Health Care Distribution of Patients With Genitourinary Birth Defects in Colombia: a Spatial Analysis of Registered Cases

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Abstract

Background: Genitourinary birth defects are reported to be present in approximately 10-30% of all newborns. Timely treatments may reduce complications that contribute to increased infant morbimortality. Understanding the distribution of health access is essential for the design of health interventions and resources distribution. We aim to evaluate geographical distribution in the healthcare access to subspecialized medical care of patients with genitourinary birth defects in Colombia.

Methods: We reviewed data collected between January 2015 to December 2019 in the Individual Health Records System (RIPS). All registered patients diagnosed with renal malformations, male genital malformations, and exstrophy-epispadias complex as well all registered live births were included. Cluster detection was performed using a Poisson model with SaTScan v9.6. To visualize the results, these were projected in a Google Earth map.

Results: Between January 2015 and December 2019 a total of 26.726 patients with renal malformations, 19.149 patients with genital malformations, and 494 patients with exstrophy-epispadias complex in the outpatient clinic were assessed in Colombian territory. A space-time analysis identified one cluster with high provided health care concentration seen in the center of the country for renal and genital malformations. Meanwhile northern regions close to the coast were identified as clusters with low rates of provided care regions. For cases with exstrophy-epispadias complex, regions in the north had lower registered assessments compared to the center of the country.

Conclusion: Patients with genitourinary malformations have inequitable access to specialized health care which can delay surgical management and impact long-term outcomes that increase disability.

Introduction

Genitourinary birth defects are reported to be present in approximately 10-30% of all newborns and can lead to varying degrees of morbimortality. (1,2) Congenital kidney anomalies are responsible for up to 50% of chronic renal failure in children worldwide.(2) A cohort study conducted by Calderon-Margalit et al (3) found a hazard ratio of 4.19 (95% CI 3.52 – 4.99) for end-stage renal disease (ESRD) in patients with a history of childhood kidney disease after 30 years of follow-up. Mild kidney abnormalities in childhood could be a risk factor for ESRD in adulthood, even there is no compromise of renal function at the time of diagnosis. (3) Similarly, Chu et al (4) followed a cohort of children survivors of Wilms tumor, founded abnormal ambulatory blood pressure monitoring in 76% of participants, masked hypertension in 34% and microalbuminuria in 6%. Timely treatments may reduce complications that otherwise would contribute to increased infant morbidity and mortality with lifelong permanent disabilities. (5) On the other hand, congenital anomalies that affect genitals have a lifelong impact on multiple domains, including urinary function, sexuality, fertility, and psychosocial wellness. (6) In both scenarios, identification and timely management of cases are essential to positively impact prognosis.

According to Global Health Estimates (7), congenital anomalies were in the top 10 global causes of disability-adjusted life years (DALYs) in 2019. Despite the burden of these conditions dropped worldwide from 61.815 million DALYs in 2010 to 51.797 million DALYs in 2019 (8), still persists disparities between regions. Around 94% of congenital anomalies occur in low- and middle-income countries. (9) The large proportion of cases added to low coverage of surgical care in these settings, delay the access to timely treatment, which in turn increases the burden of disease. Delays related to presentation to medical care, referral for specialized care and surgery has been demonstrated be longest in low-income country (Kenya) compared to high-income country (Canada). (10)

Spatial analysis has emerged as a practical tool for epidemiological research since it allows detecting spatial disparities in the occurrence of diseases. (11,12) A spatial cluster is an unusual number of cases within a population in a time period. (13) They can reveal trends that may not be apparent at an individual level, therefore, are useful for health services planning. (14) Understanding the distribution of health access is essential for the design of health interventions and resources distribution. The aim of the present study is to evaluate geographical distribution in the healthcare access to subspecialized medical care of patients with genitourinary birth defects in Colombia.

