Dialysis Care Around the World: A Global Perspectives Series

Timmy Lee,1,2 Jennifer E. Flythe,3,4 Michael Allon1

Department of Medicine and Division of Nephrology, University of Alabama at Birmingham, AL1; Veterans Affairs Medical Center, Birmingham, AL2; University of North Carolina (UNC) Kidney Center, Division of Nephrology and Hypertension, Department of Medicine, UNC School of Medicine, Chapel Hill, NC3; Cecil G. Sheps Center for Health Services Research, University of North Carolina, Chapel Hill, NC4

Address for correspondence: Timmy Lee, M.D., M.S.P.H.

Professor of Medicine
Department of Medicine
Division of Nephrology
University of Alabama at Birmingham
Zeigler Research Building 524
1720 2nd Ave South
Birmingham, AL 35294-0007

Email: txlee@uab.edu
Phone: 205-934-3589
Fax: 205-975-6288
Introduction

Worldwide, end stage kidney disease prevalence per million population (PMP) has steadily increased from 2003 to 2016\(^1\), with the greatest proportional increases occurring in lower- and middle-income countries\(^2\). Although dialysis is a life-saving therapy, it is also extraordinarily expensive, so its use is limited in lower income countries with less resources available for healthcare. Specifically, the prevalence of dialysis in 2010 was 1176 PMP in higher income countries, 688 PMP in upper-middle income countries, 170 PMP in lower income countries, and 16 PMP in low income countries\(^2\). The most common modality of kidney replacement therapy globally is dialysis (78%), and among patients receiving dialysis, only 11% receive peritoneal dialysis\(^3\).

The *Kidney360* Global Dialysis Perspective series launched in 2020 and showcases how dialysis is practiced, delivered, and financed in different countries across the world. To date, we have featured perspectives from 17 countries in 6 continents: Africa (Senegal, South Africa); Asia (India, Israel, Japan, Korea, Singapore, Thailand, Vietnam); Australia; Europe (Spain); North America (Canada, Mexico, United States); and South America (Argentina, Brazil, Guatemala)\(^4\)-\(^20\). Authors of each global perspective were asked to report standard information about their dialysis populations, including general characteristics of the dialysis system and its treatments such as percentage of patients by dialysis modality; dialysis unit financing (for profit vs. non-profit); reimbursement (public or private insurance, or self-pay); unit location (hospital vs. free standing); staffing (proportion of nurses vs. patient care technicians and nurse to patient ratios); hemodialysis frequency and session length; and frequency of nephrologist visits. Authors also discussed key challenges and needs unique to their countries, with many discussing potential
strategies to improve care moving forward. These perspectives provide fascinating insights about dialysis care in individual countries.

Although the availability of dialysis correlates roughly with a country’s wealth, there are substantial variations in specific attributes of dialysis delivery and financing that cannot be explained only by wealth differences (Figure 1). These discrepancies suggest the existence of additional factors, such as government policy and local practice patterns, that may be as important as overall healthcare expenditures. Many of these country-specific factors are highlighted in individual global perspectives. This review focuses on some of the most salient observations raised by these global perspectives.

Dialysis modalities

Although hemodialysis is the predominant form of kidney replacement therapy across the world, there are notable outliers. One might also expect richer countries to have a greater peritoneal dialysis utilization. However, there is poor correlation between a country’s wealth and the extent of its use of peritoneal dialysis (Figure 1). Among countries with a gross national income (GNI) per capita greater than $40,000, the proportion of dialysis patients receiving peritoneal dialysis ranges from a high of 25% in Canada and Australia to a low of 3% in Japan. Similarly, whereas most low income countries (GNI per capita less than $10,000) have less than 10% utilization of peritoneal dialysis, three countries in this income category (Mexico, Guatemala, and Thailand) utilize peritoneal dialysis in 28 to 59% of their dialysis patients (Figure 1). One possible reason that there is less peritoneal dialysis usage in some of these countries is because of the continued lack of training in peritoneal dialysis for nephrology trainees.
Mexico has mandated a “peritoneal dialysis first” policy, under which all patients with end-stage kidney disease (with rare exceptions) initiate peritoneal dialysis first, and are only permitted to switch to hemodialysis if peritoneal dialysis fails\textsuperscript{19}. This policy has been extremely successful, with 59\% of dialysis patients utilizing this modality, resulting in substantial healthcare savings\textsuperscript{19}. A similar policy in Guatemala has resulted in 45\% of dialysis patients being treated with peritoneal dialysis\textsuperscript{7}. Most recently, Thailand introduced a “peritoneal dialysis first” policy in 2007\textsuperscript{12}. In the first decade, the number of Thai peritoneal dialysis patients grew exponentially, from 1,198 to 26,450 patients\textsuperscript{12}.

Elsewhere, peritoneal dialysis utilization has declined precipitously, in parallel with the proliferation of hemodialysis units in close proximity to patients’ homes. For example, in Israel peritoneal dialysis use decreased from 34\% in 1990 to 7\% in 2015\textsuperscript{10}. The authors attribute this decline to a growing elderly population which enjoys the social aspects of in-center hemodialysis, family preference for elderly relatives to dialyze while monitored in a healthcare setting, high rates of multi-drug resistant peritonitis, and proliferation of outpatient units that offer accessibility and convenience\textsuperscript{10}. Similarly, in Korea the proportion of patients receiving peritoneal dialysis decreased from 22 to 7\% between 2006 and 2018, while the number of hemodialysis units doubled from 487 to 983 during the same time period\textsuperscript{13}.

