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## ORIGINAL ARTICLE

### SOCIODEMOGRAPHIC PROFILE AND KIDNEY FUNCTION IN CHILDREN ADMITTED TO AN INTENSIVE CARE UNIT

#### PERFIL SOCIODEMOGRÁFICO E FUNÇÃO RENAL DE CRIANÇAS HOSPITALIZADAS EM UNIDADE DE TERAPIA INTENSIVA

#### PERFIL SOCIODEMOGRÁFICO Y FUNCIÓN RENAL EN NIÑOS INGRESADOS EN UNA UNIDAD DE CUIDADOS INTENSIVOS

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#### ABSTRACT

**Objective:** to characterize the sociodemographic profile and kidney function of severe children hospitalized in an intensive care unit (ICU). **Method:** observational, longitudinal, prospective study, with a quantitative approach, conducted with 17 children up to 12 years old admitted to a pediatric ICU. Data was collected from questionnaires. Fisher's exact test was used for inferential analysis of data;  $p < 0.05$  was considered significant. The results are displayed into tables. **Results:** 82.4% of the mothers were unemployed or in work leave and they played the role of the child's main caregiver (72%); 64.7% of the children evolved with kidney dysfunction during hospital stay, according to the pRIFLE classification. The majority (29.4%) showed a risk for acute kidney injury (AKI). The most common diagnosis was heart disease (47.1%). There was predominance of hospitalization of girls; 23.5% died until the end of monitoring. **Conclusion:** the children followed-up were socioeconomically vulnerable and most of them were identified as having a risk for AKI. **Descriptors:** Acute Kidney Injury; Children; Intensive Care Unit.

#### RESUMO

**Objetivo:** caracterizar o perfil sociodemográfico e a função renal das crianças graves hospitalizadas em unidade de terapia intensiva (UTI). **Método:** estudo observacional longitudinal, prospectivo, de natureza quantitativa, com 17 crianças de até 12 anos internadas em uma UTI pediátrica. Os dados foram coletados a partir de questionários. O teste exato de Fisher foi utilizado para a análise inferencial dos dados;  $p < 0,05$  foi considerado significativo. Os resultados são apresentados em tabelas. **Resultados:** 82,4% das mães estavam desempregadas ou afastadas do emprego e ocupavam o papel de principal cuidador da criança (72%); 64,7% das crianças evoluíram com disfunção renal durante a internação, segundo a classificação pRIFLE. A maioria (29,4%) apresentou risco para lesão renal aguda (LRA). O diagnóstico mais comum foi de cardiopatia (47,1%). Houve predominância de internação de meninas; 23,5% evoluíram a óbito até o término do acompanhamento. **Conclusão:** as crianças acompanhadas apresentavam situação de vulnerabilidade socioeconômica e a maioria foi identificada com risco para LRA. **Descritores:** Lesão Renal Aguda; Crianças; Unidade de Terapia Intensiva.

#### RESUMEN

**Objetivo:** caracterizar el perfil sociodemográfico y la función renal de niños graves hospitalizados en una unidad de cuidados intensivos (UCI). **Método:** estudio observacional, longitudinal, prospectivo, con un enfoque cuantitativo, realizado con 17 niños de hasta 12 años ingresados en una UCI pediátrica. Los datos se recogieron de cuestionarios. La prueba exacta de Fisher se utilizó para el análisis inferencial de datos;  $p < 0,05$  se consideró significativo. Los resultados se muestran en tablas. **Resultados:** 82,4% de las madres estaban desempleadas o en licencia de trabajo y desempeñaban el papel de principal cuidadora del niño (72%); 64,7% de los niños evolucionaron con disfunción renal durante la estancia hospitalaria, según la clasificación pRIFLE. La mayoría (29,4%) mostró un riesgo de lesión renal aguda (LRA). El diagnóstico más frecuente fue cardiopatía (47,1%). Hubo predominio de hospitalización de niñas; 23,5% fallecieron hasta el final del seguimiento. **Conclusión:** los niños seguidos eran socioeconómicamente vulnerables y la mayoría de ellos fue identificada como teniendo un riesgo de LRA. **Descriptor:** Lesión Renal Aguda; Niños; Unidad de Cuidados Intensivos.

