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Research Article

Temporal Changes in Age at Diagnosis of Colorectal Cancer in Türkiye: A 9-Year Single-Center Analysis

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Abstract

Objectives: Although human lifespan is increasing, the global rise in the incidence of colorectal cancer at a young age has attracted considerable attention in recent years. The aim of this study is to demonstrate the temporal change in the age at diagnosis of colorectal cancer patients.

Methods: In this single-center retrospective epidemiological cohort study, data were obtained from hospital records of patients who presented to our center with a diagnosis of colorectal cancer between 2018 and 2026. The date of first presentation and age at diagnosis were determined for each patient, and duplicate records were eliminated. A total of 4,509 unique patients were included in the study. Changes in age at diagnosis over the years were analyzed using linear regression, correlation tests, and the Mann–Kendall trend test.

Results: Over the nine-year period, the median age at diagnosis decreased from 71 to 65 years. The mean age at diagnosis declined from 70.3 in 2018 to 64.4 in 2026 ($p<0.001$). Age at diagnosis decreased by an average of 0.71 years per year ($R^2=0.88$). The proportion of patients older than 70 years decreased from 55.4% to 35.6%, while the proportion of patients younger than 50 years increased from 5.6% to 11.2%.

Conclusion: A significant decline in age at diagnosis of colorectal cancer was detected. This trend is consistent with international findings of an increasing incidence of early-onset colorectal cancer and indicates that screening programs need to be reassessed.

Keywords: Age at diagnosis, colorectal cancer, early-onset cancer, incidence, trend analysis, Türkiye

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Today, cancer is one of the leading causes of death worldwide and in our country.[1] Colorectal cancer (CRC) is the third most commonly diagnosed cancer worldwide and the second leading cause of cancer-related death. According to GLOBOCAN 2022 data, approximately 1.93 million new CRC cases and 903,000 deaths were recorded globally.[2] In Türkiye, CRC is the third most common cancer for both sexes combined; according to 2024 estimates, 21,172 new cases and 10,630 deaths are expected.[3]The incidence of colorectal cancer in Türkiye has been increasing in recent years. According to the 2020 Türkiye Cancer Statistics, CRC ranks third when both sexes are considered together. Mortality rates attributable to CRC in our country remain high, and increasing early detection rates is an urgent public health priority. Socioeconomic factors, disparities in access to healthcare services, and low participation rates in screening programs are important factors that increase the burden of this disease.[3,4]In recent years, a remarkable rise

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in the incidence of early-onset colorectal cancer (EOCRC) has been observed on a global scale. EOCRC is traditionally defined as CRC diagnosed before the age of 50 years. A comprehensive analysis of population-based cancer registry data from 20 countries has shown that the increase in EOCRC is a global phenomenon, no longer confined solely to high-income Western countries.[5] In the United States, 20% of all CRC diagnoses in 2019 were made in individuals aged 54 years or younger, compared with 11% in 1995.[6] By 2030, it is projected that approximately 10% of colon cancers and nearly 25% of rectal cancers will be diagnosed in individuals younger than 50 years.[7] CRC has now become the leading cause of cancer-related death in men under the age of 50.[8]Early-onset colorectal cancer is not merely an epidemiological phenomenon; it is also a problem with serious clinical and societal consequences. EOCRC patients tend to present at a more advanced stage at diagnosis and to have more aggressive tumor biology compared with older patients. Diagnostic delay is common in young patients because both patients and clinicians tend to underestimate the likelihood of CRC in this age group. This delay leads to disease progression and limits treatment options. Furthermore, a CRC diagnosis in young individuals creates a significant economic and psychosocial burden owing to workforce loss, impact on family planning, and the effect of long-term treatment side effects on quality of life during extended survival.[9,10]This phenomenon has been largely attributed to a birth cohort effect.[11] High consumption of ultra-processed foods, red and processed meat, and sugar-sweetened beverages, along with a sedentary lifestyle and rising obesity rates, are implicated as strong risk factors.[12,13] In response to these developments, the American Cancer Society (ACS) in 2018 and the United States Preventive Services Task Force (USPSTF) in 2021 lowered the recommended starting age for average-risk CRC screening from 50 to 45 years.[14,15]Over the past three decades, significant changes in dietary habits have occurred in Türkiye. The shift from the traditional Mediterranean diet to a Western-style dietary pattern, the increase in ultra-processed food consumption, decreasing levels of physical activity, and rising prevalence of obesity indicate that CRC risk factors have become widespread in our country as well. According to the 2019 Türkiye Nutrition and Health Survey (TBSA) data, more than 30% of the adult population is obese and physical activity levels are inadequate. These changes reinforce the influence of environmental factors that increase CRC risk, particularly in younger generations.[12,13]Current and comprehensive data on the epidemiology of early-onset colorectal cancer from Türkiye are limited. Population-based cancer registry systems are not yet fully comprehensive nationwide, and hospital-based studies provide important epidemiological insights. Although single-center in nature, this cohort study covering a nine-year period and including 4,509 unique patients offers a valuable opportunity to evaluate colorectal cancer age-at-diagnosis trends in Türkiye and to interpret them within the context of the international literature. In this study, we aimed to demonstrate the temporal change in age at diagnosis of colorectal cancer patients and to evaluate these findings from a clinical and public health perspective.

