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Twenty-One Years of Colorectal Malignancies at a Palestinian Pathology Network: A Retrospective Analysis of 1,381 Cases (2005–2026)

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Abstract

Background

Colorectal malignancies represent a leading cause of cancer-related burden worldwide and an emerging concern in the Eastern Mediterranean region. Despite rising incidence in the Palestinian territories, no large pathology-based case series has been published from this population. We report the epidemiological and histopathological characteristics of 1,381 histologically confirmed colorectal malignancies diagnosed across a network of pathology laboratories over 21 years.

Methods

Cases were identified by keyword and ICD-O-3 screening of 14,094 pathology records from November 2005 to May 2026. Confirmed colorectal malignancies were coded for topography (ICD-10), morphology (ICD-O-3), and AJCC stage where documented. Descriptive statistics were used to characterize the cohort.

Results

Of 1,381 cases, 699 (50.6%) were male and 682 (49.4%) female (median age 60 years, range 4–95). Sigmoid colon and rectum together accounted for 34.5% of anatomically specified sites. Adenocarcinoma NOS was the dominant histology (1,254 cases, 90.8%). Strikingly, 305 cases (22.1%) occurred in patients younger than 50 years—among the highest reported early-onset burdens in the region. Nablus accounted for 44.1% of cases, reflecting the laboratory network catchment. Annual case counts rose from 1 in 2005 to 113 in 2025, with 2026 on pace to set a new record.

Conclusions

This series represents the largest pathology-based colorectal malignancy cohort reported from the Palestinian territories. The high early-onset burden, balanced sex ratio, and left-sided site predominance mirror MENA-region patterns and warrant prospective registry expansion, systematic MSI/MMR testing, and re-examination of regional screening age thresholds.

1. Introduction

Colorectal cancer (CRC) is the third most commonly diagnosed cancer and the second leading cause of cancer-related death worldwide, accounting for approximately 1.9 million new cases and 935,000 deaths in 2020 [1, 2]. Within the broader Eastern Mediterranean and Middle East and North Africa (MENA) region, CRC incidence is rising steeply, driven by epidemiological transitions associated with urbanization, dietary change, and reduced physical activity [3, 4, 5, 6]. Early-onset CRC—defined as

diagnosis before the age of 50—has emerged as a particularly pressing concern in this region, with several countries reporting a higher proportion of younger patients than Western series typically document [7, 8].

Pathology laboratory registries represent an underutilized but powerful tool for cancer epidemiology in low- and middle-income settings where population-based registries are absent or incomplete. The Palestinian territories lack a national cancer registry with comprehensive case capture; previous estimates have relied on fragmented hospital data [9, 10, 11]. To address this gap, we present a retrospective analysis of 1,381 histologically confirmed colorectal malignancy cases accrued by a multi-site pathology laboratory network across 11 governorates of the West Bank between November 2005 and May 2026. This is, to our knowledge, the largest published pathology-based colorectal malignancy series from this population, and the first to span more than two decades of continuous laboratory data.

2. Materials and Methods

2.1 Data Source

Pathology records were drawn from a network of clinical pathology laboratories operating across the West Bank, Palestinian territories. The network processed 14,094 specimens over the study period (November 2005 to May 2026), serving hospitals, outpatient clinics, and oncology centers in 11 governorates. Each specimen was associated with a requesting physician, patient demographic data (age, sex, city of residence), anatomical site, and a pathologist-generated diagnostic text report.

2.2 Case Selection

Cases were selected in two stages. In the primary screening step, all specimen records were queried using a standardized keyword and regular-expression filter targeting terms indicative of colorectal malignancy (e.g., "adenocarcinoma," "carcinoma," "malignant," "tumor," combined with anatomical site terms for colon, rectum, sigmoid, cecum, appendix, and rectosigmoid junction). In the secondary manual coding step, each flagged record was reviewed to confirm histological malignancy, exclude benign polyps, dysplasia, inflammatory conditions, and metastases from non-colorectal primaries. The final cohort consisted of 1,381 confirmed primary colorectal malignancies.

2.3 Variable Coding

Diagnoses were standardized using the International Classification of Diseases for Oncology, Third Edition (ICD-O-3), for morphology coding, and ICD-10 codes for topographic site. Where sufficient staging information was documented in the pathology report, AJCC (8th edition) T, N, and M categories were recorded. Tumor grade (G1–G4) was extracted from the pathology report free text when explicitly stated. Patient age was derived from date of birth and specimen date; cases with missing age (n = 29) were retained for all non-age analyses.

2.4 Statistical Analysis

Statistical analysis was descriptive. Frequencies and proportions were computed for categorical variables (sex, site, histology, grade, city). Age was summarized as mean ± SD, median, and range. Temporal trends were analyzed by plotting annual case counts. No multivariable modelling was performed. Analyses were conducted using Python (pandas, NumPy) and charts generated with Matplotlib/Seaborn. All proportions reported in the Results are based on non-missing denominators unless otherwise stated.

3. Results

3.1 Cohort Overview

Between November 2005 and May 2026, 1,381 histologically confirmed primary colorectal malignancies were identified from 14,094 pathology specimens processed by the laboratory network. The cohort comprised 699 males (50.6%) and 682 females (49.4%), representing near-complete sex parity. Patient age was available in 1,352 cases (97.9%), with a mean of 59.6 years, a median of 60 years, and a range of 4 to 95 years. Explicit tumor grade was extractable in 1,169 cases (84.6%), and formal TNM/AJCC staging was documented in 239 cases (17.3%). The cohort characteristics are summarized in Table 1.

