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Clinical Characteristics and Regional Distribution of Inflammatory Bowel Disease Across Egyptian Specialist Centers: A Multicenter Registry-Based Study

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Abstract

Background and Objectives: Contemporary multicenter data on inflammatory bowel disease (IBD) in Egypt remain limited, and variation across the country's geographic regions is poorly characterized. We aimed to describe the clinical characteristics, Montreal phenotype, and regional distribution of IBD across Egyptian specialist centers. **Methods:** This retrospective cross-sectional analysis used the IBDIS.net multicenter registry and included patients with Crohn's disease (CD), ulcerative colitis (UC), or IBD unclassified (IBDU) enrolled at nine registry units in four geographic regions between January 2017 and January 2023. **Results:** Of 957 patients, 542 (56.6%) had CD, 395 (41.3%) UC, and 20 (2.1%) IBDU (CD:UC ratio 1.37:1). Subtype distribution differed by region ($p < 0.001$): CD predominated in North Egypt (75.6%), whereas UC predominated in Upper Egypt (68.5%), Greater Cairo (68.3%), and the Delta (86.1%). Excluding North Egypt (one IBD service), distribution did not differ among the remaining regions ($p = 0.143$). Ileocolonic location (L3, 59.8%) and inflammatory behavior (B1, 87.1%) predominated in CD, and left-sided colitis (E2, 43.2%) and moderate severity (S2, 53.5%) in UC. **Conclusions:** Within this registry, regional variation reflected CD concentration at the single North Egypt IBD service; UC predominated elsewhere. These data describe patients at participating centers, not population disease frequency.

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1. Introduction

Inflammatory bowel disease (IBD) is a chronic relapsing inflammatory disorder of the gastrointestinal tract that comprises two principal phenotypes, Crohn's disease (CD) and ulcerative colitis (UC). Its pathogenesis involves complex interactions among genetic susceptibility, immune dysregulation, environmental triggers, and gut microbial dysbiosis [1].

Epidemiological data on IBD are essential for understanding disease burden, guiding healthcare resource allocation, and informing public health strategy. IBD imposes a substantial burden on patients, caregivers, and healthcare systems through its effects on quality of life, workplace productivity, and healthcare expenditure; accurate and current data on disease distribution and clinical characteristics are therefore critical for service planning [2].

IBD has undergone a profound global epidemiological transition over the past three decades. Historically regarded as a disease of high-income Western nations, it is now recognized as an emerging global condition, with rising incidence documented in newly industrialized regions across South America, Eastern Europe, Asia, and Africa [3–5]. A consistent pattern has been observed in these regions: UC typically precedes CD by approximately one decade as industrialization progresses, a sequence attributed to environmental changes including dietary Westernization, altered microbial exposure, improved sanitation, and increased antibiotic use [6,7]. The countries currently reporting the highest incidence of UC include the United States, the United Kingdom, and Sweden [8,9], while Asian and Middle Eastern countries are experiencing rapidly rising rates of both CD and UC [4,5,10].

Age is a well-established determinant of IBD risk. IBD can affect any age group, but 60–85% of patients are adults, most of whom are diagnosed before the age of 40 years, and children and adolescents represent 7–20% of patients globally [11,12]. Sex differences in IBD incidence and phenotype are increasingly recognized and have clinical implications for individualized management [13,14].

Egypt is the most populous country in North Africa and the Arab world. Its geography, spanning the Mediterranean coastal north, the Nile Delta, Greater Cairo, and the more agrarian Upper Egypt, encompasses substantial socioeconomic, dietary, and urbanization gradients that may shape distinct regional IBD profiles. Published Egyptian data consist largely of single-center hospital series, in which UC accounted for the large majority of cases [15], and a nationwide retrospective multicenter study of 1104 patients from 14 centers, in which 81% of patients had UC and UC predominated in each region sampled [16]. However, variation in IBD subtype and phenotype across Egypt's geographic regions remains poorly characterized, and data collected through a standardized electronic registry have not previously been reported. Moreover, no population-based incidence or prevalence studies have been conducted in Egypt; available estimates for the country and the wider Middle East and North Africa region are modelled Global Burden of Disease data [5,17].

In this study, we present data from 957 patients with IBD enrolled at nine specialist gastroenterology units in Egypt using the standardized IBDIS.net electronic registry. We describe the phenotypic profile, regional distribution, and clinical characteristics of this cohort and compare our findings with regional and global data. Because the registry has

no population denominators, the study was designed to describe the distribution of cases across the participating centers, not to estimate disease frequency.

2. Materials and Methods

2.1. Study Design and Setting

This was a retrospective, cross-sectional analysis of a multicenter registry. Clinical data were prospectively entered into the IBDIS.net electronic registry platform at the participating centers and retrospectively analyzed. Nine registry units in four Egyptian geographic regions contributed patients: (1) North Egypt: Alexandria Faculty of Medicine and Prof Ezzat Aly GI Center (Alexandria), both led by the same consultant team; (2) Upper Egypt: Assiut Faculty of Medicine (Assiut); (3) Greater Cairo: Hossam Ghoneim Clinic and Police Hospital (Cairo), Helwan University (Helwan), and ROEYA Endoscopy Center (Giza); and (4) Delta: Tanta University Teaching Hospital (Gharbia) and Dar El Kabd, Zagazig (Al Sharqia). Patients were assigned to the geographic region in which their treating unit was located; region of residence was not reliably recorded in the registry. The number of patients and the IBD subtype distribution in each unit are provided in Supplementary Table S1.

2.2. Study Period

Data were collected from January 2017 to January 2023. Units registered patients with IBD seen in their IBD clinics, endoscopy units, or inpatient wards during the study period; enrollment was not consecutive, and not all eligible patients were registered.

2.3. Patient Population

Patients of any age with a confirmed diagnosis of CD, UC, or inflammatory bowel disease unclassified (IBDU) were included, regardless of whether the diagnosis was newly established during the study period or pre-existing. Diagnosis was based on a combination of clinical assessment, endoscopic findings, radiological evaluation (small bowel follow-through, barium enema, computed tomography colonography, or magnetic resonance enterography), and histopathological examination, in accordance with European Crohn's and Colitis Organisation (ECCO) diagnostic criteria. Patients with confirmed infectious colitis, ischemic colitis, or other non-IBD inflammatory conditions were excluded.

