Mismatch Between Kidney Disease Burden and Nephrology Workforce in Mexico

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End-stage kidney disease (ESKD) is highly prevalent worldwide and is associated with high mortality, morbidity, and cost. It has been estimated that, in 2010, a total of 2.6 million people received kidney replacement therapy (KRT) globally, and that between 4.9 and 9.7 million patients needed KRT. For the Latin American and Caribbean regions, the number of patients receiving versus needing KRT was 373,000 versus 626,000. Although a national dialysis registry is lacking in Mexico, in 2005, it was estimated that there were approximately 130,000 patients with ESKD and that only half of them had access to KRT. Furthermore, the burden of disease attributed to chronic kidney disease (CKD) has increased dramatically. Among all diseases, CKD went from being ranked #16 in 1990 to #2 in 2013 for years of life lost due to premature death.

An increased number of nephrologists is needed to provide high-quality renal care to a growing CKD and ESKD population. According to the 2019 International Society of Nephrology Global Kidney Health Atlas, worldwide, the median number of nephrologists is 9.95 per million population (pmp). Nephrologists are more prevalent in Eastern and Central Europe (25.6 pmp), Western Europe (24.4 pmp), North and East Asia (19.5 pmp), North America (18.1 pmp), NIS (Newly Independent States of the former Soviet Union), and Russia (14.4 pmp) than in Latin America (9.8 pmp), the Middle East (8.1 pmp), OSEA (Oceania and Southeast Asia; 5.7 pmp), South Asia (1.2 pmp), and Africa (0.6 pmp). The prevalence of nephrologists increases with country income, with low-income countries reporting the lowest prevalence (0.2 pmp), followed by lower-middle income (1.6 pmp), upper-middle income (10.8 pmp), and high-income (23.3 pmp) countries.

The Latin American Society of Nephrology and Hypertension (SLANH) registry has reported for the year 2012 an average rate of 13.4 nephrologists pmp in the Latin American region. However, the rates were as high as 45.2 pmp in Cuba and 44.2 pmp in Uruguay, and as low as 2.0 pmp in Colombia and 1.8 pmp in Honduras. Countries such as Honduras, Colombia, Bolivia, Nicaragua, and Costa Rica have a rate of 1–5 nephrologists pmp. In contrast, El Salvador, Ecuador, Guatemala, Paraguay, Panama, Chile, and the Dominican Republic have a rate of 6–10 pmp. Other countries, such as Peru, Brazil, and Venezuela, have 11–20 nephrologists pmp, and Argentina 26.8 nephrologists pmp. The SLANH registry also reported a rate of 6 nephrologists pmp in 2012 in Jalisco, a state of Mexico. Based on the prevalence and expected growth of CKD and ESKD, SLANH estimated that at least 20 nephrologists pmp would be needed in 2020. Likewise, the British Medical Society recommended a ratio of 1 nephrologist per 75 patients receiving KRT or 1.0 work hour equivalent in nephrology per 100 dialysis/transplant patients.

The Mexican Board of Nephrology (CMN for its initials in Spanish) is a nonprofit institution in charge of certifying and recertifying nephrologists every 5 years. Since 2015, board certification has been mandatory to obtain a license to practice nephrology in Mexico. A recent cross-sectional analysis of the updated and validated database of the Mexican Board of Nephrology showed that, as of February 2019, there were 1500 nephrologists in Mexico. Among these, board certification was current for 1196 (80%) and not current for 304 (20%). In the latter group, many nephrologists...
had died, retired, moved to another country, or had incomplete data (see Supplementary Methods).

Consequently, we used the group of 1196 nephrologists for further analyses. Of these, 976 (82%) were adult nephrologists, and 220 (18%) were pediatric nephrologists (see Supplementary Table S1 and Supplementary Figure S1). Based on an estimated population of 131,450,000 inhabitants, the national rate was 9.1 nephrologists pmp. However, this figure varied substantially by state and region. For example, in Mexico City, the nephrologist rate was 45 pmp, although if we use for the denominator the population of the suburban area of Mexico’s Valley, the rate was 23 pmp. The 2 states of Jalisco and Nuevo Leon had nephrologist rates between 16 and 20 and 11 and 15 pmp, respectively. Most northern and central states had nephrologist rates between 6 and 10 pmp, and with few exceptions, the majority of southern states had rates between 0 and 5 pmp (Figure 1). The distribution of pediatric nephrologists was also uneven; for example, 12 states had less than 1 pmp, and 2 had none.

The national rate of 9.1 nephrologists pmp in Mexico is similar to that reported by the International Society of Nephrology Global Kidney Health Atlas for Latin America (9.8 pmp) and upper-middle-income countries (10.8 pmp). However, it is lower than the overall Latin American rate of 13.4 nephrologists pmp reported in the SLANH registry. The low national rate and the uneven distribution of nephrologists results in unequal access to renal services, particularly in the most disadvantaged states. Several factors may contribute to this situation, including the location of training sites (46% of adult and 67% of pediatric programs are in Mexico City) and job offerings in the same hospital where new nephrologists are trained. Also a factor is a preference for staying in capital cities, and some nephrologists choose to go into private practice, research, academia, or the pharmaceutical industry. As an example, 90.8% of board-certified nephrologists in Jalisco, the second largest Mexican state, are in the capital city of Guadalajara.

Regarding fellowship training, the minimum requirements are 2 years of internal medicine and 3 years of pediatrics for adult and pediatric nephrology, respectively. Also, the typical duration of adult and pediatric nephrology fellowships is 3 and 2 years, respectively. A survey of training sites conducted by the Mexican Board of Nephrology found that, as of February 2019, there were 24 adult and 6 pediatric nephrology training programs across Mexico (see Supplementary Figure S2). Of these, 15 (63%) of the adult and 4 (67%) of the pediatric sites opened in the past 2 decades, which partially explains why the Mexican nephrologist workforce is
relatively young. The mean age is 41.3 ± 9.7 years, and only 36 nephrologists were 65 years of age or older (see Supplementary Table S1 and Supplementary Figure S1).