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INTRODUCTION

Acute kidney injury (AKI) is currently characterized as one of the major aggravating factors to the population's health and it is among the most recurrent complications within the hospital environment. Its occurrence is a determining factor for increased mortality both among adults and children.<sup>1</sup>

The outcomes of AKI depend on the underlying disease, severity, length of complications, and baseline kidney function.<sup>2</sup>

The various stages of AKI are associated with several factors, such as incomplete kidney maturation degree in neonates, as well as exposure to risk factors for AKI, such as perinatal asphyxia, cardiac surgery, sepsis, prematurity, and use of nephrotoxic drugs.<sup>3</sup>

Clinically, AKI is characterized by abrupt drop in kidney function and it leads to decreased glomerular filtration rate and increased serum creatinine levels, associated with electrolyte imbalance and excretion of body water and waste.<sup>4</sup> Clinically, serum creatinine is a late marker, so changes in its values are associated with worse outcomes.<sup>5</sup>

In the critically ill pediatric population, chronic use of nephrotoxic drugs and mainly sepsis, besides representing the main etiologies of AKI, leads to worse prognoses.<sup>6</sup> Thus, children affected by AKI may require a renal replacement therapy (RRT) program.<sup>7</sup>

Episodes of AKI during hospitalization may lead to a higher risk of progression to chronic kidney disease.<sup>8</sup> It is believed that, both in children and adults, lack of early detection and effective treatment pose major challenges today, they are also the therapeutic key for both age groups. Early intervention aided by less and less late biochemical markers delay the deterioration of kidney function resulting from subclinical episodes, preventing end-stage kidney disease.<sup>9</sup>

Accurate measurement and correct interpretation of glomerular filtration rate in children allows us to identify not only the implications on kidney function, but above all to contribute to early detection and construction of a plan of action to promote prevention strategies in the clinical scenario within health services.<sup>10</sup>

In 2004, the standardization of AKI definitions resulted from the publication of the RIFLE classification (from the acronym Risk, Injury, Failure, Loss, End-stage).<sup>4</sup> Table 1 shows the modified version for pediatric patients (pRIFLE).<sup>11</sup>

The initial sample consisted of 20 children, 3 were excluded due to lack of records, totaling 17 children in the study. Data collection began in June and ended in December 2014. Children up to 12 years old and those admitted to the pediatric ICU without prior diagnosis of AKI were included. And those using nephrotoxic agents and contrast; children at the risk stage of the pRIFLE classification; and those with a history of chronic kidney failure were excluded.

Data were collected through two structured instruments: (1) instrument for collecting socioeconomic data about the child's parents

Table 1. pRIFLE classification. Distrito Federal, 2014.

| Stages                   | Estimated creatinine clearance (ECC)                          | Urinary volume                                   |
|--------------------------|---------------------------------------------------------------|--------------------------------------------------|
| Risk                     | Reduction of ECC by 25%                                       | <0.5 mL/kg/h for 8 hours                         |
| Injury                   | Reduction of ECC by 50%                                       | <0.5 mL/kg/h for 16 hours                        |
| Failure                  | Reduction of ECC by 75% or ECC <35 mL/min/1.73 m <sup>2</sup> | <0.3 mL/kg/h for 24 hours or anuria for 12 hours |
| Loss of kidney function  | Persistence of kidney function failure >4 weeks               |                                                  |
| End-stage kidney disease | Persistence of kidney function failure >3 months              |                                                  |

OBJECTIVE

- To characterize the sociodemographic profile and kidney function of severe children hospitalized in an intensive care unit (ICU).

METHOD

This is an observational, prospective study, with a quantitative approach conducted at a pediatric ICU of a public hospital, tertiary level, specialized hospital in the maternal and child area, located in the Central-West Region, Brazil.

or guardians; (2) instrument for collecting clinical data about the child through the medical record. The first one was completed by means of interview with a parent or guardian with signing of the free and informed consent form. Later, through the electronic system of access to medical records, the information contained in instrument 2 was obtained, which consisted of the children's clinical data (comorbidities, medicines, laboratory tests).

