

Global Perspectives in AKI: Peru

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Peru is a middle-income Latin American country with an estimated population of more than 31 million inhabitants.¹ Although our country has experienced significant improvements in some social determinants of health, the main causes of death are still related to socioeconomic status, which means people with lower incomes have higher mortality rates because of less access to health care, education, basic services, and employment, among other aspects.¹ There are other challenges in the Peruvian health system, such as its fragmented nature which makes it one of the most dysfunctional and unequal health systems in Latin America. For example, the Peruvian Ministry of Health (MINSA) covers 50% of the population through the Government health insurance, whereas approximately 20% of Peruvians have access to the Social Health Insurance (EsSalud).² However, although the health system has improved in terms of health insurance outreach, it continues to be centralized and precarious and has structural and organizational problems that have an effect not only on health care coverage but also on its delivery and quality.^{2–5}

In this context, along with the barriers to access basic health care services⁶ and the effects of climate change, the incidence of AKI is increasing in Peru and in other low- and middle-income countries.⁷ Despite the fact that AKI constitutes a public health burden of growing repercussion in Peru and surroundings, there are lack of public health data and policy, as well as suboptimal patient and provider education and clinical care. Herein, we describe important challenges and provide perspectives and possible solutions to improve AKI care in Peru.

Epidemiology of AKI in Peru

Because of the fragmented nature of the Peruvian health system, there are no detailed registries of patients with AKI at the national level, and published data are limited to single-center reports or case series. Although there are no population-based studies available in Peru, there is evidence from health care services suggesting that the incidence of AKI has increased⁷ and that it is possible that, at least in Lima, the capital of the country, the

characteristics of hospitalized patients with AKI receiving intermittent hemodialysis (iHD) are similar to those of patients in high-income countries. Those characteristics include older age, the presence of multiple comorbidities, sepsis as the cause of AKI, and the need for care in intensive care units.^{8–10} However, it is necessary to point out that these studies used medical records or the International Classification of Diseases (ICD-10) coding to identify patients with AKI, so it is not known which criteria were used to establish the diagnosis.^{8–10}

A study on the basis of the registry of AKI cases reported by MINSA between 2005 and 2016 and the data reported from death certificates during the same period showed that AKI cases increased and AKI-related deaths decreased over time.⁷ The age-standardized AKI incidence rate, regardless of severity, increased from 9.6 per 100,000 in 2005 to 14.0 per 100,000 in 2016, and the age-standardized mortality rate decreased from 2.3 per 100,000 in 2005 to 1.2 per 100,000 in 2016⁷ (Figure 1). This incidence was significantly lower than the 3000–5000 per million population (pmp) reported in high-income countries but similar to the 102 pmp incidence in 33 studies conducted in Latin America.⁷ The highest incidence and mortality rates were observed in the age group older than 60 years, and the regions with the greatest increase in AKI incidence were those in the tropical areas of Peru. Possible etiologies include volume depletion from gastroenteritis and sepsis from endemic infections, such as malaria, leptospirosis, and dengue, which are common in these regions. Furthermore, problems related to environmental sanitation, such as contaminated water, are also common, which could increase the risk of AKI.^{6,7}

The coronavirus disease 2019 (COVID-19) pandemic also meant a public health catastrophe for Peru, and AKI contributed significantly to morbidity and mortality. Although we do not have nationally representative data, a study in a reference hospital in the north of the country found that the incidence of AKI was 64.8%, being higher in intensive care unit (ICU) patients (88.1%) than in non-ICU patients (57.1%), with an overall mortality of 27.5%.¹¹ These results differ from those of some