Methods

Study Design and Setting

In this single-center, retrospective epidemiological cohort study, data used to evaluate hospital-based incidence trends were obtained from hospital records of patients who presented to our center and received a pathological diagnosis of colon or rectal cancer between 1 January 2018 and 31 December 2026.

Data Collection and Patient Selection

A total of 10 separate files were obtained from the hospital records system covering the years 2018–2026. Each file was examined, and duplicate records were identified using patients' national identification numbers. For each patient, the date of first presentation was taken into account, and subsequent visits were excluded. Initially, 79,800 patient records were identified; after deduplication, 75,280 duplicate records were eliminated, and a total of 4,509 unique patients were included in the study.

After the age at diagnosis was determined for each patient, patients were divided into six age groups: <40 years, 40–49 years, 50–59 years, 60–69 years, 70–79 years, and ≥80 years. Additionally, the "young patient" category (<50 years) and the "elderly patient" category (≥70 years) were evaluated separately.

Statistical Analysis

Changes in age at diagnosis over the years were analyzed using the following methods: (1) For each year, the mean, median, standard deviation, minimum, and maximum age at diagnosis were calculated. (2) Linear regression analysis was performed at both the individual level (4,509 patients) and the annual mean level (9 years); the slope, R^2 value, and p-value were calculated. (3) The Pearson correlation test (parametric) and the Spearman rho correlation test (non-parametric) were applied. (4) The Mann–Kendall monotonic trend test was applied to annual means to assess the significance of the monotonic trend. (5) The number and percentage distribution of age groups were calculated for each year.

Statistical analyses were performed using IBM SPSS Statistics for Windows, Version 26.0 (IBM Corp., Armonk, NY, USA)

for descriptive statistics, linear regression, and correlation tests (Pearson and Spearman). The Mann–Kendall trend test, which is not available in SPSS, was performed using Python 3.11 (Python Software Foundation, Wilmington, DE, USA) with the pymannkendall library. A $p<0.05$ was considered statistically significant.

Ethical Considerations

The study protocol was approved by the Marmara University Clinical Research Ethics Committee (no: 09.2026.26-0324, date: 17.07.2026) and was conducted in accordance with the principles of the Declaration of Helsinki and relevant national regulations. Given the retrospective nature of the study and the use of routinely collected data from the Hospital Information Management System, no direct patient contact or additional intervention was required. The requirement for written informed consent was waived by the Ethics Committee. Patient confidentiality was strictly maintained throughout the study. Only data relevant to the study objectives were accessed, and all analyses were performed using anonymized and/or coded data. No personally identifiable information was included in the study database, and access to the data was restricted to authorized members of the research team.

Results

Patient Demographics

Over the nine-year period (2018–2026), a total of 4,509 unique colorectal cancer patients were included in the study. The overall mean age at diagnosis was 66.6 years (median: 68 years). The annual distribution of patients was balanced (mean 501 patients/year; range: 357–609). The mean age at diagnosis decreased from 70.3 in 2018 to 64.4 in 2026 (Fig. 1). The median age at diagnosis declined from 71 to 65 years over the same period. The number of patients per year and the age-at-diagnosis statistics are presented in Table 1.

Results of Statistical Analysis

Linear regression analysis demonstrated a statistically significant decline in age at diagnosis. At the individual level (4,509 patients), age at diagnosis decreased by an average of 0.73 years per year ($p<0.001$). Regression analysis of annual means yielded a slope of −0.71 years/year, $R^2=0.877$, and $p<0.001$ (Table 2).

Pearson correlation analysis ($r=-0.142$, $p<0.001$) and Spearman correlation analysis ($\rho=-0.146$, $p<0.001$) both demonstrated a significant negative correlation. The Mann–Kendall trend test confirmed that the monotonically decreasing trend in annual means was statistically significant ($S=-32$, $p=0.0012$).

Marked changes were observed in the distribution of age groups over the years (Table 3, Fig. 2). The proportion of patients older than 70 years decreased from 55.4% in 2018 to 35.6% in 2026 (a decrease of 19.8 percentage points). Conversely, the proportion of the 50–59 age group increased from 11.5% to 19.6% (+8.1 pp), and the proportion of the 60–69 age group increased from 27.5% to 33.6% (+6.1 pp).

