Kidney360 Publish Ahead of Print, published on September 8, 2022 as doi:10.34067/KID.0001262022

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How to Cite this article: Darío Jiménez and Jazmín Jiménez, Global Perspectives in Acute Kidney Injury: Ecuador, *Kidney360*, Publish Ahead of Print, 2022, 10.34067/KID.0001262022

Article Type: Global Communication

Global Perspectives in Acute Kidney Injury: Ecuador

DOI: 10.34067/KID.0001262022

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Key Points:

Abstract:

Disclosures: D. Jiménez Acosta reports the following: Advisory or Leadership Role: in the management of acute patients for Fresenius (FMC) (2018/2020); and Speakers Bureau: AstraZeneca. J. Jiménez has nothing to disclose.

Funding: None

Author Contributions: Darío Jiménez: Conceptualization; Formal analysis; Methodology; Supervision; Writing - original draft; Writing - review and editing Jazmín Jiménez: Data curation; Investigation; Methodology; Visualization; Writing - review and editing

Data Sharing Statement:

Clinical Trials Registration:

Registration Number:

Registration Date:

Global Perspectives in Acute Kidney Injury: Ecuador

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Introduction

In Latin America and worldwide, Acute Kidney Injury (AKI) is a frequent and clinically severe condition with multiple etiologies (1). AKI causes can vary by country and economic status; therefore, identifying modifiable variables is necessary to reduce preventable deaths (2). AKI is a growing pathology in Ecuador with a negative socio-economic impact. However, it has not been considered a real health problem with a mortality representation otherwise evidenced within the Intensive Care Unit (ICU).

In Ecuador, two institutions specially created for critical patient care provide services to hospitals. The first one is DIALNEF which has been functioning since 2012 in Quito and UCRA working since 2020 in Guayaquil. Other than that, just a few public and social security hospitals have implemented specific centers to treat AKI, the vast majority treat AKI patients within the nephrology service, without an AKI specific program. There is no national registry to obtain an adequate epidemiological report, and the available data is obtained from the previously mentioned institution's database and the collaboration of few doctors who dedicate themselves to the care of critical patients.

Epidemiology

ICU-specific data from developed countries indicate AKI incidence of 5-20% from ICU admissions, (66-80 per million per year). No data are available from developing countries where ICUs offer limited services; however, data from large cities such as São Paulo and Montevideo are similar to those. (3,4)

EPILAT-IRA study with 905 patients, documented community-acquired AKI at 61%, and hospital AKI at 31%, Kidney Replacement Therapy (KRT) was performed in 29%, and mortality was 26.5%. After 90 days of follow-up, total renal recovery was obtained in 81% of the cases, Ecuador contributed 14 patients, so it doesn´t reflect the local reality. (5)

Other incidences showed 22% (Colombia), 57,3% in AKI-EPI study, which included 1032 ICU patients from 97 centers in 33 countries; sepsis and hypovolemia were the most common etiologies. (6)

We believe that the difference is due to the lack of research in our region, as demonstrated in the meta-analysis by Susantitaphong et al., regarding the "worldwide incidence of AKI", of 307 studies, only 3.5% are from Latin America. (7)

Due to the lack of recorded data, we have analyzed DIALNEF's treated patients over the last four years in different private hospitals (26 centers) and a suitable sample of a public hospital. Out of 7991 patients in ICUs, 3142 (39,3%) develop AKI in its different stages. Out of the AKI patients, 1351 (42,9%) required KRT: Intermittent Hemodialysis (IHD), Prolonged Intermittent Renal Replacement Therapy (PIRRT) 85% (1151n), and Continuous Renal Replacement Therapy (CRRT) 7% (97n). There is no data about Peritoneal Dialysis (PD) because it is a rare local treatment modality for AKI. Other extracorporeal therapies like Hemoperfusion (HP) are performed for poisonings (5%), HP + CRRT in COVID (2,1%), Membrane Plasma Separation (MPS) (0,6%), Coupled Plasma Filtration and Adsorption (CPFA) (0,1 %).

