Capacity for the management of kidney failure in the International Society of Nephrology Latin America region: report from the 2023 ISN Global Kidney Health Atlas (ISN-GKHA)

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Successful management of chronic kidney disease (CKD) in Latin America (LA) continues to represent a challenge due to high disease burden and geographic disparities and difficulties in terms of capacity, accessibility, equity, and quality of kidney failure care. Although LA has experienced significant social and economic progress over the past decades, there are still important inequities in health care access. Through this third iteration of the International Society of Nephrology Global Kidney Health Atlas, the indicators regarding kidney failure care in LA are updated. Survey responses were received from 22 of 31 (71%) countries in LA representing 96.5% of its total population. Median CKD prevalence was 10.2% (interquartile range: 8.4%–12.3%), median CKD disability-adjusted life year was 753.4 days (interquartile range: 581.3–1072.5 days), and median CKD mortality was 5.5% (interquartile range: 3.2%–6.3%). Regarding dialysis modality, hemodialysis continued to be the most used therapy, whereas peritoneal dialysis reached a plateau and kidney transplantation increased steadily over the past 10 years. In 20 (91%) countries, >50% of people with kidney failure could access dialysis, and in only 2 (9%) countries, people who had access to dialysis could initiate dialysis with peritoneal dialysis. A mix of public and private systems collectively funded most aspects of kidney replacement therapy (dialysis and transplantation) with many people incurring up to 50% of out-of-pocket costs. Few LA countries had CKD/kidney replacement therapy registries, and almost no acute kidney injury registries were reported. There was large variability in the nature and extent of kidney failure care in LA mainly related to countries' funding

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structures and limited surveillance and management initiatives.

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Chronic kidney disease (CKD) is a key health challenge in Latin America due to relatively higher disease burden and lower access to treatment. Latin America has 659 million people living in 31 countries that occupy an area of 19.2 million km^2.[1] The actual life expectancy is around 72 years with an annual populational growth of 0.7%. Although Latin America has experienced significant social and economic progress over the past decades, inequities in health care access continue to be an unresolved problem.[2] Some Latin American countries are dealing with challenges due to economic and political issues, and many people are leaving their home countries looking for better opportunities and quality of life. According to a World Bank report, the region had reported that 4.6% of residents live in poverty based on per capita income of <US $2.5 per day and a net migration of −273.5% in 2022.[3]

The main etiologies of CKD in the region are similar to those in the rest of the world and relate to the growing prevalence of diabetes and hypertension as well as the inadequate diagnosis and treatment of patients affected by those diseases.[2] In addition, the growing prevalence of CKD from nontraditional causes, such as Mesoamerican nephropathy or CKD of unknown etiology, mainly affecting young male workers and their families in several Central American countries, contributed to the higher CKD prevalence.[4,5] Gross national income per capita increased over the years to US $16.5 per capita in 2019, but there is variability with gross national income ranging as high as US $30,000 per capita within the region.[1]

Using data from the third iteration of the International Society of Nephrology Global Kidney Health Atlas (ISN-GKHA), the status of the capacity for kidney health care delivery in the ISN Latin America region is described, and the findings are reported using the building blocks for health services as defined by the World Health Organization. The methodology for the survey is described in detail elsewhere.[6]

RESULTS

The ISN-GKHA results are broadly categorized as literature review (Table 1[7–23] and Table 2[1,24–27]) and survey response (Table 2, Figures 1–4, and Supplementary Figures S1–S5). The results are divided into 2 sections: the literature review presents country-level registry data or published data for countries in the region, whereas the survey data present response data for countries that participated in the survey. In this survey, 22 of 31 countries in the ISN Latin America region participated.

Study setting

There are 31 United Nations Member States in the Latin America region, 20 of which are affiliated with the ISN. However, the literature review data were based on 24 countries for which data were available at the time of analysis (Figure 1). The ISN Latin America region is a defined region that ranges across a large portion of North America, Central America, South America, and parts of the Caribbean with a territory that ranges nearly 7.5 million square miles. Its northernmost country is Mexico, and its southern range extends to the nations of Chile and Argentina.[28] The region includes 31 countries with a growing population of 659 million people, more than half of which is concentrated in Mexico and Brazil. The region has a richly diverse ethnic and cultural population of Spanish-, Portuguese-, and French-speaking people.[7] The region has continuously experienced considerable economic growth with an increase in the gross national income per capita of US $4044 in 1999 to US $8688 in 2022. In addition, gross domestic product for 2022 was US $6246.62, a 13.4% increase from 2021. In line with this, average life expectancy at birth has steadily increased to 72 years as has the adult literacy rate, which is now up to 93%.[3]

Although there have been improvements in recent years, economic and political challenges have been common to many countries in the region, which have maintained socioeconomic polarization and inequality both within and between countries. Another impactful variable was the latest pandemic. An increase in poverty and income inequality occurred in 2020 as a result of the COVID-19 pandemic. An additional 15 million people are currently living in poverty in comparison with the situation before the pandemic, and there are 12 million more people in extreme poverty than in 2019.[29]

Status of kidney care in the region

Data from the Latin American Dialysis and Renal Transplantation Registry reported in 2020 that the prevalence of kidney replacement therapy (KRT) in Latin America was 848 per million population (pmp).[1,30] The prevalence ranged from 2129 pmp in Puerto Rico to 111 pmp in Nicaragua. Eight countries had a rate of >700 pmp (Argentina, Brazil, Chile, Colombia, Ecuador, Panamá, Puerto Rico, and Uruguay). Only 2 states of Mexico have a formal registry: Jalisco and Aguascalientes, both of which had a KRT prevalence rate of >700 pmp. The overall prevalence increased from 601 pmp in 2012 to 866 pmp in 2019,[30] decreasing by 2020 due to the COVID-10 pandemic.