To obtain anthropometric data, the z scores of height/age (H/A), weight/age (W/A), and weight/height (W/H) were calculated using the software *Epi-info*, version 6, which adopts as its reference the curve from the Center for Disease Control and Prevention (CDC), 'Growth Charts of the U.S.,' 2000 review.<sup>12</sup>

The identification of cases occurred initially through analysis of laboratory data and serum creatinine values. Kidney impairment was characterized in children who have shown a reduction by at least 25% of estimated creatinine clearance according to the RIFLE classification. The glomerular filtration rate was calculated according to the Schwartz equation: creatinine clearance (mL/min/1.73 m<sup>2</sup>) = [height (cm) x k] / serum creatinine), where the constant k = 0.45 was adopted for children < 1 year old; k = 0.55 for > 1 year and adolescent girls, and k = 0.70 for boys > 12 years.

Follow-up of the serum creatinine and urinary volume values registered in the medical records occurred for 3 consecutive days. We also observed, at the end of this study, the research participant's outcome (discharge, death, transfer).

The records were entered and analyzed in the software *Epi-Info*, version 7, for statistical analysis. In order to describe the results, we calculated absolute and relative frequency, mean value, and standard deviation. Categorical variables were analyzed using Fisher's exact test. *P* values < 0.05 were considered significant.

This study complied with Resolution 466/2012, from the Brazilian National Health Council (CNS), and it was approved by the Research Ethics Committee of the Fundação de Ensino e Pesquisa em Ciências da Saúde

(FEPECS) in the Federal District, Brazil, under the Brazilian Certificate of Submission for Ethical Assessment (CAAE) 30630814.9.0000.5553.

RESULTS

Analysis of the age profile showed that most of the hospitalized children were male (58.8%), with an average age of 30 months. More than half of them live in the Federal District, Brazil (52.9%). Out of the total children, only 5.9% were black. Mothers had higher education levels than fathers. While 41.2% of the mothers had High School education, the same percentage of fathers had incomplete Elementary Education. Despite this, 82.4% of the mothers were unemployed or in work leave and they played the role of the child's main caregiver (72%), while most of the parents had at least one job agreement (94.1%). The per capita income of these families was less than 1 minimum wage (88.2%). Out of the total number of families, only 29.9% received support from the Federal Government.

The mean body mass index (BMI) of the children was 15.7±4.5 kg/m<sup>2</sup>. The normal electrolyte profile was characterized by mean serum potassium levels of 5.2 mmol/L, serum sodium of 139 mmol/L, and serum urea of 42 mg/dL, all of them within the normal range; 76.5% of the children were using furosemide and 23.5% used dobutamine. Also, just over half (52.9%) of the children received antibiotic therapy. The majority (76.5%) had a history of an annual hospitalization, in addition to the current one.

Table 2 shows the children's main comorbidities and hospitalization diagnoses. Among the predominant comorbidities, cardiac diseases were highlighted (47.1%), followed by infections (29.4%) and respiratory diseases (17.6%). Among the hospitalization diagnoses, there was predominance of cardiopathy.

Table 2. Clinical characteristics of children admitted to the intensive care unit. Distrito Federal, 2014.

| Characteristics (n = 17)      |          |
|-------------------------------|----------|
| Comorbidities                 | n (%)    |
| Respiratory diseases          | 3 (17.6) |
| Heart diseases                | 8 (47.1) |
| Muscular diseases             | 3 (17.6) |
| Infections                    | 5 (29.4) |
| Intestinal diseases           | 4 (23.5) |
| Hospitalization diagnosis     |          |
| Cardiopathy                   | 8 (47.1) |
| Floppy baby syndrome          | 2 (11.8) |
| Bacterial pneumonia           | 1 (5.9)  |
| Epilepsy state                | 1 (5.9)  |
| Colon invagination            | 1 (5.9)  |
| Neoplasm                      | 1 (5.9)  |
| Lymphadenitis                 | 1 (5.9)  |
| Child's cerebral palsy        | 1 (5.9)  |
| Respiratory distress syndrome | 1 (5.9)  |

According to the pRIFLE classification, we observed that most of the children evaluated (29.4%) had a risk for kidney injury, both by the serum creatinine criterion and by the

urinary volume. However, only by the urinary volume criterion, 11.8% of the children evolved at the renal failure stage (Table 3).