Methods

Data collection

Colombia is divided into 32 *departments* and 1119 municipalities. According to the 2018 national census, 77.1% of population lives in urban areas and approximately 25% residing in four main cities (Bogotá, Medellín, Cali, and Barranquilla). (15) The central region is the territory where the largest population is located with equivalent to 70.1%, where high complexity/specialized university hospitals area also located. Followed by 21.9% inhabit the north region, the 3% in the east and the remained in the west and the south (2.7% and 2.4%, respectively). (16)

The Individual health records system (Registros Individuales de Prestación de Servicios de Salud – RIPS, by its Spanish acronym) is a data repository for the management, regulation, and control processes for the health services required by the General System of Social Security in

Colombia (17). Their aim is to follow up on the health services provided, evaluate service coverage, formulate health policies as well as allocate financial and human resources. The information must be organized according to guidelines proposed by the Ministry of Health. Data registration is mandatory and performed monthly by health-providing institutions and independent professionals. Data analysis reports are sent to insurers for validation and verification. Finally, records are consolidated and a report is generated. (17) Information is available for public consultation through an Open Database Connectivity (ODBC).

For the present study we reviewed data collected between January 2015 to December 2019. All registered patients diagnosed with renal malformations (Q600, Q601, Q602, Q603, Q604, Q605, Q610, Q611, Q612, Q613, Q614, Q615, Q618, Q619, Q620, Q621, Q622, Q623, Q624, Q625, Q626, Q627, Q628, Q630, Q631, Q632, Q633, Q638, Q639), male genital malformations (Q530, Q531, Q532, Q539, Q540, Q541, Q542, Q543, Q544, Q548, Q549, Q550, Q551, Q552, Q553, Q554, Q555, Q556), and exstrophy-epispadias complex (Q640, Q641), according to the International Statistical Classification of Diseases and Health Problems 10th revision (ICD-10) (18) were included for analysis. No identifying variables were collected. We applied the diagnostic filters “confirmed new cases” and “confirmed repeated cases”. Diagnostic impression and unspecified cases were excluded. With the purpose of quantifying the number of patients with these diagnoses, the function “people attended” was used, which includes each patient only once even if was attended multiple times during the time of the study.

The National Administrative Department of Statistics (Departamento Administrativo Nacional de Estadística – DANE, by its Spanish acronym) is the entity responsible for collecting, processing, analysing official statistics in Colombia (19). The Vital Statistics Subsystem collects and processes information about all births and deaths that occur in the country. Live birth and death certificates are filled out by doctors, nurses, or authorized health personnel who attended the event in the institutions providing health services throughout the country. Live births are defined as a product of gestation after the expulsion or removal of the mother's body, regardless of the duration of the pregnancy. They must be able to breathe or give any other sign of life, such as heartbeat or umbilical cord pulsation (20). For the present study, we included all registered live births during 2015 – 2019 in each department of the country and discriminating by gender.

Geographical variables (latitude and longitude) of each department were extracted using the DANE geoportal. This tool collects the information of georeferenced data and allow access to geographic limits and official maps of the Colombian territory.

Statistical analysis

Cluster detection was performed using SaTScan v9.6 (21) for macOS (Satscan, 2018) to identify clusters with either high or low rates of medical assessments over time. The spatial-temporal statistical analysis using a Poisson probability model was conducted for each diagnostic group. In the case file, we included all people with the specified diagnoses and in the population file, the live births were added. Latitude and longitude coordinates were entered for each department. The study period started 01/01/2015 and ended 31/12/2019. Each analysis was run using a time aggregation of 1 year of length and the option scan for areas with high or low rates was selected. The results obtained were visualized in a map from Google Earth. Areas with the highest concentration of cases are shown in red. Meanwhile, clusters in blue show those municipalities below the average value assessed for the years analyzed.

Results

Between January 2015 and December 2019, a total of 26.726 patients with renal malformations, 19.149 patients with genital malformations, and 494 patients with exstrophy-epispadias complex in the outpatient clinic were assessed in Colombian territory.

In the case of renal malformations, space-time analysis identified one cluster with high provided health care concentration seen in the center of the country (Risaralda, Caldas, Quindío, Antioquia, Tolima, Valle del Cauca, Cundinamarca, Bogotá, D.C., and Huila) (Figure 1). Meanwhile northern regions close to the coast (Bolívar, Sucre, Magdalena, Córdoba, Cesar, La Guajira, and Norte de Santander) were identified as clusters with low rates of provided care regions.

