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Original article

Differences in Gastroenterology Procedure Rates in Colombia According to Geographic Location and Health Insurance Regimen

Juan Pablo García-Marmolejo,[1*] Juan Samuel Hernández,[1] Carlos Lombo-Moreno,[2] Nancy Herrera-Leaño,[2] Julián Barahona-Correa,[2] Óscar Muñoz-Velandia,[2,3] Alberto Rodriguez-Varón.[2,4]

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[1] Physician, Internal Medicine Resident, Pontificia Universidad Javeriana. Bogotá, Colombia.
[2] Internal Medicine Physician, Hospital Universitario San Ignacio. Bogotá, Colombia.
[3] Internal Medicine Physician, Epidemiologist, Associate Professor of Internal Medicine, School of Medicine, Pontificia Universidad Javeriana. Bogotá, Colombia.
[4] Internal Medicine Physician, Gastroenterologist, Associate Professor of Gastroenterology, School of Medicine, Pontificia Universidad Javeriana. Bogotá, Colombia.

***Correspondence:** Juan Pablo García-Marmolejo.
jp-garciam@javeriana.edu.co

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Abstract

Introduction: Previous evidence suggests the existence of barriers that may result in differential access to healthcare in Colombia; however, the impact on diagnostic gastroenterology procedures has not been evaluated. **Objectives:** To assess procedure rates (PR) in gastroenterology and describe differences according to geographic location, insurance regimen, age, and sex. **Methods:** Secondary analysis of a population-based database containing data reported to the Integrated Social Protection Information System (SISPRO) in Colombia between 2017 and 2023. PRs were calculated for esophagogastroduodenoscopy (EGD), colonoscopy, endoscopic ultrasound (EUS), and endoscopic retrograde cholangiopancreatography (ERCP). Procedure rate ratios (PRRs) were computed according to geographic region, sex, and insurance regimen. **Results:** National PRs ranged from 66 per 100,000 inhabitants for EUS to 4,144 per 100,000 for EGD, with significantly lower rates in the Caribbean coast, southern, and eastern regions of Colombia. PRs were higher in women (PRR EGD: 1.66; confidence interval [CI]: 1.65–1.66; $p < 0.001$; PRR ERCP: 1.52; CI: 1.45–1.59; $p < 0.001$) and lower in patients under the subsidized insurance regimen (PRR ERCP: 0.85; CI: 0.82–0.89; $p < 0.0001$; PRR EUS: 0.50; CI: 0.49–0.51; $p < 0.0001$). A progressive increase in procedure rates with age was observed. **Conclusions:** Our findings indicate that procedure rates increase with age and are higher in women. Furthermore, patients residing in certain geographic areas of Colombia and those enrolled in the subsidized insurance regimen face barriers to accessing gastroenterology procedures. These results underscore the need to implement public health policies aimed at reducing these disparities.

Keywords

Diagnostic techniques and procedures, surgical procedures of the digestive system, gastroenterology, barriers to healthcare Access.

INTRODUCTION

Gastrointestinal diseases account for up to 10% of consultations for patients presenting to emergency departments in Colombia[1]. Some of the most prevalent include *Helicobacter pylori* infection (present in up to 38.5% of the population), irritable bowel syndrome (20%), and gastroesophageal reflux (11.9%)[2-4]. Others are less prevalent but have a high impact on mortality, such as gastric cancer, with an age-standardized mortality rate (ASMR) of 9.9 per 100,000 inhabitants, and colorectal cancer, with an ASMR of 8.0 per 100,000 inhabitants[5]. Upper gastrointestinal bleeding (UGIB) has a mortality rate close to 10%[6], and acute cholangitis, up to 65%[7]. The management of these diseases typically requires performing multiple procedures, among which upper gastrointestinal endoscopy (UGIE),

colonoscopy, endoscopic retrograde cholangiopancreatography (ERCP), and endoscopic ultrasound (EUS) are prominent.

The availability and potential barriers to access for diagnostic or therapeutic procedures for various gastrointestinal diseases in Colombia have not been studied until now. However, for different diseases, significant differences have been found in access to diagnostic interventions or specific treatments based on geographic regions or health insurance regimens. For example, Mora-Moreo et al.[8] demonstrated that the use of health services differed by regimen, finding lower demand, access, and provision of health services in the population enrolled in the subsidized regime. Parra-Lara et al.[9] analyzed the five-year overall survival of patients with gastric cancer and found lower survival among those belonging to the subsidized regime and those residing in rural areas. Gaitán et al.[10] found significant inequality in events reported to the Public Health Surveillance System (SIVIGILA) in Colombia, which disadvantages the population enrolled in the subsidized regime in almost all departments, and is more notable in areas such as Cauca, Huila, Córdoba, Santander, and Casanare. Likewise, approximately 6.5% of rural households had difficulties receiving or acquiring health services.

