

Research Article

Direct Cost Analysis of Diagnostic Digestive Endoscopy Based on Indications and Results in Yaoundé: Policy Implications for Universal Health Coverage in Cameroon

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Abstract

In low-income countries, the cost of digestive endoscopy procedures is often unknown, yet its understanding is crucial for including them in the universal health coverage benefit package. The management of digestive endoscopy requires substantial financial contribution from patients, especially in Cameroon where more than 70% of health expenditures are incurred by households. This study assessed the direct costs of diagnostic digestive endoscopy, based on indications and patient outcomes in Yaoundé Cameroon. A retrospective cross-sectional study was conducted, over a period of twelve months in the digestive endoscopy units of two referral health facilities (one private and one public). The sampling exhaustively included the reports of gastroscopies and diagnostic colonoscopies. Direct costs were estimated from expenditures for examination, anaesthesia, biopsy, colonic preparation in the patient's perspective in relation to clinical indications, endoscopies (type of anaesthesia, type of endoscopy, biopsy, results) of gastroscopies and colonoscopies performed. The average total cost was estimated by dividing the overall total cost by the number of patients. The costs were expressed in Central Africa Francs XAF, and US Dollars (\$1= 554.24 XAF). Statistical analyses used the non-parametric Mann-Whitney test. Differences at the 5% threshold were considered significant. A total of 1,147 reports met our selection criteria: 754 gastroscopies and 393 diagnostic colonoscopies with an average patient age of 45 years. In gastroscopy, 46.8% were men and 53.2% were women, while in colonoscopy, there were 58.3% men and 41.7% women. The average direct cost of gastroscopy was estimated at 46,981 XAF (\$84.77) per patient; while the cost of colonoscopy was 117,692 XAF (\$212.35) per patient. The main indications that influenced the overall direct cost of gastroscopy were: pyrosis with 42,000 XAF (\$75.7) and melena with 45,000 XAF (\$81). The endoscopic findings responsible for a fluctuation in this cost were mainly: bulbar ulcer and absence of lesions, each with 60,000 XAF (\$108.11). The overall direct cost of colonoscopy was influenced by indications such as: rectorrragies with 109,000 XAF (\$196.4) and abdominal pain with 108,200 XAF (\$194.96); as well as by certain results such as: absence of lesions with 108,000 XAF (\$194.59) and colonic polyps with 142,000 XAF (\$255.86). The study concludes that digestive endoscopy was likely expensive in the study setting. Often some inappropriate indications were posed, such as pyrosis and abdominal pain, thereby contributing to increase the cost of digestive endoscopy. This makes digestive endoscopy financially inaccessible to less well-off patients. The policy implications lies in providing evidence for subsidising the costs of digestive endoscopy as part of universal health coverage

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benefit package in Cameroon.

Keywords

Direct Cost, Diagnostic Digestive Endoscopy, Gastroscopy, Colonoscopy, Indications, Policy Implications, Universal Health Coverage, Cameroon

1. Introduction

The Diagnostic Digestive Endoscopy constitutes an important clinical public health problems worldwide. The diagnostic digestive endoscopy plays a crucial role in providing a comprehensive understanding of endoscopic indications and findings in Africa by highlighting their pooled prevalence, explores regional variation across the continent, trend over time and compares the burden and patterns of these indications and findings with global data [1]. The determination of the effective appropriate management of Diagnostic Digestive Endoscopy Based on Indications and Results has been advanced as a means to help rationalize the use of endoscopic resources in many countries where a direct cost of diagnostic digestive endoscopy would focus on the costs directly associated with the procedure itself, excluding indirect costs like staffing or facility upkeep [2]. The costing would likely be based on a review of current cost data for various endoscopic procedures (e.g., upper endoscopy, colonoscopy) thereby examining the costs of specific indications for endoscopy, such as screening for colorectal cancer or evaluating upper gastrointestinal symptoms [3].

The inaccessibility of digestive endoscopy care and services due to catastrophic expenditures linked to the increase in medical care has led policy makers to seek to understand the factors that contribute to the increase in care costs in low-income countries. Thus, the affordability of the cost of digestive endoscopy care and services becomes a critical health policy issue in a resource-limited text [4] such as in Cameroon, where approximately 39.9% of the population live below the poverty line, set at 738 XAF/day [5] while approximately 71% of total current expenditure is made by households through direct payments [6]. This results in a deterioration of health indicators largely due to the financial inaccessibility of health services and care and yet the goal of universal health coverage is to ensure that all individuals have access to the health services they need without causing users financial difficulties in terms of catastrophic expenditure. The factors that must be combined to avoid catastrophic expenditure are affordable care (a system - or a set of systems - for financing health services that prevent users from encountering financial difficulties when they use them) as well as access to essential medicines and technologies to diagnose and treat medical problems. In countries where the universal health coverage system is in the initial phase, such as Cameroon, the financial cost of examinations such as digestive

endoscopy is mainly borne by the patient [7]. A reference guide for indications and results of gastroscopy and colonoscopy was established by international experts and used in our work [8, 9]. However, no study provides cost analysis evidence for this strategy in Cameroon. Therefore, the costs of the current guidelines of Diagnostic Digestive Endoscopy Based on Indications and Results are largely unknown. The goal of this study was to assess the direct cost of diagnostic digestive endoscopy based on indications and results in Yaoundé In order to highlight the impact of video endoscopy on the health economy in Cameroon, given the scarcity of cost evaluations from the patient's perspective in the international literature.