2.4. Data Collection

Data were extracted from the IBDIS.net registry and supplemented by medical records and, for patients with incomplete records, telephone contact. Variables collected included demographics (age, age at diagnosis, sex, treating unit, and urban or rural residence); anthropometric measurements (height and standard body weight, which IBDIS.net calculates from height); dates of symptom onset and diagnosis; disease subtype; Montreal classification of disease location and behavior (CD) and extent and severity (UC); extraintestinal manifestations; family history of IBD; smoking status; medication history (including non-steroidal anti-inflammatory drugs (NSAIDs), oral contraceptive pills, and conventional and biological therapy); surgical history; and comorbidities. Age group refers to age at enrolment.

Data were entered by gastroenterologists and their assistants at each unit, all of whom were trained on the IBDIS.net platform, using its uniform electronic case report form with predefined fields and coded categorical options. Patients with incomplete records were contacted by telephone to complete missing items, including smoking status, family history, and medication exposure. Exposure to selective (COX-2 inhibitor) and non-selective NSAIDs was recorded in dedicated registry fields with three categories:

never used, used without relapse, and relapse after use. Because exposure and relapse were ascertained by patient report and record review without a standardized exposure window, this variable describes a reported temporal association and does not establish causality.

2.5. Disease Assessment

For UC, disease extent was classified according to the Montreal classification (E1, ulcerative proctitis; E2, left-sided colitis; E3, extensive colitis), as was disease severity (S0, clinical remission; S1, mild; S2, moderate; S3, severe). For CD, disease location (L1, ileal; L2, colonic; L3, ileocolonic; L4, upper gastrointestinal modifier) and behavior (B1, non-stricturing, non-penetrating; B2, stricturing; B3, penetrating) were classified according to the Montreal classification [18]. Disease activity indices (the Crohn's Disease Activity Index (CDAI), the Crohn's Disease Endoscopic Index of Severity (CDEIS) [19], and the Mayo score) were not available in the registry dataset and are not reported. Montreal location, behavior, extent, and severity were recorded on the registry patient sheet at enrollment; because the cohort included patients with pre-existing disease, these classifications represent a cross-sectional assessment rather than phenotype at diagnosis. UC severity was graded using the Montreal definitions (S1, ≤4 stools/day with or without blood and no systemic illness; S2, >4 stools/day with minimal signs of systemic toxicity; S3, ≥6 bloody stools/day with signs of systemic toxicity) [18]. Disease duration at enrollment was calculated from the date of diagnosis to the date of registry enrollment, and diagnostic delay as the interval from symptom onset to diagnosis. Both dates were recorded to the month; records in which diagnosis preceded symptom onset (n = 62) were excluded from the delay analysis.

2.6. Missing Data

Because of the multicenter retrospective design and variable documentation practices across centers, complete records were not available for all variables. Sample sizes therefore vary across analyses and are reported in each table. Age was available for 673 patients (70.3%), anthropometric data and age at diagnosis for 428 (44.7%), and treating-unit region for all patients. No imputation was performed; all analyses used the available data for each variable. Under this complete-case approach, estimates are unbiased only if data are missing completely at random. We therefore tabulated missingness for key variables by center and IBD subtype (Supplementary Table S2) and compared patients with and without age and Montreal phenotype data with respect to sex, IBD subtype, region, and setting (Supplementary Table S3). Patients whose status for a variable was recorded as "not documented" were excluded from the denominator and from statistical tests for that variable.

2.7. Statistical Analysis

Statistical analyses were performed using IBM SPSS Statistics version 25 (IBM Corp., Armonk, NY, USA). Categorical variables are presented as frequencies and percentages and were compared using the chi-square test or Fisher's exact test (FET; Fisher–Freeman–Halton (FFH) extension for tables larger than 2 × 2) when expected cell counts were <5. Continuous variables are presented as mean ± standard deviation (SD) and median (minimum–maximum). Normality was assessed using the Shapiro–Wilk test; because distributions were non-normal, comparisons across the three IBD subtypes were performed using the Kruskal–Wallis H test. Pairwise comparisons were performed using Bonferroni-adjusted column-proportion z-tests for categorical data and Dunn's test for continuous data. Effect sizes for contingency tables are reported as Cramér's V, and 95% confidence intervals (CIs) for key proportions were calculated using the Wilson score method.

Because North Egypt was represented by a single IBD service, the regional comparison was examined further by (i) repeating it after excluding North Egypt; (ii) comparing units within each region; (iii) multivariable logistic regression of CD versus UC with North Egypt versus other regions as the exposure, adjusted for sex, age group (≤19, 20–49, and ≥50 years), and urban or rural residence, with a second model replacing age group with disease duration (adjusted odds ratios (aORs) with 95% CIs); and (iv) excluding 14 records that matched an earlier record on date of birth, sex, diagnosis, and month of diagnosis. Montreal phenotypes, disease duration, and diagnostic delay were compared between North Egypt and the other regions and between urban and rural residents, using the Mann–Whitney U test for continuous variables. Exact tests for r × c tables, Cramér's V, Wilson CIs, and the regression models were computed in Python 3 (SciPy and statsmodels). A two-tailed p-value < 0.05 was considered statistically significant. All p-values are reported to three decimal places, with values below 0.001 shown as $p < 0.001$. The study is reported in accordance with the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) statement for cross-sectional studies.

2.8. Outcomes

The primary outcome was the phenotypic profile and clinical characteristics of patients with IBD across Egyptian specialist centers. Secondary outcomes were the regional distribution of IBD subtypes, the frequency of risk factors (smoking and NSAID exposure), and the prevalence of comorbidities.

3. Results

3.1. Patient Enrollment and IBD Subtype Distribution

A total of 957 patients with confirmed IBD were enrolled from nine registry units across four Egyptian geographic regions between January 2017 and January 2023. Of these, 542 (56.6%) had CD, 395 (41.3%) had UC, and 20 (2.1%) had IBDU, yielding a CD:UC ratio of 1.37:1 (95% CI for the proportion with CD, 53.5–59.7%; UC, 38.2–44.4%; IBDU, 1.4–3.2%). The two Alexandria units of the North Egypt service contributed 582 patients (60.8%), and the remaining seven units contributed between 4 and 235 patients each (Supplementary Table S1).

3.2. Demographic Characteristics

Age was available for 673 patients (70.3%): 83 (12.3%) were aged ≤19 years, 424 (63.0%) 20–49 years, and 166 (24.7%) ≥50 years, with no significant difference in age distribution across IBD subtypes ($p = 0.830$). The mean age at diagnosis, available for 428 patients, was 33.96 ± 12.76 years (range 11–82 years), again without a significant between-group difference ($p = 0.087$). Twenty-four patients (3.6% of those with age data) were younger than 18 years at registry enrollment (CD, 15; UC, 7; IBDU, 2). Age was missing for 91% of patients from Assiut, so 82.9% of patients with age data were from North Egypt (Supplementary Tables S2 and S3). Overall, 553 patients (57.8%) were female and 404 (42.2%) male. Female predominance was consistent across subtypes: 59.2% in CD (321/542), 55.9% in UC (221/395), and 55.0% in IBDU (11/20) ($p = 0.586$). Demographic data are summarized in Table 1.

