ISN Global Kidney Health Atlas

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FOREWORD

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Kidney disease is a huge public health problem: both AKI and CKD contribute significantly to globally rising healthcare costs and mortality and morbidity related to chronic disease. For instance, a recent report by the British National Health Service estimates that the cost for kidney disease care exceeds that incurred for breast, lung, colon, and skin cancer combined. In China, the economy is expected to lose USD 558 billion over the next decade because of death and disability attributable to cardiovascular and kidney diseases, while in the US, treatment of CKD is likely to exceed USD 48 billion per year over the next decade. In all advanced nations with universal access to Renal Replacement Therapy (RRT), the cost for provision of this service approximates 2%–3% of the total healthcare budget, though it treats only a tiny fraction (~0.1%–0.2%) of the total population. According to the recent Global Burden of Disease (GBD) estimates, CKD is ranked 19th among diseases for the years of life lost globally, rising from 36th in 1990, and since then the documented number of deaths attributed to CKD has more than doubled. The same reports have ranked a low glomerular filtration rate (GFR), a sign of reduced kidney function, as seventh in 2013 among the leading global risk factors for disability-adjusted life-years. It is therefore imperative to devise strategies and policies to improve our understanding of AKI and CKD and their determinants, the effectiveness of and variations in care models, and the ability to characterize and treat the disease early at country and regional both from a clinical and an economic perspective. This requires us to compile baseline data on the current global status of kidney care structures and delivery systems.

On behalf of the International Society of Nephrology (ISN), I am therefore pleased to present the first Global Kidney Health Atlas. The Global Kidney Health Atlas project was a multinational, cross-sectional survey designed to assess for the first time the current capacity for kidney care across all world regions. This was conducted as part of the ISN “Closing the Gap Initiative”. The survey had an excellent response rate: approaches to

130 countries yielded participation by 124 countries that together have 93% of the world population.

We are all elated about this success, as this exercise is the first of its kind for the nephrology community and one of the largest health-related country capacity surveys in history. The survey provided an overview of the current capacity for kidney care (comprising both AKI and CKD) and an assessment of individual country and regional readiness to enhance this capacity. The findings will be applied to engage relevant stakeholders across countries and regions to advocate for improved access to and quality of kidney care. The data have appreciable policy implications as they provide a baseline from which country and region progress over time can be measured and countries thereby held to account.

We synthesized the various approaches to kidney care across all world regions, identified opportunities to strengthen relevant health systems, and explored potential mechanisms to capitalize on these opportunities. We found several barriers to optimal kidney care delivery that were common across countries and regions: limited workforce capacity; the nearly complete absence of mechanisms for disease surveillance, lack of a coordinated strategy to care for people with CKD and AKI, poor integration of CKD care with other NCD control initiatives, and low awareness of the significance of CKD and AKI. These common challenges should be addressed to strengthen health systems and policies for optimal kidney care. Potential strategies for rising to these challenges, as well as the implications for low- and middle-income settings where RRT is unavailable or unaffordable were enumerated.

We trust that this novel work will reap handsome dividends in guiding the future direction of global kidney care.

Professor Adeera Levin

EXECUTIVE SUMMARY

This work aims to improve the understanding of inter- and intra-national variability across the globe with respect to capacity for kidney care delivery as defined by the World Health Organization's domains of health services. Overall, most aspects of kidney care were covered through public funding; however, medications were typically covered through a mix of public and private. Renal replacement therapy (RRT) was available in most countries; however, services directed toward preventing the progression of Chronic Kidney Disease (CKD) were limited. More than half of countries reported a national governing body for kidney care. Health infrastructure for both CKD and AKI was rated highly by respondents from high-income countries but was considered much more uneven in other income groups.

Workforce capacity varied across countries. The most common shortages were of renal pathologists, vascular access coordinators, dietitians, and nephrologists. Density of nephrologists relative to overall population was low, particularly in low-income countries. Thirty-five per cent of low-income countries lacked a nephrology training program, which corresponded to an equally low density of nephrology trainees. Renal replacement therapy was available in most countries: chronic hemodialysis was available in all countries; acute hemodialysis, in nearly all (98%); chronic peritoneal dialysis, in 80%; and acute peritoneal dialysis, in 61%. Kidney transplantation was available in 79% of countries. Overall, most countries funded RRT services through government, with no fees at the point of delivery.

Very few countries had a registry for non-dialysis CKD or AKI patients, whereas more than half of countries had a registry for dialysis and transplant patients. The majority (62%) of countries had data on the prevalence of CKD; however, less than half (41%) were able to estimate the prevalence of AKI requiring dialysis, and even fewer (19%) had data on the prevalence of AKI not requiring dialysis. Almost all countries offered CKD testing for high-risk groups, yet only 24% had a current CKD detection strategy.

Advocacy for CKD and AKI was low. Only 36% of countries' governments recognized CKD as a health priority. Advocacy groups for CKD and AKI within higher levels of government were reported in 42% and 19% of countries, respectively. While national policies and strategies for non-communicable diseases in general were common in many countries, policies directed toward kidney disease were often lacking. Fifty-six per cent of countries lacked a national strategy for improving the care of non-dialysis CKD, 45% lacked one for chronic dialysis, and 53% lacked one for kidney transplantation. However, of the 81 countries that lacked a national strategy, almost half (47%) did have a position paper on CKD care. More than three-quarters of countries had CKD management and referral guidelines, and 53% had guidelines for AKI. While adoption of these guidelines among nephrologists was high, adoption among non-nephrologist physicians was generally low.

Participation in renal clinical trials was high (85%); however, most low-income countries did not participate. Participation in health service delivery trials was highest in low-income countries (87%).

Forty-five per cent of countries had biobanking facilities; these were much more common in high-income countries. Eighty-five per cent of countries reported having a trained workforce to conduct observational studies; however, only 48% had funding. The majority of observational studies were in non-dialysis CKD and dialysis populations. Nearly half (47%) of countries had academic centres coordinating clinical trials. Most countries' capacity to store clinical trial medications was low.

Overall, this work has shown the variability with respect to kidney care and identified strategic needs. Key recommendations are to

- Extend healthcare financing and access to treatment
- Increase capacity by addressing workforce shortages
- Enhance consistency of care through national strategies and guidelines
- Increase support for prevention

The findings have implications for policy development towards establishment of robust kidney care programs, particularly for low- and middle-income countries. Low-income countries require a comprehensive approach spanning all components of the health system. Basic infrastructure must be strengthened at the primary care level for early detection and management of CKD and AKI. To maximize effectiveness of early CKD management and reduce risk of adverse health outcomes, access to essential medications should be assured, as should sustainable RRT provision. Health information systems (CKD and AKI registries) are needed for robust information on the burden of these diseases, and their clinical outcomes.

The findings reported in this Atlas are vital for advocacy among governmental and non-governmental stakeholders to help countries improve the quality of kidney care. Its baseline measures of where countries and regions stand with respect to each domain of the health system allows the monitoring of progress over time. Furthermore, by identifying region-specific limitations and barriers, the Atlas helps to target strategic efforts applicable to each context. Finally, sharing this knowledge across regions will help reduce global inequities in healthcare.

Next steps to enhance kidney care delivery are to focus on prevention through creating and disseminating guidelines on both CKD and AKI that are accessible and relevant to their intended audience, particularly primary care physicians or other non-nephrologist physicians.

Furthermore, increasing appropriate services at the primary care level (for example, measuring creatinine) and enhancing the use of multidisciplinary teams may help prevent the progression of kidney disease. More active CKD detection programs will further identify patients before they develop end-stage renal disease, resulting in significant cost savings to the healthcare system and patients.

Increasing information collection through registries is needed in order to predict the burden of disease and allocate resources appropriately. Furthermore, equitable participation in research across the globe will further our understanding of kidney disease and care delivery.

Lastly, advocacy groups at higher levels of government are needed to raise awareness and ensure support for optimal kidney care.

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Dr. Bello is a clinician-scientist with major research interests in improving outcomes in patients with CKD, preventing disease progression and reducing risk of complications, development of innovative care delivery models, and quality improvement. He is a member of the Alberta Kidney Disease Network (AKDN), a successful established team of scientists, health care policy-makers, clinical leaders, educators, and knowledge translation experts that studies health services solutions to reduce the burden and consequences of CKD and other chronic diseases.

Dr. Bello was the first author of the initial multinational inventory, Kidney Health for Life (KH4L), a systematic inventory on CKD burden, care structures, and organization across 17 European countries, Israel, and Canada conducted under the umbrella of the ISN. He is a member of several professional organizations and consortia in nephrology including the Canadian Clinical Trials Network, European CKD Prognosis Consortium, Global Burden of Disease (GBD) collaboration, among others. He reviews regularly for the major general medical and nephrology journals including the Lancet and Kidney International.

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ABBREVIATIONS

ACE	Angiotensin-Converting Enzyme
AKI	Acute Kidney Injury
BMI	Body Mass Index
BP	Blood Pressure
CC	Calcium Channel
CKD	Chronic Kidney Disease
CVD	Cardiovascular Disease
eGFR	Estimated Glomerular Filtration Rate
ESRD	End-Stage Renal Disease
GBD	Global Burden of Disease
GFR	Glomerular Filtration Rate
GKHA	Global Kidney Health Atlas
HbA1c	Glycated Hemoglobin
HD	Hemodialysis
IDF	International Diabetes Federation
ISN	International Society of Nephrology
KDIGO	Kidney Disease: Improving Global Outcomes
MDG	Millennium Development Goals
MDT	Multidisciplinary Team
NCD	Non-Communicable Disease
NGO	Non-Governmental Organization
NIS	Newly Independent States [of the former Soviet Union]
NP	Nurse Practitioner
OECD	Organisation for Economic Co-operation and Development
PCP	Primary Care Physician
PD	Peritoneal Dialysis
PMP	Per Million Population
RRT	Renal Replacement Therapy
SDG	Sustainable Development Goals
THE	Total Health Expenditure
UACR	Urine Albumin-to-Creatinine Ratio
UHC	Universal Health Coverage
UN	United Nations
UPCR	Urine Protein-to-Creatinine Ratio
USD	United States Dollar
WHF	World Heart Federation
WHO	World Health Organization

KEY TERMS

Action plan: A scheme or course of action that may correspond to a policy or strategy with defined activities, indicating who does what (type of activities and people responsible for implementation), when (time frame), how, and what resources are required to accomplish an objective for AKI or CKD care.

Appropriate referral and management: Availability of an organized system and/or structures to ensure that people with CKD, who may benefit from specialist care, are referred for specialist assessment appropriately.

Capacity: The ability to perform appropriate tasks effectively, efficiently and sustainably.

Guideline: A recommended, evidence-based course of action for prevention and/or management of AKI or CKD.

Identification and early detection: Availability of an organized system and/or structures for identification of people with risk factors for CKD: hypertension, diabetes, cardiovascular diseases (ischemic heart disease, heart failure, peripheral vascular disease, and stroke), urological problems (structural renal tract disease, kidney stones, prostatic disorders), multisystem diseases (systemic lupus erythematosus, rheumatoid arthritis, infective endocarditis, etc.), or a family history of kidney disease.

Identification: Measures performed in at-risk populations in order to identify individuals who have risk factors or early stages of disease but do not yet have symptoms.

Monitoring of complications, risk factor control, and disease progression: Availability of an organized system and/or structures to ensure that people with established CKD are getting guideline-concordant clinical care.

Non-communicable diseases: Diseases that cannot be transmitted from person to person, notably, cardiovascular diseases (like heart attacks and stroke), cancers, chronic respiratory diseases (such as chronic obstructive pulmonary disease and asthma), and diabetes.

Policy: A specific official decision or set of decisions designed to carry out a course of action endorsed by a government body, including a set of goals, priorities and main directions for attaining these goals. The policy document may include a strategy to give effect to the policy.

Programs: A planned set of activities or procedures directed at a specific purpose.

Registry: A systematic collection of data about AKI or CKD.

RRT availability: Availability of an organized system and/or structures to deliver dialysis and/or kidney transplantation when and where needed.

Standard care plan: Availability of an organized system and/or structures to ensure that people with CKD have a current agreed care plan appropriate to the stage and rate of progression of CKD. This means those with early stages are being monitored appropriately at the primary care level and those in need of specialist care have access to it.

Strategy: A long-term plan designed to achieve a particular goal for AKI or CKD care.

Under development: Still being developed or finalized and not yet being implemented.

ABSTRACT

Background

There has been considerable effort within individual countries to improve the care of patients with Chronic Kidney Disease (CKD). Anecdotal evidence suggests that there is substantial inter- and intra-country and regional variability in the approaches taken and progress made. Since there has previously been no concerted attempt to summarize work and progress to date, little has been known about the best way to structure health systems to facilitate CKD prevention and control, or how to integrate these objectives into emerging national and international management strategies for Non-Communicable Disease (NCD). This report describes a state-of-the-art knowledge synthesis that closes this knowledge gap, thereby facilitating more coordinated efforts for CKD prevention and control across the globe. The Global Kidney Health Atlas (GKHA), a systematic data repository developed under the auspices of the International Society of Nephrology (ISN), summarizes the structure, format, and outcomes associated with global, regional, and national efforts to improve CKD care.

Objectives:

1. To provide a high-level overview of the current state of kidney care and how it is organized and structured around the world, as well as the burden and consequences of CKD.
2. To conduct comparative analysis and data synthesis of the collated information across countries and ISN regions in order to identify key strengths and weaknesses of various systems and explore opportunities for regional networking and collaborations for optimal CKD care around the world.
3. To provide a platform for championing CKD as a leading NCD and assist in advocacy with major stakeholders (WHO, UN, OECD, European Union) to increase the profile of CKD as a public health issue.
4. To provide the foundation for a global surveillance network for CKD care.

In conjunction with an expert librarian we conducted a two-part comprehensive search of government reports and published and grey literature: a scoping literature review of national health systems characteristics and a systematic review of relevant CKD epidemiology data. This literature search set the context for a groundbreaking detailed survey of key stakeholders.

To facilitate understanding of how capacity for kidney care varies over time and between countries, the GKHA provides concise, relevant and synthesized information on the delivery of care across different health systems. First, it provides an overview of existing CKD care policy and context in the healthcare system, with a description and evaluation of relevant policies, financing, structures, guidelines, and care initiatives. Second, it provides an overview of how CKD care is organized in individual countries and a description of relevant CKD epidemiology in countries and ISN regions, focusing on elements that are most relevant to service delivery and policy development. Finally, a synthesis, comparison, and analysis of individual country/regional data are provided as a platform for recommendations to policymakers, practitioners, and researchers. The overall approach is summarized in Table A.

Table A | Methods and data sources

Objective	Methods/ approach	Coverage/ elements	Primary data sources	Secondary data sources
To obtain a snapshot of individual country and regional health systems characteristics, and specific elements relevant to CKD care	■ Scoping review ■ Survey	■ WHO UHC Domains[1]	■ Survey data ■ Interviews	■ WHO Global Observatory ■ UN, World Bank and OECD reports on NCDs ■ Published data/reports
To obtain data on relevant CKD epidemiology (risk factors, burden, and outcomes) across countries and regions	■ Systematic reviews ■ Scoping review ■ Survey	■ Estimates of CKD prevalence ■ Estimates for RRT ■ CKD risk factors	■ Survey data ■ Interviews	■ Systematic reviews and consortia publications ■ World Health Report ■ World Health Indicators Reports ■ Global NCD Repository ■ IDF Diabetes Atlas ■ WHF World Cardiovascular Disease Atlas ■ Renal registries

1 WHO UHC domains (health finance and service delivery, health workforce, medicines and medical products, information systems, and governance and leadership).

CKD = Chronic Kidney Disease, GBD = Global Burden of Disease, IDF = International Diabetes Federation, NCDs = Non-Communicable Diseases, OECD = Organisation for Economic Co-operation and Development, RRT = Renal Replacement Therapy, UHC = Universal Health Coverage, UN = United Nations, WHF = World Heart Federation, WHO = World Health Organization,

Results

A total of 124 United Nations Member States responded to the survey. These countries account for 93% of the world's population. There was wide variation across nations in service delivery, funding mechanisms, and available technologies. Key findings for each domain were as follows.

Health finance and service delivery

Nearly half of the countries reported a mix of public and private funding systems for their general healthcare systems. Over half of publicly funded systems reported universal coverage. Specific to kidney care, 35% of countries publicly funded all aspects of kidney care. Early detection and the management were the elements of care with least coverage through public funding: the services most commonly excluded were related to early detection in at-risk individuals, risk factor control, and management of complications. Non-dialysis CKD care received less public funding compared to RRT. Over half (66%) of countries involved a national body in the oversight of kidney care. The infrastructure for CKD and AKI healthcare was rated highly overall, and the high-income group unsurprisingly reported a higher rating than lower-income countries.

Health workforce for nephrology care

All but two countries (Germany and the Netherlands) identified shortages of key workforce essential for optimal kidney care. Shortages of renal pathologists, vascular access coordinators, dietitians, and nephrologists were more common than those of primary care physicians, pharmacists, and laboratory technicians. Nurses were in short supply in approximately 60% of all countries. Overall, workforce capacity was lower in low-income countries than in high-income countries. Nephrologists were the main providers responsible for both CKD and AKI care. Multidisciplinary Teams (MDTs) were accountable for CKD care in only 31% of countries. It was rare for health officers or extension workers to be primarily responsible for either CKD (9%) or AKI (4%). Nephrologist density was variable and particularly low (<5 per million population) in Africa, South Asia, and Oceania & South East Asia. Twenty-one per cent of countries had no nephrology training program, and the lack was more common in low-income countries.

Essential medicines and technologies

Overall, all services for kidney care were more available at a secondary/tertiary level than through primary care. Blood pressure monitoring was available in almost all countries and measurement of height, weight, and serum glucose were also quite highly available at a primary care level, though less so in lower-income countries. For CKD monitoring and management in primary care, serum creatinine with estimated glomerular filtration rate and proteinuria measurement were available in only 37% and 32% of countries, respectively. Most countries had structures for chronic Hemodialysis (HD) (100%), chronic Peritoneal Dialysis (PD) (80%) and kidney transplantation (79%). These services were funded publicly and free at the point of delivery in 42%, 51%, and 49% of countries that offered these services, respectively. Acute HD and PD were publicly funded and free in 39% and 49% of countries that offered these services, respectively.

Health information systems

Health information system (renal registry) data were limited, particularly for AKI and non-dialysis CKD. More than half of countries had a registry for dialysis (64%) and transplantation (58%), but very few countries had a registry for non-dialysis CKD (8%) or AKI (7%). Participation in registries was mandatory in only about half of all countries. Overall, 62% of countries overall had data on CKD prevalence; however, less than 20% of low-income countries were able to estimate CKD prevalence. Most countries performed routine tests for CKD identification across most high-risk groups (diabetes, hypertension, CVD, autoimmune/

multisystem disorders, urological disorders, family history). Only one-quarter of countries had an active detection program for identifying CKD, and the proportion was particularly low in low-income countries. Compared to 72% for CKD prevalence, only 41% of countries had prevalence data on AKI requiring dialysis, and even fewer (19%) on AKI not requiring dialysis. Almost half (44%) could estimate the incidence of AKI requiring dialysis, but only 20% could estimate the incidence of AKI not requiring dialysis.

Leadership and governance

In only 36% of countries, the government recognized CKD as a health priority. Nearly half (42%) of countries reported an advocacy group at higher levels of government or a non-governmental organization to raise the profile of CKD and its prevention. Fewer countries had advocacy groups within government for AKI (19%) than for CKD. More than three-quarters of all countries had a national strategy for chronic NCDs in general; however, national strategies for kidney care were less common (44% for non-dialysis CKD, 55% for chronic dialysis, and 47% for kidney transplantation). International guidelines for CKD and AKI management and referral were accessible in 52% and 45% of countries. Adoption of both CKD and AKI guidelines was low among non-nephrologist physicians.

Response

Awareness and barriers of kidney care and research capacity were identified in the latter portion of the survey. Awareness of both CKD and AKI was generally low or moderate in non-nephrologist specialists, and even lower in primary care physicians. The top barriers to optimal kidney disease care (both general and related to RRT) were identified as being related to geography, physicians, and patients. Shortages of nephrologists were identified as a barrier to RRT in 72% of countries. Fifteen per cent of countries did not participate in clinical trials on kidney disease, possibly related to limited training in clinical trial conduct. Biobanks were limited, particularly in low-income countries (6%). Only 32% of countries reported that most or all study medications could be stored. While 85% of countries had the capacity (trained workforce) to conduct observational cohort studies, far fewer (48%) had funding to conduct the studies, especially in low-income countries (29%).

Conclusion

The GKHA is the first attempt to capture the capacity and readiness of nations for kidney care. It demonstrates significant inter- and intra-regional variability in the current capacity of various nations across the globe. Important gaps in services, facilities and the workforce were identified in many countries and regions.

The findings have immediate implications for guiding policy development towards establishment of robust kidney care programs, particularly for low- and middle-income countries[1]. Low-income countries require a comprehensive approach spanning all components of the health system. Basic infrastructure must be strengthened at the primary care level for early detection and management of AKI and CKD. Access to essential medications should be assured to maximize effectiveness of early CKD management and reduce risk of adverse health outcomes, and RRT should be available to treat both CKD and AKI[2]. Surveillance and monitoring systems are needed to capture reliable information on the burden of CKD and AKI, and clinical outcomes. The findings will also be critical for engaging key governmental and non-governmental stakeholders to support countries in improving the quality of kidney care. Finally, the data can be used as a baseline to hold countries to account by measuring national and regional progress over time[3].

SECTION 1

INTRODUCTION

1.1 Chronic Kidney Disease (CKD)

Chronic Kidney Disease (CKD) is an immense public health problem due to its high burden of disease, which relentlessly continues to increase globally, and because many countries might be overwhelmed by the cost of providing adequate care for all patients with CKD[4],[5],[6],[7],[8],[9]. This disease affects people of every age and race; however, people from disadvantaged populations may be at higher risk of CKD and associated morbidity and mortality because they lack access to care[10],[11],[12],[13],[14].

Chronic Kidney Disease (CKD), previously known as chronic renal failure, describes a condition with gradual loss of kidney function. It is generally defined as persistent abnormality (lasting more than 3 months) of kidney function measured by levels of the Glomerular Filtration Rate (GFR). It is specifically said to be present when the GFR remains persistently lower than 60 ml/min/1.73m^2. Using the GFR, CKD is divided into six stages of worsening progression[6]. This definition was recently updated by KDIGO[15].

Figure 1.1 | Classification of CKD

- Low risk (if no other markers of kidney disease, no CKD)
- Moderately increased risk
- High risk
- Very high risk

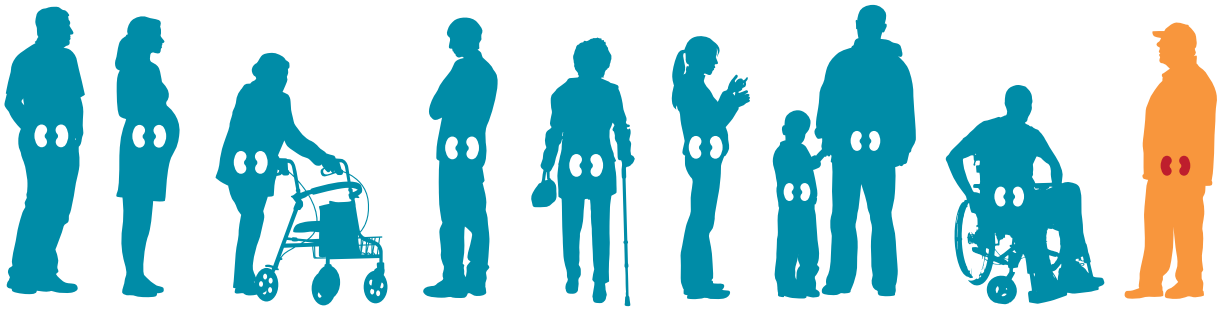
				Persistent albuminuria categories Description and range		
				A1	A2	A3
				Normal to mildly increased	Moderately increased	Severely increased
				<30 mg/g <3 mg/mmol	30–300 mg/g 3–30 mg/mmol	>300 mg/g >30 mg/mmol
GFR categories Description and range	G1	Normal or high	≥90 ml/min per 1.73 m^2			
	G2	Mildly decreased	60–89 ml/min per 1.73 m^2			
	G3a	Mildly to moderately decreased	45–59 ml/min per 1.73 m^2			
	G3b	Moderately to severely decreased	30–44 ml/min per 1.73 m^2			
	G4	Severely decreased	15–29 ml/min per 1.73 m^2			
	G5	Kidney failure	<15 ml/min per 1.73 m^2			

Source: KDIGO clinical practice guidelines for chronic kidney disease: evaluation, classification, and stratification, 2002.[16] Reproduced with permission.

Approximately 10% of people worldwide are affected with CKD; however, CKD incidence and prevalence differ significantly across countries and world regions[13],[14]. It is estimated that more than 80% of all patients receiving treatment for End-Stage Renal Disease (ESRD) are from developed countries because of their relatively larger elderly population and availability of universal access and care for kidney disease. Developing countries have a similar CKD incidence, but much lower prevalence of treated kidney failure than the developed world[13],[14]. Many estimates place the reported prevalence of treated ESRD in sub-Saharan Africa at less than one-tenth that of the United States. Although comprehensive data are not readily available from less developed countries, it appears that proportionately fewer patients in these regions receive treatment for ESRD[13],[14].

Low socio-economic status is a risk factor for CKD. Conversely, CKD is known also to have a huge impact on the social and economic well-being of patients due to their inability to work, inability to go to school, reduced quality of life (from physical fatigue and emotional problems including depression), and severe economic strains upon their families[13],[11]. The costs of RRT are exceedingly high and consume a significant proportion of healthcare budgets of developed countries. RRT remains unattainable in most developing countries because of its costs[10],[5],[6]. Many developed countries spend 2%–3% of their healthcare expenditure to provide treatment for patients with ESRD, although these patients account for just 0.1%–0.2% of their total population. Data from the United States Renal Data System (USRDS) showed that Medicare spending for all CKD rose from USD 41.2 billion in 2010 to USD 50.4 billion in 2014, representing a 22.3% increase in cost[5],[6],[17]. The total cost of CKD care in the United States in 2013 exceeds the entire national budgets of many countries in sub-Saharan Africa, Latin America, and Central and East Asia.

Renal replacement therapy remains financially unattainable in most developing countries.



One in 10 people worldwide will develop chronic kidney disease in their lifetime!

1.2 Acute Kidney Injury (AKI)

Acute Kidney Injury (AKI) is the sudden reduction in kidney function (usually within hours to weeks) and manifests clinically as a reversible acute increase of nitrogen waste products (serum urea and creatinine levels). In the past, AKI was referred to as Acute Renal Failure (ARF)[18],[19].

Acute kidney injury is a common condition associated with hospitalizations and is especially common in critically ill patients (up to 40% at ICU admission and 60% during admission). Common causes of AKI include fluid losses, infections, or drugs (or toxins[20],[21]). In developing countries, diarrhoeal illnesses and nephrotoxins (usually herbal medications) play a huge role in the development of AKI[20],[18],[22].

Risk of acute kidney injury is increased 10-fold by pre-existing chronic kidney disease.

The conditions AKI and CKD are closely related, CKD being known to be a risk factor for AKI and vice versa. Both AKI and CKD increase the risk for CVD[23],[24],[25], among other adverse outcomes. Appropriate treatment of AKI is critical, as it can reverse the kidney damage and its absence can lead to the progression of CKD.

1.3 Putting kidney health on the global health agenda

The ISN's vision aspires towards the elimination of kidney disease worldwide. The ISN is dedicated to advancing the prevention, diagnosis, and treatment of kidney diseases in the developing and developed world[26],[27].

Very worrisome is the rising number of people diagnosed yearly with kidney disease, the lack of access to adequate kidney care and treatment for millions of people around the world, and the projected prevalence figures for kidney disease for the next decade and beyond. Worldwide response to various global disease outbreaks, such as those related to more common non-communicable diseases or infectious disease, is often adequate, and resources are not spared when dealing with such outbreaks. Morbidity, loss of quality of life, and mortality arising from kidney disease continues to surpass many of these conditions, yet diseases of the kidney are not featured in many national or international health agendas. Given that CKD is a threat to global health and prosperity, global efforts are required to tackle this issue[26],[28].

Until lately, NCDs, especially CKD, were not on the radar for many national and global strategies for addressing health concerns from around the world. Chronic kidney disease and other NCDs were not included in the United Nations' Millennium Development Goals (MDGs) but have now become a part of the Sustainable Development Goals (SDGs) for 2030. Although the time lost may have contributed to increasing prevalence in various regions, the inclusion of NCDs, and specifically CKD, in these SDGs presents an opportunity to enhance strategies for kidney care. By lowering the prevalence of CKD, a health, social and economic crisis can be averted.

Universal treatment for AKI patients is highly cost-effective.

The ISN believes that it can achieve its vision of eliminating kidney disease worldwide. The ISN has developed several programs (www.theisn.org/programs) and initiatives (www.theisn.org/initiatives) geared towards education, training and research, and improving kidney disease awareness and detection.

World Kidney Day (www.worldkidneyday.org), a joint initiative of the ISN and the International Federation of Kidney Foundations (IFKF), has raised light to the importance of preventing kidney disease and, as such, has led to enhanced screening and detection in many countries. World Kidney Day is celebrated globally to increase awareness of CKD and its risk factors.

Similarly, the ISN "0by25" initiative (www.0by25.org) is a project aimed at reducing mortality of AKI through timely diagnosis and treatment, eliminating preventable deaths from AKI worldwide by 2025.

The ISN recognizes the global challenges associated with diagnosis and treatment of CKD, especially in low- to middle-income countries where other challenges abound. The ISN facilitates kidney care through providing assistance and guidance towards education, training, and setting up facilities. Where individual countries are unable to meet targets, support can also be provided to intergovernmental organizations through existing regional nephrology associations, e.g., AFRAN (African Association of Nephrology), SLANH (Society of Nephrology and Hypertension), APSN (Asian Pacific Society of Nephrology).

Universal healthcare coverage for the prevention and early management of kidney disease will greatly reduce its burden and save lives. AKI is reversible and early treatment can prevent the progression to CKD. Through increasing funding for AKI detection and treatment, various affiliated bodies can support the prevention of progression to more severe and costly conditions. Similarly, including the targeting of associated risk factors as part of the global health agenda may result in a significant reduction of CKD worldwide.

Concerted global action can reduce kidney diseases.

Furthermore, improving legislation and funding for treatment of kidney diseases is an important role of national and regional governments. Increasing access to adequate treatment of risk factors, dialysis therapies, and kidney transplantation may further contribute to the elimination of kidney disease.

A better understanding of the global capacity of kidney care, and further how that capacity varies across the world, is essential to combat kidney disease. Knowing which policies and healthcare systems currently facilitate or impede kidney care helps set benchmarks and opportunities for improvement. Furthermore, understanding how these capacities vary across regions or countries will help generate recommendations and identify areas where knowledge or resource sharing may bring great benefit.

SECTION 2

METHODS

2.1 Overview

The Global Kidney Health Atlas (GKHA) was devised through collaborative efforts with regional and country project leaders. Two key methods were used to produce the atlas: a desk research component, which involved searching literature and other data sources to generate estimates, and a key opinion leader survey, where leaders from each country submitted details on the characteristics of kidney care in that country.

Assistance from international contacts, collaborators, and ISN leadership and regional boards was sought to facilitate both approaches of developing the GKHA. Project leaders at regional and country levels enabled the inclusion of individual countries' nephrology association leadership and opinion leaders across regions and countries. Project leaders organized and followed up on responses for all countries within the region; served as a link between the steering committee, ISN, and regional stakeholders; served as a resource for additional data sources and contacts for surveys; identified or served as opinion leaders on the project for the region; and identified or served as resource persons to vet and review regional data.

2.2 Scope and timeline

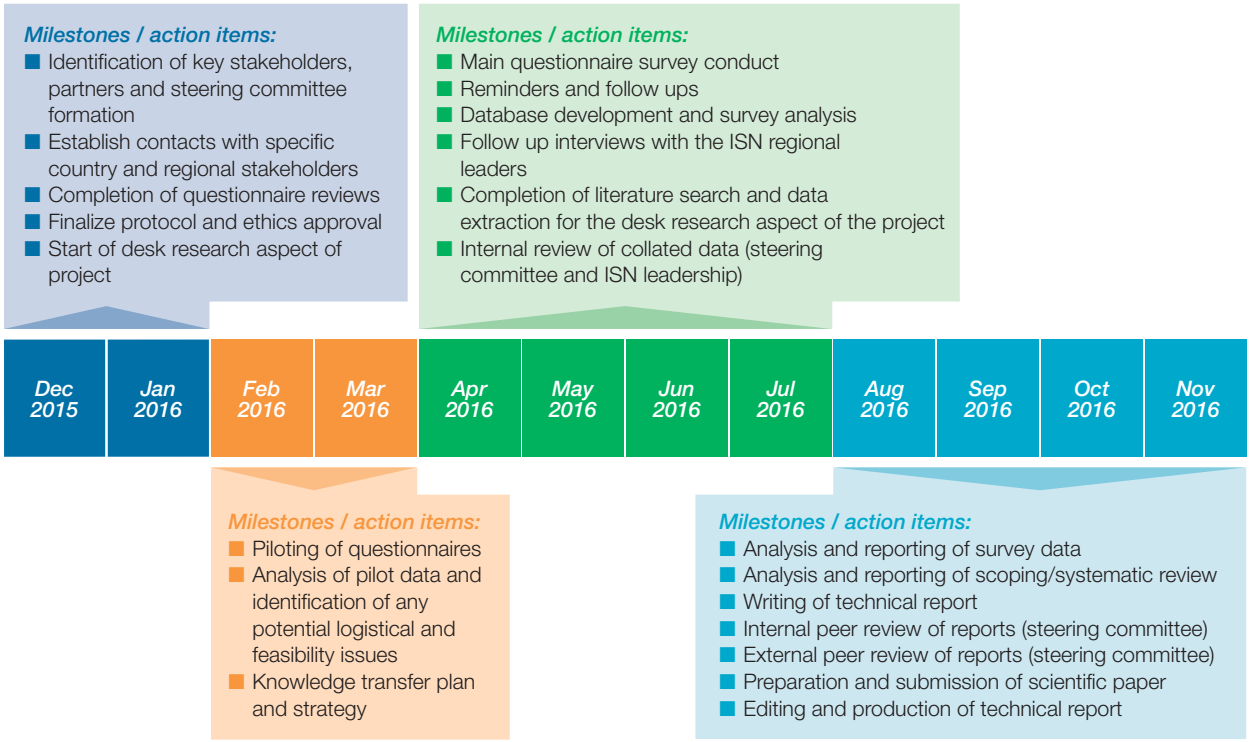
This report pertains to all 193 states recognized by the UN and specifically focuses on countries that have ISN affiliate societies. The work was carried out in these countries through the regional boards for the 10 ISN regions. Appendix 2 lists all countries.

Each region's work was led by a steering committee and working group within the stipulated timeline (Figure 2.1).

1. Africa
2. Eastern & Central Europe
3. Latin America & the Caribbean[1]
4. Middle East
5. North America & the Caribbean[1]
6. North & East Asia
7. Oceania & South East Asia
8. NIS & Russia
9. South Asia
10. Western Europe

1 Within the ISN, the islands of the Caribbean are affiliated with either North America & the Caribbean or Latin America & the Caribbean (see Appendix Table A2.1). For simplicity, the main body of the Atlas refers to these regions as North America and Latin America.

Figure 2.1 | Timeline of the GKHA project



2.3 Desk research

The desk research included a review of published scientific literature, government reports, and other relevant data sources on the various aspects of CKD epidemiology and health systems characteristics according to the WHO Universal Health Coverage (UHC) domains (service delivery, health workforce, information systems, medicines and medical products, financing, and leadership) (Tables 2.1 and 2.2). Although the published literature is important to consider, much of the available evidence was expected to be in the grey literature, including websites and reports with limited circulation. The country and regional project leaders helped identify these sources and conducted a detailed grey literature search designed by an expert research librarian.

To gather information on the current characteristics of kidney care and burden of CKD, two literature reviews were performed:

1. Scoping literature review of national health systems characteristics based on the WHO UHC domains and focusing on important elements relevant to CKD care organization and delivery.
2. Systematic review of relevant CKD epidemiology data on burden and outcomes across countries and regions.

2.3.1 Scoping review of health systems characteristics

The objective of the scoping review was to obtain a snapshot of individual country and regional health system characteristics and specific elements relevant to CKD care, focused on the general WHO UHC domains (Table 2.1) and the domains specific to kidney disease (Table 2.2). The comprehensive search strategy was developed in conjunction with an expert librarian.

Data sources included

- The WHO Global Observatory; the UN, World Bank, and OECD reports on NCDs; and published data/reports
- Both published and unpublished documents from international organizations/bodies (OECD, WHO, UN, Commonwealth Fund, World Bank, EU and its affiliates, etc.), reports published by national governments (and occasionally regional governments within countries) on the organization and delivery of CKD care
- Additional literature identified by key stakeholders (opinion leaders, national nephrology society leaders, ISN leaders) and through consults with national nephrology societies and ISN regional boards

2.3.2 Systematic review of relevant CKD epidemiological data

The objective of the systematic review was to collect epidemiological data on the key risk factors of CKD and the prevalence of both CKD and RRT. Data on CKD burden across countries and regions (prevalence estimates) and health system features with implications for CKD care were also reviewed. Data on key estimates of risk data were defined by the prevalence of obesity, hypertension, diabetes, hypercholesterolemia, and smoking[29]. These data were extracted from key reports including the WHO World Health Report, WHO World Health Statistics, and WHO NCD Document Repository, as well as the International Diabetes Federation Diabetes Atlas and World Heart Federation Global Atlas on CVD prevention and control.

Data sources included

- *Statistics/published reports from government where available:* In addition to reports from nephrology associations and registries, reports from many national governments (and occasionally regional governments within countries) were searched as identified by our grey literature search or by expert opinion
- *Reports published by international organizations (WHO, World Bank, UN, and OECD):* World Health Statistics and Health System Reports were examined
- *National nephrology societies:* The leaders of national and regional nephrology associations, along with key opinion leaders, helped us gather data relevant to all aspects of the inventory
- *Published scientific literature:* A rapid (expedited) systematic/scoping review of published scientific literature and government reports on the various aspects of CKD epidemiology and organization of care according to standard guidelines[30],[31] was included and, as in our previous work, provided additional complementary data for the atlas[32],[33]
- *Grey literature search:* The grey literature search strategy was developed with assistance from a research librarian. This search was tailored to the UHC key domains and to the taxonomy developed by WHO

Table 2.1 | General health system characteristics according to WHO universal health coverage domains

Building blocks	Indicators/metrics	Data sources	Essential elements
Country profile	■ Total population (millions) ■ Gross national income per capita	■ Literature reviews	■ Demographic and economic characteristics
Health service delivery	■ Description of healthcare system – public/private health insurance funded by national taxation/income contributions covering all/a proportion of the population. Recording of ratio of public/private MDs, renal care centres and/or HD centres.	■ Literature reviews ■ Surveys ■ Interviews	■ Comprehensiveness ■ Accessibility ■ Coverage ■ Quality ■ Coordination ■ Efficiency ■ Accountability
Health workforce	■ Density of physicians (per 10,000 population) ■ Density of nursing and midwifery personnel (per 10,000 population) ■ Density of pharmaceutical personnel (per 10,000 population)	■ Literature reviews ■ Surveys ■ Interviews ■ WHO Global Observatory	■ Reach and distribution ■ Accessibility
Health information systems	■ Health information system performance index	■ Literature reviews ■ Surveys ■ Interviews	■ Reach ■ Scope ■ Comprehensiveness
Essential medicines and technologies	■ Median availability of selected generic medicines in public and private sectors (%) ■ Median consumer price ratio of selected generic medicines in public and private sectors	■ Literature reviews ■ Surveys ■ Interviews ■ WHO Global Observatory	■ Equitable access ■ Quality and safety ■ Cost-effectiveness
Health financing	■ Total expenditure on health as a percentage of GDP ■ General government expenditure on health as a percentage of total expenditure on health ■ Private expenditure on health as a percentage of total expenditure on health ■ General government expenditure on health as a percentage of total government expenditure ■ Out-of-pocket expenditure as a percentage of private expenditure on health ■ Private prepaid plans as a percentage of private expenditure on health	■ Literature reviews ■ WHO Global Observatory ■ Database	■ Availability of funds ■ Extent of financial risk protection
Leadership and governance (national policies and frameworks)	■ National non-communicable chronic disease policy (where it exists) – overarching disease policy targeting long term conditions including CVD, diabetes, cancer, CKD, etc.	■ Literature reviews ■ Surveys ■ Interviews ■ WHO Global Observatory ■ WHO NCD Strategy	■ Existence of appropriate policies and strategies ■ Adoption of policies and strategies

Table 2.2 | Kidney disease specific health system characteristics according to WHO universal health coverage domains

Building blocks	Indicators/metrics	Data sources	Essential elements
Health service delivery	■ Number of health facilities for general CKD care ■ RRT services (e.g., number of health facilities offering HD services per country) ■ Public + private ■ Non-dialysis CKD care structure ■ RRT care structure	■ Literature reviews ■ Surveys ■ Interviews	■ Accessibility of dialysis and kidney transplant units to all within the countries ■ Access to medications ■ Reimbursement of treatment and care ■ Kidney transplant waiting list ■ Access to psychosocial counseling and support ■ Existence, strength, role of any patient organizations in each country
Health workforce	■ Number of nephrologists (per million population) ■ Number of general physicians (per 10,000 population) ■ Number of community health workers, (per 10,000 population) ■ Number of nurses (per 10,000 population) ■ Regional distribution ■ Nephrology trainees/graduates per year ■ Available of MDT	■ Literature reviews ■ Surveys ■ Interviews ■ WHO Global Observatory	■ Professionals (GPs, nephrologists, diabetologists, endocrinologists, cardiologists, other related disciplines): total and as a ratio to whole population or dialysis population ■ Financial resources, remuneration and incentives (including those for GPs/specialists to identify and manage CKD patients) ■ Presence of other credentialed healthcare providers (e.g., nephrology nurses, dietitians)
Health information systems	■ CKD (non-dialysis) registry ■ RRT registry	■ Literature reviews ■ Surveys ■ Interviews	■ Reach ■ Scope
Essential medicines and technologies	■ ACEi/ARBs ■ Statins ■ Aspirin ■ Other BP meds ■ Anemia meds (EPO/iron) ■ CKD-MBD (Ca binders, renagel, cinacalcet) ■ Specific (GN and transplant) ■ Dialysis availability, access, and coverage ■ Transplant availability, access, and coverage	■ Literature reviews ■ Surveys ■ Interviews ■ WHO Global Observatory (for some essential medicines)	■ Access to medications that manage risk factors to prevent the development or progression of AKI or CKD
Health financing	■ Total expenditure on health for CKD ■ Public + private contributions ■ Out-of-pocket payments for essential medicines ■ Out-of-pocket payments for non-dialysis CKD care ■ Out-of-pocket payments for dialysis ■ Out-of-pocket payments for transplant	■ Literature reviews ■ Surveys ■ Interviews ■ WHO Global Observatory	■ Fund medications to prevent the development or progression of AKI or CKD
Leadership and governance (national policies and frameworks)	■ Guidelines/frameworks on CKD care ■ Advocacy efforts and initiatives ■ Early detection and prevention programs ■ eGFR reporting	■ Literature reviews ■ Surveys ■ Interviews ■ WHO Global Observatory ■ WHO NCD Strategy	■ Availability, awareness, and adoption of policies and guidelines targeted toward kidney care

ACEi/ARBs = Angiotensin-Converting Enzyme Inhibitors/Angiotensin Receptor Blockers, CKD = Chronic Kidney Disease, eGFR = Estimated Glomerular Filtration Rate, EPO = Erythropoietin, GN = Glomerulonephritis, GP = General Practitioner, MBD = Mineral Bone Disorder, MDT = Multidisciplinary Team, NCD = Non-Communicable Disease, RRT = Renal Replacement Therapy, WHO = World Health Organization.

2.4 Survey

2.4.1 Development and validation

The GKHA project was a multinational, cross-sectional survey conducted by the ISN to assess current capacity for kidney care across the world.

Through our international contacts, collaborators, and ISN leadership and regional boards we identified project leaders at the regional and country level, including individual country nephrology association leadership and opinion leaders across regions and countries.

Role for regional project leaders:

- To organize and follow up on responses for all countries within the region
- To serve as a link between the steering committee, ISN, and regional stakeholders
- To serve as a resource for additional data sources and contacts for surveys
- To identify or serve as an opinion leader on the project for the region
- To identify or serve as a resource person to vet and review regional data

Role for individual country project leaders:

- To organize and follow up on responses within the country
- To serve as a link between the steering committee, ISN, and country stakeholders
- To serve as a resource for additional data sources and contacts for surveys
- To identify or serve as an opinion leader on the project for the country
- To identify or serve as a resource person to vet and review data for the country

The framework that was applied to the design of the GKHA questionnaire to derive information about nations' capacities and responses to NCD prevention and control considered a number of documents, including World Health Organization (WHO) Universal Health Coverage: Supporting Country Needs, the ISN AKI "0 by 25" Initiative, WHO NCD Surveys (2000, 2005, 2010, 2013), World Heart Federation (WHF) "25 by 25" Initiative, International Diabetes Federation (IDF) Global Diabetes Atlas, WHO Global Atlas on Cardiovascular Disease Prevention and Control, Lancet commissions in other chronic disease domains, as well as multiple UN policy documents on strategies and policy for NCDs[34],[35],[36],[37].

The initial survey questions were further developed through a series of reviews with relevant experts, the ISN Executive Committee, and regional leadership. The questionnaire was peer reviewed for content validity and comprehensiveness, and piloted across the 10 ISN regional board memberships to identify any logistical and feasibility issues (e.g., need for translation). The format and content of the questionnaire were finalized based on feedback and identified issues, including translating the original English language survey instrument into French and Spanish.

2.4.2 Structure

The questionnaire was designed in two sections that addressed the core areas of country and regional capacity for kidney care delivery:

1. The first section comprised five modules assessing country and regional profiles for readiness, capacity, and response to CKD and AKI premised on the six UHC domains[38].
    - Health Finance, Service Delivery and Safety (UHC domains 1 and 2): questions evaluating funding mechanisms, infrastructure (availability, adequacy, and reach) for CKD and AKI care (including RRT)
    - Health Workforce (UHC domain 3): questions on availability (and number) of

nephrologists, capacity for nephrology training, and adequacy of other workforce components essential for CKD and AKI care delivery

- Essential Medications and Technology Access (UHC domain 4): questions on availability and access to medicines for CKD and RRT technologies (dialysis and transplantation)
- Health Information System and Statistics (UHC domain 5): questions on availability of registries and/or other surveillance systems for CKD and AKI care (including RRT)
- Leadership and Governance (UHC domain 6): questions on advocacy, policies and strategies, awareness and adoption of guidelines for CKD and AKI.

2. The second section contained questions that assessed response of the nephrology community:
   - Strategies and policy frameworks (including care guidelines, position papers, service frameworks, and advocacy initiatives)
   - Capacity for research and development

The questionnaire was accompanied by a detailed information sheet about the GKHA, detailed instructions for completion, and a glossary defining key terms used in the survey.

2.4.3 Sampling

A non-probability, purposive sampling approach was undertaken to identify potential survey respondents. These comprised key stakeholders identified by the country and regional nephrology leadership through the ISN. Respondents included at least three key representatives per country sourced from the national nephrology society leadership, policymakers (including those involved directly with the organization of CKD care and those with a more general remit), patients' organizations, foundations, and other advocacy groups.

The key representatives were sent a letter of invitation to participate that included a link to the survey's online portal (an electronic questionnaire via SurveyMonkey, www.surveymonkey.com). Respondents were asked specifically about important within-country heterogeneity and were asked to identify other potential key respondents, increasing the likelihood that relevant information would be widely captured.

The survey was conducted from May to September 2016. During this period, intensive follow-ups were conducted by email and telephone to ISN regional leaders and country leadership to facilitate complete and timely responses. Appendix 1 shows the participating countries and disciplinary affiliations of respondents.

2.4.4 Data handling

To facilitate data collation, responses to the French and Spanish surveys were first converted to English by certified translators. Data from all individual questionnaires were subsequently automatically extracted and cleaned using Microsoft Excel and merged into a single file to create the global database. This was housed in a secured centralized computer system with automated backups.

Liaison with ISN regional leaders was undertaken to ensure that collated data were consistent with their understanding and were of high quality. Each regional board reviewed their output to clarify any ambiguity or inconsistencies. Any major inconsistencies that remained following the reviews were systematically addressed by follow-up inquiries with the stakeholders involved with the survey. Further validation was carried out at country and regional level by triangulation of the findings with published literature and grey sources of information (government reports and other sources provided by the survey respondents).

2.4.5 Analysis

The framework developed by the WHO (Assessing National Capacity for the Prevention and Control of NCDs) was leveraged in the approach to the statistical analysis of the collated data[39]. The analysis was conducted using STATA 13 software (Stata Corporation, 2013). The unit of analysis was responding country. Responses were summarized based on the key questionnaire domains using a descriptive statistical approach and reported as counts and percentages. Results were stratified by ISN region and by World Bank income group.

The results were examined with an emphasis on identification of key gaps and challenges across the various domains based on the pre-existing protocol, and reported according to the Guidelines for Accurate and Transparent Health Estimates Reporting (GATHER) statement[40].

DESK RESEARCH FINDINGS

SECTION 3

RISK AND BURDEN OF CKD

3.1 Obesity

The distribution of obesity in adults (≥18 years) varied across ISN regions (Map 3.1; Figure 3.1). All countries (100%) in South Asia and 80% of countries within North & East Asia reported a prevalence of obesity less than 10%, whereas no countries in Eastern & Central Europe, Latin America, the Middle East, NIS & Russia, North America, and Western Europe reported a prevalence of obesity less than 10%. The highest occurrences of obesity rates (national mean) were reported in the Middle East and North America, where approximately 70% and 50% of the countries in the regions, respectively, reported a national prevalence of obesity of at least 30%.

Map 3.1 | Global prevalence of obesity

Body mass index ≥ 30 kg/m^2, age ≥ 18 years

≤10.0% 10.1%–20.0% 20.0%–30.0% >30.0% N/A (not available)

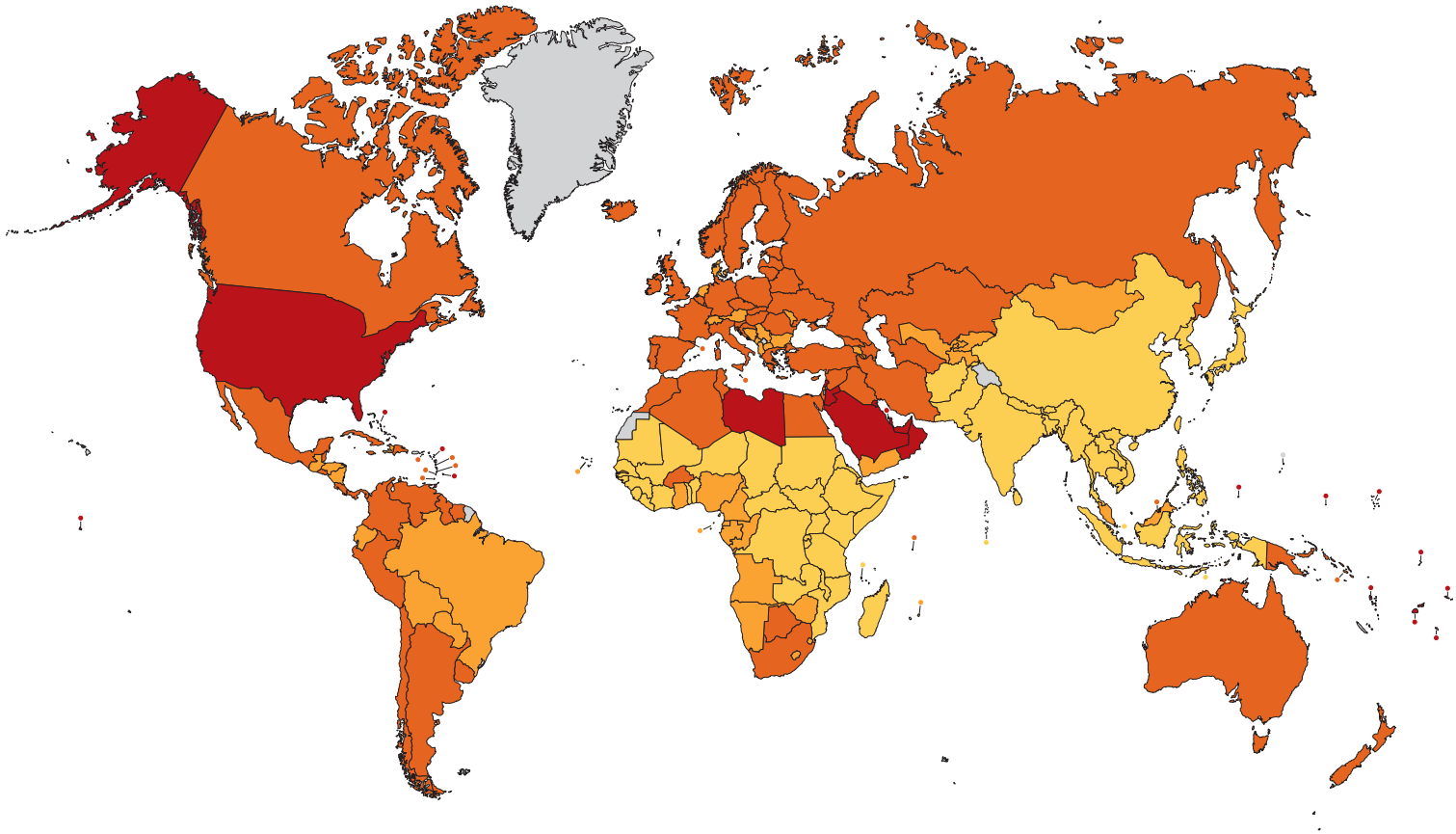
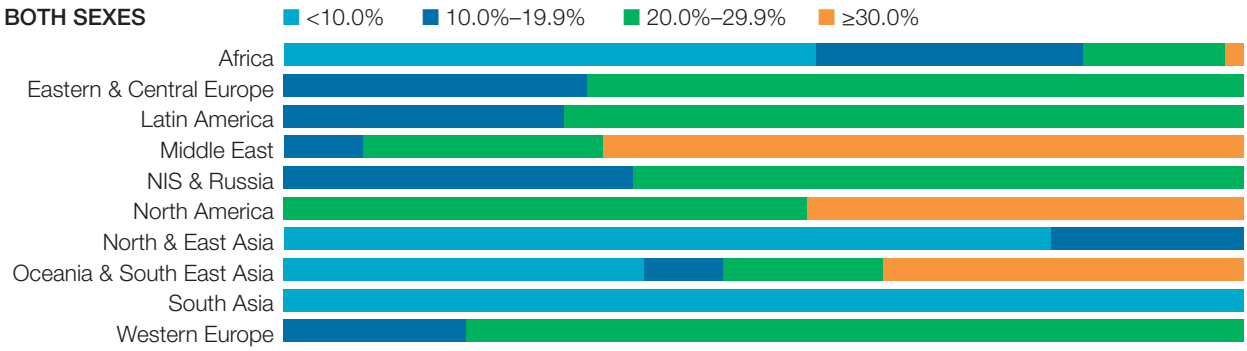


Figure 3.1 | Global prevalence of obesity

National prevalence of obesity (body mass index ≥ 30 kg/m²), age ≥ 18 years

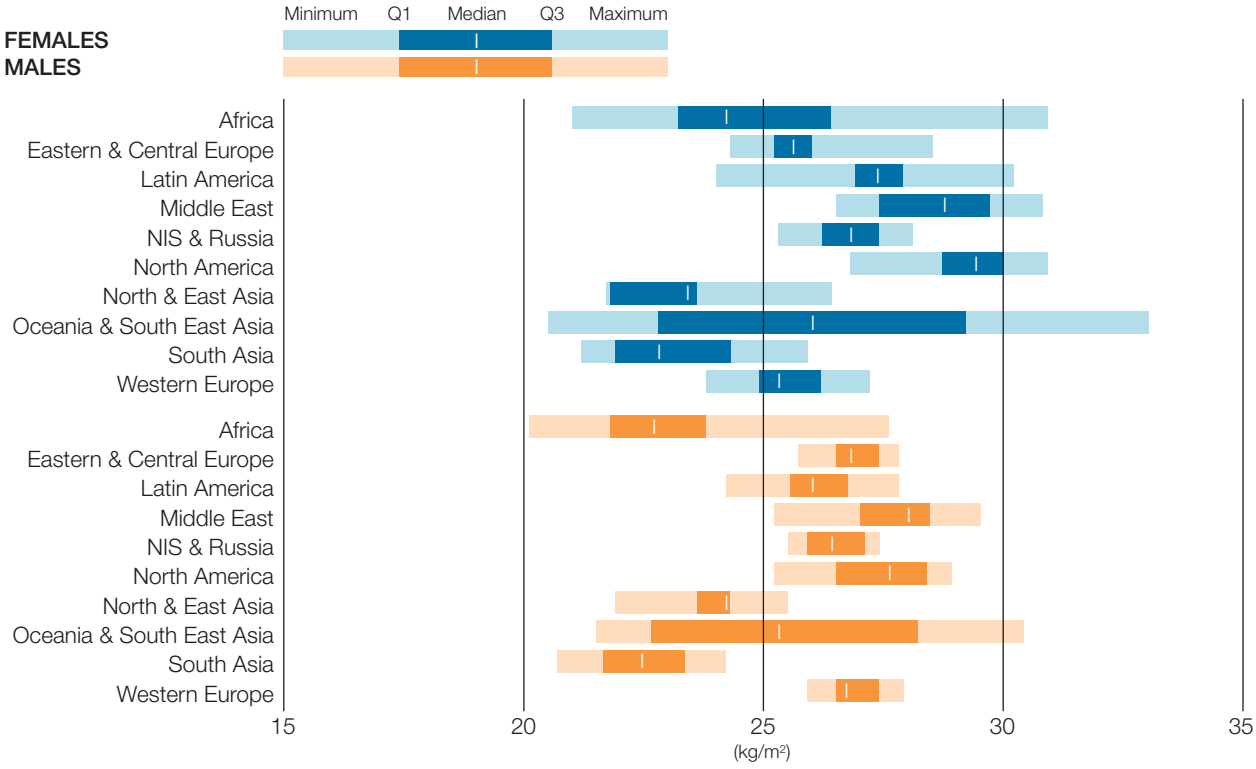


Data missing from Eastern & Central Europe (1 country), Latin America (1 country), Middle East (2 countries), North America (7 countries), North & East Asia (2 countries), Oceania & South East Asia (5 countries), and Western Europe (6 countries).

Obesity trends were similar across adult males and females, in most regions (Figure 3.2). In Africa, Latin America, North America, and Oceania & South East Asia, the median BMI was slightly higher in females than in males, whereas in Eastern & Central Europe and Western Europe, the median BMI was slightly higher in males than females. Obesity rates varied within countries, and this variance also ranged across the ISN regions. Africa and Oceania & South East Asia had the widest ranges in both males and females, NIS & Russia and Western Europe had the smallest ranges, irrespective of gender, and Eastern & Central Europe and Latin America had substantially more variation in females than males.