Table 1
Cohort characteristics summary.

Characteristic	Value
Total cases	1,381
Study period	November 2005 – May 2026 (21 years)
Male (n, %)	699 (50.6%)
Female (n, %)	682 (49.4%)
Age: mean ± range	59.6 years (range 4–95 years)
Age: median	60 years
Age available	1,352 / 1,381 (97.9%)
Tumor grade available	1,169 / 1,381 (84.6%)
TNM/AJCC stage documented	239 / 1,381 (17.3%)
Specimens screened (total)	14,094

3.2 Demographics

Sex distribution was strikingly balanced: 699 males (50.6%) versus 682 females (49.4%), with a male-to-female ratio of 1.02:1. This near-parity contrasts with the clear male predominance (M:F ≈ 1.3–1.5:1) typically reported in Western series, and is consistent with patterns observed in other MENA-region

cohorts, suggesting a possible hormonal, dietary, or microbiome-related difference in colorectal cancer (CRC) etiology in this population (Table 2).

Table 2

Sex distribution of the cohort (n = 1,381). The age distribution showed a broad peak in the sixth and seventh decades of life, consistent with the global CRC age profile. However, a notable proportion of cases occurred in younger patients: 305 cases (22.1% of those with known age) were diagnosed in patients under 50 years of age, including 82 in the 30–39 age group and 23 under the age of 30. This early-onset burden—often cited as a defining feature of CRC epidemiology in the MENA region—is substantially higher than the 10–15% typically reported in Western registries. The age distribution by decade is shown in Table 3. The high under-50 proportion warrants particular clinical attention, as early-onset CRC is more frequently associated with mismatch repair (MMR) deficiency, Lynch syndrome, and other hereditary syndromes that may be amenable to genetic counselling and cascade testing.

Sex	**n**	**%**
Male	699	50.6%
Female	682	49.4%
Total	1,381	100.0%

Table 2
Sex distribution of the cohort (n = 1,381).

Sex	n	%
Male	699	50.6%
Female	682	49.4%
Total	1,381	100.0%

Table 3
Age distribution of cases by decade (n = 1,381; age missing in 29 cases).

Age Group (years)	n	%	Cumulative %
< 30	23	1.7%	1.7%
30–39	82	6.1%	7.7%
40–49	200	14.8%	22.5%
50–59	325	24.0%	46.5%
60–69	355	26.3%	72.8%
70–79	293	21.7%	94.4%
80+	74	5.5%	99.9%
Unknown	29	2.1%	—

3.3 Geographic Distribution

Cases were distributed across 11 governorates and cities of the West Bank. Nablus dominated with 609 cases (44.1% of the total cohort), followed by Ramallah (347, 25.1%), Tulkarem (127, 9.2%), Bethlehem (108, 7.8%), and Jenin (103, 7.5%). The geographic distribution by city is presented in Table 4 and Fig. 1.

The preponderance of Nablus cases most plausibly reflects the catchment of the pathology laboratory network rather than a true incidence gradient. Major pathology referral centers affiliated with the network are located in Nablus, attracting specimens from a broad surrounding population. Nonetheless, certain population-level differences in diet, lifestyle, genetic ancestry, or access to healthcare across West Bank governorates cannot be fully excluded as contributing factors and warrant investigation in future population-based registry studies.

Table 4
Distribution of colorectal malignancy cases by city of residence (n = 1,381).

City	n	% of Total
Nablus	609	44.1%
Ramallah	347	25.1%
Tulkarem	127	9.2%
Bethlehem	108	7.8%
Jenin	103	7.5%
Hebron	46	3.3%
Qalqilia	16	1.2%
Tubas	10	0.7%
Jericho	7	0.5%
Salfit	5	0.4%
Jerusalem	3	0.2%
Total	1,381	100.0%

3.4 Anatomical Site Distribution

The largest single site category was "Colon, NOS" (535 cases, 38.7%), reflecting cases where pathology reports did not specify the colonic segment—a known limitation of retrospective free-text coding and an acknowledged data-quality issue discussed further in Section 5. Among anatomically specified sites, the left colorectum was dominant: sigmoid colon (279, 20.2%), rectum (197, 14.3%), rectosigmoid junction (82, 5.9%), and descending colon (56, 4.1%) together totaled 614 cases (44.5% of the entire cohort). Right-sided sites—ascending colon (91, 6.6%), cecum (51, 3.7%), and hepatic flexure (20, 1.4%)—together contributed 162 cases (11.7%). Transverse colon (25, 1.8%) and appendix (25, 1.8%) completed the anatomically specified distribution, while 20 cases (1.4%) fell within other/combined/unspecified colorectal sub-sites (Table 5 and Fig. 2).

The left-sided predominance is consistent with population-level data from other Middle Eastern series and contrasts with trends in some Western populations where proximal (right-sided) cancers have increased in frequency, possibly attributable to differences in screening endoscopy uptake, dietary fibre intake, and colonic microbiota composition. The large "Colon, NOS" category reflects incomplete topographic documentation in pathology reports from the earlier study period; prospective coding protocols introduced to the network from 2018 onwards have substantially reduced this ambiguity.

Table 5
Anatomical site distribution of colorectal malignancy cases (n = 1,381). ICD-10 codes: C18 = colon; C19 = rectosigmoid junction; C20 = rectum.

