

## CKJ REVIEW

# The Latin American Dialysis and Renal Transplantation Registry: report 2019

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## ABSTRACT

**Background.** Chronic kidney disease (CKD) in Latin America (LA) continues to represent a challenge due to the burden of disease it causes and the difficulty in accessing treatment. LA has a total population of 652 million people living in 20 countries that occupy an area of 19.2 million km<sup>2</sup>. The Latin American Dialysis and Renal Transplantation Registry (LADRTR), founded in 1991, has collected data and reports on patients receiving kidney replacement therapy (KRT) since 1993. This article summarizes the registry data for 2019.

**Methods.** Participating countries complete an annual survey collecting aggregated data on incident and prevalent patients on KRT in all modalities. The different treatment modalities considered were hemodialysis (HD), peritoneal dialysis (PD) and living functioning kidney graft (LFG). National gross domestic product per capita (GDP, expressed in US dollars) and life expectancy at birth (LEB) corresponding to the year 2019 were collected from the World Bank Data Bank. Prevalence and incidence were compared with previous years and were also correlated with GDP and LEB.

**Results.** On 31 December 2019 a total of 432 610 patients were in KRT in LA, corresponding to an overall unadjusted prevalence of 866 per million population (pmp). Regarding treatment modality, 66.7% of the prevalent patients were treated with HD and 9.3% with PD while 24% of the patients had an LFG. A total of 85 224 patients started KRT in LA, representing a total unadjusted incidence rate of 168 pmp. Diabetic nephropathy as a cause of CKD continues to be a relevant percentage (36%) and five countries reported CKD of nontraditional causes. The kidney transplant rate in the region was 22 pmp, varying from 1 to >60 pmp. The total prevalence of KRT correlated positively with GDP per capita ( $r^2 = 0.6$ ,  $P < 0.01$ ) and LEB ( $r^2 = 0.23$ ,  $P < 0.05$ ). The overall incidence rate also significantly correlated with GDP ( $r^2 = 0.307$ ,  $P < 0.05$ ). The overall unadjusted mortality rate was 13%.

**Conclusion.** Accessibility to KRT is still limited in LA. It is necessary to continue the efforts made by each country and the Latin American Society of Nephrology and Hypertension to guarantee equal access to treatment.

**Keywords:** dialysis, epidemiology, kidney transplantation, Latin America, registries

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## INTRODUCTION

Chronic kidney disease (CKD) in Latin America (LA) continues to represent a challenge due to the burden of disease it entails and the difficulty in accessing treatment. Currently it contributes to 3.17% of total disability-adjusted life years in the region [1]. Also, ~7.6% of cardiovascular deaths worldwide during 2017 were attributable to impaired renal function [2]. While the prevalence of diabetes and hypertension, main causes of CKD, are increasing in the region, it would be reasonable to expect a progressive increase of CKD incidence and a greater burden on healthcare systems [3–6]. Furthermore, the growing prevalence of CKD from non traditional causes (unrelated to diabetes or hypertension), mainly affecting young men, may dramatically increase expenditures for CKD healthcare coverage, focusing on the need to improve prevention measures [7, 8].

LA has a total population of 652 million people in 20 countries that occupy an area of 19.2 million km<sup>2</sup> [9]. They have in common Latin-origin language (mainly Spanish and Portuguese) and are part of one of the most ethnically diverse areas of the world. Despite being, in the past, a destination of many immigrant waves during world economic crises or wars, almost 8% of the people of LA identify themselves as indigenous, direct descendants of native American Indians, representing >522 groups spread broadly throughout the continent and speaking ~420 dialects [10, 11]. LA has extensive unpopulated areas, such as the Amazonas, but most of the urban population is concentrated in large metropolitan cities such as Sao Paulo, Mexico City and Buenos Aires.