3.3. Regional Distribution

By region of the treating unit, 582 patients (60.8%) were managed in North Egypt, 235 (24.6%) in Upper Egypt, 104 (10.9%) in Greater Cairo, and 36 (3.8%) in the Delta. IBD subtype distribution varied significantly by region ($\chi^2 = 227.35$, $p < 0.001$; Cramér's V = 0.34; Figure 1). CD was the dominant subtype in North Egypt, accounting for 75.6% of

patients from that region (440/582; 95% CI 72.0–78.9%) and 81.2% of all CD cases (440/542). In contrast, UC predominated in Upper Egypt (161/235, 68.5%), Greater Cairo (71/104, 68.3%), and the Delta (31/36, 86.1%). Outside North Egypt, the CD:UC ratio was 0.39:1 (102 CD vs. 263 UC). In the sensitivity analysis excluding North Egypt, subtype distribution did not differ among Upper Egypt, Greater Cairo, and the Delta ($p = 0.143$; Cramér's V = 0.10), with the proportion of CD ranging from 13.9% (95% CI 6.1–28.7%) in the Delta to 29.4% (95% CI 23.9–35.5%) in Upper Egypt. Within regions, the two Alexandria units had similar distributions (CD 72.4% vs. 78.8%; $p = 0.103$), as did the two Delta units ($p = 0.084$), whereas the four Greater Cairo units differed (CD 0–53.8%; $p = 0.018$; Supplementary Table S1). In multivariable analysis adjusted for sex, age group, and setting, treatment in North Egypt remained strongly associated with CD rather than UC (aOR 12.90, 95% CI 7.19–23.14; n = 621). Because age was missing for most patients from Assiut, a model replacing age group with disease duration was also fitted and gave a similar result (aOR 8.59, 95% CI 6.21–11.88; n = 858). Excluding 14 possible duplicate registrations did not change these findings (CD in North Egypt, 75.2%; $p = 0.143$ among the remaining regions). Urban residence was documented in 571 patients (65.5%) and rural residence in 301 (34.5%), with no significant difference across subtypes ($p = 0.793$).

Table 1. Demographic characteristics of patients with inflammatory bowel disease by subtype.

Test (p-Value)	IBDU	UC	CD	Total	Characteristic
FET = 1.52 (0.830)	n = 14	n = 216	n = 443	n = 673	**Age group (years)**
	2 (14.3%)	30 (13.9%)	51 (11.5%)	83 (12.3%)	≤19
	9 (64.3%)	137 (63.4%)	278 (62.8%)	424 (63.0%)	20–49
	3 (21.4%)	49 (22.7%)	114 (25.7%)	166 (24.7%)	≥50
$\chi^2 = 1.07$ (0.586)	n = 20	n = 395	n = 542	n = 957	**Sex**
	9 (45.0%)	174 (44.1%)	221 (40.8%)	404 (42.2%)	Male
	11 (55.0%)	221 (55.9%)	321 (59.2%)	553 (57.8%)	Female
$\chi^2 = 227.35$ (<0.001) *	n = 20	n = 395	n = 542	n = 957	**Region (treating unit)**
	10 (50.0%) [b]	132 (33.4%) [b]	440 (81.2%) [a]	582 (60.8%)	North Egypt
	5 (25.0%) [a,b]	161 (40.8%) [b]	69 (12.7%) [a]	235 (24.6%)	Upper Egypt
	5 (25.0%) [b]	71 (18.0%) [b]	28 (5.2%) [a]	104 (10.9%)	Greater Cairo
	0 [a,b]	31 (7.8%) [b]	5 (0.9%) [a]	36 (3.8%)	Delta
$\chi^2 = 0.46$ (0.793)	n = 14	n = 339	n = 519	n = 872	**Setting**
	10 (71.4%)	225 (66.4%)	336 (64.7%)	571 (65.5%)	Urban
	4 (28.6%)	114 (33.6%)	183 (35.3%)	301 (34.5%)	Rural

Data are n (%). Percentages are calculated from the number of patients with available data for each variable. * Statistically significant ($p < 0.05$). Superscript letters denote pairwise comparisons within a row: subtypes sharing a letter do not differ significantly. CD, Crohn's disease; FET, Fisher's exact test; IBDU, inflammatory bowel disease unclassified; UC, ulcerative colitis.

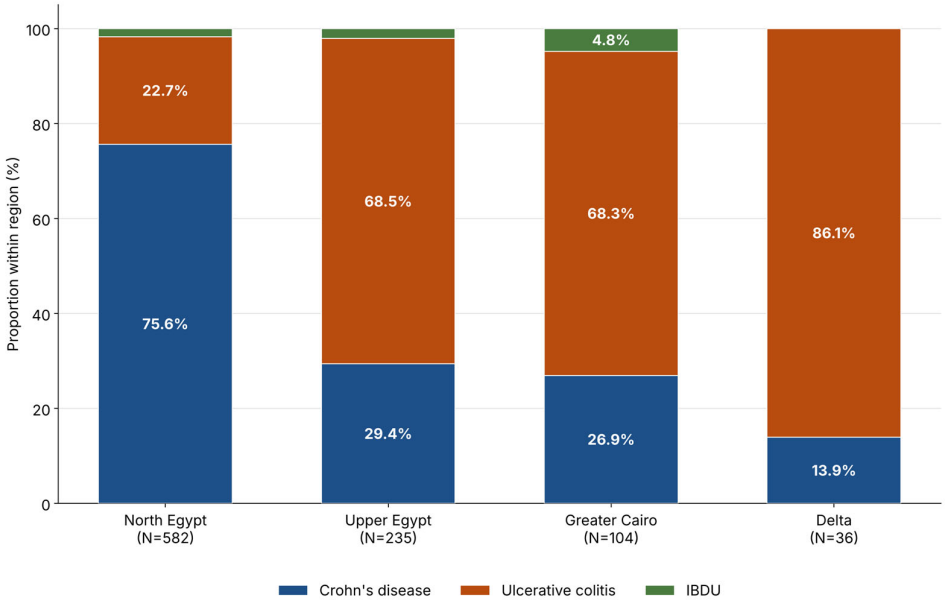


Figure 1. Regional distribution of IBD subtypes across Egyptian geographic regions. Bars show the proportion of Crohn's disease (CD), ulcerative colitis (UC), and inflammatory bowel disease unclassified (IBDU) within each region of the treating unit (n = 957). Subtype distribution differed significantly across regions ($\chi^2 = 227.35$, $p < 0.001$).