Based on the above, it is suspected that barriers to healthcare may generate differential access to diagnostic or therapeutic procedures in gastroenterology in Colombia; however, this gap has not been quantified, nor have the potential specific associated factors.

The objective of this study is to evaluate the rates of performance of diagnostic or therapeutic procedures in gastroenterology and to describe whether there are differences in the performance rate according to geographic location, insurance regimen, age, and sex, based on information reported between 2017 and 2023 to the SISPRO information system (Integrated Social Protection Information System) in Colombia.

MATERIALS AND METHODS

This is a secondary analysis of a population-based database to evaluate the frequency of performance of diagnostic or therapeutic procedures that were recorded in the SISPRO system. Procedures were identified using the CUPS code (Unique Health Procedure Classification). These codes describe in a detailed and validated manner the procedures performed based on the billing and payment of procedures to different healthcare providers in Colombia[11]. The SISPRO system is a tool developed by the Ministry of Health of Colombia where the basic information required for the direction, regulation, and control of the processes of the general social security health system is stored and processed. Its reliability has been previously demonstrated as it includes data verification and encompasses information from over 98% of the Colombian population[12]. The study was approved by the ethics committee of Pontificia Universidad Javeriana and Hospital Universitario San Ignacio under record number FM-CIE-0013-24.

Data extraction was performed using online pivot tables. To identify the procedures performed, CUPS codes 441301, 441302, 441303, 452301, 452303, 452305, 511000, and 881317 were used, corresponding to UGIE, colonoscopy, ERCP, and EUS. Information was extracted in aggregate at the national level and subsequently divided by department, sex, five-year age group, and health system membership regimen (subsidized or contributory). All information recorded between 2017 and 2023 was considered.

Procedure performance rates were adjusted according to geographic location, membership regimen, age, and sex. Performance rates were calculated by dividing the number of procedures by the number of people within a specific category. Data from the national census conducted in 2018 were used for the denominators.

The procedure rate ratio was calculated by dividing the procedure performance rate in each category by the rate in the reference category ("men" for sex, "Bogotá" for geographic regions, and "contributory" for the health system membership regimen). Statistical analysis was performed using the Stata 16 statistical program (Statacorp, College Station, TX, USA). Datawrapper software was used for graphical analysis according to the country's departments.

RESULTS

Between 2017 and 2023, a total of 3,397,816 gastroenterology procedures (UGIE, colonoscopy, ERCP, or EUS) were performed in Colombia, for a performance rate of 7041 procedures per 100,000 inhabitants. Of these, 1,999,841 were UGIE, 1,357,963 were colonoscopy, 31,853 were EUS, and 8,159 were ERCP, with procedure performance rates of 4144 (UGIE), 2814 (colonoscopy), 66 (EUS), and 17 (ERCP) per 100,000 inhabitants.

Figure 1 shows the performance rates of different procedures according to geographic location within the country. UGIE was performed most frequently in the Coffee Axis region (Risaralda, Caldas, Quindío), Caquetá, and Bogotá, with notably low procedure performance rates in areas such as Amazonas, Guainía, and the Caribbean Coast. For colonoscopy, it was noteworthy that Chocó had the highest performance rate (12,263 procedures per 100,000 inhabitants), followed by Quindío, Bogotá, and Risaralda, values significantly higher than those found for areas such as Vichada, Guainía, and Vaupés, which had the lowest rates. Regarding EUS, a significantly higher procedure per-