Although LA has experienced significant social and economic progress over the past decades, the inequities in health access continue to be a real and tangible problem. On average, government health expenditures represent 12% of the general expenditures, ranging from 28% in Costa Rica to 3.7% in Venezuela [12]. On the other hand, the out-of-pocket health expenditures for each household in each country ranges from 57.5% in Guatemala to 11.0% in Cuba [13]. Gross national income (GNI) per capita increased over the years to US\$16.5 per capita in 2019, but there is variability of up to US\$30 000 within the region [14]. Although most of the countries have an upper-middle income status, 30% of the population lives under the poverty line and 10.7% lives in extreme poverty [15].

The Latin American Dialysis and Renal Transplantation Registry (LADRTR), founded in 1991, has collected data and reports on patients receiving kidney replacement therapy (KRT) since 1993. Currently the LADRTR is composed of an executive board and delegates from each of the nephrology societies from the 20 countries that are members of the Latin American Society of Nephrology and Hypertension (SLANH). By 2019, eight countries were classified as registry category 1, meaning that there is not yet a basic type of dialysis and/or kidney transplant systematic registry [16]. Two countries were category 5, meaning that the registration of dialysis and transplantation is national in scope, with >90% of the patients registered. These registries are regulated by legislation and are multi-institutional. However, over the years, and with direct support from the SLANH and the effort of each country, the national registries have been able to progressively improve their quality.

This article summarizes the registry data for 2019.

## MATERIALS AND METHODS

Methods have been reported previously (Supplementary data, Table S1) [17–20]. Participating countries complete an annual survey collecting aggregated data on incident and prevalent patients (≥18 years) on KRT in all modalities. The incidence of KRT was defined as the number of patients starting KRT in one year (2019) and the prevalence of KRT was expressed as the number of patients alive and receiving KRT on 31 December 2019. Incidence and prevalence per million population (pmp) was calculated by dividing the observed count by the mid year population. The different treatment modalities considered were hemodialysis (HD), peritoneal dialysis (PD) and living functioning kidney graft (LFG). Transplant rate refers to the number of transplants performed during 2019, independent of whether they were performed for prevalent or incident patients. National gross domestic product per capita (GDP; expressed in US dollars) and life expectancy at birth (LEB) corresponding to the year 2019 were collected from the World Bank Data Bank [21]. Prevalence and incidence were compared with previous years and were also correlated with GDP and LEB. Mortality was calculated according to the formula: number of deaths in the year/[(number of patients at the beginning of the year + number of patients at the end of the year)/2]. Since there is no registry for all of Mexico, data from the States of Jalisco and Aguas Calientes were analyzed together. The definition of percentage of coverage is the percentage of treatment available without the patient having to spend money out of pocket in terms of health services (includes kidney replacement therapy, promotion, prevention, rehabilitation and palliative care).

Linear regression models were used to explore the correlation between the GDP and LEB and the prevalence of KRT. Pearson's coefficient (*r*) and *r*<sup>2</sup> were employed; *P* < 0.05 was considered significant.

## RESULTS

On 31 December 2019 a total of 432 610 patients were on KRT in LA, corresponding to an overall unadjusted prevalence of 866 pmp (Table 1). The prevalence ranged from 2119 pmp in Puerto Rico to 111 pmp in Nicaragua. Ten countries had a rate >700 pmp (Argentina, Brazil, Chile, Colombia, Ecuador, El Salvador, Panamá, Puerto Rico and Uruguay). The states of México, Jalisco and Aguas Calientes, also had a rate >700 pmp. The overall prevalence progressively increased, being 778 pmp for 2017 and 810 pmp in 2018 [22].

Regarding treatment modality, 66.7% of the prevalent patients were treated by HD (*n* = 288 703) and 9.3% by PD (*n* = 40 280), while 24% of patients had an LFG (*n* = 103 627). HD continues to be the most prevalent modality. While PD reached a plateau on its prevalence, LFG has increased steadily over the past 10 years. (Figure 1) HD was the most frequently used modality in all countries except Costa Rica, where PD was used in 209 pmp and HD was used in only 40 pmp. Taking into account both dialysis modalities together, these were more frequent compared with LFG in the region as a whole and in each country separately. Jalisco/Aguas Calientes should be highlighted as the region with the highest prevalence of LFG (729 pmp) (Figure 2). The percentage of prevalent patients on HD >65 years old was 36.6%.

