Global Perspectives in Acute Kidney Injury: Mexico

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Introduction
The epidemiology of AKI in Mexico comes mostly from the intensive care units (ICUs). In this perspective, we make a update of articles published in our country, and we include patients affected with coronavirus disease 2019. Before the pandemic, the previously reported mortality of patients with AKI in Mexico was 25% (1). The reports come from hospitals where they have ICU, nephrology, or internal medicine services. Outcomes for the pediatric population in LA are scant. For this perspective, we searched the available literature and found 28 reports, two of them in pediatric patients, with a total of 6500 cases and the majority of the cases reported in men. Sepsis continued to be the most common etiology, and in the context of pregnancy, preeclampsia accounted for most cases.

It is difficult to estimate AKI severity accurately because the definition for AKI is not standardized, and data are reported according to different classifications (Kidney Disease Improving Global Outcomes [KDIGO], AKIN, and RIFLE); however, on the basis of the published data, we estimate that around 40% are KDIGO stage 3. In addition, only some studies include urine output, likely due to the fact that some studies were conducted outside the ICU where measurement of urinary output is cumbersome. The universal use of biomarkers for the prediction or diagnosis of AKI has not been systematized for clinical care and is only used for research purposes.

Reported mortality is 23%, but this was three-fold higher in pediatric patients. This mortality is lower than what has been described in other cohorts with AKI, likely due to misclassification of AKI cases or due to reporting bias.

Unfortunately, subjects who survive the episode of AKI are rarely followed up, with limited or null data on outcomes (Figures 1 and 2). Mexico lacks a national AKI, CKD, or ESKD registry, and therefore, there is lack of precision on the epidemiology of the disease.

Most of our ICUs are open, and therefore, the nephrologist or primary care team follows the patient from admission until discharge and requests a consult with the intensivist. It is common for the prescription and monitoring of continuous KRTs (CKRTs) to be carried out in collaborative agreement between intensivists and nephrologists. Intermittent or hybrid KRTs, such as intermittent hemodialysis (IHD), SLED, or peritoneal dialysis, are usually prescribed by nephrologists, although in some centers due to the lack of nephrologists, the prescription can be made by a primary care physician or internist.

The incident KRTs are usually prescribed by the nephrologist; however, as mentioned above, because of the shortage of nephrologists in the country, some KRTs are prescribed by general physicians, internists, and intensivists. Because in Mexico, there are few nephrologists, in some non-teaching hospitals KRT is prescribed by internists or intensivists. According to data from the Mexican Council of Nephrology, in 2019 there were 1196 certified nephrologists in Mexico (976 adult and 220 pediatrician), with a ratio of 9.1 nephrologists per million population. There are currently 30 nephrology training programs in the country, resulting in 114 new nephrologists per year. These numbers are insufficient to solve the problem, and more residency positions have been opened in the past few years to solve this problem.

It is important to consider that in recent years, significant efforts have been made to improve the care of these patients. Nephrology programs have universally integrated AKI topics into their curricula; in addition, since 2017 regional societies have held international congresses covering AKI, and these have been widely accepted among medical societies. Along these lines, Mexican nephrologists seek training at international reference centers in critical nephrology, they participate more actively in international congresses, and in the last year, the first AKI CKRT online course was received with enthusiasm among renal fellows.

It is possible that with this recent enthusiasm for AKI care, for our patients will improve in the years to come.

Access, Costs, and Reimbursement
The most common prescribed modality for KRT is IHD followed by therapies such as peritoneal dialysis or SLED. CKRTs are only available in large referral public hospitals or in private hospitals. In our country, access to KRT, such as IHD, is limited, and CKRTs

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are only available for a minority. In large cities, like Mexico City, Guadalajara, and Monterrey, CKRTs are available in most tertiary and referral centers. Most smaller cities in the country do not have access to CKRT.

The cost of AKI therapies is paid according to the institution where they are performed; access to KRT is limited or nonexistent for the uninsured population. Social security benefits, including universal access to KRT, are only offered

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**Figure 1.** AKI epidemiology in Mexico. Report of the last 31 years, with information from centers of tertiary care facilities and mostly in patients in the intensive care unit (ICU) and patients with sepsis. MX, Mexico.

**Figure 2.** Unresolved challenges in patients with AKI in Mexico. The lack of a national registry, infrastructure, and manpower are the most determining factors.
to workers who are salaried, but this represents approximately 40% of our population; only about approximately 7% can afford private health insurance, and approximately 50% of the population does not have any kind of health care provider (2). This fragmented health system has resulted in great disparity in KRT access.

Since 2019, the Mexican Government replaced Seguro Popular for the Institute of Health for Welfare, a health insurance for all Mexicans; however, this new institute does not cover any form of KRT for either AKI or chronic hemodialysis (3).

We believe that the most important factor that limits the access to KRT continues to be the lack of financial coverage for patients without social security, although we also acknowledge the lack of nephrologists and poor infrastructure as important limitations. The combination of these factors results in inequity and disparity in the treatment of patients with AKI in Mexico.

**Unresolved Challenges**

After almost seven decades from the beginning of nephrology in Mexico, the care of patients with AKI continues to be unfair, unequal, and below the recommendations proposed by international guidelines (4). Our resources and infrastructure capacity are limited to satisfy the demand of patients with AKI. Therefore, we believe that AKI should be a priority strategy in public health policies, where prevention and control programs for this pathology should be implemented. Public policies are urgently needed for patients with AKI, and at least three points should be included: (1) improvement of the current infrastructure and increase in the number of training centers for specialists in different geographic areas of the country, especially in rural areas where AKI care is nonexistent; (2) the creation of a national AKI and kidney failure registry; and (3) universal access to KRT for patients who do not have social security.

The future for patients with AKI under the current federal administration remains uncertain. The authorized budget for health care in our country has been cut by an austerity initiative (5), which may result in fewer specialists and limited infrastructure resources to meet the AKI demand. The need be board certified to able to practice nephrology and other specialties in our country has also been questioned (6). Although the 2019–2024 National Health Plan includes universal health coverage, including for AKI, these healthy policies have not resulted in AKI coverage or improved patient outcomes (7).

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**Author Contributions**

J.S. Chávez-Iníguez and M. Madero conceptualized the study; J.S. Chávez-Iniguez was responsible for data curation; J.S. Chávez-Iniguez and M. Madero were responsible for investigation; J.S. Chávez-Iniguez was responsible for formal analysis; J.S. Chávez-Iniguez and M. Madero were responsible for methodology; J.S. Chávez-Iniguez and M. Madero were responsible for project administration; J.S. Chávez-Iniguez was responsible for software; J.S. Chávez-Iniguez and M. Madero were responsible for validation; J.S. Chávez-Iniguez was responsible for visualization; J.S. Chávez-Iniguez and M. Madero provided supervision; J.S. Chávez-Iniguez wrote the original draft; and J.S. Chávez-Iniguez and M. Madero reviewed and edited the manuscript.

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