3.4. Anthropometric and Laboratory Characteristics

Anthropometric data were available for 428 patients (44.7%) (Table 2). Mean height was 168.41 ± 8.78 cm, with no significant between-group difference (H = 4.115, $p = 0.128$). Standard body weight, which is derived from height, differed significantly among the three groups (H = 17.058, $p < 0.001$), with lower median weight in patients with IBDU (53.8 kg; range 42.4–72.0) than in those with CD (62.2 kg) or UC (61.0 kg). Mean C-reactive protein (CRP) levels were 58.31 ± 55.08 mg/L in CD, 124.21 ± 149.91 mg/L in UC, and 70.43 ± 43.79 mg/L in IBDU (H = 11.043, $p = 0.004$).

Table 2. Anthropometric data, age at diagnosis, and C-reactive protein by IBD subtype.

H (*p*-Value)	IBDU	UC	CD	Total	Characteristic
4.115 (0.128)	n = 7	n = 84	n = 337	n = 428	**Height (cm)**
	166.71 ± 12.92	167.06 ± 10.59	168.78 ± 8.17	168.41 ± 8.78	Mean ± SD
	166 (150–190)	166 (140–190)	169 (140–190)	168 (140–190)	Median (min–max)
17.058 (<0.001) *	n = 7	n = 84	n = 337	n = 428	**Standard body weight (kg)**
	56.49 ± 9.92	62.63 ± 7.19	62.70 ± 6.64	62.59 ± 6.84	Mean ± SD
	53.8 (42.4–72.0)	61.0 (46.4–82.4)	62.2 (26.4–86.4)	61.6 (26.4–86.4)	Median (min–max)
4.886 (0.087)	n = 7	n = 84	n = 337	n = 428	**Age at diagnosis (years)**
	30.71 ± 10.05	31.13 ± 11.91	34.74 ± 12.94	33.96 ± 12.76	Mean ± SD
	33 (14–41)	29 (12–78)	33 (11–82)	32 (11–82)	Median (min–max)
11.043 (0.004) *	n = 7	n = 84	n = 337	n = 428	**CRP (mg/L)**
	70.43 ± 43.79	124.21 ± 149.91	58.31 ± 55.08	71.44 ± 86.41	Mean ± SD

H, Kruskal–Wallis test statistic. Standard body weight is calculated by IBDIS.net from height. * Statistically significant ($p < 0.05$). CD, Crohn's disease; CRP, C-reactive protein; IBDU, inflammatory bowel disease unclassified; SD, standard deviation; UC, ulcerative colitis.

3.5. Disease Location, Extent, and Severity

Disease location, extent, and severity are presented in Table 3 and Figure 2. Among patients with CD with available data (n = 396), ileocolonic disease (L3) was the most common location (237, 59.8%), followed by isolated ileal disease (L1; 126, 31.8%) and colonic disease (L2; 33, 8.3%). An upper gastrointestinal (L4) modifier was present in 9 patients. Among 153 patients with CD with a documented skip-lesion count, 113 (73.9%) had four or more skip lesions.

For UC, Montreal extent was available for 296 patients: left-sided colitis (E2) was most prevalent (128, 43.2%), followed by extensive colitis (E3; 96, 32.4%) and proctitis (E1; 72, 24.3%). One patient with UC had backwash ileitis. Disease severity was available for 297 patients with UC: moderate (S2) in 159 (53.5%), severe (S3) in 80 (26.9%), mild (S1) in 53 (17.8%), and clinical remission (S0) in 5 (1.7%).

Median disease duration at registry enrollment was 1.9 years (IQR 1.0–3.4) in CD and 2.5 years (IQR 1.1–5.0) in UC. The median interval from symptom onset to diagnosis was 3.0 months (IQR 0–9.0) in CD and 1.9 months (IQR 0–7.5) in UC (n = 854). In CD, stricturing or penetrating behavior was more frequent with longer disease duration (12.0% at <2 years, 7.8% at 2–5 years, and 33.3% at ≥5 years; $p < 0.001$) but was not associated with a diagnostic delay of more than 12 months (8.6% vs. 13.0%; $p = 0.358$). Compared with the other regions, the North Egypt service had a higher proportion of ileocolonic (65.2% vs. 30.0%) and inflammatory (90.3% vs. 68.9%) CD, more extensive (42.3% vs. 26.5%) and more severe (42.0% vs. 17.8%) UC (all $p \leq 0.001$), and a longer diagnostic delay (median 3.0 vs. 1.0 months; $p < 0.001$). Montreal phenotypes did not differ between urban and rural residents (Supplementary Table S4).

Table 3. Disease location, extent, and severity according to the Montreal classification.

n (%)	Characteristic
	Crohn's disease location (n = 396)
237 (59.8%)	Ileocolonic (L3)
126 (31.8%)	Ileal (L1)
33 (8.3%)	Colonic (L2)
9	Upper gastrointestinal modifier (L4) [a]
	Crohn's disease skip lesions (n = 153)
1 (0.7%)	0
5 (3.3%)	1
23 (15.0%)	2
11 (7.2%)	3
113 (73.9%)	≥4
	Ulcerative colitis extent (n = 296)
72 (24.3%)	Proctitis (E1)
128 (43.2%)	Left-sided colitis (E2)
96 (32.4%)	Extensive colitis (E3)
	Ulcerative colitis severity (n = 297)
5 (1.7%)	Clinical remission (S0)
53 (17.8%)	Mild (S1)
159 (53.5%)	Moderate (S2)
80 (26.9%)	Severe (S3)

[a] L4 is a modifier that may coexist with L1–L3. Two patients with IBDU had a documented skip-lesion count (both ≥4) and are not shown. Percentages are calculated from patients with available data.