2. Methods

2.1. Type, Location and Duration of Study

A descriptive retrospective cross-sectional study was conducted. The study took place in the digestive endoscopy units of two health facilities: the Cathedral Medical Center (private) and the Yaoundé General Hospital (public) over a period of 12 months from January to December 2018. The Yaoundé General Hospital is a public tertiary care health facility in the health pyramid in Cameroon with a capacity of 302 beds. It has an internal medicine department including a hepato-gastroenterology service with a capacity of which is a service specialized in the management of diseases of the digestive system. Its care offer includes among others - Diagnostic digestive endoscopies: upper digestive endoscopies, colonoscopies, rectoscopy, anoscopy; -Therapeutic digestive endoscopy: biopsies, endoscopic hemostasis by injection of sclerosing products, polypectomy, placement of gastrostomy tubes, ligation of esophageal varices, hemorrhoidal ligation; -Sedation in endoscopies, etc. The technical platform includes: a waiting room with 20 places, 2 consultation boxes, a day hospitalization room with a capacity of 2 beds, two hospitalization rooms with a capacity of 10 beds, a standard endoscopy room, a proctology and emergency endoscopy room, an endoscope disinfection room, an Olympus endoscopy column equipped with 2 adult gastroscopes and 1 adult colonoscope, a Fujinon endoscopy column equipped with an adult colonoscope, an electric scalpel, proctology equipment (light source,

anoscope, rectoscope), two 24-hour esophageal pH-metry devices, an esophageal manometry device and an ano-rectal manometry device. The digestive endoscopy unit has 4 gastroenterologists. The Cathedral Medical Center is a private health facility offering multidisciplinary services including a digestive endoscopy unit with 3 gastroenterologists for a reasonable number of beds.

2.2. Study Population and Sampling

The population source consisted of patient reports who underwent digestive endoscopies in the two health facilities selected for the study. The target population consisted of patient reports who underwent esogastroduodenal endoscopy or upper endoscopy (EGD) or colonoscopy in the digestive endoscopy units of the Cathedral Medical Center and the Yaoundé General Hospital. All patient reports, regardless of gender, who underwent EGD or colonoscopy for diagnostic purposes were included, while incomplete and unusable reports were excluded from the study. We conducted exhaustive sampling, so that all patient reports of gastroscopies and colonoscopies for diagnostic purposes that met the selection criteria during the study period were recruited without distinction of sex, age, and race.

2.3. Dependent and Independent Variables of the Study

The dependent variables were: *direct cost of esogastroduodenal endoscopy or upper endoscopy (EGD)* and *direct cost of colonoscopy*. The independent variables were: *economic* (cost of the examination, cost of possible anesthesia, cost of possible biopsy, cost of colonic preparation); *sociodemographic* (age, sex, gender); *clinical* according to the indications of the examination in relation to those of the European Panel on the Appropriateness in Gastroenterology Endoscopy (EPAGE II) according to the type of endoscopy (EGD: epigastralgia, dyspepsia, pyrosis, dysphagia, odynophagia, hematemesis, melena, weight loss, chest pain, screening for precancerous lesions, etc. and *Colonoscopy*: rectal bleeding, melena, chronic diarrhea, abdominal pain, abdominal mass, iron deficiency anemia, chronic constipation, etc.); *endoscopic* according to the elements inherent in the performance of the act and the results objectified during the examination of each patient (type of endoscopy: EGD, total colonoscopy, left colonoscopy, rectosigmoidoscopy; type of anesthesia; biopsy; products used for colonic preparation for colonoscopy; *endoscopy results* retained by the Minimal Standard Terminology - MST 3.0 (Esogastroduodenal endoscopy and colonoscopy).

2.4. Costing Approach and Analysis

We conducted a non-comparative analysis of the direct costs of esogastroduodenal endoscopy or upper endoscopy

(EGD) and colonoscopy. In this analysis, we used the bottom-up approach to calculate the costs of EGD and colonoscopy. The cost analysis perspective was performed from the patient's perspective. The direct cost of endoscopy was calculated using the following two equations:

1. Direct cost of EGD = costs of examinations + costs of biopsy + costs of possible sedation;
2. Direct cost of colonoscopy = examination costs + colon preparation costs + possible biopsy costs + possible sedation costs.

In this analysis, an average cost per patient was estimated by dividing the total cost of all patients by the number of patients. Unit of measurement: Central African Francs (XAF) and US dollars (\$1 = 554.24 XAF average fixed exchange rate in August 2020).