Based on our data, the incidence of AKI within the ICU is 40.4%, 57% in men compared to 42% in women. The age of presentation was: older adults (49.9%), mature adults (37%), young adults (12%), children and adolescents (4%). We have tried to obtain data from the pediatric nephrology group, but there are no databases available for analysis.

The leading AKI causes were: sepsis (70%), exacerbated CKD (20%), intoxications (5%), glomerulopathies (3%), and other causes such as obstructive uropathy or traumatic rhabdomyolysis (2%). AKI concerning cardiac surgery date is unavailable or underreported; and the type 1 cardiorenal syndrome is classified as comorbidity rather than an etiology in the analyzed records.

The main AKI risk factors in order of frequency are: sepsis of any origin, hypovolemia, multiorgan dysfunction, older adults and hypotension.

Between 2017-2021, 2,000 cases of pesticide poisoning were reported, 56% were caused by herbicides and fungicides, (8) in our database, the main toxic substances are carbamazepine, organophosphate, paraquat and valproic acid. The treatment protocol includes general detoxification and hemoperfusion with specific resin (Jafron HA 230 cartridge); most of the patients are young (average 28 yo) and mortality was 6.8%.

AKI During COVID-19 Pandemic

Until this publication in Ecuador have been reported 927700 cases, 35769 deaths; there are no published results involving AKI incidence. In an analysis and survey of the main publics and private hospitals, AKI incidence was reported to be 7% to 35 %; 10% required some KRT.

During the COVID-19 pandemic, CRRT was available in all private hospitals and in few public hospitals (3 across the country). In addition, there was access to Hemoperfusion resin filters that helped handle the Covid Hyperinflammatory Syndrome (cHIS), in our series of cases (24n) we have evidence an expected mortality reduction from 98% to 42.8%; with the most evident benefit of Intermittent Hemoperfusion (Jafron HA330 cartridge) vs. Continuous Hemoperfusion (Cytosorb). (9,10)

We understand that further trials are needed before the implementation of hemoadsoption in critically ill patients with or without COVID-19. A systematic review and meta-analysis of randomized controlled trials by Heymann M, et al. (June 2022) about mortality and adverse events of hemoadsorption concluded that considerable uncertainty about the findings do not allow firm conclusions and suggest the need of further high-quality randomized trials before systematic use of Cytosorb hemoadsorption. (11)

Diagnosis and Management of AKI

Ecuador has a universal health care system with complimentary access for the whole population. However, the offer of KRT depends on the availability of equipment and supplies in public hospitals. In private practice, with private insurance coverage, dialytic modalities are available with innovative technology commonly called “on-demand dialysis” for individualized patient treatment. Thus, treatments are being used with appropriate clinical criteria, like IHD, PIRRT, CRRT (CVVH, CVVHDF, CVVHD, SCUF), CPFA, Intermittent and Continuous Hemoperfusion, Intermittent On-Line Hemodiafiltration (OL-HDF) and PD. AKI outpatients who require a KRT are treated with IHD in chronic-patient dialysis facilities while the renal function is recovering. CRRT, is available widely in private practice and in a restricted way at public hospitals.

ICU patients are usually diagnosed with AKI by the intensivist with a nephrologist inter-consultation. As standard, K-DIGO classification is used that combine creatinine and urine output (12). The Furosemide Stress Test (FST), which can predict the AKI progression and require dialytic therapy, is routinely used (13). Although, there are many studies that recommend the usage of biomarkers for diagnosis and prognosis of AKI (NGAL, TIMP-2, ILGFBP-7) (14), in Ecuador, pitifully, they are not available for clinical, commercial or research purposes.

Vascular access of choice is a temporary catheter placed under ultrasound guidance in the right internal jugular (70%), femoral (28%), left jugular or left femoral vein (2%). The nephrologist, in most patients, performs the placement of vascular access.