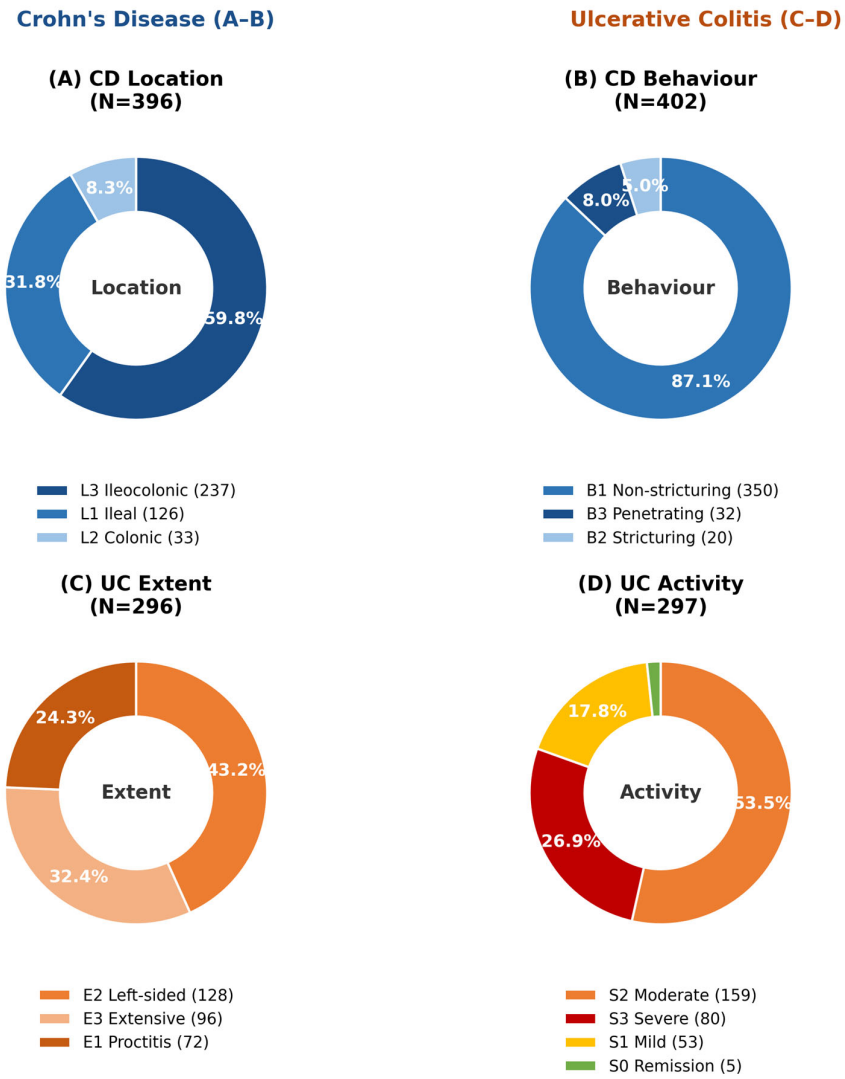


Figure 2. Disease phenotype according to the Montreal classification. (**A**) Crohn's disease (CD) location (n = 396); (**B**) CD behavior (n = 402); (**C**) ulcerative colitis (UC) extent (n = 296); (**D**) UC severity (n = 297). B, behavior; E, extent; L, location; S, severity.

3.6. Crohn's Disease Behavior and Complications

CD behavior and complications are detailed in Table 4. Behavior was classified in 402 patients: non-stricturing, non-penetrating disease (B1) predominated (350, 87.1%), whereas stricturing (B2) and penetrating (B3) disease were present in 20 (5.0%) and 32 (8.0%) patients, respectively. Perianal fistula was documented in 29 of 402 patients with CD with known status (7.2%; 95% CI 5.1–10.2%) and in no patient with UC ($p < 0.001$; Cramér's V = 0.17); of the 28 with documented complexity, 6 (21.4%) had complex fistulae, and 4 of 14 patients with available surgical data (28.6%) had undergone reconstructive surgery. Enterocutaneous fistula was rare (4 of 395 patients with CD, 1.0%; $p = 0.349$ across subtypes).

Table 4. Crohn's disease behavior and fistulizing complications.

Test (*p*-Value)	IBDU	UC	CD	Total	Characteristic
—	—	—	n = 402	—	**Montreal behavior (CD)**
	—	—	350 (87.1%)	—	Non-stricturing, non-penetrating (B1)
	—	—	20 (5.0%)	—	Stricturing (B2)
	—	—	32 (8.0%)	—	Penetrating (B3)
FFH (<0.001) *	n = 12	n = 253	n = 402	n = 667	**Perianal fistula**
	11 (91.7%) [a]	253 (100.0%) [b]	373 (92.8%) [a]	637 (95.5%)	Never
	1 (8.3%) [a]	0 [b]	29 (7.2%) [a]	30 (4.5%)	Ever
—	n = 1	—	n = 28	n = 29	**Perianal fistula complexity**
	1 (100.0%)	—	22 (78.6%)	23 (79.3%)	Non-complex
	0	—	6 (21.4%)	6 (20.7%)	Complex
—	—	—	n = 14	—	**Reconstructive surgery (CD)**
	—	—	10 (71.4%)	—	Never
	—	—	4 (28.6%)	—	Ever
FFH (0.349)	n = 11	n = 234	n = 395	n = 640	**Enterocutaneous fistula**
	11 (100.0%)	234 (100.0%)	391 (99.0%)	636 (99.4%)	Never
	0	0	4 (1.0%)	4 (0.6%)	Ever

Data are n (%). * Statistically significant ($p < 0.05$). Superscript letters denote pairwise comparisons within a row: subtypes sharing a letter do not differ significantly. B3 was derived as the number classified minus B1 and B2. Patients whose fistula status was not documented (perianal, n = 6; enterocutaneous, n = 5) were excluded from denominators and tests. Cramér's V for perianal fistula, 0.17. Fistula complexity was not recorded for one patient with CD and perianal fistula. CD, Crohn's disease; FFH, Fisher–Freeman–Halton exact test; IBDU, inflammatory bowel disease unclassified; UC, ulcerative colitis.

3.7. Comorbidities and Risk Factors

Comorbidity and risk factor data are presented in Table 5 and Figure 3. Comorbid conditions were documented in 39 of 626 evaluable patients (6.2%), with comparable rates in CD (27/376, 7.2%) and UC (12/240, 5.0%) ($p = 0.462$). Malignancy was identified in 1 of 614 patients with available data (0.2%). Current smoking was uncommon (13/675, 1.9%), with no significant between-group difference ($p = 0.770$). Relapse temporally associated with COX-2 inhibitor use was reported by 41 of 394 exposed patients (10.4%; 95% CI 7.8–13.8%; 6.2% of the 657 patients with data), and relapse associated with non-selective NSAID use by 11 of 307 exposed patients (3.6%; 95% CI 2.0–6.3%; 1.7% of 640).

Table 5. Comorbidities and risk factors by IBD subtype.