Figure 3.2 | Global distribution of body mass index

National mean BMI (kg/m²), age ≥ 18 years



3.2 Hypertension

The prevalence of hypertension varied across ISN regions and by gender (Map 3.2). Overall, hypertension was higher among males than females, particularly in Eastern & Central Europe, Latin America, the Middle East, NIS & Russia, North America, North & East Asia, and Western Europe (Figure 3.3; Figure 3.4). Prevalence was highest, irrespective of gender, in Africa, Eastern & Central Europe, and NIS & Russia.

There was generally a high variation in national mean systolic blood pressure within most ISN regions, in both males and females (Figure 3.4). Similarly, the national mean systolic blood pressure varied considerably across regions.

Map 3.2 | Global prevalence of hypertension

Systolic BP > 140 mmHg or diastolic BP > 90 mmHg, age ≥ 18 years

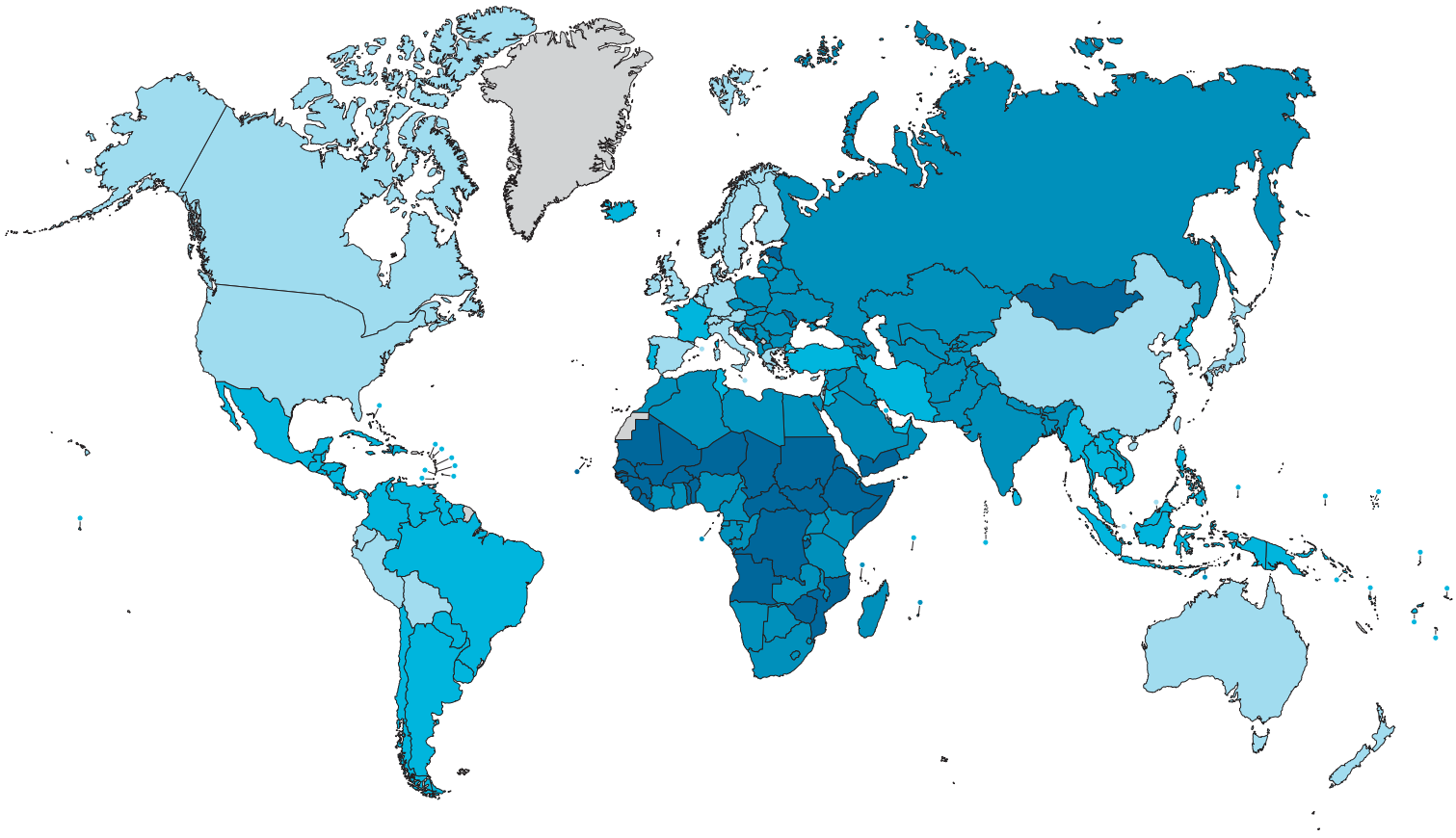
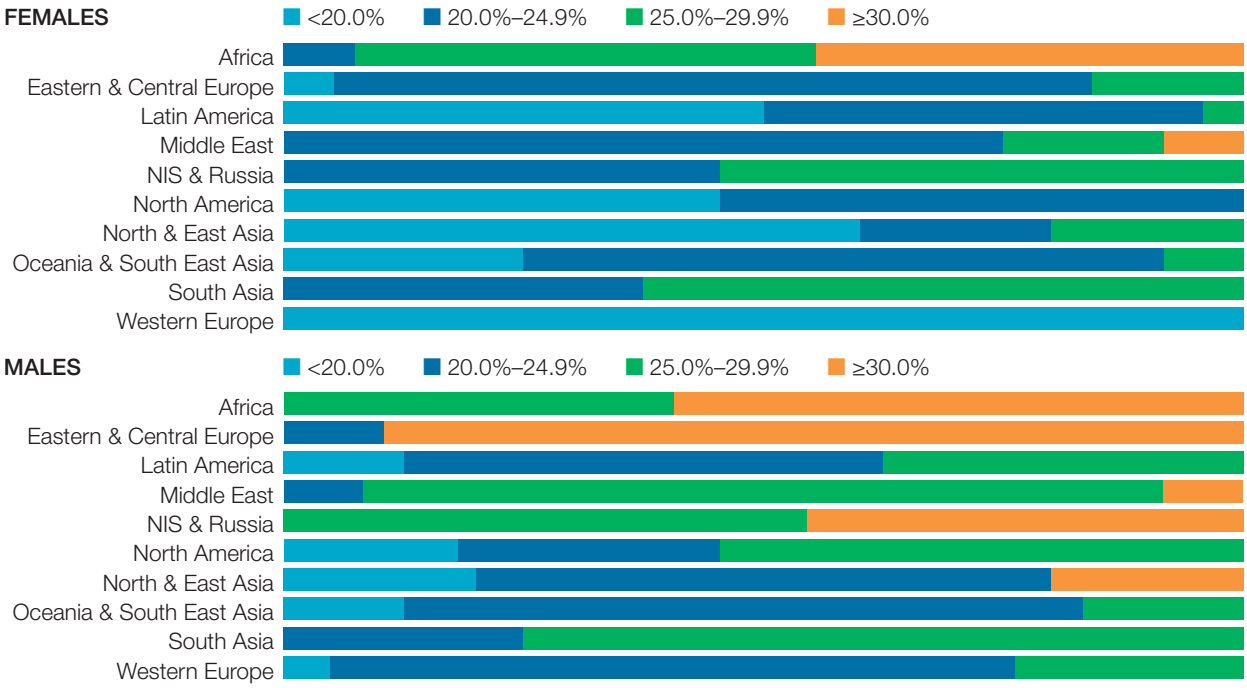


Figure 3.3 | Global prevalence of hypertension

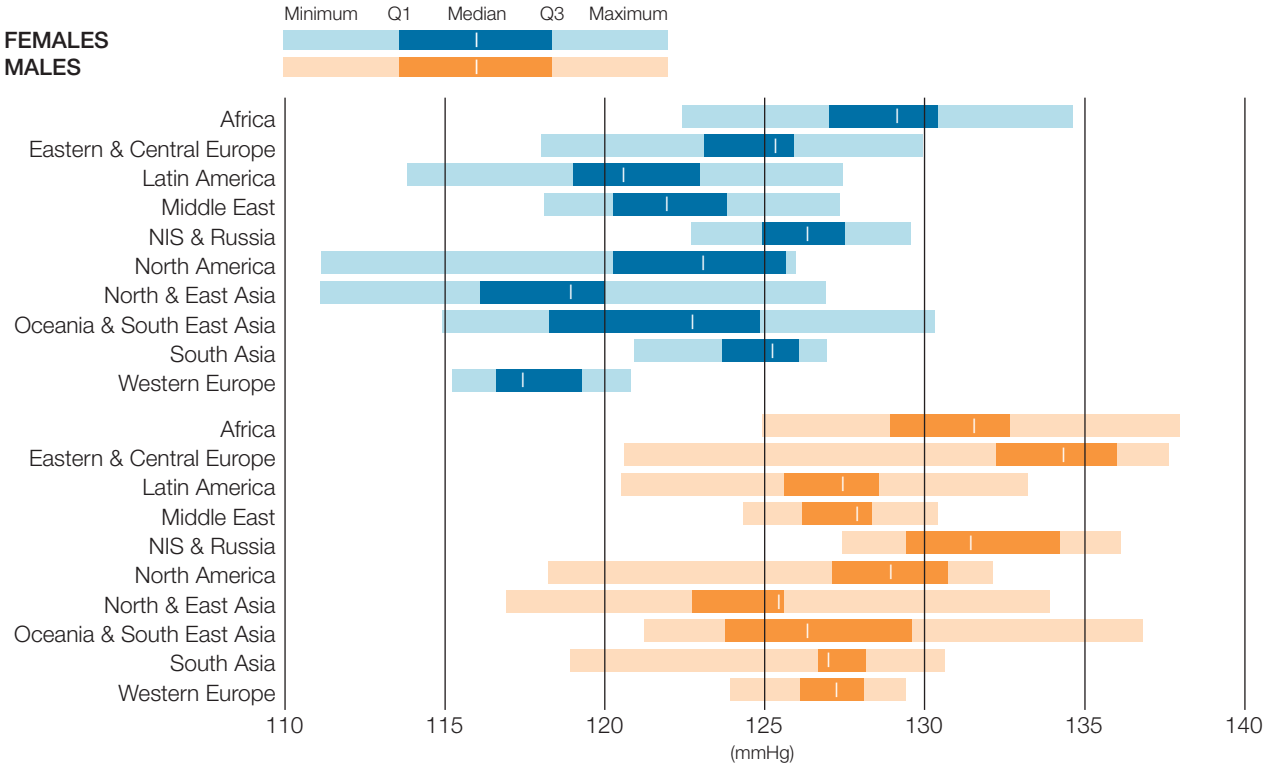
National prevalence of hypertension (systolic blood pressure (BP) > 140 mmHg or diastolic BP > 90 mmHg), age ≥ 18 years



Data missing from Eastern & Central Europe (1 country), Latin America (1 country), Middle East (2 countries), North America (7 countries), North & East Asia (2 countries), Oceania & South East Asia (5 countries), Western Europe (6 countries).

Figure 3.4 | Global distribution of blood pressure

National mean systolic blood pressure (mmHg), age ≥ 18 years



3.3 Diabetes

Prevalence of diabetes, as indicated by hyperglycemia, differed across ISN regions (Map 3.3). Countries in the Middle East and North America had the highest rates of diabetes, irrespective of gender (Figure 3.5). Diabetes was also common in NIS & Russia and Oceania & South East Asia, but was more common in males than females. Diabetes was lowest in Africa, Eastern & Central Europe, North & East Asia, South Asia, and Western Europe.

Overall, national mean Fasting Blood Glucose (FBG) levels were either equal across genders or slightly higher in males compared to females in all regions except for North America, where levels were higher in females (Figure 3.5). The largest differences between men and women were seen in Western Europe, North & East Asia, and Oceania & South East Asia (Figure 3.6). Similarly to obesity, the largest variance of FBG, irrespective of gender, was seen in Africa, Latin America, the Middle East, and Oceania & South East Asia. In females, North America had the highest median of FBG, whereas in males, the Middle East had the highest median FBG (Figure 3.6).

Map 3.3 | Global prevalence of diabetes

Fasting blood glucose (FBG) ≥ 7.0 mmol/L or on medication for raised FBG, age ≥ 18 years

≤8.0% 8.1%–12.0% 12.1%–16.0% >16.0% N/A (not available)

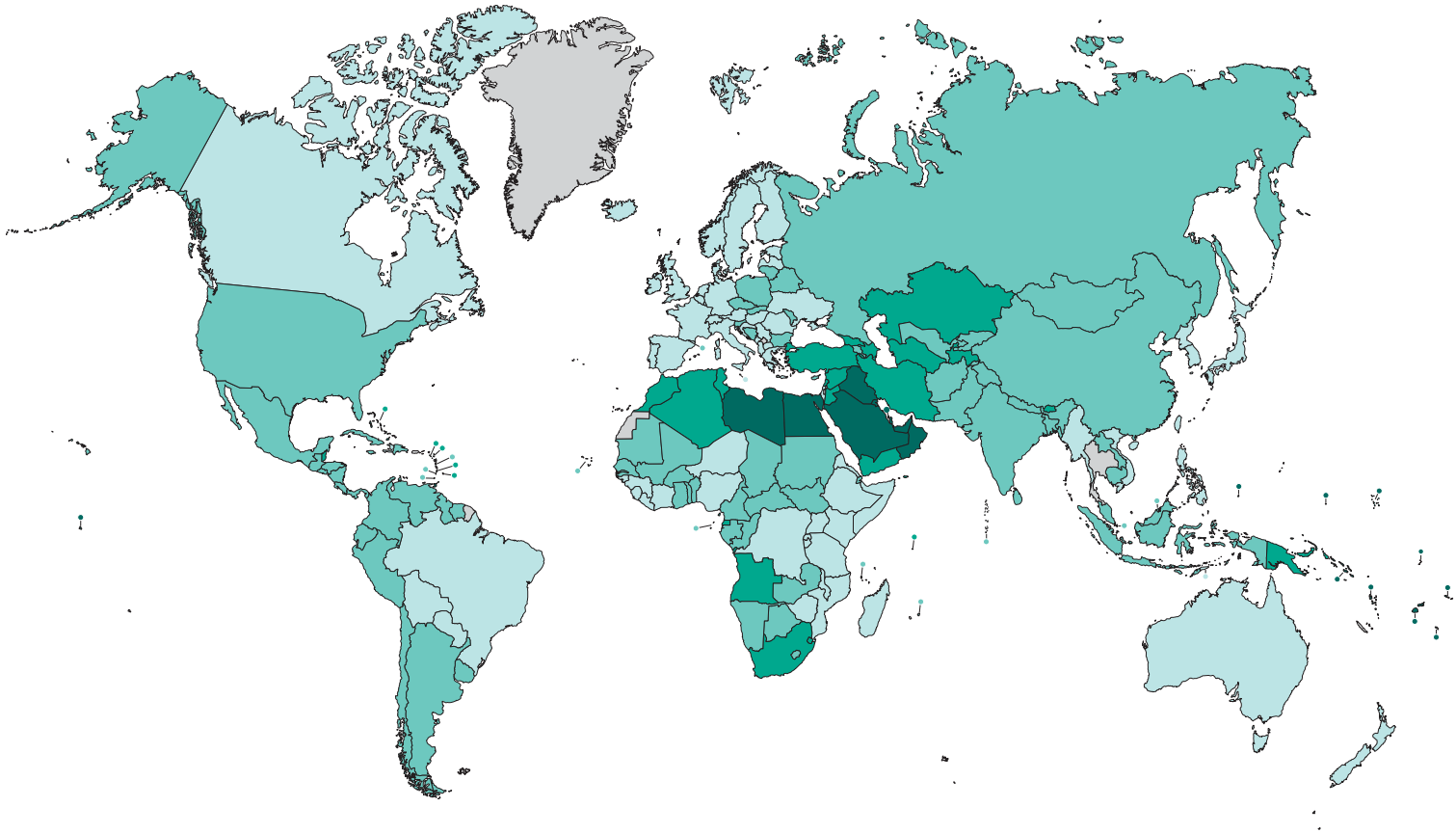
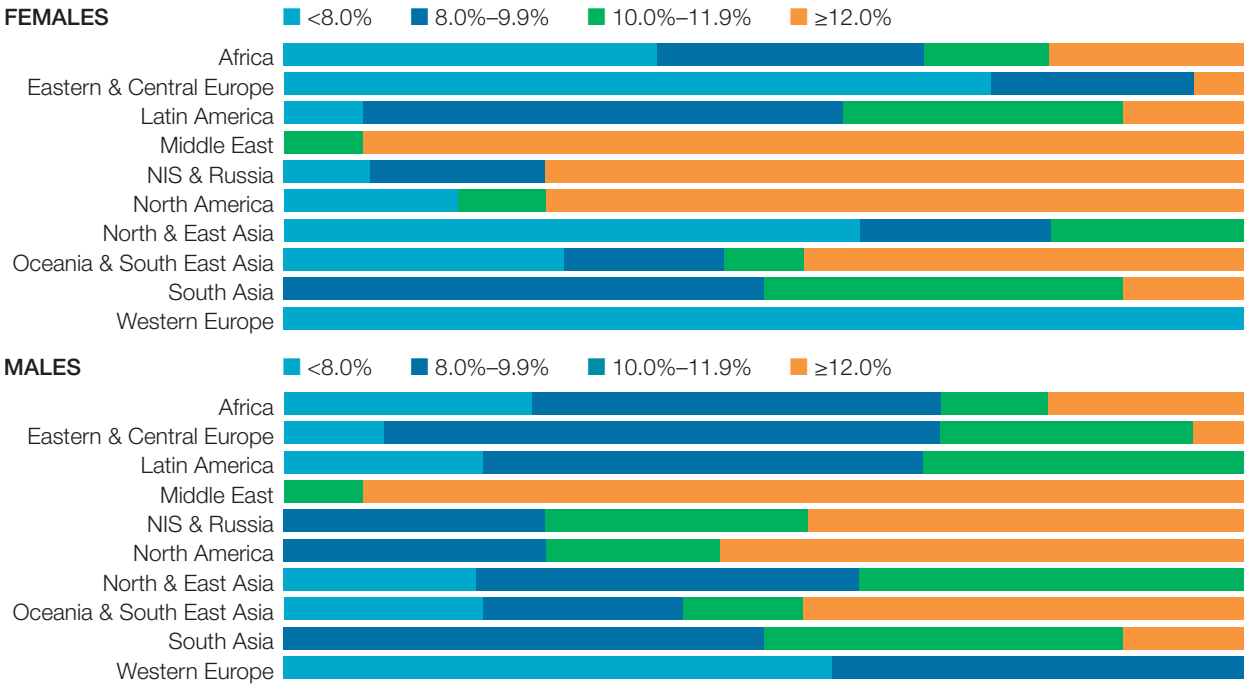


Figure 3.5 | Global prevalence of diabetes

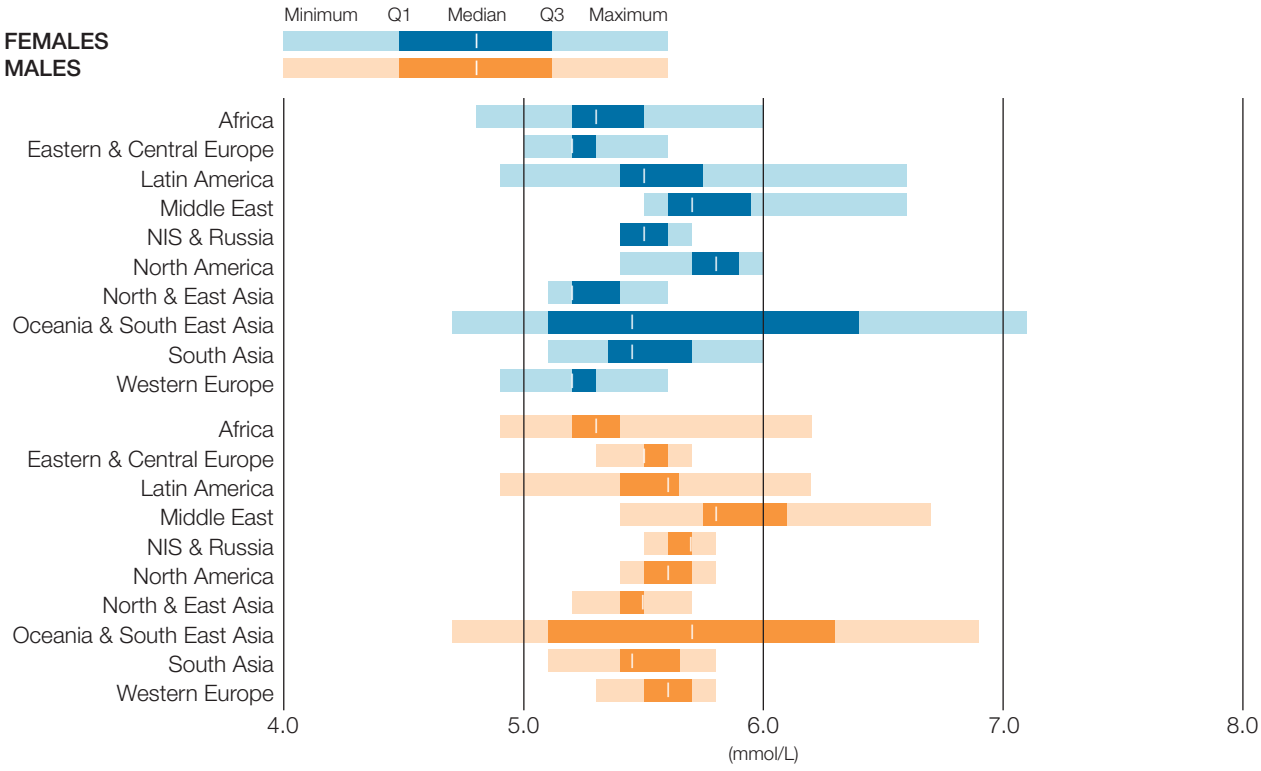
National prevalence of diabetes (fasting blood glucose (FBG) ≥ 7.0 mmol/L or on medication for raised FBG), age ≥ 18 years



Data missing from Eastern & Central Europe (1 country), Latin America (1 country), Middle East (2 countries), North America (7 countries), North & East Asia (2 countries), Oceania & South East Asia (5 countries), and Western Europe (6 countries).

Figure 3.6 | Global distribution of fasting blood glucose

National mean fasting blood glucose (mmol/L), age ≥ 25 years



3.4 Cholesterol

The prevalence of raised total cholesterol in adults, as defined by a total cholesterol ≥ 6.2 mmol/L, varied across the ISN regions (Map 3.4; Figure 3.7). The majority (68%) of countries in Africa and half (50%) of the countries in South Asia had less than 6% of the adult population with a raised total cholesterol. Conversely, regions such as Eastern & Central Europe, the Middle East, and Western Europe reported no countries with a prevalence of less than 6%, and over 40% of these regions reported a prevalence of at least 15%. Over 85% of countries in Western Europe had a prevalence of at least 15%.

There were no major differences in spread or median total cholesterol across gender (Figure 3.8). Largest discrepancies across men and women were seen in North America and Oceania & South East Asia, where the median total cholesterol was higher in females than males in both regions. Eastern & Central Europe, Western Europe, and the Middle East had more countries with a prevalence over 15%, and Africa and South Asia had more countries with a prevalence less than 6%, compared to other regions.

Map 3.4 | Global prevalence of hypercholesterolemia

Total cholesterol ≥ 6.2 mmol/L, age ≥ 25 years

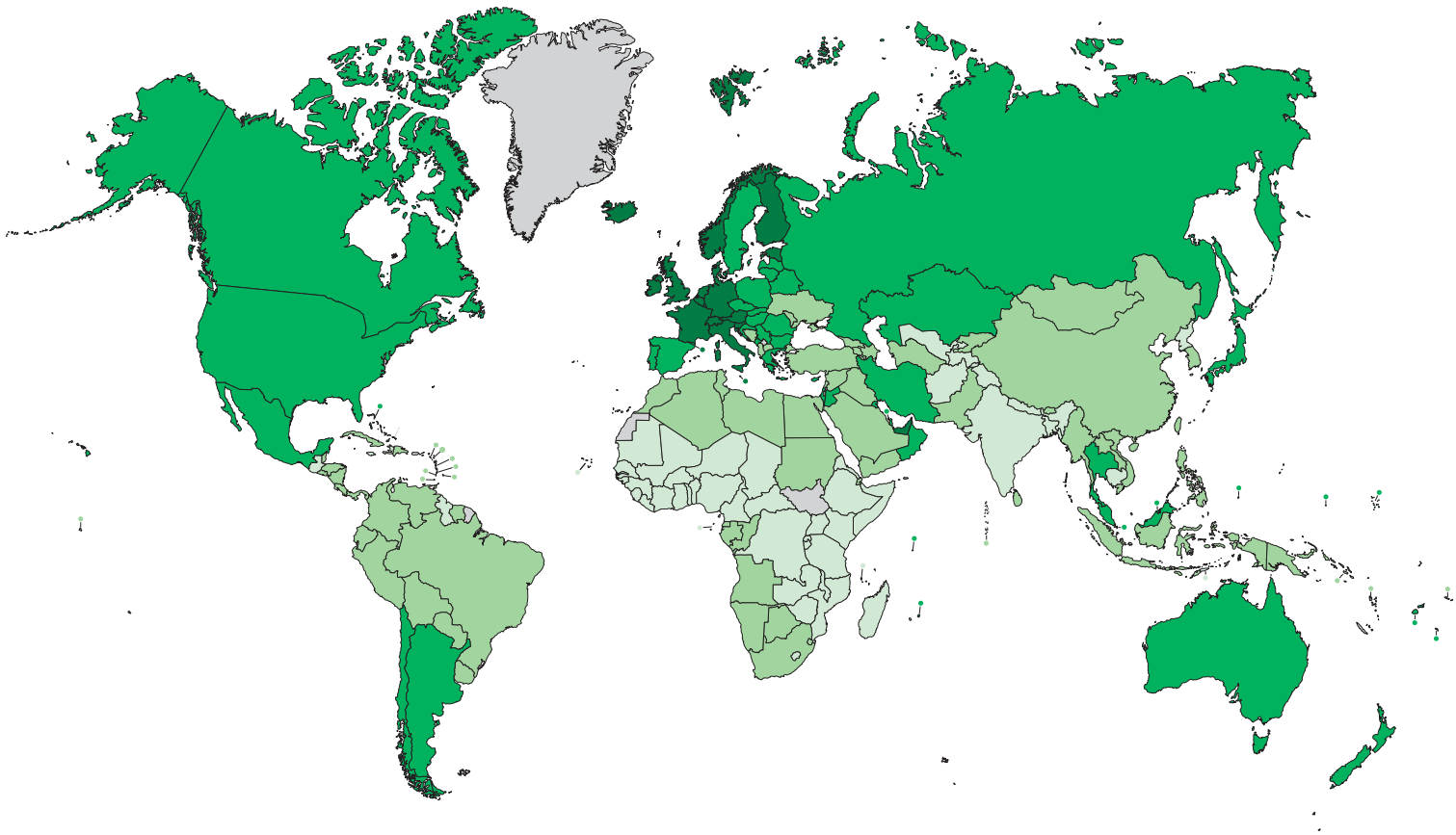
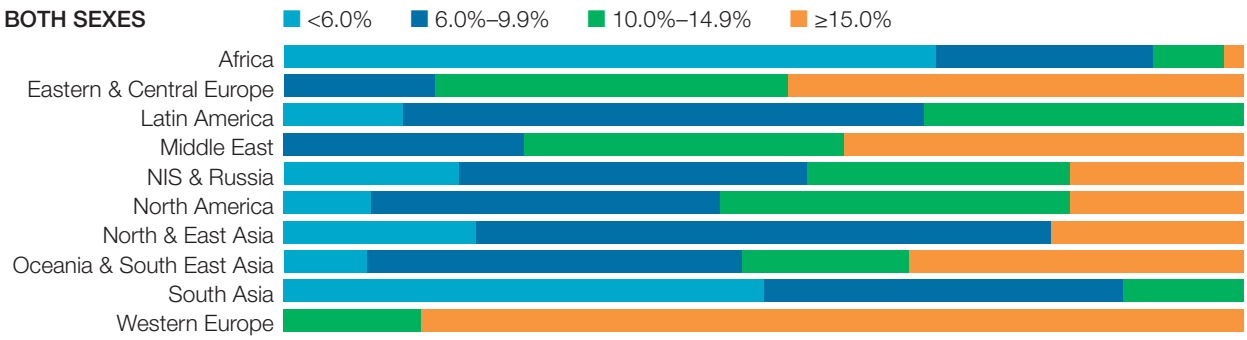


Figure 3.7 | Global prevalence of hypercholesterolemia

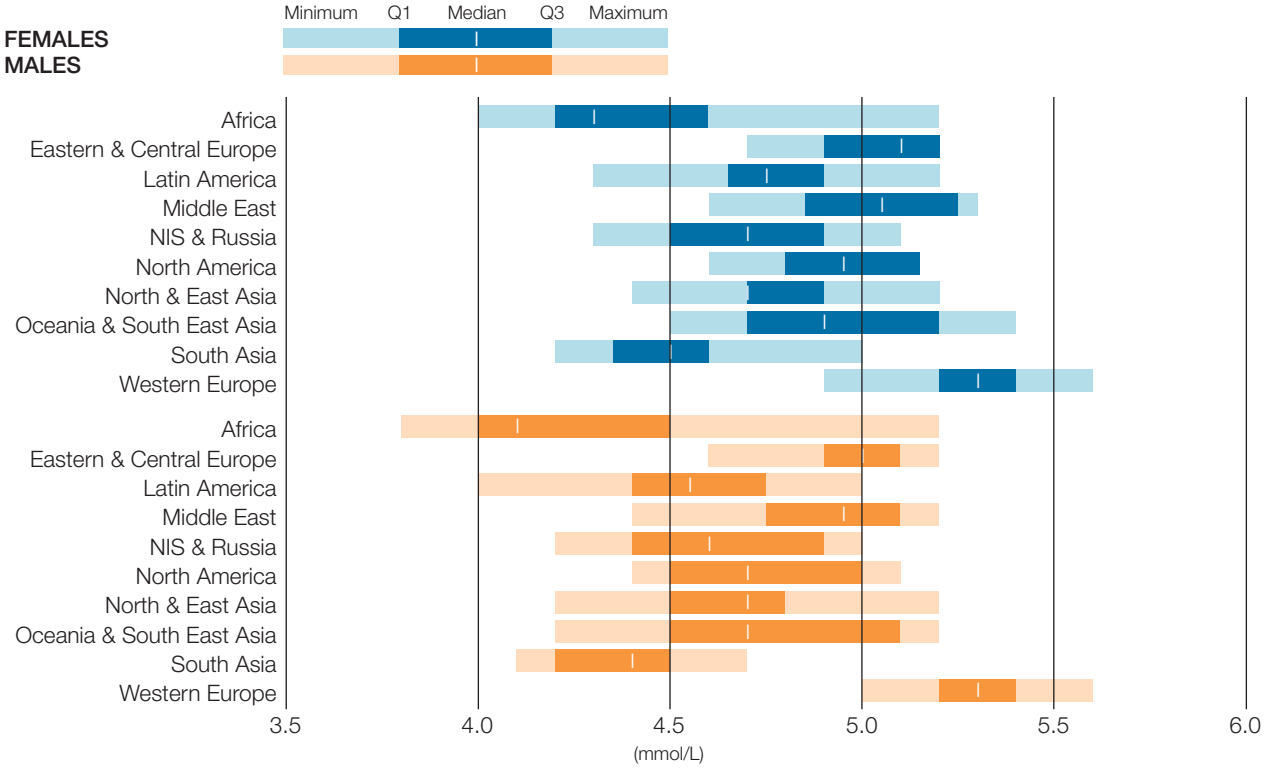
National prevalence of hypercholesterolemia (total cholesterol ≥ 6.2 mmol/L), age ≥ 25 years



Data missing from Africa (1 country), Eastern & Central Europe (1 country), Latin America (1 country), Middle East (2 countries), North America (7 countries), North & East Asia (2 countries), Oceania & South East Asia (6 countries), and Western Europe (6 countries).

Figure 3.8 | Global distribution of total cholesterol

National mean total cholesterol (mmol/L), age ≥ 25 years



3.5 Smoking status

Smoking status varied across ISN regions (Map 3.5; Figure 3.9). More than a third of countries in NIS & Russia and Oceania & South East Asia and two-thirds of countries in Eastern & Central Europe had a smoking prevalence of at least 30%. Smoking prevalence of less than 16% was most common in Africa, Latin America, the Middle East, North America, and South Asia (Figure 3.9).

Overall, smoking was more common in males than females (Figure 3.10). Variability in most ISN regions was high, particularly in Africa (males), Eastern & Central Europe (females), Latin America, the Middle East, NIS & Russia (males), Oceania & South East Asia, South Asia, and Western Europe (males).

Map 3.5 | Global prevalence of smoking

Age ≥ 15 years

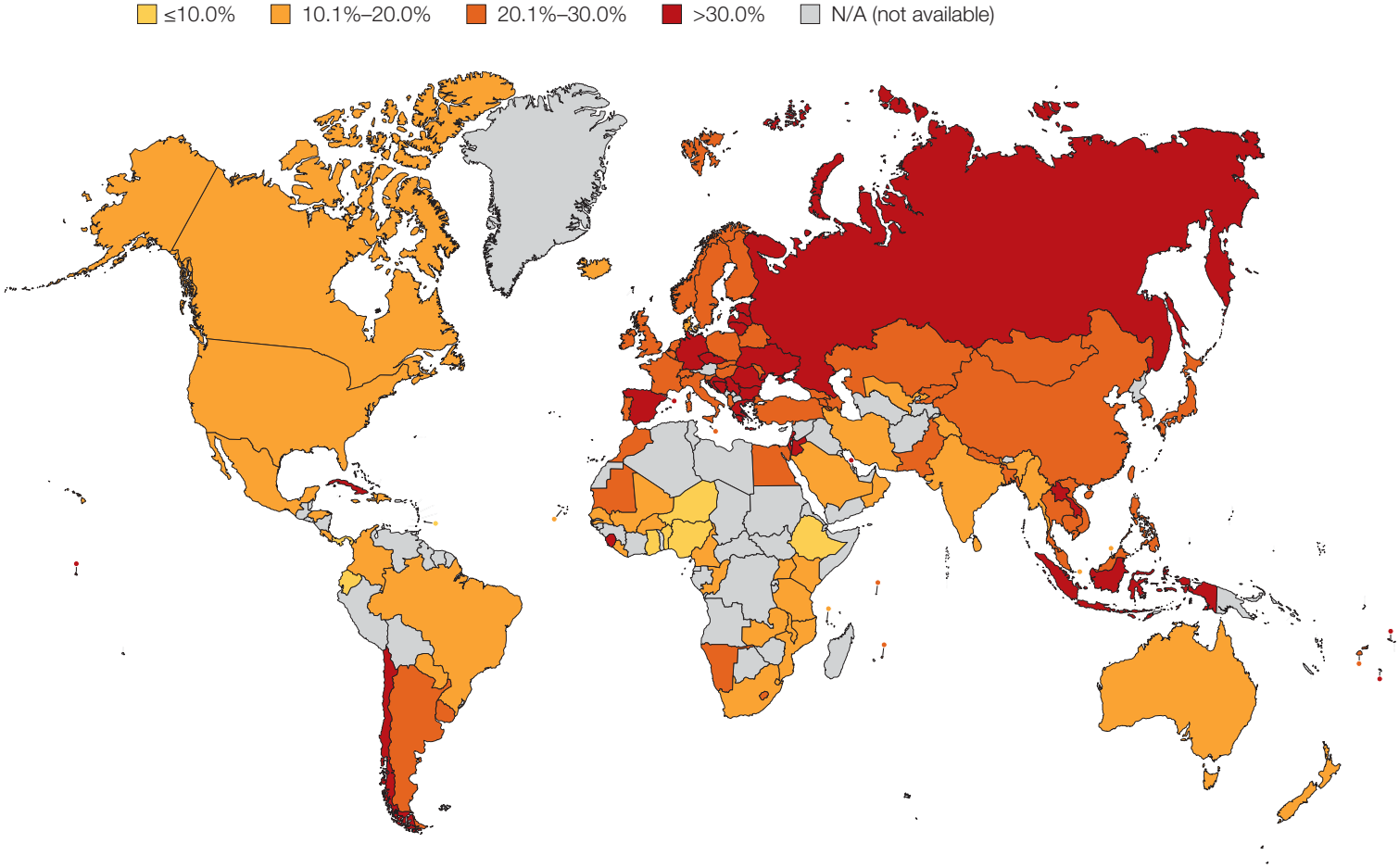
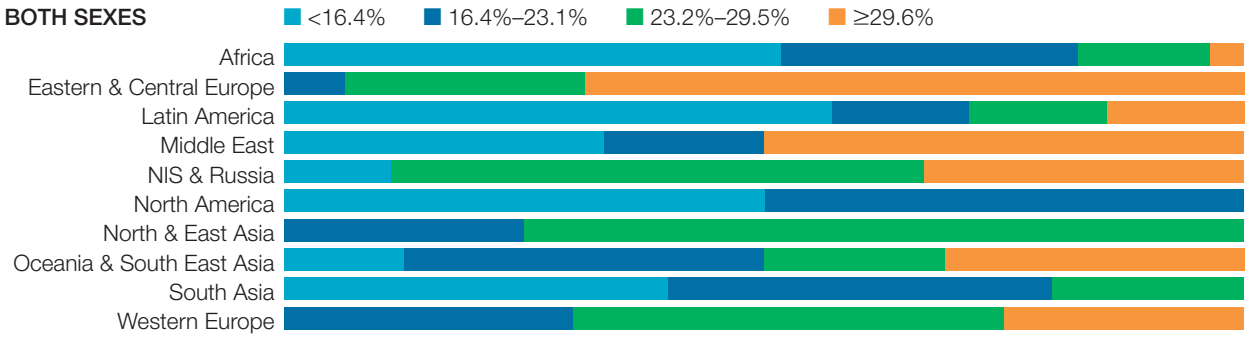


Figure 3.9 | Global prevalence of smoking

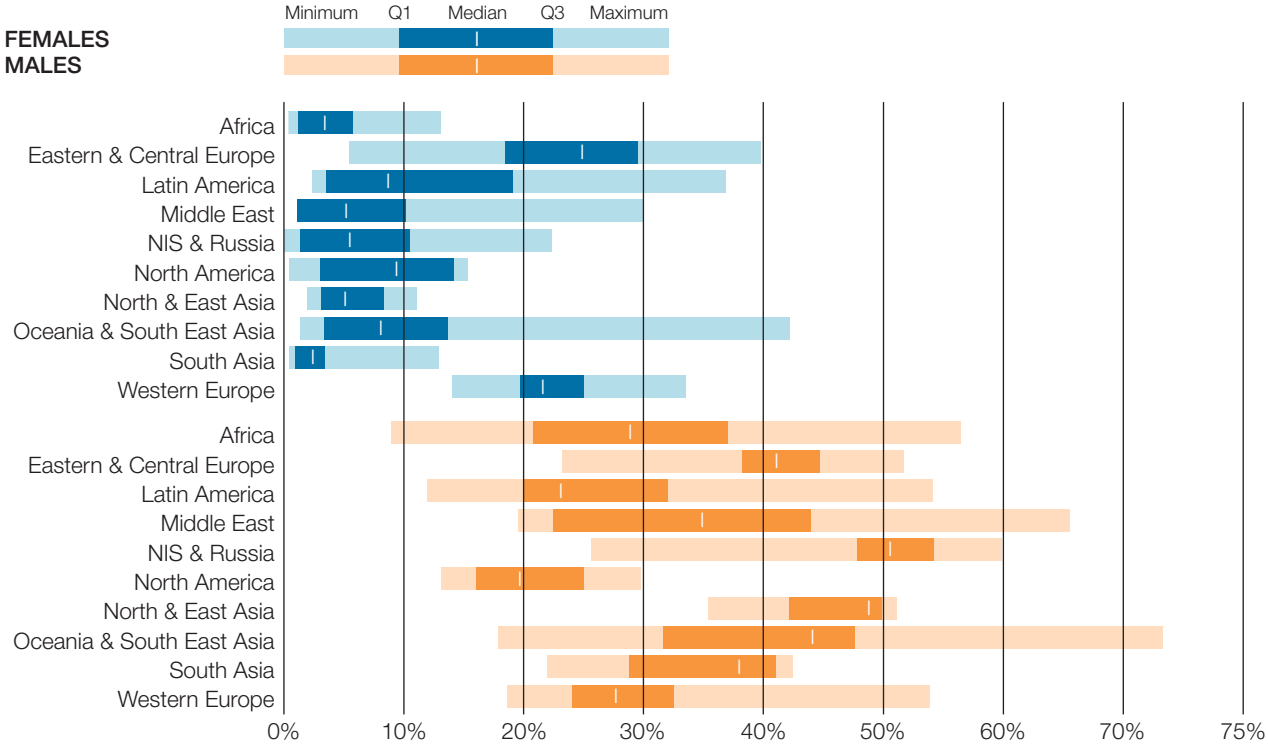
National prevalence of smoking, age ≥ 15 years



Data missing from Africa (25 countries), Eastern & Central Europe (4 countries), Latin America (11 countries), Middle East (8 countries), NIS & Russia (2 countries), North America (14 countries), North & East Asia (3 countries), Oceania & South East Asia (13 countries), South Asia (3 countries), and Western Europe (7 countries).

Figure 3.10 | Global distribution of smoking

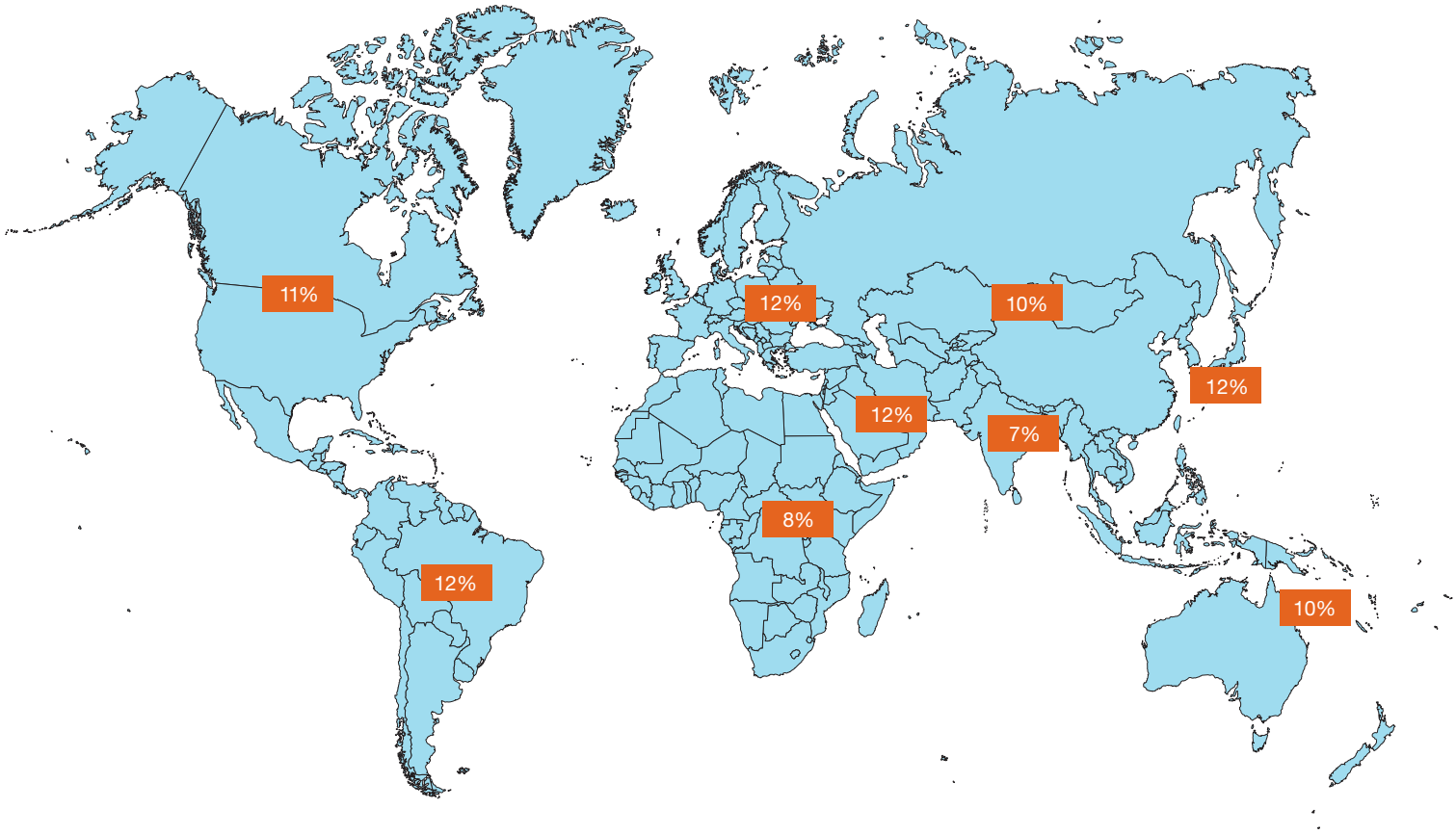
National prevalence of smoking, age ≥ 15 years



3.6 Prevalence of CKD

Overall, approximately 10% of the global population has chronic kidney disease. The prevalence of CKD and was highest in Latin America, Europe, East Asia and the Middle East, where approximately 12% of the population has CKD[41]. The lowest prevalence was reported in South Asia (7%) and Sub-Saharan Africa (8%) (Map 3.6).

Map 3.6 | Estimated global prevalence of CKD



Geographic regional structure not based on ISN regional framework
Source: Hill et al., Global prevalence of chronic kidney disease – a systematic review and meta-analysis[41].

SECTION 4

GENERAL HEALTH SYSTEM CHARACTERISTICS RELEVANT TO KIDNEY CARE

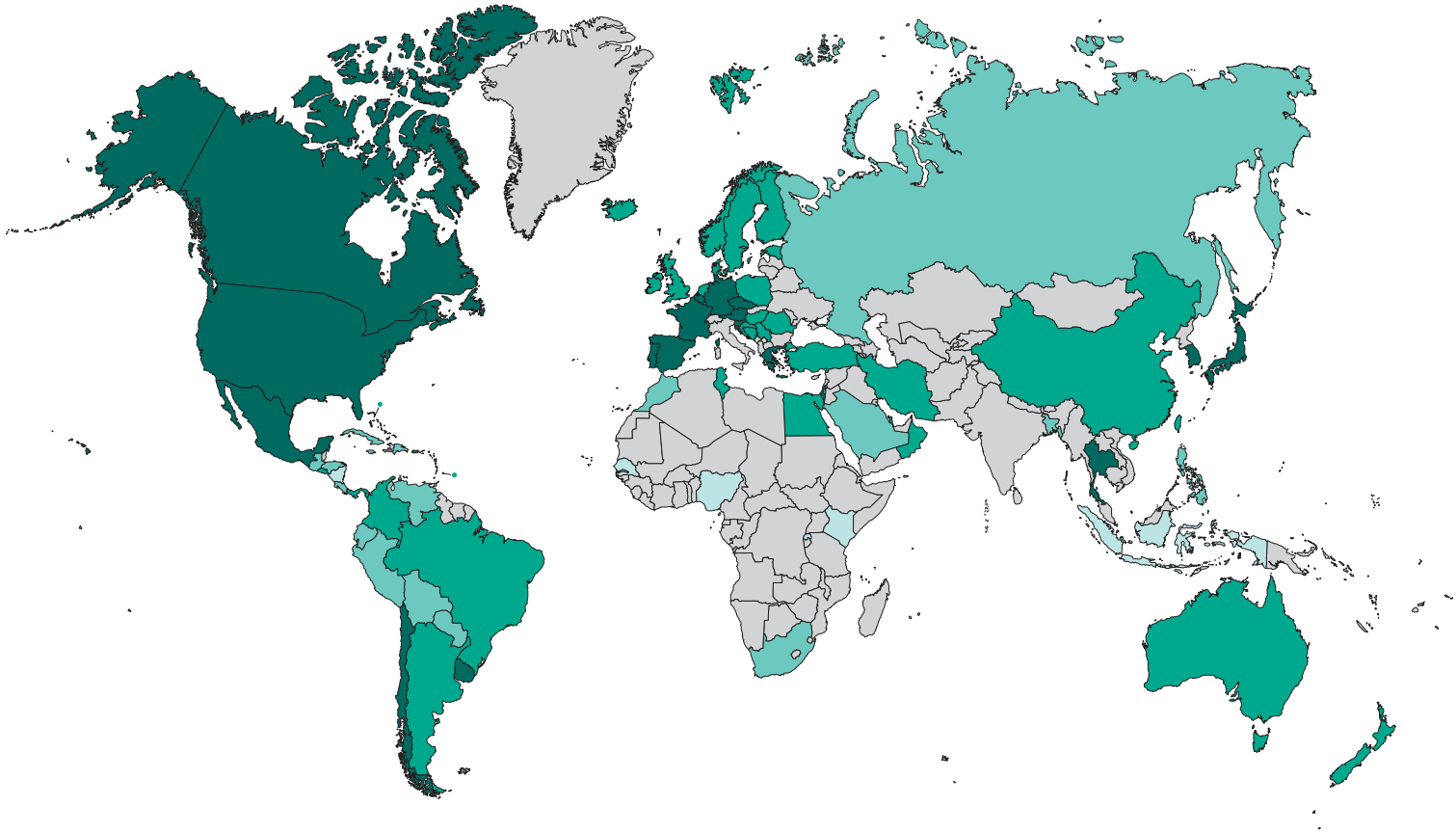
4.1 Availability of Renal Replacement Therapy (RRT)

Prevalence of treated ESRD varied within and across ISN regions (Map 4.1). The greatest median prevalence was found in North & East Asia, where it was over 2000 per million population (PMP) in Japan; the lowest, in Africa (2.8 PMP in Rwanda). Data for many countries were not available.

Map 4.1 | Global prevalence of treated end-stage renal disease

Rate per million population (PMP)

≤100 | 101–500 | 501–1000 | >1000 | N/A (not available)



4.2 Out-of-pocket healthcare expenditure

To better understand potential financial barriers for patients, respondents were asked to describe what proportion of total expenditure on health is out-of-pocket. Total health expenditure (THE) is the sum of general government health expenditure and private health expenditure in a given year. It comprises the outlays earmarked for health maintenance, restoration or enhancement of the health status of the population, paid for in cash or in kind[42]. Out-of-pocket payments are expenditures borne directly by a patient where neither public nor private insurance covers the full cost of the health good or service[43]. If a large proportion of THE is out-of-pocket, this can place high financial burden on patients, possibly limiting their access to treatment.

Of total expenditure on health, out-of-pocket costs varied within and between ISN regions (Figure 4.1). NIS & Russia and South Asia had the highest proportion of out-of-pocket costs, where in 64% and 75% of countries, respectively, more than 45% of total health costs were out-of-pocket. Western Europe and Oceania & South East Asia had the lowest, where in 52% and 58% of countries, respectively, less than 17% of total healthcare costs were out-of-pocket.

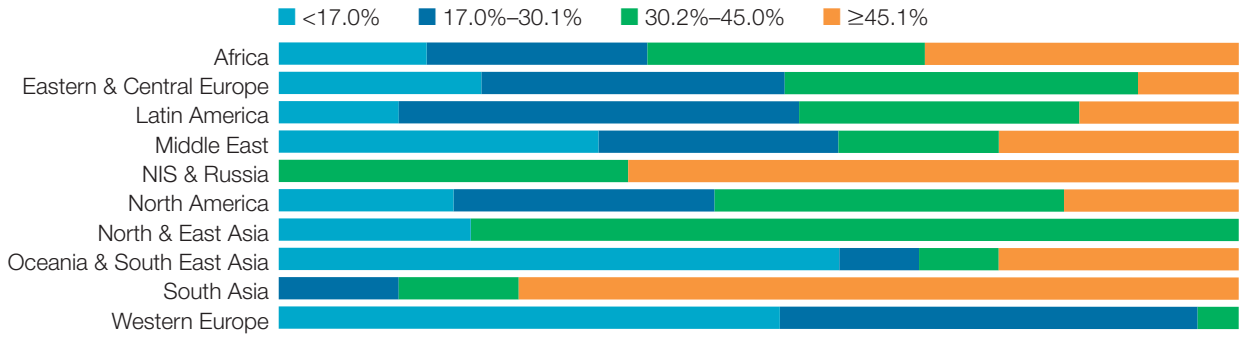
Similarly, private health expenditure is the sum of expenditures on health by private entities (for example, prepaid plans, commercial insurance, non-profit institutions, household out-of-pocket spending)[42]. A high proportion of private health expenditure due to out-of-pocket spending may represent a higher financial burden on patients, possibly preventing access to treatment.

In at least half of countries in Africa, Eastern & Central Europe, Latin America, NIS & Russia, and South Asia, at least 83% of private expenditure on health was from out-of-pocket expenses (Figure 4.2). The highest percentage (≥93.1) was most commonly seen in Eastern & Central Europe and NIS & Russia. There was a wide range across all regions.

Prepaid plans refer to private insurance, with no government control over payment rates[42]. A high proportion of total private expenditure on health from prepaid plans implies that patients are insured for treatment.

The proportion of private expenditure on health that was covered by private prepaid plans varied within and between ISN regions (Figure 4.3). The regions with the greatest coverage were the Middle East, North America, and Western Europe, where

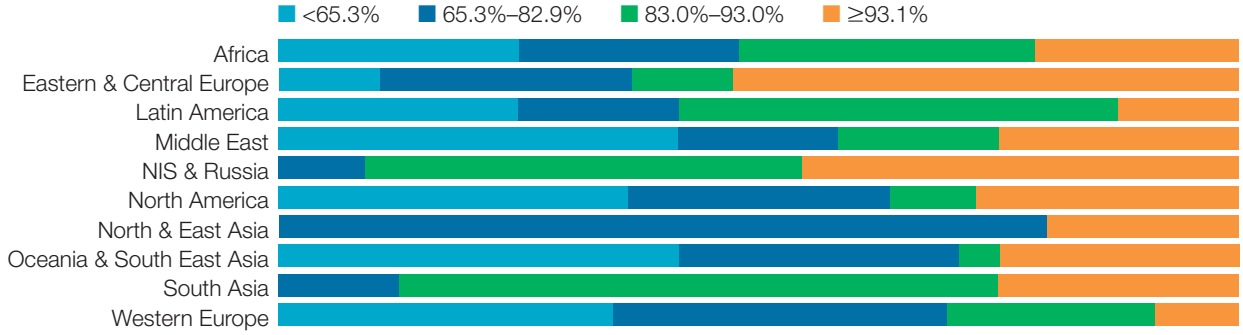
Figure 4.1 | Out-of-pocket health expenditure (relative to total expenditure on health)
National mean expenditure



Data missing from Africa (2 countries), Eastern & Central Europe (1 country), Latin America (1 country), Middle East (2 countries), North America (7 countries), North & East Asia (2 countries), Oceania & South East Asia (5 countries), and Western Europe (4 countries).

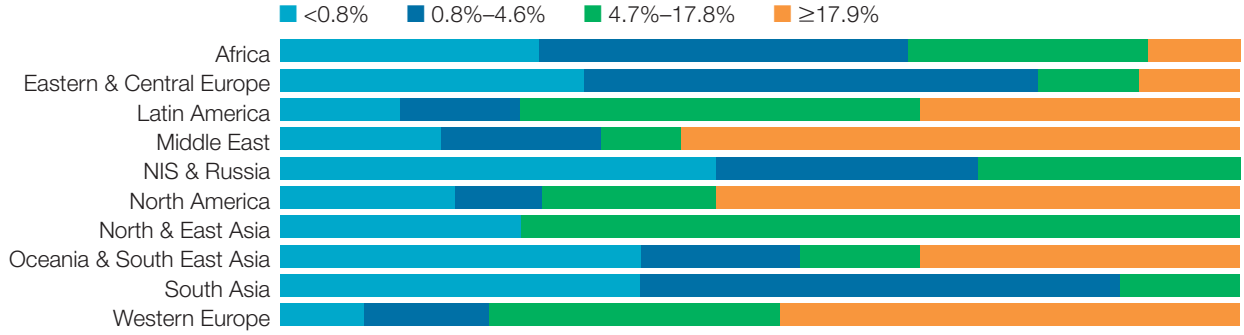
58%, 55%, and 48% of countries, respectively, had at least 17.9% of private expenditure covered by private prepaid plans. Regions with the least coverage were NIS & Russia, Oceania & South East Asia, and South Asia where 46%, 38%, and 38% of countries, respectively, had less than 0.8% of private expenditure covered by prepaid plans (Figure 4.3).

Figure 4.2 | Out-of-pocket health expenditure (relative to private expenditure on health)
National mean expenditure



Data missing from Africa (2 countries), Eastern & Central Europe (1 country), Latin America (1 country), Middle East (2 countries), North America (7 countries), North & East Asia (2 countries), Oceania & South East Asia (5 countries), and Western Europe (4 countries).

Figure 4.3 | Private prepaid plans (relative to private expenditure on health)
National mean expenditure



Data missing from Africa (2 countries), Eastern & Central Europe (1 country), Latin America (1 country), Middle East (2 countries), North America (7 countries), North & East Asia (3 countries), Oceania & South East Asia (5 countries), and Western Europe (4 countries).

4.3 Essential medicines and technology

As described above, hypertension, diabetes, and hypercholesteremia are leading risk factors for CKD. Ensuring appropriate treatment is available to patients with these conditions is important for preventing CKD.

Three common treatments for hypertension include angiotensin-converting enzyme (ACE) inhibitors, calcium channel (CC) blockers, and aspirin.

According to the World Health Organization (WHO), general availability of a medication in the public health sector refers to whether or not a country has that medication generally available in primary healthcare facilities in the public health sector[44].

ACE inhibitors are an effective treatment for hypertension, a known risk factor for CKD. Furthermore, ACE inhibitors may prevent CVD and thus aid in secondary prevention. Ensuring sufficient availability of ACE inhibitors is important for preventing the progression of CKD.

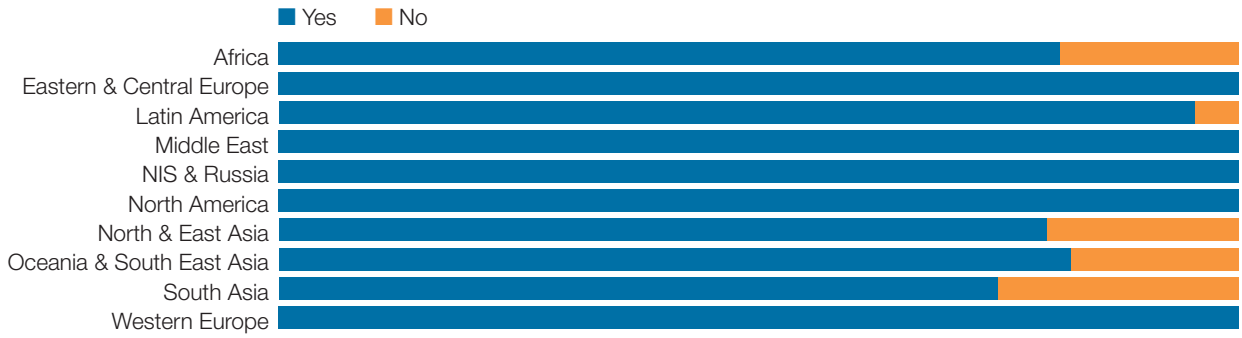
Overall, ACE inhibitors were widely available in the public health sector across all ISN regions (Figure 4.4). All countries within Eastern & Central Europe, the Middle East, NIS & Russia, North America, and Western Europe had ACE inhibitors available. Approximately 20% of countries within Africa, North & East Asia, Oceania & South East Asia, and South Asia did not have ACE inhibitors generally available.

