Title

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Journal

Kidney International Supplements, 11(2)

ISSN

2157-1724

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Publication Date

2021-05-01

DOI

10.1016/j.kisu.2021.01.001

International Society of Nephrology Global Kidney Health Atlas: structures, organization, and services for the management of kidney failure in North America and the Caribbean

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The International Society of Nephrology established the Global Kidney Health Atlas project to define the global capacity for kidney replacement therapy and conservative kidney care, and this second iteration was to describe the availability, accessibility, quality, and affordability of kidney failure (KF) care worldwide. This report presents results for the International Society of Nephrology North America and the Caribbean region. Relative to other regions, the North America and Caribbean region had better infrastructure and funding for health care and more health care workers relative to the population. Various essential medicines were also more available and accessible. There was substantial variation in the prevalence of treated KF in the region, ranging from 137.4 per million population (pmp) in Jamaica to 2196 pmp in the United States. A mix of public and private funding systems cover costs for nondialysis chronic kidney disease care in 60% of countries and for dialysis in 70% of countries. Although the median number of nephrologists is 18.1 (interquartile range, 15.3–29.5) pmp, which is approximately twice the global median of 9.9 (interquartile range, 1.2–22.7) pmp, some countries reported shortages of other health care workers. Dialysis was available in all countries, but peritoneal dialysis was underutilized and unavailable in Barbados, Cayman Islands, and Turks and Caicos. Kidney transplantation was primarily available in Canada and the United States. Economic factors were the major barriers to optimal KF care in the Caribbean countries, and few countries in the region have chronic kidney disease–specific national health care policies. To address regional gaps in KF care delivery, efforts should be directed toward augmenting the workforce, improving the monitoring and reporting of kidney replacement therapy indicators, and implementing noncommunicable disease and chronic kidney disease–specific policies in all countries.

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Received 2 October 2020; revised 9 December 2020; accepted 6 January 2021

Kidney International Supplements (2021) **11,** e66–e76; https://doi.org/10.1016/j.kisu.2021.01.001

KEYWORDS: chronic kidney disease; dialysis; funding; kidney failure; kidney registries; workforce

Relative to the other 9 regions of the International Society of Nephrology (ISN), North America and the Caribbean is a wealthy region with generally reliable infrastructure for both the delivery and funding of health care, a greater number of health workers, broad availability of and access to various essential medicines, and structured national programs for the prevention and treatment of noncommunicable diseases (NCDs).[1] Evidence from the 2019 United Nations Sustainable Development Goals report and the 2019 Global Health Security Index report shows that countries in North America and the Caribbean compare favorably against countries in other regions.[2,3] For children aged <5 years, the region has the lowest mortality rate and lowest proportion of individuals with developmental delays.[2] The region also has the highest proportion of births attended by skilled health personnel and largest population covered by at least one form of social protection benefit than other regions.[2]

Diabetes mellitus is the major cause of kidney failure (KF) in the region. In 2019, the region had the highest crude prevalence of diabetes mellitus in the world at 13.3% (interquartile range, 10.5%–15.8%), a figure that is projected to increase to 15.0% (interquartile range, 11.4%–17.7%) by 2045.[4] Recent data from 1980 and 2014 demonstrate an increasing prevalence of various NCD-related cardiometabolic risk factors in the region.[5] Although there is no uniform kidney disease registry in North America, the US Renal Data System has consistently provided robust information on kidney disease in the United States since 1988 once the national program for dialysis coverage was instituted, and conducts international comparisons that often includes data for other countries in the region. Nevertheless, much remains unknown regarding the capacity, accessibility, and quality of KF care in the region, especially in the smaller Caribbean island nations. In this article, we leverage data from the second iteration of the ISN Global Kidney Health Atlas to report on the capacity, accessibility, and quality of KF care in North America. The methods for this research are described in detail elsewhere.[6]

Results

Results of this study are presented in tables and figures and broadly summarized into 2 categories: desk research (Tables 1[7–10] and 2[11–16], Figure 1, Supplementary Table S1, and Supplementary Appendix) and survey administration (Figures 2–5 and Supplementary Figures S1–S7).

Setting. North America, the third largest of the world's continents, extends >8000 km to within 800 km of both the North Pole and the equator, it covers an area of 24.2 million km^2, representing 16.5% of the earth's land area and approximately 4.8% of its total surface.[17] The region is composed of 23 countries and 22 dependent territories.[18] For the purpose of this study, we utilized the ISN's regional classification of countries in North America and the Caribbean (Mexico is not included in the ISN North America and Caribbean region, and the British Virgin Islands and Grenada were included with the Latin America region).[19]

The region has a total population of 370.5 million people. The United States has the largest population, followed by Canada, whereas St. Kitts and Nevis have the smallest in the region. North America is the richest continent in the world, with gross domestic product (GDP) per capita of $41,830 in 2016.[20] The United States has the largest GDP at purchasing power parity in the region (US$19,490 billion), followed by Canada (US$1774 billion); Turks and Caicos have the lowest (US$632 million). The proportion of GDP spent on health care varies widely within the region, ranging from 4.2% in St. Vincent and the Grenadines to 16.8% in the United States.[7,8]

A brief summary of the current state of kidney care in the region. Diabetes mellitus is the leading cause of both chronic kidney disease (CKD) and KF in North America, and it disproportionately affects minority populations, such as African Americans, Hispanic Americans, and Aboriginal Americans more than Whites.[21–24] Data from the US Renal Data System show that between 2000 and 2013, the incidence of treated KF due to diabetes mellitus increased by 11.8% and 6.6% in Canada and the United States, respectively.[21] Variation in burden of CKD in the region has also been linked to obesity,[25] ethnic differences,[26] socioeconomic status,[27,28] and genetic factors, such as Apolipoprotein L1.[29] Country variation in the ability to fund, train, and provide resources for kidney care in the region may be associated with GDP and the percentage of GDP spent on health care. Within-country differences in the burden of KF in the region are highly associated with low socioeconomic status.[28]