FET (*p*-Value)	IBDU	UC	CD	Total	Characteristic
— (0.462)	n = 10	n = 240	n = 376	n = 626	**Comorbidity**
	10 (100.0%)	228 (95.0%)	349 (92.8%)	587 (93.8%)	None
	0	12 (5.0%)	27 (7.2%)	39 (6.2%)	Any
3.835 (0.399)	n = 10	n = 235	n = 369	n = 614	**Malignancy**
	10 (100.0%)	234 (99.6%)	369 (100.0%)	613 (99.8%)	None
	0	1 (0.4%)	0	1 (0.2%)	Present
1.51 (0.770)	n = 10	n = 262	n = 403	n = 675	**Smoking status**
	9 (90.0%)	231 (88.2%)	360 (89.3%)	600 (88.9%)	Non-smoker
	1 (10.0%)	27 (10.3%)	34 (8.4%)	62 (9.2%)	Ex-smoker
	0	4 (1.5%)	9 (2.2%)	13 (1.9%)	Current smoker

6.5 (0.144)	n = 10	n = 254	n = 393	n = 657	**Selective NSAID (COX-2 inhibitor)**
	5 (50.0%)	89 (35.0%)	169 (43.0%)	263 (40.0%)	Never used
	4 (40.0%)	151 (59.4%)	198 (50.4%)	353 (53.7%)	Used, tolerated
	1 (10.0%)	14 (5.5%)	26 (6.6%)	41 (6.2%)	Reported relapse after use
7.87 (0.090)	n = 10	n = 243	n = 387	n = 640	**Non-selective NSAID**
	6 (60.0%)	111 (45.7%)	216 (55.8%)	333 (52.0%)	Never used
	4 (40.0%)	129 (53.1%)	163 (42.1%)	296 (46.3%)	Used, tolerated
	0	3 (1.2%)	8 (2.1%)	11 (1.7%)	Reported relapse after use

Data are n (%). Denominators differ between variables because of differential documentation across centers. "Reported relapse after use" reflects a temporal association recorded by patient report and clinical records and does not imply causation; among exposed patients, it was reported by 41/394 (10.4%) COX-2 inhibitor users and 11/307 (3.6%) non-selective NSAID users. For comorbidity, the exact *p*-value is shown. CD, Crohn's disease; COX-2, cyclooxygenase-2; FET, Fisher's exact test; IBDU, inflammatory bowel disease unclassified; NSAID, non-steroidal anti-inflammatory drug; UC, ulcerative colitis.

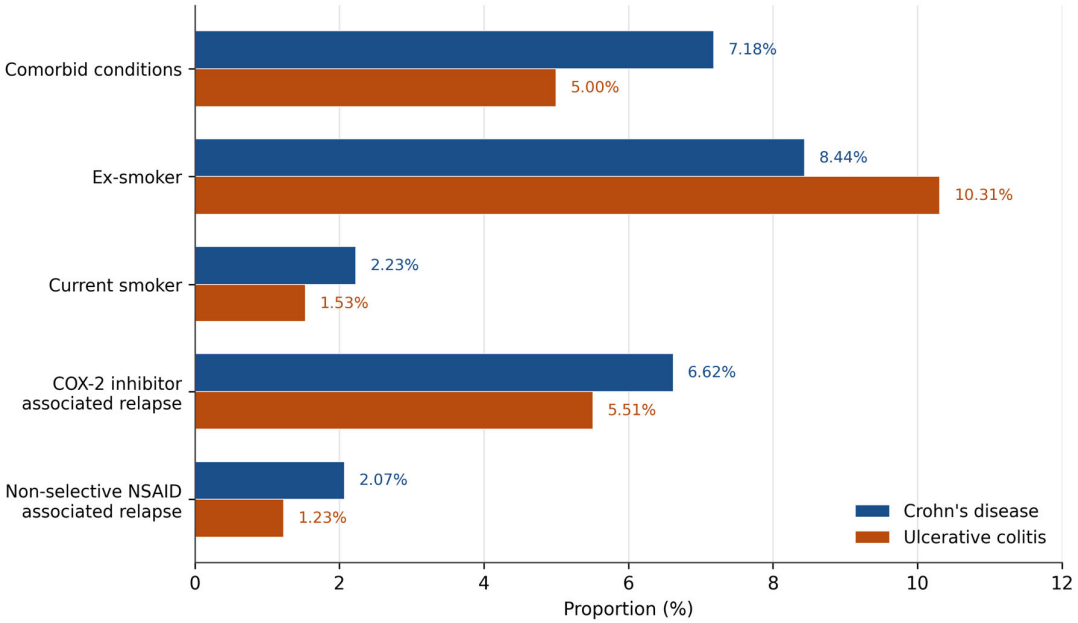


Figure 3. Risk factor and comorbidity profile in Crohn's disease versus ulcerative colitis. Bars show the proportion of patients with available data for each variable (comorbidity, n = 626; smoking status, n = 675; COX-2 inhibitor exposure, n = 657; non-selective NSAID exposure, n = 640). None of the comparisons was statistically significant (Fisher's exact test). COX-2, cyclooxygenase-2; NSAID, non-steroidal anti-inflammatory drug.

4. Discussion

This multicenter registry-based study describes the clinical, phenotypic, and geographic characteristics of 957 patients with IBD from nine specialist gastroenterology units across four Egyptian regions. The principal findings were an overall CD:UC ratio of 1.37:1; regional heterogeneity in subtype distribution attributable to a single North Egypt IBD service; female predominance across all subtypes; peak representation in the 20–49-year age group; and CD and UC phenotypes broadly similar to those reported from Asian registries.

4.1. Regional Heterogeneity

The most notable finding was the regional variation in IBD subtype distribution. CD predominated in North Egypt, accounting for 75.6% of patients from that region, whereas UC was the dominant subtype in Upper Egypt (68.5%), Greater Cairo (68.3%), and the Delta (86.1%). Whether this pattern reflects geography or referral cannot be determined from registry data.

Several explanations should be considered. North Egypt, particularly Alexandria, differs from Upper Egypt in dietary patterns, urbanization, and early-life microbial and antibiotic exposure—factors implicated in CD pathogenesis [6,7,20,21]. However, an environmental explanation alone is not supported by our own data: urban and rural residence did not differ between subtypes, and Greater Cairo, the most urbanized region, was UC-predominant. The most parsimonious explanation is a referral-concentration effect. The Alexandria service is among the most specialized IBD services in Egypt and may preferentially attract patients with CD requiring advanced diagnostic work-up and therapy; because North Egypt was represented by this single service, region and service effects cannot be separated. Our additional analyses support this interpretation. After North Egypt was excluded, the three remaining regions, served by seven units, showed UC predominance without a significant between-region difference ($p = 0.143$), and the association between North Egypt and CD persisted after adjustment for sex, age group, and setting (aOR 12.90). Subtype distribution also varied between units within Greater Cairo (CD 0–53.8%), suggesting that unit-level referral and diagnostic practices, rather than geography, drive the variation. CD at the North Egypt service was more often inflammatory and ileocolonic than elsewhere, so the concentration does not appear to reflect selective referral of complicated disease; differences in diagnostic work-up or in subtype labelling between services are alternative explanations. Notably, outside North Egypt the CD:UC ratio was 0.39:1, consistent with the UC predominance reported in previous Egyptian series [15,16]. Population-based studies with defined catchment areas and incidence denominators are needed to determine whether this heterogeneity reflects true geographic variation.