Anatomical Site	ICD-10 Code	n	%
Colon, NOS	C18.9	535	38.7%
Sigmoid colon	C18.7	279	20.2%
Rectum	C20	197	14.3%
Ascending colon	C18.2	91	6.6%
Rectosigmoid junction	C19	82	5.9%
Descending colon	C18.6	56	4.1%
Cecum	C18.0	51	3.7%
Transverse colon	C18.4	25	1.8%
Appendix	C18.1	25	1.8%
Hepatic flexure	C18.3	20	1.4%
Other/combined/unspecified sub-sites	Multiple/unspecified	20	1.4%
Total	—	1,381	100.0%

3.5 Histological Subtypes

Adenocarcinoma NOS (ICD-O-3: 8140/3) was the overwhelming dominant histology, comprising 1,254 cases (90.8% of the cohort). The next most frequent category was "Carcinoma, NOS" (8010/3; n = 50, 3.6%), which likely includes cases where definitive adenocarcinoma morphology was not explicitly stated in the pathology report—an artefact of variable reporting granularity across pathologists and centers over two decades. The complete histological distribution is shown in Table 6 and Fig. 3.

Signet ring cell carcinoma (8490/3) was identified in 34 cases (2.5%), a clinically significant finding given the aggressive biology and frequently advanced stage at diagnosis of this subtype [12, 13, 14]. Colorectal signet ring cell carcinoma is more common in younger patients and is associated with microsatellite instability (MSI-high) and hereditary diffuse gastric cancer syndrome in a subset of cases; the identification of 34 such cases should prompt a retrospective review with reflex MMR immunohistochemistry. Mucinous adenocarcinoma (8480/3) accounted for 21 cases (1.5%).

The non-epithelial minority—comprising gastrointestinal stromal tumor (GIST; n = 2), neuroendocrine tumor (NET; n = 2), neuroendocrine carcinoma (NEC; n = 1), malignant lymphoma (n = 9), and sarcoma NOS (n = 1)—represents 1.1% of the cohort. Although small in number, these diagnoses carry distinct clinical management pathways (e.g., imatinib for GIST, somatostatin analogues for NETs) and confirm the importance of comprehensive immunohistochemical profiling even in a resource-constrained setting.

Table 6
Histological subtype distribution with ICD-O-3 morphology codes (n = 1,381).

Histological Subtype	ICD-O-3 Code	n	%
Adenocarcinoma, NOS	8140/3	1,254	90.8%
Carcinoma, NOS	8010/3	50	3.6%
Signet ring cell carcinoma	8490/3	34	2.5%
Mucinous adenocarcinoma	8480/3	21	1.5%
Malignant lymphoma, NOS	9590/3	9	0.7%
Carcinoma, undifferentiated	8020/3	4	0.3%
GIST	8936/3	2	0.1%
Malignant neoplasm (NOS)	8000/3	2	0.1%
Neuroendocrine tumor	8240/3	2	0.1%
Sarcoma, NOS	8800/3	1	0.1%
Squamous cell carcinoma	8070/3	1	0.1%
Neuroendocrine carcinoma	8246/3	1	0.1%
Total	—	1,381	100.0%

3.6 Tumor Grade

Tumor grade was extractable from pathology reports in 1,169 of 1,381 cases (84.6%); 212 cases (15.4%) had no explicit grade statement. Among graded cases, moderately differentiated tumors (G2) dominated with 985 cases (84.3% of graded cases, 71.3% of the total cohort), consistent with the common predominance of G2 among colorectal adenocarcinomas at presentation. Poorly differentiated tumors (G3) accounted for 133 cases (11.4% of graded cases, 9.6% of total), and G1 (well differentiated) for 49 cases (4.2% of graded). Only 2 cases (0.2% of graded) were classified as G4 (undifferentiated), which is consistent with the rarity of this category and the inclusion of undifferentiated carcinoma within its own histological classification in some reporting frameworks (Table 7 and Fig. 4).

The G2 predominance reflects the general biology of colorectal adenocarcinoma NOS and is consistent with published series from comparable settings. The 133 G3 cases warrant attention from a prognostic standpoint, as poorly differentiated colorectal carcinoma is associated with higher rates of nodal and distant metastasis, poorer response to adjuvant chemotherapy in some studies, and worse five-year survival. The scarcity of G4 cases may partially reflect under-ascertainment—some undifferentiated carcinomas may have been coded as "Carcinoma, undifferentiated" under the histology field rather than as G4 in the grade field.

Table 7
Tumor grade distribution (n = 1,381; grade extractable in 1,169 cases).

Tumor Grade	Description	n	% of Total	% of Graded
G1	Well differentiated	49	3.5%	4.2%
G2	Moderately differentiated	985	71.3%	84.3%
G3	Poorly differentiated	133	9.6%	11.4%
G4	Undifferentiated	2	0.1%	0.2%
Unknown	Not documented	212	15.4%	—
Total	—	1,381	100.0%	—

3.7 Temporal Trends (2005–2026)

Annual case accrual showed a clear upward trajectory over the 21-year study period (Table 8 and Fig. 5). Only 1 case was recorded in 2005 (the first year of data capture), rising to 5 in 2006 and 14 in 2007, reflecting the progressive establishment and expansion of the pathology network. A steep rise occurred from 2008 (n = 22) to 2010 (n = 81) and 2011 (n = 86), consistent with network maturation and growing referral volumes. Case numbers plateaued and varied between 43 and 100 per year from 2012–2019, before a notable reduction during the COVID-19 pandemic period: 78 cases in 2020, 73 in 2021, and further falling to 51 in 2022 and 56 in 2023—likely reflecting disruption to elective diagnostic services, patient reluctance to attend healthcare facilities, and reduced endoscopy capacity during the pandemic [15, 16, 17, 18].