Regarding treatment modality, 67% of people with kidney failure were treated by hemodialysis (HD) (n = 290,099) and 9.3% by peritoneal dialysis (PD) (n = 40,450), whereas 23.6% of people had kidney transplantation (n = 102,772).[30] The total unadjusted incidence rate of KRT was 158 pmp.[30] In-center HD was the most prevalent treatment modality. Although PD seems to have

reached a plateau in its prevalence, kidney transplantation has increased steadily over the past 10 years, and home HD therapy in Latin America is very seldom performed.[30] In 2019, a total of 85,224 people started KRT for kidney failure in Latin America, representing a total unadjusted incidence rate of 168 pmp. Most incident people with kidney failure started dialysis with HD, whereas 12% used PD. PD was the KRT modality in >10% of the population in 5 countries (Guatemala 19.9%, Panama 21.1%, Colombia 40.6%, Mexico 60%, and Nicaragua 73.3%).[30]

Diabetic nephropathy was the most common cause of CKD (36% of cases), while 5 countries reported CKD of nontraditional causes in their population: Guatemala, Honduras, Jalisco/Aguascalientes, Nicaragua, and Paraguay. The kidney transplant rate in the region was 22 pmp, varying from 1 to >60 pmp. The total prevalence of KRT correlated positively with gross domestic product per capita ($r^2 = 0.6$, $P < 0.01$) and life expectancy at birth ($r^2 = 0.23$, $P < 0.05$). The overall incidence of KRT also significantly correlated with gross domestic product ($r^2 = 0.307$, $P < 0.05$). Overall unadjusted mortality in 2019 was 13% in the KRT population.[1,31]

Literature review data for countries in the ISN Latin America region

Burden of CKD, kidney failure, and health care workforce in the region. The median prevalence of CKD in the ISN Latin America region was 10.2% (interquartile range [IQR]: 8.4%–12.3%), ranging from 5.8% in Haiti (low-income country) to 16.8% in Puerto Rico (high-income country [HIC]; Table 1).[9] The highest proportions of deaths attributed to CKD were found in Mexico, El Salvador, and Nicaragua (9.8% [95% confidence interval: 9.3–10.2], 10.2% [95% confidence interval: 9.2–10.9], and 11.9% [95% confidence interval: 11.1–12.6], respectively), which were the highest reported for all countries according to the Global Burden of Disease report (global median proportion was 2.4%).[9] Regarding disability-adjusted life years, the highest proportions were in the lower-middle-income countries (LMICs—Bolivia, El Salvador, Haiti, Honduras, and Nicaragua). In El Salvador and Nicaragua, the proportions were the highest ones reported, which were also higher than the global median (1.5%; Table 1).[9]

The median prevalence of treated kidney failure in the region was 684 pmp (IQR: 457–858 pmp), which was below the global median of 822.8 pmp. The lowest prevalence of the region was in Nicaragua and the highest in Puerto Rico (Table 2).[1,24–26] The median incidence of treated kidney failure in the region was 134.5 pmp (IQR: 31–181 pmp), which was lower in comparison with the global median (145.5 pmp; IQR: 107–212.5 pmp). The lowest rate was found in Nicaragua (33 pmp) and highest in Mexico (526.5 pmp; Table 2).[1,24–26] An assessment of health workforce showed a median specialist physician prevalence of 1.9 per 1000 population (IQR: 1.4–2.9), a median medical doctor prevalence of 20.2 per 1000 population (IQR: 13.7–28.7), and a median nurse prevalence of 24.2 per 1000 population (IQR: 15.6–38.0; Table 2).[27]

Overview of gross domestic product and government health expenditure by individual countries. Median government health spending per capita in the region was US $268 (IQR: US $135– $701) and was marginally higher than global median value (US $216 [IQR: US $23–$908]). Uruguay had the highest government health spending per capita (US $1117), whereas Haiti had the lowest (US $6; Table 1).[10]

Cost of KRT. Data on costs of dialysis were available from 15 (55%) countries. The median annual costs for HD (US $17,241, IQR: US $14,275–$25,861) and PD (US $15,846, IQR: US$10,173–$19,893) were lower than the median global averages (US $18,959 and US $19,380, respectively; Table 1).[7,11–23] The highest annual costs for HD and PD were found in Costa Rica (US $103,444 and US $24,203, respectively) and the lowest in Brazil for HD (US $9615) and in Mexico for PD (US $5474). Data on the annual cost of kidney transplantation in the first year were available in 7 countries; costs ranged from US $15,250 in Bolivia to US $48,845 in Brazil. Out-of-pocket costs (% of total costs paid by the patient) for KRT were up to 50% in some countries, with higher proportions in lower-income countries (Table 1).[7,11–23]

Survey response data for countries in the ISN Latin America region

Characteristics of participating countries. Participating countries jointly represented a population of 631.3 million (96.5% of the total population in Latin America). Twelve countries were upper-middle-income countries, whereas 5 each were HICs and LMICs.[7] The respondents were nephrologists (n = 39, 88.6%), followed by pediatric nephrologists (n = 3, 6.8%) and non-nephrologist physicians (n = 2, 4.6%).

Health financing for kidney care. In the ISN Latin America region, coverage for nondialysis CKD care and most aspects of KRT care were a mix of public and private funding systems similar to what is done globally (31% CKD and 50% KRT regionally vs. 37% CKD and 23%/15% HD/PD globally). Considering kidney transplant medications, 9 countries (41%) in the region had mixed funding (private + public), and 6 (27%: Brazil, Cayman Islands, Colombia, Paraguay, Venezuela, and Dominican Republic) had these medications provided by government public funding and free at the point of delivery (Figure 2).

Availability of services for the delivery of kidney care. Availability for at least 1 modality of KRT was reported in all countries of the region. Conservative kidney management (CKM) was available through shared decision-making in 11 (55%) countries, and choice-restricted CKM (where a lack of resources prevented access to KRT) was available in 9 (45%) countries. Regarding the availability of CKM care components, 10 (50%) of the countries had established tools for shared decision-making. An infrastructure to document and share advance care plans and resuscitation decisions is generally available in 10 (50%) countries. Psychological, social, and spiritual support were systematically provided in 11

Table 1 | Demographics, health expenditure, and cost of kidney replacement therapy in the ISN Latin America region[7–23]