2.5. Statistical Analyses

Data were entered using CSDPro version 7.0 software. These data were analyzed by descriptive and analytical statistical methods using IBM SPSS 21.0 and Microsoft Excel 2016 software. Quantitative variables were presented as mean, median, and interquartile ranges. Qualitative variables were presented as counts and frequencies. The Student's "T" test and analysis of variance (ANOVA) were used to compare means, and the nonparametric Mann-Whitney test was used to compare medians. Since our dependent variables were quantitative, linear regressions were used to determine the factors (indications and outcomes) associated with a high direct cost of diagnostic digestive endoscopy. The alpha risk was set at the 5% threshold, so a p-value ≤ 0.05 was considered statistically significant.

2.6. Ethical Considerations

This study received the ethical clearance from the Ethics Committee of the Faculty of Medicine and Biomedical Sciences of the University of Yaoundé I. Administrative authorization was obtained from the management of the Cathedral Medical Center and the Yaoundé General Hospital. Data collected were coded and stored with strict respect for patient confidentiality and privacy.

3. Results and Discussion

3.1. Results of the Analysis

3.1.1. Sociodemographic Characteristics of the Study Participants

One thousand two hundred and fifty-seven examinations were analyzed. One hundred and ten examinations could not be included in the final analysis for the following criteria: control examination (n = 57); absence of indications (n = 36); absence of results (n = 17). One thousand one hundred and

fifty-seven endoscopies were retained (92%), i.e. 754 gastroscopies and 393 diagnostic colonoscopies. In gastroscopy, 353 (46.8%) concerned men and 401 (53.2%) women. The median age was 45 ± 17 years. While in colonoscopy, the

male gender was the most redundant with 229 (58.3%) versus 164 (41.7%) women for a mean age of 45.4 ± 17.6 years. The main characteristics of the patients are presented in [Table 1](#).

Table 1. Sociodemographic characteristics of endoscopy patients.

Variables	N (%)	
	Gastroscopies	Colonoscopies
Gender		
Men	353 (46.8)	229 (58.3)
Women	401 (53.2)	164 (41.7)
Age (years)		
< 20	47 (6.2)	24 (6)
20-39	287 (38.1)	116 (29.6)
40-59	257 (34.1)	140 (35.7)
60-79	149 (19.8)	109 (27.7)
>80	14 (1.9)	4 (1)

3.1.2. Indications for Gastroscopy

The most frequent indications for gastroscopy were epigastralgia (63.3%), hematemesis (9.3%) and pyrosis (7.2%)

([Figure 1](#)). While in colonoscopy we mainly found rectal bleeding (29.5%), followed by abdominal pain (19.5%) and chronic constipation (10.6%) ([Figure 2](#)).

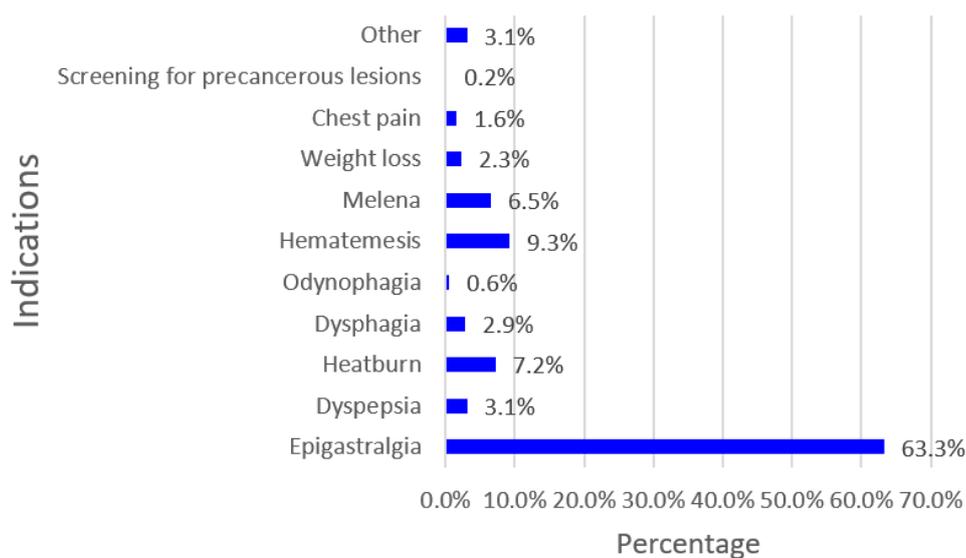


Figure 1. Indications found in gastroscopy.