In 2019, 85 224 patients started KRT in LA, representing a total unadjusted incidence rate of 168 pmp. (Table 1). The majority

Table 1. KRT prevalence, incidence and kidney transplantation rates, 2019

Country	Population in millions	Prevalence rate pmp					Incidence rate pmp		Kidney Tx rate pmp <sup>a</sup>
		HD	PD	Total dialysis	LFG	Total	Total dialysis	On PD (%)	
Argentina	44 938 712	674	46	720	243	963	163	6.4	35
Bolivia	11 513 102	452	2 <sup>b</sup>	454 <sup>b</sup>	3 <sup>b</sup>	457 <sup>b</sup>	114	0.0	2
Brazil	211 049 519	618	47	665	299	963	218	7.1	30
Chile	18 952 035	1236	81	1317	233	1550	204	10.0	22
Colombia	50 339 443	516	185	702	157	858	103	40.6	19
Costa Rica	5 047 561	40	209	249	318	567	38	NR	15
Cuba	11 333 484	293	6	299	131	430	108	0.0	15
Ecuador	17 373 657	735	21	756	12	768	6	2.7	13
El Salvador	6 453 550	297 <sup>b</sup>	380 <sup>b</sup>	677 <sup>b</sup>	99 <sup>b</sup>	776 <sup>b</sup>	217 <sup>b</sup>	0.0 <sup>b</sup>	6 <sup>b</sup>
Guatemala	16 604 026	304	221	525	51	575	140	19.9	6
Honduras	9 746 115	370 <sup>c</sup>	22 <sup>c</sup>	392 <sup>c</sup>	13 <sup>c</sup>	405 <sup>c</sup>	96 <sup>c</sup>	0.6 <sup>c</sup>	0 <sup>c</sup>
Jalisco/Aguas Calientes	8 281 714/1 415 421	611	483	1094	729	1823	530	0.0	62
Nicaragua	6 545 503	35	65	100	11	111	31	73.7	2
Panama	4 246 440	488	113	601	100	701	181	21.5	8
Paraguay	7 044 639	317	16	333	54	387	36	6.0	4
Peru	32 510 462	515	57	572	46	618	62	6.5	3
Puerto Rico	3 193 694	1607 <sup>b</sup>	130 <sup>b</sup>	1737 <sup>b</sup>	392 <sup>b</sup>	2129 <sup>b</sup>	419 <sup>b</sup>	1.1 <sup>b</sup>	18 <sup>b</sup>
Dominican Republic	10 738 957	340	98	438	47	485	221	ND	5
Uruguay	3 461 731	734	62	796	398	1194	185	10.1	42
Venezuela	28 515 829	310	10	320	0	320	96	ND	1
Total LA	627 183 988	570	80	650	216	866	168	12	22

<sup>a</sup>Number of KT's performed in 2019.<sup>b</sup>2018 data.<sup>c</sup>2020 data.

ND: no data available; Tx: transplant.

Table 2. Macroeconomic characteristics of Latin America

Country	KRT prevalence (pmp) <sup>a</sup>	GDP per capita <sup>b</sup> (current US\$)	LEB <sup>b</sup> (years)	Nephrologists (pmp)	KRT coverage <sup>c</sup> (%)
Argentina	963	9912	77	25	100
Bolivia	457 <sup>d</sup>	3552	72	7	90
Brazil	963	8717	76	20	100
Chile	1550	14 896	80	7	100
Colombia	858	6429	77	8	100
Costa Rica	567	12 244	80	5	100
Cuba	430	ND	79	44	100
Ecuador	768 <sup>d</sup>	6184	77	12 <sup>d</sup>	100
El Salvador	776 <sup>d</sup>	4187	73	9	40
Guatemala	575	4620	74	5	100
Honduras	405 <sup>e</sup>	2575	75	3 <sup>e</sup>	25
Jalisco/Aguas Calientes	1823	9946	75	9	51
Nicaragua	111	1913	74	5	50
Panama	701	15 731	79	9	80
Paraguay	387	5415	74	9	100
Peru	618	6978	77	11	100
Puerto Rico	2129 <sup>d</sup>	32 874	80	23 <sup>d</sup>	92
Dominican Republic	485	8282	74	16	67
Uruguay	1194	16 190	78	51	100
Venezuela	320	ND	72	18	100
Total LA	866	ND	76	19	ND