Characteristics of participating countries. A total of 17 respondents from 10 countries in the ISN's North America and the Caribbean region responded to the survey, including Antigua and Barbuda, the Bahamas, Canada, Cayman Islands, Jamaica, St. Kitts and Nevis, St. Lucia, St. Vincent and the Grenadines, Trinidad and Tobago, and the United States (Figure 1). This included 12 nephrologists (71%), 3 nonnephrology physicians (18%), and 2 others (12%), with an overall response rate of 47.2%. The 10 countries have a total combined population of 369.7 million people, which comprises 99.8% of the entire population for this region. The World Bank classifies 11 of the 14 countries in the region as high income (78.6%) and the other 3 as upper-middle income (21.4%). The GDP in this region ranges from US$632 million to US$19.5 trillion, with an average of US$1.53 trillion. There were significant variations in the percentage of GDP spent on health care, and this ranged from 4.2% in St. Vincent and the Grenadines to 16.8% in the United States (Table 1).[7–9]

Burden of CKD and KF in North America and the Caribbean. The prevalence of CKD in North America and the Caribbean was 11.9% (interquartile range, 10.8%–12.9%). The prevalence of CKD in this region was higher

Table 1 | Demographic characteristics and cost of KRT in countries in the ISN North America and the Caribbean region[7–10]

Country	World Bank income level	Area, km^2	Total population (2018)	GDP (PPP), $ billion[a]	Total health expenditures, % of GDP[a]	Annual cost KRT[b] (US$) and out-of-pocket cost/% paid by patient from total cost[c]		
						HD	PD	Kidney transplants (first year)
Global median	—	—	—	—	6.5	22,617	20,524	25,356
North America and the Caribbean median	—	19,853,501	370,499,303	1526.5	7.3	81,092	56,287	59,089
Antigua and Barbuda	High	443	95,882	2.4	4.3	—/0	—	—/0
Bahamas	High	13,880	332,634	12.1	6.4	—	—	—
Barbados	High	430	293,131	5.2	7.0	—	—	—
Bermuda	High	54	71,176	6.1	—	—	—	—
Canada	High	9,984,670	35,881,659	1774.0	10.5	73,789	44,434/1–25	82,852/0
Cayman Islands	High	264	59,613	2.5	—	—/1–25	—/1–25	—/1–25
Jamaica	Upper-middle	10,991	2,812,090	26.1	5.9	—/51–75	—/1–25	—/1–25
St. Kitts and Nevis	High	261	53,094	1.6	5.6	—/51–75	—/51–75	—
St. Lucia	Upper-middle	616	165,510	2.5	6.0	—/100	—	—
St. Vincent and the Grenadines	Upper-middle	389	101,844	1.3	4.2	—/1–25	—/1–25	—/1–25
Trinidad and Tobago	High	5128	1,215,527	42.9	6.0	—/26–50	—/1–25	—/1–25
Turks and Caicos	High	948	53,701	0.6	—	—	—	—
United States	High	9,833,517	329,256,465	19,490.0	16.8	88,395/0	68,139/1–25	35,325/1–25
Virgin Islands (United States)	High	1910	106,977	3.9	—	—	—	—

—, Data not reported/unavailable; GDP, gross domestic product; HD, hemodialysis; ISN, International Society of Nephrology; KRT, kidney replacement therapy; PD, peritoneal dialysis; PPP, purchasing power parity.
[a]Estimates are in US$ 2017.
[b]Detailed reference list for annual cost of KRT is available in the Supplementary Appendix.
[c]Costs are in $US 2016.

Table 2 | Kidney replacement therapy (incidence and prevalence) and nephrology workforce statistics in the ISN North America and the Caribbean region[11–16]

Country	Treated KF, pmp		Prevalence of long-term dialysis, pmp			Long-term dialysis centers, pmp		Kidney transplantation, pmp, 2018			Nephrology workforce, pmp	
	Incidence	Prevalence	HD	PD	Total (HD + PD)	HD	PD	Incidence	Prevalence	Centers	Nephrologists	Nephrology trainees
Global median [IQR]	170.0	862.4	407.8	49.4	468.7	4.5 [1.2–9.9]	1.3 [0.3–2.4]	20.7	279.9	0.4 [0.2–0.7]	9.9 [1.2–22.7]	1.4 [0.4–3.7]
North America and the Caribbean median [IQR]	287.9	884.7	930.6	53.6	976.1	18.1 [10.4–19.6]	7.2 [1.4–16.8]	56.0	251.3	0.8 [0.6–0.8]	18.1 [15.3–29.5]	0.0 [0.0–1.7][a]
Antigua and Barbuda	—	—	—	—	—	10.4	—	—	—	10.4	31.3	0.0
Bahamas	—	651.1	—	—	—	—	—	—	3.1	—	—	—
Barbados	—	682.5	678.8	0.0	678.8	—	—	—	3.7	—	—	—
Canada	197.7	1371.5	633.3	161.1	794.4	5.6	1.4	48.4	577.0	0.6	15.3	1.7
Cayman Islands	—	819.5	963.8	0.0	963.8	33.6	16.8	—	—	—	16.8	0.0
Jamaica	—	137.4	192.7	11.5	131.5	4.6	1.1	—	6.8	0.4	4.3	—
St. Kitts and Nevis	—	—	—	—	—	18.9	18.8	—	—	—	18.8	18.8
St. Lucia	—	—	—	—	—	18.1	—	—	—	—	18.1	0.0
St. Vincent and the Grenadines	—	—	—	—	—	19.6	9.8	—	—	—	29.5	0.0
Trinidad and Tobago	—	334.6	278.6	56.0	334.6	14.8	1.7	—	—	0.8	5.8	0.0
Turks and Caicos	—	—	1882.4	0.0	1882.4	—	—	—	—	—	—	—
United States	378.0	2196.0	1416.1	157.9	1582.0	20.5	7.2	63.6	666.0	0.8	29.5	1.7
Virgin Islands (United States)	—	—	1399.1	42.4	1441.5	—	—	—	—	—	—	—

—, Data not reported/unavailable; HD, hemodialysis; IQR, interquartile range; ISN, International Society of Nephrology; KF, kidney failure; PD, peritoneal dialysis; pmp, per million population.
[a]Although the median is 0, the average number of nephrology trainees is 2.8 pmp.

than the global prevalence of 9.5% (interquartile range, 6.0%–9.5%) and ranged from 9.9% (interquartile range, 9.2%–10.7%) in the Bahamas to 14.4% (interquartile range, 13.3%–15.7%) in the US Virgin Islands (Supplementary Table S1). Mortality attributed to CKD exceeded 4% in 3 countries: Trinidad and Tobago (4.14%), St. Lucia (4.16%), and Antigua and Barbuda (4.61%). Canada had the lowest CKD-attributed mortality in the region (2.18%). The number of disability-adjusted life years attributed to CKD in North America was 2.6 (interquartile range, 2.2–2.9) years, versus 1.7 (interquartile range, 1.5–1.8) years globally; Canada was the only country in the region with disability-adjusted life years lower than the global average.