Table 3. Distribution of children according to the stage of kidney dysfunction by means of the pRIFLE classification. Distrito Federal, 2014.

| Stage       | Creatinine criterion | Urinary volume criterion |
|-------------|----------------------|--------------------------|
| Risk (R)    | 4 (23.5%)            | 5 (29.4%)                |
| Injury (I)  | 1 (5.9%)             | 0 (0.0%)                 |
| Failure (F) | 0 (0.0%)             | 2 (11.8%)                |

There was an association between urinary tract infection and women ( $p = 0.015$ ). Besides, the relation between the number of previous hospitalizations and women ( $p = 0.008$ ) was significant.

At the end of the study, most of the children monitored (35.3%) were still hospitalized or they were transferred (23.5%) to another unit or died (23.5%).

DISCUSSION

The social and historical context shows us the cultural values about the family structure where the mother plays the role of the children's provider, educator, and main caregiver and the father takes the burden of family needs support. The healing process and treatment success involving hospitalized and severely ill children are associated with integration of the multiprofessional team and participation of caregivers and family members.<sup>14</sup>

The increasing introduction of the father in family relations has been the aim of studies and emphasized the inclusion of the father as a character both in home actions and in the child's social development. Modern society invokes a father who shares with his wife the pleasures, the chores, and the responsibilities of caring for the children. The responsibilities related to the father as a character have

changed over time, reflecting changes in the socioeconomic and cultural context from the patriarchal-type to the multifaceted and postmodern societies, where being a father involves deep changes in the men's lives, including new roles, consolidating responsibilities, and strengthening the relationship between the father and the child.<sup>15,16</sup>

Social weaknesses contribute to greater demand for a public health service. Just as in this study, scientific evidence showed that the population that seeks a public health service, in most cases (72.5%), besides having low education levels, is characterized by socioeconomic vulnerability.<sup>10,17</sup>

Children who are more exposed to treatments using nephrotoxic and vasoactive drugs and to mechanical ventilation devices have greater kidney impairment.<sup>9</sup> A finding also observed in this study. In this scenario, the use of aminoglycosides is highlighted as one of the antibiotic drug classes associated with a higher incidence of AKI, increased length of hospital stay, and hospital expenses.<sup>18</sup>

Multiple organ failure, need for mechanical ventilation, and need for inotropic support, as well as cardiovascular diseases, show up as factors associated with AKI.<sup>19</sup> The mortality rate among patients with severe AKI reaches

36.4%.<sup>20</sup> Moreover, postoperative cardiac surgery using extracorporeal circulation is also reported as an AKI determinant.<sup>21</sup>

The incidence of AKI in children has been variable depending on the main diagnosis, treatment adopted, period of therapeutic strategies initiation, and definition of AKI diagnosed by the multiprofessional team.<sup>22</sup>

When assessing kidney function by means of the serum creatinine or urinary volume criteria separately, we observed that the urinary volume criterion has shown greater discriminatory power to identify children with kidney dysfunction.<sup>23</sup> This finding was also identified in this study. Besides, evidence describes serum creatinine as a late biomarker, something which has been associated with delayed adoption of preventive measures for AKI<sup>23</sup> and, consequently, the need for longer hospital stay<sup>24</sup>, as observed in this study.

The limitation of this research is related to scarcity of information in medical records. In addition, the length of hospital stay among children admitted to the ICU was a factor that may have influenced the low turnover, something which affected the sample size. The study suggests the importance of parental support and participation in the recovery of ICU children.

## CONCLUSION

The social profile of children with AKI admitted to the ICU involves socioeconomic vulnerability.

Most of the children admitted to the ICU were identified as having a risk for AKI, according to the pRIFLE classification.

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