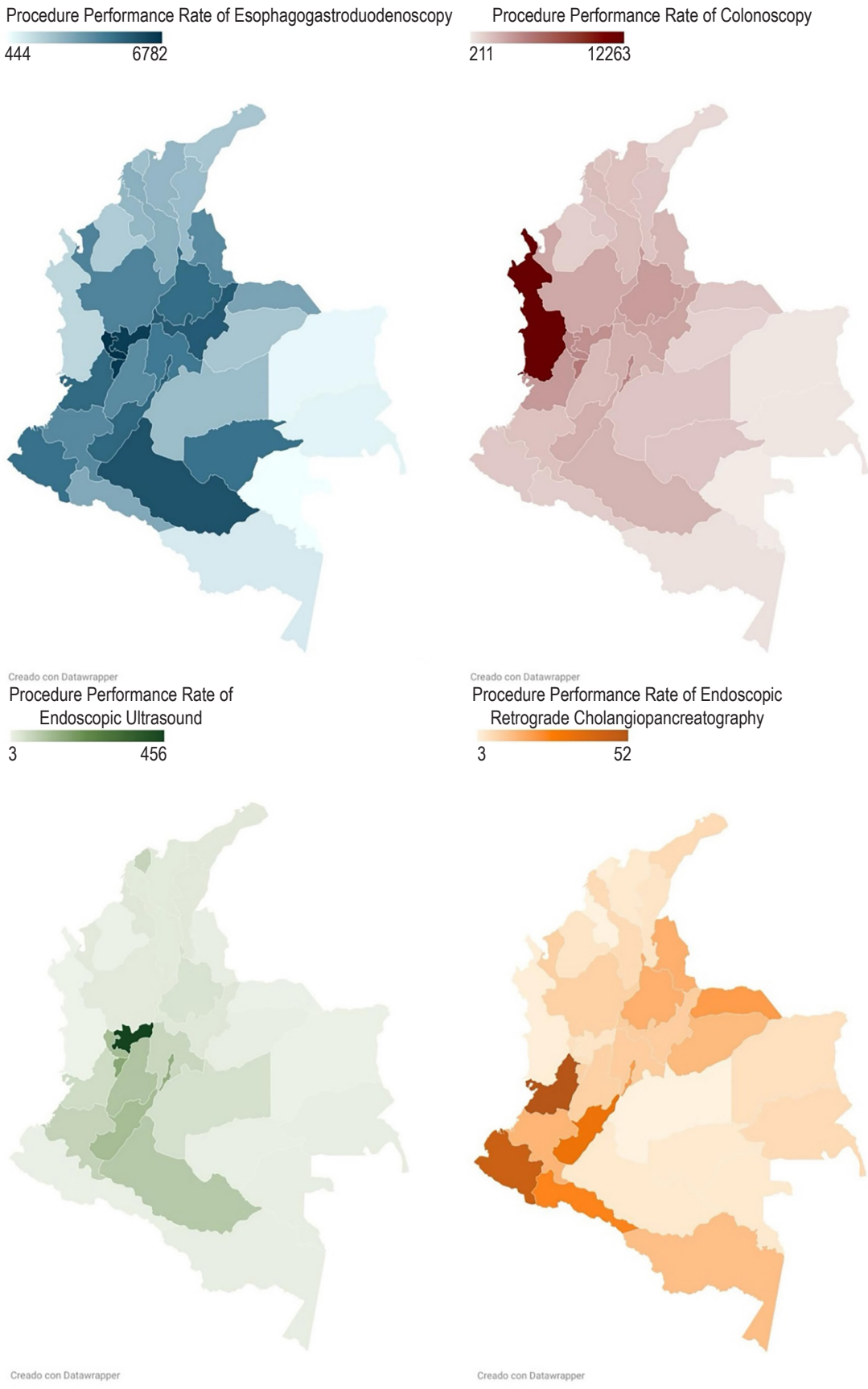

Figure 1. Procedure performance rate according to geographic distribution*. *Rates adjusted by department per 100,000 inhabitants. Images property of the authors.

formance rate was evidenced in the Coffee Axis, and especially in Caldas (456 procedures per 100,000 inhabitants), followed by Quindío (164 procedures), which is higher than that found in areas like Bogotá, Valle del Cauca, and Antioquia. Finally, for ERCP, the highest rate was in Valle del Cauca, Nariño, and Huila, with rates exceeding 30 procedures per 100,000 inhabitants.

Table 1 shows the procedure rate ratio of Colombian departments compared to the city of Bogotá. For UGIE, a higher rate ratio was noted in the Coffee Axis (Risaralda, Quindío, and Caldas), Boyacá, and Caquetá. For colonoscopy, the rate was especially higher in Chocó (2.91; confidence interval [CI]: 2.88-2.93). For EUS, the performance rate ratio was higher in Caldas (3.07; CI: 2.96-3.18). Finally, the departments of Valle del Cauca (2.53; CI: 2.37-2.7) and Nariño (2.17; CI: 1.99-2.37) had the highest ERCP performance rate ratio, all with a statistically significant difference compared to Bogotá (p <0.0001).

