How to Cite this article: Jonathan Chávez-Iñiguez and Magdalena Madero, Global Perspectives in Acute Kidney Injury: Mexico, *Kidney360*, Publish Ahead of Print,

**Article Type:** Global Communication

**Global Perspectives in Acute Kidney Injury: Mexico**

**DOI:**
Jonathan Chávez-Iñiguez and Magdalena Madero

**Key Points:**

**Abstract:**

**Disclosures:** J. Chavez has nothing to disclose. M. Madero reports the following: Research Funding: Abbvie, Boehringer, Bayer, Astra Zeneca; Honoraria: Baxter, Fresenius Medical Center, Astra Zeneca; Advisory or Leadership Role: American Journal of Kidney Disease, Kidney Disease Improving Global Outcomes (KDIGO) Executive Committee, International Society of Nephrology, Astra Zeneca, Bayer, Abbvie Advisory Boards; and Speakers Bureau: Astra Zeneca.

**Funding:**

**Author Contributions:** Jonathan Chávez-Iñiguez: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Project administration; Software; Supervision; Validation; Visualization; Writing - original draft; Writing - review and editing Magdalena Madero: Conceptualization; Investigation; Methodology; Project administration; Supervision; Validation; Writing - review and editing

**Data Sharing Statement:**

**Clinical Trials Registration:**

**Registration Number:**

**Registration Date:**

The information on this cover page is based on the most recent submission data from the authors. It may vary from the final published article. Any fields remaining blank are not applicable for this manuscript.
Global Perspectives in Acute Kidney Injury: Mexico

Jonathan S. Chávez-Íñiguez¹,² and Magdalena Madero³

¹ Nephrology Service, Hospital Civil de Guadalajara Fray Antonio Alcalde, Guadalajara, Jalisco. Mexico.
² University of Guadalajara Health Sciences Center, Guadalajara, Jalisco. Mexico.
ORCID https://orcid.org/0000-0003-2786-6667
³ Nephrology Division, Instituto Nacional de Cardiología Ignacio Chávez, Mexico City

Correspondence:
Magdalena Madero, MD
Instituto Nacional de Cardiología
Juan Badiano no 1
Mexico
madero.magdalena@gmail.com
The epidemiology of AKI in Mexico comes mostly from the intensive care units (ICU). In this perspective we made an update of articles published in our country where we include patients affected with COVID-19. Before the pandemic, the previously reported mortality of AKI patients 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, our search found twenty-eight reports, 2 of them are in pediatric patients, with a total of 6500 cases and the majority of the cases reported in males. 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 since the definition for AKI is not standardized, and data is reported according to different classifications (KDIGO, AKIN and RIFLE) but based on 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 some studies were conducted outside the ICU were 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 are only used for research purposes. Reported mortality is 22.8%, but this was 3-fold higher in pediatric patients. This mortality is lower than what has been described on other cohorts with AKI, likely due to misclassification of AKI cases or due reporting bias. Unfortunately, subjects that survive the episode of AKI are rarely followed up with limited or null data on outcomes (Figure 1). 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 patients from admission until discharge and requests a consult to the intensivist. It is common for the prescription and monitoring of continuous kidney replacements therapies (KRT) 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 lack of nephrologists, the prescription can be made by a primary care physician or internist. The incident KRT are usually prescribed by the nephrologists however, as mentioned above, due to shortage of nephrologists in the country some KRT are prescribed by general physicians, internists, and intensivists. As in Mexico there are few nephrologists, in some nonteaching hospitals KRT is prescribed by internists or intensivists. According to data from the Mexican Council of Nephrology, in 2019 there were 1,196 certified nephrologists in Mexico (976 adults and 220 pediatricians), 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 amongst 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 (PD) or SLED. CKRT are only available in large referral public hospitals or in private hospitals. In our country, access to KRT such as IHD is limited and CKRT is only available for a minority. In large cities like Mexico city, Guadalajara and Monterrey, CKRT 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, it is only offered to workers who are salaried, but this represents ~40% of our population, only about ~7% can afford private health insurance, and ~50% of the population does not have any kind of health care provider [3]. This fragmented health system has resulted in a great disparity for KRT access. Since 2019, the Mexican Government replaced Seguro Popular for INSABI (Institute of Health for Welfare), a health insurance for all Mexicans however this benefit does not cover any form of KRT either for AKI or chronic HD. [4].

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 nephrology in Mexico, the care of patients with AKI continues to be unfair, unequal and below the recommendations proposed by international guidelines [5]. Our resources and infrastructure capacity are limited to satisfy the demand for the AKI patients. 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:

A) Improvement of the current infrastructure, increase in the number of training centers for specialists in different geographical areas of the country, especially in rural areas where AKI care is non existent.