While ACE inhibitors are the optimal treatment for hypertension, calcium channel (CC) blockers also reduce hypertension and should be available at a primary care level.

The availability of CC blockers was slightly less than that of ACE inhibitors in some regions but still very high across most regions (Figure 4.5). All countries within Eastern & Central Europe, Western Europe, the Middle East, and North America had 100% availability of CC blockers. Less than 70% of countries within Africa and 71% of countries in South Asia had CC blockers available.

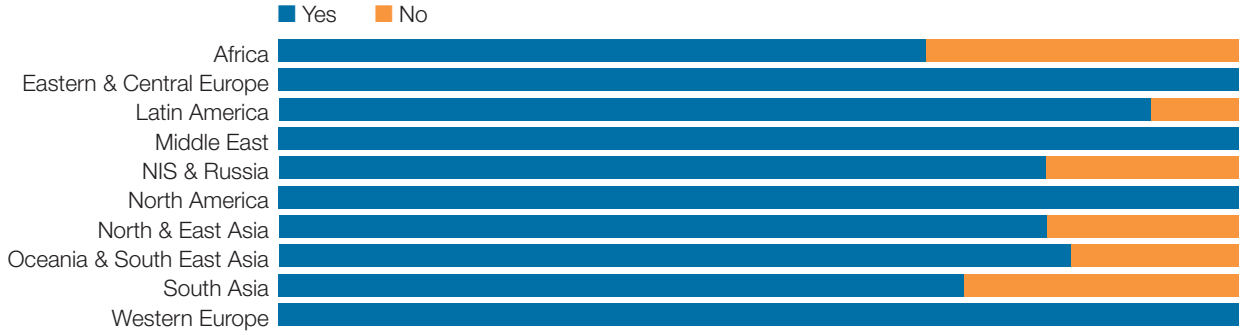
Thiazide diuretics act on the kidneys to increase urinary sodium excretion, thereby reducing blood volume and controlling hypertension. Thiazide diuretics were widely available across most regions (Figure 4.6). Less than 65% of countries in South Asia, 86% in Africa, and 91% in Oceania & South East Asia had thiazide diuretics publicly available; otherwise, they were available in 100% of countries in all other regions.

Figure 4.4 | General availability of ACE inhibitors in the public health sector



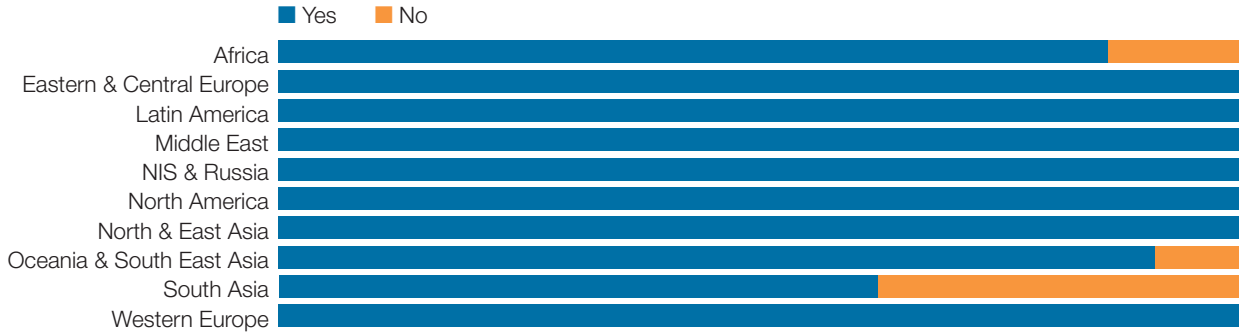
Data missing from Africa (11 countries), Eastern & Central Europe (3 countries), Latin America (3 countries), Middle East (2 countries), NIS & Russia (1 country), North America (9 countries), North & East Asia (2 countries), Oceania & South East Asia (6 countries), and Western Europe (4 countries).

Figure 4.5 | General availability of calcium channel blockers in the public health sector



Data missing from Africa (11 countries), Eastern & Central Europe (3 countries), Latin America (3 countries), Middle East (2 countries), NIS & Russia (1 country), North America (9 countries), North & East Asia (2 countries), Oceania & South East Asia (6 countries), South Asia (1 country), and Western Europe (4 countries).

Figure 4.6 | General availability of thiazide diuretics in the public health sector



Data missing from Africa (10 countries), Eastern & Central Europe (3 countries), Latin America (3 countries), Middle East (2 countries), NIS & Russia (1 country), North America (8 countries), North & East Asia (2 countries), Oceania & South East Asia (6 countries), and Western Europe (4 countries).

Alternatively, aspirin may be an effective treatment for hypertension, typically at a lower cost.

Aspirin was highly available across ISN regions, with 100% of countries within Eastern & Central Europe, the Middle East, NIS & Russia, North America, and North & East Asia having aspirin available (Figure 4.7). The majority of countries in Western Europe (96%), Latin America (91%), and South Asia (88%), and nearly 80% of countries in Africa and Oceania & South East Asia had aspirin generally available.

Insulin is a treatment for type II diabetes and reduces the effects of hyperglycemia. Elevated blood sugar levels can damage kidneys, contributing to the development or progression of CKD. While metformin may be the preferred treatment for hyperglycemia, insulin is critical for managing emergencies in diabetes or for treating diabetes, non-responsive to oral treatment.

The availability of insulin was quite high in the public sector for most countries, with the exception of South Asia and Africa, where 63% and 77%, respectively, had insulin available (Figure 4.8). All countries within Eastern & Central Europe, the Middle East, NIS & Russia, North America, and North & East Asia had insulin generally available.

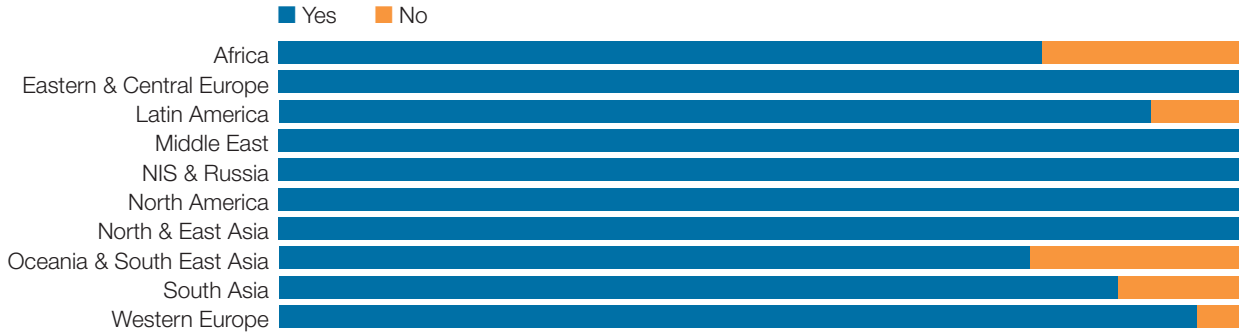
Metformin is the most cost-effective oral medication for hyperglycemia. Availability of metformin was very high in most ISN regions (Figure 4.9). Eastern & Central Europe, the Middle East, NIS & Russia, North America, and Western Europe had metformin available in all countries (Figure 4.9), and most do in Latin America (95%), Oceania & South East Asia (91%), South Asia (86%), and North East Asia (80%). Seventy-two per cent of countries in Africa have metformin generally available.

High cholesterol has been associated with kidney damage, possibly through oxidative stress or insulin resistance[45]. Statins, which inhibit the production of cholesterol, are a common treatment for hypercholesterolemia.

Statins were less available than other medications (Figure 4.10). Less than 40% of countries in Africa had statins publicly available, and only four ISN regions had statins available in all countries (Eastern & Central Europe, the Middle East, NIS & Russia, and Western Europe).

Diabetes testing, defined by blood glucose measurement, oral glucose tolerance test (OGTT), or HbA1c availability at the primary healthcare level[44], was available in 100% of countries across all regions except Africa and Oceania & South East Asia, where testing was available in 84% and 96% of countries, respectively (Figure 4.11).

Figure 4.7 | General availability of aspirin in the public health sector

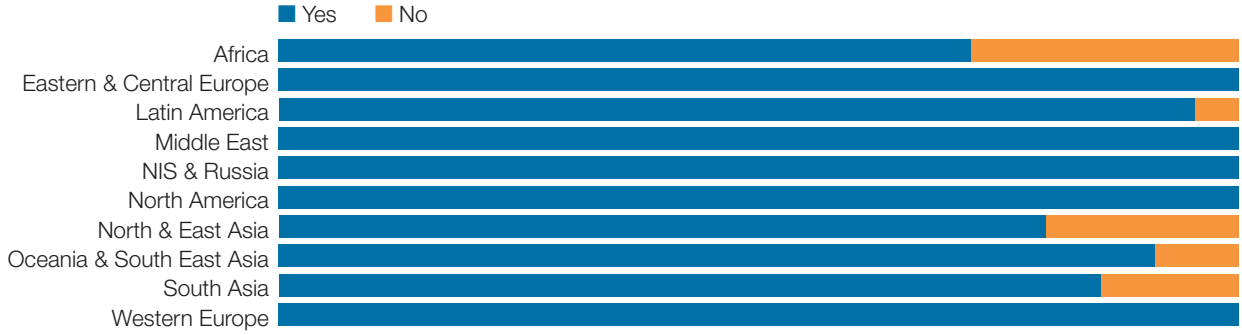


Data missing from Africa (10 countries), Eastern & Central Europe (3 countries), Latin America (3 countries), Middle East (2 countries), NIS & Russia (1 country), North America (9 countries), North & East Asia (2 countries), Oceania & South East Asia (6 countries), and Western Europe (4 countries).

Figure 4.8 | General availability of insulin in the public health sector

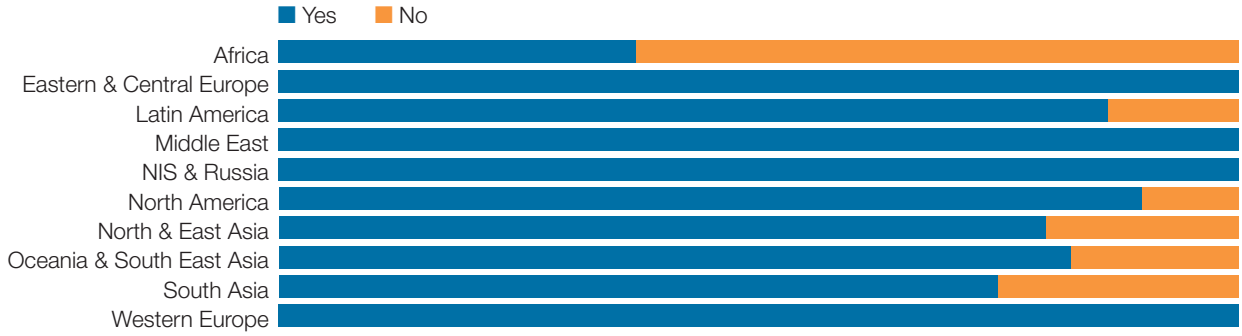
Data missing from Africa (10 countries), Eastern & Central Europe (3 countries), Latin America (3 countries), Middle East (2 countries), NIS & Russia (1 country), North America (8 countries), North & East Asia (2 countries), Oceania & South East Asia (6 countries), and Western Europe (4 countries).

Figure 4.9 | General availability of metformin in the public health sector



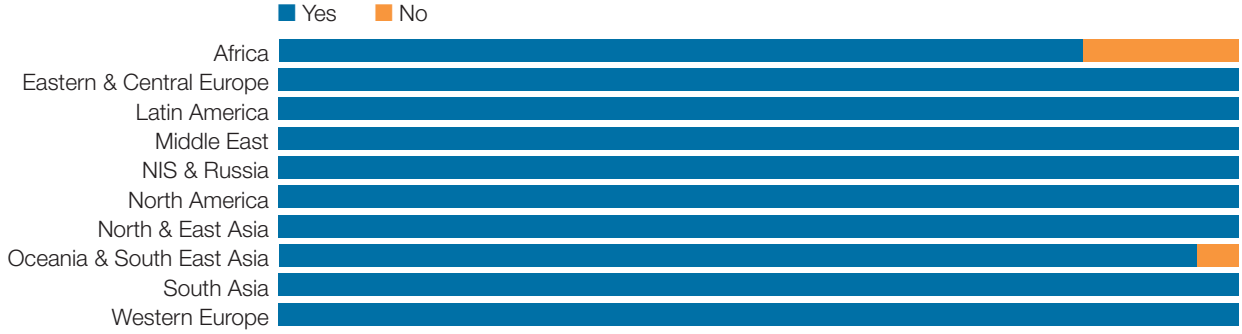
Data missing from Africa (11 countries), Eastern & Central Europe (3 countries), Latin America (3 countries), Middle East (2 countries), NIS & Russia (1 country), North America (8 countries), North & East Asia (2 countries), Oceania & South East Asia (6 countries), South Asia (1 country), and Western Europe (4 countries).

Figure 4.10 | General availability of statins in the public health sector



Data missing from Africa (11 countries), Eastern & Central Europe (3 countries), Latin America (3 countries), Middle East (2 countries), NIS & Russia (1 country), North America (8 countries), North & East Asia (2 countries), Oceania & South East Asia (6 countries), and Western Europe (4 countries).

Figure 4.11 | General availability of diabetes testing at the primary healthcare level



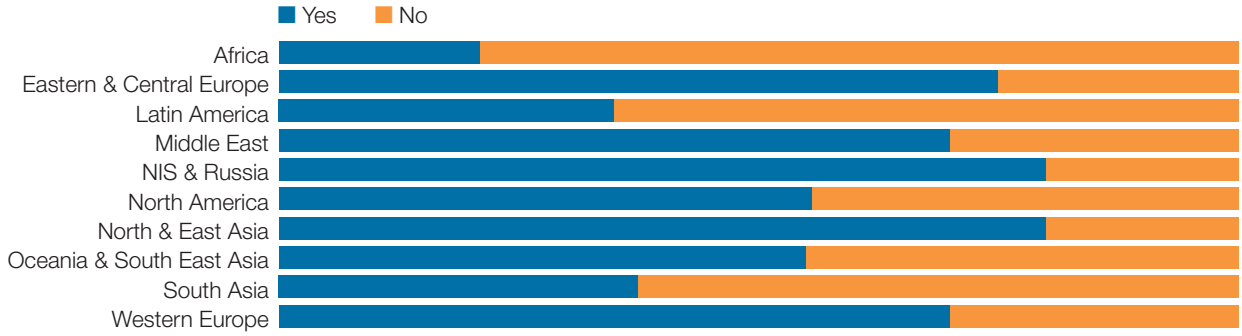
Data missing from Africa (11 countries), Eastern & Central Europe (2 countries), Latin America (3 countries), Middle East (2 countries), NIS & Russia (1 country), North America (8 countries), North & East Asia (3 countries), Oceania & South East Asia (6 countries), and Western Europe (4 countries).

4.4 Systems and policies

The WHO defines existence of evidence-based national guidelines or protocols for the management of major NCDs through a primary care approach as including guidance on managing CVD, diabetes, cancer, and chronic respiratory diseases[44]. Countries that had a "Yes" for this indicator had indicated that national guidelines/protocols/standards existed for all four NCDs and that these were being at least partially or fully implemented. NCD guidelines provide an opportunity to expand on the knowledge and advocacy of kidney disease, as recommendations for CKD prevention, referral, and management can be incorporated into broader guidelines of multiple NCDs.

Guidelines for the management of major NCDs were not available in many countries, across all regions (Figure 4.12). The majority of countries in Africa (79%), South Asia (63%), and Latin America (65%) did not have guidelines. The regions with the highest adoption of guidelines were NIS & Russia (80%) and North & East Asia (80%), Eastern & Central Europe (75%), the Middle East (70%), and Western Europe (70%). Countries within North America and Oceania & South East Asia had guidelines in just over half (56% and 55%, respectively).

Figure 4.12 | Existence of evidence-based national guidelines for the management of major non-communicable diseases



Data missing from Africa (11 countries), Eastern & Central Europe (4 countries), Latin America (5 countries), Middle East (4 countries), NIS & Russia (1 country), North America (9 countries), North & East Asia (2 countries), Oceania & South East Asia (9 countries), and Western Europe (7 countries).

4.5 Workforce

Care is a continuum and all elements of workforce are vital. Shortages in any element would result in poor-quality care, higher costs, and adverse outcomes.

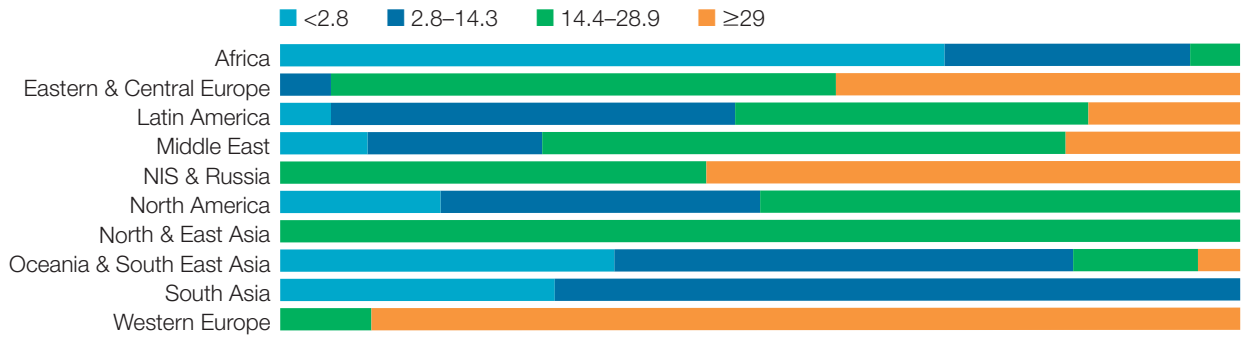
Density of physicians represents a smaller health workforce, and is calculated as the number of physicians, irrespective of primary care or specialist status, per 10,000 population. The World Health Organization defines physician density as the number of medical doctors (physicians), including generalist and specialist medical practitioners, per 1,000 population[44]. The prevalence of physicians varied within and across ISN regions (Figure 4.13). The regions with the lowest physician availability were Africa, Oceania & South East Asia, and South Asia, with 69%, 35%, and 29% of countries having less than 2.8 physicians per 10,000 population. The highest physician density was seen in Western Europe, NIS & Russia, Eastern & Central Europe, with 91%, 56%, and 42%, respectively, of regions having a physician density of more than 29 physicians per 10,000 population. A large within-region variance was shown in Latin America, the Middle East, North America, and Oceania & South East Asia.

Availability of nursing and midwifery personnel can also be reflected by density, and varied within and across ISN regions (Figure 4.14). Similarly, the World Health Organization defines density of nursing and midwifery personnel as the number of nursing and midwifery personnel per 1,000 population[44]. Regions with the highest density of nursing/midwifery providers were Western Europe, NIS & Russia, and Eastern & Central Europe. Eighty per cent of countries in Western Europe have more than 62 providers per 10,000 population. Africa, on the other hand, had less than 9 providers per 10,000 population in more than 65% of countries. Within-region variation was high across Latin America, the Middle East, Oceania & South East Asia, and South Asia.

Pharmacies ensure the safe and appropriate use of medications, and shortages in pharmaceutical personnel can have detrimental effects on patients' health. The WHO defines the density of pharmaceutical personnel as the number of pharmaceutical personnel (including pharmacists, pharmaceutical assistants, pharmaceutical technicians, and related occupations) per 1,000 population.

Figure 4.13 | Density of physicians

National density per 10,000 population

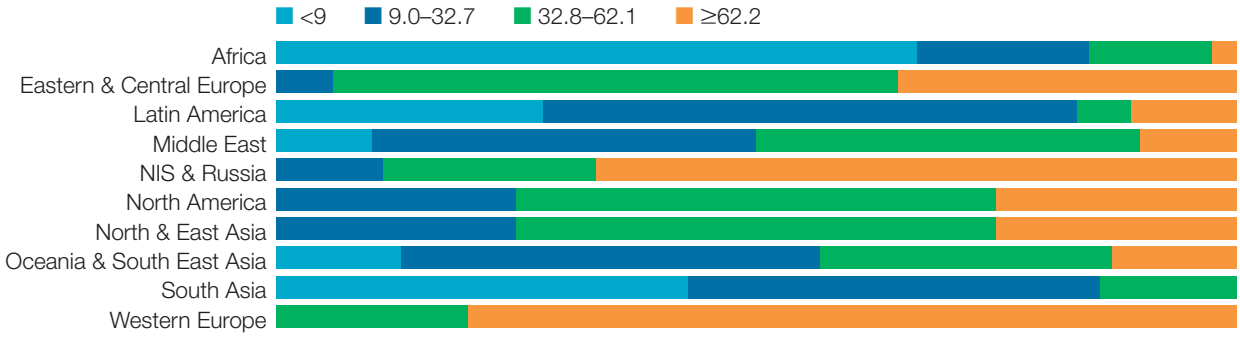


Data missing from Africa (15 countries), Eastern & Central Europe (1 country), Latin America (6 countries), Middle East (3 countries), NIS & Russia (2 countries), North America (12 countries), North & East Asia (3 countries), Oceania & South East Asia (6 countries), South Asia (1 country), and Western Europe (6 countries).

Similarly, Western Europe had the highest density of pharmaceutical personnel, with more than 80% of countries reporting a density of 6.7 or more per 10,000 population (Figure 4.15). The regions with the lowest density were Africa, NIS & Russia, Oceania & South East Asia, and South Asia. Within-region variance was high across most regions.

Figure 4.14 | Density of nursing and midwifery personnel

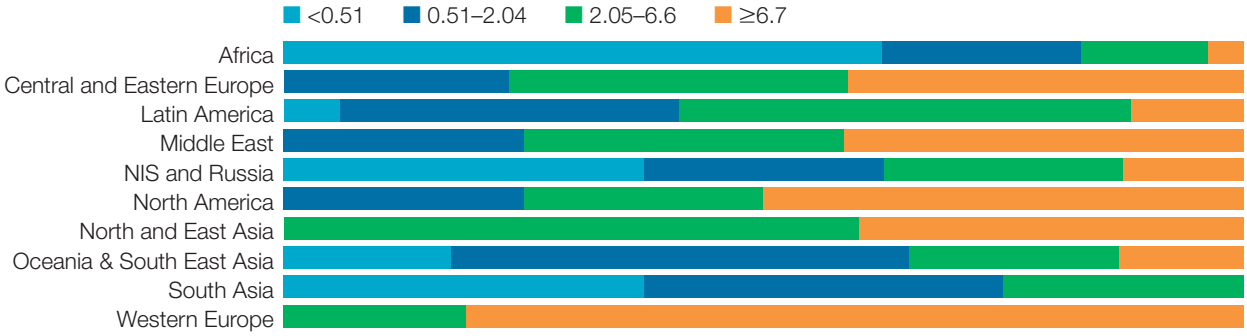
National density per 10,000 population



Data missing from Africa (15 countries), Eastern & Central Europe (3 countries), Latin America (7 countries), Middle East (4 countries), NIS & Russia (2 countries), North America (14 countries), North & East Asia (3 countries), Oceania & South East Asia (6 countries), South Asia (1 country), and Western Europe (7 countries).

Figure 4.15 | Density of pharmaceutical personnel

National density per 10,000 population



Data missing from Africa (15 countries), Eastern & Central Europe (3 countries), Latin America (7 countries), Middle East (4 countries), NIS & Russia (2 countries), North America (14 countries), North & East Asia (3 countries), Oceania & South East Asia (6 countries), South Asia (1 country), and Western Europe (7 countries).

SURVEY FINDINGS

SECTION 5

HEALTH FINANCE AND SERVICE DELIVERY

5.1 General health financing

Countries were asked to describe their healthcare system and funding mechanism in general, their capacity to provide kidney care (availability, funding and access to services and medications), and their overall assessment of healthcare infrastructure for kidney care.

Nearly half (44%) of the countries reported a mix of public and private funding systems for their healthcare systems (Table 5.1). No systems were funded exclusively by private and out-of-pocket sources, and 19% of countries' healthcare systems were fully funded by government with no fees at the point of delivery. Almost one-quarter (24%) of countries' systems were funded by government but had some fees at the point of delivery. Thirteen per cent of countries had

Table 5.1 | Funding models of general health systems

	Publicly funded by govt; free at the point of delivery N (%)	Publicly funded by govt: some fees at the point of delivery N (%)	Mix of public and private funding systems N (%)	Solely private and out-of-pocket N (%)	Multiple systems programs provided by govt, non-govt organizations (NGOs), and communities N (%)
Overall	**23 (19)**	**28 (24)**	**52 (44)**	**0 (0)**	**16 (13)**
ISN regions					
Africa	5 (15)	13 (38)	9 (26)	0 (0)	7 (21)
Eastern & Central Europe	8 (47)	6 (35)	2 (12)	0 (0)	1 (6)
Latin America	2 (15)	0 (0)	11 (85)	0 (0)	0 (0)
Middle East	2 (15)	1 (8)	8 (62)	0 (0)	2 (15)
NIS & Russia	2 (33)	0 (0)	3 (50)	0 (0)	1 (17)
North America	0 (0)	0 (0)	2 (100)	0 (0)	0 (0)
North & East Asia	0 (0)	2 (33)	4 (67)	0 (0)	0 (0)
Oceania & South East Asia	0 (0)	3 (23)	9 (69)	0 (0)	1 (8)
South Asia	0 (0)	0 (0)	2 (40)	0 (0)	3 (60)
Western Europe	4 (40)	3 (30)	2 (20)	0 (0)	1 (10)
World Bank income groups					
Low-income	3 (18)	7 (41)	3 (18)	0 (0)	4 (24)
Lower-middle-income	1 (3)	9 (26)	16 (47)	0 (0)	8 (24)
Upper-middle-income	9 (30)	4 (13)	15 (50)	0 (0)	2 (7)
High-income	10 (26)	8 (21)	18 (47)	0 (0)	2 (5)

healthcare systems funded through multiple sources including government, non-governmental organizations (NGOs), and communities. In many (41% of) low-income countries, the government funded healthcare costs, but there were some fees at the point of delivery. Many lower-middle- (47%), upper-middle- (50%), and high-income (47%) countries reported a mix of public and private systems. Of the 16 countries that reported multiple sources (government, NGOs, communities), half were in the low- or lower-middle-income groups.

Over half (59%) of the 121 countries responding to the question about universality reported universal coverage (Table 5.2), meaning that all residents within their country were eligible for coverage. This was similar across national income levels, with high-income countries providing slightly higher universal coverage (64%).

Table 5.2 | Universality of healthcare coverage in countries with publicly funded systems

	Countries covering all residents N (%)	Countries not covering all residents N (%)
Overall	**71 (59)**	**50 (41)**
ISN regions		
Africa	19 (56)	15 (44)
Eastern & Central Europe	12 (71)	5 (29)
Latin America	11 (69)	5 (31)
Middle East	6 (46)	7 (54)
NIS & Russia	5 (83)	1 (17)
North America	1 (50)	1 (50)
North & East Asia	3 (50)	3 (50)
Oceania & South East Asia	6 (50)	6 (50)
South Asia	2 (40)	3 (60)
Western Europe	6 (60)	4 (40)
World Bank income groups		
Low-income	10 (59)	7 (41)
Lower-middle-income	19 (56)	15 (44)
Upper-middle-income	17 (55)	14 (45)
High-income	25 (64)	14 (36)

5.2 Funding mechanisms for kidney care

Respondents were then asked to describe which elements of kidney care were not included in this coverage. Overall, 35% of the 115 countries responding to the question publicly funded all aspects of kidney care (Table 5.3). Fewer than 30% of countries excluded services for AKI management and dialysis.

Early detection and management were the elements of care with the least coverage. Over half (52%) reported that early detection in individuals at risk (i.e., screening) was not included in this coverage. Similarly, management to reduce risk of CKD progression was not provided in 43% (early management) and 42% (management in general). Management of AKI was excluded in 25% of countries, whereas management of CKD complications was excluded in 40% of countries. Twenty-nine per cent of countries did not cover dialysis by public funding and 37% did not cover transplantation.

Countries within North America excluded the most services from public funding coverage, particularly the management of CKD complications, risk factor control, and early detection in at-risk individuals (Figure 5.1). Western Europe, the Middle East, and Eastern & Central Europe funded the most, where 50%, 42%, and 75% of countries, respectively, did not exclude any aspects of kidney care from public funding.

Table 5.3 | Aspects of kidney care excluded from public funding

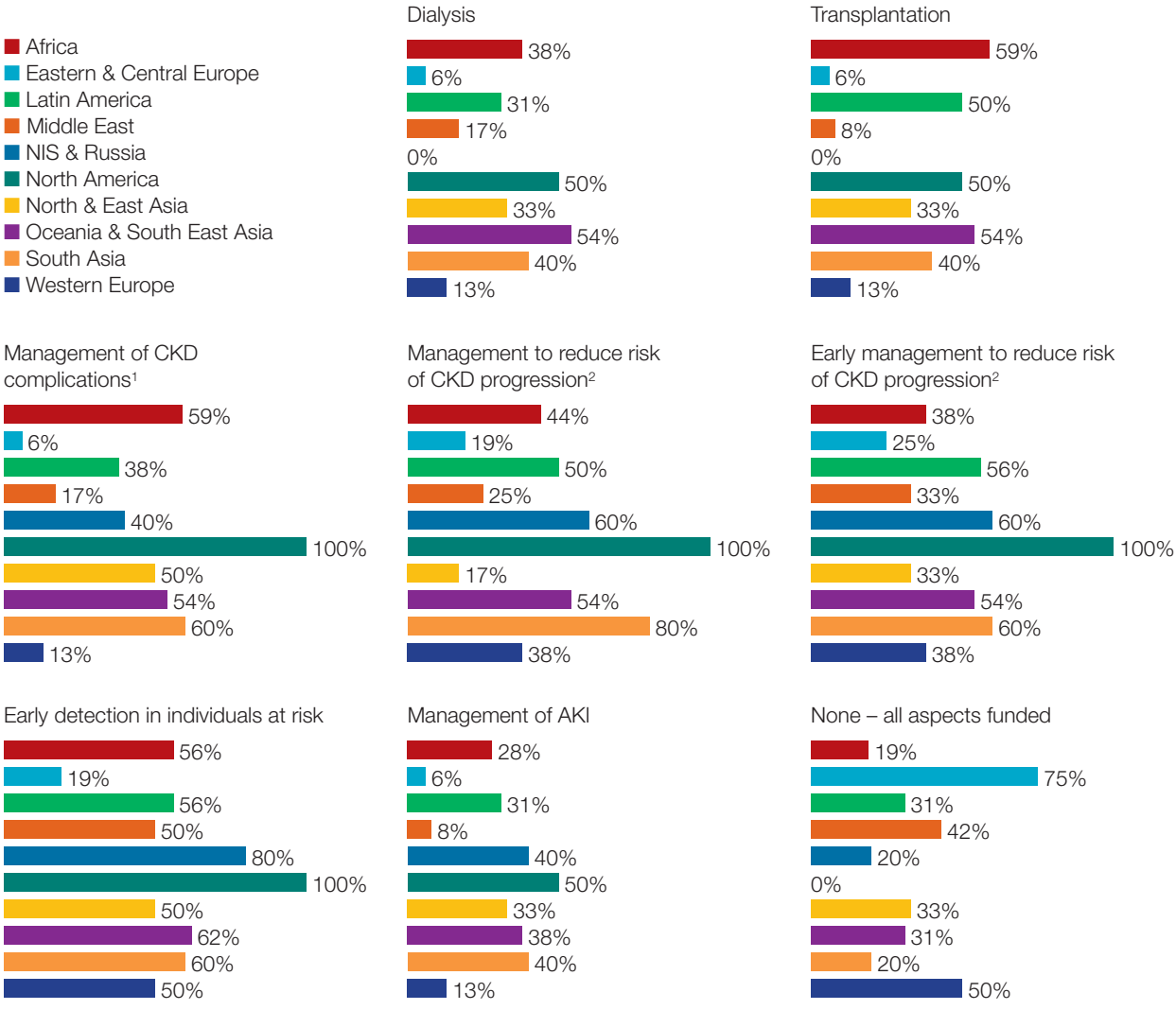
	Dialysis N (%)	Transplantation N (%)	Management of CKD complications[1] N (%)	Management to reduce risk of CKD progression[2] N (%)	Early management to reduce risk of CKD progression[2] N (%)	Early detection in individuals at risk N (%)	Management of AKI N (%)	None – all aspects funded N (%)
Overall	**33 (29)**	**42 (37)**	**46 (40)**	**48 (42)**	**49 (43)**	**60 (52)**	**29 (25)**	**40 (35)**
ISN regions								
Africa	12 (38)	19 (59)	19 (59)	14 (44)	12 (38)	18 (56)	9 (28)	6 (19)
Eastern & Central Europe	1 (6)	1 (6)	1 (6)	3 (19)	4 (25)	3 (19)	1 (6)	12 (75)
Latin America	5 (31)	8 (50)	6 (38)	8 (50)	9 (56)	9 (56)	5 (31)	5 (31)
Middle East	2 (17)	1 (8)	2 (17)	3 (25)	4 (33)	6 (50)	1 (8)	5 (42)
NIS & Russia	0 (0)	0 (0)	2 (40)	3 (60)	3 (60)	4 (80)	2 (40)	1 (20)
North America	1 (50)	1 (50)	2 (100)	2 (100)	2 (100)	2 (100)	1 (50)	0 (0)
North & East Asia	2 (33)	2 (33)	3 (50)	1 (17)	2 (33)	3 (50)	2 (33)	2 (33)
Oceania & South East Asia	7 (54)	7 (54)	7 (54)	7 (54)	7 (54)	8 (62)	5 (38)	4 (31)
South Asia	2 (40)	2 (40)	3 (60)	4 (80)	3 (60)	3 (60)	2 (40)	1 (20)
Western Europe	1 (13)	1 (13)	1 (13)	3 (38)	3 (38)	4 (50)	1 (13)	4 (50)
World Bank income groups								
Low-income	9 (56)	12 (75)	11 (69)	10 (63)	8 (50)	11 (69)	8 (50)	2 (13)
Lower-middle-income	9 (27)	16 (48)	18 (55)	19 (58)	20 (61)	20 (61)	8 (24)	7 (21)
Upper-middle-income	8 (27)	8 (27)	11 (37)	10 (33)	11 (37)	14 (47)	7 (23)	12 (40)
High-income	7 (19)	6 (17)	6 (17)	9 (25)	10 (28)	15 (42)	6 (17)	19 (53)

1 Anemia, bone disease, malnutrition.
2 Risk factor control.

Renal replacement therapy was less covered in the low-income group, where more than half (56%) of countries did not cover dialysis and 75% did not cover transplantation, compared to 19% and 17%, respectively, in high-income countries (Figure 5.2). Overall, the majority of high-income countries included all the listed aspects of kidney care in their universal coverage, whereas each of these aspects was excluded by most countries in the low-income group.

Specifically, respondents were then asked to describe their country's healthcare system's coverage for care of patients with kidney disease, excluding medications. Dialysis was primarily funded by the government with no fees to patients at the point of delivery (63%), as were kidney transplantation (57%) and AKI care (56%). Non-dialysis CKD care was funded nearly equally by a mix of public and private sources and government funding (Figure 5.3). For these four elements of kidney care, few countries reported funding that was solely private and out-of-pocket or solely private through health insurance providers.

Figure 5.1 | Elements of kidney care excluded from public funding, by ISN region

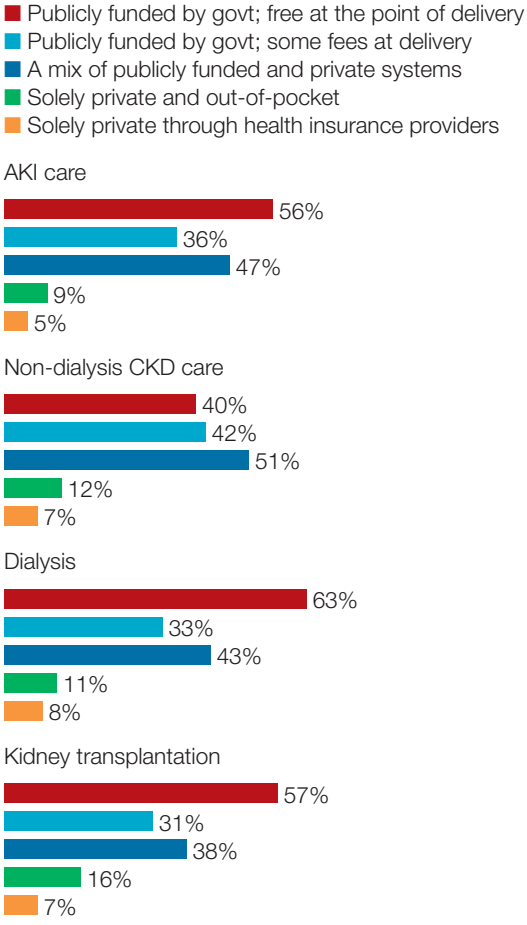


1 Anemia, bone disease, malnutrition.
2 Risk factor control.

Figure 5.2 | Elements of kidney care excluded from public funding, by World Bank income group

1 Anemia, bone disease, malnutrition.
2 Risk factor control.

Figure 5.3 | Funding models for kidney disease care



In high-income countries, RRT was largely funded by government with no patient fees at the point of delivery (Table 5.4). Most low-income countries funded RRT through government (with some fees to patients at the point of delivery) or through a mix of public and private sources (Table 5.4). The use of solely private funding models was more prevalent in low- and lower-middle-income countries than in upper-middle- and high-income countries. The majority of countries funded non-dialysis CKD care and AKI care through public funding (with or without some fees at the point of delivery), or a mix of public and private (Table 5.4). The funding models for the four elements of kidney care varied across ISN regions (Figure 5.4).

Table 5.4 | Funding models for AKI care, non-dialysis CKD care, dialysis, and transplantation

	Publicly funded by govt; free at the point of delivery N (%)	Publicly funded by govt; some fees at the point of delivery N (%)	A mix of publicly funded and private systems N (%)	Solely private and out-of-pocket N (%)	Solely private through health insurance providers N (%)
AKI CARE					
Overall	**67 (56)**	**43 (36)**	**56 (47)**	**11 (9)**	**6 (5)**
ISN regions					
Africa	13 (39)	13 (39)	15 (45)	5 (15)	3 (9)
Eastern & Central Europe	16 (94)	1 (6)	1 (6)	0 (0)	0 (0)
Latin America	8 (53)	6 (40)	12 (80)	1 (7)	2 (13)
Middle East	6 (46)	5 (38)	7 (54)	0 (0)	0 (0)
NIS & Russia	4 (67)	3 (50)	2 (33)	0 (0)	0 (0)
North America	1 (50)	0 (0)	1 (50)	0 (0)	0 (0)
North & East Asia	4 (67)	5 (83)	3 (50)	0 (0)	0 (0)
Oceania & South East Asia	6 (46)	7 (54)	9 (69)	3 (23)	1 (8)
South Asia	1 (25)	1 (25)	3 (75)	2 (50)	0 (0)
Western Europe	8 (80)	2 (20)	3 (30)	0 (0)	0 (0)
World Bank income groups					
Low-income	6 (38)	6 (38)	6 (38)	5 (31)	0 (0)
Lower-middle-income	10 (30)	18 (55)	19 (58)	5 (15)	3 (9)
Upper-middle-income	22 (71)	8 (26)	14 (45)	1 (3)	3 (10)
High-income	29 (74)	11 (28)	17 (44)	0 (0)	0 (0)
NON-DIALYSIS CKD CARE					
Overall	**48 (40)**	**50 (42)**	**61 (51)**	**14 (12)**	**8 (7)**
ISN regions					
Africa	10 (29)	14 (41)	15 (44)	7 (21)	4 (12)
Eastern & Central Europe	12 (75)	5 (31)	2 (13)	1 (6)	0 (0)
Latin America	7 (47)	5 (33)	12 (80)	1 (7)	2 (13)
Middle East	5 (38)	6 (46)	8 (62)	0 (0)	0 (0)
NIS & Russia	1 (17)	2 (33)	4 (67)	1 (17)	1 (17)
North America	1 (50)	0 (0)	1 (50)	0 (0)	0 (0)
North & East Asia	2 (33)	6 (100)	3 (50)	0 (0)	0 (0)
Oceania & South East Asia	3 (23)	7 (54)	9 (69)	2 (15)	1 (8)
South Asia	1 (25)	1 (25)	4 (100)	2 (50)	0 (0)
Western Europe	6 (60)	4 (40)	3 (30)	0 (0)	0 (0)
World Bank income groups					
Low-income	4 (24)	9 (53)	4 (24)	5 (29)	1 (6)
Lower-middle-income	5 (16)	14 (44)	23 (72)	7 (22)	4 (13)
Upper-middle-income	17 (55)	12 (39)	16 (52)	1 (3)	3 (10)
High-income	22 (56)	15 (38)	18 (46)	1 (3)	0 (0)

Table 5.4 | continued

	Publicly funded by govt; free at the point of delivery N (%)	Publicly funded by govt; some fees at the point of delivery N (%)	A mix of publicly funded and private systems N (%)	Solely private and out-of-pocket N (%)	Solely private through health insurance providers N (%)
DIALYSIS					
Overall	**77 (63)**	**40 (33)**	**52 (43)**	**13 (11)**	**10 (8)**
ISN regions					
Africa	13 (38)	14 (41)	12 (35)	7 (21)	4 (12)
Eastern & Central Europe	16 (94)	1 (6)	2 (12)	1 (6)	2 (12)
Latin America	11 (69)	6 (38)	12 (75)	2 (13)	3 (19)
Middle East	10 (77)	3 (23)	7 (54)	0 (0)	0 (0)
NIS & Russia	6 (100)	1 (17)	1 (17)	0 (0)	0 (0)
North America	2 (100)	0 (0)	1 (50)	0 (0)	0 (0)
North & East Asia	4 (67)	5 (83)	3 (50)	0 (0)	0 (0)
Oceania & South East Asia	4 (31)	6 (46)	9 (69)	2 (15)	1 (8)
South Asia	3 (60)	2 (40)	3 (60)	1 (20)	0 (0)
Western Europe	8 (80)	2 (20)	2 (20)	0 (0)	0 (0)
World Bank income groups					
Low-income	6 (35)	10 (59)	4 (24)	5 (29)	1 (6)
Lower-middle-income	17 (49)	13 (37)	18 (51)	7 (20)	4 (11)
Upper-middle-income	23 (74)	6 (19)	14 (45)	1 (3)	3 (10)
High-income	31 (79)	11 (28)	16 (41)	0 (0)	2 (5)
KIDNEY TRANSPLANTATION					
Overall	**64 (57)**	**35 (31)**	**43 (38)**	**18 (16)**	**8 (7)**
ISN regions					
Africa	10 (37)	3 (11)	9 (33)	11 (41)	3 (11)
Eastern & Central Europe	16 (94)	2 (12)	0 (0)	0 (0)	0 (0)
Latin America	8 (53)	7 (47)	12 (80)	2 (13)	3 (20)
Middle East	8 (62)	6 (46)	6 (46)	0 (0)	0 (0)
NIS & Russi	4 (67)	2 (33)	1 (17)	1 (17)	0 (0)
North America	2 (100)	0 (0)	1 (50)	0 (0)	0 (0)
North & East Asia	2 (33)	6 (100)	2 (33)	0 (0)	0 (0)
Oceania & South East Asia	5 (42)	5 (42)	8 (67)	3 (25)	2 (17)
South Asia	1 (25)	2 (50)	3 (75)	1 (25)	0 (0)
Western Europe	8 (80)	2 (20)	1 (10)	0 (0)	0 (0)
World Bank income groups					
Low-income	3 (23)	1 (8)	1 (8)	8 (62)	2 (15)
Lower-middle-income	9 (31)	12 (41)	17 (59)	8 (28)	2 (7)
Upper-middle-income	21 (68)	12 (39)	13 (42)	2 (6)	4 (13)
High-income	31 (79)	10 (26)	12 (31)	0 (0)	0 (0)

Figure 5.4 | Funding models for AKI care, non-dialysis CKD care, dialysis, and transplantation

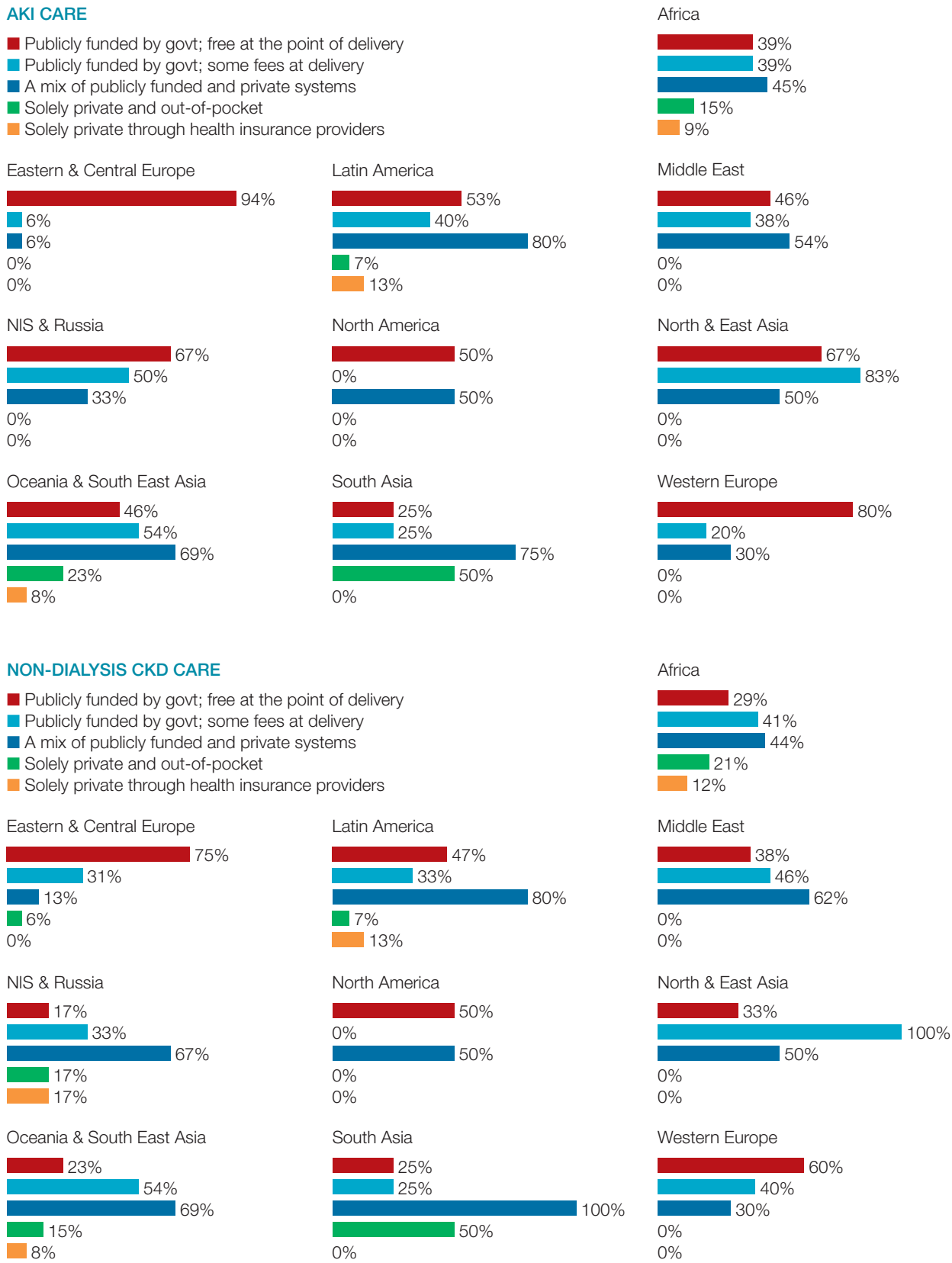
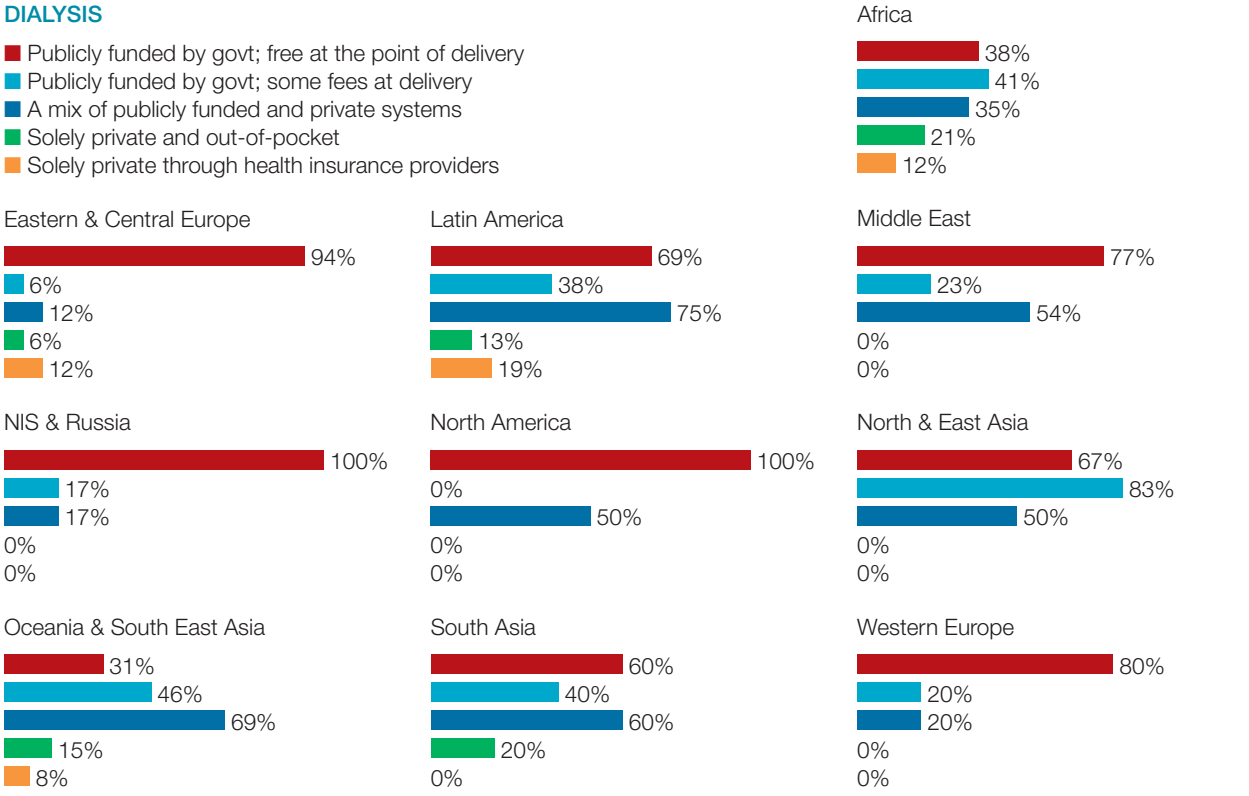
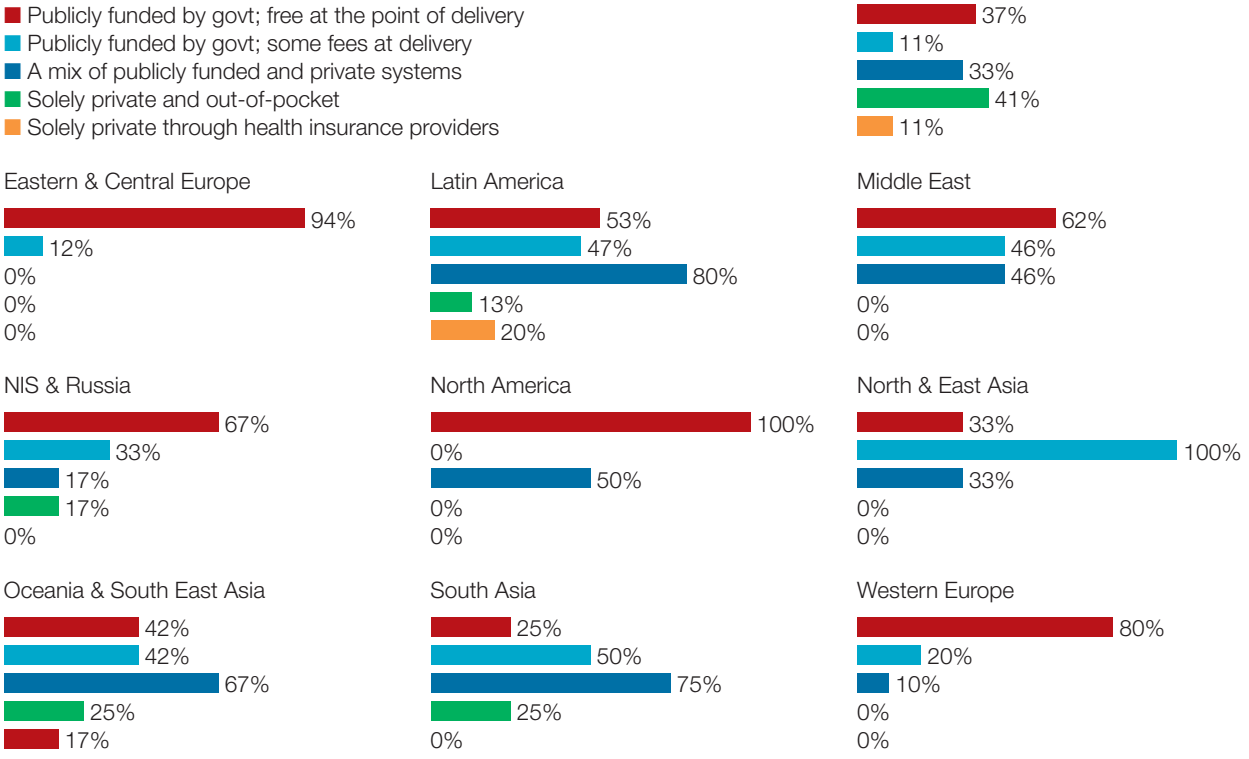


Figure 5.4 | continued

DIALYSIS



KIDNEY TRANSPLANTATION



5.3 Structure and organization of care delivery

5.3.1 Oversight/direction of kidney disease care

The majority (66%) of countries directed kidney care through national bodies (Figure 5.5). In just over half of countries (51%), kidney care was managed by individual hospitals, trusts, or organizations; and in 15% of countries, non-governmental organizations led kidney care. Kidney care was managed only at a provincial or regional level in 30% of countries. Six per cent had no organized system for managing kidney care, and 18% reported another governing approach.

Management of care through NGOs was most common in Oceania & South East Asia (Table 5.5). At least of half of countries in North America, North & East Asia, Oceania & South East Asia, and South Asia reported provincial or regional management.

Figure 5.5 | Jurisdiction or institutions responsible for kidney care

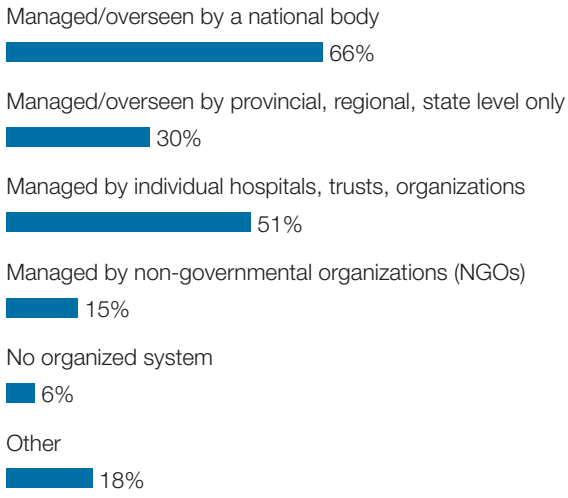


Table 5.5 | Management systems for kidney disease care

	National body N (%)	Provincial, regional, or state level bodies only N (%)	Individual hospitals, trusts, or organizations N (%)	Non-governmental organizations (NGOs) N (%)	No organized system N (%)	Other N (%)
Overall	**80 (66)**	**37 (30)**	**62 (51)**	**18 (15)**	**7 (6)**	**22 (18)**
ISN regions						
Africa	19 (56)	6 (18)	16 (47)	2 (6)	4 (12)	4 (12)
Eastern & Central Europe	10 (59)	4 (24)	8 (47)	4 (24)	1 (6)	1 (6)
Latin America	13 (81)	4 (25)	7 (44)	1 (6)	0 (0)	6 (38)
Middle East	8 (62)	3 (23)	7 (54)	1 (8)	2 (15)	1 (8)
NIS & Russia	4 (67)	2 (33)	2 (33)	0 (0)	0 (0)	1 (17)
North America	1 (50)	1 (50)	0 (0)	0 (0)	0 (0)	1 (50)
North & East Asia	6 (100)	3 (50)	4 (67)	1 (17)	0 (0)	0 (0)
Oceania & South East Asia	8 (62)	7 (54)	10 (77)	8 (62)	0 (0)	4 (31)
South Asia	3 (60)	3 (60)	4 (80)	1 (20)	0 (0)	0 (0)
Western Europe	8 (80)	4 (40)	4 (40)	0 (0)	0 (0)	4 (40)
World Bank income groups						
Low-income	10 (59)	2 (12)	10 (59)	2 (12)	2 (12)	1 (6)
Lower-middle-income	18 (51)	12 (34)	18 (51)	8 (23)	3 (9)	7 (20)
Upper-middle-income	21 (68)	9 (29)	14 (45)	2 (6)	2 (6)	6 (19)
High-income	31 (79)	14 (36)	20 (51)	6 (15)	0 (0)	8 (21)

5.3.2 Infrastructure for kidney disease care

Countries were then asked to rate the health infrastructure of their country in terms of adequacy for providing AKI and CKD care. Overall, nearly half (45%) of countries reported at least good or above average infrastructure for CKD care, and slightly more countries (48%) reported at least good or above average infrastructure for AKI care (Figure 5.6). Eighteen (15%) and four (3%) countries reported below average and extremely poor infrastructure, respectively, for CKD care; and similarly, 17 (14%) and eight (7%) for AKI care, respectively.

Overall, health infrastructure ratings for AKI and CKD were similar. Seventy-nine per cent of countries rated AKI infrastructure at least fair/average, and nearly 82% rated CKD infrastructure as at least fair/average. Ratings of extremely poor were documented in only 7% and 3% of countries for AKI and CKD, respectively (Table 5.6). High-income countries reported better ratings for both AKI and CKD compared to all other income groups (Table 5.6).