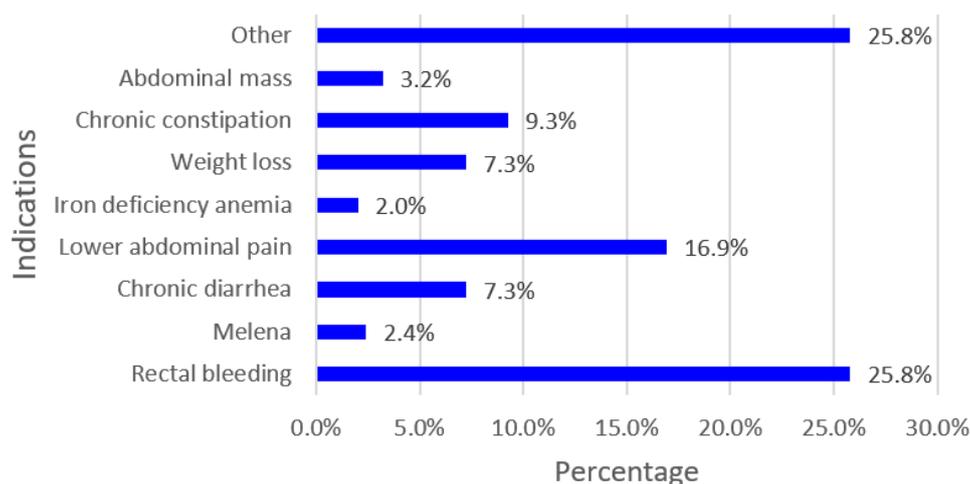


Figure 2. Indications found in colonoscopy.

3.1.3. Endoscopic Profile

Gastroscopy was the most requested endoscopic examination with 66% compared to 34% for colonoscopy (total colonoscopy 21%, left colonoscopy 9%, rectosigmoidoscopy 4%). The type of anesthesia used for gastroscopies was mainly local anesthesia with viscous xylocaine in 734 cases (97.3%) compared to only 20 cases (2.7%) under intravenous sedation. A biopsy was performed after 581 (77.1%) gastroscopies.

However, in colonoscopy, 229 (57.3%) patients had benefited from sedation to the detriment of 164 (41.7%) cases

without sedation. The majority of colonoscopies were performed without recourse to a biopsy, i.e. 298 (75.7%) of cases, 85 cases required a biopsy and 10 reports were without information. Colonic preparation was required in 178 cases based on the combination of Poly Ethylene Glycol and sodium dihydrogen phosphate (Table 2).

Upper digestive pathology was dominated by gastritis, mainly erythematous antritis (18.8%), followed by bulbar and antral ulcers (7.7% and 6.8%). Following colonoscopies, the absence of lesions was the most frequent result with 39.1%, followed by hemorrhoids 17.1% and colonic polyps 10.4% (Tables 3 and 4).

Table 2. Elements performed during endoscopy.

Variables	n (%)	
	Gastroscopies	Colonoscopies
Type of anesthesia		
Local anesthesia	734 (97.3)	---
Intravenous sedation	20 (2.7)	229 (57.3)
Without anesthesia	---	164 (41.7)
Biopsy		
Yes	581 (77.1)	85 (21.7)
No	173 (22.9)	298 (75.7)
Not specified	---	10 (2.6)
Colonic preparation		
Fortrans® + Normacol®	---	178 (45.2)
Normacol®	---	133 (33.9)
Fortrans®	---	48 (12.2)
Normacol® + X-prep®	---	20 (5.2)

Variables	n (%)	
	Gastroscopies	Colonoscopies
Senna (X-Prep®)	---	4 (0.9)

Table 3. Results found in gastroscopy.

Results	n (%)
Erythematous antritis	219 (18)
Erythematous pangastritis	161 (13.3)
Erythematous funditis	109 (9.0)
Bulbar ulcer	94 (7.7)
No lesions	85 (7.0)
Congestive pangastritis	84 (6.9)
Antral ulcer	82 (6.8)
Congestive heart failure	69 (5.7)
Congestive funditis	50 (4.1)
Esophageal varices	50 (4.1)
Esophageal mycoses	39 (3.2)
Peptic esophagitis	34 (2.8)
Other injuries	31 (2.5)
Endobrachyoesophagus	27 (2.2)
Fundal ulcer	19 (1.6)
Hiatal hernia	15 (1.2)
Malignant-appearing gastric tumor	14 (1.2)
Pyloric ulcer	13 (1.1)
Malignant-appearing esophageal tumor	12 (1.0)
Pyloric stenosis	7 (0.6)

Table 4. Results found in colonoscopy.

Results	n (%)
No lesions	158 (39.1)
Hemorrhoids	69 (17.1)
Colonic polyps	42 (10.4)
Diverticulosis	30 (7.4)
Malignant-appearing colorectal tumor	27 (6.7)
Colitis	24 (5.9)
Recites	23 (5.7)

Results	n (%)
Solitary colon ulcer	12 (3.0)
Other injuries	11 (2.7)
Anal fissures	4 (1.0)
Anal ulcer	4 (1.0)

3.1.4. Economic Profile: Evaluation of the Direct Overall Cost

The analysis shows that the average overall direct cost of diagnostic gastroscopy is approximately 46,981 XAF (\$84.77) without anesthesia. With anesthesia costs, this cost amounts to 105,028 XAF (\$189.50) with extremes of 110,000 XAF

(\$198.5) and 69,570 XAF (\$125.6), thus representing 55.3% of the cost (Table 5). The direct cost of diagnostic colonoscopy is estimated on average at 117,692 XAF (\$212.35) with extremes of 53,000 XAF (\$95.7) and 153,200 XAF (\$276.5). It is mainly made up of expenses incurred for anesthesia (48%) regardless of the type of colonoscopy (Table 6).