<sup>a</sup>All dialysis techniques plus persons living with a functioning kidney graft.<sup>b</sup>Data from the World Bank Data Bank for 2019.<sup>c</sup>Treatment available without having to spend money out of pocket in terms of health services (includes KRT, promotion, prevention, rehabilitation and palliative care).<sup>d</sup>2018 data.<sup>e</sup>2020 data.

ND: no data available.

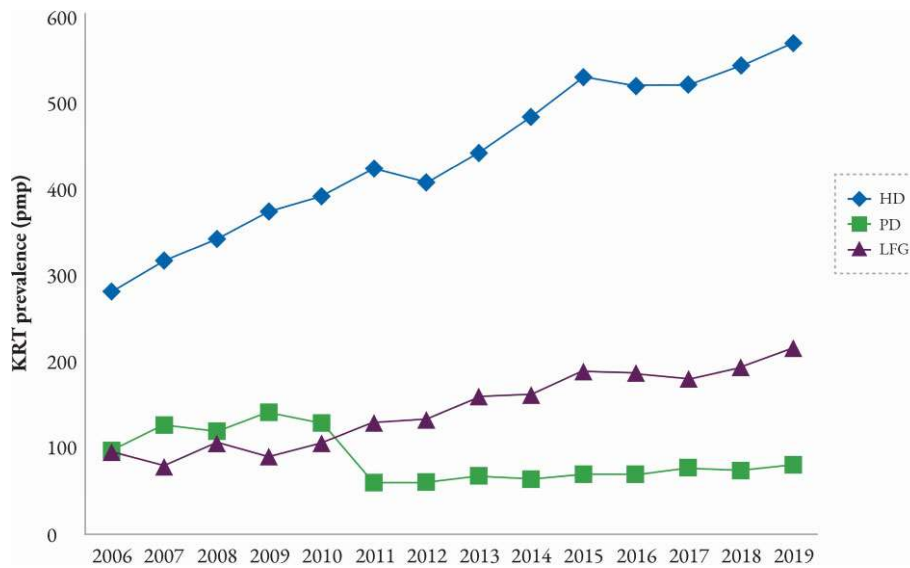


FIGURE 1: Unadjusted prevalence rates pmp of patients on KRT for all LA, by modality.