Figure 5.6 | Rating of health infrastructure for adequacy of kidney care

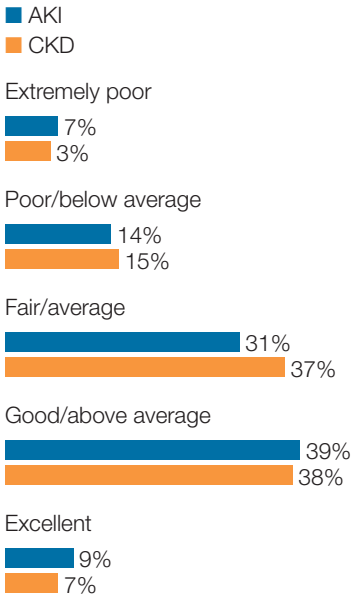


Table 5.6 | Rating of health infrastructure for adequacy of kidney care

	Extremely poor N (%)	Poor/ below average N (%)	Fair/average N (%)	Good/ above average N (%)	Excellent N (%)
AKI					
Overall	**8 (7)**	**17 (14)**	**38 (31)**	**48 (39)**	**11 (9)**
ISN regions					
Africa	6 (18)	11 (32)	9 (26)	8 (24)	0 (0)
Eastern & Central Europe	0 (0)	0 (0)	6 (35)	9 (53)	2 (12)
Latin America	1 (6)	2 (13)	7 (44)	6 (38)	0 (0)
Middle East	1 (8)	1 (8)	4 (31)	7 (54)	0 (0)
NIS & Russia	0 (0)	1 (17)	2 (33)	2 (33)	1 (17)
North America	0 (0)	0 (0)	0 (0)	0 (0)	2 (100)
North & East Asia	0 (0)	0 (0)	2 (33)	3 (50)	1 (17)
Oceania & South East Asia	0 (0)	2 (15)	4 (31)	5 (38)	2 (15)
South Asia	0 (0)	0 (0)	3 (60)	2 (40)	0 (0)
Western Europe	0 (0)	0 (0)	1 (10)	6 (60)	3 (30)
World Bank income groups					
Low-income	3 (18)	5 (29)	4 (24)	5 (29)	0 (0)
Lower-middle-income	3 (9)	8 (23)	13 (37)	10 (29)	1 (3)
Upper-middle-income	2 (6)	4 (13)	13 (42)	11 (35)	1 (3)
High-income	0 (0)	0 (0)	8 (21)	22 (56)	9 (23)
CKD					
Overall	**4 (3)**	**18 (15)**	**45 (37)**	**46 (38)**	**9 (7)**
ISN regions					
Africa	4 (12)	11 (32)	13 (38)	6 (18)	0 (0)
Eastern & Central Europe	0 (0)	1 (6)	7 (41)	7 (41)	2 (12)
Latin America	0 (0)	1 (6)	7 (44)	8 (50)	0 (0)
Middle East	0 (0)	1 (8)	6 (46)	6 (46)	0 (0)
NIS & Russia	0 (0)	0 (0)	4 (67)	2 (33)	0 (0)
North America	0 (0)	0 (0)	1 (50)	0 (0)	1 (50)
North & East Asia	0 (0)	1 (17)	1 (17)	3 (50)	1 (17)
Oceania & South East Asia	0 (0)	2 (15)	4 (31)	5 (38)	2 (15)
South Asia	0 (0)	1 (20)	2 (40)	2 (40)	0 (0)
Western Europe	0 (0)	0 (0)	0 (0)	7 (70)	3 (30)
World Bank income groups					
Low-income	2 (12)	5 (29)	6 (35)	4 (24)	0 (0)
Lower-middle-income	1 (3)	7 (20)	18 (51)	9 (26)	0 (0)
Upper-middle-income	1 (3)	6 (19)	15 (48)	8 (26)	1 (3)
High-income	0 (0)	0 (0)	6 (15)	25 (64)	8 (21)

SECTION 6

HEALTH WORKFORCE FOR KIDNEY CARE

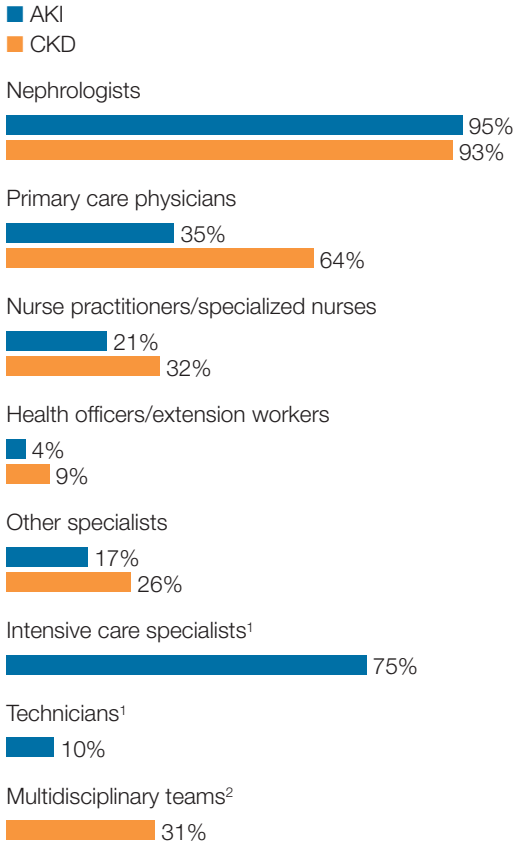
6.1 Existing workforce capacity

Respondents were asked to describe the distribution of primary responsibility for the delivery of CKD and AKI care in their respective countries. Overall, nephrologists were primarily responsible for the delivery of both AKI (95%) and CKD (93%) care (Figure 6.1). Overall, primary care physicians (PCPs) had less responsibility for AKI care than for CKD care (35% vs. 64%, respectively), as did Nurse Practitioners (NPs) (21% vs. 32%, respectively). Multidisciplinary Teams (MDTs) were accountable for CKD care in 31% of countries. Intensive care specialists had primary responsibility for AKI in 75% of countries. Other specialists were responsible for AKI in 17% of countries and for CKD in 26%. Technicians were primarily responsible for AKI in 10% of countries. It was rare for health officers or extension workers to be primarily responsible for either AKI (4%) or CKD (9%).

Nephrologists were primarily responsible for CKD care, irrespective of national income level (Figure 6.2). Similarly, PCPs had the second highest level of responsibility across all income levels; however, the number of low-income countries that rated other specialists as primarily responsible for CKD care was similar to the number of low-income countries that rated PCPs as primarily responsible (41% vs. 47%, respectively). Nurse practitioners had higher primary responsibility compared to MDTs in low-income countries, but in other income groups the two categories were similar. The proportion of countries that rated other specialists as bearing primary responsibility for CKD care fell with income level.

Similarly, in most ISN regions, nephrologists were primarily responsible for CKD care (Figure 6.3). In North & East Asia, Oceania & South East Asia, and South Asia, nephrologists and PCPs were equally responsible, whereas in both North American

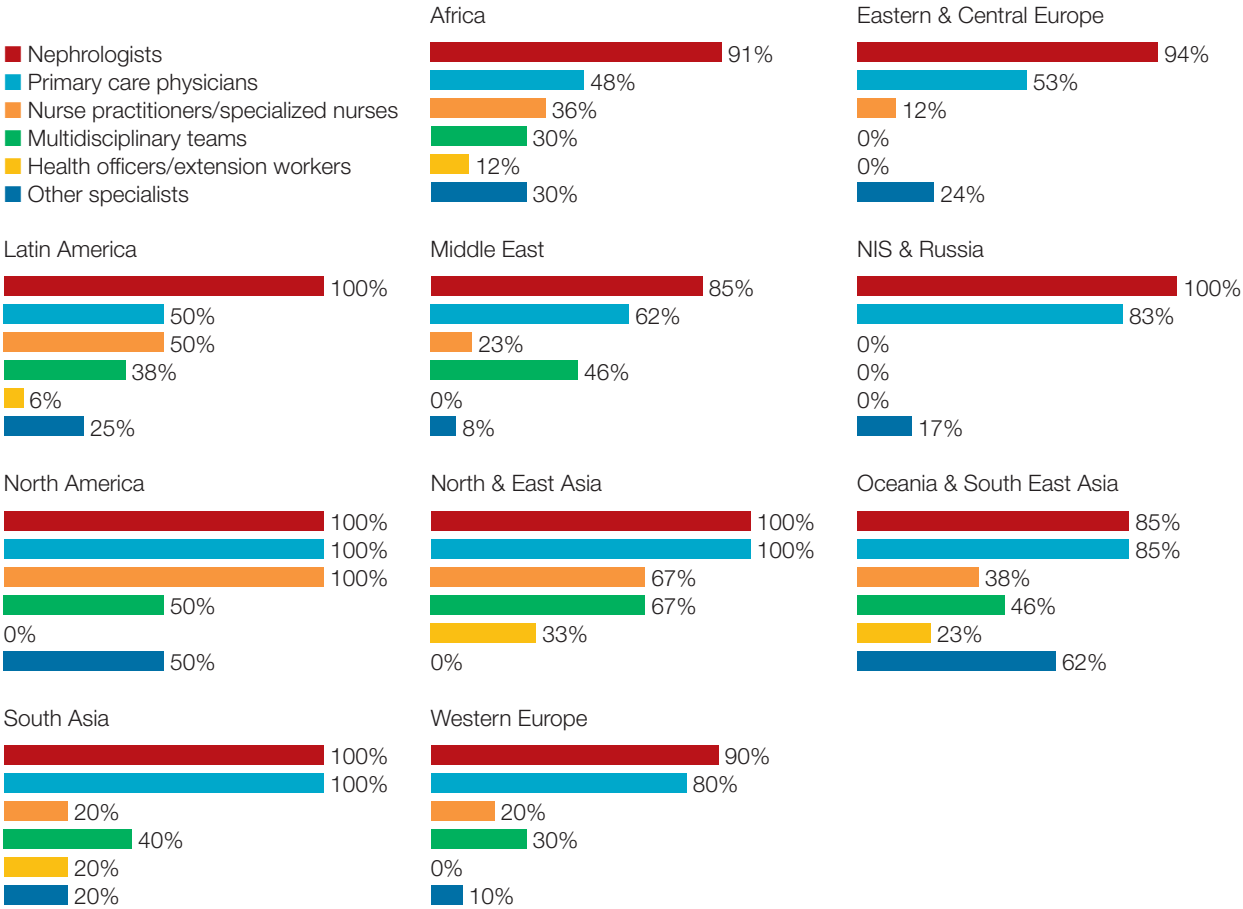
Figure 6.1 | Healthcare providers primarily responsible for AKI and CKD care



1 The CKD survey question did not offer IC specialists or technicians as options.
2 The AKI survey question did not offer MDT as an option.

Figure 6.2 | Healthcare providers primarily responsible for CKD care, by World Bank income group

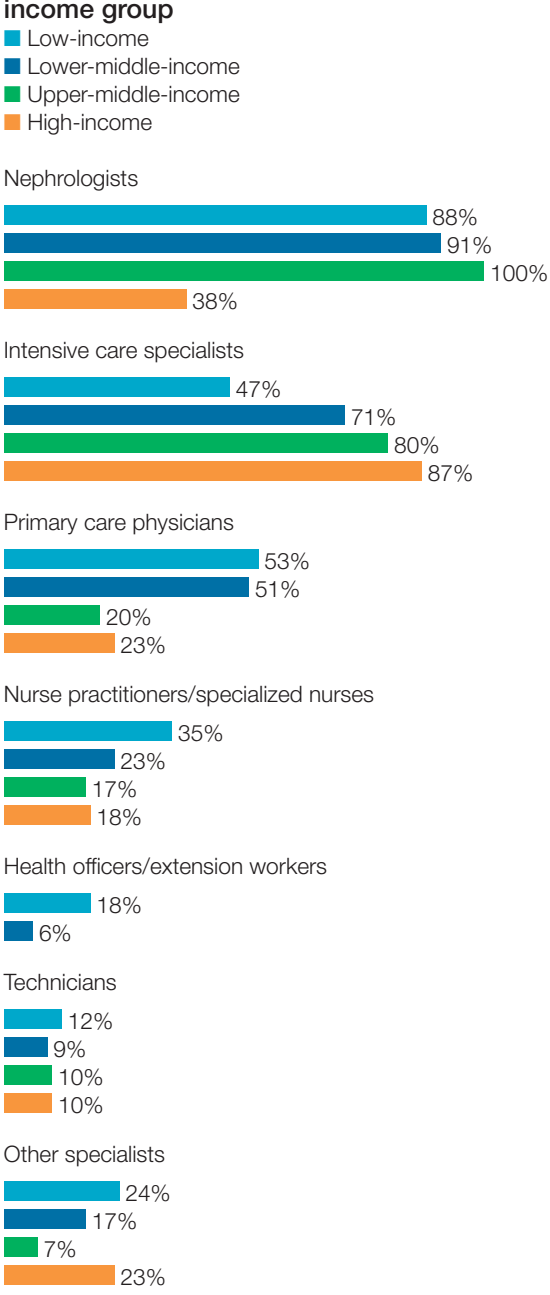
Figure 6.3 | Healthcare providers primarily responsible for CKD care, by ISN region



countries, nephrologists, PCPs, and NPs were equally responsible. In most regions, nurses were primarily responsible in less than half of countries, as were MDTs. Other specialists were typically less than 30%, other than in North America and Oceania & South East Asia.

Comparable findings were shown for AKI care (Figure 6.1; Figure 6.4; Figure 6.5). Nephrologists were primarily responsible for AKI, irrespective of income group or ISN region. Intensive care specialists were the next leading provider responsible for AKI care except in the low-income group, where PCPs were reported as the second most common provider type for AKI (Figure 6.4). Nurse practitioners and health officers had more responsibility in low-income countries than in other income groups (Figure 6.4). Technicians and other specialists had little responsibility for AKI, irrespective of income group.

Figure 6.4 | Healthcare providers primarily responsible for AKI care, by World Bank income group



With respect to ISN region, intensive care specialists were also the next leading provider in all regions, and were equal to nephrologists in NIS & Russia, North America, North & East Asia, and South Asia, where nephrologists and PCPs were equally responsible in all countries (Figure 6.5). PCPs had a lesser role in AKI care than in CKD care. In all countries in South Asia, PCPs, nephrologists, and intensive care specialists all shared the primary responsibility for AKI care, and in Western Europe, PCPs were primarily responsible in 83% of countries; in all other regions, PCPs were primarily responsible in less than half the countries.

Respondents were asked to specify their country's shortages of healthcare providers specific to kidney care. Workforce shortages were identified in nearly all (98%) countries (Figure 6.6). The most common workforce shortages were of renal pathologists (86%), vascular access coordinators (81%), dietitians (78%), and nephrologists (74%). Social workers, NPs, psychologists, transplant coordinators, dialysis nurses, and dialysis technicians were limited in just over half (~60%) of countries. Pharmacists, PCPs, and laboratory technicians were limited in only one-third of countries (Figure 6.6).

Overall, workforce capacity was lower in low-income countries than in high-income countries (Figure 6.7). Dietitians and renal pathologists were limited in all low-income countries (100%), and nephrologists and vascular access coordinators were limited in nearly all low-income countries (94%), compared to only 67%, 72%, 51%, and

72% of high-income countries, respectively. Shortages of social workers, NPs and PCPs were essentially equal across income groups. Dialysis nurses were in slightly shorter supply in low-income- (81%) compared to high-income- (62%) countries.

Nephrologists were limited in most countries in Africa, Latin America, the Middle East, Oceania & South East Asia, and South Asia (Map 6.1). Renal pathologists were limited in all countries in Africa, Latin America, and Oceania & South East Asia. Western Europe reported the fewest shortages and was the only ISN region in which any countries (Germany and the Netherlands) reported no shortages (Figure 6.7).

Overall, the mean number of nephrologists reported was 8.83 per million population (PMP), and the mean number of nephrology trainees was 1.87 PMP. High-income countries had the highest density of nephrologists (28.52 PMP), followed by upper-middle-income (7.23 PMP), lower-middle-income (2.38 PMP), and low-income (0.31 PMP). Similarly, the prevalence of nephrology trainees in high-income countries was more than 30-fold that in low-income countries (6.03 vs. 0.18 PMP). The prevalence of nephrology trainees in upper-middle- and lower-middle-income countries was 0.78 PMP and 1.19 PMP, respectively.

Figure 6.5 | Healthcare providers primarily responsible for AKI care, by ISN region

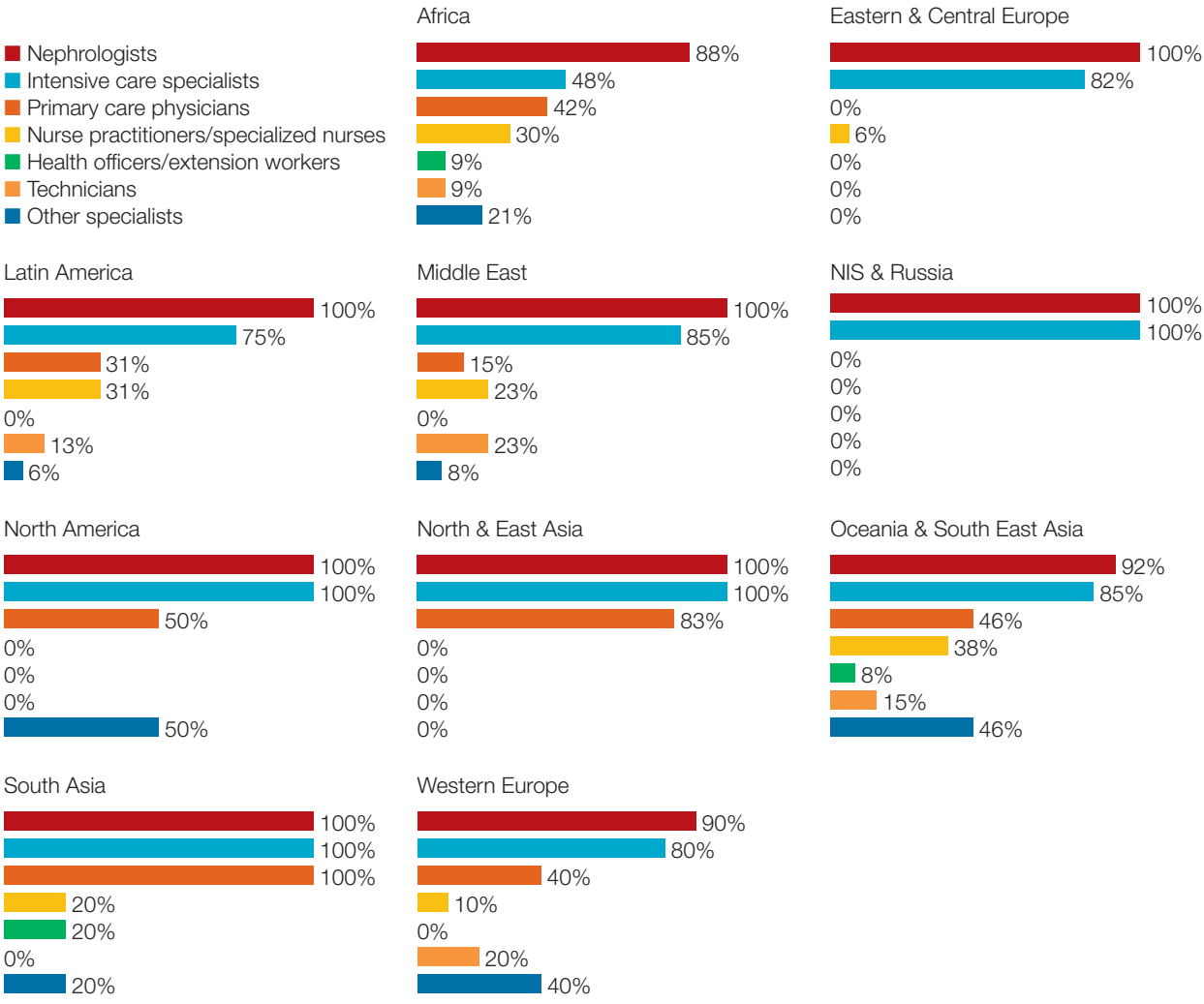


Figure 6.6 | Workforce shortages of healthcare providers essential for kidney disease care

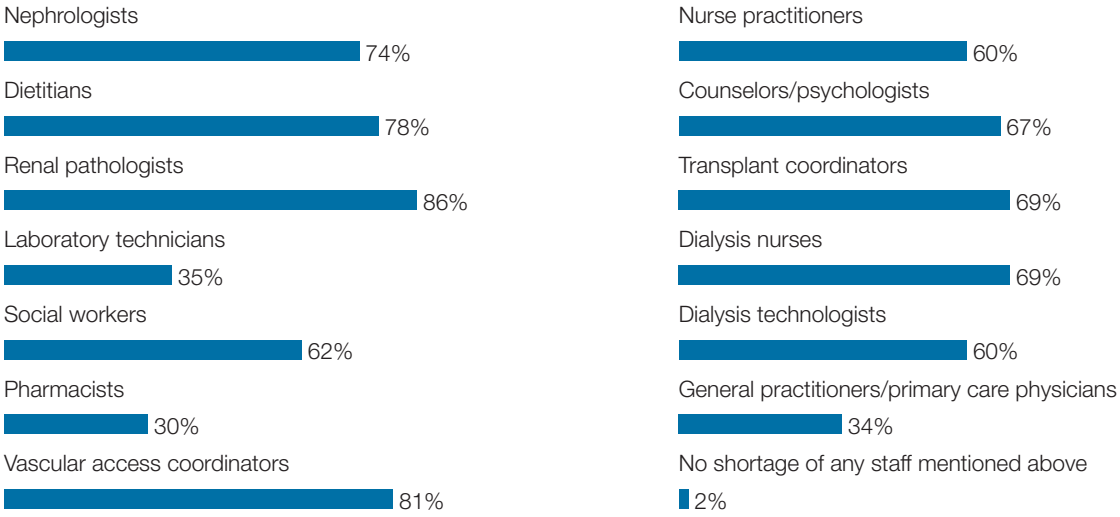
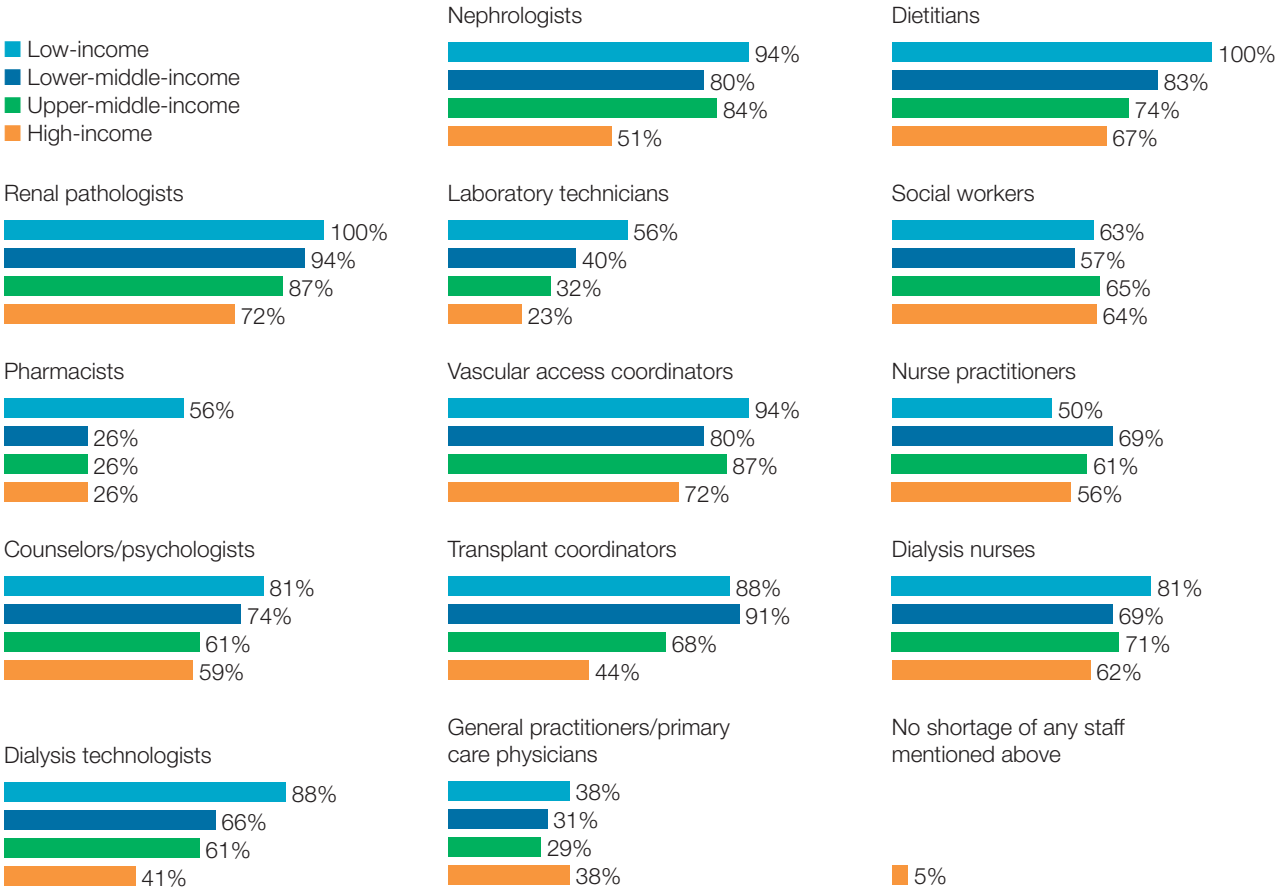


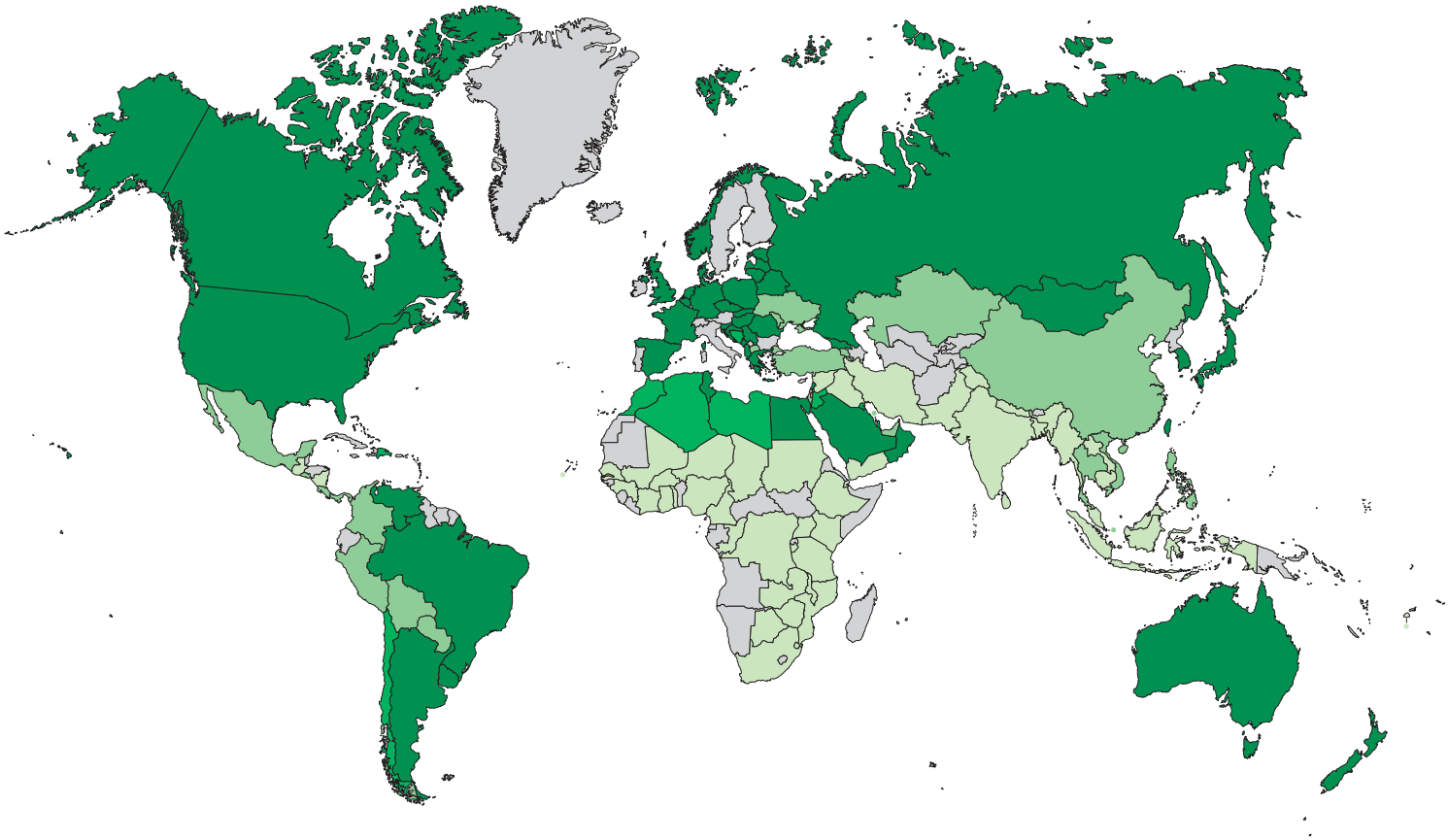
Figure 6.7 | Workforce shortages of healthcare providers essential for kidney disease care, by World Bank income group



Map 6.1 | Global prevalence of nephrologists

Rate per million population (PMP)

≤5.0 5.1–10.0 10.1–15.0 >15.0 N/A (not available)



6.2 Training capacity

Overall, 79% of countries have a nephrology training program. Nearly all (97%) of high-income countries have a program and 80% of upper-middle- and lower-middle-income countries have a program (Figure 6.8). Less than half (35%) of low-income countries have a nephrology training program.

All (100% of) countries in NIS & Russia, North America, North & East Asia, South Asia, and Western Europe have a nephrology training program. Nearly all countries in Eastern & Central Europe (all but 6%) and Latin America (all but 12%) have training programs. Nearly half of countries in Africa (48%) lack a nephrology training program.

Of the 96 countries that have a nephrology training program, 86% had a program between 2 and 4 years in length, and programs in 11% were longer than 4 years. All six of the training programs in low-income countries were 2 to 4 years (Figure 6.9). The only two programs shorter than 2 years were offered in upper-middle-income countries.

Just over half (56%) of countries set up their program to follow a general internal medicine program (Table 6.1). Nine per cent were structured as solo training after basic qualification, and 27% were a mix of both. Seven per cent used some other structure.

Figure 6.8 | Availability of nephrology training program, by World Bank income group

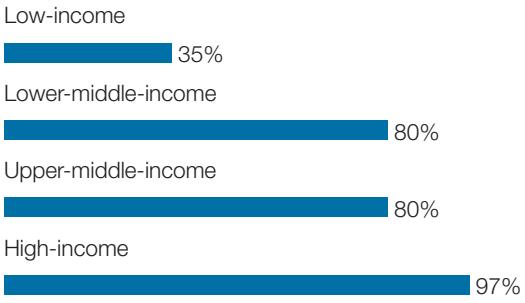


Figure 6.9 | Duration of nephrology training program, by World Bank income group

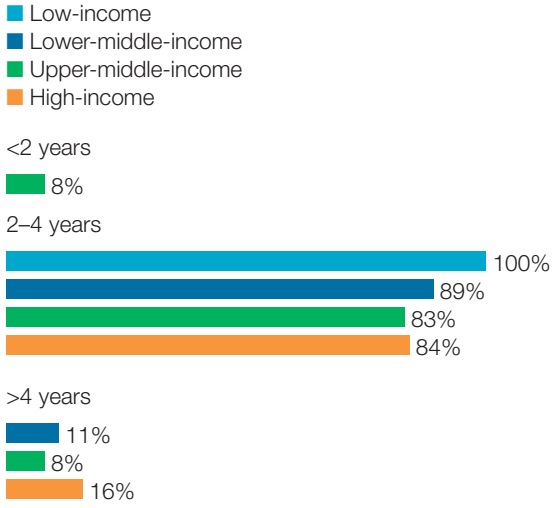


Table 6.1 | Structures of nephrology training programs

	1. Following general internal medicine N (%)	2. Solo training after basic qualification N (%)	A mix of 1 & 2 depending on region and/or training centre N (%)	Other N (%)
Overall	**54 (56)**	**9 (9)**	**26 (27)**	**7 (7)**
ISN regions				
Africa	10 (59)	4 (24)	2 (12)	1 (6)
Eastern & Central Europe	7 (44)	3 (19)	2 (13)	4 (25)
Latin America	8 (57)	1 (7)	5 (36)	0 (0)
Middle East	6 (60)	0 (0)	3 (30)	1 (10)
NIS & Russia	2 (33)	1 (17)	3 (50)	0 (0)
North America	2 (100)	0 (0)	0 (0)	0 (0)
North & East Asia	3 (50)	0 (0)	3 (50)	0 (0)
Oceania & South East Asia	8 (80)	0 (0)	2 (20)	0 (0)
South Asia	2 (40)	0 (0)	3 (60)	0 (0)
Western Europe	6 (60)	0 (0)	3 (30)	1 (10)
World Bank income groups				
Low-income	5 (83)	1 (17)	0 (0)	0 (0)
Lower-middle-income	14 (50)	3 (11)	9 (32)	2 (7)
Upper-middle-income	15 (63)	2 (8)	6 (25)	1 (4)
High-income	20 (53)	3 (8)	11 (29)	4 (11)

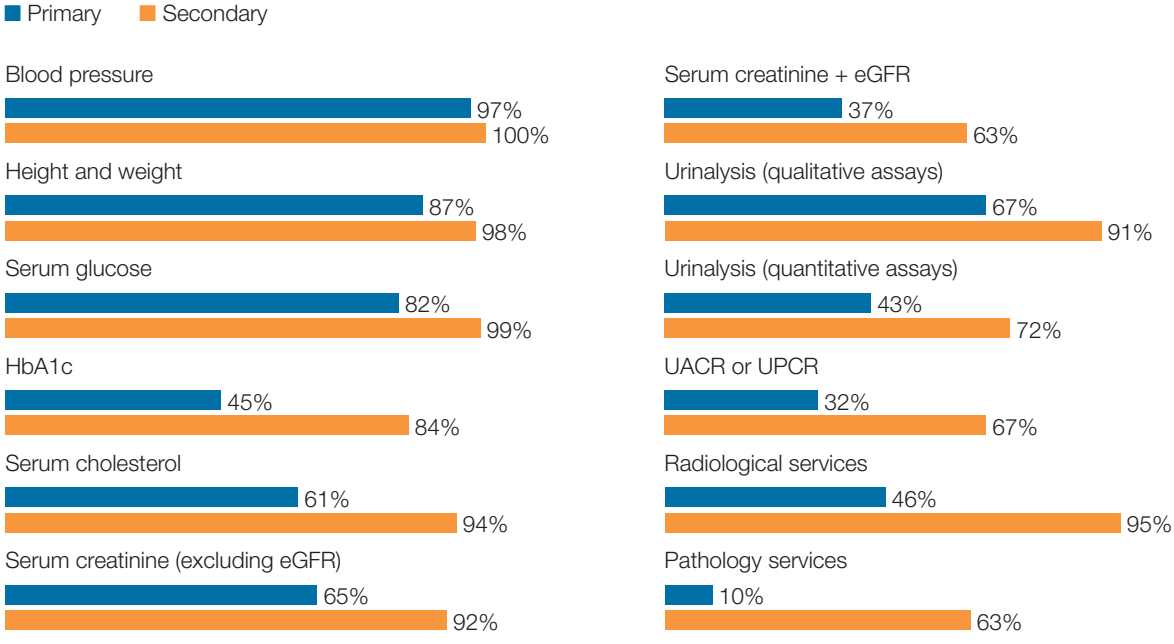
SECTION 7

ACCESS TO ESSENTIAL MEDICATIONS AND HEALTH PRODUCTS

7.1 Capacity for identification and management of CKD

Availability of services to identify and manage CKD was collected from respondents. Generally available refers to at least 50% of healthcare facilities within a country offering the service. Overall, all services were more available at a secondary/tertiary level than primary care level (Figure 7.1). Blood pressure monitoring was available in almost all countries (97%), and monitoring of height/weight (87%) and serum glucose (82%) was also quite highly available at a primary care level. Other services were generally unavailable through primary care: HbA1c, serum creatinine (with eGFR), quantitative urinalysis assays, UACR/UPCR, radiology, and pathology. More than half of the services were available through secondary/tertiary care in more than 90% of countries (Figure 7.1): blood pressure, height/weight, serum glucose, serum cholesterol, serum creatinine (without eGFR), qualitative urinalysis assays, and radiology. Estimated GFR and pathology were available through secondary care in 63% of the countries, and UACR/UPCR was available in 67% of countries.

Figure 7.1 | Kidney care services generally available through primary and secondary care



Blood pressure and height and weight were offered at a primary care level, irrespective of income level (Figure 7.2). All other services were also generally available at a primary care level in upper-middle and high-income countries, but not in low-income countries, with the exception of serum glucose and qualitative urinalysis (offered in 76% and 56% of countries, respectively). Other than blood pressure and height and weight, kidney care services were generally unavailable in most low-income countries.

Kidney care services were more available at the secondary level. Blood pressure, height and weight, serum glucose, serum cholesterol, serum creatinine (without eGFR), qualitative urinalysis, and radiology services were generally available at the secondary or tertiary care level in most countries, irrespective of income level (Figure 7.2). All other services were generally available in most upper-middle- and high-income countries and nearly half of all lower-middle-income countries, and generally unavailable in most low-income countries (Figure 7.2). Particularly, HbA1c, serum creatinine with eGFR, UACR/UPCR, and pathology were generally unavailable in most low-income countries.

Figure 7.2 | Availability of kidney care services through primary and secondary care, by World Bank income group

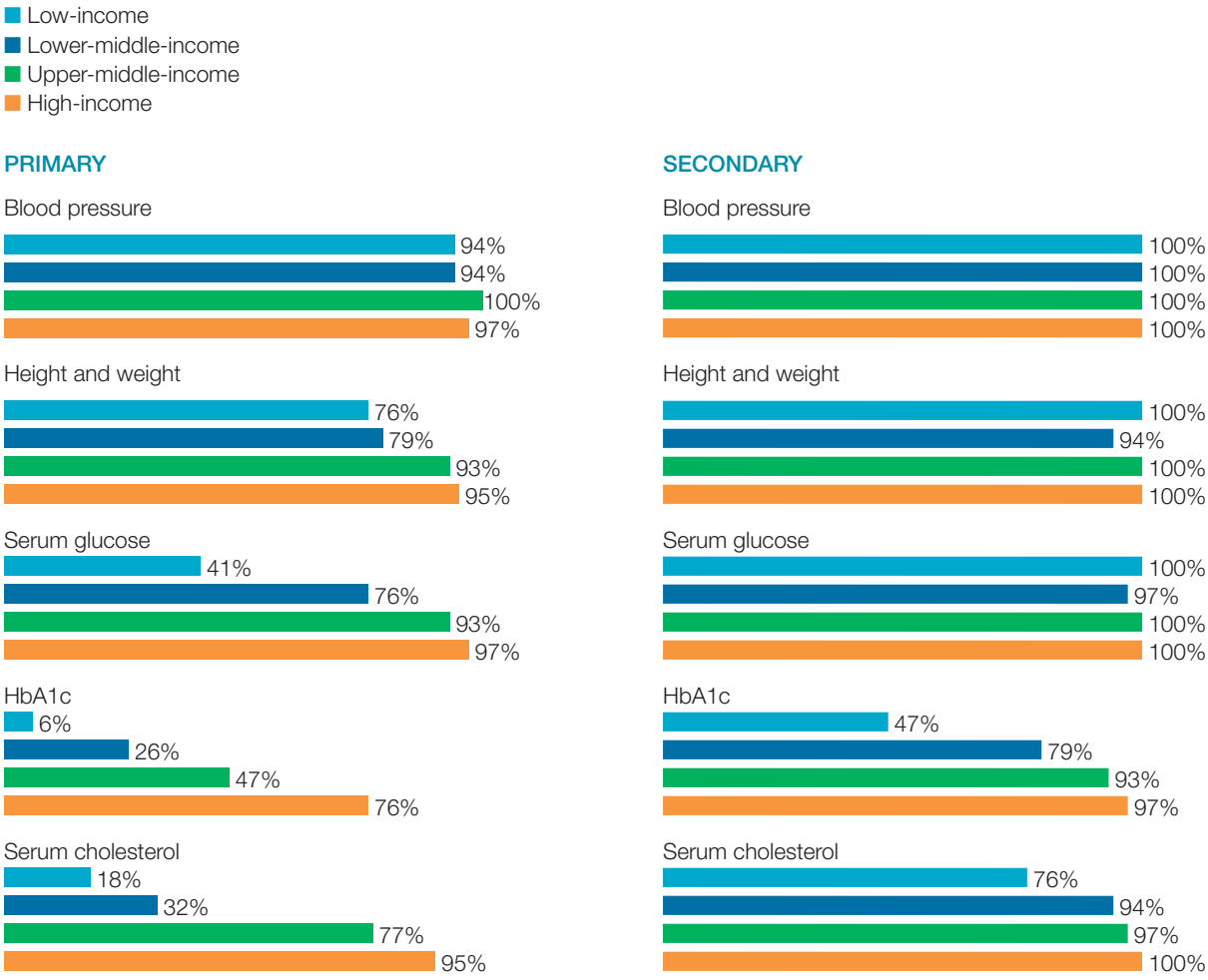
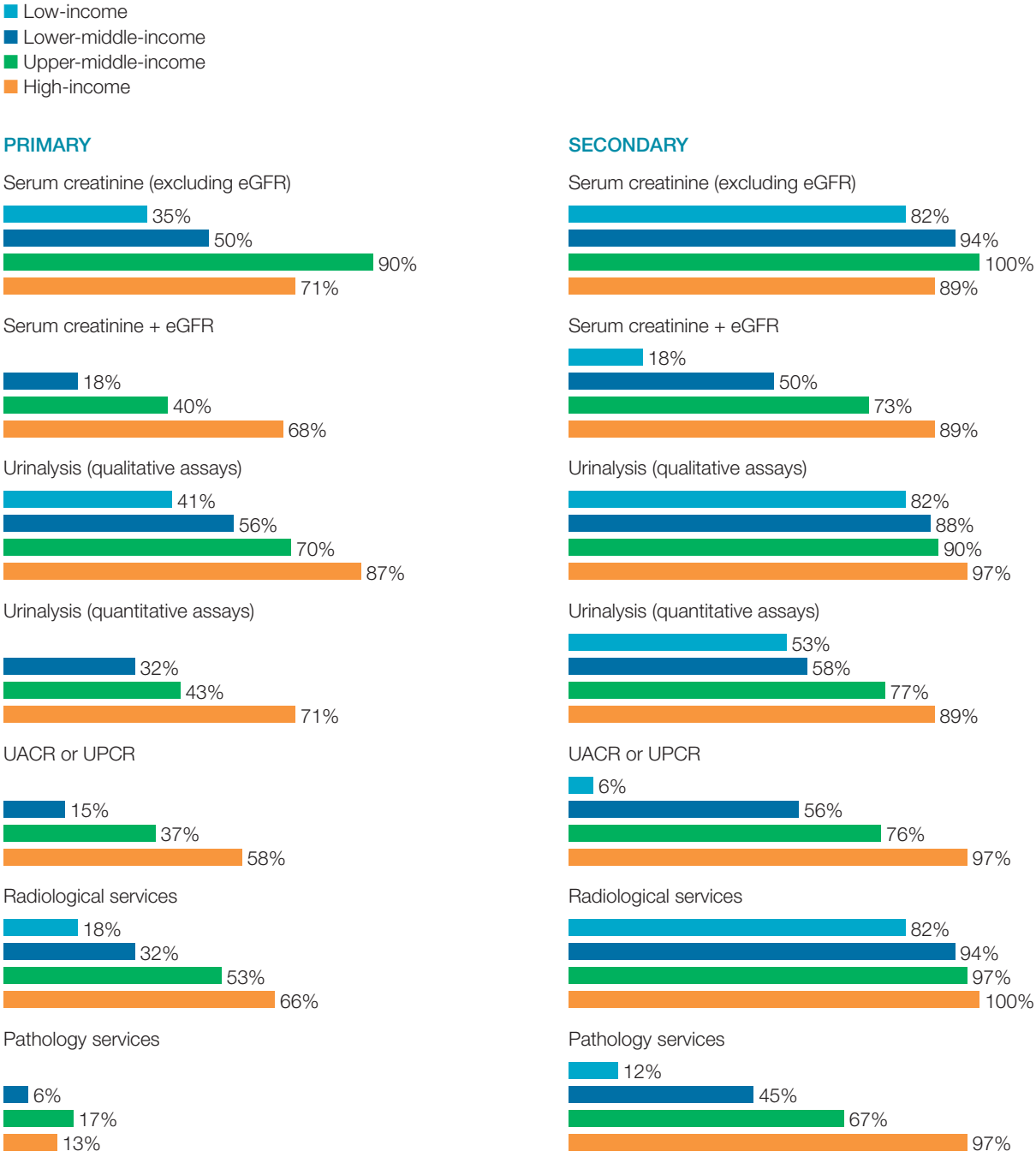


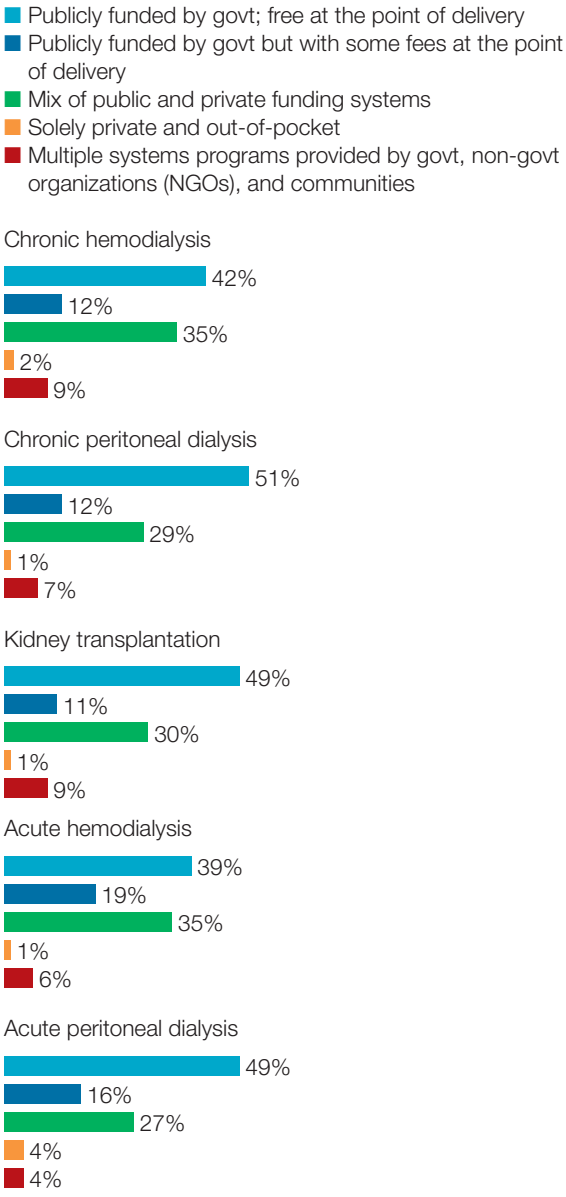
Figure 7.2 | continued



7.2 Capacity for RRT service provision

Across all modalities and conditions, funding of RRT services was most often through a combination of government (with no fees at the point of delivery) and a mix of public and private sources (Figure 7.3). Over a quarter of countries funded RRT services through a mix of public and private systems. Approximately under 10% of countries funded RRT through multiple systems, and in very few countries (1%–4%) funding for RRT was through private and out-of-pocket sources. When funding was compared across ISN regions or World Bank income groups, the structures appeared to vary according to income level: generally speaking, higher-income countries provided more funding through government, and lower-income countries varied between government, private, and mixed sources.

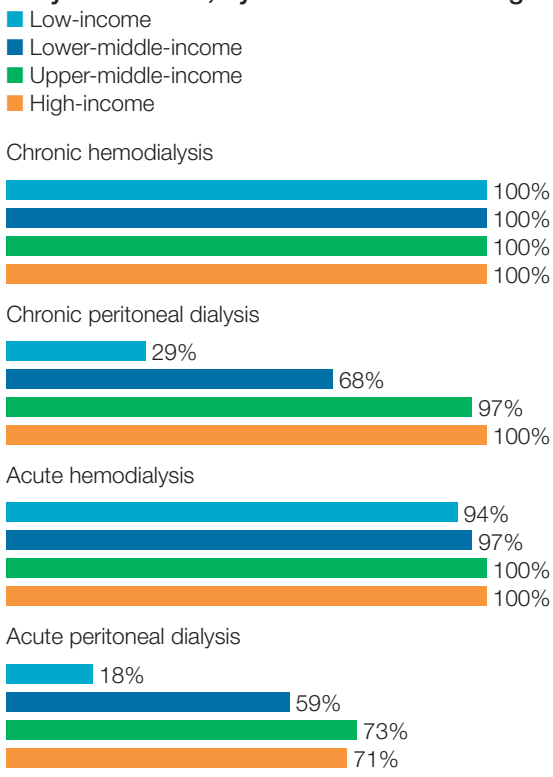
Figure 7.3 | Funding models for all renal replacement therapy types



7.2.1 Capacity for chronic RRT service provision

Chronic hemodialysis (HD) was available in all (100% of) countries (Figure 7.4). Chronic peritoneal dialysis (PD) was available in 80% of countries, the most available in high- (100%) and upper-middle-income countries (97%), and moderate in lower-middle-income countries (68%). Chronic PD was offered in only 29% of low-income countries.

Figure 7.4 | Availability of chronic and acute dialysis services, by World Bank income group



All countries offered chronic HD, and nearly all offered acute HD, with the exception of two countries in Africa. All countries in Eastern & Central Europe, NIS & Russia, North America, North & East Asia, South Asia, and Western Europe offered chronic PD; the service was widely available in most other regions except Africa, where it was offered in less than half the countries (48%). Acute PD was less available, offered in only 61% of all countries, lowest in Africa and Oceania & South East Asia.

Overall, 42% of countries funded chronic HD services through the government, with no fees at the point of delivery (Figure 7.5). Thirty-five per cent of countries offered chronic HD though a mix of public and private funding sources. Only two countries funded chronic HD through private and out-of-pocket systems.

Higher-income countries tended to fund chronic HD services through the government, where 69% of high-income countries funded chronic HD through government, 58% with no fees at the point of delivery, and 11% with some fees at the point of delivery (Figure 7.6). Forty-eight per cent of lower-middle-income countries funded chronic HD through a mix of public and private. There was high variability in low-income countries, where 48% of countries funded chronic HD through government (24% with some fees and 24% with no fees at the point of delivery), 29% funded through a mix of public and private, 12% through multiple systems (government, NGOs, and communities), and 12% were funded solely through private companies and out-of-pocket. No countries funded chronic HD solely through health insurance providers.

The majority of countries in Eastern & Central Europe, the Middle East, NIS & Russia, North America, and Western Europe funded chronic HD through government, with no fees at the point of delivery (Table 7.1).

Table 7.1 | Funding models for chronic hemodialysis

	Publicly funded by govt; free at the point of delivery N (%)	Publicly funded by govt; some fees at the point of delivery N (%)	Mix of public and private funding systems N (%)	Solely private and out-of-pocket N (%)	Solely private through health insurance providers N (%)	Multiple systems programs provided by govt, non-govt organizations (NGOs), and communities N (%)
Overall	**50 (42)**	**14 (12)**	**41 (35)**	**2 (2)**	**0 (0)**	**11 (9)**
ISN regions						
Africa	10 (30)	7 (21)	12 (36)	1 (3)	0 (0)	3 (9)
Eastern & Central Europe	14 (88)	0 (0)	2 (13)	0 (0)	0 (0)	0 (0)
Latin America	3 (20)	0 (0)	11 (73)	0 (0)	0 (0)	1 (7)
Middle East	9 (69)	1 (8)	1 (8)	0 (0)	0 (0)	2 (15)
NIS & Russia	4 (67)	0 (0)	1 (17)	0 (0)	0 (0)	1 (17)
North America	2 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
North & East Asia	0 (0)	3 (50)	2 (33)	0 (0)	0 (0)	1 (17)
Oceania & South East Asia	1 (8)	2 (15)	7 (54)	1 (8)	0 (0)	2 (15)
South Asia	0 (0)	1 (20)	3 (60)	0 (0)	0 (0)	1 (20)
Western Europe	7 (78)	0 (0)	2 (22)	0 (0)	0 (0)	0 (0)
World Bank income groups						
Low-income	4 (24)	4 (24)	5 (29)	2 (12)	0 (0)	2 (12)
Lower-middle-income	6 (18)	6 (18)	16 (48)	0 (0)	0 (0)	5 (15)
Upper-middle-income	18 (60)	0 (0)	10 (33)	0 (0)	0 (0)	2 (7)
High-income	22 (58)	4 (11)	10 (26)	0 (0)	0 (0)	2 (5)

Similarly to chronic HD, chronic PD was funded publicly in the majority of countries (63%), 51% of countries at no cost, and 12% with some fees at the point of delivery (Figure 7.7). Almost 30% of countries funded chronic PD through a mix of public and private sources, and 7% through multiple systems (government, NGO, community). One country funded chronic PD solely through private and out-of-pocket sources. No countries funded chronic PD solely through health insurance providers.

The majority of upper-middle- (61%) and high-income-countries (66%) funded chronic PD through the government with no fees at the point of delivery (Figure 7.8). Only 25% of lower-middle-income countries funded chronic PD services through the government with no fees, and no low-income countries had this funding model. The majority of low-income countries funded chronic PD through the government with some fees (40%) or a mix of public and private (40%), and less than a quarter (20%) funded it through multiple systems (government, NGOs, and communities). Only one country (4%) funded it solely through private and out-of-pocket sources. No countries funded chronic PD solely through health insurance.

The majority of countries in Eastern & Central Europe, the Middle East, NIS & Russia, North America, and Western Europe funded chronic PD through government, with no fees (Table 7.2). The majority of countries in North & East Asia (67%) funded it through government with some fees at the point of delivery, and most countries in Latin America (73%) and Oceania & South East Asia (67%) funded it through a mix of public and private. Thirty-five per cent of countries in Africa funded it through government with no fees, 24% with fees, 35% as a mix of public and private, and 6% through multiple systems.

Figure 7.5 | Funding models for chronic hemodialysis

- Publicly funded by govt; free at point of delivery – 42%
- Publicly funded by govt; some fees at point of delivery – 12%
- Mix of public and private funding systems – 35%
- Solely private and out-of-pocket – 2%
- Multiple systems programs provided by govt, non-govt organizations (NGOs), and communities – 9%

Figure 7.6 | Funding models for chronic hemodialysis, by World Bank income group

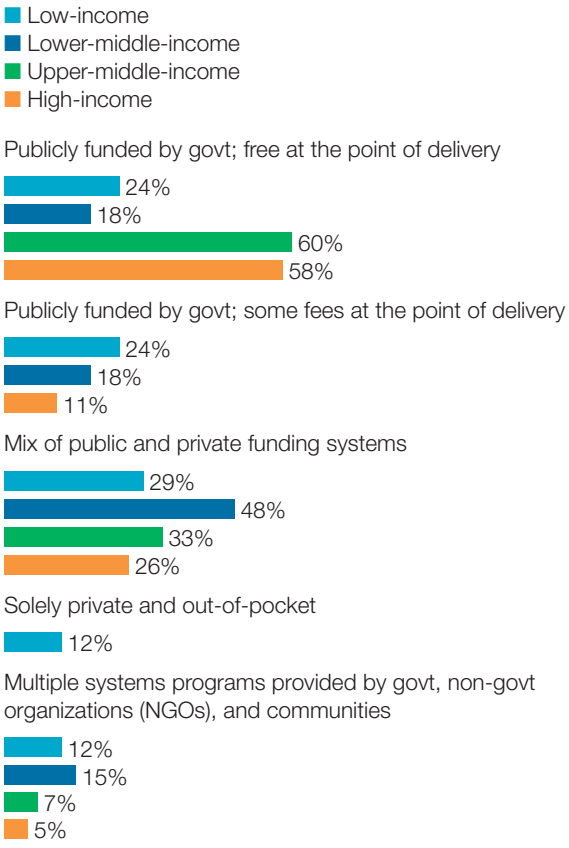


Figure 7.7 | Funding models for chronic peritoneal dialysis

- Publicly funded by govt; free at point of delivery – 51%
- Publicly funded by govt; some fees at point of delivery – 12%
- Mix of public and private funding systems – 29%
- Solely private and out-of-pocket – 1%
- Multiple systems programs provided by govt, non-govt organizations (NGOs), and communities – 7%

Kidney transplantation was available in 79% of countries (Table 7.3). Transplantation was available in all countries of every ISN region except Africa (36%) and Oceania & South East Asia (69%) (Table 7.3). Of the two low-income countries that provided kidney transplantation, both (100%) used only live donor types.

Almost all of the 38 high-income countries (97%) that provided transplantation used a combination of deceased and live donor types (Table 7.3); whereas one country used only live (Figure 7.9). Of lower-middle-income countries, 62% used only live donors, one country (4%) used deceased only, and 35% used a combination. The majority (86%) of upper-middle-income countries used a combination of deceased and live donors, and the remaining countries (14%) used live donors only.

Across all ISN regions, the majority of countries had a combination of deceased and live donors, except for Africa and South Asia, where 58% and 60% of countries, respectively, used live donors only. One country, in Africa, relied on deceased donors only (Table 7.3).

Almost half (49%) of countries funded transplantation exclusively by government, with no fees at the point of delivery (Figure 7.10; Table 7.4). Eleven per cent funded it exclusively by government, with some fees. Thirty per cent used a mixed funding model (public and private), and 9% received sources from government, NGOs, and communities. One country (1%) funded it solely from private and out-of-pocket sources. No countries funded it through health insurance providers.

