global Health India, New Delhi, India; [11]University of Oxford, Oxford, UK; [12]Division of Nephrology and Hypertension, University of California Irvine Medical Center, Orange, California, USA; [13]Division of Nephrology, Bezmialem Vakif University, Istanbul, Turkey; [14]Department of Nephrology, Monash Medical Centre, Monash Health, Clayton, Victoria, Australia; [15]Department of Medicine, Monash University, Clayton, Victoria, Australia; [16]Department of Medicine, Division of Nephrology, University of British Columbia, Vancouver, British Columbia, Canada; [17]Department of Community Health Sciences, University of Calgary, Calgary, Alberta, Canada; [18]Division of Nephrology and Hypertension, University of Cape Town, Cape Town, South Africa; [19]Kidney and Hypertension Research Unit, University of Cape Town, Cape Town, South Africa; [20]Department of Medicine, College of Health Sciences, University of Ilorin, Ilorin, Nigeria; [21]Division of Nephrology, St. Michael's Hospital and the Keenan Research Centre in the Li Ka Shing Knowledge Institute, St. Michael's Hospital, Toronto, Ontario, Canada; [22]Department of Medicine, Division of Nephrology, University of Toronto, Toronto, Ontario, Canada; [23]Department of Nephrology, Kidney Foundation Hospital and Research Institute, Dhaka, Bangladesh; [24]Intensive Care Nephrology and Transplantation Department, Hopital Tenon, Assistance Publique-Hopitaux de Paris, Paris, France; [25]Université Paris VI, Paris, France; [26]Department of Medicine, College of Medicine, University of Ibadan, Ibadan, Nigeria; [27]Division Epidemiologia, Direccion General de Salud-Ministerio Salud Publica, Montevideo, Uruguay; [28]Nephrology Development Clinical Center, Tbilisi State Medical University, Tbilisi, Georgia; [29]Department of Medicine, University of Calgary, Calgary, Alberta, Canada; [30]Kidney Research Center, Department of Nephrology, Chang Gung Memorial Hospital, Chang Gung University College of Medicine, Taoyuan, Taiwan; [31]Department of Internal Disease and Nephrology, North-Western State Medical University named after I.I. Mechnikov, Saint Petersburg, Russia; [32]Department of Nephrology and Dialysis, Pavlov First Saint Petersburg State Medical University, Saint Petersburg, Russia; [33]Renal Division, Department of Medicine, Peking University First Hospital, Beijing, China; [34]Key Lab of Renal Disease, Ministry of Health of China, Beijing, China; [35]Key Lab of Chronic Kidney Disease Prevention and Treatment, Ministry of Education of China, Beijing, China; [36]Peking-Tsinghua Center for Life Sciences, Beijing, China; [37]Centre for Kidney Disease Research, University of Queensland at Princess Alexandra Hospital, Brisbane, Australia; and [38]Translational Research Institute, Brisbane, Australia

Access to essential medications and health products is critical to effective management of kidney disease. Using data from the ISN Global Kidney Health Atlas multinational cross-sectional survey, global access of patients with kidney disease to essential medications and health products was examined. Overall, 125 countries participated, with 118 countries, composing 91.5% of the world's population, providing data on this domain. Most countries were unable to access eGFR and albuminuria in their primary care settings. Only one-third of low-income countries (LICs) were able to measure serum creatinine and none were able to access eGFR or quantify proteinuria. The ability to monitor diabetes mellitus through serum glucose and glycated hemoglobin measurements was suboptimal. Pathology services were rarely available in tertiary care in LICs (12%) and lower middle-income countries (45%). While acute and chronic hemodialysis services were available in almost all countries, acute and chronic peritoneal dialysis services were rarely available in LICs (18% and 29%, respectively). Kidney transplantation was available in 79% of

Correspondence: *D.W. Johnson, Department of Nephrology, Level 2, ARTS Building, Princess Alexandra Hospital, 199 Ipswich Road, Woolloongabba, Brisbane Qld 4102, Australia. E-mail: david.johnson2@health.qld.gov.au*

[39]Cochairs, Global Kidney Health Atlas Project.

countries overall and in 12% of LICs. While over one-half of all countries publicly funded RRT and kidney medications with or without copayment, this was less common in LICs and lower middle-income countries. In conclusion, this study demonstrated significant gaps in services for kidney care and funding that were most apparent in LICs and lower middle-income countries.