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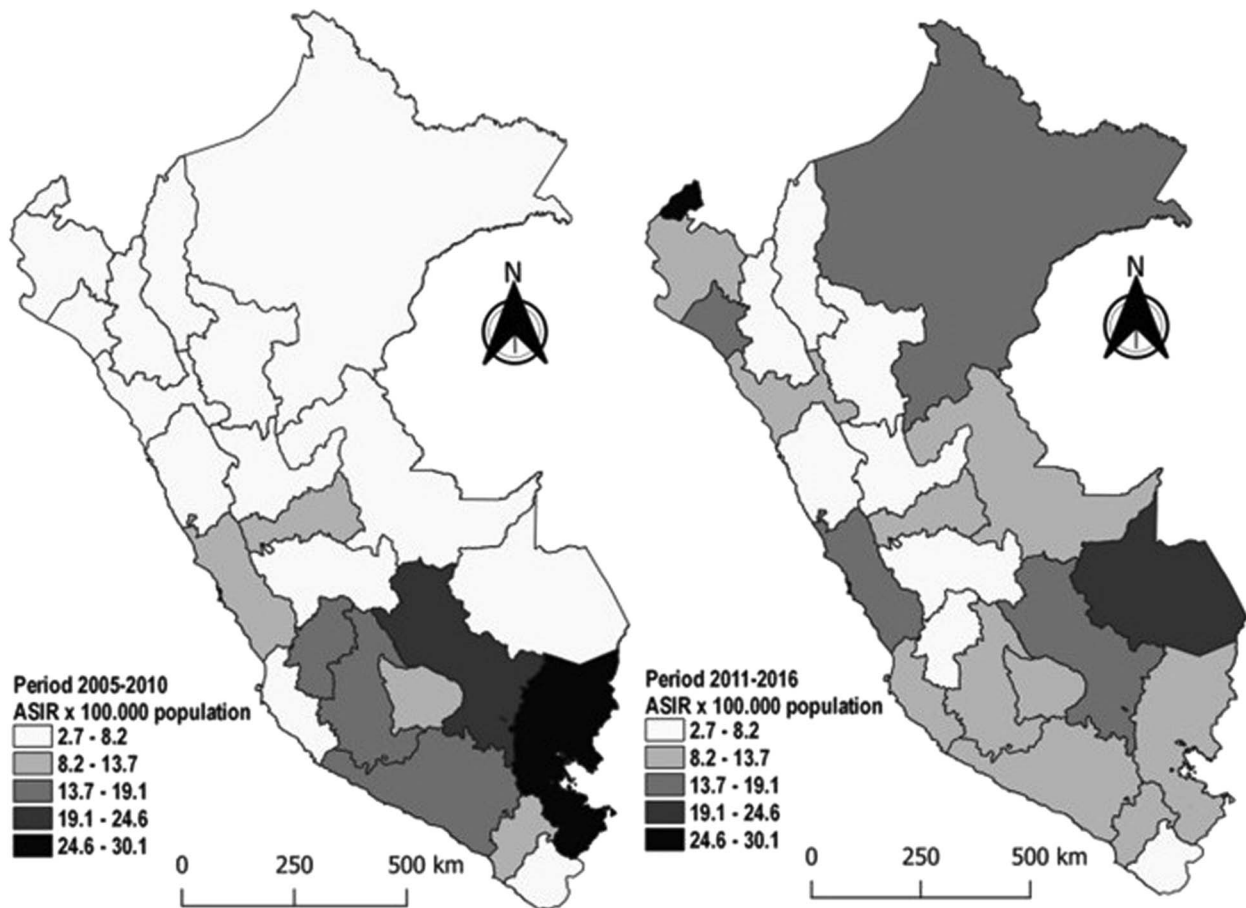


Figure 1. Age-standardized incidence rate of AKI in Peru by region: comparison between the periods.⁷

systematic reviews that show a lower incidence and higher mortality particularly in ICU patients worldwide.^{12,13} This difference could probably be related to the delayed medical care caused by the saturation of Peruvian hospitals during the first and second waves of the pandemic and the prioritization of ICU admission of patients with better prognosis.¹⁴

Similar to other countries in Latin America, in Peru, hospitalized patients with AKI in need of dialysis most frequently receive hemodialysis (HD) given the little availability of continuous renal replacement therapy (CRRT), prolonged intermittent renal replacement therapy, or peritoneal dialysis (PD) even for critically ill patients.¹⁵ Although some experience exists with CRRT and PD in patients with AKI, their use is not fully standardized. Specifically in patients with AKI on HD, data from single-center studies in Peru showed that sepsis and other nonsurgical conditions, such as severe volume depletion, heart failure, and obstructive uropathy, were among the leading causes of in-hospital AKI.^{8–10} Importantly, mortality rates were very variable, 40.2% in a MINSa hospital¹⁰ and 17.2% and 55% in two EsSalud hospitals.^{8,9} Although this heterogeneity may be due to differences in the acuity of illness of the patients represented in these studies, the indications and characteristics of patients requiring acute dialysis were similar to reports from high-income countries^{8–10}.

Diagnosis and Prevention of AKI in Peru

Although there is no formal evaluation of the current resources available in Peru for the diagnosis and management of AKI, some reports regarding the infrastructure of the health system in the country suggest that those are limited.

As of December 2021, 97.6% of Peruvian hospitals nationwide had an inadequate installed capacity expressed in the precariousness of the infrastructure and obsolete, inoperative, or insufficient equipment.¹⁶ In the case of MINSa hospitals, these exhibited notable deficiencies in their capacity to provide optimal and timely patient care because of the absence of diagnostic tools and resources, lack of updated and functional equipment, and deficiencies in the acquisition and provision of medications and other logistical supplies.¹⁷ Thus, it is not uncommon for referral hospitals at the national level to struggle with the absence of imaging equipment, such as magnetic resonance or angiography, nuclear medicine studies, immunohistochemical tests, molecular biology studies, and genetic studies, among others.¹⁷ These deficiencies may directly or indirectly affect the ability to diagnose and treat patients with AKI in Peru. Because of the lack of risk-classification scores to identify patients at highest risk of AKI, the diagnosis is solely based on the Kidney Disease Improving Global Outcomes serum creatinine and urine output criteria.