The incidence and prevalence of treated KF in North America were 287.9 and 884.7 per million population (pmp), respectively.[11–14] Jamaica had the lowest prevalence of treated KF (137.4 pmp) in the region, whereas the United States had the highest (2196 pmp). Data on the prevalence of CKD and treated KF were unavailable for St. Kitts and Nevis and Turks and Caicos. Long-term hemodialysis (HD) was available in all countries in the region and was the predominant form of dialysis, with prevalence that ranged from 278.6 to 1882.4 pmp. Long-term peritoneal dialysis (PD) was available in 78% of countries, with the highest prevalence in Canada (161.1 pmp); long-term PD was not available in Barbados, the Cayman Islands, and Turks and Caicos (Table 2).[11–14]

Health finance and service delivery. Figure 2 summarizes available funding structures for kidney care in North America and the Caribbean region. A mixture of public and private funding systems covered the costs of nondialysis CKD delivered care in 60% of countries and the cost of dialysis in 70% of countries in the region. The cost of surgery for kidney transplantation were covered from out-of-pocket expenses in 22% of countries in the region (vs. 12% of countries worldwide). In 60% of countries, the costs of medications for transplant patients were publicly funded by government and free at the point of delivery.

Data on the annual cost of kidney replacement therapy (KRT) were only available for Canada and the United States (Table 1).[10] Overall, cost of treatment was lower in Canada than in the United States for dialysis (HD: US$73,789 vs. US$88,395; PD: US$44,434 vs. US$68,139), but significantly higher in Canada than in the United States for kidney transplant treatment in the first year (US$82,852 vs. US$35,325). Although the specific cost of treatment was unavailable, the proportion of out-of-pocket payment for HD was highest in Jamaica and St. Kitts and Nevis (51%–75%) and St. Lucia (100%) (Table 1).[10] Out-of-pocket payment for HD in the United States was 0%, same as for first year of kidney transplant in Canada. The oversight of KF care was handled primarily by individual hospitals, trusts, or organizations in 70% of countries in North America, compared with 38% of all countries and 47% of high-income countries worldwide.

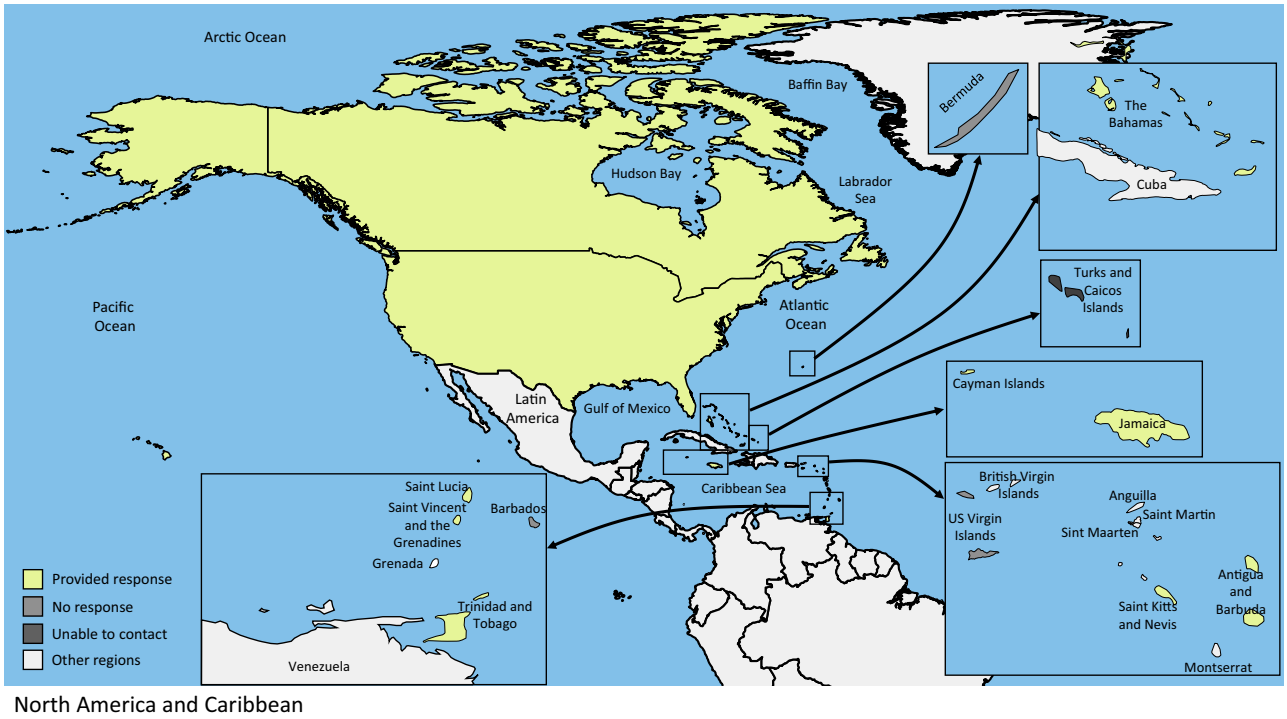

Figure 1 | Countries in the International Society of Nephrology (ISN) North America and the Caribbean region that participated in the ISN Global Kidney Health Atlas survey.