Country	World Bank income level	Area (km^2)	Total population (2022)	CKD prevalence % (95% CI)	DALY to CKD (%) rate (95% CI)
Global, median [IQR]	–	–	–	9.5 [5.9–11.7]	1.5 [1.1–2.3]
Latin America, median [IQR]	–	–	–	10.2 [8.4–12.3]	3.1 [2.3–3.7]
Global	–	–	–	9.4 (8.7–10)	1.6 (1.5–1.8)
Latin America	–	–	–	10.2 (8.4–12.3)	3.3 (3.0–3.6)
Argentina	UMIC	2,780,400	44,694,198	8.6 (8.1–9.2)	2.6 (2.3–2.8)
Bolivia	LMIC	1,098,581	11,306,341	6.2 (5.8–6.6)	3.1 (2.5–3.7)
Brazil	UMIC	8,515,770	208,846,892	8.4 (7.8–8.9)	1.8 (1.7–2.0)
British Virgin Islands	HIC	151	39,369	–	–
Cayman Islands	HIC	264	64,309	–	–
Chile	HIC	756,102	17,925,262	10.2 (9.5–10.8)	2.3 (2.0–2.5)
Colombia	UMIC	1,138,910	48,168,996	11.4 (10.7–12.3)	2.3 (2.0–2.5)
Costa Rica	UMIC	51,100	5,204,411	14.8 (14.1–15.5)	3.6 (3.1–4.1)
Cuba	UMIC	110,860	11,116,396	12.3 (11.5–13.2)	2.3 (2.0–2.5)
Dominican Republic	UMIC	48,670	10,298,756	7.6 (7.1–8.1)	2.3 (1.9–2.8)
Ecuador	UMIC	283,561	17,483,326	8.3 (7.7–8.8)	3.9 (3.3–4.4)
El Salvador	LMIC	21,041	6,187,271	11.9 (11.1–12.6)	6.5 (5.6–7.3)
Guatemala	UMIC	108,889	16,581,273	8.9 (8.3–9.5)	3.7 (3.3–4.0)
Haiti	LMIC	27,750	10,788,440	5.8 (5.3–6.2)	1.6 (1.3–2.1)
Honduras	LMIC	112,090	9,571,352	8.0 (7.5–8.6)	3.6 (3.1–4.3)
Mexico	UMIC	1,964,375	125,959,205	13.8 (13.0–14.7)	6.3 (5.6–7.0)
Nicaragua	LMIC	130,370	6,301,880	10.8 (10.1–11.5)	7.1 (6.1–8.0)
Panama	HIC	75,420	3,800,644	11.7 (11.0–12.5)	3.4 (3.0–3.8)
Paraguay	UMIC	406,752	7,025,763	7.6 (7.0–8.0)	3.1 (2.6–3.5)
Peru	UMIC	1,285,216	31,331,228	10.0 (8.3–12.3)	2.6 (2.2–3.0)
Puerto Rico	HIC	13,791	3,294,626	16.8 (15.6–18.1)	4.3 (3.8–4.9)
Uruguay	HIC	176,215	3,369,299	9.8 (9.1–10.4)	1.7 (1.5–1.9)
Venezuela, RB	UMIC	912,050	31,689,176	12.3 (11.4–13.0)	3.6 (3.2–4.0)
US Virgin Islands	HIC	1910	106,977	14.2 (13.2–15.3)	3.4 (3.0–3.8)

–, data not reported or unavailable; CKD, chronic kidney disease; CI, confidence interval; DALY, disability-adjusted life year; GDP, gross domestic product; Govt, government; HIC, high-income country; IQR, interquartile range; ISN, International Society of Nephrology; KRT, kidney replacement therapy; LMIC, lower-middle-income country; PPP, purchasing power parity; RB, República Bolivarian; UMIC, upper-middle-income country.

(55%) countries, and 9 (45%) countries had an active system for the recognition and management of symptoms secondary to kidney disease (Figure 3). Eight (40%) countries reported that a multidisciplinary team with formal links to clinicians trained in CKM was generally available for people receiving CKM types, and 7 (35%) countries had formal multidisciplinary links with palliative care. Most countries did not have information available about public funding for medications. Only 7 (31.8%) countries reported to have public funding that was free at the point of delivery for dialysis medications. The numbers increased (14 countries, 63.6%) when public funding (and free) of medications for kidney transplantation was evaluated (Supplementary Figure S1). Fifteen (75%) countries had access to the World Health Organization Essential Medications, required for palliative care.

Availability of services to diagnose and treat complications of kidney failure. All countries had the capability to assess blood pressure through analog devices. The assessment of anemia, electrolyte disorders, and chronic metabolic acidosis as well as mineral bone disease status was available in almost all countries. Two countries (9%) reported iron parameters, bicarbonate, and parathyroid hormone measurements as being generally not available. Anemia management was done through the application of oral (22 countries, 100%) and parenteral iron (21 countries, 95%) and erythropoiesis-stimulating agents (19 countries, 86% generally available). Mineral bone disease was treated mainly with calcium-based phosphate binders (21 countries, 95%), with 8 (36%) and 7 (32%) countries reporting general nonavailability of non–calcium phosphate binders and cinacalcet, respectively. Parathyroidectomy was available only in 13 (59%) countries. Potassium exchange resins were generally not or were never available in 11 (50%) countries (Figure 4).

Capacity for KRT provision and access to kidney care. Chronic HD services were available in all countries of the region with a median prevalence of HD treatment centers of 4.7 pmp. PD services were available in 20 countries (91%), and the median prevalence of PD treatment centers was 1.8 pmp (Table 2). Regarding kidney transplantation, services were available in 19 (86%) countries, and the median prevalence of kidney transplant centers was 0.47 pmp.

Health workforce. In most countries of the ISN Latin America region, nephrologists were primarily responsible for the medical care of people with kidney failure (n = 21, 95%). Similar to the global median (11.8 pmp, IQR: 1.8–24.8 pmp), the median number of nephrologists in Latin America was 12.5 pmp (IQR: 8.5–25.9 pmp), with a higher median of adult nephrologists compared with pediatric nephrologists (11.6

Table 1 | (Continued)

Death attributed to CKD % (95% CI)	GDP (PPP) ($ billion)	Govt spending per person (US$ 2021)	Out-of-pocket health spending per person (2021)	Total health expenditures (% of GDP)	Annual cost KRT (US$ 2021)		
					CAPD cost (US$ 2021)	In-center HD cost (US$ 2021)	1st year cost (US$ 2021)
2.4 [1.6–3.9]	133.8	216	92	6.2	18,959.2	19,380.3	26,903.20
5.5 [3.2–6.3]	129.5	268	153	7.2	15,845.90	17,240.60	20,837.00
–	133.8	–	–	6.2	19,380.30	18,959.20	26,903.20
1.5 (1.2–1.9)	1259.0	268	233	8.65	15,845.90	17,240.60	20,837.00
4.5 (4.1–4.9)	1083.4	547	217	9.5	19,893.05	17,240.64	23,499.64
5.8 (4.9–6.8)	106.9	135	48	6.9	–	20,688.77	15,250.40
3 (2.8–3.2)	3435.9	300	165	9.6	7823.49	9614.97	48,844.66
–	0.5	–	–	–	–	–	–
–	5.1	–	–	–	–	–	–
4.5 (4–4.8)	559.2	695	379	9.3	18,152.41	14,550.66	–
3.9 (3.4–4.2)	866.5	307	63	7.7	10,173.08	10,033.83	20,837.01
5.6 (5.0–6.1)	120.2	743	196	7.3	24,203.21	103,443.84	23,934.42
2.6 (2.4–2.8)	137	1004	110	11.3	–	–	–
3.2 (2.7–4.0)	227.5	216	171	5.9	–	–	–
7.5 (6.8–8.0)	189.9	–	–	8.5	–	–	–
10.2 (9.2–10.9)	63.0	243	80	7.2	15,845.89	18,531.41	–
6.4 (5.9–6.7)	167.8	121	153	6.2	–	–	–
2.4 (1.9–3.4)	36.1	6	20	4.7	5992.09	14,589.43	–
6.0 (5.1–7.5)	57.3	–	–	9	–	–	–
9.8 (9.3–10.2)	2569.2	268	186	5.4	–	–	–
11.9 (11.1–12.6)	42.4	103	53	8.4	5473.90	10,689.20	18,243.54
5.8 (5.2–6.3)	138.8	701	297	7.6	–	–	–
5.5 (5.0–6.0)	100.8	196	152	7.2	22,186.27	22,900.21	–
5.3 (4.6–5.8)	463.5	224	78	5.2	16,942.24	15,516.58	–
6.3 (5.5–6.9)	117.0	941	243	–	15,328.70	14,275.08	15,598.56
2.9 (2.6–3.2)	85.8	1117	235	9.4	–	–	–
5.6 (5.0–6.1)	269.1	31	38	5.4	14,588.23	25,860.96	–
4.1 (3.7–4.45)	3.8	–	–	–	–	–	–