Within-country variations in dialysis use

Some perspectives’ authors also describe substantial in-country variations in dialysis services and use. For example, in Brazil the prevalence of dialysis is lower in the northern region as compared to the southern region\textsuperscript{17}. Despite universal insurance coverage in Brazil, access to healthcare is more limited in the northern region due to reduced health services in more rural
areas. Another example is in Guatemala, where the majority of patients with end stage kidney disease are located near Guatemala City. The prevalence is markedly lower in rural highland areas with predominantly indigenous populations. Similarly, Australia has experienced challenges in staffing remote dialysis units for Indigenous patients. Access to dialysis is very limited in rural India, where 60% of patients have to travel over 50 km and 25% over 100 km to the closest unit.

**Hemodialysis treatment duration and frequency**

Treatment duration and frequency of hemodialysis also varies substantially across the world. The most common prescribed hemodialysis treatment time is 3-4 hours, and the most common frequency is 2-3 treatments per week. However, there are several notable exceptions. In Mexico, the average number of hemodialysis treatments per week is 1.2, with only 2% of patients undergoing hemodialysis treatments three times a week. In Guatemala, many patients receive hemodialysis just weekly, with the frequency varying by type of healthcare funding. Specifically, patients with one type of health insurance coverage receive hemodialysis thrice weekly, whereas those with a different coverage are dialyzed only once weekly. Locations of dialysis units also vary, with the majority of countries in this series having both hospital-based and freestanding units. Guatemala is an exception with 100% freestanding units.

**Dialysis staffing**

Dialysis unit staffing differs substantially by country. Many countries use a combination of dialysis nurses and technicians. However, countries such as Canada, Korea, Australia, Thailand, Israel, Japan, and Spain utilize dialysis nurses exclusively. In contrast,
Guatemala uses patient-care technicians exclusively\textsuperscript{7}. Furthermore, the nursing staff to patient ratio varies markedly from 1:3 in Mexico\textsuperscript{19} and Australia\textsuperscript{6} to 1:35 in Brazil\textsuperscript{17}. The frequency of patient visits by a nephrologist is once monthly in most countries, but is every dialysis session in a few countries (e.g., Korea, Japan, Brazil, and Spain).

\textit{Vascular access}

Given that central vein catheters (CVCs) are considered the least desirable type of vascular access, one might expect the richest countries to have the lowest rates of CVC use. In fact, there is a disconnect between national income and CVC use among hemodialysis patients across the globe (\textbf{Figure 1}). Among those countries with a GNI per capita greater than $40,000, CVC use varies from a high of 59\% in Canada\textsuperscript{5} to a low of 2\% in Japan\textsuperscript{9}. Similarly, among countries with a GNP per capita less than $10,000, CVC use varies from a high of 92\% in Mexico\textsuperscript{19} to a low of 15\% in Thailand\textsuperscript{12} (\textbf{Figure 1}). Interestingly, the frequency of catheter-related bloodstream infections is exceptionally low in Canada\textsuperscript{5}, despite the very high rate of CVC use.

\textit{Financing of Dialysis}

The majority of countries featured in the \textit{Kidney360} Global Dialysis Series have a combination of for-profit and non-profit dialysis units. At the two extremes, Guatemala and Korea have only for-profit dialysis units\textsuperscript{7,13}, whereas Canada and Japan have only not-for-profit dialysis units\textsuperscript{5,9}. Financing for dialysis also differs by country. The majority of countries have both public and private health insurance coverage for dialysis or use a combination of insurance coverage and individual out of pocket payments. However, several countries such as Australia,
Israel, and Korea have only public insurance (government insurance). Private insurance is forbidden in Korea. These insurance differences often correlate with observed practice pattern differences, with those countries without insurance-covered dialysis care having shorter hemodialysis treatment times and lower frequencies of treatments.

Access to healthcare is a significant barrier to receiving dialysis in developing countries. For example, in Mexico only 49% of the population have health insurance, and uninsured patients only receive dialysis if they can pay for treatment out of pocket. As a consequence, many Mexican patients with kidney failure die without receiving dialysis.

Similarly, in India, a quarter of patients receive dialysis once a week or “as needed” due to financial constraints.

**Summary**

Kidney failure requiring dialysis continues to increase worldwide. In many cases, the growth is outpacing the capacity for kidney replacement therapy, particularly in developing countries. Hemodialysis remains the most common form of kidney replacement therapy. However, several countries utilize a peritoneal dialysis first policy to conserve resources and mitigate costs. The global perspectives featured in *Kidney360* highlight the wide range of health system characteristics, dialysis practice patterns, and outcomes across the globe. Further study regarding whether and how the reported differences affect morbidity and mortality is warranted. Establishment of more robust and uniform registries to collect these data will help address these questions and guide resource allocation and policy development for dialysis patients globally.
Disclosures


Funding

T Lee is supported by grant R44DK109789 from National Institutes of Diabetes, Digestive and Kidney Diseases (NIDDK), grant R01HL139692 from the National Heart, Lung, and Blood Institutes, and grant I01BX003387 from a Veterans Affairs Merit Award. JE Flythe is supported by R01 HL152034 from the National Heart, Lung, and Blood Institute (NHLBI) of the National Institutes of Health (NIH) and K23 DK109401 from the
National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) of the NIH. M Allon is supported by R01 MD013818 from the National Institute on Minority Health and Health Disparities (NIMHD).

**Author Contributions**

T Lee: Conceptualization; Methodology; Visualization; Writing - original draft

J Flythe: Conceptualization; Visualization; Writing - original draft; Writing - review and editing

M Allon: Conceptualization; Visualization; Writing - review and editing
References


Figure 1. Global comparisons of gross national income (GNI) per capita, prevalence of kidney replacement therapy (KRT) per million population (PMP), relative use of peritoneal dialysis (PD), and frequency of central vein catheter (CVC) use among prevalent hemodialysis patients. Whereas higher KRT correlates roughly with GNI per capita, PD and CVC use have poor correlations with GNI per capita. * not reported.