A post-pandemic rebound is clearly evident: 97 cases were recorded in 2024, and 2025 set a new single-year record of 113 cases. As of May 2026, 43 cases had been registered in the current year, placing 2026 on a trajectory for approximately 103 cases by year-end—consistent with the high recent annual rates and continued network growth. Two important interpretive caveats apply: (1) the secular increase in annual cases almost certainly reflects, in part, the progressive geographic and institutional expansion of the laboratory network, in addition to any true increase in colorectal malignancy burden; and (2) comparisons across years must account for possible changes in pathology report coding practice and the completeness of data extraction from the network database.

Table 8
Annual colorectal malignancy case counts, November 2005 to May 2026 (n = 1,381). *2026 partial year (through May 2026).

Year	Cases	Year	Cases
2005	1	2015	82
2006	5	2016	100
2007	14	2017	99
2008	22	2018	74
2009	62	2019	98
2010	81	2020	78
2011	86	2021	73
2012	43	2022	51
2013	44	2023	56
2014	59	2024	97
—	—	2025	113
—	—	2026*	43

4. Discussion

This 21-year series of 1,381 histologically confirmed colorectal malignancies from a Palestinian pathology laboratory network constitutes the largest such cohort published from the Palestinian territories and offers several insights relevant to regional cancer epidemiology. The near-equal sex distribution (M:F = 1.02:1) contrasts with the clear male predominance (typically M:F = 1.3–1.5:1) documented in Western and East Asian registries [19], but aligns with patterns observed in other MENA countries including Jordan, Egypt, and Saudi Arabia [7, 20, 21]. This sex parity has been hypothesized to reflect differences in endogenous oestrogen-related protective effects, dietary composition (particularly red and processed meat consumption patterns) [22], and possibly differences in colonoscopy access and uptake by sex within the regional healthcare system. The finding reinforces the importance of treating women as an equally high-risk group when formulating screening recommendations for this population.

The early-onset CRC signal is among the most clinically important findings of this series. With 22.1% of cases occurring before the age of 50—and 7.8% in the 30–39 age group alone—this cohort exhibits one of the highest young-onset burdens reported in the broader MENA region [8, 21]. Early-onset CRC (EO-CRC) is a biologically distinct entity: it is enriched for left-sided primary tumors (as observed in this

cohort), mismatch repair-deficient and microsatellite-instability-high (MSI-H) tumors associated with Lynch syndrome, and POLE/POLD1 mutations in some series [23, 24, 25, 26, 27]. The absence of routine MMR immunohistochemistry data in this retrospective cohort represents a major missed opportunity; prospective implementation of reflex MMR IHC on all resection specimens—and ideally on biopsies—should be considered a high priority for this network. If the MSI-H proportion is consistent with global EO-CRC data (~ 15–20%), this cohort may harbor approximately 40–60 Lynch syndrome cases, with direct implications for family-cascade testing and cancer prevention.

The left-sided dominance of anatomically specified cancers (sigmoid colon + rectum + rectosigmoid + descending colon = 44.5% of all cases) is consistent with the predominance of left-sided colorectal carcinoma historically and in contemporary MENA literature. While some high-income countries have observed a relative shift towards right-sided colorectal carcinoma over the last two decades—attributed to increasing uptake of flexible sigmoidoscopy (which protects the left colon preferentially) and rising incidence of serrated adenoma pathways [28, 29]—there is limited evidence for such a shift in this population, where endoscopy penetration remains low relative to Western healthcare systems. The large "Colon, NOS" category (38.7%), while a data-quality limitation, does not alter the qualitative left-sided predominance when distributional assumptions are applied.

From a public health perspective, the rising annual case counts—from 1 in 2005 to 113 in 2025—carry an important policy signal. Even accounting for network growth effects, colorectal malignancy burden in the West Bank appears to be rising in absolute terms, consistent with the epidemiological transition occurring across the MENA region [3, 4]. Current colonoscopy screening guidelines from major societies recommend initiation at age 45–50 [30, 31, 32]; given the 22.1% under-50 burden in this cohort, the Palestinian health authorities should consider guidance specific to this population, potentially initiating family-history screening assessments and offering symptomatic evaluation at younger ages. The 2025 record and projected 2026 trajectory also suggest that pathology and endoscopy service capacity will need to scale in parallel with rising demand.

5. Limitations

This study has several important limitations that should be considered when interpreting its findings:

- Immunohistochemistry and molecular data sparsity: MMR/MSI status, KRAS/NRAS/BRAF mutation data, HER2 amplification status, and other biomarkers relevant to systemic therapy selection are not available in this retrospective dataset. Given the early-onset burden and the high proportion of signet ring cell carcinomas, MMR IHC data would be particularly valuable.
- Incomplete topographic coding: The "Colon, NOS" category (535 cases, 38.7%) reflects cases where the colonic segment was not specified in the pathology report free text. This limits sub-site analysis and may understate true left- or right-sided predominance. Prospective synoptic reporting protocols introduced from 2018 have reduced this ambiguity in recent years, but the earlier dataset is affected.