Health workforce for nephrology care. KF care in North America and the Caribbean was provided mainly by nephrologists (89%), multidisciplinary teams (33%), and primary care physicians or nurse practitioners (or specialized nurses) (22%). The median number of nephrologists in the region was 18.1 (interquartile range, 15.3–29.5) pmp, which was nearly twice as high as the global median of 9.9 (interquartile range, 1.2–22.7) pmp, but lower than the median in high-income countries of 23.2 (interquartile range, 16.7–30.9) pmp (Table 2).[15] Only 2 countries in the region had <10 nephrologists pmp: Jamaica (4.27 pmp) and Trinidad and Tobago (5.76 pmp). A shortage of nephrologists was reported in 4 countries: the Cayman Islands, Jamaica, St. Kitts and Nevis, and the United States (Supplementary Figure S1). Shortages were also commonly reported for transplant surgeons (78%), access surgeons (56%), and interventional radiologists for HD access (56%) in the region; the Bahamas and Canada reported no shortages of KF providers (Supplementary Figure S1). There was significant disparity in the median versus average number of nephrology trainees in the region. The median number of nephrology trainees in the region was 0.0 (interquartile range, 0.0–1.7) pmp, whereas the average number of nephrology trainees in the region is 2.78 pmp, with trainees reported only in 3 countries: Canada, St. Kitts and Nevis, and the United States (Table 2).[15]

Essential medications and health product access for KF care. In North America and the Caribbean, 78% of countries had the capacity to provide long-term HD, and 56% of countries had the capacity to provide it with adequate frequency (i.e., 3 times per week, 3–4 hours per session) (Figure 3). Home HD was only available in 22% of countries. Long-term PD was available in only 44% of countries and was not the predominant form of dialysis in any country. Jamaica had the lowest prevalence of long-term dialysis (HD: 192.7 pmp; PD: 11.5 pmp), in addition to dialysis and transplant centers (HD centers: 4.62 pmp; PD centers: 1.07 pmp; transplant centers: 0.36 pmp) in the region. Turks and Caicos had the highest prevalence of long-term dialysis in the region at 1882.4 pmp (Table 2).[12,14,16]

Only 44% of countries reported having the capacity to transport patients to PD centers, the ability to measure urea reduction ratio and/or measure of dialysis adequacy, and the ability to exchange PD bags 3 to 4 times per day (or equivalent number of cycles on automated PD). In 11% of countries, 51% to 75% of patients initiated HD with a functioning vascular access (arteriovenous fistula or arteriovenous graft), and in 33% of countries, 11% to 50% of patients initiated dialysis with either a tunneled dialysis catheter or a temporary dialysis catheter (Supplementary Figure S2). Geographic variations in access to HD and PD were reported in 11% and 44% of countries, respectively. Among patients who were able to access PD, 22% of countries report they were unable to start with this modality and 11% of countries report they were able to start with PD at time of initiation of dialysis in >50% of cases (Figure 4).

Kidney transplantation was available in 56% of countries in North America and the Caribbean region (vs. 74% of all countries and 89% of high-income countries worldwide).

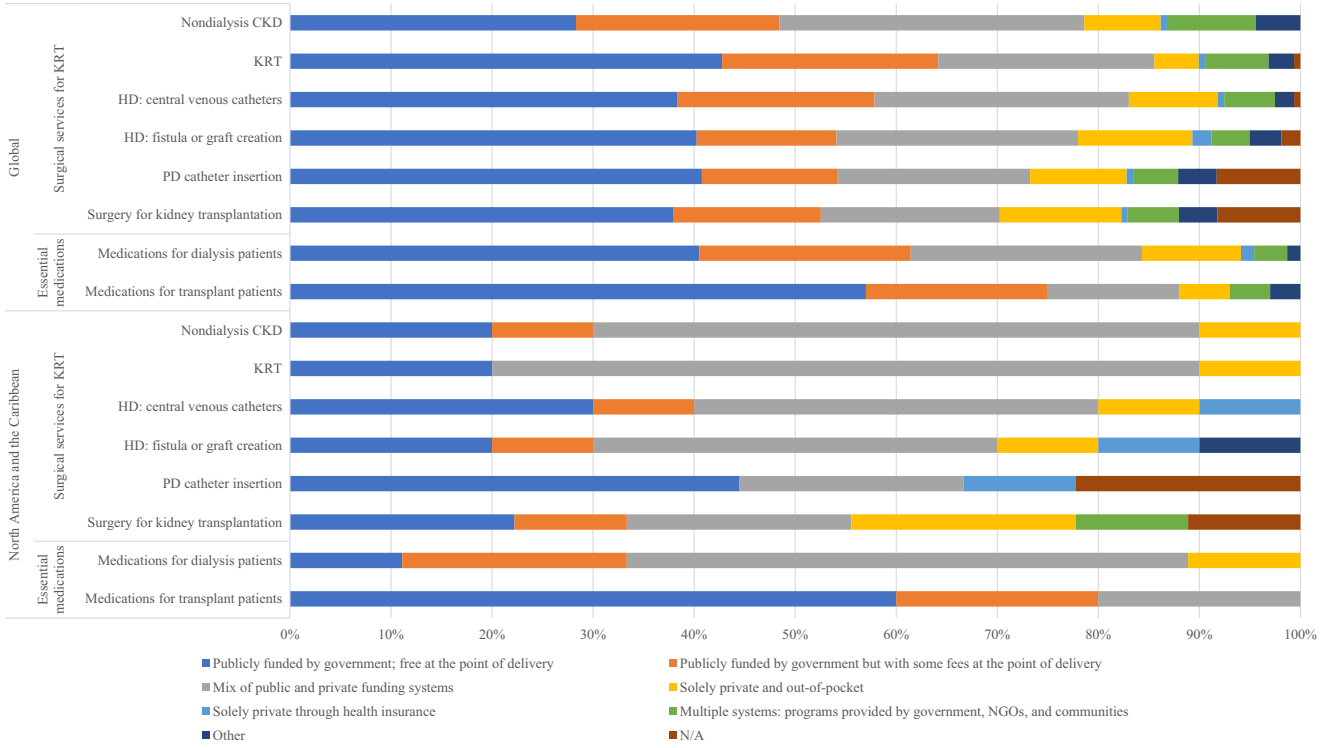

Figure 2 | Funding structures for nondialysis chronic kidney disease (CKD) and kidney replacement therapy (KRT) care in the International Society of Nephrology North America and the Caribbean region. Absolute number of countries in each category expressed as a percentage of total number of countries. HD, hemodialysis; N/A, not available; NGOs, nongovernmental organizations; PD, peritoneal dialysis.