B) The creation of a national AKI and kidney failure registry.

C) Grant universal access to KRT in patients who do not have social security.
The future for AKI patients under the current federal administration remains uncertain. The authorized budget for health care in our country has been cut by an austerity initiative [6] which may result in fewer specialists and limited infrastructure resources to meet the AKI demand. The need be board certified in able to practice nephrology and other specialties in our country has also been questioned [7]. Although the 2019-2024 National Health Plan includes universal health coverage, including AKI, these healthy policies have not resulted in AKI coverage or improved patient outcomes [8].

Disclosures
J. Chavez has nothing to disclose. M. Madero reports the following: Research Funding: Abbvie, Boehringer, Bayer, Astra Zeneca; Honoraria: Baxter, Fresenius Medical Center, Astra Zeneca; Advisory or Leadership Role: American Journal of Kidney Disease, Kidney Disease Improving Global Outcomes (KDIGO) Executive Committee, International Society of Nephrology, Astra Zeneca, Bayer, Abbvie Advisory Boards; and Speakers Bureau: Astra Zeneca.

Funding
None

Acknowledgments
The content of this article reflects the personal experience and views of the author(s) and should not be considered medical advice or recommendation. The content does not reflect the views or opinions of the American Society of Nephrology (ASN) or Kidney360. Responsibility for the information and views expressed herein lies entirely with the author(s).

Author Contributions
Jonathan Chávez-Iñiguez: Conceptualization; Data curation; Formal analysis; Investigation; Methodology; Project administration; Software; Supervision; Validation; Visualization; Writing - original draft; Writing - review and editing. Magdalena Madero: Conceptualization; Investigation; Methodology; Project administration; Supervision; Validation; Writing - review and editing.
References

1. Chávez-Iñiguez JS, García-García G, Lombardi R. Epidemiología y desenlaces de la lesión renal aguda en Latinoamérica. Gac Med Mex. 2018;154(Suppl 1):S6–S14.

2. Thakar CV, Arrigain S, Worley S, Yared JP, Paganini EP. A clinical score to predict acute renal failure after cardiac surgery. J Am Soc Nephrol. 2005 Jan;16(1):162-8. doi: 10.1681/ASN.2004040331. Epub 2004 Nov 24. PMID: 15563569.

3. Guía Tecnológica No. 15. Sistema de Hemodiálisis. Mexico City: Secretaria de Salud. Centro Nacional de Excelencia Técnica en Salud; 2004. Available from: http://www.cenetec.salud.gob.mx/

4. Garcia-García G, Chavez-Iñiguez JS. The tragedy of having ESRD in Mexico. Kidney Int Rep. 2018;3(5):1027–9.

5. Garcia-García G. et al. (2021) Nephrology in Mexico. In: Moura-Neto J.A., Divino-Filho J.C., Ronco C. (eds) Nephrology Worldwide. Springer, Cham. https://doi.org/10.1007/978-3-030-56890-0_14

6. Instituto De Salud para el Bienestar. Mexico City: Secretaria de Salud; 2020. Available from: https://www.gob.mx/insabi.

7. Senado de la República. Gaceta de la Comisión Permanente. Iniciativa con proyecto de decreto por el que se reforma el Artículo 81 de la Ley General de Salud. Mexico City: Senado de la República. Gaceta de la Comisión Permanente; 2019. Available from: http://www.senado.gob.mx/64/gaceta_comision_permanente/documento/97421.

8. Secretaria de Salud. Proyecto Plan Nacional de Salud 2019–2024. Mexico City: Secretaria de Salud; 2019. Available from: http://www.hgm.salud.gob.mx/descargas/pdf/dirgral/Plan_Nacional_Salud_2019_2024.pdf.
Figure Legends

Figure 1. AKI epidemiology in Mexico. Report of the last 31 years, prevalent information from centers of tertiary-care facilities, mostly in ICU and septic patients.

Figure 2. Unresolved challenges in AKI patients in Mexico. The lack of a national registry, infrastructure, and manpower as the most determining factors.
1990-2021

28 AKI patients

6,477 patients

ICU 64%

Tertiary-care facility 100%

Pediatric 43

Women 40%

Sepsis 71%

Mortality 22.8%

KRT 30%

Long Follow up 0%
Obtain funds and resources to KRT

Increase nephrologists (~1,200) and intensivists (~2,000) pool

Create a national registry

Improve pediatric and female representation

Unite the fragmented and inequitable health care system

Mexico City

Guadalajara

Monterrey