- Lack of linked treatment and outcome data: The pathology database does not reliably capture subsequent surgery, systemic therapy, recurrence, survival, or cause-specific mortality. As a result, the study cannot evaluate prognosis, treatment patterns, or survival differences across anatomical sites and histological subtypes. Furthermore, the absence of a unique patient identifier across all network sites means that a small number of cases with specimens processed at more than one laboratory may be double-counted, and the absence of uniform linkage to complete clinical electronic medical records (EMR) across all 11 West Bank governorates—compounded by differences in database management practices over the 21-year study period—prevents longitudinal survival analysis or control for confounding variables such as comorbidity, treatment intent, and socioeconomic factors.

6. Conclusion

This 21-year retrospective analysis of 1,381 colorectal malignancies from a Palestinian pathology laboratory network represents the largest pathology-based colorectal malignancy series published from the Palestinian territories. The cohort demonstrates left-sided sigmoid/rectal predominance, a strikingly balanced sex distribution, and a meaningful young-onset burden (22.1% under 50 years of age) that exceeds typical Western registries and warrants urgent prospective investigation. The adenocarcinoma NOS histological predominance is expected; the identification of 34 signet ring cell carcinomas highlights a subgroup requiring particular attention. Annual case counts have risen sharply over the study period, with 2025 recording a series-high of 113 cases. These findings collectively support the case for expanding the pathology network into a formal population-based cancer registry for the Palestinian territories, implementing routine reflex MMR immunohistochemistry on confirmed colorectal carcinoma specimens, and revisiting screening age thresholds in light of the early-onset signal. Future prospective work should prioritize comprehensive biomarker data capture, structured synoptic reporting, and linkage with clinical outcomes data to enable survival analysis.

Declarations

Ethics Approval and Consent to Participate

This study was approved by the Institutional Review Board (IRB) of Medicare Laboratories, Palestine (approval waiver granted under retrospective de-identified data exemption). The laboratory tests included in this study were performed as part of routine physician-requested clinical investigations. Data used in this retrospective cohort analysis were extracted from the laboratory information system (LIS) in fully anonymized form, and no identifiable patient information was accessed or released. Due to the retrospective nature of the study and the use of fully de-identified data, the requirement for individual informed consent was waived by the IRB of Medicare Laboratories in accordance with institutional policy and applicable ethical standards for retrospective audit studies.

Clinical Trial Number

Clinical trial number: not applicable.

Consent for Publication

Not applicable.

Conflict of Interest

The authors declare no conflicts of interest relevant to this work.

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Author Contribution

Dr. Ibrahim Salhi and Zaidoun Salah contributed to conceptualization, data curation, formal analysis, methodology, and writing of the original draft. Dr. Husni Maqboul, Firas Jallad, Hani Jaradat, Sami Bannoura, Duaa El-Krunz, and Bashar Karmi contributed to investigation, pathological review, data interpretation, and critical review and editing of the manuscript. All authors read and approved the final manuscript.

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Data Availability

De-identified data are available from the corresponding author upon reasonable request, subject to institutional data governance approval.