pmp, IQR: 6.9–22.6 pmp vs. 1.02 pmp, IQR: 0.7–2.5 pmp, respectively). The ratio of treated KRT (pmp) to nephrologists (pmp) in the region was 54.1 and was highest in Mexico (182.3) and lowest in Uruguay (18.5; Table 2). The median number of nephrology trainees (1.4 pmp, IQR: 0.9–2.7 pmp) in Latin America was also similar to the median number of trainees worldwide (1.2 pmp, IQR: 0.2–3.8 pmp; Supplementary Figure S1). The number of nephrologists increased with increasing income level. The HICs had more than 30 nephrologists pmp, such as Curaçao, Cayman Islands, and Uruguay, whereas in the LMICs, the numbers ranged from 0.44 pmp in Haiti to 9.9 pmp in Bolivia. Regarding physicians' specialties, the most reported workforce shortages were for transplant surgeons (n = 19, 86%), followed by pediatric nephrologists (n = 16, 73%) and nephrologists (n = 15, 68%). Considering the overall multidisciplinary team, the most important shortages were for dietitians, dialysis nurses, kidney supportive care nurses, kidney nurses, and dialysis technicians (n = 12, 55%; n = 13, 59%; n = 10, 45%; n = 9, 41%; and n = 8, 36%, respectively; Supplementary Figure S2).

Health information systems and early identification mechanisms for kidney disease

Most countries of the region did not have acute kidney injury (AKI) registries, with Costa Rica, Paraguay, and Puerto Rico being exceptions. There was significant variability in the availability of nondialysis CKD registries with only half of countries reporting such registry data (n = 11; 52%); this was independent of country income. CKM registries were reported in 10 (45.5%) countries, chronic dialysis registries in 15 (68.2%), and kidney transplantation registries in 14 (63.6%). Only Costa Rica and Puerto Rico had a registry for all levels of disease care (CKD, dialysis, KT, and AKI; Supplementary Figure S1).

Hospitalization and death during the first year for people living with kidney failure on dialysis

In Latin America, 7 (33%) countries reported that 11% to 20% of people with kidney failure on HD required at least 1 hospitalization in the first year of dialysis. The commonest cause of these hospitalizations was related to the dialysis access (arteriovenous fistula or central venous catheter), either related to infection in 7 (33%) countries or access malfunctioning in 6 (29%) countries. In 10 (48%) participating countries, 11% to 50% of people with kidney failure died within the first year on HD, with 9 (43%) countries reporting death rates of 1% to 10%. The most frequently reported causes of death in HD patients were cardiovascular diseases in 17 (81%) countries and infections in 3 (14%) countries. Only 1 country (Haiti) reported the most common cause of death in people treated with HD to be dialysis withdrawal due to excessive cost of care.

Table 2 | KRT and health care workforce in the ISN Latin America region[1,24–27]

Country	World Bank income level	Treated KF (pmp)		Prevalence of long-term dialysis				Long-term dialysis centers (pmp)[a]	
				Chronic dialysis (HD+PD)		Chronic HD	Chronic PD	Chronic HD	Chronic PD
		Incidence	Prevalence	Incidence	Prevalence	Prevalence	Prevalence	Prevalence	Prevalence
Global, median		145.5	822.8	119	396.6	322.7	21	5.1	1.6
Latin America, median		134.5	684	111	633	501.5	59.5	4.7	1.8
Argentina	UMIC	198	963	163	720	674	46	9.97	1.08
Bolivia	LMIC	116	457	114	454	452	2	12.44	0.50
Brazil	UMIC	209	684	218	665	618	47	3.87	0.37
British Virgin Islands	HIC	–	–	–	–	–	–	25.89	–
Cayman Islands	HIC	–	819.5	–	963.8	963.8	0	31.10	15.55
Chile	HIC	226	1550	204	1317	1236	81	14.16	2.39
Colombia	UMIC	122	858	103	702	516	185	3.67	2.45
Costa Rica	UMIC	53	567	38	249	40	209	1.15	1.92
Cuba	UMIC	123	430	108	299	293	6	13.13	6.56
Dominican Republic	UMIC	226	485	–	438	340	98	9.54	0.56
Ecuador	UMIC	19	768	6	756	735	21	5.32	0.58
El Salvador	LMIC	223	776	217	677	297	380	–	3.81
Guatemala	UMIC	146	575	140	525	304	221	1.47	0.40
Haiti	LMIC	–	–	–	–	–	–	0.71	–
Honduras	LMIC	96	405	96	392	370	22	–	3.10
Mexico	UMIC	526.5	1905	–	1201	730.8	473.95	1.75	0.48
Nicaragua	LMIC	33	111	31	100	35	65	4.61	2.54
Panama	HIC	189	701	181	601	488	113	2.72	0.41
Paraguay	UMIC	40	387	36	333	317	16	4.65	1.39
Peru	UMIC	65	618	–	572	515	57	4.84	5.16
Puerto Rico	HIC	437	2129	–	1737	1607	130	11.74	1.76
Uruguay	HIC	227	1194	–	796	734	62	3.69	–
Venezuela, RB	UMIC	97	320	–	320	310	10	–	–
US Virgin Islands	HIC	–	–	–	1441.5	1399.1	42.4	–	–

–, data not reported or unavailable; HD, hemodialysis; HIC, high-income country; ISN, International Society of Nephrology; KRT, kidney replacement therapy; LMIC, lower-middle-income country; PD, peritoneal dialysis; pmp, per million population; pop, population; RB, República Bolivarian; UMIC, upper-middle-income country.
[a]Survey response data.
[b]Assessed as (prevalence of dialysis [pmp] + prevalence of kidney transplantation [pmp])/prevalence of nephrologists [pmp].