Slightly more than half of the countries in the region (56%) were able to provide effective therapy to control infections, as well as immunosuppression and antirejection treatments to transplant patients (Figure 3). The prevalence of kidney transplantation varies significantly in the region, ranging from 3.1 pmp in the Bahamas to 666 pmp in the United States (Table 2).[11,12,14]

Conservative kidney care was available in 67% of countries in North America and the Caribbean (Figure 3) when either medically advised or chosen by the patient. Choice-restricted conservative care and a multidisciplinary team approach to care via shared decision making were available in 56% of countries in the region. The systematic provision of psychological, cultural, and spiritual support is available in 33% of countries in the region, and 22% of countries in the region systematically provide additional training on conservative care to health care providers. Overall, various diagnostic services and treatments for complications of KF were readily available in North America and the Caribbean (Supplementary Figure S3).

Reporting of KRT quality indicators. KRT quality indicators in the form of patient-reported outcome measures were not reported in many countries in the region. For instance, 33% of countries did not report patient-reported outcome measures for HD, 14% of countries did not report patient-reported outcome measures for PD, and 40% did not report patient-reported outcome measures for kidney transplantation (Supplementary Figure S4). In contrast, KRT quality indicators for dialysis patients, such as blood pressure, hemoglobin, bone mineral markers, and small solute clearance, typically were well reported. In kidney transplant recipients, kidney allograft function, delayed graft function, graft survival, and patient survival statistics were reported >75% of the time in 80% of countries in the region.

Health information systems, statistics, and national health policy. There were no CKD registries in North America and the Caribbean region. Only Canada and the United States have both dialysis and kidney transplantation registries; dialysis and kidney transplantation data were available in 44% and 33% of countries, respectively (Figure 5 and Supplementary Figure S5). Three countries (Antigua and Barbuda, the Cayman Islands, and St. Kitts and Nevis) reported no registries of any kind. Participation in dialysis registries was mandatory in 33% of countries, whereas participation in transplant registries was mandatory in 67% of countries. Many registries do not collect the full spectrum of patient outcome measures. For instance, data on quality of life were not collected in dialysis and transplant registries, and data on patient hospitalization were only collected in 33% of transplant registries (Supplementary Figure S5).

Routine testing for kidney disease among elderly individuals and high-risk patients, including those with hypertension, diabetes, cardiovascular disease, and urological abnormalities, is available in most countries, except in St.

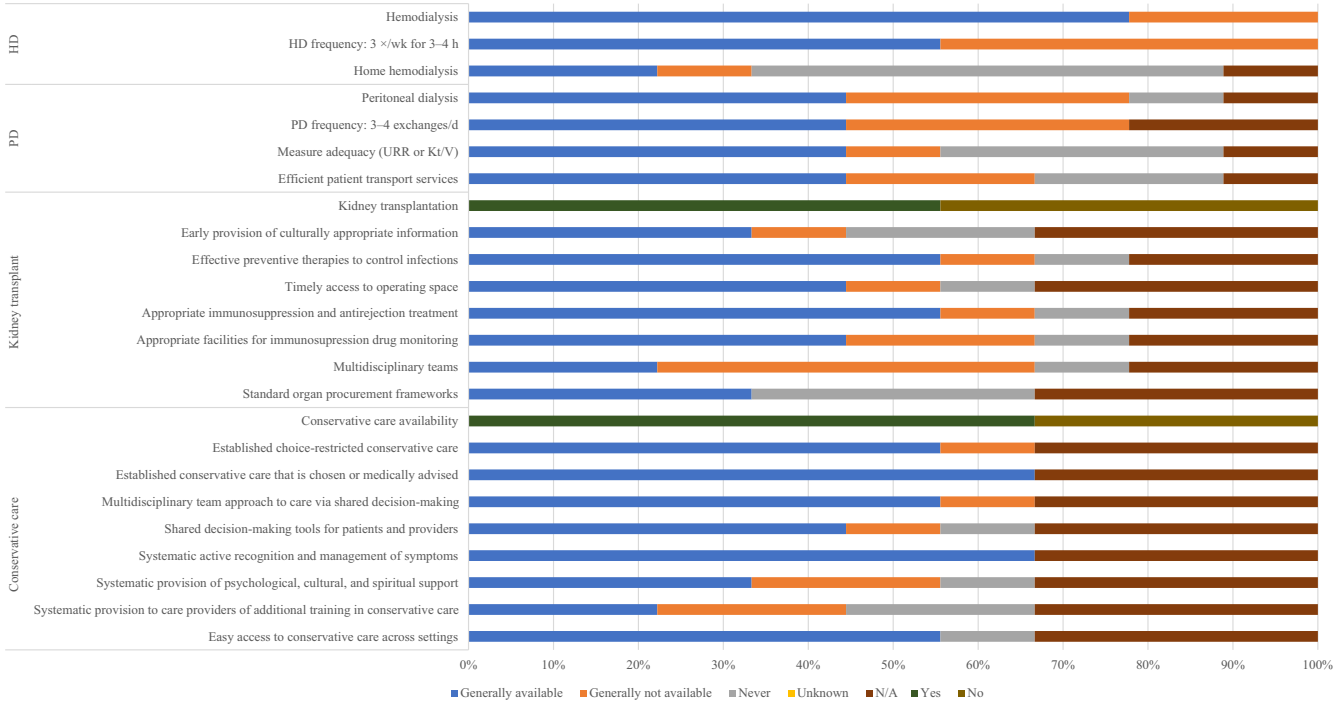

Figure 3 | Availability of choice in kidney replacement therapy or conservative kidney management for patients with kidney failure. Values represent absolute number of countries in each category, expressed as a percentage of total number of countries. HD, hemodialysis; Kt/V, measure of dialysis adequacy; N/A, not provided; PD, peritoneal dialysis; URR, urea reduction ratio.