IBDU accounted for only 2.1% of the cohort (4.8% of patients with colonic disease), below the approximately 6% reported in adult cohorts [22]. Two features of the registry probably contribute. First, it is a prevalent rather than an inception cohort, and IBDU is frequently reclassified as CD or UC as diagnostic information accumulates during follow-up [23]; the registry records the current diagnosis. Second, specialist units with access to cross-sectional imaging and repeated endoscopy are more likely to assign a definitive subtype. Nevertheless, diagnoses were not centrally adjudicated, and differences between centers in how colonic IBD is labelled could have contributed to the regional differences in the CD:UC ratio.

4.2. CD:UC Ratio

The overall CD:UC ratio of 1.37:1 differs from the UC predominance reported in earlier Egyptian studies, in which UC accounted for 81–86% of cases [15,16]. Given that 81.2% of our CD cases came from North Egypt, the overall ratio largely reflects the composition of the contributing centers and should not be interpreted as evidence of a national shift toward CD. The progression from UC predominance toward CD parity with industrialization, documented in South Korea, Japan, and China [4,10,24], may nonetheless be relevant to Egypt, and longitudinal population-based data are required to assess it.

Table 6 compares the present cohort with previous Egyptian series. The UC predominance (80.5–86.0%) reported in two single-center Cairo series [15,25] and in the nationwide multicenter study by Elbadry et al. [16] is consistent with our findings outside North Egypt. In that study, the proportion of CD in Greater Cairo (25.3%) closely matched ours (26.9%), whereas it was lower in Upper Egypt (9.3% vs. 29.4%); Alexandria was not

reported separately, so the concentration of CD in North Egypt has no direct Egyptian comparator. Our cohort also had fewer patients with stricturing or penetrating CD (13.0% vs. 34.3%) and more with severe UC (26.9% vs. 19.5%) than the study by Elbadry et al. [16]; differences in the timing of phenotype assessment, the definitions used, and the referral profiles of contributing centers probably account for much of this variation.

Table 6. Comparison of the present cohort with previous Egyptian IBD studies.

Other Phenotype Data	CD Proportion by Region, %	UC/CD, %	n	Design, Setting, Period	Study
UC extent E1 18.5%, E2 65.2%, E3 16.3%; CD male:female 2.6:1	Not reported	86.0/14.0	157	Single center, Cairo University; 1995–2009	Esmat et al., 2014 [15]
Female 53.8%; CD ileal 48.5%, colonic 36.4%	Not reported	80.5/19.5	169	Single center, Ain Shams University, Cairo; 2009–2019	Shamkh et al., 2022 [25]
CD B1/B2/B3 61.4/20.8/13.5%; severe UC 19.5%; CD 60.4% male	Greater Cairo 25.3; Delta and Coastal 19.5; Upper Egypt 9.3	81.3/18.7	1104	14 tertiary centers, nationwide, retrospective	Elbadry et al., 2022 [16]
CD B1/B2/B3 87.1/5.0/8.0%; severe UC 26.9%; CD 40.8% male	North Egypt 75.6; Upper Egypt 29.4; Greater Cairo 26.9; Delta 13.9	41.3/56.6 (IBDU 2.1)	957	9 specialist units, IBDIS.net registry; 2017–2023	Present study

Percentages are those reported in each study; phenotype definitions and the timing of assessment differed between studies. B1, non-stricturing, non-penetrating; B2, stricturing; B3, penetrating; CD, Crohn's disease; E1, proctitis; E2, left-sided colitis; E3, extensive colitis; IBDU, inflammatory bowel disease unclassified; UC, ulcerative colitis.

4.3. Age at Diagnosis

The mean age at diagnosis of 33.96 ± 12.76 years is consistent with the well-established peak of IBD onset in the third and fourth decades of life [26–30]. The 20–49-year age group comprised 63.0% of patients with age data, in keeping with data from Asia-Pacific and Middle Eastern cohorts [4,5]. Patients aged ≤19 years accounted for 12.3%. Coward et al. projected a rising burden and age at diagnosis in Canada, with IBD rates in older adults exceeding those in children [31]; the relatively young age profile in our cohort may reflect the younger demographic structure of the Egyptian population.

4.4. Sex Distribution

Female predominance was observed across all subtypes (57.8% overall; 59.2% CD, 55.9% UC, 55.0% IBDU). This contrasts with Western and several Asian cohorts, which typically report male predominance in UC and approximate sex parity in CD [14,27,32]; Shivashankar et al. found male sex to be associated with higher UC incidence in Olmsted County, Minnesota [27], and Shah et al. reported male predominance in both CD and UC across Asia-Pacific populations [32]. Previous Egyptian series also reported male predominance in CD (male:female 2.6:1 [15]; 60.4% male [16]). In a specialist-center registry, sex distribution may also be influenced by differences in healthcare-seeking behavior and referral, and the finding warrants confirmation in population-based data.

4.5. UC Extent and Severity

Left-sided colitis (E2) was the most prevalent UC extent (43.2%), followed by extensive colitis (E3, 32.4%) and proctitis (E1, 24.3%). This distribution differs from the

population-based Asia-Pacific (ACCESS) cohort, which reported a higher proportion of proctitis [4], and is more consistent with hospital-based Asian cohorts from India (E1 17.5%, E2 58.6%, E3 23.9%) and Thailand (E1 21%, E2 35%, E3 43%) [33,34]. The lower proportion of proctitis in tertiary-center studies likely reflects referral bias, because patients with mild proctitis are more often managed in community settings. The high proportion of moderate-to-severe UC (53.5% moderate, 26.9% severe) may similarly reflect referral patterns. The median interval from symptom onset to diagnosis in UC was short (1.9 months), but onset and diagnosis dates were recorded only to the month and severity was assessed at registry enrollment, so the contribution of diagnostic delay cannot be judged reliably.