Figure 2 presents the procedure performance rate by five-year age groups and sex. It is generally evident that the performance rate for all procedures increases with age and is highest in patients over 60 years old. Additionally, it was found that the performance rate in women was higher, with a procedure rate ratio for UGIE of 1.66 (CI: 1.65-1.66), for colonoscopy of 1.61 (CI: 1.61-1.62), for EUS of 1.65 (CI: 1.61-1.69), and for ERCP of 1.52 (CI: 1.45-1.59). All differences were statistically significant (p <0.0001).

When comparing the procedure rate ratio according to the type of health system membership, it was found that fewer procedures are performed in patients belonging to the subsidized regime compared to the contributory regime. For UGIE, the rate ratio was 0.81 (CI: 0.80-0.81), for colonoscopy 0.68 (CI: 0.67-0.68), for EUS 0.50 (CI: 0.49-0.51), and for ERCP 0.85 (CI: 0.82-0.89), all with a statistically significant difference (p <0.0001).

DISCUSSION

This study evaluates the performance rates of gastroenterology procedures and the differences according to geographic location, insurance regimen, age, and sex. Our results show that there are regional differences in procedure performance rates, which are higher in the Coffee Axis, southwestern Colombia, and Bogotá, and lower in the Caribbean

Table 1. Procedure Rate Ratio by Department, Compared to Bogotá*

Department	UGIE	Colonoscopy	EUS	ERCP
Bogotá	1	1	1	1
Antioquia	0.78 (0.77-0.78)	0.66 (0.65-0.67)	0.12 (0.11-0.13)	0.48 (0.44-0.53)
Valle	0.94 (0.93-0.94)	0.81 (0.81-0.82)	0.33 (0.31-0.34)	**2.53 (2.37-2.70)**
Caldas	**1.20 (1.19-1.21)**	0.90 (0.89-0.91)	**3.07 (2.96-3.18)**	0.26 (0.20-0.35)
Nariño	0.89 (0.88-0.90)	0.37 (0.36-0.37)	0.06 (0.05-0.07)	**2.17 (1.99-2.37)**
Chocó	0.30 (0.29-0.30)	**2.91 (2.88-2.93)**	0.02 (0.01-0.03)	0.19 (0.11-0.29)
Putumayo	0.56 (0.55-0.57)	0.32 (0.31-0.33)	0.06 (0.04-0.09)	**1.27 (1.01-1.57)**
Caquetá	**1.07 (1.06-1.09)**	0.55 (0.54-0.56)	0.62 (0.55-0.68)	0.26 (0.16-0.40)
Quindío	**1.23 (1.22-1.24)**	**1.17 (1.15-1.18)**	**1.10 (1.03-1.18)**	0.48 (0.36-0.63)
Huila	0.95 (0.94-0.96)	0.61 (0.60-0.62)	0.78 (0.74-0.83)	**1.63 (1.44-1.82)**
Risaralda	**1.27 (1.26-1.29)**	0.98 (0.97-0.99)	0.79 (0.74-0.84)	0.32 (0.24-0.41)
Boyacá	**1.02 (1.01-1.03)**	0.69 (0.69-0.70)	0.17 (0.15-0.19)	0.55 (0.46-0.65)
Santander	0.92 (0.91-0.92)	0.78 (0.78-0.79)	0.84 (0.74-0.94)	0.24 (0.22-0.26)
Atlántico	0.41 (0.42-0.43)	0.39 (0.38-0.39)	0.17 (0.13-0.21)	0.44 (0.41-0.46)

*All results are statistically significant (p <0.0001). UGIE: upper gastrointestinal endoscopy, ERCP: endoscopic retrograde cholangiopancreatography. EUS: endoscopic ultrasound. Table prepared by the authors.