Kitts and Nevis. There were no acute kidney injury or CKD detection programs in any country in the North America and the Caribbean region.

All governments in the region recognized CKD as a health priority, except St. Vincent and the Grenadines and Trinidad and Tobago. There was advocacy for both CKD and KF in Canada, Jamaica, St. Lucia, and the United States. A national NCD strategy had been implemented in 67% of countries or was under development in 11% of countries in the region. Only 44% of countries in North America and the Caribbean had a national strategy to improve care for CKD patients (Supplementary Figure S6). Among national NCD strategies in the region, 50% covered nondialysis CKD patients, 75% covered dialysis patients, and 25% covered kidney transplant patients (Supplementary Figure S7). Among several barriers highlighted for optimal KF care in the region, economic factors were common in all countries, except Canada and the United States (Figure 5).

Discussion

The overarching aim of the second iteration of the ISN Global Kidney Health Atlas was to define global capacity to deliver care for KF by assessing metrics of availability, accessibility, quality, and affordability of services in all regions and countries.[15] In line with this aim, our study has highlighted several significant characteristics of KF care in the ISN North America and the Caribbean region and revealed important differences between countries. Our findings show that: (i) the median prevalence of treated KF is higher than the global median; (ii) HD is the main modality of dialysis therapy; (iii) transplantation services were not available in all countries, and where it is available, the prevalence of transplantation varies widely; (iv) the median prevalence of nephrologists is about twice the global median; and (v) less than half of the countries in the region have dialysis or transplant registries, and no country in the region has a national strategy for improving care for CKD patients.

It is relevant to highlight that all regional-level data were significantly influenced by the high capacity for KF care in the United States and Canada. Hence, although the prevalence of treated KF is higher in the region than it is globally, only 3 countries in the region (Canada, Cayman Islands, and the United States) were able to provide treatment above the target of 700 pmp set by the Pan American Health Organization in 2013.[30] This could be due to differences in GDP, percentage of GDP spent on health care, and/or differences in dialysis delivery systems.[31–33] For instance, in Canada, long-term dialysis therapy is almost entirely provided by not-for-profit, government-funded facilities, because the country does not have private or for-profit dialysis providers.[32] However, in the United States, although the costs of KF care are primarily covered by the government (80%), reimbursement for dialysis occurs via parallel systems of public and private funding (i.e., Medicare/Medicaid and private insurers, depending on the patient's employment status).[31] Other countries in the region also appear to have mixed models of funding for KF care, as cost is highlighted as a problem.[34,35] Another factor that might be associated with the higher prevalence of treated KF in the region is the increasing prevalence of cardiometabolic risk factors,[5] especially of obesity and diabetes.

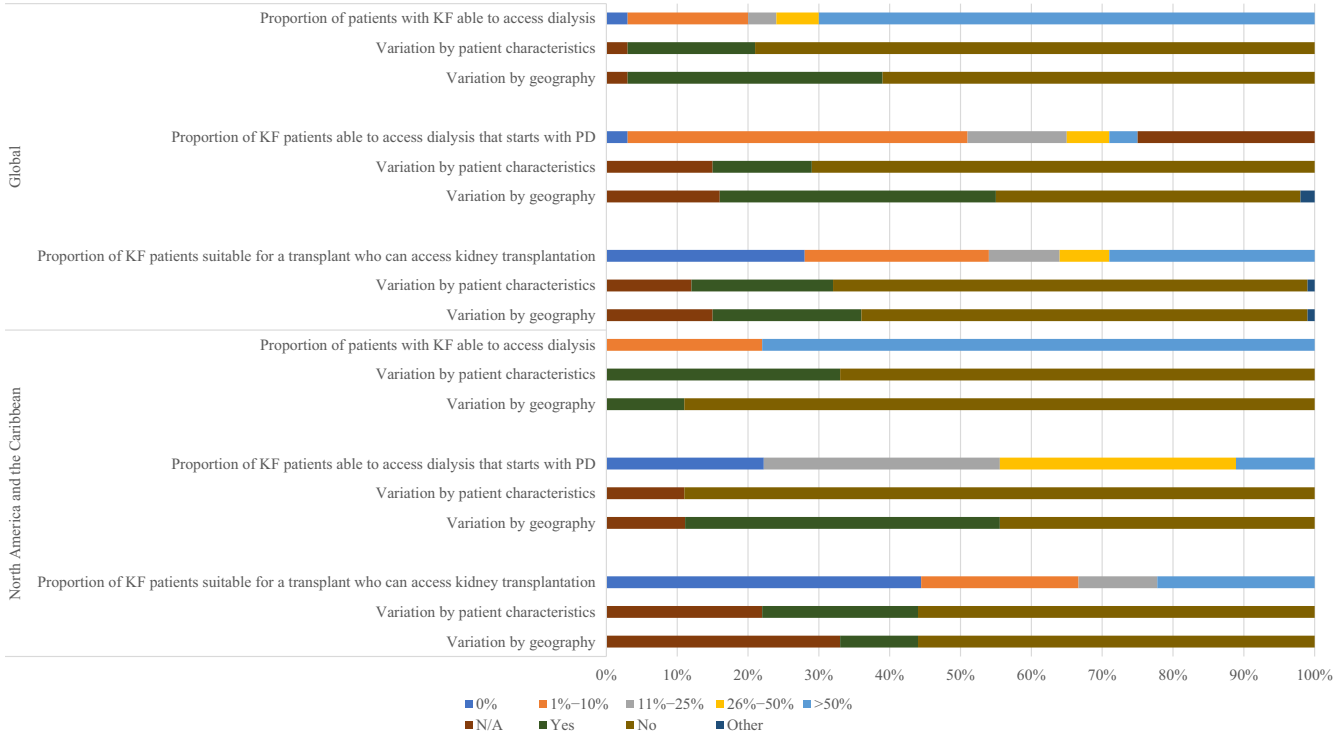

Figure 4| Accessibility of kidney replacement therapy for patients with kidney failure (KF) in the International Society of Nephrology North America and the Caribbean region. Values represent absolute number of countries in each category, expressed as a percentage of total number of countries. N/A, not available; PD, peritoneal dialysis.