Figure 7.8 | Funding models for chronic peritoneal dialysis, by World Bank income group

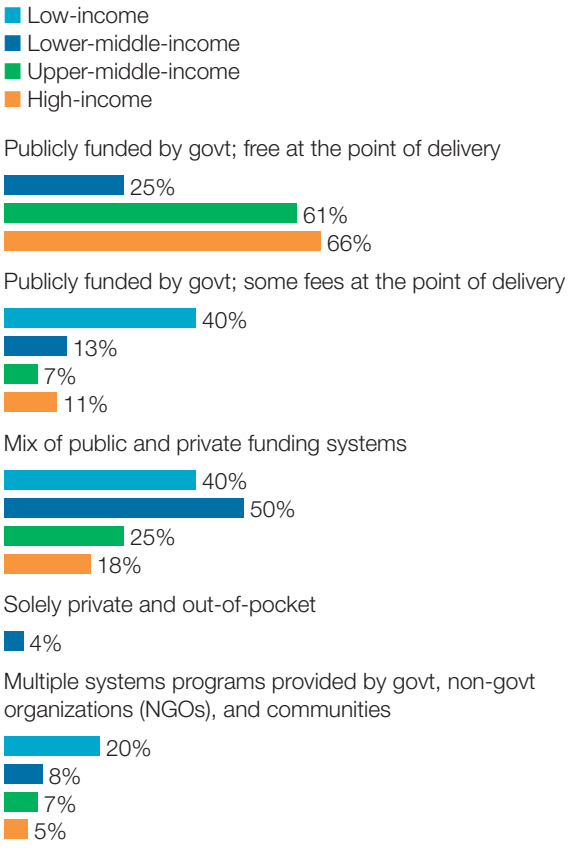


Figure 7.9 | Donor types of kidney transplantation, by World Bank income group

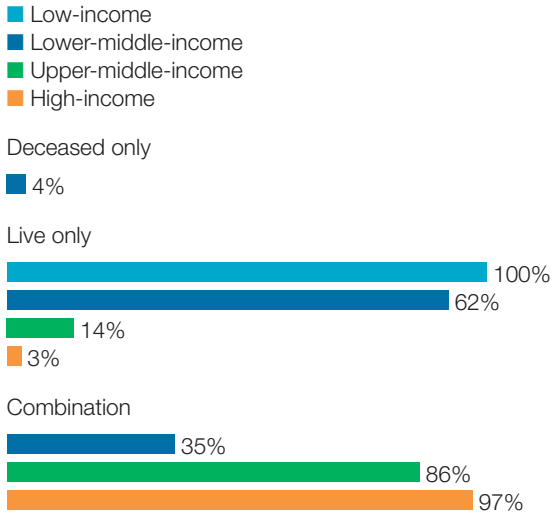


Figure 7.10 | Funding models for kidney transplantation

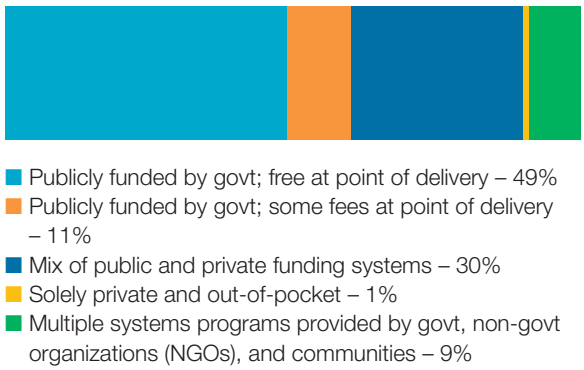


Table 7.2 | Funding models for chronic peritoneal dialysis

	Publicly funded by govt; free at the point of delivery N (%)	Publicly funded by govt; some fees at the point of delivery N (%)	Mix of public and private funding systems N (%)	Solely private and out-of-pocket N (%)	Solely private through health insurance providers N (%)	Multiple systems programs provided by govt, non-govt organizations (NGOs), and communities N (%)
Overall	**48 (51)**	**11 (12)**	**28 (29)**	**1 (1)**	**0 (0)**	**7 (7)**
ISN regions						
Africa	6 (35)	4 (24)	6 (35)	0 (0)	0 (0)	1 (6)
Eastern & Central Europe	14 (93)	0 (0)	1 (7)	0 (0)	0 (0)	0 (0)
Latin America	4 (27)	0 (0)	11 (73)	0 (0)	0 (0)	0 (0)
Middle East	7 (64)	2 (18)	0 (0)	1 (9)	0 (0)	1 (9)
NIS & Russia	5 (83)	0 (0)	0 (0)	0 (0)	0 (0)	1 (17)
North America	2 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
North & East Asia	0 (0)	4 (67)	1 (17)	0 (0)	0 (0)	1 (17)
Oceania & South East Asia	1 (11)	0 (0)	6 (67)	0 (0)	0 (0)	2 (22)
South Asia	1 (20)	1 (20)	2 (40)	0 (0)	0 (0)	1 (20)
Western Europe	8 (89)	0 (0)	1 (11)	0 (0)	0 (0)	0 (0)
World Bank income groups						
Low-income	0 (0)	2 (40)	2 (40)	0 (0)	0 (0)	1 (20)
Lower-middle-income	6 (25)	3 (13)	12 (50)	1 (4)	0 (0)	2 (8)
Upper-middle-income	17 (61)	2 (7)	7 (25)	0 (0)	0 (0)	2 (7)
High-income	25 (66)	4 (11)	7 (18)	0 (0)	0 (0)	2 (5)

Table 7.3 | Availability and characteristics of kidney transplantation

	Kidney transplantation N (%)[1]	Donor type		
		Deceased only N (%)[2]	Live only N (%)[2]	Combination N (%)[2]
Overall	**94 (79)**	**1 (1)**	**23 (24)**	**70 (74)**
ISN regions				
Africa	12 (36)	1 (8)	7 (58)	4 (33)
Eastern & Central Europe	16 (100)	0 (0)	2 (13)	14 (88)
Latin America	16 (100)	0 (0)	2 (13)	14 (88)
Middle East	13 (100)	0 (0)	5 (38)	8 (62)
NIS & Russia	6 (100)	0 (0)	2 (33)	4 (67)
North America	2 (100)	0 (0)	0 (0)	2 (100)
North & East Asia	6 (100)	0 (0)	0 (0)	6 (100)
Oceania & South East Asia	9 (69)	0 (0)	2 (22)	7 (78)
South Asia	5 (100)	0 (0)	3 (60)	2 (40)
Western Europe	9 (100)	0 (0)	0 (0)	9 (100)
World Bank income groups				
Low-income	2 (12)	0 (0)	2 (100)	0 (0)
Lower-middle-income	26 (76)	1 (4)	16 (62)	9 (35)
Upper-middle-income	28 (93)	0 (0)	4 (14)	24 (86)
High-income	38 (100)	0 (0)	1 (3)	37 (97)

1 Percentages are calculated relative to the corresponding number of countries that responded to the question.
2 Percentages are calculated relative to the corresponding number of countries where kidney transplantation is available.

Similarly to dialysis, the majority of transplantation funding models in upper-middle and high-income countries were exclusively through government with no fees (Figure 7.11; Table 7.4). There was a variety in lower-middle-income countries, with 56% being a mixed model of private and public, and a total of 28% of lower-middle-income countries funded exclusively by government, 16% with no fees and 12% with some fees at the point of delivery. The two low-income countries offering transplantation funded it either publicly with no fees or through a mix of public and private systems.

All countries in Eastern & Central Europe and North America and a large majority in NIS & Russia (83%) and Western Europe (89%) funded transplantation through government with no fees at the point of delivery (Table 7.4). All countries in South Asia and the majority in Latin America (80%) and Oceania & South East Asia (56%) funded it through a mix of public and private sources. The majority (83%) of countries in North & East Asia funded it through government, with some fees at the point of delivery. Africa and the Middle East used a variety of funding models.

7.2.2 Capacity for acute RRT service provision

Acute HD was available in all (100%) countries in upper-middle- and high-income groups, 94% of low-income and 97% of lower-middle-income. Overall, the distribution of funding models across all countries for acute HD was similar to that for chronic HD. Most common was funding by government with no fees (39%), followed closely by a mix of public and private sources (35%). Nearly 20% funded it through government with some fees at the point of delivery. Only one country (1%) funded it solely through private and out-of-pocket sources (Figure 7.12; Table 7.5).

Table 7.4 | Funding models for kidney transplantation

	Publicly funded by govt; free at the point of delivery N (%)	Publicly funded by govt; some fees at the point of delivery N (%)	Mix of public and private funding systems N (%)	Solely private and out-of-pocket N (%)	Solely private through health insurance providers N (%)	Multiple systems programs provided by govt, non-govt organizations (NGOs), and communities N (%)
Overall	**46 (49)**	**10 (11)**	**28 (30)**	**1 (1)**	**0 (0)**	**8 (9)**
ISN regions						
Africa	4 (33)	1 (8)	4 (33)	1 (8)	0 (0)	2 (17)
Eastern & Central Europe	16 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
Latin America	2 (13)	0 (0)	12 (80)	0 (0)	0 (0)	1 (7)
Middle East	6 (46)	4 (31)	0 (0)	0 (0)	0 (0)	3 (23)
NIS & Russia	5 (83)	0 (0)	1 (17)	0 (0)	0 (0)	0 (0)
North America	2 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
North & East Asia	0 (0)	5 (83)	0 (0)	0 (0)	0 (0)	1 (17)
Oceania & South East Asia	3 (33)	0 (0)	5 (56)	0 (0)	0 (0)	1 (11)
South Asia	0 (0)	0 (0)	5 (100)	0 (0)	0 (0)	0 (0)
Western Europe	8 (89)	0 (0)	1 (11)	0 (0)	0 (0)	0 (0)
World Bank income groups						
Low-income	1 (50)	0 (0)	1 (50)	0 (0)	0 (0)	0 (0)
Lower-middle-income	4 (16)	3 (12)	14 (56)	1 (4)	0 (0)	3 (12)
Upper-middle-income	15 (54)	2 (7)	8 (29)	0 (0)	0 (0)	3 (11)
High-income	26 (68)	5 (13)	5 (13)	0 (0)	0 (0)	2 (5)

The majority of high-income (53%) and upper-middle-income (55%) countries funded acute HD exclusively through the government with no fees (Figure 7.13; Table 7.5). Low-income countries were equally dispersed across government with no fees (31%), government with some fees (31%), and a mix of public and private (31%). Few countries in any income group funded acute HD through multiple systems, and only one country (low-income) funded it solely through private and out-of-pocket sources.

The majority of ISN regions funded acute HD through government; however, in Latin America and South Asia, 78% and 80% of countries, respectively, funded it through a mix of public and private (Table 7.5). Additionally, half (50%) of countries in North America and 46% of countries in Oceania & South East Asia funded it through a mix of public and private sources. Only one country (in Africa) funded acute HD through private sources exclusively.

Acute PD was available in 61% of countries. Less than 20% of countries in low-income countries

Figure 7.11 | Funding models for kidney transplantation, by World Bank income group

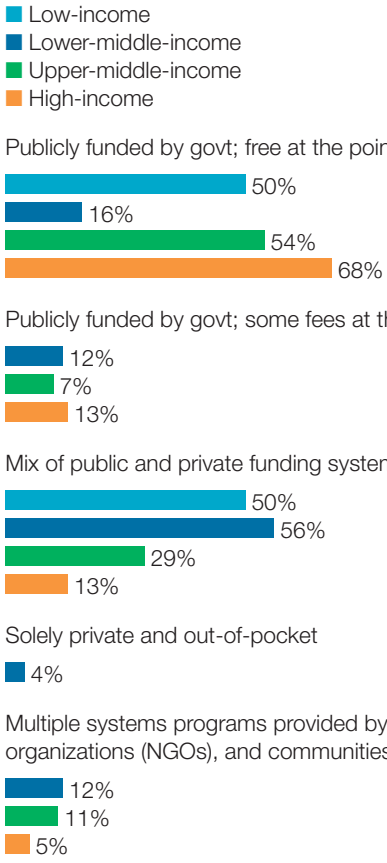


Figure 7.12 | Funding models for acute hemodialysis

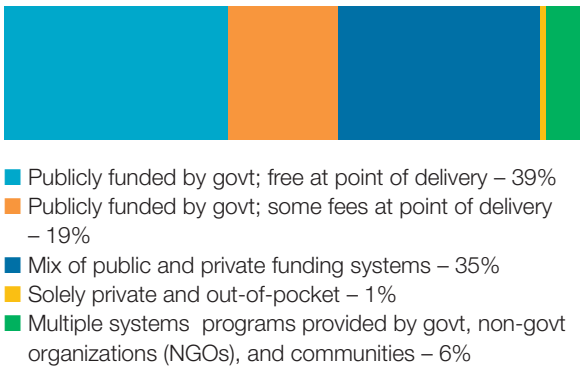
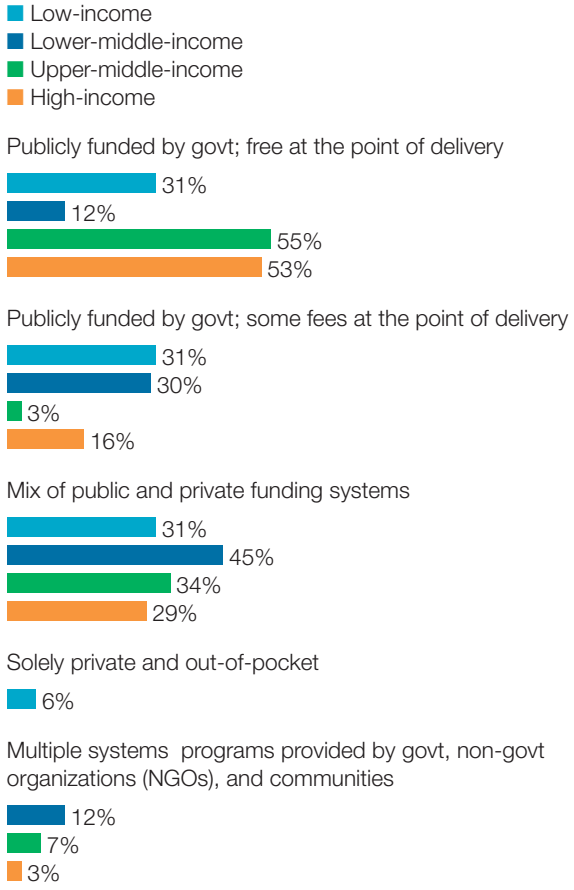


Figure 7.13 | Funding models for acute hemodialysis, by World Bank income group



offered acute PD, followed by 59% of lower-middle-income countries. Nearly three-quarters of upper-middle- (73%) and high-income countries (71%) had acute PD available. All countries (100%) in North America and South Asia, and over half of countries in all other regions, offered acute PD services except for Africa (available in only 36% of countries) and Oceania & South East Asia (46%).

The distribution of funding models across countries combined for acute PD was similar to that for chronic PD, with slightly more funding from government (Figure 7.14; Table 7.6). Nearly half of the countries (49%) funded chronic PD exclusively through the government with no fees. Twenty-seven per cent funded it through a mix of public and private systems. Sixteen per cent funded it through government with some fees at the point of delivery, and 4% (three countries) funded it through multiple systems of government, NGOs, and communities. Additionally, three countries (4%) funded it solely through private and out-of-pocket sources.

Figure 7.14 | Funding models for acute peritoneal dialysis

- Publicly funded by govt; free at point of delivery – 49%
- Publicly funded by govt; some fees at point of delivery – 16%
- Mix of public and private funding systems – 27%
- Solely private and out-of-pocket – 4%
- Multiple systems programs provided by govt, non-govt organizations (NGOs), and communities – 4%

Table 7.5 | Funding models for acute hemodialysis

	Publicly funded by govt; free at the point of delivery N (%)	Publicly funded by govt; some fees at the point of delivery N (%)	Mix of public and private funding systems N (%)	Solely private and out-of-pocket N (%)	Solely private through health insurance providers N (%)	Multiple systems programs provided by govt, non-govt organizations (NGOs), and communities N (%)
Overall	**45 (39)**	**22 (19)**	**41 (35)**	**1 (1)**	**0 (0)**	**7 (6)**
ISN regions						
Africa	10 (31)	9 (28)	9 (28)	1 (3)	0 (0)	3 (9)
Eastern & Central Europe	14 (88)	1 (6)	1 (6)	0 (0)	0 (0)	0 (0)
Latin America	2 (13)	0 (0)	13 (87)	0 (0)	0 (0)	0 (0)
Middle East	6 (46)	1 (8)	4 (31)	0 (0)	0 (0)	2 (15)
NIS & Russia	3 (60)	1 (20)	1 (20)	0 (0)	0 (0)	0 (0)
North America	1 (50)	0 (0)	1 (50)	0 (0)	0 (0)	0 (0)
North & East Asia	0 (0)	4 (67)	1 (17)	0 (0)	0 (0)	1 (17)
Oceania & South East Asia	2 (15)	4 (31)	6 (46)	0 (0)	0 (0)	1 (8)
South Asia	0 (0)	1 (20)	4 (80)	0 (0)	0 (0)	0 (0)
Western Europe	7 (78)	1 (11)	1 (11)	0 (0)	0 (0)	0 (0)
World Bank income groups						
Low-income	5 (31)	5 (31)	5 (31)	1 (6)	0 (0)	0 (0)
Lower-middle-income	4 (12)	10 (30)	15 (45)	0 (0)	0 (0)	4 (12)
Upper-middle-income	16 (55)	1 (3)	10 (34)	0 (0)	0 (0)	2 (7)
High-income	20 (53)	6 (16)	11 (29)	0 (0)	0 (0)	1 (3)

The majority of high-income (52%) and upper-middle-income (62%) countries funded acute PD exclusively through the government with no fees (Figure 7.15; Table 7.6). Lower-middle-income countries funded acute PD through government with or without fees (53%), solely private (5%), a mix of public and private (32%), or multiple systems (11%). All low-income countries that offer acute PD funded it through a mix of public and private (100%).

The majority of countries that offer acute PD funded it through government, except in South Asia, where 80% of countries had a mix of public and private (Table 7.6). Half (50%) of countries in Latin America and North America, and around a third of those in Oceania & South East Asia and Africa also funded it through a mix of public and private sources.

Figure 7.15 | Funding models for acute peritoneal dialysis, by World Bank income group

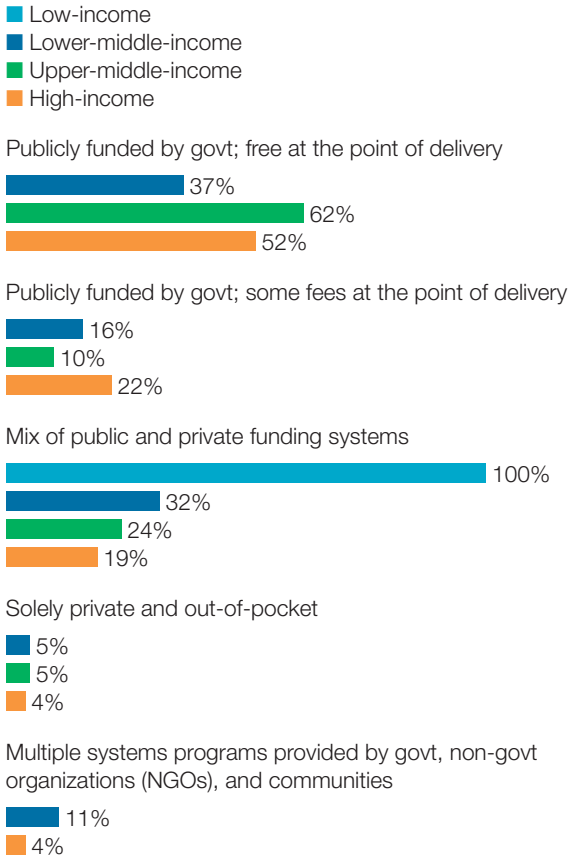


Table 7.6 | Funding models for acute peritoneal dialysis

	Publicly funded by govt; free at the point of delivery N (%)	Publicly funded by govt; some fees at the point of delivery N (%)	Mix of public and private funding systems N (%)	Solely private and out-of-pocket N (%)	Solely private through health insurance providers N (%)	Multiple systems programs provided by govt, non-govt organizations (NGOs), and communities N (%)
Overall	**34 (49)**	**11 (16)**	**19 (27)**	**3 (4)**	**0 (0)**	**3 (4)**
ISN regions						
Africa	3 (27)	2 (18)	4 (36)	1 (9)	0 (0)	1 (9)
Eastern & Central Europe	10 (91)	1 (9)	0 (0)	0 (0)	0 (0)	0 (0)
Latin America	4 (29)	1 (7)	7 (50)	2 (14)	0 (0)	0 (0)
Middle East	5 (71)	1 (14)	0 (0)	0 (0)	0 (0)	1 (14)
NIS & Russia	4 (100)	0 (0)	0 (0)	0 (0)	0 (0)	0 (0)
North America	1 (50)	0 (0)	1 (50)	0 (0)	0 (0)	0 (0)
North & East Asia	0 (0)	4 (100)	0 (0)	0 (0)	0 (0)	0 (0)
Oceania & South East Asia	1 (17)	2 (33)	2 (33)	0 (0)	0 (0)	1 (17)
South Asia	1 (20)	0 (0)	4 (80)	0 (0)	0 (0)	0 (0)
Western Europe	5 (83)	0 (0)	1 (17)	0 (0)	0 (0)	0 (0)
World Bank income groups						
Low-income	0 (0)	0 (0)	3 (100)	0 (0)	0 (0)	0 (0)
Lower-middle-income	7 (37)	3 (16)	6 (32)	1 (5)	0 (0)	2 (11)
Upper-middle-income	13 (62)	2 (10)	5 (24)	1 (5)	0 (0)	0 (0)
High-income	14 (52)	6 (22)	5 (19)	1 (4)	0 (0)	1 (4)

7.3 Access to medications

Many countries (43%) funded medications of CKD patients through mixed models of public and private sources (Figure 7.16; Table 7.7). In total, 37% of countries funded these medications exclusively through government, where half of these 44 countries had no fees at the point of delivery, and half did have some fees at the point of delivery. Eleven per cent of countries funded these medications through multiple sources (government, NGOs, communities). Eight per cent funded these medications solely through private and out-of-pocket sources, and 1% (one country) funded them solely through insurance providers. Similarly, medications of CKD patients were funded through a mix of public and private models in most ISN regions except Eastern & Central Europe, where 69% of countries funded these medications publicly with no fees at the point of delivery.

There was a wide variation in funding models when income level was considered. In low-income countries, an equal proportion of countries funded

Figure 7.16 | Funding models for medications of CKD patients

- Publicly funded by govt; free at point of delivery – 18.5%
- Publicly funded by govt; some fees at point of delivery – 18.5%
- Mix of public and private funding systems – 43%
- Solely private and out-of-pocket – 8%
- Solely private through health insurance providers – 1%
- Multiple systems programs provided by govt, non-govt organizations (NGOs), and communities – 11%

Table 7.7 | Funding models for medications of CKD patients

	Publicly funded by govt; free at the point of delivery N (%)	Publicly funded by govt; some fees at the point of delivery N (%)	Mix of public and private funding systems N (%)	Solely private and out-of-pocket N (%)	Solely private through health insurance providers N (%)	Multiple systems programs provided by govt, non-govt organizations (NGOs), and communities N (%)
Overall	**22 (19)**	**22 (19)**	**51 (43)**	**9 (8)**	**1 (1)**	**13 (11)**
ISN regions						
Africa	1 (3)	8 (25)	12 (38)	6 (19)	0 (0)	5 (16)
Eastern & Central Europe	11 (69)	4 (25)	1 (6)	0 (0)	0 (0)	0 (0)
Latin America	2 (13)	0 (0)	12 (75)	0 (0)	1 (6)	1 (6)
Middle East	3 (23)	2 (15)	5 (38)	1 (8)	0 (0)	2 (15)
NIS & Russia	1 (17)	0 (0)	3 (50)	0 (0)	0 (0)	2 (33)
North America	0 (0)	0 (0)	2 (100)	0 (0)	0 (0)	0 (0)
North & East Asia	1 (17)	2 (33)	2 (33)	0 (0)	0 (0)	1 (17)
Oceania & South East Asia	1 (8)	2 (15)	8 (62)	2 (15)	0 (0)	0 (0)
South Asia	0 (0)	0 (0)	4 (80)	0 (0)	0 (0)	1 (20)
Western Europe	2 (22)	4 (44)	2 (22)	0 (0)	0 (0)	1 (11)
World Bank income groups						
Low-income	0 (0)	4 (24)	5 (29)	5 (29)	0 (0)	3 (18)
Lower-middle-income	0 (0)	6 (18)	16 (48)	4 (12)	1 (3)	6 (18)
Upper-middle-income	10 (33)	2 (7)	16 (53)	0 (0)	0 (0)	2 (7)
High-income	12 (32)	10 (26)	14 (37)	0 (0)	0 (0)	2 (5)

medications of CKD patients solely through private and out-of-pocket sources (29%) or a mix of public and private (29%), followed closely by government with some fees at the point of delivery (24%) (Figure 7.17; Table 7.7). Eighteen per cent of low-income countries funded medications through multiple systems (18%), and no low-income countries funded medications exclusively by government with no fees at the point of delivery. Many lower-middle- (48%), upper-middle- (53%) and high-income countries (37%) funded medications of CKD patients through a mix of public and private sources. A large proportion of higher-income countries also funded medications exclusively through government, with no fees at the point of delivery (33% for upper-middle- and 32% for high-income countries). No upper-middle- or high-income countries funded medications solely through private resources (out-of-pocket or insurance).

As in the case of CKD patients, many countries (39%) funded medications of dialysis patients through mixed models of public and private sources (Figure 7.18; Table 7.8). In total, 47% of countries funded these medications exclusively through government, almost evenly split between having no fees or some fees at the point of delivery. Seven per cent of countries funded these medications through multiple sources (government, NGOs, communities), 7% funded them solely through private and out-of-pocket sources, and 1% (one country) funded them solely through insurance providers.

When income level was considered, the funding model for dialysis patients (Figure 7.19; Table 7.8) was similar to the model for CKD patients. Low-income countries funded medications of dialysis patients through either public funds (with some fees to patients), a mix of public and private sources, or solely private and out-of-pocket sources. The majority of lower-middle-income countries funded medications of dialysis patients through a mix of public and private sources.

Table 7.8 | Funding models for medications of dialysis patients

	Publicly funded by govt; free at the point of delivery N (%)	Publicly funded by govt; some fees at the point of delivery N (%)	Mix of public and private funding systems N (%)	Solely private and out-of-pocket N (%)	Solely private through health insurance providers N (%)	Multiple systems programs provided by govt, non-govt organizations (NGOs), and communities N (%)
Overall	**26 (22)**	**29 (25)**	**46 (39)**	**8 (7)**	**1 (1)**	**8 (7)**
ISN regions						
Africa	2 (6)	9 (28)	11 (34)	6 (19)	0 (0)	4 (13)
Eastern & Central Europe	12 (75)	4 (25)	0 (0)	0 (0)	0 (0)	0 (0)
Latin America	3 (19)	0 (0)	12 (75)	0 (0)	1 (6)	0 (0)
Middle East	5 (38)	4 (31)	2 (15)	0 (0)	0 (0)	2 (15)
NIS & Russia	1 (17)	0 (0)	4 (67)	0 (0)	0 (0)	1 (17)
North America	0 (0)	0 (0)	2 (100)	0 (0)	0 (0)	0 (0)
North & East Asia	0 (0)	3 (50)	2 (33)	0 (0)	0 (0)	1 (17)
Oceania & South East Asia	0 (0)	4 (31)	8 (62)	1 (8)	0 (0)	0 (0)
South Asia	0 (0)	0 (0)	4 (80)	1 (20)	0 (0)	0 (0)
Western Europe	3 (33)	5 (56)	1 (11)	0 (0)	0 (0)	0 (0)
World Bank income groups						
Low-income	0 (0)	5 (29)	6 (35)	5 (29)	0 (0)	1 (6)
Lower-middle-income	0 (0)	6 (18)	19 (58)	3 (9)	1 (3)	4 (12)
Upper-middle-income	13 (43)	4 (13)	11 (37)	0 (0)	0 (0)	2 (7)
High-income	13 (34)	14 (37)	10 (26)	0 (0)	0 (0)	1 (3)

The upper-middle-income group was split between public (no fees to patients) and a mix of public and private, and high-income countries funded medications either through government or a mix of public and private sources (Figure 7.19). Very few countries used a multiple model system (government, NGOs, communities). Only lower-middle- and low-income countries used an exclusively private funding model.

Funding models for medications of dialysis patients varied across ISN regions (Table 7.8).

More countries utilized a solely private funding model for medications of transplant patients (Figure 7.20; Table 7.9) than for those of CKD or dialysis patients. Fifteen per cent of countries used a solely private and out-of-pocket model, and 30% used a mix of public and private models. Twenty-nine per cent of countries funded medications of transplant patients exclusively through government with no fees at

Figure 7.18 | Funding models for medications of dialysis patients

- Publicly funded by govt; free at point of delivery – 22%
- Publicly funded by govt; some fees at point of delivery – 25%
- Mix of public and private funding systems – 38%
- Solely private and out-of-pocket – 7%
- Solely private through health insurance providers – 1%
- Multiple systems programs provided by govt, non-govt organizations (NGOs), and communities – 7%

Figure 7.17 | Funding models for medications of CKD patients, by World Bank income group

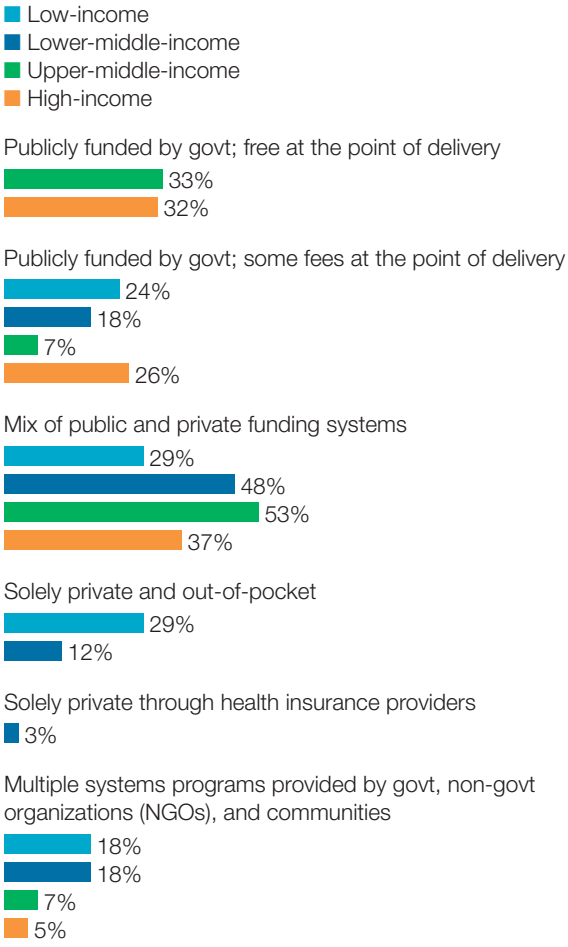
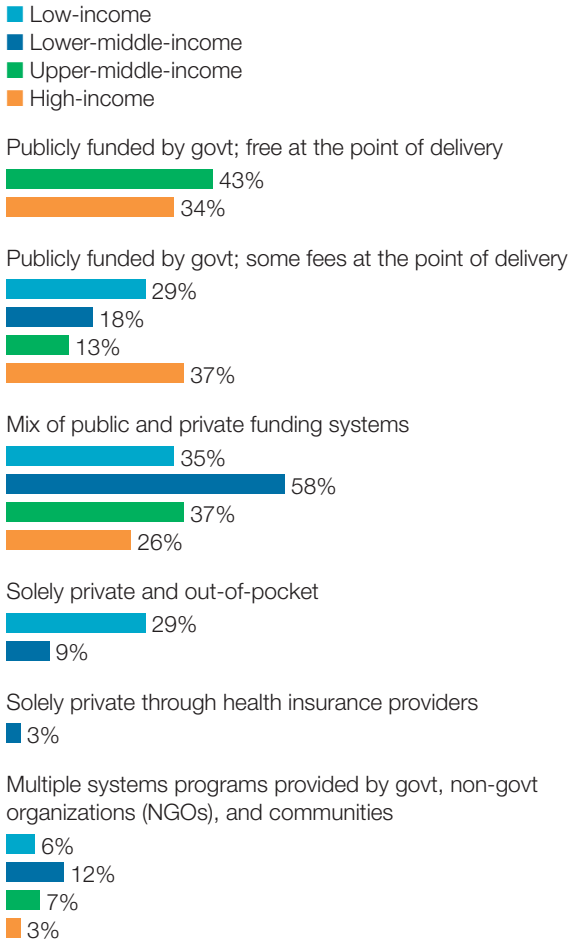


Figure 7.19 | Funding models for medications of dialysis patients, by World Bank income group



the point of delivery, and 19% funded them through government, with some fees at the point of delivery. Six per cent used multiple sources (government, NGOs, and communities).

Most high-income countries funded medications of transplant patients through government, with or without fees (37% each) (Figure 7.21; Table 7.9). Most upper-middle-income countries funded these medications through government with no fees (50%), or through a mix of public and private (33%). Most lower-middle-income countries funded these medications through a mix (39%) or solely private and out-of-pocket (24%). In the majority (53%) of low-income countries these medications of transplant patients were funded through private sources.

Similarly, the funding models for medications of kidney transplant patients varied across ISN regions but mainly were through government or a mix of public and private sources (Table 7.9). Some countries in Africa (44%), Oceania & South East Asia (23%), South Asia (20%), and Latin America (6%) funded these medications exclusively through private sources.

Figure 7.20 | Funding models for medications of kidney transplant patients

- Publicly funded by govt; free at point of delivery – 29%
- Publicly funded by govt; some fees at point of delivery – 19%
- Mix of public and private funding systems – 30%
- Solely private and out-of-pocket – 15%
- Solely private through health insurance providers – 1%
- Multiple systems programs provided by govt, non-govt organizations (NGOs), and communities – 6%

Figure 7.21 | Funding models for medications of kidney transplant patients, World Bank income group

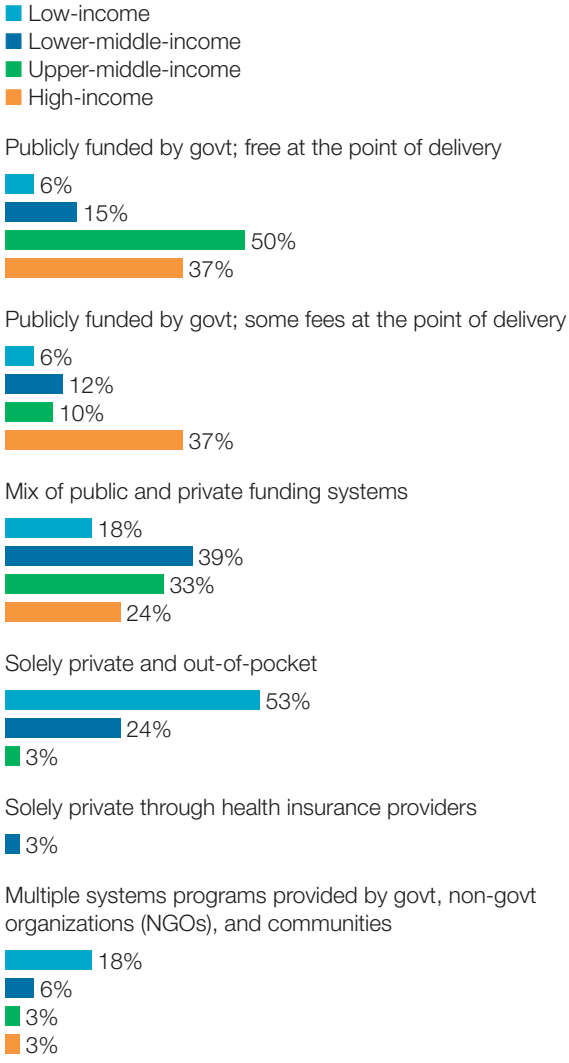


Table 7.9 | Funding models for medications of kidney transplant patients

	Publicly funded by govt; free at the point of delivery N (%)	Publicly funded by govt; some fees at the point of delivery N (%)	Mix of public and private funding systems N (%)	Solely private and out-of-pocket N (%)	Solely private through health insurance providers N (%)	Multiple systems programs provided by govt, non-govt organizations (NGOs), and communities N (%)
Overall	**35 (30)**	**22 (19)**	**35 (30)**	**18 (15)**	**1 (1)**	**7 (6)**
ISN regions						
Africa	5 (16)	3 (9)	6 (19)	14 (44)	0 (0)	4 (13)
Eastern & Central Europe	13 (81)	3 (19)	0 (0)	0 (0)	0 (0)	0 (0)
Latin America	4 (25)	0 (0)	11 (69)	0 (0)	1 (6)	0 (0)
Middle East	7 (54)	3 (23)	0 (0)	0 (0)	0 (0)	3 (23)
NIS & Russia	4 (67)	1 (17)	1 (17)	0 (0)	0 (0)	0 (0)
North America	0 (0)	0 (0)	2 (100)	0 (0)	0 (0)	0 (0)
North & East Asia	0 (0)	3 (50)	3 (50)	0 (0)	0 (0)	0 (0)
Oceania & South East Asia	1 (8)	2 (15)	7 (54)	3 (23)	0 (0)	0 (0)
South Asia	0 (0)	0 (0)	4 (80)	1 (20)	0 (0)	0 (0)
Western Europe	1 (11)	7 (78)	1 (11)	0 (0)	0 (0)	0 (0)
World Bank income groups						
Low-income	1 (6)	1 (6)	3 (18)	9 (53)	0 (0)	3 (18)
Lower-middle-income	5 (15)	4 (12)	13 (39)	8 (24)	1 (3)	2 (6)
Upper-middle-income	15 (50)	3 (10)	10 (33)	1 (3)	0 (0)	1 (3)
High-income	14 (37)	14 (37)	9 (24)	0 (0)	0 (0)	1 (3)

SECTION 8

HEALTH INFORMATION SYSTEMS AND STATISTICS

8.1 Availability of renal registries

Dialysis and transplant registries were more common than AKI or non-dialysis CKD registries, across all regions (Figure 8.1; Table 8.1). The majority of countries had a registry for dialysis (64%) and for transplantation (58%) (Table 8.1). All countries within North & East Asia and North America had a kidney transplantation registry, followed by ~90% of countries within Western Europe and Eastern & Central Europe (Figure 8.1). Less than half of the countries in South Asia and 20% of countries in Africa had a kidney transplant registry. All countries in North America had a dialysis registry, followed by Eastern & Central Europe, Western Europe, and North & East Asia. Less than half of the countries in South Asia (40%) and Africa (35%) had a registry for dialysis. Availability of AKI and non-dialysis CKD registries was under 30% in all regions and zero in several regions. North America, North & East Asia, and Oceania & South East Asia had no countries with either an AKI or CKD registry. Western Europe and Latin America had registries in a small number of countries for CKD, but not for AKI. South Asia had some countries with a registry for AKI, but none with a CKD registry.

A large majority of high-income countries had a dialysis or transplant registry (89% each) (Figure 8.2; Table 8.1). Similarly, a high proportion of upper-middle-income countries had a dialysis (72%) or transplant registry (66%). Few low-income countries had a dialysis registry (24%), and no low-income countries had a transplant registry. Few countries had a non-dialysis CKD registry (8%) or an AKI registry (7%).

Nine countries had a registry for non-dialysis CKD patients: Albania, Bolivia, Guinea, Montenegro, Norway, Ukraine, United Kingdom, Uruguay, and West Bank (Table 8.2). Of these registries, the majority covered CKD stages 1–5 and one-third covered stages 4–5 only. Overall, availability of registries of dialysis and transplant patients increased with income, but this relationship was not shown for AKI or non-dialysis CKD registries (Figure 8.2).

Figure 8.1 | Availability of renal registries

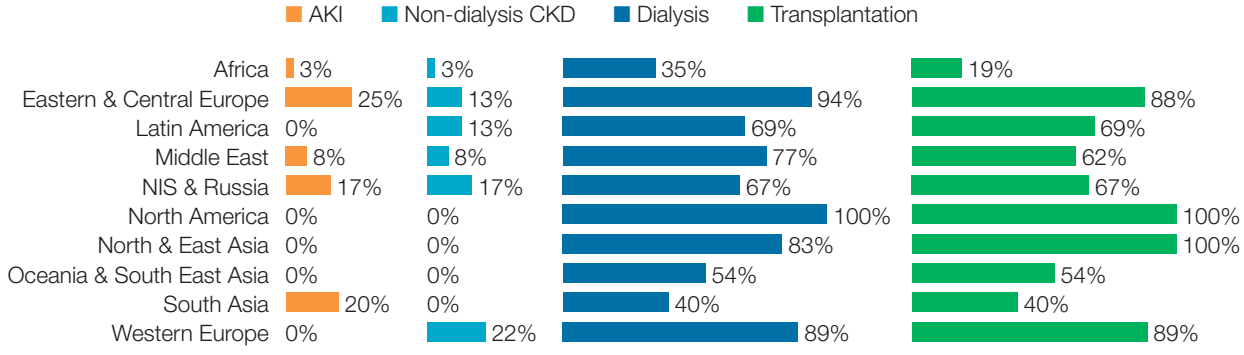
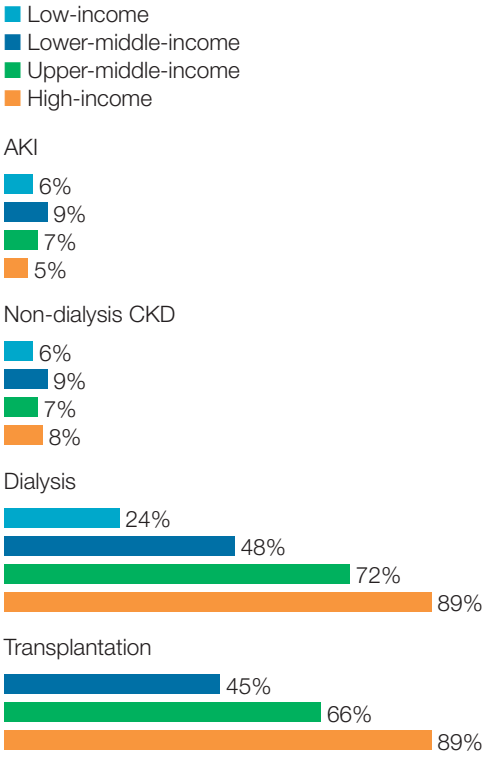


Figure 8.2 | Availability of renal registries, by World Bank income group



Of the nine countries with a non-dialysis CKD registry, seven were at a national level and two were at a regional level. The one low-income country (Guinea) that had a non-dialysis CKD registry applied it at a national level and did not report any regional registries. Similarly, all three of the lower-middle-income countries had national registries, but not regional registries. One of the two upper-middle-income countries had a registry available at a national level, but not at a regional level. All three of the high-income countries had a national registry, and two of the three had a regional registry. Provider participation in the non-dialysis CKD registry was mandatory in five countries and voluntary in two (Table 8.3).

Mandatory provider participation was more common for dialysis and transplant registries than for AKI registries (Table 8.3). Over half of the 75 countries that had a dialysis registry required participation from providers, and 57% of the 68 countries with a transplant registry made participation mandatory. Less than half (three of eight) countries with an AKI registry made participation mandatory (Table 8.3).

Table 8.1 | Availability of of renal registries

	AKI N (%)	Non-dialysis CKD N (%)	Dialysis N (%)	Transplantation N (%)
Overall	**8 (7)**	**9 (8)**	**75 (64)**	**68 (58)**
ISN regions				
Africa	1 (3)	1 (3)	11 (35)	6 (19)
Eastern & Central Europe	4 (25)	2 (13)	15 (94)	14 (88)
Latin America	0 (0)	2 (13)	11 (69)	11 (69)
Middle East	1 (8)	1 (8)	10 (77)	8 (62)
NIS & Russia	1 (17)	1 (17)	4 (67)	4 (67)
North America	0 (0)	0 (0)	2 (100)	2 (100)
North & East Asia	0 (0)	0 (0)	5 (83)	6 (100)
Oceania & South East Asia	0 (0)	0 (0)	7 (54)	7 (54)
South Asia	1 (20)	0 (0)	2 (40)	2 (40)
Western Europe	0 (0)	2 (22)	8 (89)	8 (89)
World Bank income groups				
Low-income	1 (6)	1 (6)	4 (24)	0 (0)
Lower-middle-income	3 (9)	3 (9)	16 (48)	15 (45)
Upper-middle-income	2 (7)	2 (7)	21 (72)	19 (66)
High-income	2 (5)	3 (8	34 (89)	34 (89)

Table 8.2 | Coverage of registries for non-dialysis CKD

Countries having a registry with specific scope

	CKD stages 1–5 N (%)	CKD stages 4–5 N (%)	Whole country N (%)	Specific regions N (%)
Overall	**5 (56)**	**3 (33)**	**8 (89)**	**2 (22)**
ISN regions				
Africa	0 (0)	1 (100)	1 (100)	0 (0)
Eastern & Central Europe	2 (100)	0 (0)	1 (50)	0 (0)
Latin America	1 (50)	1 (50)	2 (100)	1 (50)
Middle East	1 (100)	0 (0)	1 (100)	0 (0)
NIS & Russia	1 (100)	0 (0)	1 (100)	0 (0)
North America	0 (0)	0 (0)	0 (0)	0 (0)
North & East Asia	0 (0)	0 (0)	0 (0)	0 (0)
Oceania & South East Asia	0 (0)	0 (0)	0 (0)	0 (0)
South Asia	0 (0)	0 (0)	0 (0)	0 (0)
Western Europe	0 (0)	1 (50)	2 (100)	1 (50)
World Bank income groups				
Low-income	0 (0)	1 (100)	1 (100)	0 (0)
Lower-middle-income	2 (67)	1 (33)	3 (100)	0 (0)
Upper-middle-income	2 (100)	0 (0)	1 (50)	0 (0)
High-income	1 (33)	1 (33)	3 (100)	2 (67)

Table 8.3 | Provider participation in renal registries

	AKI registry		Non-dialysis CKD registry		Dialysis registry		Transplantation registry	
	Mandatory N (%)	Voluntary N (%)	Mandatory N (%)	Voluntary N (%)	Mandatory N (%)	Voluntary N (%)	Mandatory N (%)	Voluntary N (%)
Overall	**3 (38)**	**4 (50)**	**5 (63)**	**2 (25)**	**40 (54)**	**28 (38)**	**39 (57)**	**24 (35)**
ISN regions								
Africa	0 (0)	0 (0)	0 (0)	0 (0)	4 (40)	4 (40)	4 (67)	2 (33)
Eastern & Central Europe	1 (25)	3 (75)	1 (100)	0 (0)	6 (40)	9 (60)	9 (64)	4 (29)
Latin America	0 (0)	0 (0)	1 (50)	1 (50)	7 (64)	3 (27)	8 (73)	3 (27)
Middle East	1 (100)	0 (0)	1 (100)	0 (0)	7 (70)	2 (20)	4 (50)	3 (38)
NIS & Russia	1 (100)	0 (0)	0 (0)	1 (100)	2 (50)	1 (25)	1 (25)	2 (50)
North America	0 (0)	0 (0)	0 (0)	0 (0)	1 (50)	1 (50)	1 (50)	1 (50)
North & East Asia	0 (0)	0 (0)	0 (0)	0 (0)	3 (60)	1 (20)	2 (33)	3 (50)
Oceania & South East Asia	0 (0)	0 (0)	0 (0)	0 (0)	4 (57)	3 (43)	4 (57)	2 (29)
South Asia	0 (0)	1 (100)	0 (0)	0 (0)	0 (0)	2 (100)	0 (0)	2 (100)
Western Europe	0 (0)	0 (0)	2 (100)	0 (0)	6 (75)	2 (25)	6 (75)	2 (25)
World Bank income groups								
Low-income	0 (0)	0 (0)	0 (0)	0 (0)	2 (50)	1 (25)	0 (0)	0 (0)
Lower-middle-income	2 (67)	1 (33)	2 (67)	1 (33)	8 (50)	6 (38)	6 (40)	6 (40)
Upper-middle-income	1 (50)	1 (50)	1 (100)	0 (0)	10 (50)	8 (40)	10 (53)	7 (37)
High-income	0 (0)	2 (100)	2 (67)	1 (33)	20 (59)	13 (38)	23 (68)	11 (32)

Percentages may not total 100% because responses of "I do not know/information not available" are not included.

8.2 Burden of CKD

Nearly two-thirds of countries (62%) reported that data were available on the prevalence of CKD in their country. Seventy per cent of lower-middle-, 69% of upper-middle-, and 68% of high-income countries reported that CKD prevalence data were available. Less than 20% of low-income countries reported that the data were available (Figure 8.3).

At least half of the countries in all ISN regions except Africa had CKD prevalence data available (Figure 8.4).

Figure 8.3 | Availability of data on CKD prevalence, by World Bank income group

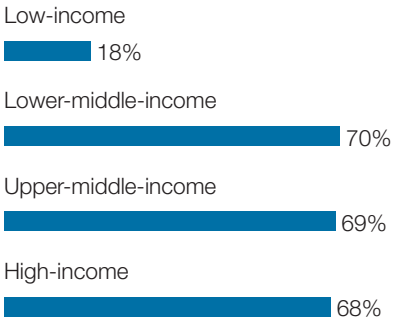
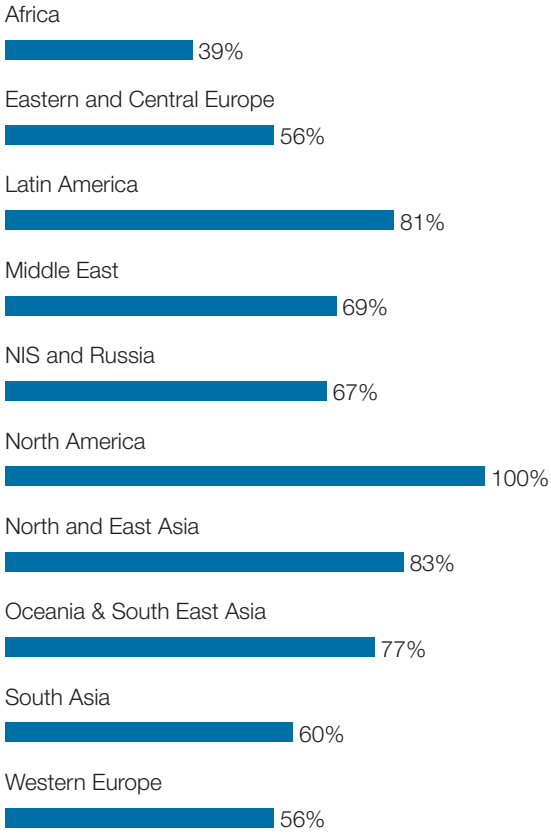


Figure 8.4 | Availability of data on CKD prevalence, by ISN region



8.3 Screening and early detection for CKD

Most countries performed routine tests for CKD identification across the majority of high-risk groups (Figure 8.5). All countries (n=117) offered CKD testing in people with diabetes, and almost all (97%) of countries offered testing of those with hypertension. Approximately 80% of countries offered CKD testing of people with CVD, autoimmune/multisystem disorders, or urological disorders. Patients who had a family history of CKD, were 65 years or older, or were chronic users of nephrotoxic medications were offered CKD testing in 68%, 62%, and 60% of countries, respectively. Members of high-risk ethnic groups were offered testing for CKD in only 17% of countries.

Across country income levels, CKD testing in individuals with hypertension and diabetes was nearly 100%, and most countries tested in patients with CVD (Figure 8.6). Fewer countries in the low-income group tested in patients that had an autoimmune or multisystem disorder, were

Figure 8.5 | Adoption of practices to identify CKD in high-risk groups

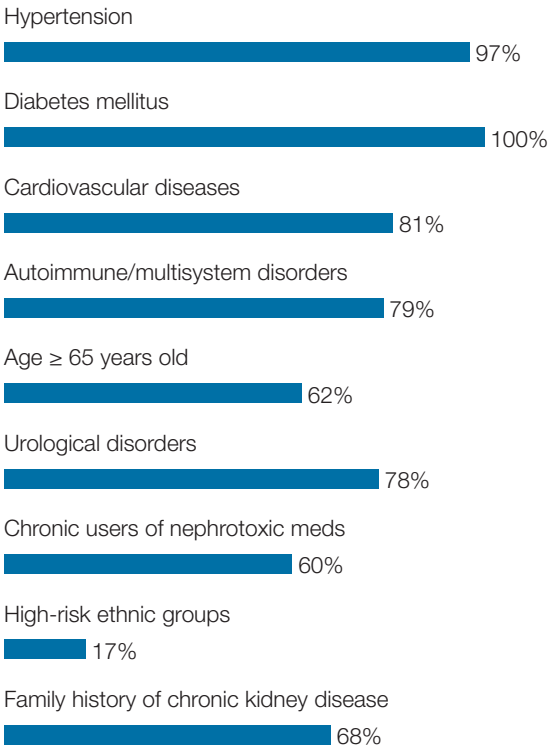
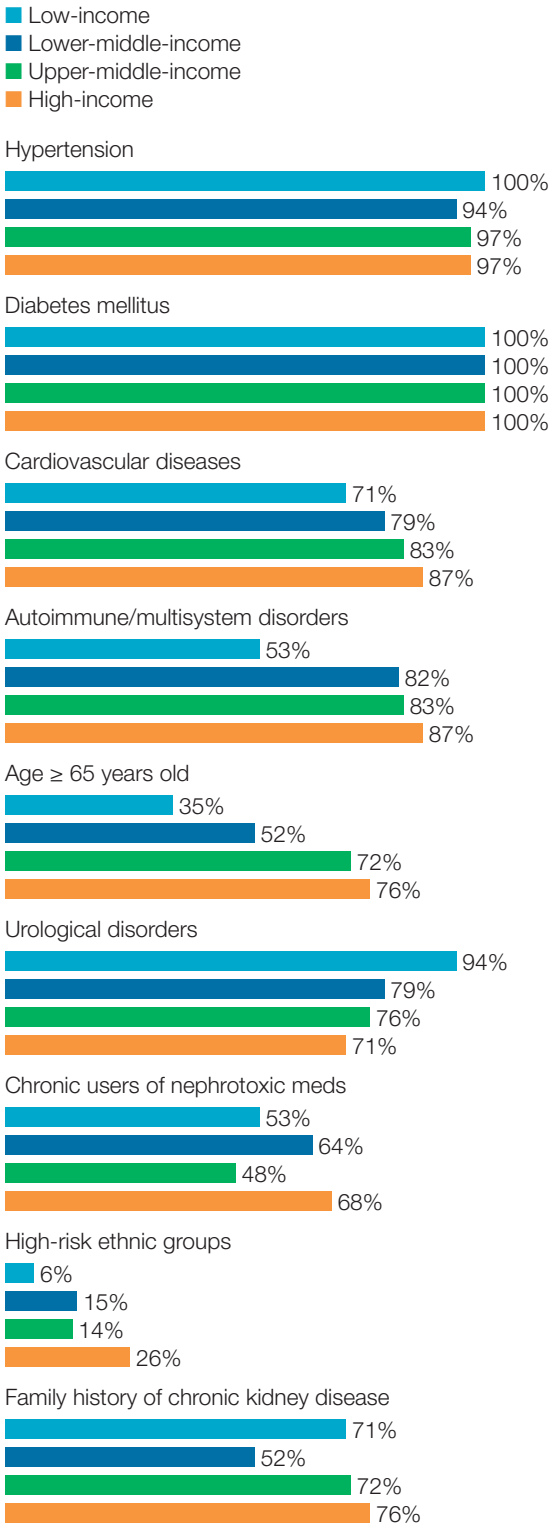


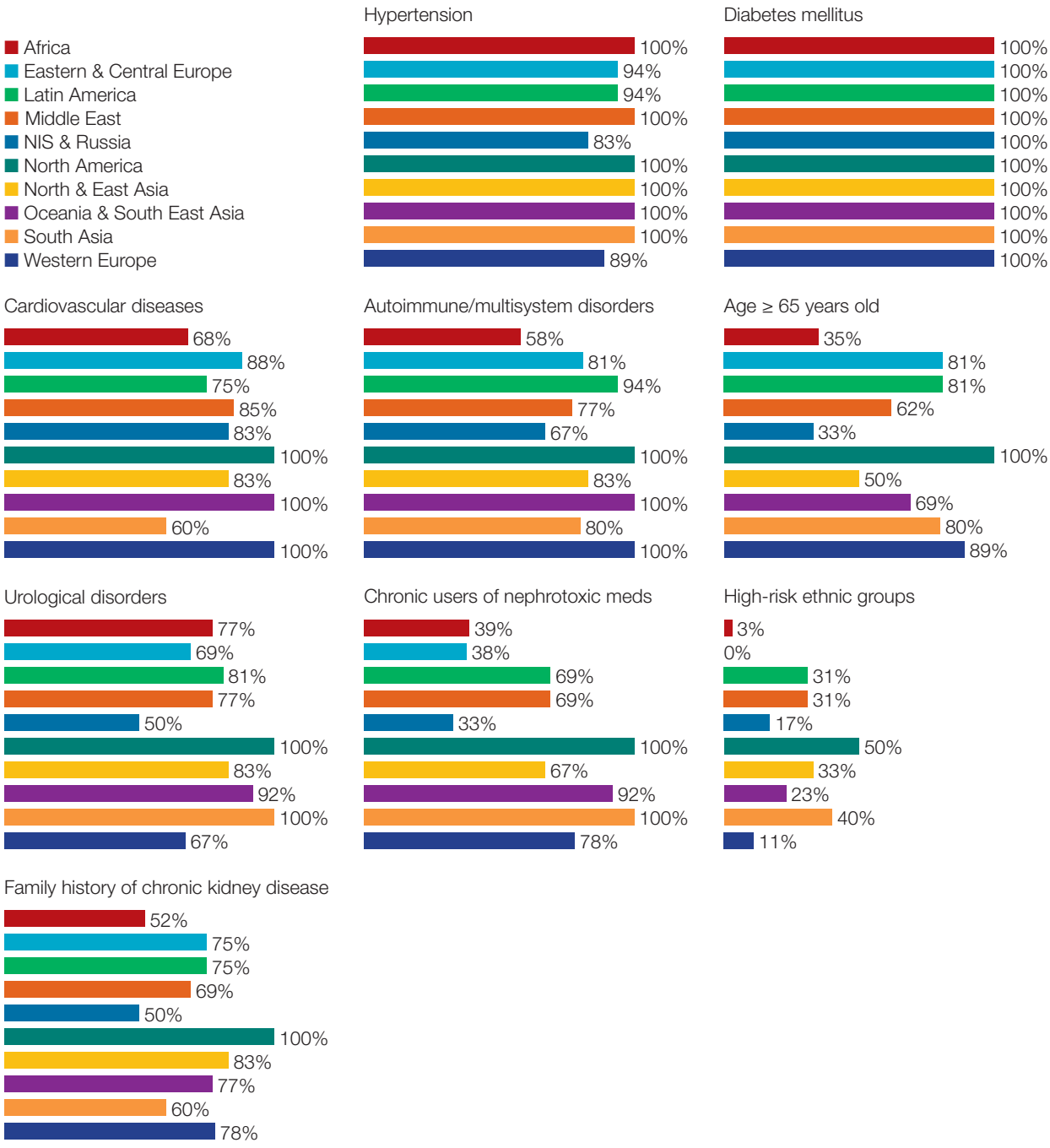
Figure 8.6 | Adoption of practices to identify CKD in high-risk groups, by World Bank income group



65 years or older, or belonged to high-risk ethnic groups. Generally, higher-income countries had higher rates of testing in risk groups; however, testing of patients with urological disorders was highest in low-income countries.

Across all ISN regions, CKD testing in people with hypertension, diabetes, CVD, and family history of CKD was high (Figure 8.7). CKD testing in other high-risk groups, particularly people 65 years or older, people with urological disorders, chronic

Figure 8.7 | Adoption of practices to identify CKD in high-risk groups, by ISN region



users of nephrotoxic medications, or people with a family history of CKD, varied across ISN regions. Testing in high-risk ethnic groups was low, irrespective of ISN region; it was highest in North America (half of countries) and South Asia (40%).