Table 5. Estimated average direct cost of diagnostic gastroscopy.

Variables	Average XAF (\$)	Percentage%	Minimum XAF (\$)	Maximum XAF (\$)
Lab Exam cost	42,263 (76.2)	40.2	37,000 (66.8)	45,000 (81.2)
Cost of possible sedation	58,047 (104.7)	55.3	29,000 (52.3)	60,000 (108.3)
Cost of possible biopsy	4,718 (8.5)	4.5	3,570 (6.4)	5,000 (9)
Cost of gastroscopy				
Without sedation	46,981 (84.7)	44.7	40,570 (73.2)	50,000 (90.2)
With sedation	105,028 (189.6)	100	69,570 (125.6)	110,000 (198.5)

Table 6. Estimated average direct cost of diagnostic colonoscopy.

Variables	Average XAF (\$)	Percentage%	Minimum XAF (\$)	Maximum XAF (\$)
Lab Exam cost	52,515 (94.8)	44.6	18,750 (33.8)	70,000 (126.3)
Cost of possible anesthesia	56,537 (102)	48.0	29,000 (52.3)	70,000 (126.3)
Cost of possible biopsy	4,471 (8)	3.8	3,750 (6.7)	5,000 (9)
Cost of colonic preparation	4,169 (7.5)	3.5	1,500 (2.7)	8,200 (14.8)
Cost of colonoscopy				
Without sedation	61,402 (110.8)	52	24,000 (43.3)	83,200 (150.2)
With sedation	117,692 (212.3)	100	53,000 (95.7)	153,200 (276.5)

3.1.5. Factors Influencing the Overall Direct Cost

(i). Indications' Factors Influencing the Direct Costs

In gastroscopy, pyrosis ($p < 0.01$); melena ($p < 0.03$) and

weight loss ($p < 0.01$) were the indications that influenced the overall direct cost (Figure 3). Among these three indications, pyrosis was the most expensive with a cost of 5,811,196 XAF (\$10,485), then melena with 5,297,780 XAF (\$9,558), and finally weight loss with 836,500 XAF (\$1,509). The costs of

pyrosis and melena are mainly made up of anesthesia costs, as indicated in Table 7 below.

In colonoscopy, the indications that significantly influenced the overall direct cost were: rectal bleeding ($p < 0.00$), melena ($p < 0.02$), chronic diarrhea ($p < 0.00$), abdominal pain ($p < 0.00$), iron deficiency anemia ($p < 0.02$) and presentation of an abdominal mass ($p < 0.02$) (Figure 4). With an estimated costs of 5,968,754 XAF (\$10,769), rectal bleeding is the most com-

mon and most expensive indication in colonoscopy. This is followed by abdominal pain with an estimated costs of 3,776,850 XAF (\$6,814), chronic diarrhea with the costs of 1,604,710 XAF (\$2,895), abdominal mass, melena and iron deficiency anemia with respectively a total cost of 641,757 (\$1,158), 520,200 (\$939) and 438,100 XAF (\$790.8). In the majority of these indications, the cost is mainly made up of anesthesia costs as shown in Table 8 below.

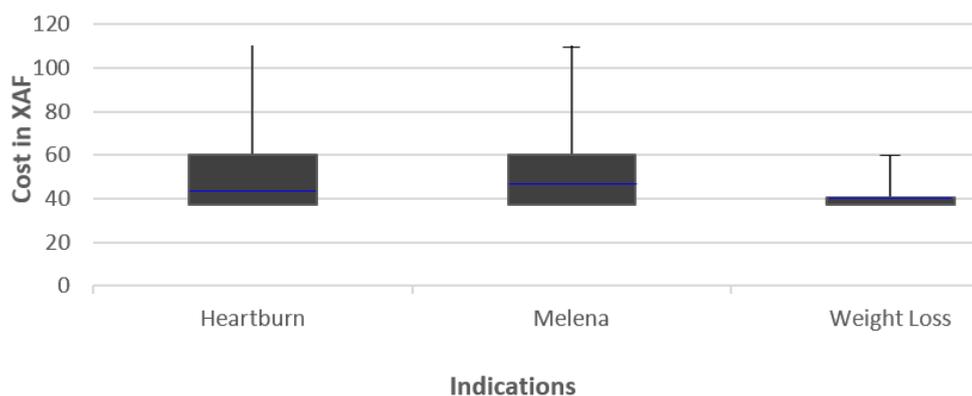


Figure 3. Diagram of indications influencing the cost of diagnostic gastroscopy.