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Figures

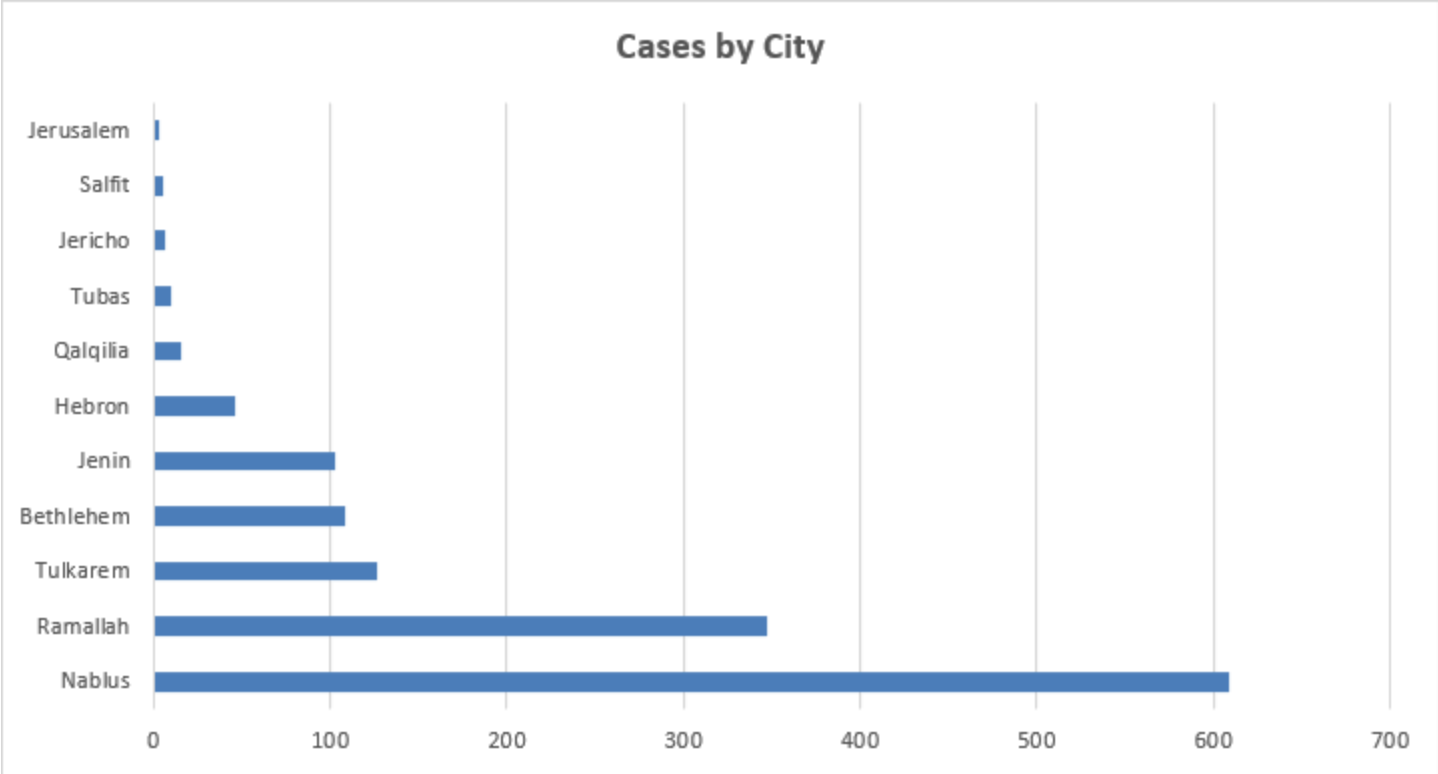


Figure 1

Geographic distribution of colorectal malignancy cases by city, 2005–2026 (n = 1,381).

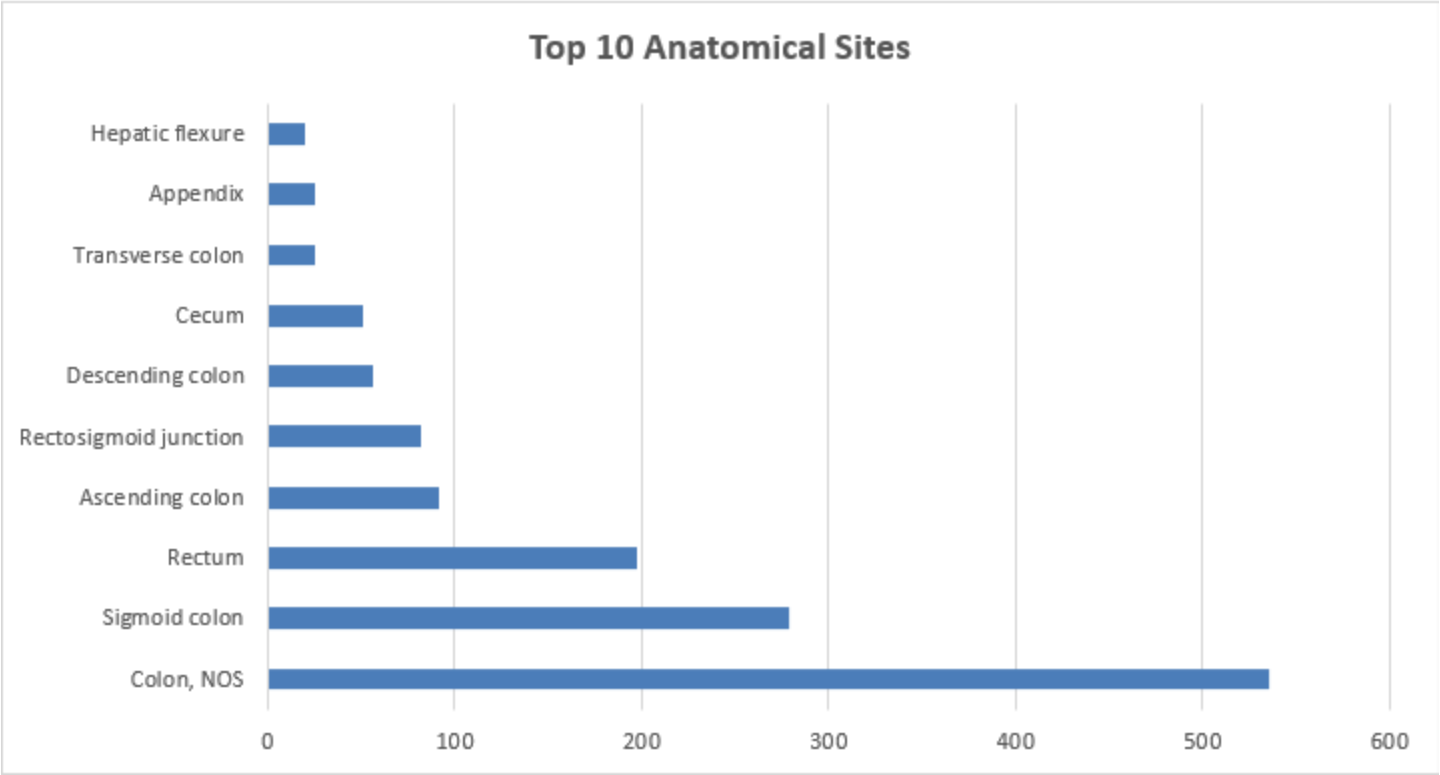


Figure 2

Anatomical site distribution of colorectal malignancy cases, 2005–2026 (n = 1,381).