In the case of people on PD, 8 (42%) countries reported that 11% to 20% of people required at least 1 hospitalization in the first year of PD. The most common cause of hospitalization in 15 (79%) countries was PD-related infection (peritonitis, exit-site infection, or tunnel infection). Regarding death rates in people on PD, 11 (58%) countries reported that 1% to 10% of people died in the first year on PD, and the commonest causes were cardiovascular diseases (14 countries, 74%) and PD-related infection (4 countries, 21%). These rates were overall similar to the rates identified globally (Supplementary Figure S3).

Barriers to optimal care

Reporting of barriers to optimal kidney care varied across countries of the region, with the majority of countries reporting geographical distance from point of care, patients' knowledge and attitude, and availability of nephrologists as the most important ones (n = 15, 68%), followed by physician availability and accessibility (n = 14; 64%), health economic factors and system access and availability (n = 13, 59%), and lack of political will and enabling policies (n = 11; 50%). In contrast, globally, the main barriers identified were patients' knowledge and attitudes (n = 125, 75%), followed by physician availability and accessibility (n = 118, 71%) and availability of nephrologists (n = 112, 67%; Supplementary Figure S4).

Policy and advocacy for kidney disease value-based care

CKD detection programs were based on national policies or guidelines in 10 (48%) countries out of 21 that had responded to this question. Most countries used a reactive approach where cases were typically managed only if they were incidentally identified during routine care in 6 (60%) countries, whereas case finding in people with risk factors was a deliberate strategy in 4 countries (40%). Only 10 (48%) countries had a national strategy for noncommunicable diseases, and a national specific strategy for improving CKD care was reported only by 6 (29%) countries. However, 4 (19%) countries were developing national strategies for CKD, and 8 (38%) were developing national strategies for CKD.

CKD-specific policies were available in 12 (57%) countries. CKD and kidney failure and its treatment by KRT were recognized as a health priority by the government in 12 (57%) countries, which was completely different from AKI and its

Table 2 | (Continued)

Kidney transplantation					Health care workforce		
Incidence overall	Prevalence overall	Incidence of deceased donor	Incidence of living donor	Ratio of treated KRT to nephrologists[b]	Medical doctor prevalence (per 1000 pop)	Physician prevalence (per 1000 pop)	Nurse prevalence (per 1000 pop)
12.2	279	3.2	3.4	–	17.74	1.95	36.2
4.4	99.5	2.9	1.6	54.05	20.2	1.88	24.18
27.13	243	22.28	4.85	37.11	40.60	3.99	26.00
0.85	3	0	0.85	45.91	10.30	1.59	15.59
21.3	299	19.73	1.57	52.35	23.11	2.16	74.01
–	–	–	–	–	–	–	–
–	–	–	–	–	–	–	–
12.81	233	10	2.81	90.40	28.35	2.59	43.48
10.33	157	7.98	2.36	86.00	23.27	2.19	14.56
5.88	318	3.14	2.75	105.39	33.01	2.89	38.02
5.66	131	4.87	0.8	–	–	–	–
4.09	47	1.45	2.64	24.24	–	–	–
3.24	12	2.9	0.34	62.63	14.52	1.53	14.59
4.15	99	0	4.15	130.70	–	–	–
1.62	51	0	1.62	91.87	28.70	1.57	18.34
–	–	–	–	–	12.41	0.36	22.36
0.1	13	0	0.1	–	2.34	0.23	3.98
15.15	704	3.65	11.5	182.25	–	–	–
2	11	0.31	1.41	21.86	24.25	2.38	28.24
3.02	100	1.4	1.63	82.18	16.65	0.98	15.52
4.58	54	3.33	1.25	30.94	16.32	1.57	32.06
1.48	46	0.88	0.61	34.21	10.52	1.35	16.60
18	392	–	–	77.61	13.69	1.30	29.77
26.29	398	22.29	4	18.49	–	3.06	–
0.11	0	0	0.11	–	49.40	5,08	72.17
–	–	–	–	–	17.30	–	20.66

prevention, whereby the government did not recognize AKI as a health priority in 17 (81%) countries. Furthermore, there was a paucity of information related to AKI detection programs in the ISN Latin America region. National/regional physician-oriented and patients' organizations for kidney failure care were available in 12 (58%) countries. Some advocacy groups existed for AKI, CKD, kidney failure, and KRT. For example, 10 (48%) countries reported having CKD advocacy groups, whereas only 3 (20%) countries reported AKI advocacy groups and 5 (24%) countries reported KRT advocacy groups (Supplementary Figure S5).

DISCUSSION

Kidney care in the ISN Latin America region varies significantly across countries. The important aspects highlighted in this report were the differences in CKD prevalence and in the inequalities in accessibility and affordability of KRT. The capacity of programs aimed to prevent, detect, and manage CKD and kidney failure in the region is lacking in many countries, especially in the LMICs such as Bolivia, El Salvador, Haiti, Honduras, and Nicaragua. Further, the COVID-19 pandemic has brought additional challenges regarding not only provision of health care services, but widening income inequality, making Latin America one of the most disparate and wide income differences in the world.[29]

CKD poses a significant burden on nearly all countries in terms of disability-adjusted life years and premature death. Latin America has the highest rates of these outcomes among all countries according to a Global Burden of Disease report;[2] this is undoubtedly due at least in part to the constrained capacity of some countries in the region to effectively prevent and treat CKD/kidney failure, as has been highlighted by the Latin American Dialysis and Renal Transplantation Registry per many years.[1] CKD prevalence appears lower in LMICs within the region; however, this may be due to the low capacity to detect the disease. This in turn increases the risk of progression to kidney failure and the need for KRT, which causes even higher burden to the fragile economic scenario and burdens the already saturated health care systems.[32]

Considering the provision of KRT and its coverage, most countries have a mixed model of funding by private and public resources. Thus, there are large differences in the extent to which KRT funding was consistent and universal both between and within countries, especially those with greater socioeconomic inequality.[4,33] The median annual costs for HD and PD were lower than the global median, with higher costs identified in HICs and LMICs. A higher proportion of out-of-pocket costs for KRT were demonstrated in LMICs. Countries with a larger proportion of government-funded coverage (e.g., Brazil, Uruguay, and Chile) tended to have more robust and affordable KRT programs, whereas LMICs with fragmented and saturated health care services relied more heavily on private sources, leading citizens to pay high out-of-pocket costs for treatment.[4,34]