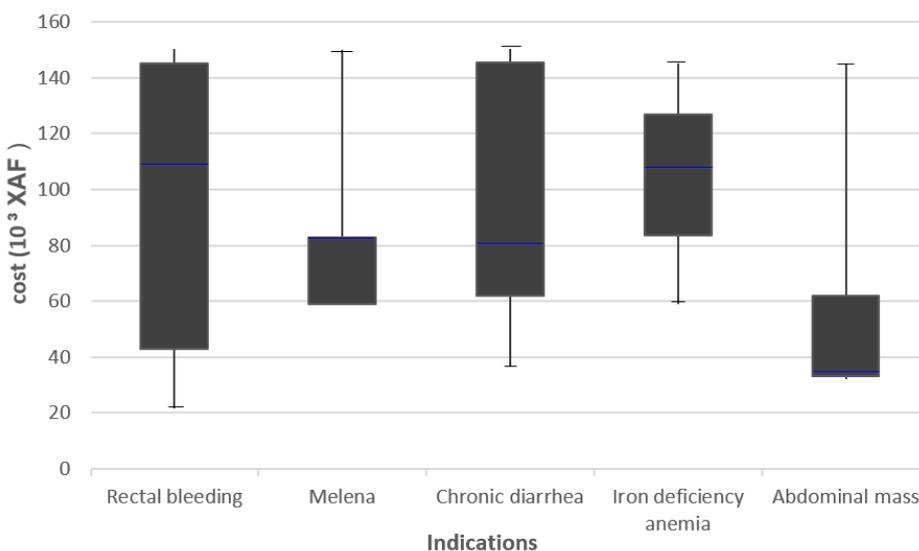


Figure 4. Diagram of indications significantly influencing the cost of colonoscopy.

Table 7. Estimated total costs of gastroscopy according to significant indications.

Indications	Lab Exam cost XAF (\$)	Cost of sedation XAF (\$)	Biopsy cost XAF (\$)	Overall cost of gastroscopy XAF (\$)
Heartburn	2,579,031 (4,655)	3,030,943 (5,471)	201,222 (363.2)	5,811,196 (10,485)
Melena	2,388,984 (4,312)	2,704,280 (4,881)	204,516 (369)	5,297,780 (9,558)
Weight loss	764,000 (1,379)	---	72,500 (130.8)	836,000 (1,509)

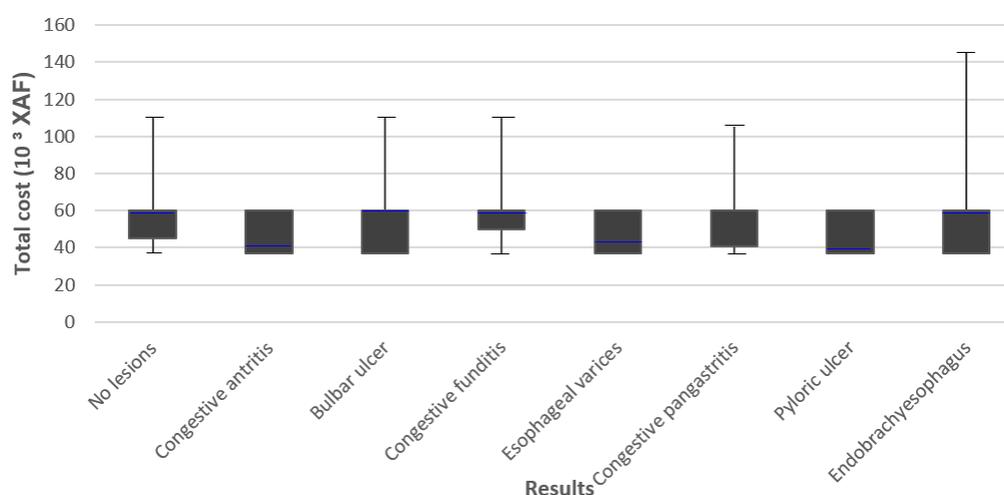
Table 8. Estimated costs of colonoscopy based on significant indications.

Indications	Lab Exam cost XAF (\$)	Cost of anesthesia XAF (\$)	Biopsy cost XAF (\$)	Cost of colonic preparation XAF (\$)
Rectorrhagia	2,828,504 (5,105.6)	2,713,176 (4,897.4)	206,488 (372.7)	220,586 (398.2)
Melena	242,000 (436.8)	241,000 (435)	20,000 (36.1)	17,200 (31)
Chronic diarrhea	820,005 (1,480.1)	669,400 (1,208.3)	47,505 (85.7)	67,800 (122.4)
Lower abdominal pain	1,763,510 (3,183.2)	1,749,300 (3,157.6)	133,735 (241.4)	130,305 (235.2)
Iron deficiency anemia	238,000 (429.6)	187,500 (338.4)	---	12,600 (22.7)
Abdominal mass	276,003 (498.2)	312,400 (564)	31,752 (57.3)	21,602 (39)

(ii). Results' Factors Influencing the Direct Costs

The absence of lesions following a gastroscopy would significantly influence its direct cost ($p < 0.01$). This is due to certain indications that had been posed, including the significant indications mentioned above, with mainly pyrosis at 58.8%, then melena 29.5% and finally weight loss at 11.7% (Table 9). In addition, the presence of the following lesions also influences the direct cost: congestive antritis ($p < 0.00$),

bulbar ulcer ($p < 0.02$), congestive funditis ($p < 0.01$), esophageal varices ($p < 0.02$), pyloric ulcer ($p < 0.02$), endobrachyoesophagus ($p < 0.00$) (Figure 5). With a total cost of 8,763,548 XAF (\$15,811), bulbar ulcer is the most expensive outcome, followed by the absence of lesion, the cost of which is estimated at 8,285,634 XAF (\$14,949). The costs of these outcomes are mainly represented by the costs related to the examination and sedation (Table 10).