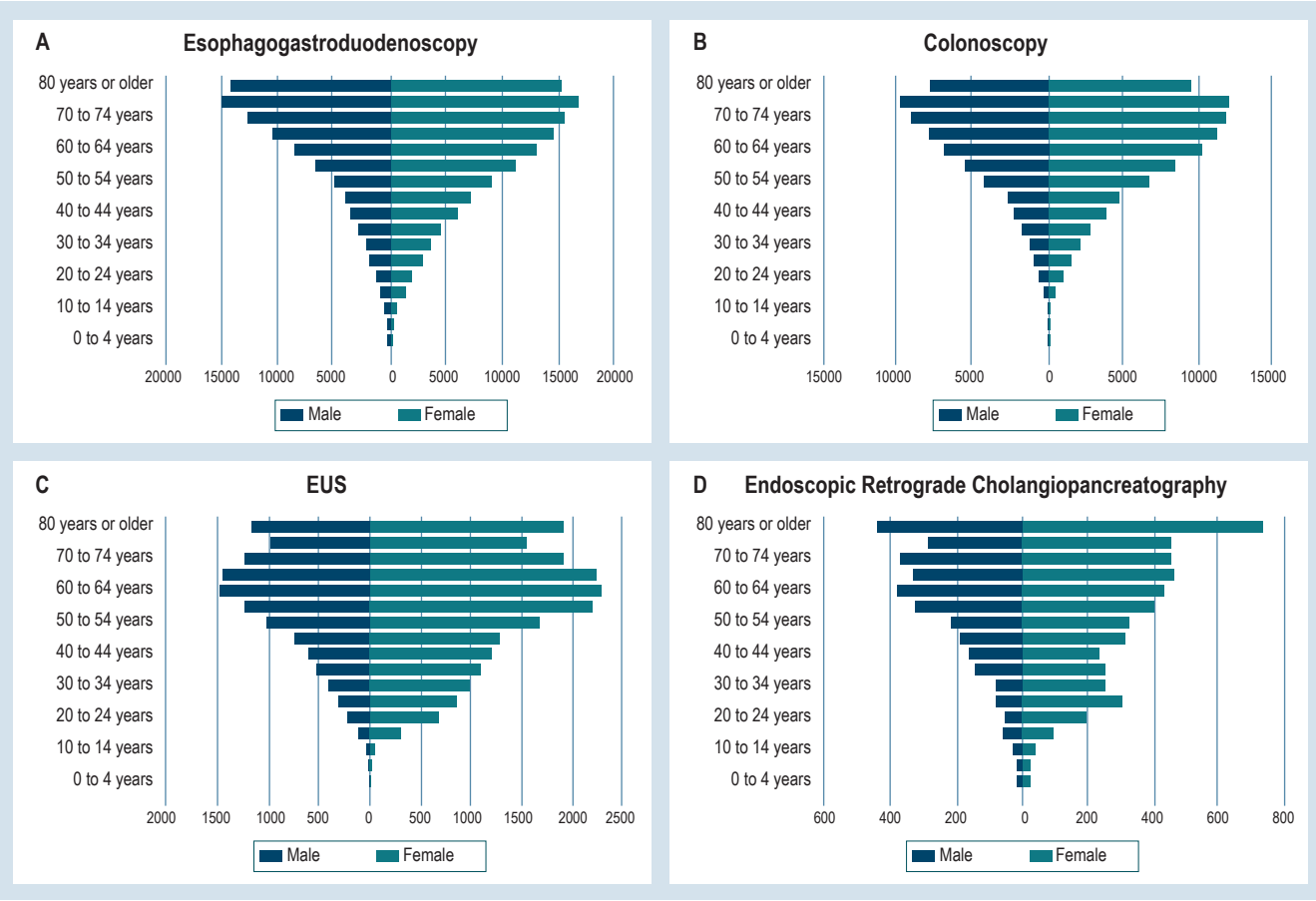

Figure 2. Procedure performance rates by age and sex, adjusted by department per 100,000 inhabitants. Images property of the authors.

coast, the south, and eastern Colombia, with specific differences for each type of procedure. It was also demonstrated that the procedure performance rate increases with age, is higher in women than in men, and that patients belonging to the contributory regime undergo more procedures than those belonging to the subsidized regime.

In our study, we found that a total of 3,397,816 diagnostic or therapeutic procedures were performed in Colombia over 7 years, with an annual average of 250,000 UGIE, 200,000 colonoscopies, 4,500 EUS, and 1,200 ERCP. The procedure with the highest annual performance rate was UGIE (518 per 100,000 inhabitants), a value much lower than that reported in the United States (5882 per 100,000 inhabitants)[13], but higher than that reported in Spain for 2014 (61.6 per 100,000 inhabitants)[14]. However, it is difficult to compare these results given the different methodologies used in each study. Similarly, it is difficult to compare rates with other Latin American countries due to the absence of data in the literature.