Kidney International Supplements (2018) **8,** 64–73; https://doi.org/10.1016/j.kisu.2017.10.010

KEYWORDS: acute kidney injury and chronic kidney disease care; funding for health care; funding for medications; global health care; health care service provision; renal replacement therapy

Equitable access to quality, affordable, safe, effective, and essential medications; health services; and health products or technologies that meet peoples' priority health care needs without exposing them to financial hardship in paying for them is a key platform of the worldwide push for universal health coverage[1,2] and the World Health Organization (WHO) Sustainable Development Goal 3: Health.[3] Such access is particularly important for people with chronic kidney disease (CKD) or acute kidney injury (AKI) or both given that kidney disease is a major global public health problem with extremely high morbidity and premature mortality[4] and significant financial impacts for individuals, societies, and health care systems.[5,6] CKD is a common cause of noncommunicable disease with a mean global prevalence of 12% to 15%.[7] It is strongly associated with excessive health care costs, high medication burden, kidney failure requiring renal replacement therapy (RRT), poor quality of life, and increased risks of both communicable and other noncommunicable diseases (particularly cardiovascular disease).[4,8–10] Similarly, AKI is common, not infrequently requires supportive RRT, and is associated with high rates of morbidity and mortality.[11,12] Furthermore, AKI is associated with an increased risk of CKD, and vice versa.[13]

Despite the public health importance of CKD and AKI, global access of people with kidney disease to essential medications and health products has not been comprehensively studied or described to date. The aim of the present study, which formed part of the International Society of Nephrology (ISN) Global Kidney Health Atlas project, was to characterize the availability, coverage, scope, capacity, and accessibility of health services for identification, monitoring, and management of kidney care; capacity and funding structure for acute and chronic RRT provision; and medication provision and reimbursement, across countries, ISN regions,[14] and 2014 World Bank country classification as low-, lower middle-, upper middle-, and high-income nations.[15]

RESULTS

Characteristics of participating countries

Of 130 countries surveyed, 125 countries participated, with 118 countries (17 low income, 33 lower middle income, 30 upper middle income, and 38 high income), composing 91.5% of the world's population, providing data pertaining to this domain. The total percentage of gross domestic product spent on health care for each of these countries is presented in Supplementary Figure S1.[16]

Identification, monitoring, and management of CKD

The availability of 12 different health care services related to identification, monitoring, and management of CKD was examined at primary and secondary or tertiary care levels in all participating countries (Figures 1 and 2). Overall, there was a graded effect with greater availability observed in secondary or tertiary care compared with primary care and increasing levels of availability in countries through the progression from low-income to lower middle-income to upper middle-income to high-income categorizations (Figures 1 and 2).

Primary health care services in low-income countries, particularly in the region of Africa, had limited capacity to diagnose and monitor CKD, being primarily constrained to measurement of blood pressure (94%) and height and weight (73%). Only one-third of low-income countries were able to measure serum creatinine in primary care, and none was able to access estimated glomerular filtration rate (eGFR), quantitative urinalysis, urine albumin to creatinine ratio (UACR), or urine protein to creatinine ratio (UPCR). Qualitative urinalysis using test strips for albumin or protein or both was available in 41% of low-income countries, while 18% had access to radiology services, and 6% to glycated hemoglobin (HbA1c) measurements. Remarkably, only 58% of high-income countries had access to UACR or UPCR in primary care.

Secondary and tertiary health care services enjoyed greater access to CKD identification, monitoring, and management services, although limitations were commonly observed for proteinuria assessment, pathology services, and HbA1c measurement, particularly in low-income countries.

Capacity for provision of RRT

Chronic dialysis facilities. All participating countries ($n = 118$) had capacity to provide chronic hemodialysis (HD) services whereas only 80% ($n = 95$) of countries had capacity to provide chronic peritoneal dialysis (PD) services. Chronic PD services were rarely available in low-income countries, with only 29% ($n = 5$) of countries reporting such capacity (Figure 3). When analyzed according to ISN regions, 48% ($n = 16$) of African countries and 69% (n = 9) of Oceanian and Southeast Asian (OSEA) countries had capacity to provide chronic PD services (Supplementary Figure S2). The proportions of countries with capacity to provide chronic PD ranged from 69% to 100% in the remaining ISN regions (Supplementary Figure S2).

Transplant facilities. A total of 93 of 118 (79%) participating countries had the capacity to perform kidney transplantation. Only 12% ($n = 2$) of low-income countries had kidney transplantation services (Figure 3). The types of