**Figure 5.** Diagram of results significantly influencing the cost of gastroscopy.**Table 9.** Estimated costs of gastroscopy according to significant results.

Results	Lab Exam cost XAF (\$)	Cost of sedation XAF (\$)	Biopsy cost XAF (\$)	Overall cost of gastroscopy XAF (\$)
No lesions	3,673,020 (6,630)	4,275,079 (7,716)	337,535 (609)	8,285,634 (14,956)
Congestive heart failure	2,824,998 (5,099)	---	228,735 (412)	3,053,733 (5,512)
Bulbar ulcer	3,910,024 (7,057)	4,553,570 (8,219)	299,954 (541)	8,763,548 (15,818)
Congestive funditis	2,194,000 (3,960)	2,383,000 (4,301)	212,500 (383)	4,789,500 (8,645)

Results	Lab Exam cost XAF (\$)	Cost of sedation XAF (\$)	Biopsy cost XAF (\$)	Overall cost of gastroscopy XAF (\$)
Esophageal varices	2,026,000 (3,657)	---	240,000 (433)	2,266,000 (4,090)
Congestive pangastritis	3,468,024 (6,260)	4,026,938 (7,268)	292,488 (528)	7,787,450 (14,056)
Pyloric ulcer	513,006 (926)	---	51,753 (93)	564,759 (1,019)
Endobrachyoesophagus	1,125,000 (2,030)	---	125,000 (225)	1,250,000 (2,256)

The different endoscopic findings that have a statistically significant influence on the cost of diagnostic colonoscopy are: absence of lesion ($p<0.00$), colonic polyps ($p<0.00$), diverticulosis ($p<0.00$), and colonic ulcer ($p<0.02$) (Figure 6). The absence of lesion following colonoscopies is the most ex-

pensive significant outcome with an overall cost of 4,365,330 XAF (\$7,876), followed by colonic polyps with 1,173,977 XAF (\$2,118). In the majority of these results, the cost of the examination is at the forefront (Table 10).

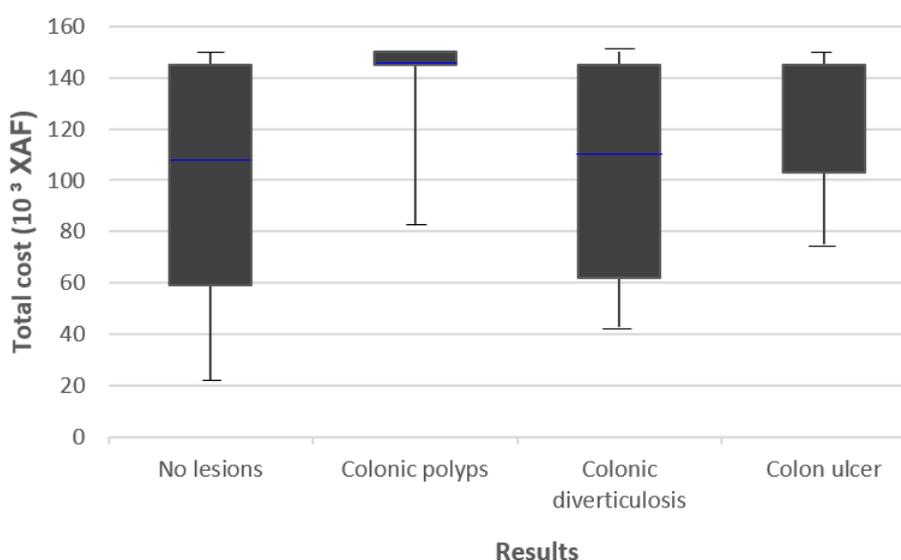


Figure 6. Diagram of results significantly influencing the cost of colonoscopy.

Table 10. Estimated total cost of colonoscopy based on significant results.

Results	Lab Exam cost XAF (\$)	Cost of anesthesia XAF (\$)	Biopsy cost XAF (\$)	Cost of colonic preparation XAF (\$)	Cost of colonoscopy XAF (\$)
No lesions	2,454,744 (4,431)	1,561,860 (2,819)	158,010 (285)	190,716 (344)	4,365,330 (7,879)
Colonic polyps	576,000 (1,039)	526,580 (950)	28,998 (52)	42,399 (76)	1,173,977 (2,119)
Diverticulosis	543,996 (932)	339,148 (612)	35,496 (64)	33,399 (60)	952,039 (1,718)
Colonic ulcer	310,000 (559)	249,900 (449)	20,000 (36)	23,800 (43)	603,700 (1,089)

3.2. Discussion

In this study including 754 gastroscopies and 393 diagnos-

tic colonoscopies, the sociodemographic characteristics were identical to those revealed by some authors [10, 11]. The indications and results referenced by the EPAGE and recorded in our survey were superimposable with the data reported in

studies [12-17]. However, there is a preponderance of normal-appearing mucous membranes following colonoscopies at 39.1% and with the main indications being abdominal pain and rectal bleeding.