Genital malformations spatial scan statistical analysis identified one cluster during the study time of shown in Figure 2 with a similar geographic distribution described above.

For cases with exstrophy-epispadias complex, a total of two clusters were identified (Figure 3). Regions in the north had lower registered assessments compared to the center of the country.

Discussion

Health care distribution demonstrate high cluster concentration of patients with renal malformations, male genital malformations and exstrophy-epispadias complex in highly dense urban areas mostly distributed in the center of the country. Other major cities do not show high concentration clusters. These results highlight unequitable distribution in the care of patients with congenital genitourinary malformations. Distance between home and hospitals, difficulty in obtaining medical care and type of healthcare provider might influence these results. (22)

This has implications in patient prognosis, which in turn produce an increase cost to the health system. The identification of genitourinary malformation clusters can be used to optimize health care access (23).

Bladder exstrophy-epispadias complex is a severe abdominal midline malformation in which reconstructive procedures affect significantly patients' long-term quality of life. (24,25) Increased risk of urinary incontinence and the need for multiples reinterventions are some of the consequences of failed primary bladder closure. (26) It has been demonstrated that subspecialty surgical training has a positive influence on successful results. (27) Gupta, *et al* (25) describe that UK experience in the centralization of these patients has resulted in experienced multidisciplinary teams, follow-up and psychological support. These, in turn, improved overall outcomes for patients. Our results suggests that patients living in remote areas of the country are less likely to receive specialized care in a timely manner what can affect their prognosis.

On the other hand, kidney congenital anomalies represent a significant cause of chronic kidney disease in children and young adults.(28,29) Previous studies have demonstrated that socioeconomic factors are related to end-stage renal disease due to difficult access to healthcare resources, including delayed referral. (30,31) Our study does not provide information about the percentage of patients who develop chronic kidney failure. However, the areas of the country where we do not find clusters with high rates of medical attention are those with the greatest economic limitations, probably these patients are under deferred assessment. A study by Sanna-Cherchi, *et al* (32) followed a cohort of 312 children with renal and urinary tract anomalies until the age of 30 years. All patients with a diagnosis of posterior urethral valves had at least one surgical treatment, 35% of the children with solitary kidney and 22% of children with vesicoureteral reflux had ureteral reimplantation and all patients had been treated with prophylaxis for urinary tract infection for at least 1 year. This emphasizes the importance of an appropriate diagnosis and follow-up.

This is the first study to examine the spatial clusters of medical attention of genitourinary malformations in Colombia. Clustered areas need to be identified to facilitate the assessment of access to health care and design effective health interventions. In most cities, there are no subspecialists, and we cannot know how is the referral process and the waiting times. There are certain limitations to our study. Underreporting cases, methods of registration in certain areas, and differences in clinical practices or diagnostic techniques could have affected these results. Based on our findings, some recommendations can be proposed. It is necessary to collect more detailed information including waiting time to first specialized consultation as well as construct a system of tracking and reference of these patients.

Conclusion

Patients with genitourinary malformations have inequitable access to specialized health care which can delay surgical management and impact long-term outcomes that increase disability. There is a greater concentration of cases assessed in the center of the country, where most of pediatrics urologist, technology and hospitals are available.

Declarations

Ethics approval and consent to participate

"Not applicable"

Consent for publication

"Not applicable"

Availability of data and materials

The datasets generated during and/or analysed during the current study are available from the corresponding author on reasonable request.

Competing interests

"The authors declare that they have no competing interests"

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None

Authors' contributions

"NF developed research idea. MP and JS, recovered data base information. IS analyzed and interpreted the patient's database. All authors read and approved the final manuscript."

"Not applicable"

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Figures

Figure 1

Spatial-temporal analysis of renal malformations. Identified hypospadias clusters with increasing trends in cases assessed (red) and clusters with decreasing trends (blue).

Figure 2

Spatial-temporal analysis of male genital malformations.

Figure 3

Spatial-temporal analysis of Exstrophy-epispadias complex