Regarding geographic distribution, we found a higher procedure performance rate in the Coffee Axis, southwestern Colombia, and Bogotá, an expected finding given the greater number of healthcare provider institutions capable of performing these procedures in these regions of the country. For colonoscopy, it was found that Chocó had a considerably higher performance rate compared to the rest of the country, 2.91 times higher than that reported in Bogotá. Analyzing the trend in the number of procedures performed per year, an increase is evident from 609 in 2021, to 12,770 in 2022, and up to 49,268 colonoscopies in 2023. Similar findings (but to a lesser extent) were found for UGIE and EUS in Guaviare and for ERCP in Putumayo. These results can be explained by potential voluntary or involuntary errors in the billing of the procedure or reporting to the health system, either due to reports of procedures not performed in that area or procedures that were referred and performed in other regions; considering that the mentioned departments have lower socioeconomic development and lack the installed

capacity and sufficient resources to perform such a volume of procedures. These findings should trigger audit and control mechanisms in the system to determine the causes and generate corrective measures if voluntary errors in billing the system are documented.

Regarding sex, it was found that, on average, 60% more procedures are performed in women, a finding that contrasts with reports by the Pan American Health Organization (PAHO), with data suggesting that women have clear barriers to accessing health services, which could decrease the procedure performance rate[15]. This finding can be explained by a higher frequency of functional gastrointestinal pathology[16], which becomes the indication for performing procedures. Additionally, it suggests that women have greater adherence to clinical and procedural follow-ups.

The higher performance rate of ERCP and EUS in those over 80 years of age is noteworthy, which may be due to a higher prevalence of neoplastic pathology involving the biliary tract in this age group and a higher frequency of comorbidities that may contraindicate surgical management of these pathologies[17]. In fact, Rodríguez et al. have reported that ERCP is a safe technique, with a low percentage of complications and effective in patients over 90 years old[18]. Additionally, an increase in the ERCP performance rate is evident in women between 25 and 29 years old, a finding consistent with the peak prevalence age for cholelithiasis and choledocholithiasis[19], conditions that increase the need to perform ERCP.

A lower procedure performance rate was also found in the subsidized regime, and the gap is greater for high-cost procedures like EUS (50% less compared to the contributory regime), a finding possibly associated with the fact that health institutions providing care to patients in this regime do not have the availability of such procedures, or due to barriers to healthcare access in that regime. These findings are similar to those found by Mora-Moreo et al.[8] in their systematic literature review, which demonstrated that the use of health services differed by regime, and found lower demand, access, and provision of health services in the subsidized regime.

Among the limitations of this study is, first, the potential bias associated with recording errors in the SISPRO platform, which, being for public use, can lead to errors in data entry resulting in underreporting. However, this bias is mitigated by the verification mechanisms implemented for the system. Audit and control mechanisms should be strengthened to limit the number of voluntary or involuntary errors in the system. A second limitation is the lack of detail in the data, which, for example, makes it difficult to identify in which region a procedure was billed and in which region it was ultimately performed. Third, our study shows the procedure performance rate and allows for generating hypotheses about potential barriers to system access, but it does not allow for specifically characterizing the reasons or the importance of each of them. Complementary studies should delve deeper into these findings to generate specific actions that mitigate the described differences in access to procedures.

Fourth, our study did not include procedures performed privately and, therefore, not reported to the SISPRO system. However, we believe the impact of this potential bias is low, as demonstrated in previous studies estimating that out-of-pocket health expenditure of the Colombian population is less than 10%[20] and, therefore, high-cost procedures are not typically performed privately. Fifth, it must be considered that the COVID-19 pandemic may have caused a transient reduction in the frequency of procedure performance during 2020 and 2021 due to health restrictions and the suspension of elective procedures in many regions of the country. This phenomenon could explain part of the observed interannual variability and must be considered when interpreting the results. Finally, this is an exploratory study based on administrative records and, as such, does not allow for the direct identification of the specific causes of access barriers. However, the patterns found allow for generating hypotheses about potential structural inequalities that should be investigated through qualitative or longitudinal studies.

CONCLUSIONS

Our study is the first to describe, at a national level, the performance rate of gastroenterology procedures and shows significant regional differences. Additionally, it demonstrated that the procedure performance rate increases with age, is higher in women, and in patients belonging to the contributory regime, findings consistent with previous studies showing barriers to healthcare access in certain areas of Colombia and differential access according to the type of membership. This is a call to action to establish public health policies that minimize these gaps. More studies are needed to identify the barriers to access and the impact of each of them.

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