Regarding the overall direct cost of diagnostic gastroscopy found in our series, it is estimated on average at 46,981 XAF per patient, or \$84.77. However, in the case of sedation, this cost rises to 105,025 XAF (\$189.5). This cost is higher than the minimum wage which is 36,270 XAF (\$65.47). These results tend to corroborate with the international literature on cost-effectiveness studies in endoscopy [18] and upper gastrointestinal endoscopy according to the appropriateness of the indication [19, 20]. Indeed, sedation was performed in only 2.7% of gastroscopies, which is insufficient compared to the recommendations in the literature, which advocates performing the procedure under intravenous sedation for better tolerance of the examination [17, 21].

As for the average direct overall cost of colonoscopy, it is approximately 117,692 XAF (\$212.35) per patient. Without anesthesia, it drops to 61,155 XAF (\$110.34). This result suggests that a patient spends approximately three times the minimum wage to benefit from a diagnostic colonoscopy. This amount could be explained by the fact that it is mainly made up of the costs of anesthesia, which are more expensive than those of the procedure, but it is more related to the cost of total colonoscopy (134,681 XAF), which is the most performed and most expensive type of colonoscopy in our series.

Speaking of factors that influence the cost of gastroscopy. The statistically significant indications are: heartburn, melena and weight loss. This influence can be explained by the lack of awareness of the prescription of the examination in the face of these symptoms. Indeed, the symptoms of typical gastroesophageal reflux are inappropriate indications for gastroscopy in young subjects under 50 years old, who do not present alarm signs [8]. As for melena, we would note in our practice, an incomplete investigation during the anamnesis without looking for a notion of consumption of iron, charcoal, beetroot, cabbage or spinach. As well as the absence of systematic rectal examination to verify the nature of the bleeding. These results are in line with those of previous studies on the same topic [22].

In terms of endoscopic results, the direct cost of gastroscopy is mainly influenced by: the absence of lesions due to inappropriate indications; gastritis and gastroduodenal ulcers which could be linked to the costs inherent in biopsies performed for the systematic search for *Helicobacter pylori* infection; as well as by esophageal varices which are lesions of portal hypertension, secondary to cirrhosis linked to the endemicity of viral hepatitis B, more so in a population with high alcohol consumption such as ours. These results are in line with those reported by the international literature [1, 2].

In this series, the overall direct cost of colonoscopy is influenced primarily by rectal bleeding, followed by abdominal pain and chronic diarrhea. Our results could be explained by the high frequency for some; or by the systematic prescription

of a colonoscopy in the presence of rectal bleeding in subjects aged at least 50 years as recommended by EPAGE [17] in addition, by the low yield of abdominal pain which had been demonstrated by Ankouane *et al.* (2013). probably reflects the inappropriate prescription of this examination [15] Regarding the endoscopic findings that influence the overall cost of colonoscopy, our study revealed that the absence of lesions was the main one. Abdominal pain and rectal bleeding were among the predominant indications responsible for normal examinations. Indeed, inappropriate prescriptions for these would explain this fluctuation in cost generated by the latter. These results corroborate with those of the international literature on the cost of an endoscopy management using an indication-based approach [3, 22].

4. Conclusion and Recommendations

4.1. Conclusion

The practice of digestive endoscopy for diagnostic purposes in our study has characteristics similar to those reported in the literature. Despite its importance for the gastroenterologist in the exploration of upper and lower digestive pathologies, it remains expensive, with a high cost compared to the minimum wage and sedation costs being at the forefront. Heartburn, melena, and abdominal pain are the main inappropriate indications that influence the direct cost of digestive endoscopy. Every year, thousands of Cameroonians fall into poverty for having paid out of pocket for digestive endoscopy services and care in the country's health facilities, and around a few thousand of them are exposed to financial disaster for the same reason. The policy implications from these findings are that subsidizing the cost of digestive endoscopy could make it affordable for many people, households and patients in resource-constraints settings of Cameroon's health system.

4.2. Recommendations

The key recommendations that can be made based on the study's findings are concerned with the inclusion of the management of digestive endoscopy in the benefit package of the universal health coverage system. Indeed, the protection against financial risk is at the heart of universal health coverage. It is also the central objective of the health financing policy to ensure access to basic health services for all, regardless of their socioeconomic conditions. It is with this in mind that the Cameroonian government has initiated a process aimed at ultimately providing the country with a universal health coverage system whose objective is to guarantee the entire population equitable access to quality health care and services, without financial hardship.

Abbreviations

EGD	Esogastroduodenal Endoscopy or Upper Endoscopy
EPAGE	European Panel on the Appropriateness in Gastroenterology Endoscopy
FMBS	Faculty of Medicine and Biomedical Sciences
HEREG	Health Economics & Policy Research and Evaluation for Development Results Group
MST	Minimal Standard Terminology
XAF	Franc of Central African Country Community

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Conflicts of Interest

The authors declare no conflicts of interest.

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