4.6. Crohn's Disease Phenotype

Ileocolonic involvement (L3) was the predominant CD location (59.8%), followed by isolated ileal (L1, 31.8%) and colonic (L2, 8.3%) disease. This distribution is consistent with East Asian CD cohorts, in which L3 is the most common location [4,24,35,36], and contrasts with several Western series in which colonic disease is more frequent [37–41], supporting the concept of an "East meets West" phenotype in transitioning countries [42]. The predominance of inflammatory behavior (B1, 87.1%) is consistent with natural history data showing that CD behavior evolves from inflammatory to stricturing or penetrating phenotypes over time: Cosnes et al. reported that most patients develop B2 or B3 complications with longer disease duration [43], and a 30-year Korean registry showed a progressive increase in penetrating behavior [24]. Because behavior was assessed at registry enrollment in a prevalent cohort with a median disease duration of 1.9 years, the B1 proportion is a cross-sectional snapshot; consistent with natural history data, stricturing or penetrating behavior was considerably more frequent in patients with a disease duration of 5 years or longer (33.3% vs. 7.8–12.0%). Diagnostic delay may also accelerate progression: in a meta-analysis of 101 studies, delayed diagnosis of CD was associated with stricturing (OR 1.88) and penetrating (OR 1.64) disease and with intestinal surgery, and diagnostic intervals were longer in lower-middle-income than in high-income countries [44]; in the Swiss IBD Cohort Study, a delay of ≥25 months was associated with bowel stenosis and surgery [45]. In our cohort, the median diagnostic delay in CD was 3.0 months, and a delay of more than 12 months was not associated with complicated behavior. However, dates were recorded only to the month, the number of complicated cases was small, and the longer delay at the North Egypt service coincided with less, not more, complicated disease; no difference in phenotype was observed between urban and rural residents. Longitudinal follow-up of this cohort is needed to document behavior progression in the Egyptian context.

4.7. Risk Factors: Smoking and NSAIDs

The very low prevalence of current smoking (1.9%) may reflect the young, predominantly female composition of the cohort and the healthcare-seeking context. The known inverse association between smoking and UC and the positive association with CD could not be meaningfully examined given this low prevalence. Relapse temporally associated with use was reported by 10.4% of patients exposed to COX-2 inhibitors and 3.6% of those exposed to non-selective NSAIDs. These figures derive from patient report and record review, without a standardized exposure window or objective confirmation of relapse, and cannot establish causality; the higher proportion for COX-2 inhibitors may also reflect confounding by indication, because these agents may be preferentially prescribed to patients considered at higher gastrointestinal risk. The findings nonetheless support routine documentation of analgesic use in IBD clinics, particularly where NSAIDs are available over the counter.

4.8. Strengths and Limitations

The strengths of this study include multicenter recruitment from nine specialist units across four Egyptian regions; the use of a standardized electronic registry (IBDIS.net), which supports consistent data collection and coding across centers; comprehensive phenotyping using validated classification systems; and the inclusion of risk factor data (smoking and NSAID exposure) rarely reported in Egyptian IBD literature.

Several limitations must be acknowledged. First, as a specialist-center registry, the study is subject to referral and ascertainment bias, with likely over-representation of more severe or complex disease. Enrollment was not consecutive, which may have introduced further selection bias. Second, North Egypt, represented by a single IBD service, accounted for 60.8% of patients; regional differences cannot be separated from service-level referral and diagnostic practices, although the heterogeneity was confined to this service and persisted after adjustment. Third, the absence of population denominators precludes calculation of incidence or prevalence; all figures are case counts from participating centers. Fourth, data were missing for several variables, particularly anthropometric data and age at diagnosis (each available for 44.7% of patients), and documentation varied between units (Supplementary Table S2); age, for example, was largely missing for patients from Assiut. Because missingness was not random, estimates for these variables may not represent the whole cohort. Fifth, this is a cross-sectional characterization of a prevalent cohort: Montreal phenotype was assessed at a single time point, symptom-onset and diagnosis dates were recorded only to the month, and longitudinal data on behavior progression, treatment outcomes, and long-term complications were not available. Sixth, diagnoses were not centrally adjudicated, which may explain the low proportion of IBDU and could have contributed to between-center differences in subtype labelling. Finally, NSAID-associated relapse relied on patient report and record review and does not establish causality.

5. Conclusions

In this multicenter registry of Egyptian specialist centers, regional variation in IBD subtype was driven by the concentration of CD at the single North Egypt IBD service, whereas UC predominated in Upper Egypt, Greater Cairo, and the Delta. Female predominance, a peak in the 20–49-year age group, and phenotypes resembling those of Asian registries—ileocolonic CD and left-sided UC—were observed. These data describe the patients currently managed at Egyptian specialist centers and may help these centers plan specialist services, but they do not provide population-level estimates. Population-based studies with defined catchment areas are needed to establish incidence and prevalence and to determine whether the regional heterogeneity reflects environmental factors or referral patterns.

Supplementary Materials: The following supporting information can be downloaded at: https://www.mdpi.com/article/10.3390/jcm15239305/s1, Table S1: Number of patients and IBD subtype distribution by registry unit; Table S2: Proportion of missing data for key variables by registry unit and IBD subtype; Table S3: Comparison of patients with and without age and CD behavior data; Table S4: Montreal phenotype, disease duration, and diagnostic delay by region and by urban or rural residence.

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draft preparation, E.A.A., D.A.H., K.A.A., A.M.R., N.A.O., H.E., H.F., A.E.A., M.I., H.I.M., M.I.R., H.S.G., R.O.R., N.N.F., M.E.E. and M.M.M.; writing—review and editing, E.A.A., D.A.H., K.A.A., M.M.A. and M.M.M.; visualization, A.M.R.; supervision, H.E., M.I. and N.N.F.; project administration, N.A.O., H.F., N.N.F. and M.M.M. All authors have read and agreed to the published version of the manuscript.

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Informed Consent Statement: Written informed consent was obtained from all subjects involved in the study.

Data Availability Statement: The data presented in this study are available on reasonable request from the corresponding author. The data are not publicly available due to patient privacy restrictions.

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Abbreviations

The following abbreviations are used in this manuscript: aOR, adjusted odds ratio; CD, Crohn's disease; CDAI, Crohn's Disease Activity Index; CDEIS, Crohn's Disease Endoscopic Index of Severity; CI, confidence interval; COX-2, cyclooxygenase-2; CRP, C-reactive protein; ECCO, European Crohn's and Colitis Organisation; FET, Fisher's exact test; FFH, Fisher–Freeman–Halton; IBD, inflammatory bowel disease; IBDU, inflammatory bowel disease unclassified; IQR, interquartile range; NSAID, non-steroidal anti-inflammatory drug; SD, standard deviation; STROBE, Strengthening the Reporting of Observational Studies in Epidemiology; UC, ulcerative colitis.

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