At the primary prevention health care level, the situation in Peru is suboptimal. In a study that evaluated 32 health

care facilities in three districts of the northern region of Lima, it was found that 28.6% of these facilities never had a serum creatinine test available, 39.3% had it sometimes available, and only 32.1% had it available for routine use.¹⁸ One should note that this study was done in Lima and given the centralized nature of the Peruvian health care system, it is possible that the availability of a simple test of kidney function, such as serum creatinine, is less available in more rural areas of Peru, which underpins the real struggle of the health care providers for the timely diagnosis and management of patients at risk of or with AKI.

Although there are successful initiatives of kidney health programs in Peru, such as the one in an EsSalud hospital in Lima, focused on the prevention, detection, and early management of patients with CKD,¹⁹ there are no similar programs for patients with community-acquired or hospitalized AKI. However, the *status quo* of AKI care in Peru may be changing because clinical practice guidelines for the prevention and management of AKI were recently published in December 2022.²⁰ Although the latter is a great start, overall efforts to optimize AKI care for the early diagnosis, management, and follow-up depend in part on gathering critical nationwide data that could inform clinical guidelines, policy changes, and equal and quality value-based care. In this context, because there is no national consensus for the management of patients with AKI, the treatment and follow-up depend on the organizational structure of each hospital or the individual judgment of the treating provider. However, the indication for dialysis initiation in patients with AKI is indicated in all circumstances by a nephrologist.

Availability and Access to Dialysis for the Management of Patients with Severe AKI

The provision of acute dialysis for patients with AKI depends on the availability of devices and the local expertise

of providers which is most of the time extrapolated from the care of patients with ESKD. Notably, the most common dialysis modality that is used to support patients with AKI in Peru is HD.²¹ In fact, the growing number of patients with ESKD in MINSa compelled the Peruvian state to finance dialysis therapies through the Intangible Solidarity Health Fund and to contract Health Service Provider Institutions to provide iHD to these patients.²¹ Using this coverage, patients with severe AKI in need of dialysis are able to access iHD resources from hospitals. This context added to the overall costs of dialysis therapy limiting the availability of acute dialysis services, which was alarming during the recent COVID-19 pandemic. In mid-2021, a survey examining the availability of dialysis devices for CRRT nationwide showed that only three public hospitals had CRRT machines available.²² Importantly, the lack of dialysis devices limits the training of nephrology residents, which, as reported in other comparable Latin American countries, is deficient in Peru.²³

The increase in the number of nephrologists in Peru is not proportional to the increase of patients with CKD, which continues to adversely impair the nephrology workforce, including those caring for patients with AKI, specifically when they require support with acute dialysis. One should note that nephrologists are the ones who prescribe and supervise any form of dialysis in Peru. Alarming, the number of nephrologists per 1000 patients with CKD decreased from 4.4 in 2010 to 1.9 in 2016.²³ Despite the number of residency positions for nephrology training in Peru has increased, it is probably still insufficient and, most importantly, does not directly address problems, such as the deficient training in CRRT and other aspects of extracorporeal organ support for critically ill patients with AKI.²³ These facts raise the important issue of reorganizing the Peruvian nephrology workforce and training curriculum.

In conclusion, multifaceted barriers for the provision of evidence-based and equal care for patients with AKI exist in Peru (Table 1). This highlights the dire need to develop

Table 1. Summary of key problems and potential solutions to improve AKI care in Peru

Problem	Potential Solutions
Absence of epidemiological data from national registries	Creation of a national registry of patients with community-acquired and hospital-acquired AKI
Limited availability of laboratory and imaging tests for the diagnosis, management, and follow-up of patients at risk of or with AKI	Assessment of the available resources and improvement of logistical capacity in hospitals for the diagnosis and treatment of patients with AKI
Lack of availability of different dialysis modalities for patients with AKI, such as CRRT, PIRRT, or PD	Increase human and logistical resources for the provision of multiple acute dialysis modalities for the management of patients with AKI, particularly those who are critically ill with multiple extracorporeal organ support demands
Shortage of specialists with expertise in AKI and critical care nephrology	Increase in the number and quality of nephrology training positions and continuous evaluation of the curricular plan of nephrology training programs in Peru Partnership with international institutions to enhance the critical care nephrology workforce in Peru (e.g., international rotations for Peruvian nephrology residents)
Education initiatives to prevent AKI in high-risk patients	Incorporation of AKI prevention modules in the educational initiatives of the nephrology services of the country with outreach to the general public

CRRT, continuous renal replacement therapy; PIRRT, prolonged intermittent renal replacement therapy; PD, peritoneal dialysis.

proponents to surpass the current adversity. Although we describe the limited epidemiology of AKI in Peru, our appraisal could be used to encourage collective efforts of clinicians, researchers, trainees, administrators, health care leaders, and policy makers to improve the diagnosis and management of not only AKI but overall kidney health in the Peruvian population. Overcoming current barriers could also have repercussions for public health in the country and the region. As a starting point, there are successful health care programs at the national level for patients with CKD¹⁹ that could be replicated for patients with AKI as an effort to challenge *status quo* and promote positive change.

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