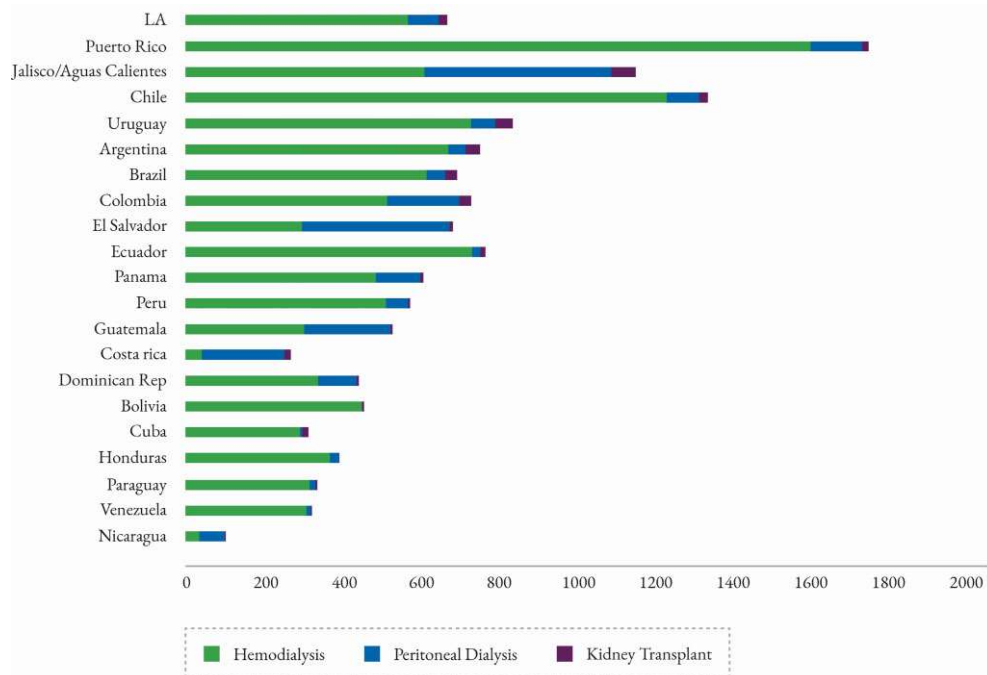


FIGURE 2: Unadjusted prevalence rates pmp of patients on renal replacement therapy in 2019, by treatment modality.

of the patients started KRT with HD, while only 12% used PD. PD represented >10% of the incident modality in only four countries (Guatemala 19.9%, Panama 21.1%, Colombia 40.6% and Nicaragua 73.7%).

Diabetic nephropathy as a cause of CKD continues to be a relevant percentage (36%), ranging from 48% in Jalisco/Aguas Calientes to 19% in El Salvador. In 2019, five countries reported CKD of non-traditional causes (CKDnt): Guatemala, Honduras, Jalisco/Aguas Calientes, Nicaragua and Paraguay.

The kidney transplant (KT) rate in the region was 22 pmp, ranging from close to 1 to >60 pmp, as is the case in Jalisco/Aguas Calientes (Table 1). Eleven countries reported data on the source

of transplant, either cadaveric or living donor. Argentina, Brazil, Chile, Colombia, Ecuador, Paraguay and Uruguay reported >70% of cadaveric donors.

The total prevalence of KRT correlated positively with GDP per capita ( $r^2 = 0.6$ ,  $P < 0.01$ ) and LEB ( $r^2 = 0.23$ ,  $P < 0.05$ ) (Figure 3A and B). Considering treatment modality, HD prevalence also correlated positively with both indicators (GDP:  $r^2 = 0.609$ ; LEB:  $r^2 = 0.23$ ,  $P < 0.05$ ) while the KT and PD prevalence rates showed no correlation (Figure 3D and E).

The overall incidence rate also significantly correlated with GDP ( $r^2 = 0.307$ ,  $P < 0.05$ ) (Figure 3C). Overall, the Gini index is between 30 and 50%. Finally, regarding human resources, great