Overall, testing for CKD in high-risk ethnic groups was low, offered by only 20 countries (Figure 8.8). Testing was highest in high-income countries: more than a quarter of high-income countries offered testing for high-risk ethnic groups, compared to ~15% in lower-middle- and upper-middle-income groups. Only one low-income country had CKD testing available for high-risk ethnic groups.

The lower availability of CKD testing in high-risk ethnic groups may be due to a lower recognition of ethnic groups considered to be at increased risk for CKD. Ethnic groups at a higher risk for CKD than the general population were reported to be present in 27% of countries. Similarly, the lowest proportion of countries was in the low-income group, followed by lower-middle- (21%), upper-middle- (31%) and high-income groups (34%) (Figure 8.9).

Less than a quarter (24%) of countries reported a current CKD detection program based on national policy and/or guidelines. Nearly one-third of high-income countries had a program, followed by almost a quarter of upper-middle and lower-middle-income countries. Only one low-income country had a program (Figure 8.10). North & East Asia was unique among the 10 ISN regions in having a current CKD program in half of its countries (Figure 8.11). Only two countries in Africa had a program, and no countries in North America had a program. Nearly half (44%) of the countries in Latin America had a detection program.

Of the 28 countries that offered a detection program, the majority (68%) implemented their programs through active screening (routine health encounters); 57%, through active screening (specific screening processes); and 54%, through reactive approaches (Figure 8.12).

The one low-income country that had a detection program implemented it exclusively through active screening (both routine and specific processes) (Figure 8.13). Four of the eight lower-middle-income countries deployed their detection program through active routine

Figure 8.8 | Adoption of practices to identify CKD in ethnic groups at a higher risk of CKD than the general population, by World Bank income group

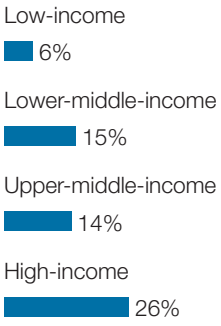


Figure 8.9 | Proportion of countries that report an ethnic group at a higher risk for CKD than the general population

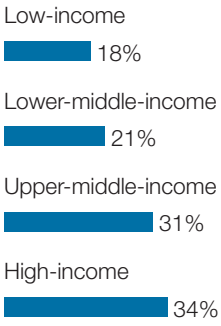
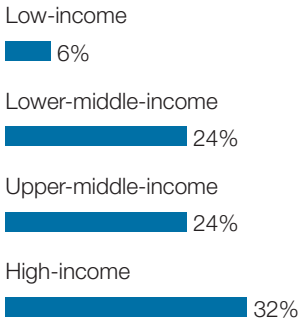


Figure 8.10 | Existence of current CKD detection programs, by World Bank income group



screening, four through active specific screening, and two through reactive approaches. Four upper-middle-income countries utilized reactive approaches, five used active routine screening, and four used active specific screening. Of the 12 high-income countries that had a detection program, nine reported a reactive approach, nine reported active screening through routine encounters, and seven reported active screening through specific screening processes.

An active screening approach for CKD was dominant in most ISN regions except Latin America and North & East Asia, which reported mainly a reactive approach (Figure 8.14). Both countries in Western Europe reported a reactive program as well as an active program.

Figure 8.11 | Existence of current CKD detection programs, by ISN region

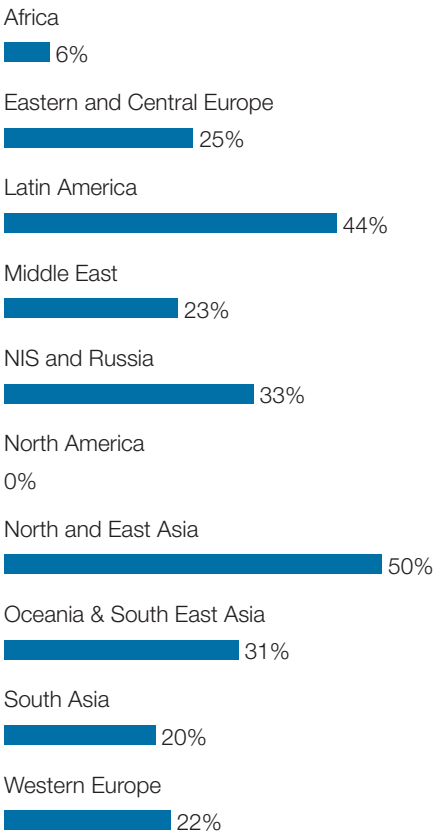


Figure 8.12 | Methods of implementing CKD detection programs

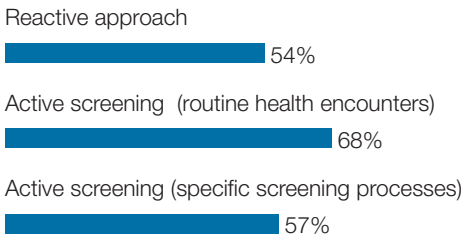


Figure 8.13 | Identification strategies for CKD, by World Bank income group

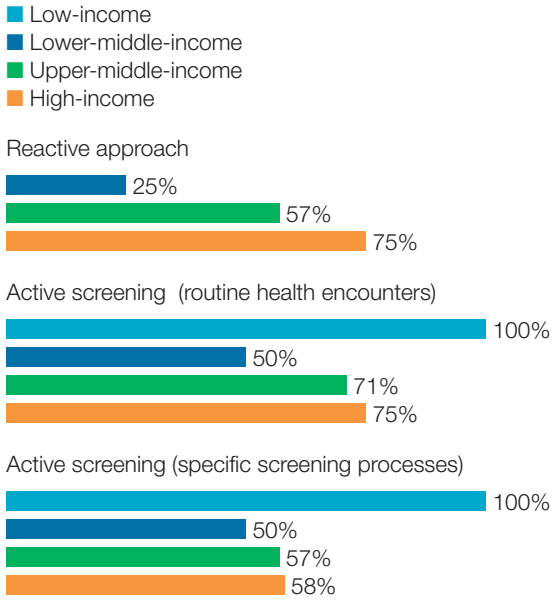
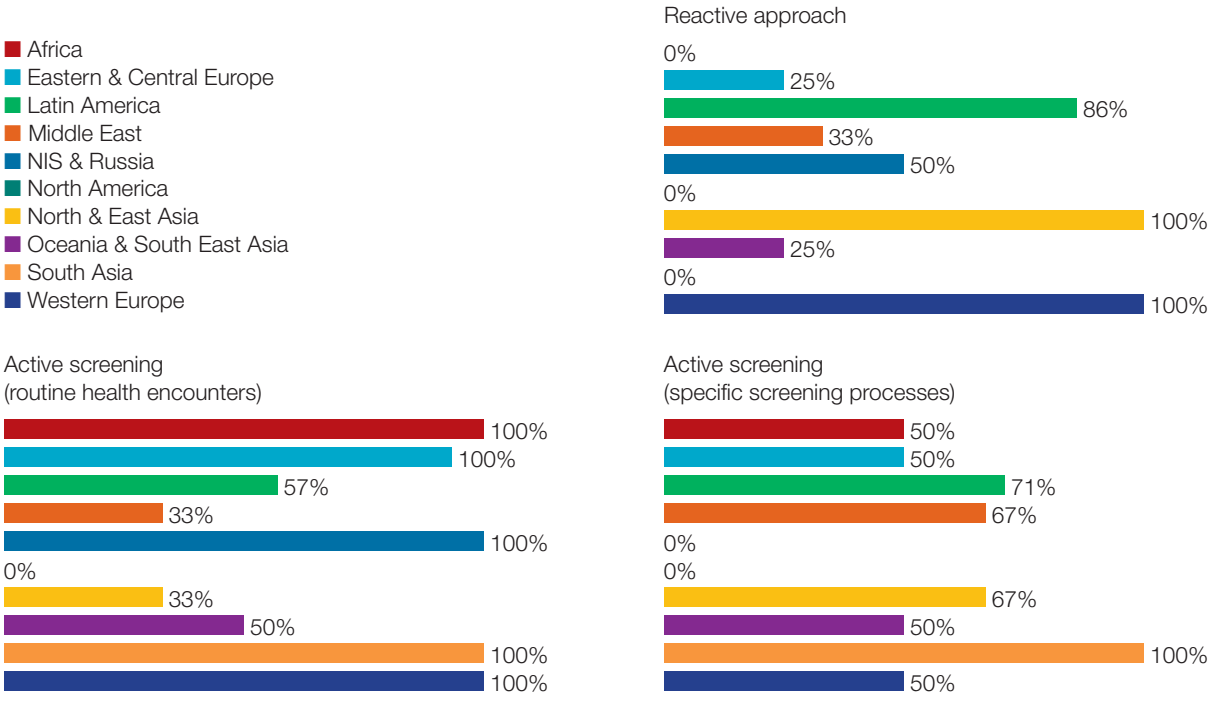


Figure 8.14 | Identification strategies for CKD, by ISN region



8.4 Burden of AKI

Overall, 41% of countries were able to determine the prevalence of AKI requiring dialysis. Even fewer (19%) were able to determine the prevalence of AKI not requiring dialysis (Figure 8.15).

In nine of the ISN regions, less than 30% of the countries were able to determine the prevalence of AKI not requiring dialysis, whereas both countries in North America were able to. More countries (41%) were able to determine the prevalence of AKI requiring dialysis, particularly in North America (both countries), Eastern & Central Europe (10 countries), and Western Europe (five countries).

Similarly, 20% of countries could determine the incidence of AKI not requiring dialysis (Figure 8.16). More than half (57%) could not, and 23% did not know. Likewise, more countries could determine the incidence of AKI requiring dialysis (44%).

Few countries across all ISN regions were able to determine the incidence of AKI not requiring dialysis. More regions were able to determine the incidence of AKI requiring dialysis; however, the proportion of countries able to determine the incidence of AKI requiring dialysis was less than half in Africa (45% of countries), Latin America (31%), the Middle East (23%), Oceania & South East Asia (46%), and South Asia (0%).

Figure 8.15 | Ability to determine prevalence of AKI

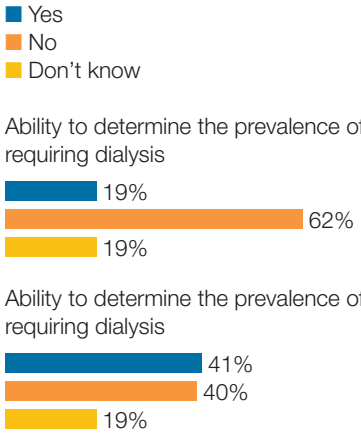
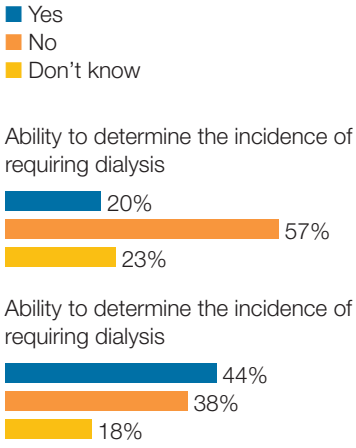


Figure 8.16 | Ability to determine incidence of AKI



8.5 Identification of AKI

Over half (57%) of countries identified specific groups with an increased risk of AKI.

The reporting of specific groups at high risk for AKI appeared to be broadly similar across the World Bank income groups, though a slightly higher proportion of high-income countries reported specific at-risk groups (Figure 8.17).

No countries in NIS & Russia reported specific groups, whereas both countries in North America, and the majority of countries in Latin America (81%), Western Europe (78%), and the Middle East (69%) reported at-risk groups for AKI (Figure 8.18).

Figure 8.17 | National presence of at-risk groups for AKI, by World Bank income group

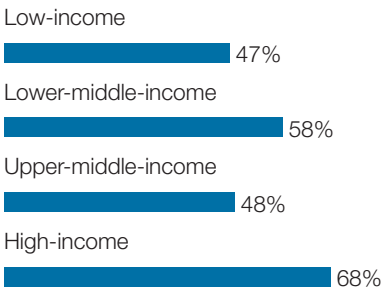
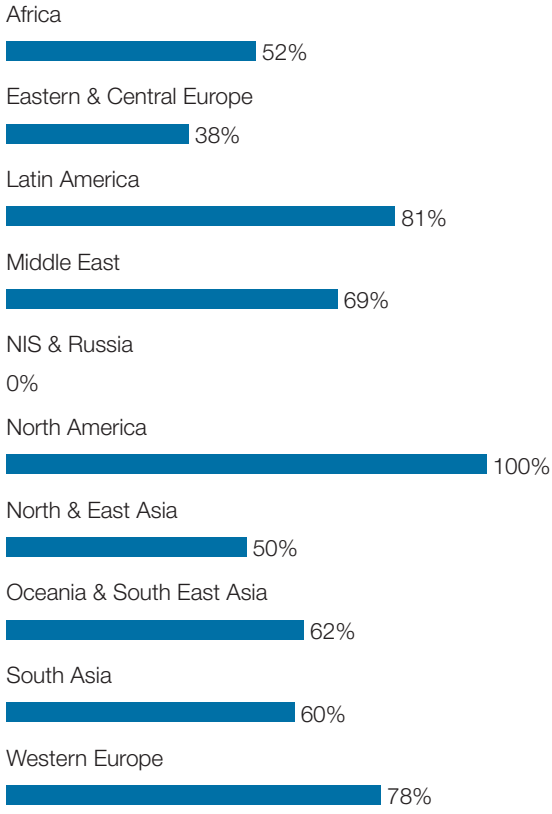


Figure 8.18 | National presence of at-risk groups for AKI, by ISN region



SECTION 9

LEADERSHIP AND GOVERNANCE

9.1 Advocacy for kidney care

9.1.1 CKD advocacy

In only 36% of countries, the government recognized CKD as a health priority. More than half of low-income countries (59%) recognized CKD as a health priority, followed by 50% of lower-middle-, 17% of upper-middle-, and 29% of high-income countries. Chronic kidney disease was recognized as a health priority by the governments of less than half of the countries in every ISN region except South Asia (60% of countries did recognize it) and NIS & Russia (50%).

Similarly, 42% of countries reported an advocacy group at higher levels of government or an NGO to raise the profile of CKD and its prevention (Table 9.1). Advocacy groups existed in half of low- (53%) and lower-middle-income countries (50%), and 34% and 37% of upper-middle- and high-income countries, respectively. Advocacy groups were reported in at least half the countries in North America, Oceania & South East Asia, Africa, and NIS & Russia (Table 9.1). No countries (0%) in North & East Asia reported an advocacy group for CKD.

Table 9.1 | Advocacy and support for CKD treatment and prevention
Countries with specified forms of advocacy and support

	Governmental recognition of CKD as a health priority N (%)	Presence of advocacy group for CKD or organization at higher level of government N (%)	National/regional physician-oriented organizations or patient organizations that provide resources for CKD management N (%)
Overall	**42 (36)**	**49 (42)**	**62 (53)**
ISN regions			
Africa	14 (47)	16 (53)	16 (53)
Eastern & Central Europe	2 (13)	3 (19)	9 (56)
Latin America	5 (31)	7 (44)	7 (44)
Middle East	6 (46)	6 (46)	8 (62)
NIS & Russia	3 (50)	3 (50)	3 (50)
North America	0 (0)	2 (100)	2 (100)
North & East Asia	2 (33)	0 (0)	1 (17)
Oceania & South East Asia	4 (31)	8 (62)	9 (69)
South Asia	3 (60)	1 (20)	2 (40)
Western Europe	3 (33)	3 (33)	5 (56)
World Bank income groups			
Low-income	10 (59)	9 (53)	5 (29)
Lower-middle-income	16 (50)	16 (50)	19 (59)
Upper-middle-income	5 (17)	10 (34)	13 (45)
High-income	11 (29)	14 (37)	25 (66)

More than half (53%) of countries had national or regional physician- (or patient-) oriented organizations that provided resources for CKD management. Such organizations provided resources in 66% of high-income countries but did so in less than half of upper-middle- and low-income countries. Organizations for CKD management were found in at least 40% of the countries of each ISN region other than North & East Asia, where only 17% of countries had organizations.

9.1.2 AKI advocacy

Fewer countries had advocacy groups within government for AKI (19%) than for CKD (42%). Advocacy for AKI was more common in lower-income groups: 25% of low- and 32% of lower-middle-income countries reported government advocacy groups for AKI, compared to 18% in upper-middle- and 5% in high-income countries (Table 9.2). Advocacy groups for AKI were found in no more than a third of the countries in any ISN region and were particularly rare in Eastern & Central Europe, the Middle East, North America, North & East Asia, and Western Europe.

Similarly, fewer countries reported a national or regional physician- (or patient-) oriented organization that provided resources for AKI management, compared to CKD: 23% of countries had organizations for AKI, compared to 53% for CKD. Nearly a third of high-income and upper-middle countries had organizations that provided resources for AKI management, compared to 22% of lower-middle and 6% of low-income countries. Organizations for AKI management were found in less than a third of countries in each ISN region other than North America (both countries had an organization), Oceania & South East Asia (46%), and Western Europe (33%). No countries in South Asia had organizations for AKI management.

Table 9.2 | Advocacy and support for AKI treatment and prevention

Countries with specified forms of advocacy and support

	Presence of advocacy group for AKI N (%)	Presence of organizations that provide resources for AKI management N (%)
Overall	**21 (19)**	**27 (23)**
ISN regions		
Africa	9 (32)	7 (23)
Eastern & Central Europe	1 (6)	4 (25)
Latin America	3 (20)	2 (13)
Middle East	1 (8)	1 (8)
NIS & Russia	2 (33)	1 (17)
North America	0 (0)	2 (100)
North & East Asia	0 (0)	1 (17)
Oceania & South East Asia	3 (23)	6 (46)
South Asia	1 (20)	0 (0)
Western Europe	1 (11)	3 (33)
World Bank income groups		
Low-income	4 (25)	1 (6)
Lower-middle-income	10 (32)	7 (22)
Upper-middle-income	5 (18)	8 (28)
High-income	2 (5)	11 (29)

9.2 CKD and non-communicable chronic disease policy and strategy

More than three-quarters of all countries had a policy and strategy for chronic NCDs (Figure 9.1). Fifty-nine per cent of countries had a completed policy, and 18% of countries had one under development. Twenty-three per cent of countries did not have any policies or strategies for chronic NCDs.

Across all income groups, more than half of countries had a policy or strategy for chronic NCDs in place (Figure 9.2).

At least 40% of countries in Eastern & Central Europe, NIS & Russia, South Asia, and Western Europe lacked a national chronic NCD strategy (Table 9.3).

In each of the three major areas of kidney patient care—care of non-dialysis CKD patients, chronic dialysis, and kidney transplantation—at least 45% of countries lacked a national strategy for improvement. Where there was a national strategy for non-dialysis CKD, it was more commonly combined with an overarching NCD strategy (27%), whereas national strategies for chronic dialysis and kidney transplantation were more often stand-alone (43% and 40%, respectively) (Figure 9.3).

High-income countries reported more national strategies targeted specifically toward kidney care, whereas low-income countries reported more strategies incorporated into a general NCD strategy.

In total, of the 81 countries that lacked a national strategy for improving the care of CKD patients, almost half (47%) had a national position paper on CKD care. This was more common in higher-income countries than in lower-income ones. Thirty-two per cent and 35% offered provider incentives for identifying CKD and providing quality care to CKD patients, respectively. Twenty countries (25%) had important regional or state level strategies for CKD care. There was substantial regional variation (Figure 9.4).

Figure 9.1 | Existence of a national strategy for non-communicable chronic diseases

Strategy in place – 59%
Strategy under development – 18%
No strategy – 23%

Figure 9.2 | Existence of a national strategy for non-communicable chronic diseases, by World Bank income group

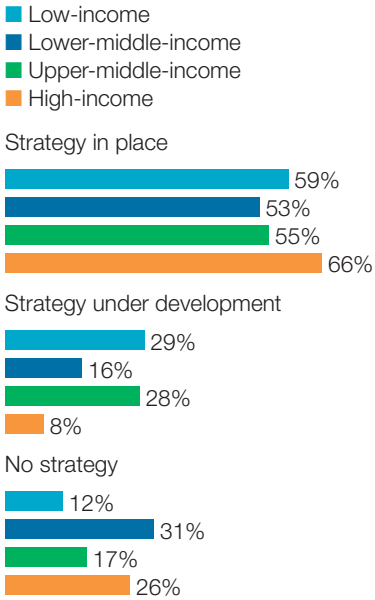


Figure 9.3 | Existence of a national strategy for improving the care of CKD patients

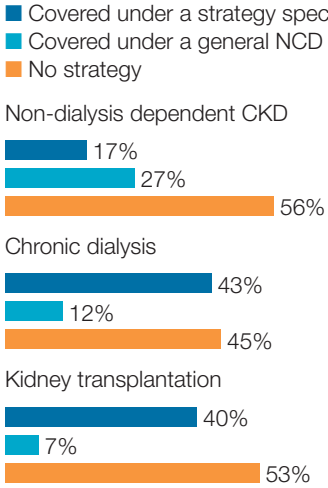
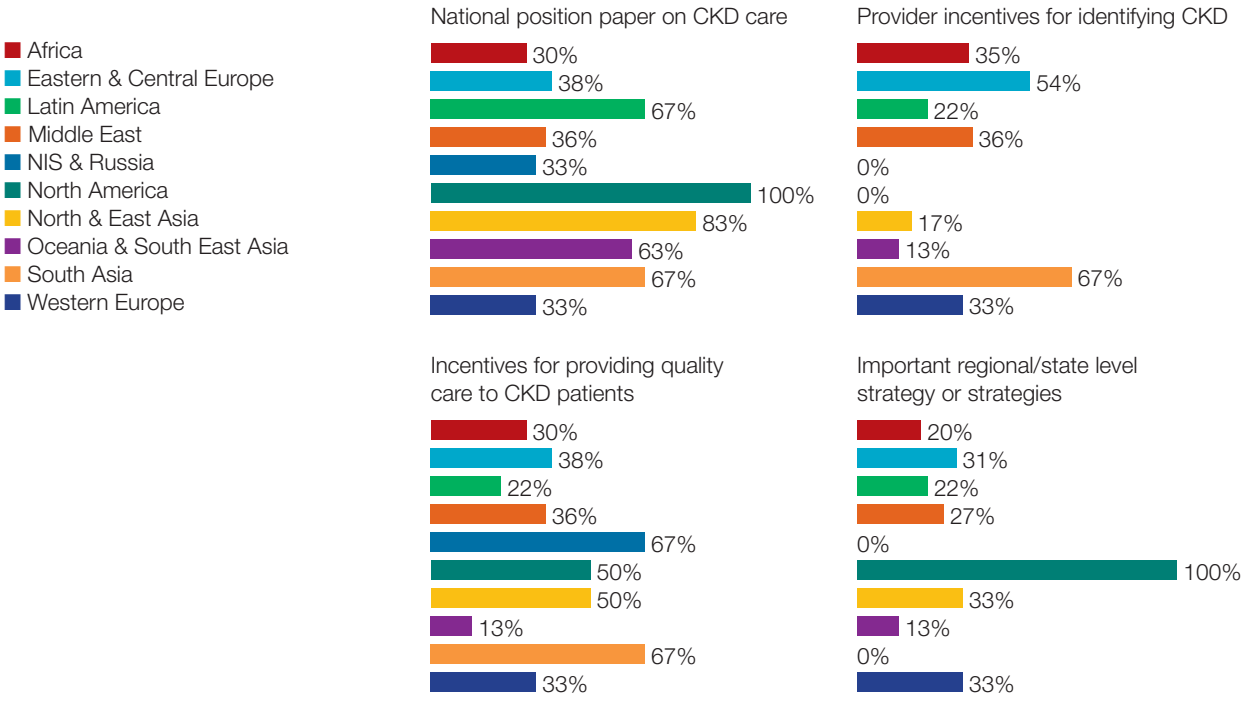


Table 9.3 | Existence of a national strategy for non-communicable chronic diseases

Countries with specified status of implementation

	Strategy in place N (%)	Strategy under development N (%)	No strategy N (%)
Overall	**68 (59)**	**21 (18)**	**27 (23)**
ISN regions			
Africa	18 (60)	9 (30)	3 (10)
Eastern & Central Europe	7 (44)	1 (6)	8 (50)
Latin America	9 (56)	5 (31)	2 (13)
Middle East	6 (46)	4 (31)	3 (23)
NIS & Russia	3 (50)	0 (0)	3 (50)
North America	2 (100)	0 (0)	0 (0)
North & East Asia	6 (100)	0 (0)	0 (0)
Oceania & South East Asia	11 (85)	0 (0)	2 (15)
South Asia	2 (40)	1 (20)	2 (40)
Western Europe	4 (44)	1 (11)	4 (44)
World Bank income groups			
Low-income	10 (59)	5 (29)	2 (12)
Lower-middle-income	17 (53)	5 (16)	10 (31)
Upper-middle-income	16 (55)	8 (28)	5 (17)
High-income	25 (66)	3 (8)	10 (26)

Figure 9.4 | Existence of initiatives for improving the care of CKD patients, by ISN region



9.3 CKD specific policies, guidelines, and/or service frameworks

Twenty one per cent of countries did not have any CKD management and referral guidelines (Figure 9.5; Table 9.4). Half (52%) had access to international guidelines, and 27% to national guidelines. One country had major regional guidelines. Over half (53%) of low-income countries did not have any management and referral guidelines for CKD, compared to 28% of lower-middle-, 17% of upper-middle-, and 3% of high-income countries (Figure 9.5; Table 9.4).

More than 80% of countries that had guidelines included identification of CKD progression, timing and urgency for nephrology referral, risk factor management, and management of complications. More than 70% of countries with guidelines covered a multidisciplinary care approach (Figure 9.6; Table 9.5).

Figure 9.5 | Availability of CKD management and referral guidelines, by World Bank income group

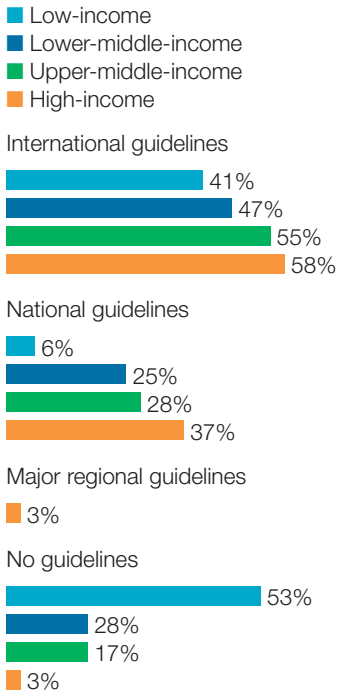


Table 9.4 | Availability of CKD management and referral guidelines

	International guidelines N (%)	National guidelines N (%)	Regional guidelines N (%)	No guidelines N (%)
Overall	**60 (52)**	**31 (27)**	**1 (1)**	**24 (21)**
ISN regions				
Africa	13 (43)	4 (13)	0 (0)	13 (43)
Eastern & Central Europe	13 (81)	2 (13)	0 (0)	1 (6)
Latin America	7 (44)	9 (56)	0 (0)	0 (0)
Middle East	8 (62)	1 (8)	1 (8)	3 (23)
NIS & Russia	5 (83)	1 (17)	0 (0)	0 (0)
North America	1 (50)	1 (50)	0 (0)	0 (0)
North & East Asia	3 (50)	3 (50)	0 (0)	0 (0)
Oceania & South East Asia	2 (15)	6 (46)	0 (0)	5 (38)
South Asia	3 (60)	0 (0)	0 (0)	2 (40)
Western Europe	5 (56)	4 (44)	0 (0)	0 (0)
World Bank income groups				
Low-income	7 (41)	1 (6)	0 (0)	9 (53)
Lower-middle-income	15 (47)	8 (25)	0 (0)	9 (28)
Upper-middle-income	16 (55)	8 (28)	0 (0)	5 (17)
High-income	22 (58)	14 (37)	1 (3)	1 (3)

Percentages do not total 100 due to rounding.

Figure 9.6 | Topics covered in CKD guidelines

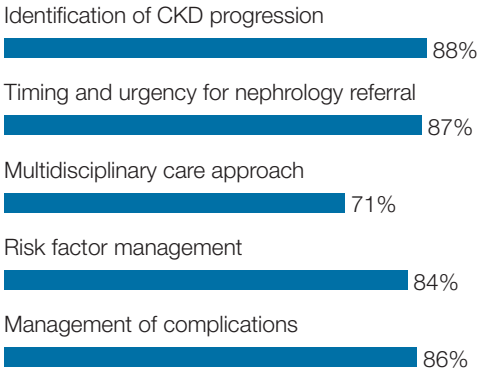
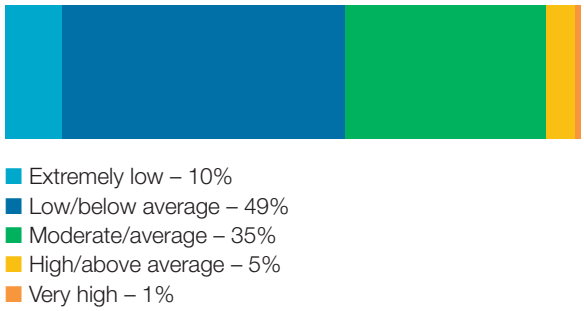


Figure 9.7 | Awareness of CKD guidelines among non-nephrologist physicians



The inclusion of identification of CKD progression, and timing and urgency for nephrology referral increased uniformly with income level (Table 9.5).

Nearly half (49%) of countries reported that the awareness of CKD guidelines among non-nephrologist physicians was low/below average (Figure 9.7; Table 9.6). Ten per cent reported extremely low awareness, and 35% reported moderate/average awareness. Five per cent reported high/above average awareness. One country reported very high awareness.

Low- and lower-middle-income countries reported generally poorer awareness among non-nephrologist physicians compared to upper-middle- and high-income countries (Figure 9.8; Table 9.6).

Most countries, irrespective of ISN region, rated awareness of CKD guidelines among non-

Table 9.5 | Coverage of CKD management and referral guidelines

Countries having guidelines covering the specified aspect of care

	Identification of CKD progression N (%)	Timing and urgency for nephrology referral N (%)	Multidisciplinary care approach N (%)	Risk factor management N (%)	Management of complications N (%)
Overall	**81 (88)**	**80 (87)**	**65 (71)**	**77 (84)**	**79 (86)**
ISN regions					
Africa	13 (76)	11 (65)	12 (71)	11 (65)	14 (82)
Eastern & Central Europe	15 (100)	15 (100)	8 (53)	13 (87)	13 (87)
Latin America	13 (81)	15 (94)	12 (75)	14 (88)	13 (81)
Middle East	7 (70)	7 (70)	7 (70)	6 (60)	8 (80)
NIS & Russia	6 (100)	6 (100)	2 (33)	6 (100)	5 (83)
North America	2 (100)	2 (100)	2 (100)	2 (100)	2 (100)
North & East Asia	6 (100)	6 (100)	6 (100)	6 (100)	5 (83)
Oceania & South East Asia	8 (100)	7 (88)	8 (100)	8 (100)	7 (88)
South Asia	3 (100)	2 (67)	1 (33)	2 (67)	3 (100)
Western Europe	8 (89)	9 (100)	7 (78)	9 (100)	9 (100)
World Bank income groups					
Low-income	6 (75)	4 (50)	7 (88)	6 (75)	7 (88)
Lower-middle-income	19 (83)	19 (83)	11 (48)	17 (74)	17 (74)
Upper-middle-income	21 (88)	21 (88)	18 (75)	20 (83)	20 (83)
High-income	35 (95)	36 (97)	29 (78)	34 (92)	35 (95)

Percentages are calculated relative to the corresponding countries that have CKD guidelines available.

nephrologist physicians as low or moderate (Table 9.6).

Similarly, adoption of CKD guidelines was quite low among non-nephrologist physicians (Figure 9.9; Table 9.6). Almost half (46%) of countries reported low/below average adoption, and 20% reported extremely low adoption. No countries reported very high adoption among non-nephrologist physicians.

Table 9.6 | Awareness and adoption of CKD guidelines among non-nephrologist physicians
Countries with specified ratings

	Extremely low N (%)	Low/below average N (%)	Moderate/ average N (%)	High/above average N (%)	Very high N (%)
AWARENESS OF CKD GUIDELINES					
Overall	**9 (10)**	**45 (49)**	**32 (35)**	**5 (5)**	**1 (1)**
ISN regions					
Africa	2 (12)	11 (65)	3 (18)	1 (6)	0 (0)
Eastern & Central Europe	2 (13)	5 (33)	7 (47)	1 (7)	0 (0)
Latin America	2 (13)	8 (50)	6 (38)	0 (0)	0 (0)
Middle East	2 (20)	3 (30)	4 (40)	1 (10)	0 (0)
NIS & Russia	0 (0)	4 (67)	2 (33)	0 (0)	0 (0)
North America	0 (0)	1 (50)	0 (0)	1 (50)	0 (0)
North & East Asia	0 (0)	4 (67)	2 (33)	0 (0)	0 (0)
Oceania & South East Asia	1 (13)	3 (38)	3 (38)	1 (13)	0 (0)
South Asia	0 (0)	2 (67)	1 (33)	0 (0)	0 (0)
Western Europe	0 (0)	4 (44)	4 (44)	0 (0)	1 (11)
World Bank income groups					
Low-income	2 (25)	5 (63)	0 (0)	1 (13)	0 (0)
Lower-middle-income	4 (17)	13 (57)	5 (22)	1 (4)	0 (0)
Upper-middle-income	3 (13)	10 (42)	10 (42)	1 (4)	0 (0)
High-income	0 (0)	17 (46)	17 (46)	2 (5)	1 (3)
ADOPTION OF CKD GUIDELINES					
Overall	**18 (20)**	**42 (46)**	**25 (27)**	**6 (7)**	**0 (0)**
ISN regions					
Africa	6 (38)	7 (44)	2 (13)	1 (6)	0 (0)
Eastern & Central Europe	1 (7)	8 (53)	5 (33)	1 (7)	0 (0)
Latin America	3 (19)	8 (50)	5 (31)	0 (0)	0 (0)
Middle East	4 (40)	2 (20)	3 (30)	1 (10)	0 (0)
NIS & Russia	1 (17)	3 (50)	2 (33)	0 (0)	0 (0)
North America	0 (0)	2 (100)	0 (0)	0 (0)	0 (0)
North & East Asia	1 (17)	4 (67)	1 (17)	0 (0)	0 (0)
Oceania & South East Asia	0 (0)	4 (50)	2 (25)	2 (25)	0 (0)
South Asia	1 (33)	1 (33)	1 (33)	0 (0)	0 (0)
Western Europe	1 (11)	3 (33)	4 (44)	1 (11)	0 (0)
World Bank income groups					
Low-income	3 (38)	4 (50)	0 (0)	1 (13)	0 (0)
Lower-middle-income	8 (36)	9 (41)	4 (18)	1 (5)	0 (0)
Upper-middle-income	5 (21)	11 (46)	7 (29)	1 (4)	0 (0)
High-income	2 (5)	18 (49)	14 (38)	3 (8)	0 (0)

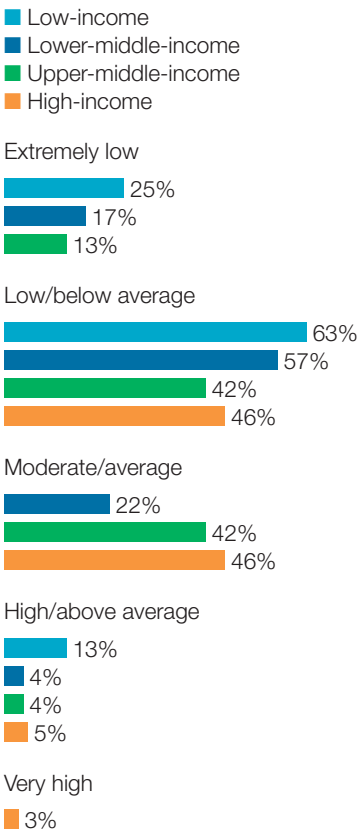
Percentages are calculated relative to the corresponding countries that have CKD guidelines available.

Low- and lower-middle-income countries reported generally poorer adoption of CKD guidelines among non-nephrologist physicians compared to upper-middle- and high-income countries (Figure 9.10; Table 9.6).

While awareness of CKD guidelines was generally low or moderate among non-nephrologist physicians, countries reported a high level of awareness among nephrologists (Figure 9.11). Nearly three-quarters (74%) of countries reported that the awareness among nephrologists was very high or high/above average.

The majority of countries, regardless of income level, rated CKD guideline awareness among nephrologists as high (Figure 9.12). In most ISN regions, at least half the countries rated awareness of CKD guidelines among nephrologists as high; however, ratings were slightly lower in NIS & Russia and South Asia (Table 9.7).

Figure 9.8 | Awareness of CKD guidelines among non-nephrologist physicians, by World Bank income group



More than half (56%) of all countries rated adoption of CKD guidelines by nephrologists as very high or high/above average (Figure 9.13).

Similarly, in every income group, the majority of countries rated CKD guideline adoption among nephrologists as moderate or high (Figure 9.14; Table 9.7). In every ISN region, a large majority of countries rated adoption of CKD guidelines among nephrologists as at least moderate (Table 9.7).

Figure 9.9 | Adoption of CKD guidelines among non-nephrologist physicians

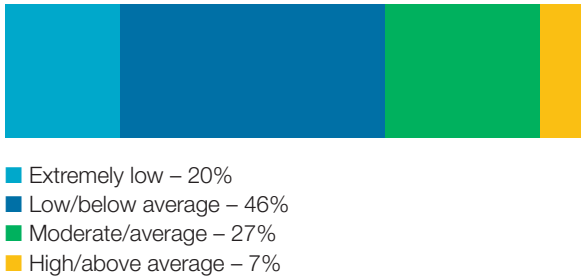


Figure 9.10 | Adoption of CKD guidelines among non-nephrologist physicians, by World Bank income group

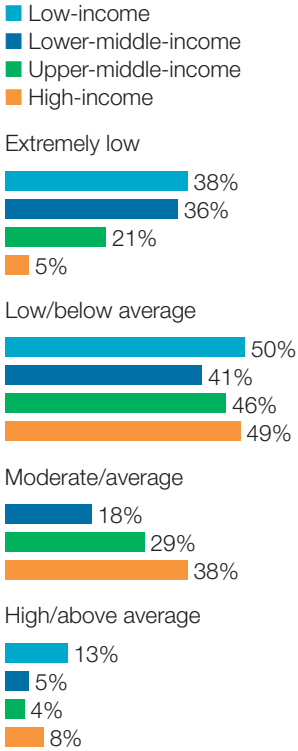


Figure 9.11 | Awareness of CKD guidelines among nephrologists

- Extremely low – 2%
- Low/below average – 2%
- Moderate/average – 22%
- High/above average – 56%
- Very high – 18%

Figure 9.12 | Awareness of CKD guidelines among nephrologists, by World Bank income group

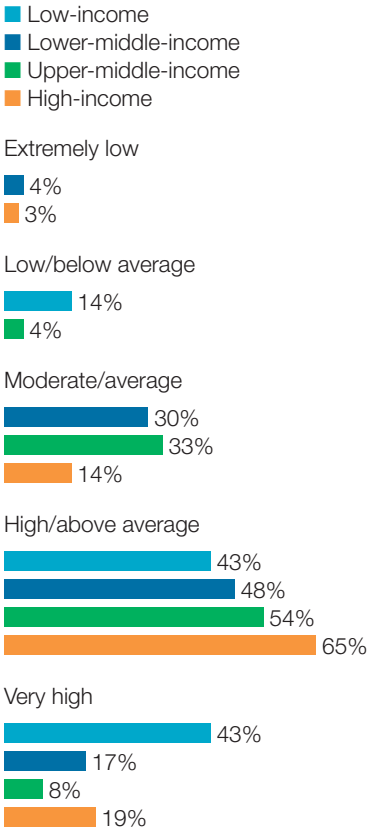


Figure 9.13 | Adoption of CKD guidelines among nephrologists

- Low/below average – 5%
- Moderate/average – 39%
- High/above average – 47%
- Very high – 9%

Figure 9.14 | Adoption of CKD guidelines among nephrologists, by World Bank income group

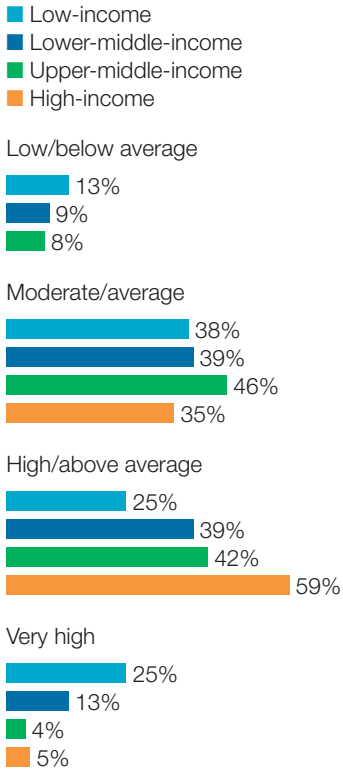


Table 9.7 | Awareness and adoption of CKD guidelines guidelines among nephrologists

Countries with specified ratings

	Extremely low N (%)	Low/below average N (%)	Moderate/ average N (%)	High/above average N (%)	Very high N (%)
AWARENESS OF CKD GUIDELINES					
Overall	**2 (2)**	**2 (2)**	**20 (22)**	**51 (56)**	**16 (18)**
ISN regions					
Africa	1 (6)	1 (6)	2 (13)	8 (50)	4 (25)
Eastern & Central Europe	0 (0)	0 (0)	3 (20)	11 (73)	1 (7)
Latin America	0 (0)	1 (6)	6 (38)	6 (38)	3 (19)
Middle East	1 (10)	0 (0)	1 (10)	7 (70)	1 (10)
NIS & Russia	0 (0)	0 (0)	3 (50)	3 (50)	0 (0)
North America	0 (0)	0 (0)	0 (0)	1 (50)	1 (50)
North & East Asia	0 (0)	0 (0)	1 (17)	4 (67)	1 (17)
Oceania & South East Asia	0 (0)	0 (0)	0 (0)	4 (50)	4 (50)
South Asia	0 (0)	0 (0)	2 (67)	1 (33)	0 (0)
Western Europe	0 (0)	0 (0)	2 (22)	6 (67)	1 (11)
World Bank income groups					
Low-income	0 (0)	1 (14)	0 (0)	3 (43)	3 (43)
Lower-middle-income	1 (4)	0 (0)	7 (30)	11 (48)	4 (17)
Upper-middle-income	0 (0)	1 (4)	8 (33)	13 (54)	2 (8)
High-income	1 (3)	0 (0)	5 (14)	24 (65)	7 (19)
ADOPTION OF CKD GUIDELINES					
Overall	**0 (0)**	**5 (5)**	**36 (39)**	**43 (47)**	**8 (9)**
ISN regions					
Africa	0 (0)	3 (18)	5 (29)	6 (35)	3 (18)
Eastern & Central Europe	0 (0)	1 (7)	4 (27)	10 (67)	0 (0)
Latin America	0 (0)	1 (6)	7 (44)	5 (31)	3 (19)
Middle East	0 (0)	0 (0)	5 (50)	4 (40)	1 (10)
NIS & Russia	0 (0)	0 (0)	3 (50)	3 (50)	0 (0)
North America	0 (0)	0 (0)	1 (50)	1 (50)	0 (0)
North & East Asia	0 (0)	0 (0)	4 (67)	2 (33)	0 (0)
Oceania & South East Asia	0 (0)	0 (0)	1 (13)	7 (88)	0 (0)
South Asia	0 (0)	0 (0)	2 (67)	1 (33)	0 (0)
Western Europe	0 (0)	0 (0)	4 (44)	4 (44)	1 (11)
World Bank income groups					
Low-income	0 (0)	1 (13)	3 (38)	2 (25)	2 (25)
Lower-middle-income	0 (0)	2 (9)	9 (39)	9 (39)	3 (13)
Upper-middle-income	0 (0)	2 (8)	11 (46)	10 (42)	1 (4)
High-income	0 (0)	0 (0)	13 (35)	22 (59)	2 (5)

Percentages are calculated relative to the corresponding countries that have CKD guidelines available.

9.4 AKI specific policy and strategy

Nearly half (49%) of countries had a strategy for improving the identification of AKI (Table 9.8). Nineteen per cent of countries rated adoption of countries had a national position paper on AKI identification and care. Thirty-two per cent of countries had tools available for the identification of AKI, and 12% offered incentives for providing quality care to AKI patients. Ten per cent had an important regional/state level strategy or strategies. Thirty-one per cent of countries had incentives to increase access to acute dialysis facilities. Half (51%) of countries had no strategies for AKI care. Eleven per cent of countries had another type of initiative that identified AKI as an important healthcare priority in their country.

Most countries in Africa (60%), Eastern & Central Europe (56%), Latin America (63%), NIS & Russia (67%), and Western Europe (56%) had no strategy for improving the identification of AKI (Table 9.8). Except in North & East Asia, a minority of countries had a national position paper on AKI identification and care. Both countries in North America had at least one form of strategy for AKI, mainly tools, regional strategies, or other.

Nearly half (47%) of countries did not have any AKI management and referral guidelines (Figure 9.15; Table 9.9). Forty-five per cent had international guidelines, and 7% had national guidelines. One country had major regional guidelines.

Over 75% of low-income countries did not have any management and referral guidelines for AKI (Figure 9.15). Of countries that had access to guidelines, the majority were international guidelines. Availability of guidelines increased with income level (Figure 9.15). Very few countries had national or major regional guidelines for AKI.

Table 9.8 | Availability of strategies for improving the identification of AKI
Countries using specified strategies

	National position paper on AKI identification and care N (%)	Tools available for identification of AKI N (%)	Incentives for providing quality care to AKI patients N (%)	Important regional/state level strategy or strategies N (%)	Increasing access to acute dialysis facilities N (%)	No strategies exist for AKI N (%)	Other N (%)
Overall	**19 (16)**	**37 (32)**	**14 (12)**	**12 (10)**	**36 (31)**	**59 (51)**	**13 (11)**
ISN regions							
Africa	3 (10)	8 (27)	1 (3)	2 (7)	7 (23)	18 (60)	2 (7)
Eastern & Central Europe	1 (6)	5 (31)	4 (25)	2 (13)	5 (31)	9 (56)	0 (0)
Latin America	4 (25)	3 (19)	0 (0)	1 (6)	4 (25)	10 (63)	2 (13)
Middle East	2 (15)	4 (31)	2 (15)	0 (0)	6 (46)	6 (46)	0 (0)
NIS & Russia	1 (17)	2 (33)	1 (17)	0 (0)	2 (33)	4 (67)	0 (0)
North America	0 (0)	1 (50)	0 (0)	1 (50)	0 (0)	0 (0)	1 (50)
North & East Asia	3 (50)	2 (33)	2 (33)	0 (0)	1 (17)	2 (33)	1 (17)
Oceania & South East Asia	2 (15)	6 (46)	1 (8)	3 (23)	8 (62)	4 (31)	3 (23)
South Asia	0 (0)	3 (60)	2 (40)	2 (40)	2 (40)	1 (20)	2 (40)
Western Europe	3 (33)	3 (33)	1 (11)	1 (11)	1 (11)	5 (56)	2 (22)
World Bank income groups							
Low-income	0 (0)	5 (29)	1 (6)	2 (12)	2 (12)	11 (65)	1 (6)
Lower-middle-income	4 (13)	9 (28)	4 (13)	3 (9)	11 (34)	16 (50)	3 (9)
Upper-middle-income	6 (21)	10 (34)	3 (10)	3 (10)	14 (48)	15 (52)	5 (17)
High-income	9 (24)	13 (34)	6 (16)	4 (11)	9 (24)	17 (45)	4 (11)

Percentages are calculated relative to the corresponding number of countries.

Figure 9.15 | Availability of AKI management and referral guidelines

In every ISN region and every income group, any guidelines for managing and referring AKI were most commonly international. Very few countries reported the use of national or regional guidelines (Table 9.9). The majority of countries in Africa, the Middle East, North & East Asia, Oceania & South East Asia, and South Asia reported no guidelines for AKI.

Figure 9.16 | Topics covered in AKI guidelines

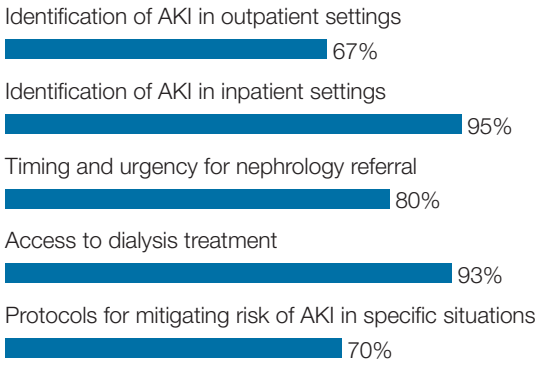


Table 9.9 | Availability of AKI management and referral guidelines

Countries having guidelines of the specified level

	International guidelines N (%)	National guidelines N (%)	Regional guidelines N (%)	No guidelines N (%)
Overall	**52 (45)**	**8 (7)**	**1 (1)**	**55 (47)**
ISN regions				
Africa	8 (27)	2 (7)	0 (0)	20 (67)
Eastern & Central Europe	15 (94)	0 (0)	0 (0)	1 (6)
Latin America	7 (44)	1 (6)	0 (0)	8 (50)
Middle East	5 (38)	0 (0)	0 (0)	8 (62)
NIS & Russia	3 (50)	2 (33)	0 (0)	1 (17)
North America	2 (100)	0 (0)	0 (0)	0 (0)
North & East Asia	2 (33)	0 (0)	0 (0)	4 (67)
Oceania & South East Asia	3 (23)	2 (15)	1 (8)	7 (54)
South Asia	1 (20)	0 (0)	0 (0)	4 (80)
Western Europe	6 (67)	1 (11)	0 (0)	2 (22)
World Bank income groups				
Low-income	4 (24)	0 (0)	0 (0)	13 (76)
Lower-middle-income	11 (34)	5 (16)	0 (0)	16 (50)
Upper-middle-income	13 (45)	1 (3)	1 (3)	14 (48)
High-income	24 (63)	2 (5)	0 (0)	12 (32)

Nearly all of the 62 countries with AKI guidelines covered the identification of AKI in inpatient settings (95%), and access to dialysis treatment (93%) (Figure 9.16; Table 9.10). Eighty per cent covered timing and urgency for nephrology referral, and 70% included protocols for mitigating risk of AKI in specific situations. Two-thirds (67%) covered the identification of AKI in outpatient settings.

More than half (56%) of countries reported that the awareness of AKI guidelines among non-nephrologist physicians was extremely low or low/below average (Figure 9.17; Table 9.11).

Low- and lower-middle-income countries reported generally poorer awareness among non-nephrologist physicians compared to upper-middle- and high-income countries (Figure 9.18; Table 9.11).

Similarly to CKD guidelines, the adoption of AKI guidelines was quite low among non-nephrologist physicians (Figure 9.19; Table 9.11). Almost two-thirds (65%) of countries reported adoption as extremely low or low/below average.

Most countries, regardless of income level, rated the adoption of AKI guidelines among non-nephrologist physicians as low or moderate (Figure 9.20; Table 9.11). Lower-income countries had lower ratings than those at other income levels.

Adoption of AKI guidelines among non-nephrologist physicians was similar across ISN regions (Table 9.11). More countries in Africa, Latin America, and the Middle East had ratings of extremely low than in other ISN regions.

Table 9.10 | Coverage of AKI management and referral guidelines
Countries having guidelines covering the specified aspect of care

	Identification of AKI in outpatient settings N (%)	Identification of AKI in inpatient settings N (%)	Timing and urgency for nephrology referral N (%)	Access to dialysis treatment N (%)	Protocols for mitigating risk of AKI in specific situations N (%)
Overall	**40 (67)**	**57 (95)**	**48 (80)**	**56 (93)**	**42 (70)**
ISN regions					
Africa	3 (33)	9 (100)	7 (78)	9 (100)	7 (78)
Eastern & Central Europe	10 (67)	14 (93)	13 (87)	14 (93)	9 (60)
Latin America	8 (100)	8 (100)	8 (100)	8 (100)	8 (100)
Middle East	4 (80)	5 (100)	4 (80)	5 (100)	3 (60)
NIS & Russia	1 (20)	4 (80)	3 (60)	5 (100)	2 (40)
North America	1 (50)	2 (100)	0 (0)	1 (50)	2 (100)
North & East Asia	2 (100)	2 (100)	2 (100)	2 (100)	1 (50)
Oceania & South East Asia	4 (67)	6 (100)	6 (100)	5 (83)	4 (67)
South Asia	1 (100)	0 (0)	0 (0)	1 (100)	0 (0)
Western Europe	6 (86)	7 (100)	5 (71)	6 (86)	6 (86)
World Bank income groups					
Low-income	2 (50)	4 (100)	3 (75)	4 (100)	3 (75)
Lower-middle-income	6 (40)	13 (87)	10 (67)	14 (93)	9 (60)
Upper-middle-income	12 (80)	14 (93)	14 (93)	15 (100)	9 (60)
High-income	20 (77)	26 (100)	21 (81)	23 (88)	21 (81)

Percentages are calculated relative to the corresponding countries that have AKI guidelines available.

Table 9.11 | Awareness and adoption of AKI guidelines among non-nephrologist physicians

Countries with specified ratings

	Extremely low N (%)	Low/below average N (%)	Moderate/ average N (%)	High/above average N (%)	Very high N (%)
AWARENESS OF AKI GUIDELINES					
Overall	**8 (13)**	**26 (43)**	**21 (34)**	**5 (8)**	**1 (2)**
ISN regions					
Africa	2 (20)	6 (60)	1 (10)	1 (10)	0 (0)
Eastern & Central Europe	2 (13)	7 (47)	5 (33)	1 (7)	0 (0)
Latin America	1 (13)	4 (50)	3 (38)	0 (0)	0 (0)
Middle East	1 (20)	1 (20)	2 (40)	1 (20)	0 (0)
NIS & Russia	1 (20)	1 (20)	3 (60)	0 (0)	0 (0)
North America	0 (0)	1 (50)	1 (50)	0 (0)	0 (0)
North & East Asia	0 (0)	1 (50)	1 (50)	0 (0)	0 (0)
Oceania & South East Asia	1 (17)	3 (50)	1 (17)	1 (17)	0 (0)
South Asia	0 (0)	0 (0)	0 (0)	0 (0)	1 (100)
Western Europe	0 (0)	2 (29)	4 (57)	1 (14)	0 (0)
World Bank income groups					
Low-income	1 (25)	3 (75)	0 (0)	0 (0)	0 (0)
Lower-middle-income	5 (31)	4 (25)	4 (25)	2 (13)	1 (6)
Upper-middle-income	2 (13)	6 (40)	7 (47)	0 (0)	0 (0)
High-income	0 (0)	13 (50)	10 (38)	3 (12)	0 (0)
ADOPTION OF AKI GUIDELINES					
Overall	**10 (17)**	**29 (48)**	**17 (28)**	**4 (7)**	**0 (0)**
ISN regions					
Africa	3 (33)	6 (67)	0 (0)	0 (0)	0 (0)
Eastern & Central Europe	1 (7)	9 (60)	3 (20)	2 (13)	0 (0)
Latin America	3 (38)	4 (50)	1 (13)	0 (0)	0 (0)
Middle East	2 (40)	1 (20)	1 (20)	1 (20)	0 (0)
NIS & Russia	0 (0)	3 (60)	2 (40)	0 (0)	0 (0)
North America	0 (0)	1 (50)	1 (50)	0 (0)	0 (0)
North & East Asia	0 (0)	1 (50)	1 (50)	0 (0)	0 (0)
Oceania & South East Asia	1 (17)	2 (33)	2 (33)	1 (17)	0 (0)
South Asia	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)
Western Europe	0 (0)	2 (29)	5 (71)	0 (0)	0 (0)
World Bank income groups					
Low-income	1 (25)	3 (75)	0 (0)	0 (0)	0 (0)
Lower-middle-income	5 (33)	6 (40)	3 (20)	1 (7)	0 (0)
Upper-middle-income	2 (13)	7 (47)	5 (33)	1 (7)	0 (0)
High-income	2 (8)	13 (50)	9 (35)	2 (8)	0 (0)

Percentages are calculated relative to the corresponding countries that have AKI guidelines available.

As with CKD guidelines, countries reported a high level of awareness of AKI guidelines among nephrologists (Figure 9.21; Table 9.12). More than two-thirds (68%) of countries reported that the awareness among nephrologists was very high or high/above average.

Notably, a higher proportion of low- and lower-middle-income countries rated awareness as high or very high, compared to upper-middle- and high-income countries (Figure 9.22; Table 9.12).

More than half (57%) of countries reported that adoption of AKI guidelines by nephrologists was

Figure 9.17 | Awareness of AKI guidelines among non-nephrologist physicians

- Extremely low – 13%
- Low/below average – 43%
- Moderate/average – 34%
- High/above average – 8%
- Very high – 2%

Figure 9.18 | Awareness of AKI guidelines among non-nephrologist physicians, by World Bank income group

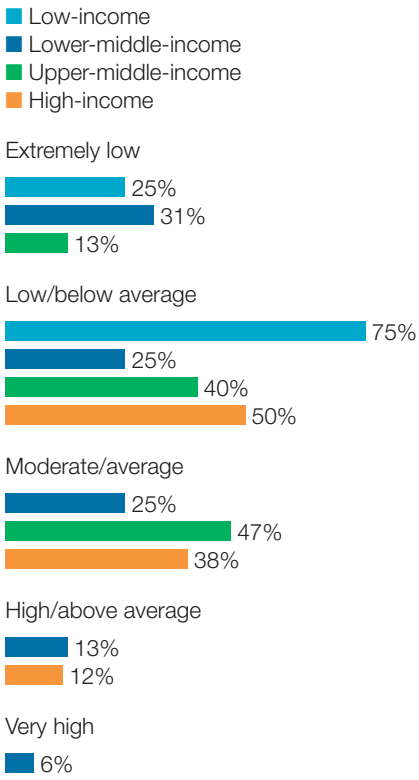
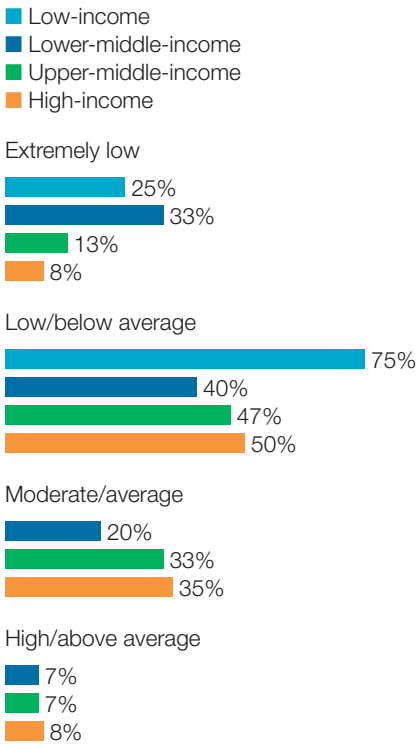


Figure 9.19 | Adoption of AKI guidelines among non-nephrologist physicians

- Extremely low – 17%
- Low/below average – 48%
- Moderate average – 28%
- High/above average – 7%

Figure 9.20 | Adoption of AKI guidelines among non-nephrologist physicians, by World Bank income group



very high or high/above average (Figure 9.23; Table 9.12).