HD is available in all countries and is the predominant modality of KRT in the region. Despite having some advantages over HD, such as lower cost,[36,37] improved health-related quality of life,[38] patient independence,[39] preservation of residual kidney function,[40] and better early survival rates,[37] PD is underutilized in the region and is unavailable in some countries

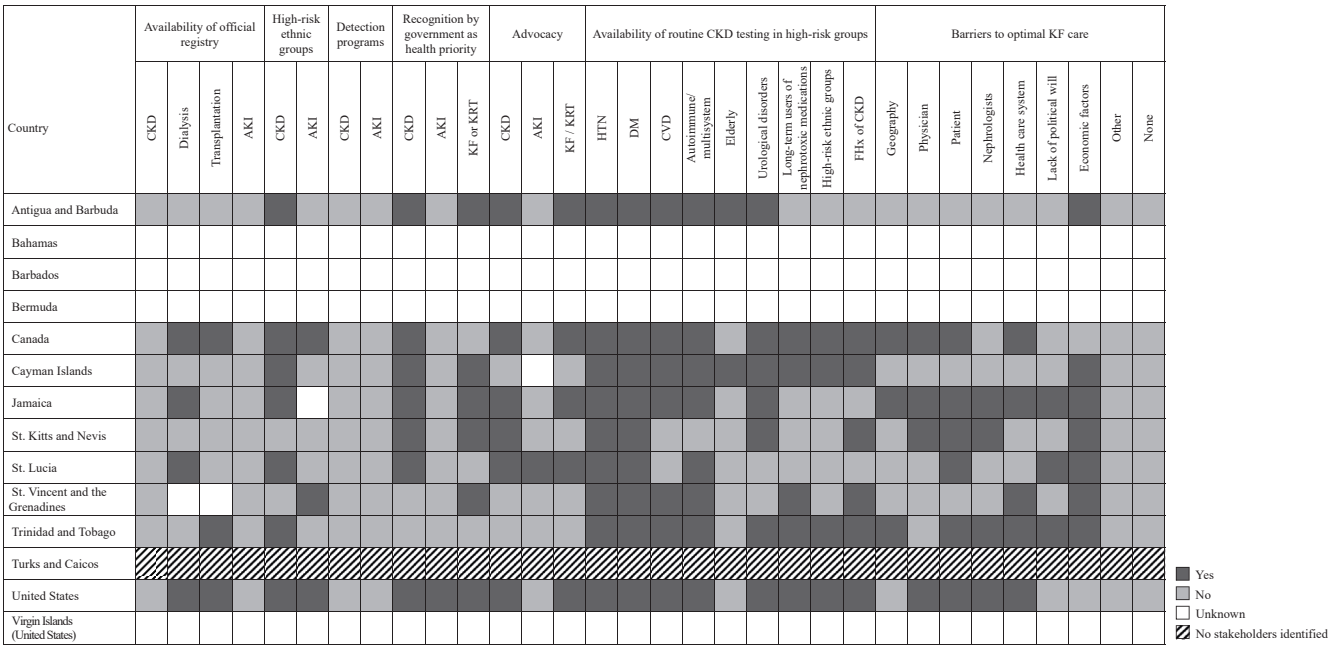

Figure 5| Country-level scorecard for registries, national policies, advocacy, and barriers to optimal kidney failure (KF) care in the International Society of Nephrology North America and the Caribbean region. AKI, acute kidney injury; CKD, chronic kidney disease; CVD, cardiovascular disease; DM, diabetes mellitus; FHx, family history; HTN, hypertension; KRT, kidney replacement therapy.

(Barbados, the Cayman Islands, and Turks and Caicos). Canada has the highest utilization of PD in the region (161.1 pmp), but even this declined from 32% in 1996 to 19% in 2005,[41] partly because of physician reimbursement policies.[42] It has been suggested that in Caribbean countries, strategies and policies regarding care for KF patients often focus on HD and not PD, thereby neglecting patients' rights to choose their preferred modality.[35] In the Empowering Patients on Choices for Renal Replacement Therapy (EPOCH-RRT) study, 47% of HD patients reported that the treatment modality decision was not theirs; in contrast, only 3% of PD patients reported this.[43]

In the United States, the Advancing American Kidney Health initiative was launched by presidential order in mid-2019 with a goal to treat 80% of KF patients with either home dialysis or kidney transplantation by 2025.[44] It has been proposed that to be able to meet this target, PD utilization needs to expand markedly in the United States.[45] There should be increased efforts to make both modalities available in all countries of the region, and to ensure modality decisions are based on patients' preferences as well as clinical and behavioral factors, rather than availability. This will require establishing various programs centered on patient and staff education, patient and family support, and quality improvement around catheter insertion and peritonitis prevention, as well as incentives for PD treatment.[45,46]

The region's trends in the incidence and prevalence of kidney transplantation are similar to those for dialysis and are driven primarily by the United States and Canada, with many countries reporting little to no data (Table 2). Shortages of transplant surgeons and transplant coordinators were salient constraints in Caribbean nations (Supplementary Figure S1). Other challenges to transplantation in Caribbean nations include costs of immunosuppression therapies and ineffective or nonexistent organ procurement programs.[35] For instance, in Trinidad and Tobago, the transplant program is supported mainly by living donors, thus limiting the number of organs available for transplantation. However, kidney transplantation has increased in the country since the implementation of the Spain-Europe-USA program aimed at improving organ donation and transplant systems, with support from the National Organ Transplant Unit and the Ministry of Health.[47] Similar initiatives that are backed by government support could help transform kidney transplantation in other Caribbean countries. In the United States and Canada, transplantation referral practices need to be standardized. Other factors affecting access to kidney transplantation, including racial disparities and socioeconomic factors, must continue to be rigorously examined.[48,49]