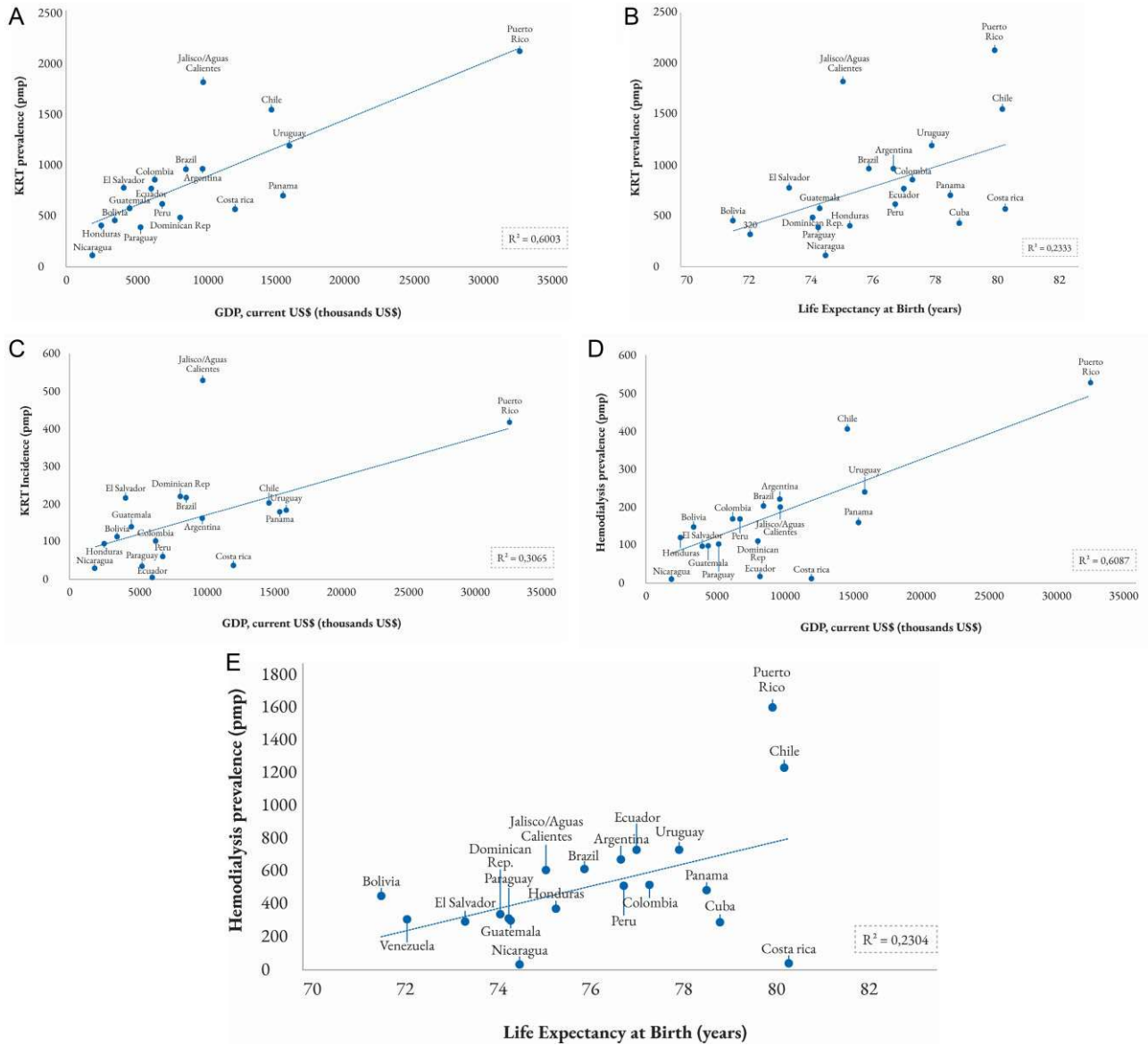


FIGURE 3: (A) Association between GDP per capita and prevalence of KRT (pmp). (B) Association between LEB and prevalence of KRT (pmp). (C) Association between GDP per capita and incidence of KRT (pmp). (D) Association between GDP per capita and prevalence of HD (pmp). (E) Association between LEB and prevalence of HD (pmp).

heterogeneity was reported in the number of nephrologists per population rate, from 3 pmp in Honduras to 51 pmp in Uruguay. Only Argentina, Chile, Cuba, Puerto Rico and Uruguay have <20 nephrologist pmp (Table 2).

Eleven countries reported data for mortality, showing significant heterogeneity between them. The overall unadjusted mortality rate was 13% (Table 3).

## DISCUSSION

This report shows that the overall prevalence rate of KRT in LA is continuously increasing, being 660 pmp in 2010 and reaching 866 pmp in 2019 [23]. Although prevalence rates >700 pmp were achieved only after 2014, they remained above this value for the following years. During 2013 the Pan-American Health

Organization (PAHO) developed a strategic plan called ‘In favor of health: sustainable development and equity’ that proposed to increase access to interventions to prevent and control the noncommunicable diseases and their risk factors. In collaboration with the SLANH, which is a non-governmental organization collaborating with the PAHO since 2015, the goal proposed was to achieve universal coverage of KRT and a prevalence rate of at least 700 pmp by 2019 [16]. In order to make this goal feasible, the plan also proposed to increase the use of PD as a cost-effective KRT modality (20% use was suggested) and to reach a rate of 20 nephrologists pmp to provide adequate care for patients with CKD. Whereas the overall prevalence rate goal was achieved, 10 countries still had <700 pmp in 2019. However, four countries (Colombia, Ecuador, El Salvador and Panama) not only increased their prevalence rate, but also achieved the proposed goal in the last 5 years [24].