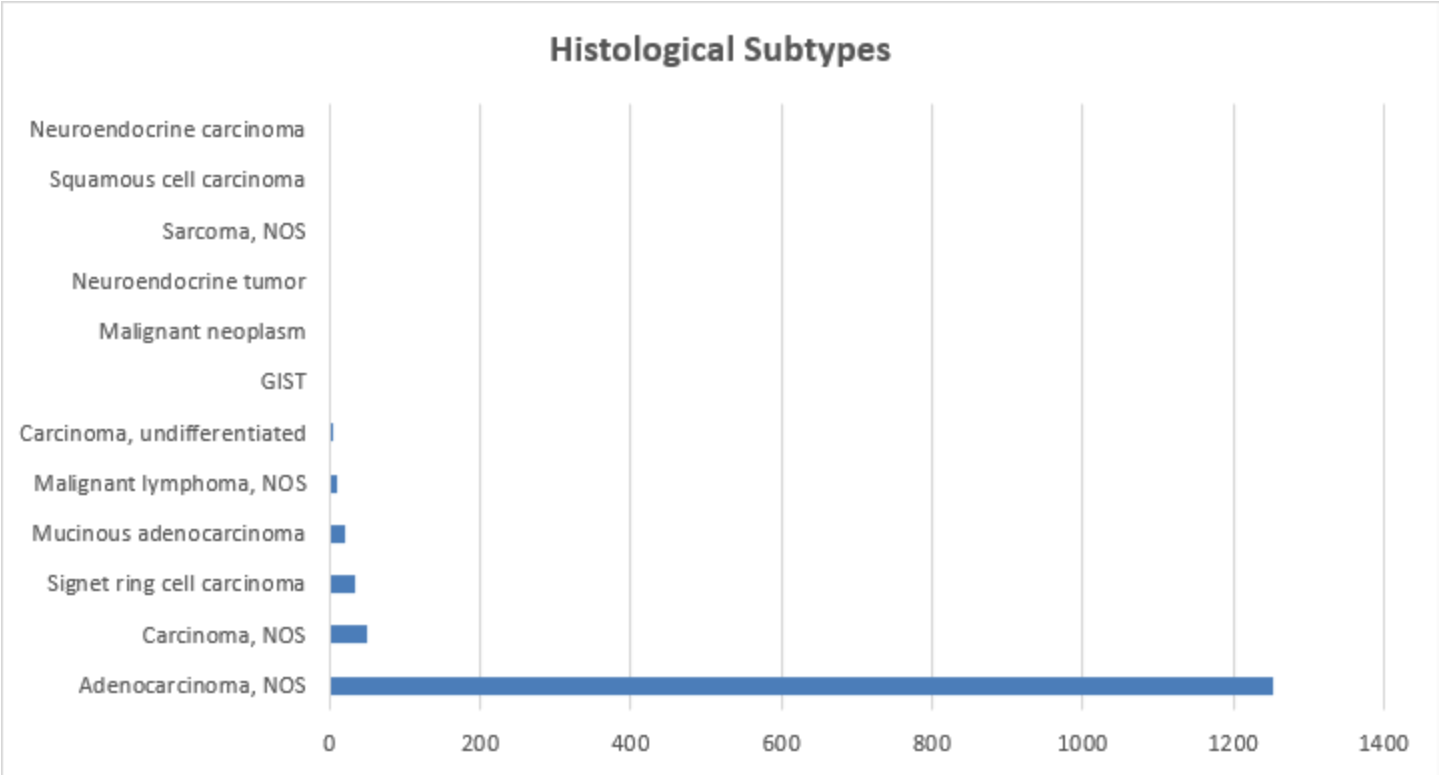


Figure 3

Histological subtype distribution of colorectal malignancy cases, 2005–2026 (n = 1,381).