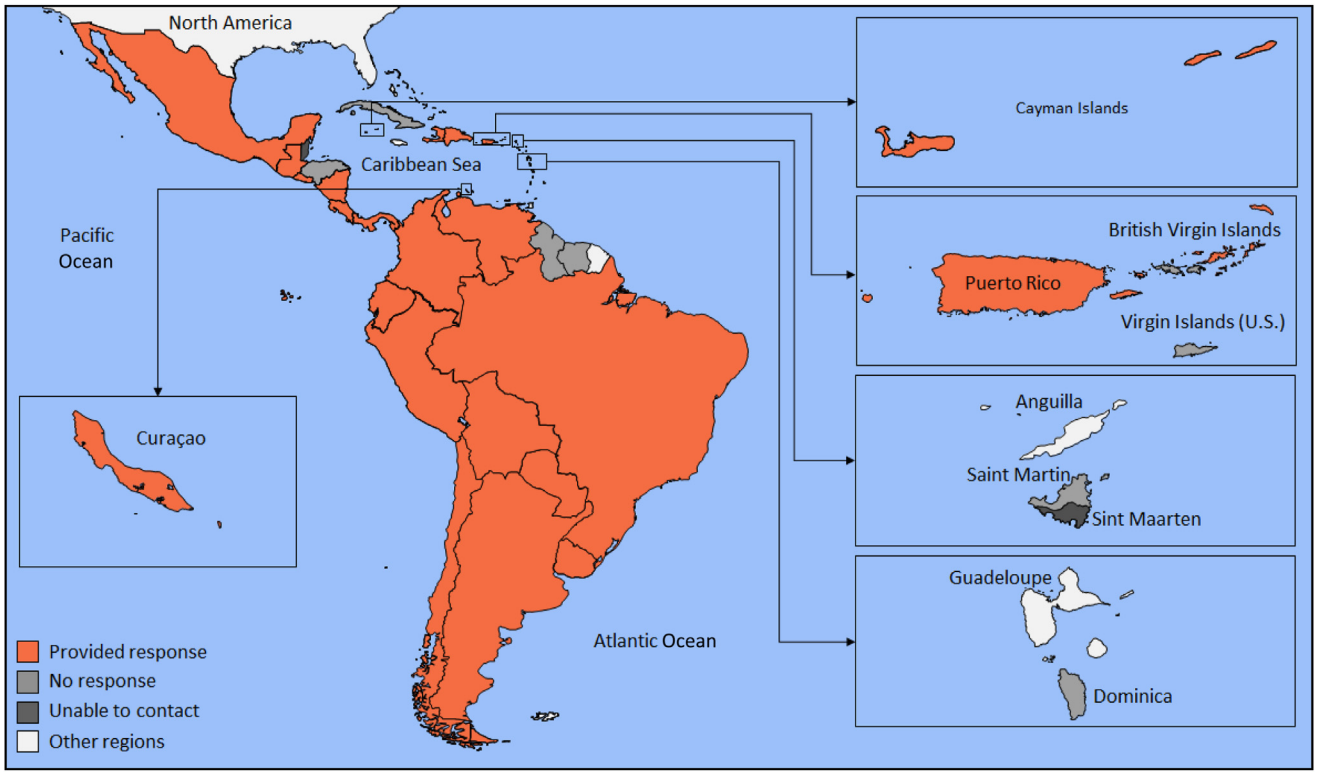

Figure 1 | Countries of the International Society of Nephrology Latin America region.

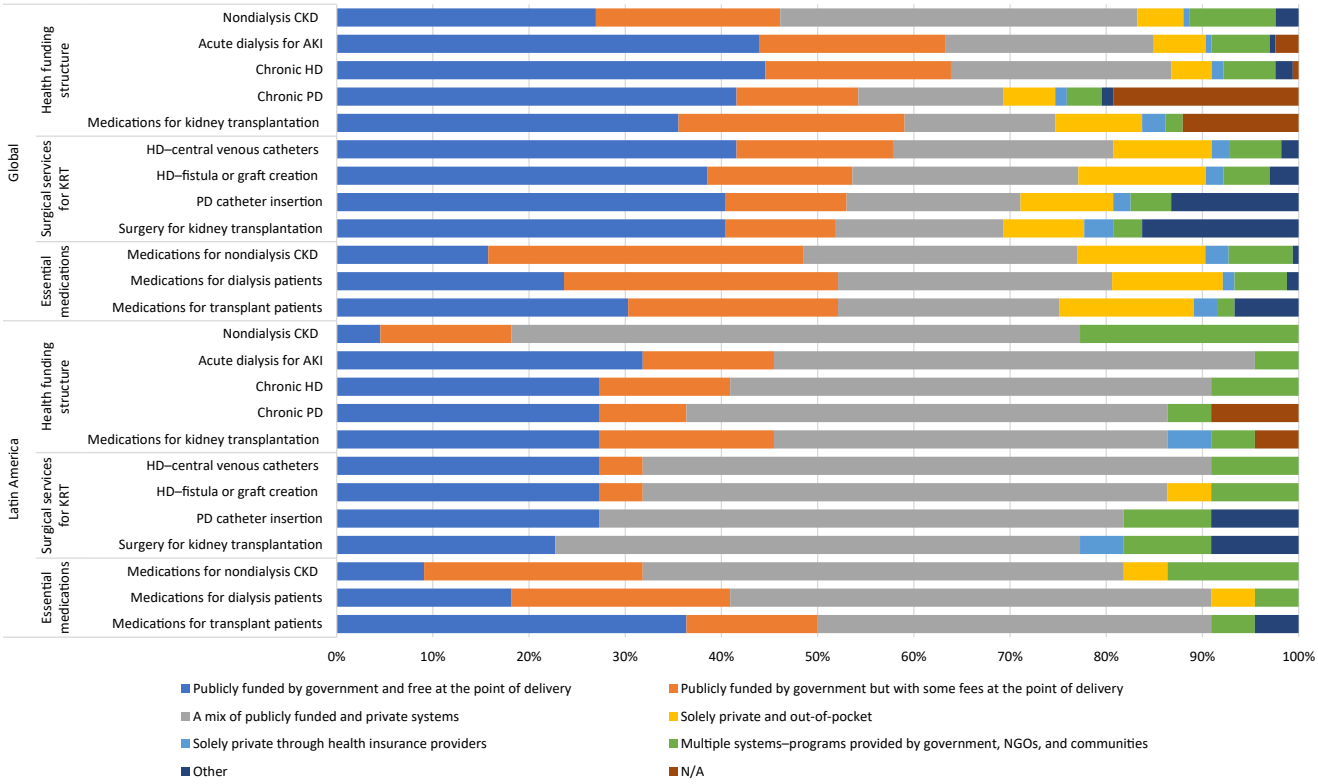

Figure 2 | Funding structures for nondialysis chronic kidney disease (CKD) and kidney replacement therapy (KRT), globally and in the International Society of Nephrology Latin America region. Values represent the absolute number of countries in each category expressed as a percentage of the total number of countries. AKI, acute kidney injury; HD, hemodialysis; N/A, not applicable; NGO, nongovernment organization; PD, peritoneal dialysis.