Table 3. Overall mortality rate, 2019

Country	Mortality rate (%)
Argentina	16
Bolivia	ND
Brazil	19
Chile	12
Colombia	14
Costa Rica	ND
Cuba	25
Ecuador	ND
El Salvador	ND
Guatemala	15
Honduras	25
Jalisco/Agua Calientes	ND
Nicaragua	4
Panamá	17
Paraguay	6
Perú	ND
Puerto Rico	ND
Dominican Republic	ND
Uruguay	17
Venezuela	ND
Total LA	

ND: no data.

This increase in the overall prevalence rate in the region could be explained by many factors. First, not only the economic development measured through GDP, but also the percentage of health coverage of KRT seem to correlate positively with prevalence in those countries with the highest GDP and 100% health coverage of the treatment. On the other hand, the number of nephrologist pmp also increased progressively, not only improving the treatment quality, but also allowing access to patients living in remote areas. Although not presented here, local data presented by countries that have good-quality registries, such as Argentina, Chile and Uruguay, suggest that their prevalence increases along with an increase in survival as well as the increasing number of patients that re-enter dialysis treatment after KT failure [25–27]. Finally, the promotion and development of data collection registries in every country was emphasized through workshops and seminars designed specifically to train and certify those responsible for national KRT registries in the framework of the SLANH–PAHO alliance. This action allowed countries to improve their registry quality by identifying more patients who were already receiving treatment but were not registered.

The modality prevalence rate that grew the most was HD. Even though KT is feasible, available and increasingly used in all LA countries, its growth rate (19.1 pmp in 2010, 15 pmp in 2012, 19.8 pmp in 2014 and 22 pmp in 2019) is still not as fast as it should be, not only to compensate for the increasing prevalence of patients on waiting lists, but also to decrease the number of patients on HD.

In contrast, the PD prevalence rate remained flat over the last 10-year span. As in Europe and the USA, PD is still the least-favored choice in LA [28–30]. The causes are presumably multifactorial, for example, the shortage of trained nephrologists and nurses and the lack of financial support and health policies. This approach could be adequate to overcome particular geographical demands and to reduce the need for long-distance travel to receive treatment in some specific regions. The ability to produce dialysis solutions in the area should be considered cost effective.

Moreover, the incidence of KRT increased from 1992 to date, but in recent years it has shown a tendency to stabilize: 151 pmp in 2012, 157.6 pmp in 2014 and 168 pmp in 2019 [24]. The great variation between the incidences among countries can be explained by the different prevalence rates of noncommunicable diseases in each population, such as diabetes, arterial hypertension and obesity, as well as the presence of new causes such as an epidemic of CKDnt. In this case, the terrible working conditions in agricultural communities dedicated mainly to the cultivation of sugar cane, the use of pesticides and heat stress are common factors that have been shown to lead to kidney dysfunction in the affected populations [31]. Countries that reported the highest incidence rate in 2019 (Jalisco/Agua Calientes, Puerto Rico, Brazil, Dominican Republic) are reporting cases of CKDnt.

Finally, this report has several limitations. Heterogeneity and a lack of data in some LA countries is concordant with inequities among end-stage CKD patients in getting access to KRT. Moreover, given that only aggregated data are currently collected, the LADRTR cannot report survival results. However, this registry has several strengths. Among them, its continuity allows comparisons among different countries and previous records, along with the generation of trends for the treatment of CKD in LA.

## CONCLUSION

Diagnostic and prevention programs for leading causes of CKD, along with health policies that promote organ procurement and growth of PD, are needed in the region. At the same time, training for countries that are developing their registries and cooperation among LA nephrology societies affiliated with the SLANH and PAHO will allow the initiation, continuity and growth of national registries.

## SUPPLEMENTARY DATA

Supplementary data are available at [ckj](https://ckj.oxfordjournals.org/) online.

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## CONFLICT OF INTEREST STATEMENT

The authors declare they have no conflict of interest.

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