Similarly, the majority of countries, irrespective of income group, rated adoption of AKI guidelines among nephrologists as moderate or high (Figure 9.24; Table 9.12). A greater proportion of low-income countries rated adoption as high or very high than in other income groups, which were split between moderate and high awareness (Figure 9.24; Table 9.12).

Figure 9.21 | Awareness of AKI guidelines among nephrologists

- Low/below average – 3%
- Moderate average – 28%
- High/above average – 56%
- Very high – 13%

Figure 9.22 | Awareness of AKI guidelines among nephrologists, by World Bank income group

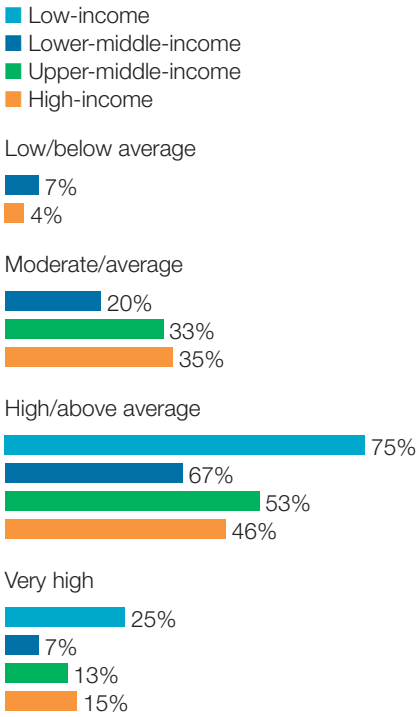


Figure 9.23 | Adoption of AKI guidelines among nephrologists

- Low/below average – 2%
- Moderate/average – 41%
- High/above average – 46%
- Very high – 11%

Figure 9.24 | Adoption of AKI guidelines among nephrologists, by World Bank income group

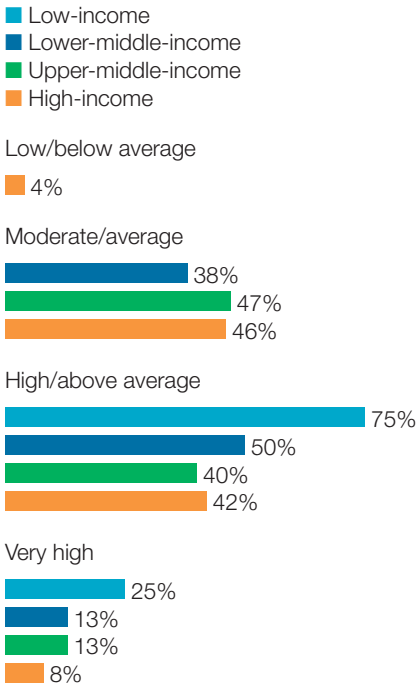


Table 9.12 | Awareness and adoption of AKI guidelines among nephrologists

Countries with specified ratings

	Extremely low N (%)	Low/below average N (%)	Moderate/ average N (%)	High/above average N (%)	Very high N (%)
AWARENESS OF AKI GUIDELINES					
Overall	**0 (0)**	**2 (3)**	**17 (28)**	**33 (55)**	**8 (13)**
ISN regions					
Africa	0 (0)	0 (0)	1 (11)	7 (78)	1 (11)
Eastern & Central Europe	0 (0)	0 (0)	3 (20)	9 (60)	3 (20)
Latin America	0 (0)	1 (13)	4 (50)	2 (25)	1 (13)
Middle East	0 (0)	0 (0)	2 (40)	3 (60)	0 (0)
NIS & Russia	0 (0)	1 (20)	2 (40)	2 (40)	0 (0)
North America	0 (0)	0 (0)	1 (50)	0 (0)	1 (50)
North & East Asia	0 (0)	0 (0)	2 (100)	0 (0)	0 (0)
Oceania & South East Asia	0 (0)	0 (0)	0 (0)	5 (83)	1 (17)
South Asia	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)
Western Europe	0 (0)	0 (0)	1 (14)	5 (71)	1 (14)
World Bank income groups					
Low-income	0 (0)	0 (0)	0 (0)	3 (75)	1 (25)
Lower-middle-income	0 (0)	1 (7)	3 (20)	10 (67)	1 (7)
Upper-middle-income	0 (0)	0 (0)	5 (33)	8 (53)	2 (13)
High-income	0 (0)	1 (4)	9 (35)	12 (46)	4 (15)
ADOPTION OF AKI GUIDELINES					
Overall	**0 (0)**	**1 (2)**	**25 (41)**	**28 (46)**	**7 (11)**
ISN regions					
Africa	0 (0)	0 (0)	1 (10)	7 (70)	2 (20)
Eastern & Central Europe	0 (0)	0 (0)	6 (40)	7 (47)	2 (13)
Latin America	0 (0)	0 (0)	5 (63)	2 (25)	1 (13)
Middle East	0 (0)	1 (20)	2 (40)	2 (40)	0 (0)
NIS & Russia	0 (0)	0 (0)	3 (60)	2 (40)	0 (0)
North America	0 (0)	0 (0)	1 (50)	0 (0)	1 (50)
North & East Asia	0 (0)	0 (0)	2 (100)	0 (0)	0 (0)
Oceania & South East Asia	0 (0)	0 (0)	1 (17)	4 (67)	1 (17)
South Asia	0 (0)	0 (0)	1 (100)	0 (0)	0 (0)
Western Europe	0 (0)	0 (0)	3 (43)	4 (57)	0 (0)
World Bank income groups					
Low-income	0 (0)	0 (0)	0 (0)	3 (75)	1 (25)
Lower-middle-income	0 (0)	0 (0)	6 (38)	8 (50)	2 (13)
Upper-middle-income	0 (0)	0 (0)	7 (47)	6 (40)	2 (13)
High-income	0 (0)	1 (4)	12 (46)	11 (42)	2 (8)

Percentages are calculated relative to the corresponding countries that have AKI guidelines available.

SECTION 10

ASSESSING RESPONSE OF THE NEPHROLOGY COMMUNITY

10.1 Kidney disease awareness

Overall, non-nephrologist specialists were reported to have comparable levels of awareness of CKD and of AKI. Most countries rated their awareness as low/below average or moderate/average (Figure 10.1).

Likewise, the levels of awareness of CKD and of AKI among PCPs were comparable (Figure 10.2).

10.1.1 Awareness of CKD

Non-nephrologist specialists

Almost half of countries (48%) rated CKD awareness among non-nephrologist specialists as moderate/average, and another 42% rated it extremely low or low/below average (Figure 10.1).

Irrespective of ISN region, most countries rated the awareness of CKD among non-nephrologist specialists as moderate or low. Slightly higher proportions of countries in lower income groups rated awareness as low, and a higher proportion of high-income countries rated awareness as moderate (Figure 10.3). Extremely low levels of awareness were reported by a total of five countries, which were in Latin America, the Middle East, and NIS & Russia.

Figure 10.1 | Awareness of CKD and AKI among non-nephrologist specialists

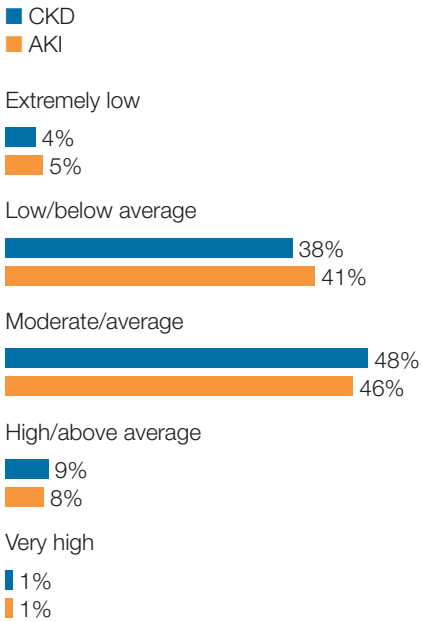
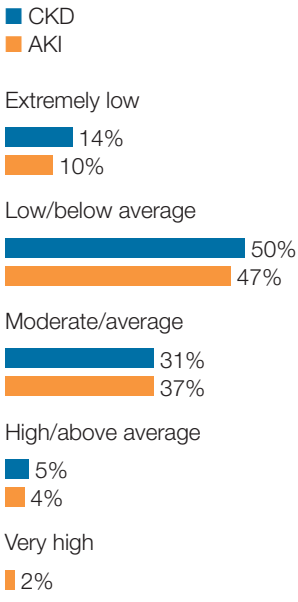


Figure 10.2 | Awareness of CKD and AKI among primary care physicians



Primary care physicians

Almost two-thirds (64%) of countries rated CKD awareness among PCPs as low/below average or extremely low (Figure 10.2). Very few countries, regardless of income level, rated awareness of CKD among PCPs as higher than moderate (Figure 10.4). Nearly 40% of countries in Latin America rated PCP awareness as extremely low.

10.1.2 Awareness of AKI

Non-nephrologist specialists

Nearly half (46%) of countries reported that AKI awareness among non-nephrologist specialists was low/below average or extremely low, while another 46% rated awareness as moderate/average (Figure 10.1).

Higher-income countries generally reported a higher level of awareness than did lower-income countries (Figure 10.5). Irrespective of ISN region, most countries rated AKI awareness among non-nephrologist specialists as low or moderate. Higher proportions of countries in Eastern & Central Europe, North America, and Western Europe rated awareness as moderate than in other ISN regions.

Primary care physicians

Nearly half (47%) of countries rated AKI awareness among PCPs as low/below average, and most of the rest (37%) rated it moderate/average (Figure 10.2).

Similarly to AKI awareness among non-nephrologist specialists, AKI awareness among PCPs was generally rated higher in higher-income countries than in lower-income countries (Figure 10.6). Irrespective of ISN region, most countries rated awareness of AKI among PCPs as low or moderate. Extremely low ratings were more common in Africa, Latin America, NIS & Russia, and South Asia, compared to other regions.

Figure 10.3 | Awareness of CKD among non-nephrologist specialists, by World Bank income group

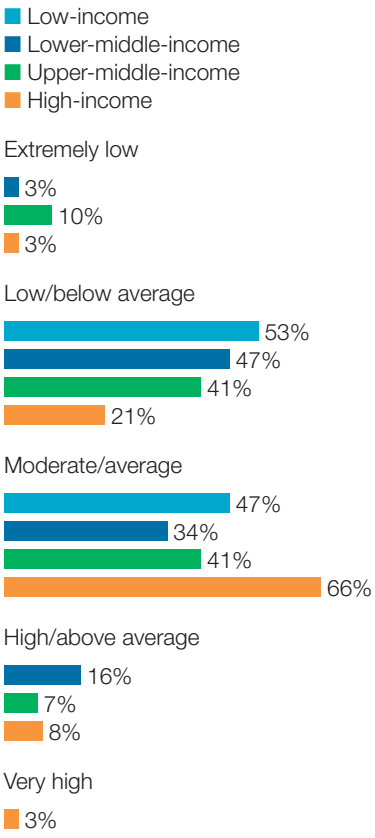


Figure 10.4 | Awareness of CKD among primary care physicians, by World Bank income group

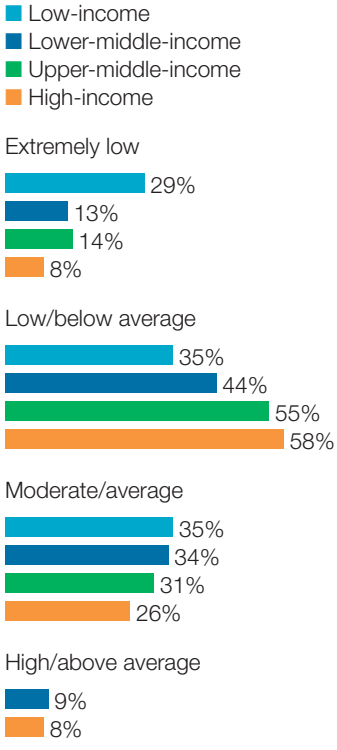


Figure 10.5 | Awareness of AKI among non-nephrologist specialists, by World Bank income group

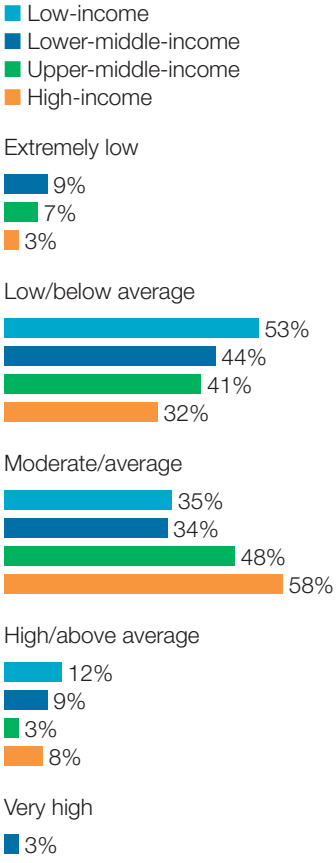
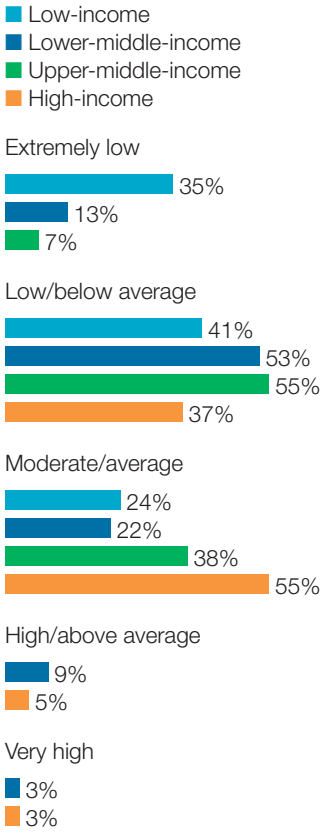


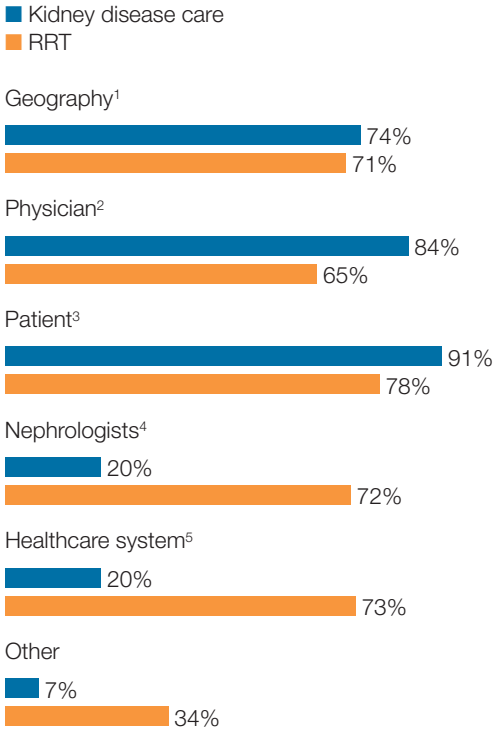
Figure 10.6 | Awareness of AKI among primary care physicians, by World Bank income group



10.2 Identified barriers to kidney disease care

The top barriers to optimal kidney disease care (both general and related to RRT) were identified as being related to geography, physicians, and patients (Figure 10.7; Table 10.1). In most countries, availability of nephrologists and the healthcare system were also considered major barriers to RRT, but not to kidney disease care generally (Figure 10.7; Table 10.1). Barriers to optimal kidney disease care and to optimal RRT were generally lower in the high-income group and otherwise broadly similar across the other three income groups.

Figure 10.7 | Barriers to optimal kidney disease care and renal replacement therapy



1 Distance from care or prolonged travel time
2 Availability, access, knowledge, attitude
3 Knowledge, attitude
4 Availability
5 Availability, access, capability

Table 10.1 | Barriers to optimal kidney disease care and renal replacement therapy

Countries reporting specified barriers

	Geography[1] N (%)	Physician[2] N (%)	Patient[3] N (%)	Nephrologists[4] N (%)	Healthcare system[5] N (%)	Other N (%)
BARRIERS TO OPTIMAL KIDNEY DISEASE CARE						
Overall	**81 (74)**	**92 (84)**	**100 (91)**	**22 (20)**	**22 (20)**	**8 (7)**
ISN regions						
Africa	28 (97)	23 (79)	26 (90)	7 (24)	7 (24)	0 (0)
Eastern & Central Europe	5 (38)	11 (85)	13 (100)	0 (0)	0 (0)	0 (0)
Latin America	13 (81)	13 (81)	11 (69)	13 (81)	13 (81)	6 (38)
Middle East	6 (50)	11 (92)	12 (100)	0 (0)	0 (0)	0 (0)
NIS & Russia	5 (83)	4 (67)	5 (83)	0 (0)	0 (0)	0 (0)
North America	1 (50)	2 (100)	2 (100)	0 (0)	0 (0)	0 (0)
North & East Asia	2 (33)	6 (100)	6 (100)	0 (0)	0 (0)	0 (0)
Oceania & South East Asia	11 (85)	13 (100)	13 (100)	1 (8)	1 (8)	1 (8)
South Asia	5 (100)	5 (100)	5 (100)	0 (0)	0 (0)	0 (0)
Western Europe	5 (63)	4 (50)	7 (88)	1 (13)	1 (13)	1 (13)
World Bank income groups						
Low-income	16 (94)	14 (82)	15 (88)	6 (35)	6 (35)	1 (6)
Lower-middle-income	29 (94)	28 (90)	30 (97)	5 (16)	5 (16)	2 (6)
Upper-middle-income	23 (82)	23 (82)	23 (82)	8 (29)	6 (21)	2 (7)
High-income	13 (38)	27 (79)	32 (94)	3 (9)	5 (15)	3 (9)
BARRIERS TO OPTIMAL RRT CARE						
Overall	**82 (71)**	**75 (65)**	**90 (78)**	**83 (72)**	**85 (73)**	**40 (34)**
ISN regions						
Africa	25 (83)	22 (73)	21 (70)	25 (83)	29 (97)	6 (20)
Eastern & Central Europe	5 (31)	4 (25)	9 (56)	7 (44)	9 (56)	5 (31)
Latin America	13 (81)	9 (56)	12 (75)	13 (81)	4 (25)	3 (19)
Middle East	6 (46)	10 (77)	11 (85)	9 (69)	12 (92)	5 (38)
NIS & Russia	5 (83)	3 (50)	6 (100)	4 (67)	3 (50)	1 (17)
North America	1 (50)	1 (50)	2 (100)	2 (100)	2 (100)	1 (50)
North & East Asia	4 (67)	4 (67)	6 (100)	4 (67)	4 (67)	4 (67)
Oceania & South East Asia	12 (92)	13 (100)	13 (100)	12 (92)	13 (100)	8 (62)
South Asia	5 (100)	5 (100)	5 (100)	5 (100)	5 (100)	2 (40)
Western Europe	6 (67)	4 (44)	5 (56)	2 (22)	4 (44)	5 (56)
World Bank income groups						
Low-income	15 (88)	14 (82)	14 (82)	14 (82)	17 (100)	3 (18)
Lower-middle-income	29 (91)	23 (72)	27 (84)	30 (94)	25 (78)	13 (41)
Upper-middle-income	22 (76)	20 (69)	23 (79)	23 (79)	20 (69)	5 (17)
High-income	16 (42)	18 (47)	26 (68)	16 (42)	23 (61)	19 (50)

1 Distance from care or prolonged travel time
2 Availability, access, knowledge, attitude
3 Knowledge, attitude
4 Availability
5 Availability, access, capability

10.3 Capacity for research and development

10.3.1 Clinical trials

Capacity for all clinical trials

Twenty-seven per cent of countries reported a national agency for funding clinical trials. Existence of an agency increased with income level (Figure 10.8).

All countries in North America and at least half in Oceania & South East Asia, Western Europe, and North & East Asia had an agency for funding clinical trials (Figure 10.9; Table 10.2). Few countries in Africa, Latin America, and Eastern & Central Europe reported an agency.

Almost half (46%) of countries had formal training for physicians in clinical trial conduct (Table 10.2). Of the 53 countries with formal training, 21 (40%) made it mandatory. Formal training was more widely available (up to 66%) and much more likely to be mandatory (up to 54%) in higher-income groups. Both countries in North America and most in North & East Asia, Western Europe, Latin America, and Oceania & South East Asia had

Figure 10.8 | Presence of a national agency for funding clinical trials, by World Bank income group

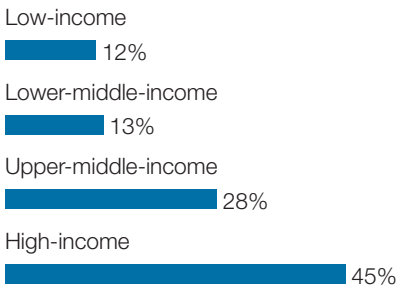


Table 10.2 | Availability of training programs in clinical trials
Countries with specified status of formal training in clinical trial conduct

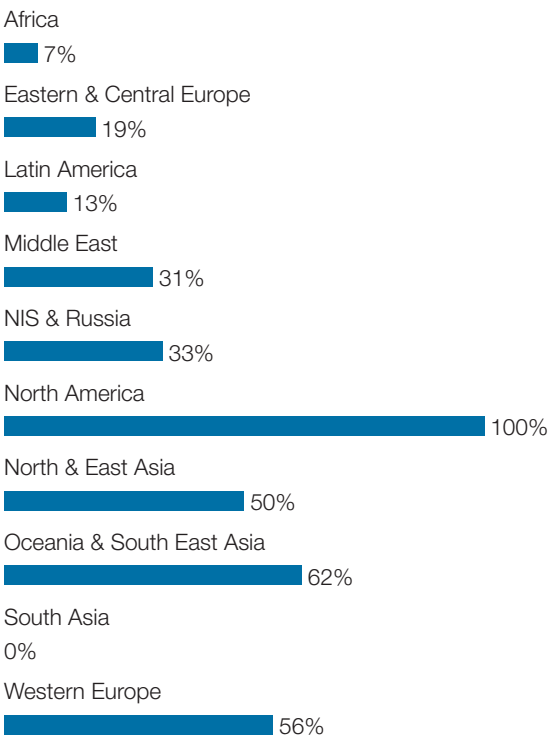
	Formal training for physicians is available N (%)	Formal training for physicians is mandatory N (%)[1]	Formal training for non-physicians/ research assistants and associates is available N (%)	Formal training for non-physicians/ research assistants and associates is mandatory N (%)[2]
Overall	**53 (46)**	**21 (40)**	**39 (34)**	**23 (61)**
ISN regions				
Africa	8 (27)	0 (0)	4 (13)	1 (25)
Eastern & Central Europe	8 (50)	5 (63)	6 (38)	4 (67)
Latin America	11 (69)	5 (45)	6 (38)	5 (83)
Middle East	2 (15)	1 (50)	4 (31)	0 (0)
NIS & Russia	3 (50)	2 (67)	2 (33)	2 (100)
North America	2 (100)	0 (0)	2 (100)	1 (50)
North & East Asia	5 (83)	2 (40)	3 (50)	3 (100)
Oceania & South East Asia	8 (62)	2 (25)	5 (38)	2 (40)
South Asia	0 (0)	0 (0)	1 (20)	5 (83)
Western Europe	6 (67)	4 (67)	6 (67)	0 (0)
World Bank income groups				
Low-income	3 (18)	0 (0)	1 (6)	0 (0)
Lower-middle-income	12 (38)	4 (33)	8 (25)	4 (57)
Upper-middle-income	13 (45)	7 (54)	10 (34)	6 (60)
High-income	25 (66)	10 (40)	20 (53)	13 (65)

1 Percentages are calculated relative to the number of countries where such training for physicians is available.
2 Percentages are calculated relative to the number of countries where such training for non-physicians is available.

formal training. Mandatory participation for physicians varied across regions (Table 10.2). At least half of programs in Eastern & Central Europe, the Middle East, NIS & Russia, and Western Europe were mandatory. None of the programs in Africa or North America were mandatory.

Formal training programs for non-physicians or research assistants/associates in clinical trials were fewer (34%) than for physicians (Table 10.2). Existence of a formal training program increased with income level, being most common in the high-income group (53%). Of the 39 countries with formal training for non-physicians, 23 (61%) required the training. Such training was mandatory in at least half of the countries in the high-, upper-middle-, and lower-middle-income groups, but in none of the low-income countries. Where training programs for non-physicians existed, at least half were mandatory in Eastern & Central Europe, Latin America, NIS & Russia, North America, North & East Asia, and South Asia (Table 10.2).

Figure 10.9 | Presence of a national agency for funding clinical trials, by ISN region



Of the 116 countries responding to the question about biobanking, nearly half (45%) had facilities.This varied widely with income level, from 6% in the low-income group to 79% in the high-income group. Both countries (100%) in North America and more than 80% of those in Western Europe and North & East Asia had facilities.

Overall, capacity for storing clinical trial medications was moderate across countries (Figure 10.10). Only 32% of countries reported that most or all study medications could be stored.

Overall, lower-income countries had less (or unknown) capacity for storing clinical trial medications, compared to higher-income countries (Figure 10.11). Countries in Eastern & Central Europe, Western Europe, North America, and North & East Asia reported higher capacities relative to other ISN regions (Figure 10.12).

Capacity for renal clinical trials

Fifteen per cent of all countries did not participate in clinical trials on kidney disease. Over half of countries participated in phase 3 (62%), phase 4 (63%), and health service delivery trials (68%). Less than half participated in phase 1 (33%) and phase 2 trials (46%) on kidney disease (Figure 10.13).

Few countries in Africa, Eastern & Central Europe, Latin America, the Middle East, and NIS & Russia participated in phase 1 trials. Low-income countries had lower participation in clinical trials (Figure 10.14). Two low-income countries participated in phase 1 research and no low-

Figure 10.10 | Capacity to store clinical trial medications

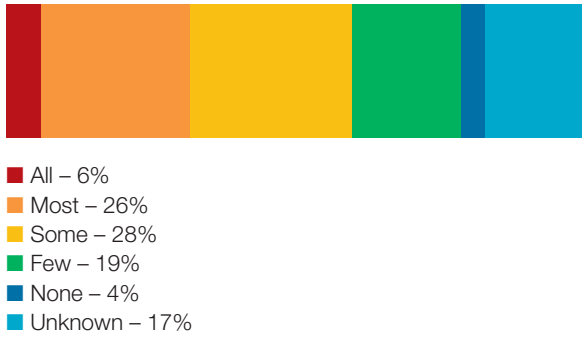


Figure 10.11 | Capacity to store clinical trial medications, by World Bank income group

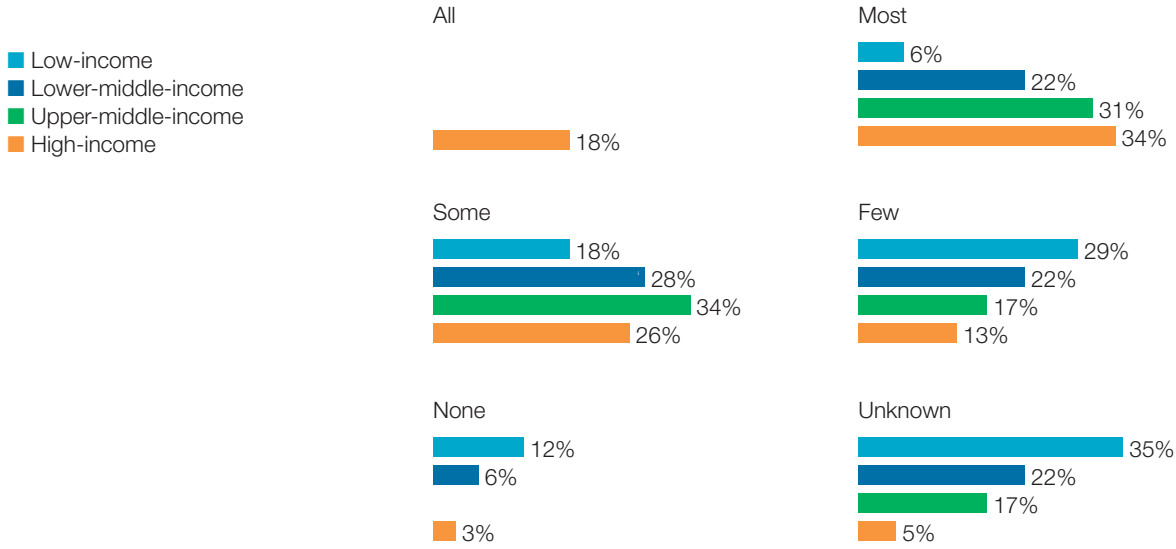
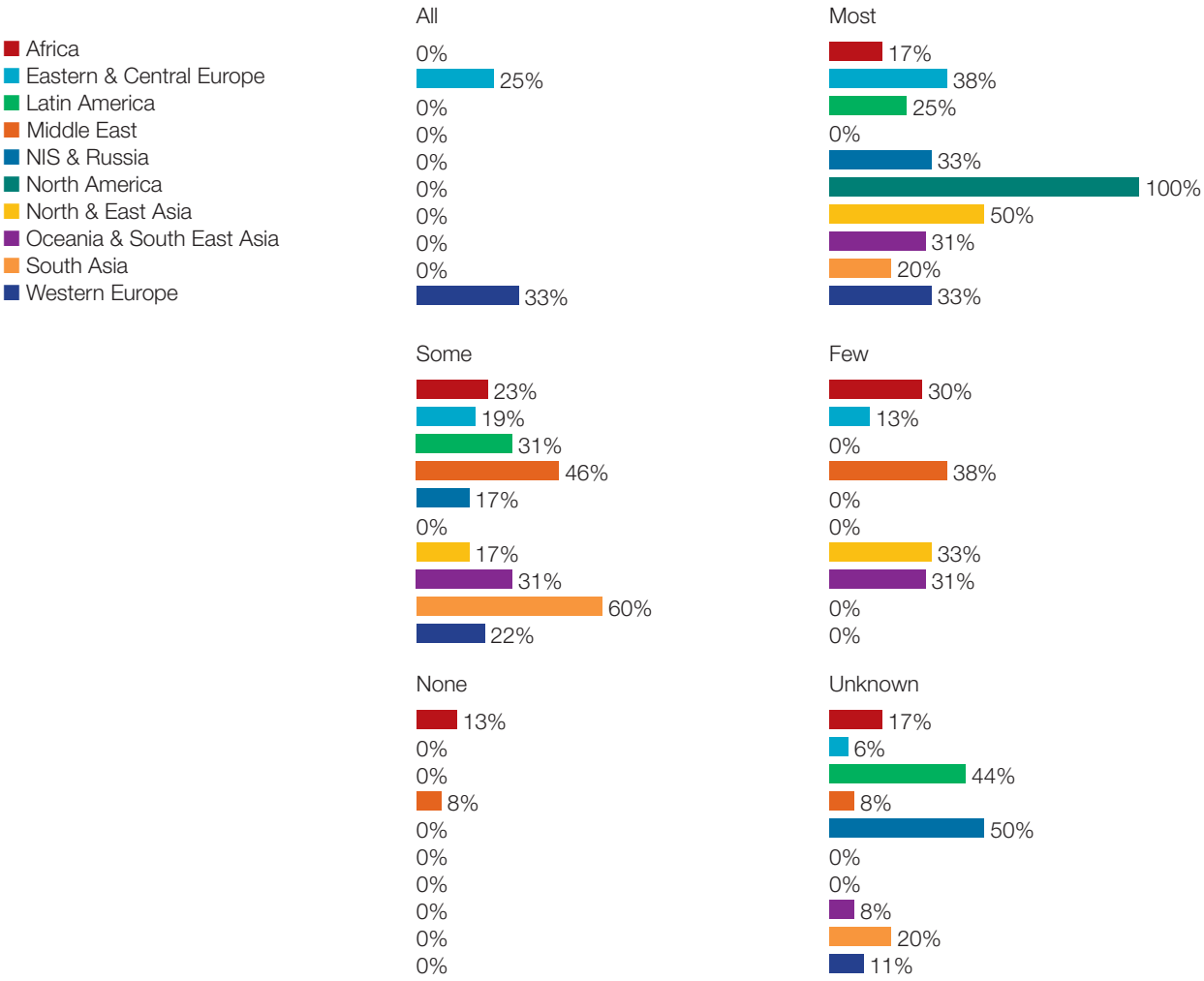


Figure 10.12 | Capacity to store clinical trial medications, by ISN region



income countries participated in phases 2, 3, or 4. However, low-income countries reported the highest proportion of health service delivery trials, compared to the other income groups. Health service delivery trials had participation from a majority of countries in all ISN regions except Eastern & Central Europe, NIS & Russia, and South Asia (Figure 10.15). Few countries in Africa participated in any other phase of clinical trials.

Figure 10.13 | Renal clinical trial participation

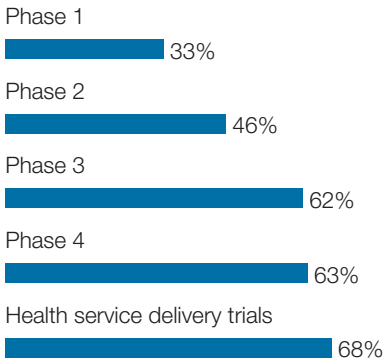


Figure 10.14 | Renal clinical trial participation, by World Bank income group

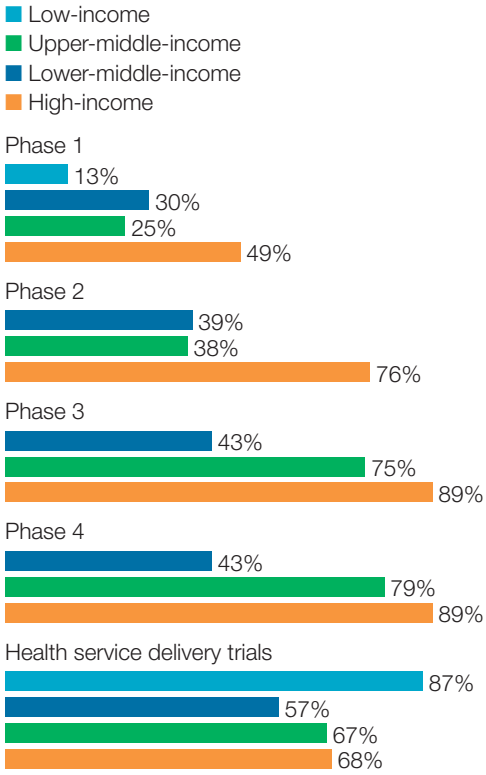
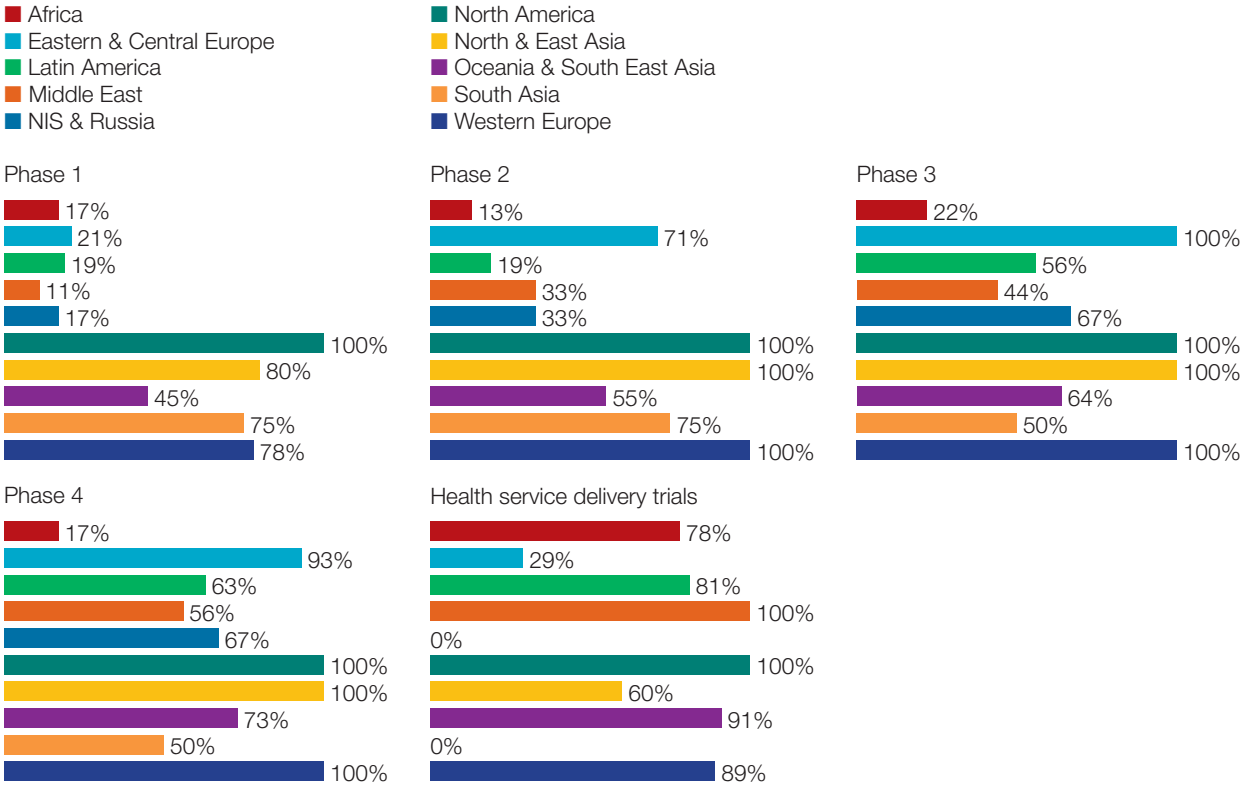


Figure 10.15 | Renal clinical trial participation, by ISN region



High-income countires reported the highest participation across phases 1–4 of clinical research. Both countries in North America participated in all phases of research.

Almost half (47%) of all countries had academic centres that coordinated and monitor sites involved in renal clinical trials. The proportion of countries that had a centre was higher in high- (63%) and upper-middle-income countries (62%) compared to lower-middle- (34%) and low-income countries (12%) (Figure 10.16).

All countries in North America and North & East Asia and more than half in Western Europe, Eastern & Central Europe, South Asia, and Oceania & South East Asia had an academic centre for conducting renal clinical trials (Figure 10.17).

10.3.2 Observational cohort studies

A large majority (85%) of countries stated they had the capacity to conduct observational cohort studies (Table 10.3). While this was higher in high-income countries (95% for high-, 83% for upper-middle-, and 81% for lower-middle-income), the proportion of low-income countries that had the capacity for observational cohort studies was still quite high (76%). More than 80% of countries in all ISN regions except Eastern & Central Europe, the Middle East, and NIS & Russia had workforce capacity for observational studies (Figure 10.18; Table 10.3).

Although 99 countries had a capacity to conduct observational studies, only 56 had funding (Table 10.3). The proportion of countries with funding was much higher in high-income countries (76%) than in upper-middle-, lower-middle-, or low-income countries (between 29% and 38%). More than 60% of countries in North America, North & East Asia, South Asia, and Western Europe had funding (Figure 10.18). Few countries in Africa, Eastern & Central Europe, Latin America, and NIS & Russia had funding. Overall, 53 countries were involved in any observational cohort studies in CKD; the proportion was higher in high-income countries (79%) than in upper-middle-, lower-middle-, or low-income countries (all under 35%). All countries in North America and North & East Asia, and most in Western Europe, participated in observational studies. Less than half of countries in Africa, Latin America, the Middle East, NIS & Russia, and South Asia participated in observational studies.

Figure 10.16 | Availability of academic centres for renal clinical trial management, by World Bank income group

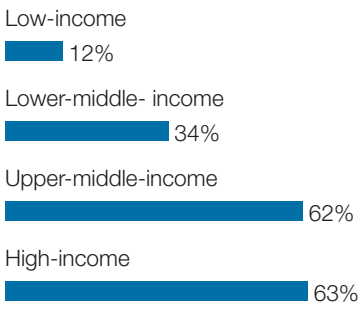


Figure 10.17 | Availability of academic centres for renal clinical trial management, by ISN region

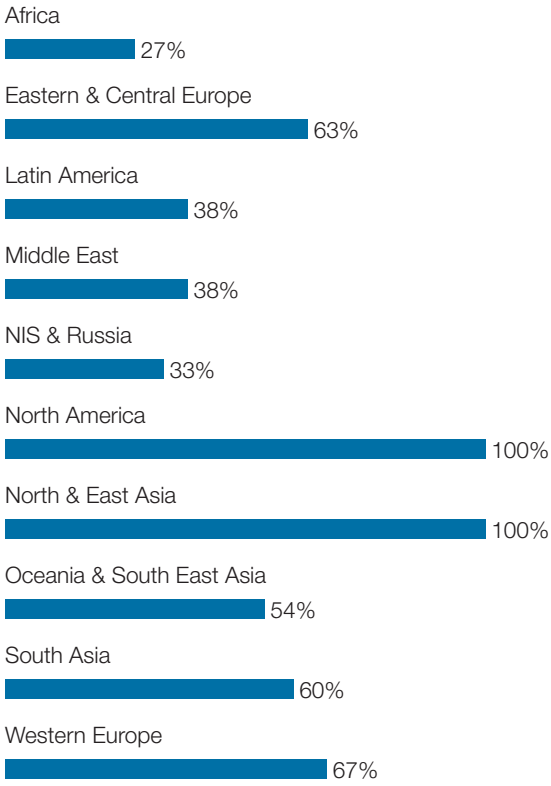


Figure 10.18 | Observational cohort studies for kidney disease, by ISN region

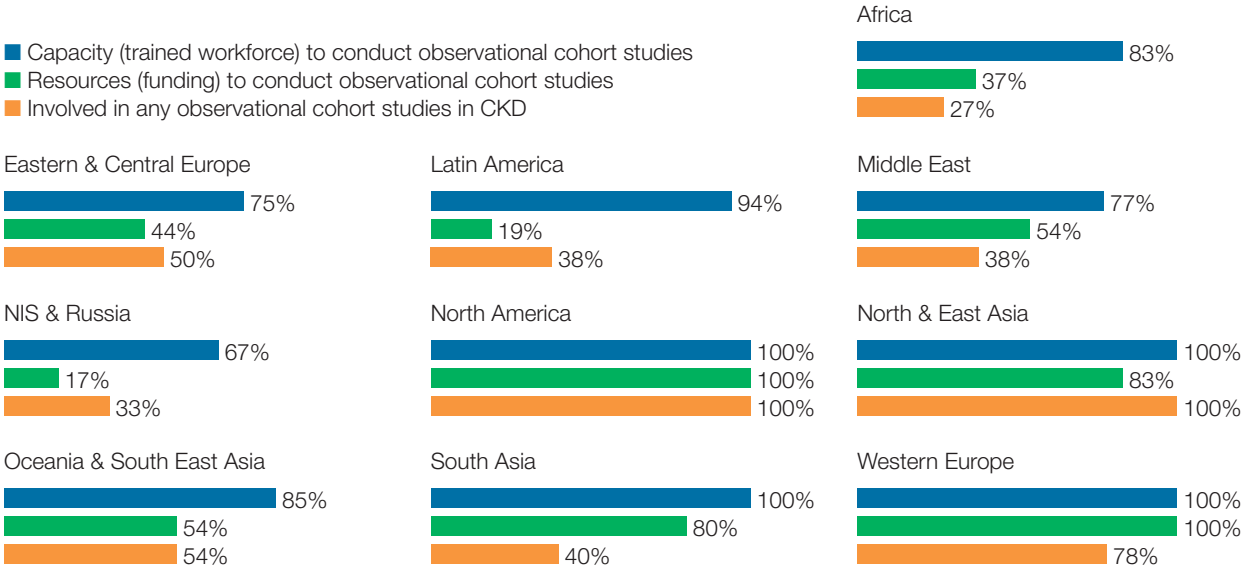


Table 10.3 | Capacity for and scope of observational cohort studies

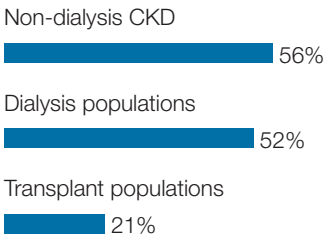
Countries meeting specified criteria

	Trained workforce to conduct observational cohort studies N (%)[1]	Funding to conduct observational cohort studies N (%)[1]	Involvement in any observational cohort studies in CKD N (%)[1]	Population studied in observational cohort studies		
				Non-dialysis CKD populations N (%)[2]	Dialysis populations N (%)[2]	Transplant populations N (%)[2]
Overall	**99 (85)**	**56 (48)**	**53 (46)**	**29 (56)**	**27 (52)**	**11 (21)**
ISN regions						
Africa	25 (83)	11 (37)	8 (27)	6 (75)	4 (50)	0 (0)
Eastern & Central Europe	12 (75)	7 (44)	8 (50)	3 (38)	3 (38)	2 (25)
Latin America	15 (94)	3 (19)	6 (38)	4 (67)	3 (50)	1 (17)
Middle East	10 (77)	7 (54)	5 (38)	1 (20)	5 (100)	0 (0)
NIS & Russia	4 (67)	1 (17)	2 (33)	0 (0)	1 (50)	1 (50)
North America	2 (100)	2 (100)	2 (100)	2 (100)	0 (0)	1 (50)
North & East Asia	6 (100)	5 (83)	6 (100)	6 (100)	3 (50)	1 (17)
Oceania & South East Asia	11 (85)	7 (54)	7 (54)	2 (29)	6 (86)	3 (43)
South Asia	5 (100)	4 (80)	2 (40)	1 (50)	0 (0)	1 (50)
Western Europe	9 (100)	9 (100)	7 (78)	4 (67)	2 (33)	1 (17)
World Bank income groups						
Low-income	13 (76)	5 (29)	3 (18)	2 (67)	1 (33)	1 (33)
Lower-middle-income	26 (81)	12 (38)	10 (31)	7 (70)	5 (50)	1 (10)
Upper-middle-income	24 (83)	10 (34)	10 (34)	6 (60)	6 (60)	1 (10)
High-income	36 (95)	29 (76)	30 (79)	14 (48)	15 (52)	8 (28)

1 Percentages are calculated relative to the corresponding total number of countries.

2 Percentages are calculated relative to the corresponding number of countries that were involved in observational cohort studies in CKD and responded to the question about areas of research.

Figure 10.19 | Kidney patient populations under observational study



Of the 53 countries that participated in observational studies in CKD, more than half studied non-dialysis CKD (56%) and dialysis patients (52%), and 21% studied transplant populations (Figure 10.19; Table 10.3). Non-dialysis CKD studies were most commonly conducted in Africa, Latin America, North America, North & East Asia, and Western Europe. Observational studies in dialysis patients were most commonly conducted in the Middle East and Oceania & South East Asia.

Half of countries in NIS & Russia, North America, and South Asia, and 43% of countries in Oceania & South East Asia conducted transplant observational studies; elsewhere, participation in transplant studies was quite low.

Ethics approval was mandatory for observational studies in most countries, across all regions of income and irrespective of ISN region (Table 10.4). The majority (62%) of ethics approvals were managed by an institutional regulatory agency. Thirty-nine per cent were overseen by a national body, and 12% by a regional body. Twelve per cent were managed by another regulatory agency.

Twenty per cent of countries stated that there were often challenges in getting timely approvals. Thirty-three per cent reported "sometimes," and 25% "occasionally." Challenges were reported most often in South Asia, NIS & Russia, and the Middle East. North America reported the least challenge.

Table 10.4 | Ethics approval process for observational cohort studies in CKD
Countries meeting specified criteria for ethics approval of observational cohort studies

	Mandatory N (%)[1]	Responsible body			
		Institutional N (%)[2]	Regional N (%)[2]	National N (%)[2]	Other N (%)[2]
Overall	**106 (91)**	**66 (62)**	**13 (12)**	**41 (39)**	**13 (12)**
ISN regions					
Africa	26 (87)	11 (42)	4 (15)	12 (46)	3 (12)
Eastern & Central Europe	16 (100)	8 (50)	1 (6)	6 (38)	2 (13)
Latin America	15 (94)	12 (80)	1 (7)	5 (33)	3 (20)
Middle East	10 (77)	7 (70)	2 (20)	4 (40)	0 (0)
NIS & Russia	6 (100)	3 (50)	0 (0)	3 (50)	1 (17)
North America	2 (100)	2 (100)	1 (50)	0 (0)	0 (0)
North & East Asia	6 (100)	6 (100)	1 (17)	1 (17)	0 (0)
Oceania & South East Asia	12 (92)	8 (67)	0 (0)	6 (50)	2 (17)
South Asia	4 (80)	4 (100)	0 (0)	2 (50)	0 (0)
Western Europe	9 (100)	5 (56)	3 (33)	2 (22)	2 (22)
World Bank income groups					
Low-income	14 (82)	5 (36)	1 (7)	9 (64)	1 (7)
Lower-middle-income	27 (84)	18 (67)	2 (7)	9 (33)	4 (15)
Upper-middle-income	27 (93)	17 (63)	2 (7)	13 (48)	5 (19)
High-income	38 (100)	26 (68)	8 (21)	10 (26)	3 (8)

1 Percentages are calculated relative to the corresponding total number of countries.
2 Percentages are calculated relative to the corresponding number of countries where ethics approval for observational cohort studies in CKD is mandatory.

SECTION 11

DISCUSSION

11.1 Gaps in services and resources

This is the first initiative to assess global capacity for kidney care in terms of the key building blocks of a functional health system – and to evaluate the readiness of countries and regions to enhance such care. Some countries and regions reported significant gaps in their services, facilities, and workforce.

This information is helpful to identify inconsistencies of care across the globe and to further document the current status of kidney care as a means to monitor progress in future.

Irrespective of income level or ISN region, AKI and non-dialysis CKD appeared to receive less attention than ESRD. For example, the proportion of countries that reported an advocacy group for AKI at higher levels of government was less than half that for CKD. Similarly, both AKI and non-dialysis CKD registries were far less common than those for dialysis or transplant patients. Most countries had access to CKD management and referral guidelines, yet less than half had access to AKI guidelines. Less than a quarter of countries identified an existing CKD detection program. Lastly, public funding for medications was less available, as were technologies to identify or prevent the progression of CKD, particularly in low-income countries.

Across most countries, renal pathologists, vascular access coordinators, dietitians, and nephrologists were identified as in short supply. Gaps in workforce capacity were notably higher in low-income countries. Awareness and adoption of both CKD and AKI guidelines among non-nephrologist physicians were low or moderate across all income groups and regions.

We identified major discrepancies between countries in the extent of care offered. Health infrastructure for both CKD and AKI were rated more poorly in low-income countries than in those at a higher income level. Nephrologist density was much lower in low-income countries, and general workforce shortages were more common in low-income countries. No low-income countries reported a general availability of eGFR testing through primary care, and pathology services at any level of care were limited. Low-income countries had less capacity for and lower participation in kidney disease research than did countries at higher income levels, and were less able to estimate CKD prevalence.

Key implications of these findings are discussed below based on the six WHO UHC Domains covered on the survey.

11.2 Implications

11.2.1 Health finance and service delivery

Almost half (43%) of countries funded healthcare publicly, either with no fees at the point of delivery, or with some fees. Nearly half (44%) funded healthcare through a mix of public and private sources. Just over half (59%) of countries that had publicly funded systems included all residents in their public coverage.

Only 35% of countries funded all aspects of kidney care. The aspects most commonly excluded from coverage were related to detection and early management of CKD. Early detection in at-risk individuals was excluded from coverage by the most countries (52%), followed by early or general management to reduce the risk of progression (42%–43%) and management of CKD complications (40%). Considering the importance of prevention and delaying progression to ESRD, coverage of these aspects of care should be increased; doing so would benefit both patients and the healthcare system by averting costs associated with treating more severe cases of kidney disease.

Coverage of care for dialysis and kidney transplant patients was most often publicly funded, whereas coverage for non-dialysis CKD and AKI was slightly more through a mix of public and private. While coverage for dialysis and transplantation is very necessary for managing kidney disease, further efforts could be made to support non-dialysis and AKI patients to prevent the progression or development of kidney disease.

Nearly all (94%) countries reported some form of direction regarding kidney disease care. Most countries either reported direction by a national body (66%) or by individual hospitals, trusts, or organizations (51%). Of the countries that had no organized system, none were in the high-income group. For countries with limited resources, international standards or guidelines may help provide direction until national bodies have been developed.

Health infrastructure for CKD was rated as good or above average by the majority of high-income countries, and excellent by nearly a quarter. Lower-income countries reported poorer health infrastructure for CKD. Health infrastructure for AKI was similar. Unsurprisingly, the high-income groups also reported better infrastructure for AKI than did lower-income groups. This may suggest that infrastructure may be a barrier to care in lower-income countries; however, infrastructure may not be as limiting as workforce capacity and leadership and governance, which were rated low among low-income countries.

11.2.2 Health workforce

Not surprisingly, nephrologists were primarily responsible in most countries for both CKD and AKI. Primary care physicians had more responsibility for CKD than for AKI: 64% of countries reported PCPs primarily responsible for CKD and 35% for AKI, respectively. Intensive care specialists were primarily responsible for AKI in 75% of countries, typically because AKI is an acute condition often treated in hospital. Only ~45% of low-income countries reported that intensive care specialists were primarily responsible for AKI, compared to ~90% of high-income countries. This discrepancy may be due to a general shortage of intensive care specialists in low-income countries.

The mean density of nephrologists was 8.83 PMP (number per million population). Nephrologist density varied strongly with national income, from 28.52 PMP in the high-income group to 0.31 PMP in the low-income group. The appropriate number of nephrologists in a country depends on many factors including need, priority, and resources; as such, there is no global standard with respect to nephrologist density. Regardless, the density in low-income countries suggests a shortage of nephrologists, which is problematic, as nephrologists are essential to provide leadership, and a lack of

them had negative consequences for policy and practice. Notably, the role of a nephrologist may differ depending on how the healthcare system is structured. In some regions, kidney disease care was managed by both PCPs and nephrologists, whereas other regions depended primary on nephrologists. Lastly, density in itself does not indicate the quality of care or adequacy of the provider.

Similar findings were observed for nephrology trainees. The mean density of nephrology trainees was 1.87 PMP overall and was more than 30-fold higher in the high-income group than the low-income group (6.03 vs. 0.18 PMP). Seventy-nine per cent of countries had a nephrology training program, and the proportion was much higher in the high-income group (97%) than in the low-income group (35%). The large majority (86%) of programs were 2 to 4 years in length. Most (56%) were structured following completion of a general medicine degree. Again for nephrology trainees, the data collected did not indicate the quality of the program.

The most common provider shortages overall were renal pathologists (86%), vascular access coordinators (81%), dietitians (78%), and nephrologists (74%). Shortages were more common in low-income countries than in high-income countries except for social workers, NPs, and PCPs, for which the shortages were similar across income groups. (~40%–50%). Shortages of pathologists can greatly limit proper diagnosis and treatment of primary renal diseases. However, health technologies enable pathologists in developed regions to offer support remotely via telehealth, which could reduce this barrier in low- and lower-middle-income countries. Time and resources for training should be considered when allocating roles or tasks to providers across settings. For example, given that nephrologists are in short supply across most countries, delegating tasks to members of other disciplines (e.g., nurses, PCPs, social workers, and pharmacists) may address some of the identified limitations and furthermore promote the adoption of MDTs and collaborative practice. Moreover, in interpreting these discrepancies it is important to recognize that no standard metrics exist to indicate what provider supply is needed for a given population. Thus, reported differences in perceived workforce shortages may reflect discrepancies in how countries identify a short supply as well as objective shortages.

11.2.3 Essential medicines and technologies

Nearly all countries, irrespective of income level, offered measurement of blood pressure and height and weight at the primary level, although almost one-quarter of low-income countries and 21% of lower-middle-income countries reported not measuring height and weight. Fewer services specifically targeted toward preventing CKD were available.

There were serious deficiencies in laboratory diagnostic services available through primary care. Measurements of cholesterol and HbA1c were all minimally available in low-income countries (18% and 6%), which may limit efforts to prevent the development or progression of CKD. No low-income countries measured serum creatinine and estimated GFR, and only 35% measured serum creatinine without eGFR. While these services had greater availability in high-income countries (68% and 71%, respectively), less than three-quarters of countries offered the tests. Less than half (41%) of low-income countries offered qualitative urinalysis, and none offered quantitative urinalysis. Similarly, no low-income countries offered UACR or UPCR.

As expected, radiology and pathology services were less available through primary care (46% and 10%, respectively). Nearly all (95%) countries offered radiology through secondary care, but only 63% offered pathology through secondary care: from 12% of low-income countries to 97% of high-income countries. A lack of pathology services in low-income countries is problematic because fewer cases of CKD may be properly diagnosed.

Chronic HD was available in all countries. Chronic PD was available in 100% of high-income countries, but in only 29% of low-income countries. Acute HD was also available in almost all (98%) countries, but acute PD was available in only 61% of countries overall, and in only 18% of low-income countries. Transplantation was available in 100% of high-income countries but in only 12% of low-income countries.

Most countries funded RRT services through government. Just over half (54%) of countries funded chronic HD publicly, and 35% funded it through a mix of public and private sources. Similarly, 58% and 35% of countries funded acute HD through government and a mix, respectively. Sixty-three per cent of countries funded chronic PD through government, and 29% used a mixed funding model of private and public sources, and the proportions for these funding models were similar for acute PD. Of countries that offered transplantation, 60% funded it through government, and 30% used a mixed funding model. While more than half of all countries funded RRT through government, many (mainly low-income) countries used a mixed model or private sources, which could be a potential barrier for patients. When funding models for RRT were compared across ISN regions or World Bank income groups, the structures appeared to vary according to income level: generally speaking, higher-income countries provided more funding through government and lower-income countries varied between government, private, and mixed sources.

Funding of medications of CKD patients was covered by government somewhat less often than was RRT. Thirty-eight per cent of countries publicly funded medications of CKD patients, and 43% used a mixed model. Nearly half of countries publicly funded medications of dialysis patients (47%) and medications of transplant patients (49%). Overall, the lower coverage of medications of CKD patients relative to those for ESRD patients could be a barrier to preventing the progression of CKD to ESRD.

11.2.4 Health information systems

Most countries (64%) had a registry for dialysis, and 58% had a registry for transplantation. Very few had a registry for CKD not requiring dialysis (8%) and AKI (7%). This is expected, in that patients undergoing dialysis and transplantation are typically entered into a system for resource management and thus are more traceable than patients with CKD, who may be primarily treated by a family doctor, or AKI patients who may not receive dialysis or care requiring tracking for resource allocation purposes. However, increasing the capture of information for these patients is critical for understanding whether the incidence of CKD and AKI is changing over time, and for better managing cases and predicting future resource requirements.

Nearly two-thirds of countries (62%) were able to estimate the prevalence of CKD; this capacity was much higher in high-income countries (68%) than in low-income countries (18%). Difficulty collecting epidemiological information on CKD in low-income countries is likely due to a combination of both resource and nephrologist limitations.

Fewer countries were able to estimate the prevalence of AKI than that of CKD. Only 19% of countries could estimate the prevalence of AKI not requiring dialysis, and 41% of countries could estimate the prevalence of AKI requiring dialysis. Capacity to estimate the incidence of AKI of either severity was closely comparable.