Figure 3 | Availability of choice in kidney replacement therapy (KRT) or conservative kidney management (CKM) for people with kidney failure in the International Society of Nephrology Latin America region. Values represent the absolute number of countries in each category expressed as a percentage of the total number of countries. HD, hemodialysis; Kt/V, measure of dialysis adequacy; N/A, not applicable; PD, peritoneal dialysis; URR, urea reduction ratio.

There is a need for adequate funding structures combined with government support and provision of choice regarding KRT modality to meet the local financial capability and patient-specific needs. These elements are key for successful accessibility and delivery of kidney failure care. It is likely that differences in funding structures and out-of-pocket costs, which map to geographic and patient characteristics in the region, explain the large variations in access to dialysis and the proportion of people with kidney failure who initiate PD or receive transplants. Countries with limited health budgets and greater territorial extension should consider allocating larger proportions of funding to "cost-effective" KRT modalities, so as to increase the proportion and number of people who can access treatment. Although some countries face challenges regarding the high cost of importing PD fluids, PD should be a highly cost-effective form of KRT in resource-limited countries. In addition, PD is associated with better preservation of residual kidney function, preservation of vascular access, greater patient satisfaction, and greater suitability for people living in rural and remote areas.[35–37] Thus, it should be considered a relevant option to use in Latin American countries.

The overall prevalence of people with kidney failure undergoing KRT has progressively increased, with HD being the preferred modality in the majority of countries. PD remained underused (9.3% of people with kidney failure). There has been an increase in people with a kidney transplant (24% of people with kidney failure) along the years. These changes may reflect some initiatives, including one set up by the Pan American Health Organization. In 2013, the Pan American Health Organization set a target goal of 700 treated people with kidney failure pmp by 2019 in 25 Latin American countries[38] and brought special attention to CKD in agricultural communities in Central America, both of which have been responsible for an increase in CKD prevalence in the region.[39]

The Latin American countries offering PD services have substantially increased compared with the 2019 ISN-GKHA (from 50% in 2019 to 91% in 2023). Countries with public policies for PD first, such as Mexico, represent over 50% of prevalent KRT in the country. After Mexico, the countries Guatemala, Panama, Colombia, and Nicaragua have a PD incidence rate of approximately10%, which explains the relative underutilization of this dialysis modality in the region, especially in LMICs (e.g., Bolivia) and geographically large countries (e.g., Brazil and Argentina).[31,40–42] Common barriers to the subutilization of PD in Latin America include the lack of trained staff for catheter insertion, patient training, and health care workers' knowledge of how to manage people on PD, as well as the absence of health policies and adequate financial support to implement PD programs and provide enough supplies in the long term.[42] Successful examples of

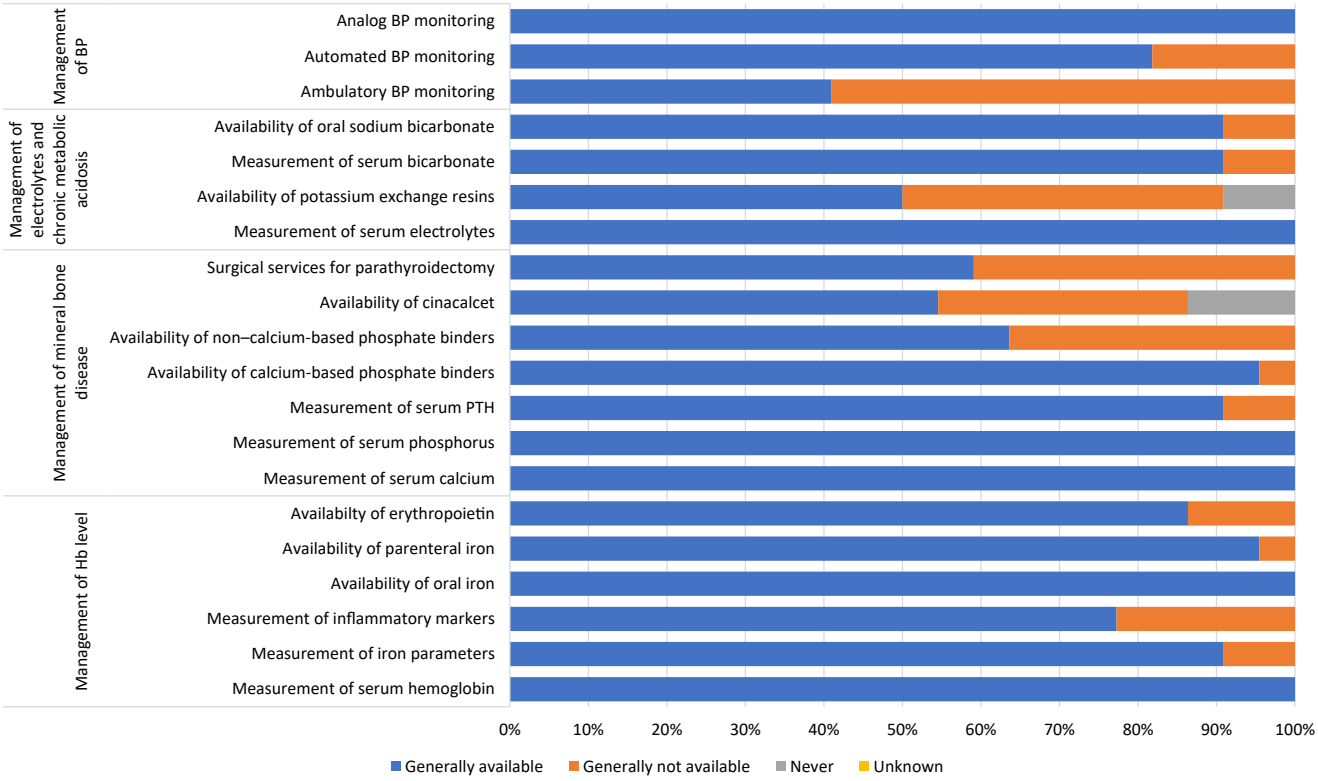

Figure 4| Available services to diagnose and treat complications of kidney failure in the International Society of Nephrology Latin America region. Values represent the absolute number of countries in each category expressed as a percentage of the total number of countries. BP, blood pressure; Hb, hemoglobin; PTH, parathyroid hormone.