We also noted variations in monitoring and infrequent reporting of key KRT quality indicators in the region, particularly modality and survival data for dialysis patients, in addition to rejection rates, graft status, and survival data for kidney transplant patients (Supplementary Figure S4). Although such information generally aids the improvement of patient care, it also informs resource allocation decisions and other quality improvement activities. The lack of monitoring and reporting has been shown in other studies in the region, highlighting the need to measure health system performance to improve patient care and outcomes.[50,51]

Our study also showed that apart from Jamaica and Trinidad and Tobago, the median density of nephrologists far exceeded the global median. Nonetheless, several countries still reported shortages in KF care providers, especially for transplantation, surgical procedures, and interventional care, with the median number of nephrology trainees in the region falling below the global median (Table 2 and Supplementary Figure S1). Some reasons for this may include declining interest in nephrology among trainees,[52] an unappealing practice environment, and a poor work-life balance.[53] Strategies that incorporate workforce training, planning, and development for all KF caregivers could help ensure sustainable kidney care delivery in the region.

Health information systems are crucial for health service surveillance and monitoring, governance and regulation, and planning and development.[54] Registries remain an important component of health information systems by providing data that describe disease burden, treatments, and outcomes and can be used to improve patient care. However, there is no uniform registry for kidney disease in the region; moreover, not all countries have kidney disease registries, and some registry reports may not be updated regularly.[35] Although up to two-thirds of countries in the region had a national NCD strategy, no country in the region had a national strategy to improve care for CKD patients. CKD was not a recognized government health priority in some countries, and some did not have CKD advocacy groups (Figure 5). The World Health Organization recommends that national NCD policies, strategies, and plans should guide efforts to address the growing threat of NCDs, and provide clear objectives, priorities, targets, timetables, and budgets as well as integrated monitoring mechanisms in line with global efforts.[55] The World Health Organization recommends that these efforts should be participatory, involving both government agencies and nongovernmental organizations. Partnerships established to support CKD and KF patients in Caribbean countries by organizations such as the ISN, the World Health Organization, and the National Kidney Foundation should be strengthened and expanded.[35]

In summary, our study has highlighted several gaps in funding, as well as structures that ensure availability, accessibility, affordability, and quality of KF care in the ISN's North America and the Caribbean region. Notable gaps exist between the 2 largest nations (i.e., the United States and Canada) and the smaller island nations of the Caribbean. Particular attention needs to be directed toward increasing health care workers' access to training, improving KRT monitoring and reporting of quality indicators, and ensuring that NCD- and CKD-specific policies are in place in all countries.

DISCLOSURE

DWJ reports grants and personal fees from Baxter Healthcare and Fresenius Medical Care, travel sponsorship from Amgen, personal fees from Astra Zeneca, AWAK, and Ono, and grants from National Health and Medical Research Council of Australia, outside the submitted work. VJ reports grants from GlaxoSmithKline and Baxter Healthcare, provides scientific leadership to George Clinical, and receives consultancy fees for Biocon, Zudis Cadilla, and NephroPlus, all paid to his institution, outside the submitted work. KK-Z reports personal fees from Abbott, Abbvie, Alexion, Amag Pharma, Amgen, Astra-Zeneca, Aveo, Baxter, Chugai, Dr. Schaer, Fresenius Medical Services, Genentech, Haymarket, Hospira, Kabi, Keryx, Novartis, Patient-Centered Outcomes Research Institute (PCORI), Pfizer, Relypsa, Resverlogix, Sandoz, Sanofi, Shire, Vifor, ZS-Pharma, and UpToDate, fees paid to his institution from DaVita, and grants and personal fees from National Institutes of Health, outside the submitted work. CPK reports personal fees from Amgen, Sanofi-Aventis, Fresenius Medical Care, Keryx, Bayer, Abbott, Abbvie, Dr. Schar, Astra-Zeneca, Takeda, Tricida, and Reata, and grants from Shire, outside the submitted work. MW reports personal fees from Amgen, DiaSorin, Akebia, Amag, Ardelyx, Lutipold, and Keryx, outside the submitted work. All the other authors declared no competing interests.

ACKNOWLEDGEMENTS

This article is published as part of a supplement supported by the International Society of Nephrology (ISN; grant RES0033080 to the University of Alberta).

The ISN provided administrative support for the design and implementation of the study and data collection activities. The authors were responsible for data management, analysis, and interpretation, as well as manuscript preparation, review, and approval, and the decision to submit the manuscript for publication.

We thank Kara Stephenson Gehman in International Society of Nephrology Global Kidney Health Atlas (ISN-GKHA) for carefully editing the English text of a draft of this article. We thank Jo-Ann Donner, coordinator at the ISN, for her prominent role and leadership in the manuscript management, editorial reviews, and submission process to *Kidney International Supplements*; and Sandrine Damster, senior research project manager at the ISN, and Alberta Kidney Disease Network staff (Ghenette Houston, Sue Szigety, and Sophanny Tiv) for helping to organize and conduct the survey and for providing project management support. We also thank the ISN headquarters staff, including the Executive Director, Charu Malik, and the Advocacy team. We also appreciate the support from the ISN's Executive Committee, regional leadership, and Affiliated Society leaders at the regional and country levels for their help with the ISN-GKHA survey.

SUPPLEMENTARY MATERIAL

Supplementary File (PDF)

Table S1. Burden of chronic kidney disease and its risk factors in the North America and the Caribbean region.

Figure S1. Shortages of kidney failure providers in the North America and the Caribbean region.

Figure S2. Proportion of patients starting dialysis with different forms of vascular access and adequate education in the North America and the Caribbean region.

Figure S3. Availability of services to diagnose and treat complications of kidney failure in the North America and the Caribbean region.

Figure S4. Quality indicators monitored and reported by countries in the North America and the Caribbean region that participated in the ISN-GKHA survey.

Figure S5. Registry characteristics for countries in the North America and the Caribbean region that reported having ≥1 in the ISN-GKHA survey.

Figure S6. National strategies in the North America and the Caribbean region.

Figure S7. Populations covered by national noncommunicable disease and chronic kidney disease strategies.

Supplementary Appendix. Reference list for annual cost of kidney replacement therapy (for Table 1).

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