Less than a quarter (24%) of countries reported a current CKD detection program, much more common in high-income (32%) than low-income (6%) countries. Detection programs for CKD are essential for identifying and preventing the progression of kidney disease, and more efforts should be placed to increasing these programs, particularly in low-income countries. Better understanding of what factors may impede detection programs in low-income countries, for example, awareness or access to services, will help in developing strategies to increase the implementation of such programs.

11.2.5 Leadership and governance

In only 36% of countries did the government recognize CKD as a health priority. A lack of priority could represent a lack of awareness or the precedence of other political issues. Also, the definition of health priority differs across countries: in some regions it could represent a focus on prevention, whereas elsewhere it could refer to increasing access to treatment. One caution is that priority does not in itself translate into effective action.

Nearly half (42%) of countries reported an advocacy group at higher levels of government or NGOs for CKD; however, only 19% of countries reported a group for AKI. The lesser attention to AKI advocacy has been recognized, and as such, the ISN launched the "0by25" initiative in 2013, which strives to eliminate all preventable deaths from AKI worldwide by 2025. By disseminating this strategy, the ISN hopes to increase advocacy for AKI and awareness of the importance of its prevention.

Both CKD and AKI advocacy groups were more common in low-income countries than high-income; however, details regarding these groups' actions or roles were not captured. More than half (53%) of countries had national or regional physician- (or patient-) oriented organizations that provided resources for CKD management. These organizations were more common in high-income (66%) than low-income countries (29%).

Fifty-nine per cent of countries had a completed national strategy or policy for chronic NCDs, and 18% had one under development. Twenty-three per cent of countries did not have any policies or strategies. Specific to kidney disease, 17% had a national strategy for non-dialysis CKD, 43% had a strategy for chronic dialysis, and 40% had one for kidney transplantation. A focus on earlier stages of kidney disease may significantly affect patient care and costs, and thus strengthening the direction and standardization of care for these patients is critical. Overall, national strategies were uncommon, particularly in low-income countries. Because of their importance for providing consistent high-quality and safe care, and additionally for standardizing metrics for evaluating quality and outcomes of care, such strategies should be given more attention.

Seventy-nine per cent of countries had CKD management and referral guidelines, whereas only 53% had AKI management and referral guidelines. This difference likely reflects the greater strength and persistence of CKD advocacy. The perceived public-health importance of CKD is enhanced by its association with other conditions such as diabetes and high blood pressure, whereas AKI tends to be a hospital-based condition and often is not recognized as the primary focus. For both CKD and AKI, the proportion of low-income countries reporting no guidelines was greater than in the high-income group.

Awareness and adoption of both CKD and AKI guidelines were generally low among non-nephrologist physicians. This may be reflected in a similarly low reported level of awareness of CKD in general among non-nephrologist physicians. The reasons for non-nephrologist physicians' levels of awareness and adoption of CKD guidelines need to be better understood to help facilitate guideline use. Even where national or regional guidelines do not exist, international guidelines should be accessible globally; if barriers such as language or access to the Internet are preventing the distribution or adoption of guidelines, these issues should be addressed. Because CKD guidelines often cover identification of CKD progression, referral, and risk factor management, wider adoption of guidelines by non-nephrologist physicians would improve the identification of early cases of CKD, thereby reducing unnecessary referrals, which are burdensome to patients and costly to the healthcare system. If guidelines are underused because of lack of time, it may be helpful to develop a condensed version of them for PCPs and other non-nephrologist providers.

Awareness and adoption of CKD guidelines among nephrologists were considerably higher

than among non-nephrologist physicians; however, it is of concern that awareness and adoption were lower in low-income countries. Barriers to CKD guidelines in these countries should be identified and mitigated.

11.2.6 Response

The top barriers to optimal kidney disease care (both general and related to RRT) were identified as being related to geography, physicians, and patients. For most countries, availability of nephrologists and the healthcare system were also considered major barriers to RRT, but not for kidney disease care generally. To mitigate patient-related barriers, we must first clarify whether these are related to, for example, financial reasons, poor access, or low motivation or education. Secondly, barriers related to physicians should also be explored to identify areas where other providers may be able to assist. The supply of nephrologists was identified as a barrier to RRT in most countries. Where possible, utilizing dialysis nurses or technologists to take on certain duties with respect to RRT may be a potential solution. The ISN is funding a nephrology-fellowship training program designed to increase the number of nephrologists in developing countries, which could help reduce nephrologist-related barriers to RRT. Barriers related to geography may sometimes be reduced or resolved through applications of telehealth or homecare.

Ensuring global representation of research for kidney disease is imperative. Only 27% of countries reported a national agency for funding clinical trials. Agencies were much more common in high-income countries (45%) than in low-income countries (12%). Specific to kidney disease, 15% of all countries did not participate in clinical trials on kidney disease. Overall, low-income countries had lower participation across all phases (1–4) of clinical trials.

Less than half (46%) of countries had formal training for physicians in clinical trial conduct, and even fewer (34%) countries had formal training for non-physicians or research assistants/associates in clinical trials. For both physician and non-physician training, programs were more common in the high-income group than in the low-income group, which may be both the cause and effect of lower participation in research.

Biobanks, which enable the storage of specimens for ongoing investigations, support countries' capacity for biomedical research. Less than half (45%) of countries reported biobank facilities, which were much more common in high-income countries (79%) than in low-income countries (6%). Further understanding of the barriers to biobanks may be useful for developing strategies to increase participation in this area of research.

Similarly, capacity for storing clinical trial medications was low across countries. Only 32% of countries reported that most or all study medications could be stored, and 17% did not know. Storing medications requires equipment, electricity, facilities, and other resources.

While 85% of countries had the capacity (trained workforce) to conduct observational cohort studies, far fewer (48% overall) had funding to conduct the studies, particularly in the low-income group. Regardless, 91% of countries had ethics approval for observational studies in CKD, 62% of which were managed by an institutional regulatory agency. Half (47%) of all countries had academic centres for coordinating and monitoring sites for renal clinical studies, which was much more common in high-income countries (63%) than low-income (12%). Initiatives targeted specifically toward funding research, for example the Clinical Research Program through the ISN, are essential for enhancing participation and commitment of marginalized countries in both clinical trials and observational studies for kidney disease research.

11.3 Limitations in national and regional capacity

Globally, the prevalence of CKD is 1 in every 10 people. This ranges from 7% in South Asia to over 12% in Latin America, Europe, East Asia, and the Middle East. Furthermore, CKD is associated with several other conditions, which together can have great impact on both patients and a healthcare system. Despite this, infectious diseases or other more common NCDs (CVDs, cancer, chronic respiratory diseases, and diabetes) may be given precedence over CKD for several reasons including higher prevalence, costs, awareness, and advocacy. Similarly, issues not related to specific health conditions—conflict or famine, for example—may be of higher priority. Even so, it is worth raising awareness of the impact of kidney disease on patients' quality of life, progression to other conditions, and the healthcare system. By sharing guidelines and information and suggesting low-cost therapeutic and preventative solutions, we may reduce the need for kidney care to compete with countries' other priorities.

Additionally, a lack of funding may be a major limiting factor for optimal kidney care delivery. Whether related to infrastructure, workforce, medications, or technology, shortages in resources undoubtedly reduce capacity for care. Most countries identified a shortage in healthcare providers, particularly dialysis nurses, and nearly three-quarters of countries identified a shortage in nephrologists. Furthermore, funding models for RRT and medications for kidney disease may limit care delivery. Out-of-pocket or health insurance may limit who can access treatment, which creates inequity and inevitably increases the cost of kidney disease management.

Optimizing the workforce by delegating workload appropriately and introducing international telehealth, whereby providers from higher-income countries may support lower-income countries, may help prevent the incidence or progression of kidney disease. Additionally, helping patients overcome financial barriers may further reduce the burden of kidney disease, which could result in cost savings to the healthcare system at large.

Overall, healthcare systems exhibited a stronger focus on treatment and management of kidney disease than on prevention. Less than a quarter of countries reported an active CKD detection program. Increasing efforts to identify patients before they are diagnosed with kidney failure will greatly benefit the healthcare system, especially in lower-income countries.

Lastly, a lack of consistency, both nationally and internationally, can limit the capacity for kidney care. While 59% of countries had a national NCD strategy in place, few had strategies specifically focused on kidney disease care. Awareness and adoption of CKD and AKI guidelines were low among non-nephrologist physicians, which can impact prevention of developing CKD or AKI. Standard guidelines facilitate the provision of consistent, high-quality evidence-based care and further provide benchmarks or goals for monitoring care over time.

11.4 Opportunities to build capacity

While competing priorities, limited resources, lack of attention to prevention, and lack of standardization may all impede kidney care, there are solutions.

Preventing both CKD and AKI is cost-effective and achievable through appropriate use of guidelines at a primary care level, ensuring patients have access to medications, and increasing advocacy[26],[46],[47]. Given that guidelines created for nephrologists may not be appropriate for PCPs or other non-nephrologist physicians, creating tailored guidelines may increase adoption among providers relevant to prevention. Delegation of duties from more specialized, resource-intensive providers to a primary care team (PCPs, nurses, community health extension workers, etc.) is another approach to providing cost-effective care to patients, particularly in developing nations. Furthermore, expanding care teams to include PCPs, nurses, pharmacists, and social workers, all of whom were in greater supply, may enhance the quality of care from both preventive and management perspectives. Furthermore, establishing guidelines on how to evaluate workforce shortages may lead toward more equitable workforce capacity in all regions.

Standardization may also build capacity so that optimal approaches to care delivery are documented and, furthermore, developed through input from multiple countries. In this way, lessons learned can be shared collectively and applied efficiently. Standardized practice guidelines and metrics for evaluation may also help track progress to learn which methods are resulting in optimal outcomes. Ongoing revision of guidelines to keep practice recommendations current is essential in maintaining their relevancy and fostering their adoption.

Good information systems help countries prepare for healthcare needs and better understand the health conditions they are aiming to prevent and manage. Registries are useful in predicting costs for RRT and can further track progress of preventing kidney disease over time, to better understand which approaches are most effective. Furthermore, global participation in research strengthens the generalizability of the resultant findings. Wide involvement in research enables strategies to be applicable to varying demographics and healthcare systems.

Patient awareness, access, and motivation together influence the effectiveness of care. Translating knowledge appropriately to patients may help them access information relevant to their needs and interests. Patients' engagement in their own care plans, and access to relevant information about their conditions may increase awareness and self-management. Patients may thus be more motivated to take on more responsibility in preventing the progression of CKD through lifestyle interventions (exercise, nutrition) and treatment adherence.

11.5 Recommendations

The desk research and survey yielded useful findings on the current status of kidney care across the globe, from which we identify key areas for future efforts.

Workforce shortage was identified as a significant limitation to optimal kidney care delivery. This is more germane for some key specialties such as renal pathologists, vascular access coordinators, dietitians, and nephrologists. A lack of national policy or standard of care or poor adoption of guidelines in primary care was also highlighted, which may hinder the prevention of CKD and may also lead to an inefficient use of resources through unnecessary referral. Similarly, other aspects of preventive care received less focus compared to management of CKD and RRT. Increasing the support for non-dialysis kidney disease patients may prevent or delay the progression to ESRD, thereby alleviating strain on healthcare professionals and saving on costs to the healthcare system. Lastly, ensuring equal participation in research and promoting use of registries across all types of kidney patients may bring several benefits.

In this section we describe each of these priorities and suggest remedial strategies.

Extend healthcare financing and services to reduce shortfalls in access to RRT

Several elements of kidney care were excluded from public coverage, particularly those related to detection and early management of CKD. Coverage of care for non-dialysis CKD and AKI was less than for RRT. Increasing funding for preventive kidney care, including medications of non-dialysis CKD patients, may reduce the need for RRT. Access to RRT is essential for patients with ESRD but may be limited in most low- and middle-income countries[26],[46],[47]. Such prevention of CKD and AKI to the extent possible, followed by sound identification and management practices for these conditions, can keep them from progressing to ESRD and thus reduce the number of patients requiring RRT, thereby lowering treatment-associated costs for the healthcare system and patients.

Increase capacity by addressing workforce shortages

A shortage of healthcare professionals was highlighted across most countries, particularly those in the low-income group. Density of nephrologists and nephrology trainees varied significantly across countries and regions; to better interpret this discrepancy, one must consider the local context, available resources, and development index. A universal benchmark for the density of nephrologists and other healthcare providers would be challenging to develop because differences in resources, demand, awareness, and overall healthcare systems would influence the number of personnel needed for a given population. Given that training and costs associated with increasing the availability of workers vary by specialty, delegating work where possible that is appropriate for care and available resources may increase workforce in a cost-effective manner. For example, dialysis technologists could adopt certain aspects of work from dialysis nurses, or healthcare extension workers could support prevention at a primary care level. Primary care physicians, social workers, health extension workers, and other members of an MDT had a much smaller role in kidney care than did nephrologists. Incorporating MDTs in delivering care for kidney disease patients may lessen the impact of shortages of nephrologists and dialysis nurses.

Enhance consistency of care through national strategies and guidelines

In few countries did the government recognize CKD as a health priority. Less than half reported an advocacy group for CKD and even fewer reported one for AKI. Advocacy at an international, regional, and national level is needed around the globe to

enhance access to dialysis and transplantation, as well as CKD and AKI prevention efforts[26],[46],[48]. Many countries reported a national strategy for NCDs, but CKD care was included in only a portion of these strategies (27% for non-dialysis CKD, 12% for chronic dialysis, and 7% for transplant). Less than half of countries had national strategies specific to kidney care, the least common in non-dialysis CKD (17%). More than three-quarters of countries did have management and referral guidelines for CKD, but the adoption of these guidelines among non-nephrologist physicians, particularly PCPs, was low. Leadership and governance for AKI care were less developed than for CKD care. More than half of countries had no strategies for AKI. Because AKI is a risk factor for CKD and can lead to costly and grave health effects on patients, more focus on preventing and appropriately managing AKI is warranted.

Increase support for prevention

Similarly, other aspects of preventing CKD could be expanded to improve kidney care. Primary care physicians, MDTs, and health extension workers played a smaller role in CKD and AKI care compared to nephrologists. While this is expected to a degree, an increased role of kidney care at the primary care level may prevent the incidence or progression of CKD, alleviating some of the burden on nephrologists, whose numbers limit care in many countries. Furthermore, increasing the number of non-dialysis CKD registries would place more emphasis on preventing the progression of kidney disease and on learning more about earlier stages of kidney disease. Similarly, AKI registries would help improve planning for resource allocation including workforce demand, as AKI can lead to CKD.

Enhance knowledge by facilitating equitable participation in research

Few countries, particularly those of low income, had a national agency for funding clinical trials. Most countries participated in health service delivery trials, but few reported capacity for phase 1 and 2. Low-income countries had low participation in all phases of clinical research but reported the highest participation in health services delivery trials. The capacity in observational cohort studies was much higher, across all income levels; however, funding was a limitation and, as such, less than half of countries could actually participate in studies. Academic institutions for overseeing research in kidney disease were common in upper-middle- and high-income countries, but limited in lower-income countries, possibly resulting in the discrepancy in participation in kidney research. Enhancing involvement in research in lower-income countries through funding research programs and coordinating academic centres may lead to a more representative understanding of kidney disease across the globe.

11.6 Conclusion

This survey demonstrated significant inter- and intra-regional variability in the current capacity for kidney care across the world. Significant gaps in services, facilities, and workforce were identified in many countries and regions.

The findings have implications for policy development towards establishment of robust kidney care programs, particularly for low- and middle-income countries. Low-income countries require a comprehensive approach spanning all components of the health system. Basic infrastructure must be strengthened at the primary care level for early detection and management of CKD and AKI. To maximize effectiveness of early CKD management and reduce risk of adverse health outcomes, access to essential medications should be assured, as should sustainable RRT provision. Health information systems (CKD and AKI registries) are needed for robust information on the burden of these diseases, and their clinical outcomes.

The findings reported in this Atlas are vital for advocacy among governmental and non-governmental stakeholders to help countries improve the quality of kidney care. Its baseline measures of where countries and regions stand with respect to each domain of the health system allow the monitoring of progress over time. Furthermore, by identifying region-specific limitations and barriers, the Atlas helps to target strategic efforts applicable to each context. Finally, sharing this knowledge across regions will help reduce global inequities in healthcare.

11.7 Future Work

Next steps to enhance kidney care delivery are to focus on prevention through creating and disseminating guidelines on both CKD and AKI that are accessible and relevant to their intended audience, particularly PCPs or other non-nephrologist physicians.

Furthermore, increasing appropriate services at the primary care level (for example, measuring creatinine) and enhancing the use of MDTs may help prevent the progression of kidney disease. More active CKD detection programs will further identify patients before they develop ESRD, resulting in significant cost savings to the healthcare system and patients.

Increasing information collection through registries is needed in order to predict the burden of disease and allocate resources appropriately. Furthermore, equitable participation in research across the globe will further our understanding of kidney disease and care delivery.

Lastly, advocacy groups at higher levels of government are needed to raise awareness and ensure support for optimal kidney care.

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APPENDICES

APPENDIX 1

SURVEY RESPONSE

A total of 124 UN Member States responded to the survey, comprising 93% of the world population with adequate representation based on number of countries and population size across regions (Table A1.1).

The affiliations of survey respondents were: nephrologists (76%), non-nephrologist physicians (4%), healthcare administrators/policymakers (11%), and others affiliated with kidney disease patient advocacy (9%) (Table A1.2).

Table A1.1 | Countries and population covered by survey responses

	Number of countries	Total population (millions)	Number of countries that completed survey	Total population of countries that completed survey (millions)
Overall	**200**	**7250**	**124**	**6754**
ISN regions				
Africa	54	1156	35	964
Eastern & Central Europe	20	209	17	199
Latin America & the Caribbean	25	608	16	560
Middle East	14	225	13	223
NIS & Russia	11	281	6	223
North America & the Caribbean	14	362	2	356
North & East Asia	7	1602	6	1577
Oceania & South East Asia	25	671	13	661
South Asia	8	1707	5	1673
Western Europe	22	429	11	318
World Bank income groups				
Low-income	31	631	18	405
Lower-middle-income	52	2862	34	2786
Upper-middle-income	53	2370	32	2293
High-income	63	1386	40	1270
Not classified	1	0.015	0	-

Table A1.2 | Disciplinary affiliation of survey respondents

	Nephrologists N (%)	Physicians (non-nephrologists) N (%)	Policymakers N (%)	Other N (%)
Overall	**246 (75)**	**14 (4)**	**37 (11)**	**29 (9)**
ISN regions				
Africa	42 (65)	6 (9)	8 (12)	9 (14)
Eastern & Central Europe	26 (90)	1 (3)	1 (3)	1 (3)
Latin America & the Caribbean	49 (88)	1 (2)	3 (5)	3 (5)
Middle East	29 (69)	2 (5)	8 (19)	3 (7)
NIS & Russia	7 (54)	0 (0)	5 (38)	1 (8)
North America & the Caribbean	6 (86)	0 (0)	0 (0)	1 (14)
North & East Asia	29 (88)	0 (0)	2 (6)	2 (6)
Oceania & South East Asia	31 (72)	2 (5)	6 (14)	4 (9)
South Asia	10 (67)	1 (7)	3 (20)	1 (7)
Western Europe	17 (74)	1 (4)	1 (4)	4 (17)
World Bank income groups				
Low-income	22 (69)	4 (13)	3 (9)	3 (9)
Lower-middle-income	50 (66)	5 (7)	14 (18)	7 (9)
Upper-middle-income	76 (81)	4 (4)	8 (9)	6 (6)
High-income	98 (79)	1 (1)	12 (10)	13 (10)

APPENDIX 2
LIST OF COUNTRIES

Table A2.1 | List of countries by ISN region and World Bank income group
Countries that participated in the survey are highlighted.

Country	ISN Region	Income Group
Afghanistan	South Asia	Low-income
Albania	Eastern & Central Europe	Upper-middle-income
Algeria	Africa	Upper-middle-income
American Samoa	Oceania & South East Asia	Upper-middle-income
Andorra	Western Europe	High-income
Angola	Africa	Upper-middle-income
Anguilla	Latin America & the Caribbean	Not classified
Antigua and Barbuda	North America & the Caribbean	High-income
Argentina	Latin America & the Caribbean	High-income
Armenia	NIS & Russia	Lower-middle-income
Aruba	North America & the Caribbean	High-income
Australia	Oceania & South East Asia	High-income
Austria	Western Europe	High-income
Azerbaijan	NIS & Russia	Upper-middle-income
Bahamas, The	North America & the Caribbean	High-income
Bahrain	Middle East	High-income
Bangladesh	South Asia	Lower-middle-income
Barbados	North America & the Caribbean	High-income
Belarus	NIS & Russia	Upper-middle-income
Belgium	Western Europe	High-income
Belize	Latin America & the Caribbean	Upper-middle-income
Benin	Africa	Low-income
Bermuda	North America & the Caribbean	High-income
Bhutan	South Asia	Lower-middle-income
Bolivia	Latin America & the Caribbean	Lower-middle-income
Bosnia and Herzegovina	Eastern & Central Europe	Upper-middle-income
Botswana	Africa	Upper-middle-income
Brazil	Latin America & the Caribbean	Upper-middle-income
Brunei Darussalam	Oceania & South East Asia	High-income
Bulgaria	Eastern & Central Europe	Upper-middle-income
Burkina Faso	Africa	Low-income
Burma	Oceania & South East Asia	Lower-middle-income
Burundi	Africa	Low-income
Cambodia	Oceania & South East Asia	Low-income
Cameroon	Africa	Lower-middle-income

Country	ISN Region	Income Group
Canada	North America & the Caribbean	High-income
Cape Verde	Africa	Lower-middle-income
Cayman Islands	North America & the Caribbean	High-income
Central African Republic	Africa	Low-income
Chad	Africa	Low-income
Chile	Latin America & the Caribbean	High-income
China	North & East Asia	Upper-middle-income
Colombia	Latin America & the Caribbean	Upper-middle-income
Comoros	Africa	Low-income
Congo, Republic of the	Africa	Lower-middle-income
Costa Rica	Latin America & the Caribbean	Upper-middle-income
Cote d'Ivoire	Africa	Lower-middle-income
Croatia	Eastern & Central Europe	High-income
Cuba	Latin America & the Caribbean	Upper-middle-income
Cyprus	Eastern & Central Europe	High-income
Czech Republic	Eastern & Central Europe	High-income
Democratic Republic of Congo	Africa	Low-income
Denmark	Western Europe	High-income
Djibouti	Africa	Lower-middle-income
Dominica	Latin America & the Caribbean	Upper-middle-income
Dominican Republic	Latin America & the Caribbean	Upper-middle-income
Ecuador	Latin America & the Caribbean	Upper-middle-income
Egypt	Africa	Lower-middle-income
El Salvador	Latin America & the Caribbean	Lower-middle-income
Equatorial Guinea	Africa	High-income
Eritrea	Africa	Low-income
Estonia	Eastern & Central Europe	High-income
Ethiopia	Africa	Low-income
Fiji	Oceania & South East Asia	Upper-middle-income
Finland	Western Europe	High-income
France	Western Europe	High-income
Micronesia, Federated States	Oceania & South East Asia	Lower-middle-income
Gabon	Africa	Upper-middle-income
Gambia, The	Africa	Low-income
Gaza	Middle East	Lower-middle-income
Georgia	NIS & Russia	Lower-middle-income
Germany	Western Europe	High-income
Ghana	Africa	Lower-middle-income
Greece	Western Europe	High-income
Grenada	North America & the Caribbean	Upper-middle-income
Guatemala	Latin America & the Caribbean	Lower-middle-income
Guinea	Africa	Low-income
Guinea Bissau	Africa	Low-income
Guyana	Latin America & the Caribbean	Lower-middle-income
Haiti	Latin America & the Caribbean	Low-income
Honduras	Latin America & the Caribbean	Lower-middle-income
Hong Kong	North and East Asia	High-income
Hungary	Eastern & Central Europe	High-income
Iceland	Western Europe	High-income

Country	ISN Region	Income Group
India	South Asia	Lower-middle-income
Indonesia	Oceania & South East Asia	Lower-middle-income
Iran	Middle East	Upper-middle-income
Iraq	Middle East	Upper-middle-income
Ireland	Western Europe	High-income
Israel	Western Europe	High-income
Italy	Western Europe	High-income
Jamaica	North America & the Caribbean	Upper-middle-income
Japan	North & East Asia	High-income
Jordan	Middle East	Upper-middle-income
Kazakhstan	NIS & Russia	Upper-middle-income
Kenya	Africa	Lower-middle-income
Kiribati	Oceania & South East Asia	Lower-middle-income
Korea, Democratic People's Republic of	North & East Asia	Low-income
Korea, South	North & East Asia	High-income
Kosovo	Eastern & Central Europe	Lower-middle-income
Kuwait	Middle East	High-income
Kyrgyzstan	NIS & Russia	Lower-middle-income
Laos	Oceania & South East Asia	Lower-middle-income
Latvia	Eastern & Central Europe	High-income
Lebanon	Middle East	Upper-middle-income
Lesotho	Africa	Lower-middle-income
Liberia	Africa	Low-income
Libya	Africa	Upper-middle-income
Lithuania	Eastern & Central Europe	High-income
Luxembourg	Western Europe	High-income
Macedonia	Eastern & Central Europe	Upper-middle-income
Madagascar	Africa	Low-income
Malawi	Africa	Low-income
Malaysia	Oceania & South East Asia	Upper-middle-income
Maldives	South Asia	Upper-middle-income
Mali	Africa	Low-income
Malta	Western Europe	High-income
Marshall Islands	Oceania & South East Asia	Upper-middle-income
Mauritania	Africa	Lower-middle-income
Mauritius	Africa	Upper-middle-income
Mexico	Latin America & the Caribbean	Upper-middle-income
Moldova	Eastern & Central Europe	Lower-middle-income
Mongolia	North & East Asia	Upper-middle-income
Montenegro	Eastern & Central Europe	Upper-middle-income
Morocco	Africa	Lower-middle-income
Mozambique	Africa	Low-income
Namibia	Africa	Upper-middle-income
Nepal	South Asia	Low-income
Netherlands	Western Europe	High-income
New Zealand	Oceania & South East Asia	High-income
Nicaragua	Latin America & the Caribbean	Lower-middle-income
Niger	Africa	Low-income
Nigeria	Africa	Lower-middle-income

Country	ISN Region	Income Group
Norway	Western Europe	High-income
Oman	Middle East	High-income
Pakistan	South Asia	Lower-middle-income
Palau	Oceania & South East Asia	Upper-middle-income
Panama	Latin America & the Caribbean	Upper-middle-income
Papua New Guinea	Oceania & South East Asia	Lower-middle-income
Paraguay	Latin America & the Caribbean	Upper-middle-income
Peru	Latin America & the Caribbean	Upper-middle-income
Philippines	Oceania & South East Asia	Lower-middle-income
Poland	Eastern & Central Europe	High-income
Portugal	Western Europe	High-income
Qatar	Middle East	High-income
Romania	Eastern & Central Europe	Upper-middle-income
Russia	NIS & Russia	High-income
Rwanda	Africa	Low-income
Samoa	Oceania & South East Asia	Lower-middle-income
San Marino	Western Europe	High-income
Sao Tome and Principe	Africa	Lower-middle-income
Saudi Arabia	Middle East	High-income
Senegal	Africa	Lower-middle-income
Serbia	Eastern & Central Europe	Upper-middle-income
Seychelles	Africa	High-income
Sierra Leone	Africa	Low-income
Singapore	Oceania & South East Asia	High-income
Slovakia	Eastern & Central Europe	High-income
Slovenia	Eastern & Central Europe	High-income
Solomon Islands	Oceania & South East Asia	Lower-middle-income
Somalia	Africa	Low-income
South Africa	Africa	Upper-middle-income
South Sudan	Africa	Low-income
Spain	Western Europe	High-income
Sri Lanka	South Asia	Lower-middle-income
St. Kitts and Nevis	North America & the Caribbean	High-income
St. Lucia	North America & the Caribbean	Upper-middle-income
St. Vincent and Grenadine	North America & the Caribbean	Upper-middle-income
Sudan	Africa	Lower-middle-income
Suriname	Latin America & the Caribbean	Upper-middle-income
Swaziland	Africa	Lower-middle-income
Sweden	Western Europe	High-income
Switzerland	Western Europe	High-income
Syria	Middle East	Lower-middle-income
Taiwan	North and East Asia	High-income
Tajikistan	NIS & Russia	Lower-middle-income
Tanzania	Africa	Low-income
Thailand	Oceania & South East Asia	Lower-middle-income
Timor Leste (East Timor)	Oceania & South East Asia	Lower-middle-income
Togo	Africa	Low-income
Tonga	Oceania & South East Asia	Upper-middle-income
Trinidad and Tobago	North America & the Caribbean	High-income

Country	ISN Region	Income Group
Tunisia	Africa	Upper-middle-income
Turkey	Eastern & Central Europe	Upper-middle-income
Turkmenistan	NIS & Russia	Upper-middle-income
Tuvalu	Oceania & South East Asia	Upper-middle-income
Uganda	Africa	Low-income
Ukraine	NIS & Russia	Lower-middle-income
United Arab Emirates	Middle East	High-income
United Kingdom	Western Europe	High-income
United States	North America & the Caribbean	High-income
Uruguay	Latin America & the Caribbean	High-income
Uzbekistan	NIS & Russia	Lower-middle-income
Vanuatu	Oceania & South East Asia	Lower-middle-income
Venezuela	Latin America & the Caribbean	High-income
Vietnam	Oceania & South East Asia	Lower-middle-income
West Bank	Middle East	Lower-middle-income
Yemen	Middle East	Lower-middle-income
Zambia	Africa	Lower-middle-income
Zimbabwe	Africa	Low-income

APPENDIX 3

GLOBAL KIDNEY HEALTH ATLAS (GKHA) QUESTIONNAIRE

Assessing country and regional profile for readiness, capacity and response to CKD and AKI

The International Society of Nephrology (ISN) plans to work collaboratively with existing organizations and initiatives at international and national levels – to promote early detection and effective treatment of kidney diseases in order to improve patient health and quality of life. Through understanding and potentially helping to shape relevant health policies, practices and infrastructure, ISN aims to facilitate the implementation of equitable and ethical care for kidney patients in all regions and countries of the world.

ISN intends to conduct a research exercise on the current status of care for kidney patients across all countries of the world. This project will determine the global status of CKD and AKI care structures and organization towards achieving universal health care (UHC), and devise policy implications for including CKD and AKI in the global health agenda.

This questionnaire is designed to address the 6 core areas which inform aspects of universal health coverage: health finance, health workforce, essential medications and health products access, health information systems and statistics, national health policy, and service delivery and safety as well as the response of nephrology community and capacity for research and development. Using this framework, we will be able to develop an appropriate global perspective on the state of kidney health and disease.

If you have any questions about completing the questionnaire please contact: Sandrine Damster (email: globalatlas@theisn.org).

Thank you for your involvement and readiness to participate.

Dr. Adeera Levin, MD, FRCPC, FACP
President, International Society of Nephrology

Questionnaire modules

Standardized questions to allow comparisons of country capacities and readiness based on WHO six domains of UHC, and responses (based on awareness, identified barriers and capacity for research and development in nephrology community)

Assessing capacity and readiness of nations for kidney care based on UHC domains

A HF, SDS Health finance, service delivery and safety
- Funding mechanism and availability
- Structure and organization of care delivery for CKD
- Structure and organization of care delivery for AKI

B HW Health workforce for nephrology care
- Essential workforce for CKD and AKI care

C EMHPA Essential medications and health product access
- Availability, coverage and access

D HISS Health information systems and statistics
- Databases, registries and surveillance systems

E NHP National health policy
- CKD policy, strategies and frameworks in the context of existing NCD programs
- AKI policy, strategies and frameworks

Assessing response of nephrology community (awareness, identified barriers and capacity for research and development)

F. CKD awareness and education

G. AKI awareness and education

H. Barriers to optimal kidney disease care

I. Capacity for research and development

Contact

Who is the focal person completing this survey?
Survey ID (optional):

Status? *Please tick all that apply.*
☐ Nephrologist
☐ Health professional (non-physician)
☐ Other (please specify)
☐ Non-nephrologist (physician)
☐ Administrator/policymaker

In which country do you reside?

ISN region?

City?

Assessing capacity and readiness of nations for kidney care

A. Health finance, service delivery and safety

A1. Description of the healthcare system

A.1.1. In general, what best describes your healthcare system?

- ☐ Publicly funded by government and free at the point of delivery
- ☐ Publicly funded by government but with some fees at the point of delivery
- ☐ A mix of publicly funded (whether or not publicly funded component is free at point of delivery) and private systems (please explain)
- ☐ Solely private and out-of-pocket
- ☐ Multiple systems –programs provided by government, nongovernmental organizations (NGOs), and communities

If a mix of publicly funded and private systems (please explain) or "Other" (please specify)

A.1.1.1. If your healthcare system is publicly funded (in whole or in part) is this coverage universal (ie: are all residents of your country eligible to participate)?

- ☐ Yes, all residents are included in the coverage
- ☐ No, not all residents are included (please provide details)

A.1.1.2. If your healthcare system is publicly funded (in whole or in part), which aspects of care are not included in the coverage? *Please tick all that apply.*

- ☐ Dialysis
- ☐ Transplantation
- ☐ Management of CKD complications (anemia, bone disease, malnutrition)
- ☐ Management to reduce the risk of CKD progression (risk factor control)
- ☐ Other (please specify)
- ☐ Early management to reduce risk of CKD progression (risk factor control)
- ☐ Early detection in individuals at risk
- ☐ Management of AKI
- ☐ None – all aspects funded

A.1.2. What best describes your healthcare system's coverage for care of patients with kidney disease (excluding medications)? *Please tick all that apply. For option 'a mix of publicly funded and private systems': 'publicly funded' is whether or not publicly funded component is free at point of delivery.*

	Publicly funded by government and free at the point of delivery	Publicly funded bygovernment but with some fees at the point of delivery	A mix of publicly funded and private systems	Solely private and out-of pocket	Solely private through health insurance providers
Non-dialysis CKD	☐	☐	☐	☐	☐
Dialysis	☐	☐	☐	☐	☐
Kidney transplantation	☐	☐	☐	☐	☐
AKI	☐	☐	☐	☐	☐

Other (please specify)

A.1.3. We are interested in understanding within-country variation in kidney care delivery as well as between-country variation. In your opinion, is there important variation in the way that kidney care is organized or delivered between different regions/states within your country?

☐ Yes (if possible, please provide brief details)

☐ No (please explain why)

A.2 Service delivery and safety: structure and organization of care delivery for CKD and AKI

A.2.1. What best describes the oversight/direction of kidney disease care in your country?
Please tick all that apply.

☐ Managed/overseen by a national body

☐ Managed/overseen by provincial/regional/state level authorities only

☐ Managed by individual hospitals/trusts/Organizations

☐ Other (please specify)

☐ Managed by non-governmental organizations (NGOs)

☐ No organized system

A.2.2. How would you rate the health infrastructure in your country, in terms of adequacy for providing CKD care?

☐ Extremely poor

☐ Poor/below average

☐ Fair/average

☐ Good/above average

☐ Excellent

A.2.3. How would you rate the health infrastructure in your country, in terms of adequacy for providing AKI care?

☐ Extremely poor

☐ Poor/below average

☐ Fair/average

☐ Good/above average

☐ Excellent

Data sources for Section A

We would like you to consult as many colleagues or sources of data as needed to provide the answers that best describe nephrology care in your country.

What is/are the sources for the data you provided above for Section A?

How certain are you of the answers you have provided for Section A?

☐ Very uncertain

☐ Uncertain

☐ Moderate

☐ Certain

☐ Very certain

B. Health workforce for nephrology care

B1. Existing workforce capacity

B.1.1. Who bears primary responsibility for the delivery of CKD care in your country?
Please tick all that apply.

- ☐ Nephrologists
- ☐ Primary care physicians
- ☐ Nurse practitioners or specialized nurses
- ☐ Other specialists? (please specify)
- ☐ Multidisciplinary teams
- ☐ Health officers/extension workers

B.1.2. Who bears primary responsibility for the delivery of AKI care in your country?
Please tick all that apply.

- ☐ Nephrologists
- ☐ Intensive care specialists
- ☐ Primary care physicians
- ☐ Nurse practitioners or specialized nurses
- ☐ Other specialists? (please specify)
- ☐ Health officers/extension workers
- ☐ Technicians

B.1.3. Approximately how many nephrologists are there in your country, and how many nephrology trainees?

Nephrologists:

Nephrology trainees:

B.1.4. In your opinion, is there a shortage of any of the following providers in your country?
Please tick all that apply.

- ☐ Nephrologists
- ☐ Dietitians
- ☐ Renal pathologists
- ☐ Laboratory technicians
- ☐ Social workers
- ☐ Pharmacists
- ☐ Vascular access coordinators
- ☐ Nurse practitioners
- ☐ Counselors/ psychologists
- ☐ Transplant coordinators
- ☐ Dialysis nurses
- ☐ Dialysis technicians
- ☐ General practitioners/ primary care physicians
- ☐ No shortage of any of the staff mentioned above

B2. Training capacity

B.2.1. Is there a nephrology training program in your country?

☐ Yes ☐ No

B.2.2. How long is the training in nephrology (years)?

☐ 1
☐ 2
☐ 3
☐ 4
☐ > 4

B.2.3. How is the training in nephrology structured?

☐ Following general internal medicine
☐ Solo training after basic qualification as medical doctor
☐ A mix of 1 & 2 depending on region and/or training centre
☐ Other (please specify)

Data sources for Section B

We would like you to consult as many colleagues or sources of data as needed to provide the answers that best describe nephrology care in your country.

What is/are the sources for the data you provided above for Section B?

How certain are you of the answers you have provided for Section B?

☐ Very uncertain
☐ Uncertain
☐ Moderate
☐ Certain
☐ Very certain

C. Essential medications and health products access

C1. Identification and Management of CKD

C.1.1. Indicate the availability of the following services for CKD monitoring and management at PRIMARY care level in your country:

	Always	Usually	Rarely	Never
Blood pressure measurement	☐	☐	☐	☐
Height and weight measures	☐	☐	☐	☐
Serum glucose measurement	☐	☐	☐	☐
HbA1C test	☐	☐	☐	☐
Serum cholesterol measurement	☐	☐	☐	☐
Serum creatinine measurement without automated eGFR reporting	☐	☐	☐	☐
Serum creatinine measurement with automated eGFR reporting	☐	☐	☐	☐
Urinalysis using test strips for albumin/protein (qualitative assays)	☐	☐	☐	☐
Urinalysis using test strips for albumin/protein (quantitative assays)	☐	☐	☐	☐
Urine albumin: creatinine ratio (ACR) or protein: creatinine ratio (PCR) measurements	☐	☐	☐	☐
Radiological services (eg: facilities for kidney ultrasound)	☐	☐	☐	☐
Pathology services (renal biopsy interpretation facilities)	☐	☐	☐	☐

C.1.2. Indicate the availability of the following services for CKD monitoring and management at SECONDARY OR TERTIARY care level in your country:

	Always	Usually	Rarely	Never
Blood pressure measurement	☐	☐	☐	☐
Height and weight measures	☐	☐	☐	☐
Serum glucose measurement	☐	☐	☐	☐
HbA1C test	☐	☐	☐	☐
Serum cholesterol measurement	☐	☐	☐	☐
Serum creatinine measurement without automated eGFR reporting	☐	☐	☐	☐
Serum creatinine measurement with automated eGFR reporting	☐	☐	☐	☐
Urinalysis using test strips for albumin/protein (qualitative assays)	☐	☐	☐	☐
Urinalysis using test strips for albumin/protein (quantitative assays)	☐	☐	☐	☐
Urine albumin: creatinine ratio (ACR) or protein: creatinine ratio (PCR) measurements	☐	☐	☐	☐
Radiological services (eg: facilities for kidney ultrasound)	☐	☐	☐	☐
Pathology services (renal biopsy interpretation facilities)	☐	☐	☐	☐

C2. Capacity for chronic renal replacement therapy (RRT) service provision

C.2.1 Is chronic hemodialysis available in your country?

☐ Yes ☐ No

C.2.1.1 If yes, how is chronic hemodialysis funded in your country?

☐ Publicly funded by government and free at the point of delivery

☐ Publicly funded by government but with some fees at the point of delivery

☐ A mix of publicly funded (whether or not publicly funded component is free at point of delivery) and private systems (please explain)

☐ Solely private and out-of-pocket

☐ Solely private through health insurance providers

☐ Multiple systems – programs provided by government, nongovernmental organizations (NGOs), and communities

If a mix of publicly funded and private systems (please explain) or "Other" (please specify)

C.2.2 Is chronic peritoneal dialysis (PD) available in your country?

☐ Yes ☐ No

C.2.2.1 If yes, how is chronic PD funded in your country?

☐ Publicly funded by government and free at the point of delivery

☐ Publicly funded by government but with some fees at the point of delivery

☐ A mix of publicly funded (whether or not publicly funded component is free at point of delivery) and private systems (please explain)

☐ Solely private and out-of-pocket

☐ Solely private through health insurance providers

☐ Multiple systems – programs provided by government, nongovernmental organizations (NGOs), and communities

If a mix of publicly funded and private systems (please explain) or "Other" (please specify)

C.2.3 Is kidney transplantation available in your country?

☐ Yes ☐ No

C.2.3.1 If yes:

☐ Deceased donor kidney transplant only

☐ Live donor kidney transplant only

☐ A combination of deceased and live donor kidney transplant (proportion: deceased % live %)

C.2.3.2. If yes, how is kidney transplantation funded in your country?

- ☐ Publicly funded by government and free at the point of delivery
- ☐ Publicly funded by government but with some fees at the point of delivery
- ☐ A mix of publicly funded (whether or not publicly funded component is free at point of delivery) and private systems (please explain)
- ☐ Solely private and out-of-pocket
- ☐ Solely private through health insurance providers
- ☐ Multiple systems – programs provided by government, nongovernmental organizations (NGOs), and communities

If a mix of publicly funded and private systems (please explain) or "Other" (please specify)

C.2.4. Is there a national kidney transplant waitlist?

☐ Yes ☐ No, waiting lists are regional ☐ No

C3. Capacity for acute RRT service provision

C.3.1 Is acute hemodialysis available in your country?

☐ Yes ☐ No

C.3.1.1 If yes, how is acute hemodialysis funded in your country?

- ☐ Publicly funded by government and free at the point of delivery
- ☐ Publicly funded by government but with some fees at the point of delivery
- ☐ A mix of publicly funded (whether or not publicly funded component is free at point of delivery) and private systems (please explain)
- ☐ Solely private and out-of-pocket
- ☐ Solely private through health insurance providers
- ☐ Multiple systems – programs provided by government, nongovernmental organizations (NGOs), and communities

If a mix of publicly funded and private systems (please explain) or "Other" (please specify)

C.3.2 Is acute peritoneal dialysis available in your country?

☐ Yes ☐ No

C.3.2.1 If yes, how is acute peritoneal dialysis funded in your country?

- ☐ Publicly funded by government and free at the point of delivery
- ☐ Publicly funded by government but with some fees at the point of delivery
- ☐ A mix of publicly funded (whether or not publicly funded component is free at point of delivery) and private systems (please explain)
- ☐ Solely private and out-of-pocket
- ☐ Solely private through health insurance providers
- ☐ Multiple systems – programs provided by government, nongovernmental organizations (NGOs), and communities

If a mix of publicly funded and private systems (please explain) or "Other" (please specify)

C4. Access to Medications and reimbursement plans

C.4.1 For all CKD patients: How are medications funded?

- ☐ Publicly funded by government and free at the point of delivery
- ☐ Publicly funded by government but with some fees at the point of delivery
- ☐ A mix of publicly funded (whether or not publicly funded component is free at point of delivery) and private systems (please explain)
- ☐ Solely private and out-of-pocket
- ☐ Solely private through health insurance providers
- ☐ Multiple systems – programs provided by government, nongovernmental organizations (NGOs), and communities

If a mix of publicly funded and private systems (please explain) or "Other" (please specify)

C.4.2 For all dialysis patients: How are medications funded?

- ☐ Publicly funded by government and free at the point of delivery
- ☐ Publicly funded by government but with some fees at the point of delivery
- ☐ A mix of publicly funded (whether or not publicly funded component is free at point of delivery) and private systems (please explain)
- ☐ Solely private and out-of-pocket
- ☐ Solely private through health insurance providers
- ☐ Multiple systems – programs provided by government, nongovernmental organizations (NGOs), and communities

If a mix of publicly funded and private systems (please explain) or "Other" (please specify)

C.4.3 For all transplant patients: How are medications funded?

- ☐ Publicly funded by government and free at the point of delivery
- ☐ Publicly funded by government but with some fees at the point of delivery
- ☐ A mix of publicly funded (whether or not publicly funded component is free at point of delivery) and private systems (please explain)
- ☐ Solely private and out-of-pocket
- ☐ Solely private through health insurance providers
- ☐ Multiple systems – programs provided by government, nongovernmental organizations (NGOs), and communities

If a mix of publicly funded and private systems (please explain) or "Other" (please specify)

Data sources for Section C

We would like you to consult as many colleagues or sources of data as needed to provide the answers that best describe nephrology care in your country.

What is/are the sources for the data you provided above for Section C?

How certain are you of the answers you have provided for Section C?

- ☐ Very uncertain
- ☐ Uncertain
- ☐ Moderate
- ☐ Certain
- ☐ Very certain

D. Health information systems and statistics

D1. Availability of registry

D.1.1. Is there an official registry in your country for?

	Yes	No
Non-dialysis CKD	☐	☐
Dialysis	☐	☐
Transplantation	☐	☐
AKI	☐	☐

D.1.1.1. If yes [Non-dialysis CKD], is participation by providers?

☐ Voluntary

☐ Mandatory

☐ I do not know/Information not available

D.1.1.2. If yes [Non-dialysis CKD], what does this non-dialysis dependent CKD registry cover?
Please tick all that apply.

☐ The whole spectrum of CKD (Stages 1-5)

☐ Advanced CKD only (Stages 4/5)

☐ The whole country

☐ Specific regions only (please name)

D.1.1.3. If yes [Dialysis], is participation by providers?

☐ Voluntary

☐ Mandatory

☐ I do not know/Information not available

D.1.1.4. If yes [Transplantation], is participation by providers:

☐ Voluntary

☐ Mandatory

☐ I do not know/Information not available

D.1.1.5. If yes [AKI], is participation by providers:

☐ Voluntary

☐ Mandatory

☐ I do not know/Information not available

D2. Burden of CKD (CKD prevalence)

D.2.1. Are there data on the prevalence of CKD in your country?

☐ Yes ☐ No

D3. Identification of CKD

D.3.1. For which of the following high-risk groups do practitioners in your country routinely offer testing for CKD?

- ☐ Those with hypertension
- ☐ Those with diabetes
- ☐ Those with cardiovascular disease (Ischaemic heart disease, stroke, PVD, heart failure)
- ☐ Those with autoimmune/multisystem diseases (systemic lupus erythematous, Rheumatoid arthritis)
- ☐ The elderly (65 years and older)
- ☐ Those with urological disorders (structural, stone diseases)
- ☐ Chronic users of nephrotoxic medications
- ☐ Members of high-risk ethnic groups (Aboriginal, Africans, Indo-Asians)
- ☐ Those with a family history of CKD

D.3.2. In your country, are there ethnic groups considered to be at increased risk for CKD?

☐ No ☐ Yes (please specify)

D.3.3. In your country, is there an active CKD detection program based on national policy and/or guidelines?

☐ Yes ☐ No

D.3.3.1. If yes, how is this program implemented? Please tick all that apply.

- ☐ Reactive approach - cases managed as identified through practice
- ☐ Active screening of population at-risk through routine health encounters
- ☐ Active screening of population at-risk through specific screening processes
- ☐ Other (please specify)

D4. Burden of AKI (incidence and prevalence)

D.4.1. Does your country have the ability to determine the prevalence of AKI not requiring dialysis?

☐ Yes ☐ No ☐ I do not know/info not available

D.4.2. Does your country have the ability to determine the incidence of AKI NOT requiring dialysis?

☐ Yes ☐ No ☐ I do not know/info not available

D.4.3. Does your country have the ability to determine the prevalence of AKI requiring dialysis?

☐ Yes ☐ No ☐ I do not know/info not available

D.4.4. Does your country have the ability to determine the incidence of AKI requiring dialysis?

☐ Yes ☐ No ☐ I do not know/info not available

D5. Identification of AKI

D.5.1. In your country, are there specific groups considered to be at increased risk for AKI?

☐ No ☐ Yes (please specify)

Data sources for Section D

We would like you to consult as many colleagues or sources of data as needed to provide the answers that best describe nephrology care in your country.

What is/are the sources for the data you provided above for Section D?

How certain are you of the answers you have provided for Section D?

☐ Very uncertain
☐ Uncertain
☐ Moderate
☐ Certain
☐ Very certain

E. National health policy

E1. CKD advocacy

E.1.1. In your opinion, is CKD recognized as a health priority by the government in your country?

☐ Yes (please provide details)
☐ No (please explain why)

E.1.2. Is there an advocacy group at the higher levels of government (ie: a Parliamentary committee) or an NGO (ie: a health charity) to raise the profile of CKD and its prevention?

☐ Yes (please provide details)
☐ No (please explain why)

E.1.3. Are there existing national/regional physician oriented organizations or patient organizations that,provide resources for CKD management?

☐ Yes (please provide details)
☐ No (please explain why)

E2. AKI advocacy

E.2.1. Is there an advocacy group at the higher levels of government (ie: a Parliamentary committee) or an NGO to raise the profile of AKI and its prevention?

☐ Yes (please provide details)
☐ No (please explain why)

E.2.2. Are there existing national/regional physician oriented organizations or patient organizations that provide resources for AKI management?

☐ Yes (please provide details)
☐ No (please explain why)

E3. CKD and non-communicable chronic disease (NCD) policy and strategy

E.3.1. Does your country have a national non-communicable chronic disease strategy?

☐ Yes (please provide details)

☐ Yes, under development (please provide details)

☐ No (not detail needed)

E.3.2. Does your country have a national strategy for improving the care of CKD patients?

	Non-dialysis dependent CKD	Chronic dialysis	Kidney transplantation
Yes, a national CKD specific strategy exists for the following populations *(please tick all that apply)*:	☐	☐	☐
Yes, but the CKD strategy is incorporated into a NCD strategy that includes other diseases. The CKD strategy applies to the following populations *(please tick all that apply)*:	☐	☐	☐
No	☐	☐	☐

E.3.3. If your country does not have a national strategy for improving the care of CKD patients, are there other initiatives that identify CKD as a health care priority in your country? *Please tick all that apply.*

☐ National position paper on CKD care

☐ Provider incentives for identifying CKD

☐ Incentives for providing quality care to CKD patients

☐ Important regional/level strategy or strategies (please provide details)

If Important regional/state level strategy or strategies or "Other" (please specify)

E4. CKD specific policies, guidelines and/or service frameworks

E.4.1. Are there available CKD management and referral guidelines in your country?

☐ Yes, national guidelines

☐ Yes, major regional guidelines

☐ Yes, uses or adopt the existing international guidelines (eg: KDIGO)

☐ No

E.4.1.1. If yes, what do these management and referral guidelines cover? *Please tick all that apply.*

☐ Identification of CKD progression

☐ Timing and urgency for nephrology referral

☐ Multidisciplinary care approach

☐ Risk factor management

☐ Management of complications (cardiovascular disease, hematologic and bone disorders, malnutrition)

E.4.1.2. Please rate awareness of the CKD guideline among non-nephrologists in your country.

- ☐ Extremely low
- ☐ Low/below average
- ☐ Moderate/average
- ☐ High/above average
- ☐ Very high

E.4.1.3. Please rate the adoption (application in clinical practice) of the CKD guideline among non-nephrologists in your country.

- ☐ Extremely low
- ☐ Low/below average
- ☐ Moderate/average
- ☐ High/above average
- ☐ Very high

E.4.1.4. Please rate the awareness of the CKD guideline among nephrologists in your country.

- ☐ Extremely low
- ☐ Low/below average
- ☐ Moderate/average
- ☐ High/above average
- ☐ Very high

E.4.1.5. Please rate the adoption (application in clinical practice) of the CKD guideline among nephrologists in your country.

- ☐ Extremely low
- ☐ Low/below average
- ☐ Moderate/average
- ☐ High/above average
- ☐ Very high

E5. AKI specific policy and strategy

E.5.1. Does your country have a national strategy for improving the identification of AKI, are there other initiatives that identify AKI as an important health care priority in your country?
Please tick all that apply.

- ☐ National position paper on AKI identification and care
- ☐ Tools available for identification of AKI
- ☐ Incentives for providing quality care to AKI patients
- ☐ Important regional/state level strategy or strategies (please provide details)
- ☐ Increasing access to acute dialysis facilities
- ☐ No strategies exist for AKI

If Important regional/state level strategy or strategies or Other (please specify)

E.5.2. Please provide additional details on important regional/state level strategy or strategies important regional/state level strategy or strategies (5 lines):

E6. AKI specific policies, guidelines and/or service frameworks

E.6.1. Are there AKI management & referral guidelines in your country?

- ☐ Yes, national guidelines
- ☐ Yes, major regional guidelines
- ☐ Yes, uses or adopt the existing international guidelines (eg KDIGO)
- ☐ No

E.6.1.1. If yes, what do these management & referral guidelines cover? *Please tick all that apply.*

- ☐ Identification of AKI in outpatient settings
- ☐ Identification of AKI in inpatient settings
- ☐ Timing and urgency for nephrology referral
- ☐ Access to dialysis treatment
- ☐ Protocols for mitigating risk of AKI in specific situations

E.6.1.2. Please rate the awareness of the AKI management guideline among non-nephrologists in your country.

- ☐ Extremely low
- ☐ Low/below average
- ☐ Moderate/average
- ☐ High/above average
- ☐ Very high

E.6.1.3. Please rate the adoption (application in clinical practice) of the AKI management guideline among non-nephrologists in your country.

- ☐ Extremely low
- ☐ Low/below average
- ☐ Moderate/average
- ☐ High/above average
- ☐ Very high

E.6.1.4. Please rate the awareness of the AKI management guideline among nephrologists in your country.

- ☐ Extremely low
- ☐ Low/below average
- ☐ Moderate/average
- ☐ High/above average
- ☐ Very high

E.6.1.5. Please rate the adoption (application in clinical practice) of the AKI management guideline among nephrologists in your country.

- ☐ Extremely low
- ☐ Low/below average
- ☐ Moderate/average
- ☐ High/above average
- ☐ Very high

Data sources for Section E

We would like you to consult as many colleagues or sources of data as needed to provide the answers that best describe nephrology care in your country.

What is/are the sources for the data you provided above for Section E?

How certain are you of the answers you have provided for Section E?

- ☐ Very uncertain
- ☐ Uncertain
- ☐ Moderate
- ☐ Certain
- ☐ Very certain

Assessing response of nephrology community

F. Awareness and education about CKD

F1. Please rate the typical level of CKD awareness among non-nephrologist specialists.

- ☐ Extremely low
- ☐ Low/below average
- ☐ Moderate/average
- ☐ High/above average
- ☐ Very high

F2. Please rate the typical level of CKD awareness among primary care physicians (eg: general practitioners).

- ☐ Extremely low
- ☐ Low/below average
- ☐ Moderate/average
- ☐ High/above average
- ☐ Very high

G. Awareness and education about AKI

G1. Please rate the typical level of AKI awareness among non-nephrologist specialists.

- ☐ Extremely low
- ☐ Low/below average
- ☐ Moderate/average
- ☐ High/above average
- ☐ Very high

G2. Please rate the typical level of AKI awareness among primary care physicians (eg: general practitioners)

- ☐ Extremely low
- ☐ Low/below average
- ☐ Moderate/average
- ☐ High/above average
- ☐ Very high

H. Barriers to optimal kidney disease care

H1. Barriers to optimal kidney disease care

H.1.1. Are there specific barriers to optimal kidney disease care in your country? *Please tick all that apply.*

- ☐ Geography (distance from care or prolonged travel time)
- ☐ Physician (availability, access, knowledge, attitude)
- ☐ Patient (knowledge, attitude)
- ☐ Nephrologists (availability)
- ☐ Healthcare system (availability, access, capability)
- ☐ Other (please specify)

H2. Barriers to optimal RRT provision

H.2.1. Are there specific barriers to optimal RRT care in your country? *Please tick all that apply.*

- ☐ Geography (distance from care or prolonged travel time)
- ☐ Physician (availability, access, knowledge, attitude)
- ☐ Patient (knowledge, attitude)
- ☐ Nephrologists (availability)
- ☐ Healthcare system (availability, access, capability)
- ☐ Other (please specify)

I. Capacity for research and development

I.1. Is there a national agency responsible for funding clinical trials in your country?

☐ Yes ☐ No

I.2. Does your country participate in clinical trials in kidney disease? *Please tick all that apply.*

☐ Phase 1
☐ Phase 2
☐ Phase 3
☐ Phase 4
☐ Health service delivery trials

I.3. Does your country have formal training for physicians in clinical trial conduct?

☐ Yes ☐ No ☐ I do not know/info not available

I.3.1. If yes, is it mandatory?

☐ Yes ☐ No ☐ I do not know/info not available

I.4. Does your country have formal training for non-physicians/ research assistants and associates in clinical trial conduct?

☐ Yes ☐ No ☐ I do not know/info not available

I.4.1. If yes, is it mandatory?

☐ Yes ☐ No ☐ I do not know/info not available

I.5. Does your country have biobanking facilities?

☐ Yes ☐ No ☐ I do not know/info not available

I.6. Does your country have the capacity (trained workforce) to conduct observational cohort studies?

☐ Yes ☐ No ☐ I do not know/info not available

I.7. Does your country usually have resources (funding) to conduct observational cohort studies?

☐ Yes ☐ No ☐ I do not know/info not available

I.8. Is your country involved in any observational cohort studies in CKD?

☐ Yes ☐ No ☐ I do not know/info not available

I.8.1. If yes, where?

☐ In non dialysis CKD populations
☐ In dialysis populations
☐ In transplant populations

I.9. Is ethics approval in your country mandatory for observational cohort studies in CKD?

☐ Yes ☐ No ☐ I do not know/info not available

I.9.1. If yes, is the ethics approval

☐ Institutional ☐ National

☐ Regional ☐ Other (please specify)

I.10. Which regulatory agencies oversee clinical trials in your country? Please list if known.

I.11. Are there challenges in getting timely regulatory approvals in your country?

☐ Often ☐ Occasionally

☐ Sometimes ☐ No

I.11.1. If yes, please list any common issues you are aware of.

I.12. Are there academic centres that co-ordinate and monitor sites involved in renal clinical trials in your country?

☐ Yes ☐ No ☐ I do not know/info not available

I.12.1. If yes, please list any you are aware of, and if possible provide website links and/or contact details.

I.13. In what proportion of sites in your country is there capacity for storing clinical trial medications?

☐ All ☐ Few

☐ Most ☐ None

☐ Some ☐ Unknown

Thank you

Thank you very much for taking the time to respond to this survey!

Your active participation in helping ISN develop an appropriate global perspective on the state of kidney health and disease is greatly appreciated.

The Global Kidney Disease Atlas (GKHA) Questionnaire team

Online version of *ISN Global Kidney Health Atlas*: www.theisn.org/global-atlas

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