The prescription of extracorporeal therapies (ECT) is the nephrologist's responsibility, there aren´t many nephrologists (283 registered, 16 pmp) so, in hospitals where there aren´t nephrologists, therapies are prescribed by an intensivist.

The nephrologist's competence and expertise in ECT promote interdisciplinary teamwork when facing diseases that require ECT, for example Guillain Barré, HUS, Vasculitis, etc.

Prophylactic Prevention of AKI

Routinely, as prophylactic strategies, we try to evaluate risk factors and identify signs of renal angina; the use of nephrotoxic drugs, contrast and fluid overload is avoided, enforcing every effort to maintain an adequate renal perfusion pressure.

AKI due to reversal hypovolemic causes acquired in the community (digestive losses, dehydration, infections) can be managed clinically in primary health care centers; for this reason we have carried out work with the Ecuadorian Society of Nephrology (ESN), educating general doctors in kidney prevention so that it does not evolve into major complications. AKI requiring KRT must be transferred to a second-level hospital in all cities of the country. At least three public and/or private hospitals usually provide multidisciplinary care in large cities. (Figure 1).

Outcomes

67% of patients with AKI K-DIGO 3 fully recovered renal function, 24% died, and 9% progressed to ESRD at 90-day follow-up. As there are no longer-term follow-up data for AKI, it is very likely that the percentage of progression to CKD is higher than reported. In a previous report, our raw mortality was 22%, being sepsis the main cause of death for more than 50% of the patients (15). Actually, the mortality obtain is 24%, very similar to USA reports (20,3%). (16)

Challenges and Conclusions

We propose an action plan summarized in Table 1.

Few nephrologists are interested in critical nephrology because most concentrate their work in dialysis facilities. The necessity to agree on joint management of acute patients has been identified, consequently, dialysis support meetings and trainings with intensivist and nurses have been performed.

AKI patients' management and care will continue under the recommendations of international guidelines, including the developed knowledge from the Ecuadorian experience, such as acute poisoning with substances uncommon in other countries.

The expectation of the program started in 2020 with the ESN initiative for CKD prevention aimed at primary health care physicians, where topics like AKI patient's care are contemplated, in order to start an appropriate preventive and curative treatment with early nephrologist reference and complete management of PD in rural areas for attend emergencies of community AKI.

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Funding: None.

Acknowledgments: The authors appreciate the support of DIALNEF members: Andrea Portilla, Víctor Ortega, Paulo Reinoso, Gustavo Paredes, Andrés Herdoiza.

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: Darío Jiménez: Conceptualization; Formal analysis; Methodology; Supervision; Writing - original draft; Writing - review and editing. Jazmín Jiménez: Data curation; Investigation; Methodology; Visualization; Writing - review and editing.