Each year, the training programs offer an average of 102 and 23 adult and pediatric nephrology fellowship slots to Mexican candidates, respectively. The ratio of candidates to positions for adult and pediatric nephrology is 2:1 and 1:1, respectively, and the average filling rate of the positions is 94 (92%) and 20 (87%), respectively. Given that virtually 100% of the fellows complete their training on time, these numbers result in the addition of approximately 114 new nephrologists to the national workforce each year.

Given this growth rate, and without considering losses due to death, retirement, or other causes, we projected that the proposed SLANH goal of 20 nephrologists pmp, by the year 2020, could rather be reached between the years 2035 and 2040. Alternatively, if the current growth rate were to double, the proposed SLANH goal could be reached between the years 2025 and 2030 (Figure 2). Given that these projections assume a constant rate of CKD and ESKD care needs, they likely underestimate the time required to reach the SLANH goal.

We also estimated that maximizing the capacity of existing training programs would raise the annual output of new nephrologists by only about 10%. Hence, an increase in the number of training sites is needed. The strategic location of new programs in regions with the least number of nephrologists could also enhance the chances that trainees remain there. Collaboration between these new training sites and consolidated national programs, the SLANH Education Committee, and the International Society of Nephrology Sister Renal Center program could improve the feasibility of this strategy.

We conclude that several regions of the world, including most Latin American countries, have a shortage of nephrologists. The case of Mexico is compelling because Mexico not only is second to Brazil in the number of patients receiving chronic dialysis in the Latin American region and has an alarmingly high burden of CKD and ESKD, but also highlights the challenges faced by many countries. Careful assessment of the nephrology workforce was an unmet need that prevented framing country-specific strategies to achieve an adequate balance between supply and demand. The Mexican Board of Nephrology analysis has provided critical data to inform public policy regarding the nephrology workforce in Mexico. Yearly updates of this database will facilitate advocacy efforts with health authorities and evaluation of the effectiveness of public policy interventions.

Potential solutions to improve the Mexican nephrology workforce include increasing the number and location of training sites, but this approach is subject to budgetary limitations and an adequate applicant pool. Medical schools could enhance interest by offering full nephrology courses, and governments could provide more job positions. In the meantime, improving the competency of primary care physicians to care for patients with early CKD stages, task-shifting by nephrology extenders, and implementation of multidisciplinary CKD care models are appropriate public health
These efforts are in line with the conclusions of the International Society of Nephrology’s Global Kidney Policy Forum with Focus in Latin America that took place on April 21, 2017, in Mexico City, on the occasion of the World Congress of Nephrology.

**DISCLOSURE**

All the authors declared no competing interests.

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**SUPPLEMENTARY MATERIAL**

Supplementary File (PDF)

**Table S1.** General characteristics of nephrologists in Mexico.

**Figure S1.** Age distribution of nephrologists in Mexico (n = 1196).

**Figure S2.** Location of (A) Mexican adult and (B) pediatric nephrology training sites. The darkest color indicates the highest number of sites; the lightest color indicates the lowest number of sites.

**REFERENCES**

1. Liyanage T, Ninomiya T, Jha V, et al. Worldwide access to treatment for end-stage kidney disease: a systematic review. *Lancet*. 2015;385:1975–1982.

2. López-Cervantes M, Rojas-Russell M, Tirado-Gómez L, et al. *Enfermedad Renal Crónica Y Su Atención Mediante Tratamiento Sustitutivo en México* [Chronic Kidney Disease and Its Care Through Replacement Therapy in Mexico]. Mexico City, Mexico: Faculty of Medicine, National Autonomous University of Mexico; 2009 (in Spanish).

3. Lastiri Quirós HS. *Enfermedad Renal Crónica en México: Una Política Nacional de Salud Todavía Pendiente* [Chronic Kidney Disease in Mexico: A National Health Policy Still Pending]. In: Tamayo y Orozco JA, Lastiri Quirós HS, eds. *La Enfermedad Renal Crónica en México: Hacia una Política Nacional para Enfrentarla* [Chronic Kidney Disease in Mexico: Towards a National Policy to Cope With It]. Mexico City, Mexico: National Academy of Medicine; 2016:6 pp. (in Spanish).

4. Harley KT, Streja E, Rhee CM, et al. Nephrologist caseload and hemodialysis patient survival in an urban cohort. *J Am Soc Nephrol*. 2013;24:1678–1687.

5. Bello A, Levin A, Tonelli M, et al. *Global Kidney Health Atlas: A Report by the International Society of Nephrology on the Current State of Organization and Structures for Kidney Care Across the Globe*. Brussels, Belgium: International Society of Nephrology; 2017.

6. Rosa-Diez G, Gonzalez-Bedat M, Ferreiro A, et al. Burden of end-stage renal disease (ESRD) in Latin America. *Clin Nephrol*. 2016;86:29–33.

7. Cusumano AM, Rosa-Diez GJ, Gonzalez-Bedat MC. Latin American Dialysis and Transplant Registry: experience and contributions to end-stage renal disease epidemiology. *World J Nephrol*. 2016;5:389–397.

8. Sharif MU, Elsayed ME, Stack AG. The global nephrology workforce: emerging threats and potential solutions. *Clin Kidney J*. 2016;9:11–22.

9. Osman MA, Alrukhaimi M, Ashuntantang GE, et al. Global nephrology workforce: gaps and opportunities toward a sustainable kidney care system. *Kidney Int Suppl*. 2018;8:52–63.