countries in the region that have implemented PD programs that should be modeled include those in Mexico, Guatemala, and Colombia.[31,34]

Regarding workforce capacity (both nephrologists and trainees), there is still a large heterogeneity in the region, especially between LMICs and HICs. Most medical aspects of kidney failure care in Latin America are managed by nephrologists, thereby highlighting the need to have an adequate number of training centers to ensure sufficient workforce capacity and distribution.[38,41] Past estimates of the minimum number of nephrologists pmp in Latin America suggest at least 20 nephrologists pmp, which is much higher than the actual median number of nephrologists in the region (12.5 pmp).[38,41] This goal has been achieved in HICs (>30 nephrologists pmp) such as Curaçao, Cayman Islands, and Uruguay, whereas in LMICs, the numbers range from 0.44 pmp in Haiti to 9.9 pmp in Bolivia. These discrepancies may be explained by the lack of training centers in LMICs, the lower resources allocated in some countries to train kidney health professionals, and the migration of skilled professionals overseas looking for better opportunities.[4,33] Multidisciplinary teams also have an important role in patients' adequate management.[43] Latin American countries have reported important shortages of social workers, psychologists, dialysis technicians, and dietitians. All these factors may explain some of the gaps we found regarding both the presence and quality of kidney disease detection and management programs.

Investments and initiatives that help to improve specialist capacity in the ISN Latin America region and globally are important to improve kidney care. Many partnerships, such as the ISN Fellowships program, allow kidney health professionals from LICs and LMICs to receive appropriate training in HICs and later return home with acquired skills. Collaborations between countries and training within the same region are also important to develop comprehensive and accurate kidney disease/failure registries with the aim to understand the natural course of kidney disease in the Latin American population and recognize the main gaps of care.[44] This report demonstrates the paucity of official registries in Latin America, especially in LMICs. One of the main barriers identified in a meeting of kidney care experts in the region was the lack of national registries or demonstrable kidney care programs due to lack of political will to support these.[45]

The Pan American Health Organization and the Latin America Society of Nephrology and Hypertension recently embarked on a program to provide training and certification courses to help Latin American countries to build their own kidney disease registries.[46] However, for these registries to be sustainable, some formal accountability structure is required, such as a multidisciplinary group composed of representatives from scientific societies, government, and key financial stakeholders. Some examples of registries that have been

successful in their activities are the kidney health cooperation project between Uruguay and Bolivia developed in 2012[47] and the ISN initiative in partnership with the Latin America Society of Nephrology and Hypertension and the Latin American Dialysis and Renal Transplantation Registry with the Sharing Expertise in establishing Renal Registries project.[32] Reimbursement according to a mandatory registry is one of the main strategies to achieve a global kidney disease registry in Latin America.

There are many other barriers to kidney care in specific countries within the region. The most important ones are those related to the geographical distance from point of care, patients' knowledge and attitudes, availability of nephrologists, health economic factors, and system access and availability.[45] Some strategies to reduce those barriers include the development of some initiatives similar to the PD first policy for those countries with issues related to distance from point of care.[48] Education is also an important intervention, targeting not only people with kidney failure and their caregivers but also the health care workers. Improving knowledge about kidney disease and its risk factors, as well as improving diagnostic capability through training and use of simple tools, and reinforcing basic assessments such as clinical evaluation of hydration status, urine output, and signs and symptoms of uremic syndrome are important.[49,50] Telemedicine and teleconsultation have been demonstrated to help primary and general care physicians to improve patient managements in many areas, which may help to address some of the issues regarding shortages of nephrologists in many regions worldwide and in Latin America.[26] Advocacy initiatives are also important to improve care for people with kidney failure.[51,52] Through advocacy, attention can be brought to kidney disease and claims for stakeholders and government involvement to work on health policies development and strategies to increase the access of preventive care as well as essential medications and KRT.[53]

In conclusion, the ISN Latin America region is a diverse region in terms of access to and delivery of care for people with kidney disease. The region has a high burden of kidney disease, and this analysis highlights important disparities in the capacity of provision of care, especially between LMICs and HICs within the region. Fragmented funding structures and prohibitive costs to people, especially regarding KRT, in addition to the shortage of specialized health care workers are significant issues. There remains an important underutilization of cost-effective dialysis therapies, such as PD, and inadequate delivery of CKM for those who choose not to receive or are unable to access KRT, which further impacts the capacity to care for people with kidney failure. This survey has highlighted the key issues that must be addressed in the region. The involvement of the nephrology community and the establishment and/or maintenance of regional and international collaborations and partnerships are the key to overcoming the barriers and achieving universal and quality health care for people with kidney disease in the ISN Latin America region.

There were some limitations to the 2023 ISN-GKHA; these have been discussed.[6] However, this work is important for guiding kidney care policy in the ISN Latin America region.

APPENDIX

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SUPPLEMENTARY MATERIAL
Supplementary File (PDF)

Supplementary Figure S1. Country level scorecard showing availability of KRT, funding of medications, registries, and advocacy groups in the ISN Latin America region, 2019 and 2023.

Supplementary Figure S2. Workforce shortages for medical kidney care in the ISN Latin America region.

Supplementary Figure S3. Outcomes (hospitalization and death) in people on dialysis in the ISN Latin America region. (**A**) Proportion of people with kidney failure on hemodialysis and die in the first year; (**B**) proportion of people with kidney failure on peritoneal dialysis and die in the first year; (**C**) proportion of people with kidney failure on hemodialysis and at least 1 hospitalization in the first year; (**D**) proportion of people with kidney failure on peritoneal dialysis and at least 1 hospitalization in the first year.

Supplementary Figure S4. Barriers to optimum kidney failure care, globally and in the ISN Latin America region.

Supplementary Figure S5. Strategies for advocacy efforts, globally and in the ISN Latin America region. (**A**) National NCD strategy (% of total number of countries responded); (**B**) national strategy for improved care (% of total number of countries responded); (**C**) population covered by national CKD specific strategy (% of total number of countries responded "Yes" in [**B**]), and general NCD strategy (% of total number of countries responded "Yes, but incorporated in NCD strategy" in [**B**]); (**D**) national advocacy for CKD.

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