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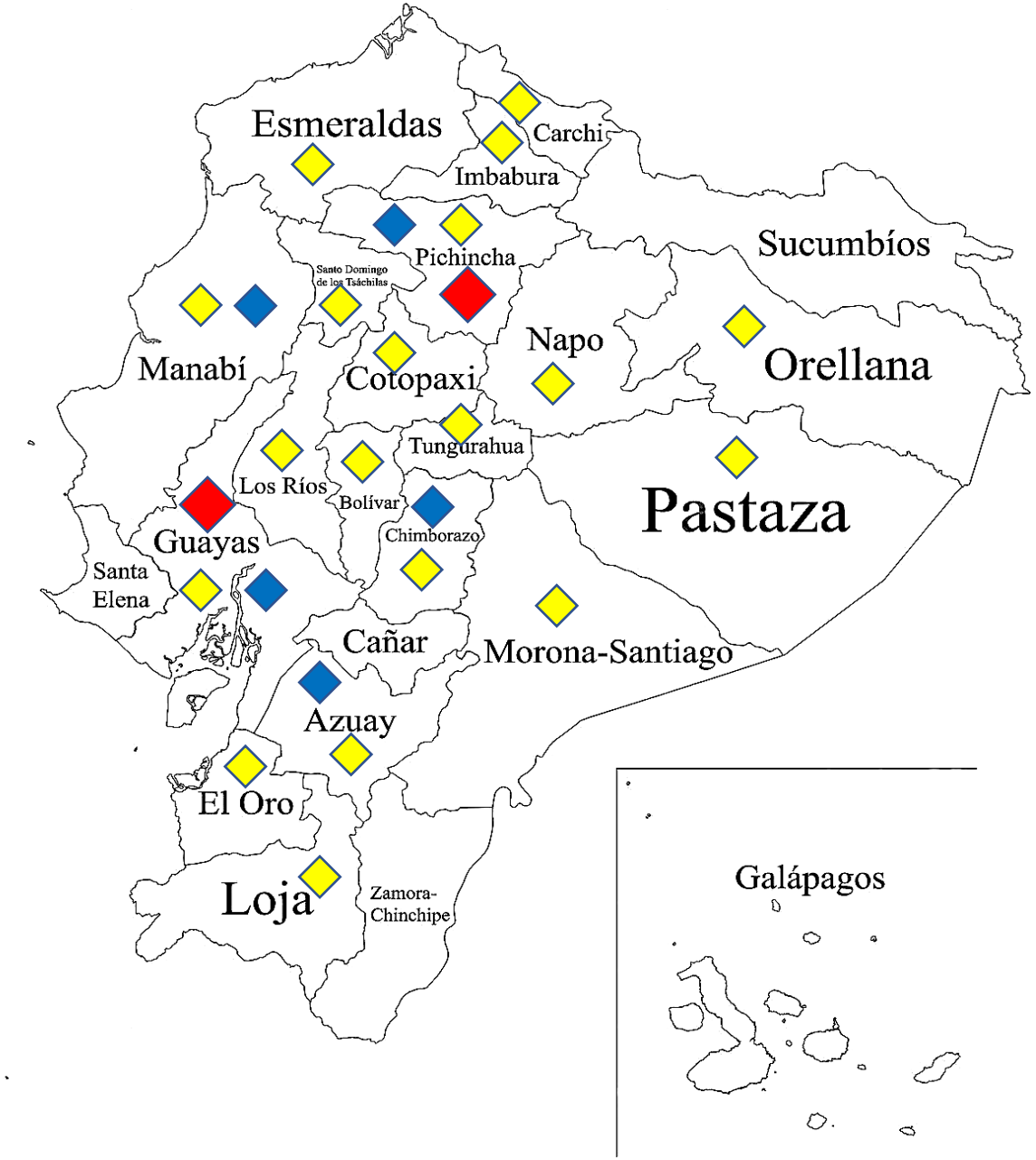
Table 1. Plan of action to motivate critical care nephrology

Problem	Solution	Activity	Responsible
Little interest	Incentive training program	Institutional Internationa alliances	Ecuadorian Society of Nephrology E N)
Trainin	Scientific	Critical Nephrology National meetings	ESN
Absent Acute Kidney Injury committee	Create a experts committee.	National announcement	ESN
Absence of National Guides management protocol	Elaborate Guides	Work Groups. With international collaboration	ESN Public Health System. (PHS) Private Institutions (DIALNEF and others)
AKI Health absenc	Health policy that grants total health availability for AKI	Meetings with PHS	ESN and PHS
National	Designation of a responsible entity for a national registry to show AKI current situation.	Workgroup (ES - PHS)	ESN and

Figure 1. AKI Hospital Care. KRT Availability.



- EXCLUSIVE CARE FOR AKI PATIENTS
  Quito: DIALNEF
  Guayaquil: UCRA
- PUBLIC OR PRIVATE HOSPITAL WITH AVAILABILITY OF DIALYSIS and/or CHRONIC DIALYSIS FACILITY
- OTHER PRIVATE PROVIDERS