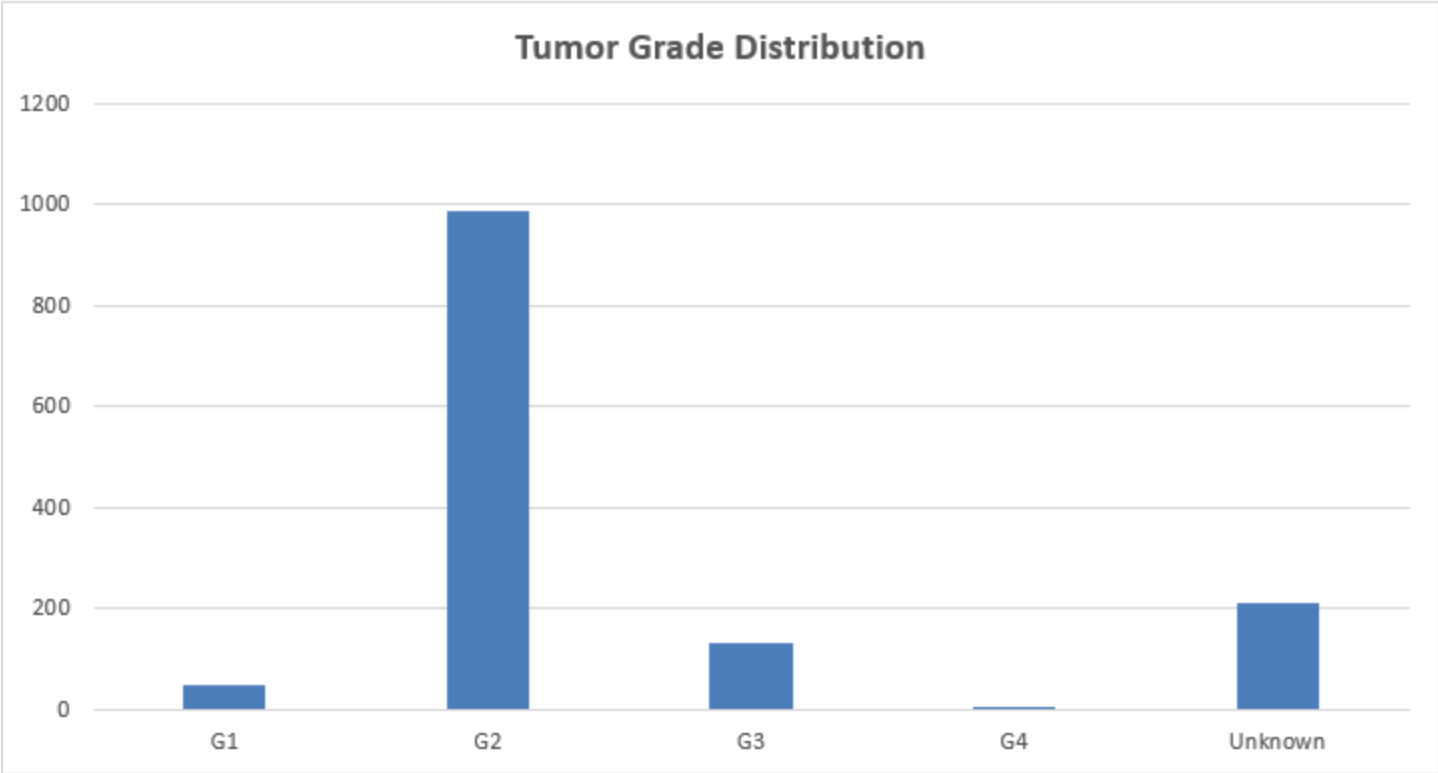


Figure 4

Tumor grade distribution of colorectal malignancy cases, 2005–2026 (n = 1,381).

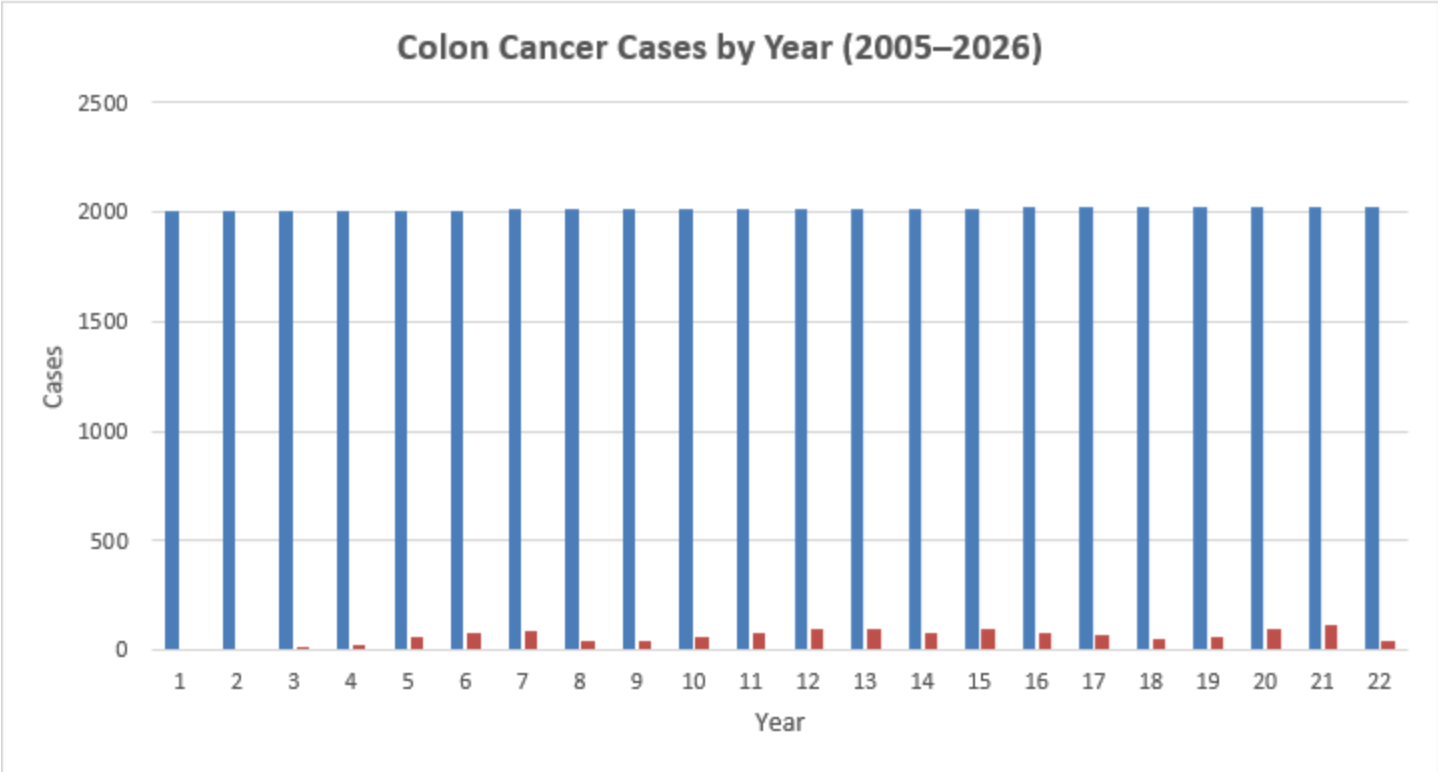


Figure 5

Annual colorectal malignancy case counts at a Palestinian pathology laboratory network, 2005–2026. Bar for 2026 represents January–May 2026 only (partial year).