The proportion of young patients (<50 years) increased from 5.6% in 2018 to 11.2% in 2026 (Fig. 3). This upward trend was statistically significant (slope: +0.64 percentage points/year, $p=0.031$).

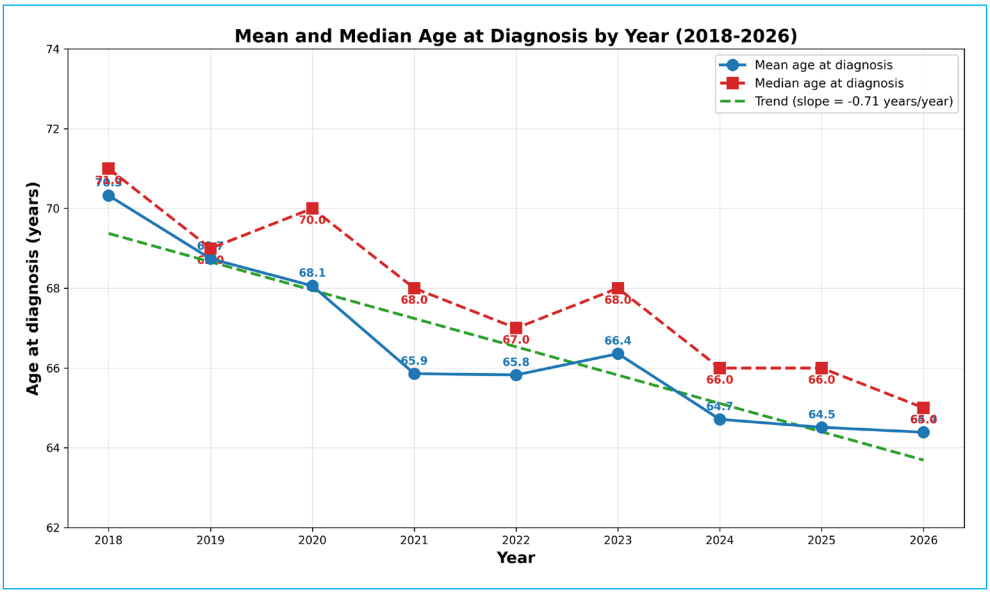

Figure 1. Mean and median age at diagnosis of colorectal cancer by year (2018–2026). The dashed green line shows the linear trend calculated from annual means (slope = −0.71 years/year; R^2 = 0.877; $p<0.001$). The mean age at diagnosis declined from 70.3 to 64.4 years.

Table 1. Number of patients and age at diagnosis statistics by year (2018–2026)

Year	n	%	Mean	Median	SD	Min	Max
2018	520	11.5	70.3	71.0	12.1	23	96
2019	609	13.5	68.7	69.0	13.4	19	101
2020	470	10.4	68.1	70.0	13.6	19	98
2021	501	11.1	65.9	68.0	13.3	19	99
2022	485	10.8	65.8	67.0	13.5	21	98
2023	542	12.0	66.4	68.0	12.5	27	94
2024	486	10.8	64.7	66.0	12.7	20	98
2025	539	12.0	64.5	66.0	12.2	27	96
2026	357	7.9	64.4	65.0	12.1	19	92
Total	4,509	**100**	**66.6***	**68**	-	-	-

SD: Standard deviation. *Overall mean age at diagnosis for the entire cohort. 2026 data represents partial data not covering the full year.

Table 2. Results of statistical analysis of the temporal change in age at diagnosis

Test	Level	n	Slope / Coefficient	R^2	p
Linear regression	Individual	4,509	−0.73 years/year	0.020	<0.001
Linear regression	Annual mean	9	−0.71 years/year	0.877	<0.001
Pearson correlation	Individual	4,509	$r = -0.142$	-	<0.001
Spearman correlation	Individual	4,509	$\rho = -0.146$	-	<0.001
Mann–Kendall	Annual mean	9	$S = -32$	-	0.0012
Linear regression	<50 years rate	9	+0.64 percentage points/year	0.51	0.031

Slope unit: years/year (regression) or percentage points/year (young patient trend). R^2: Coefficient of determination. A negative Mann–Kendall S statistic indicates a decreasing trend.

Table 3. Patient distribution by age group (n, %)

Year	<40	40–49	50–59	60–69	≥70
2018	7 (1.3)	22 (4.2)	60 (11.5)	143 (27.5)	288 (55.4)
2019	13 (2.1)	43 (7.1)	80 (13.1)	170 (27.9)	303 (49.8)
2020	16 (3.4)	27 (5.7)	74 (15.7)	117 (24.9)	236 (50.2)
2021	17 (3.4)	43 (8.6)	85 (17.0)	130 (25.9)	226 (45.1)
2022	16 (3.3)	48 (9.9)	79 (16.3)	132 (27.2)	210 (43.3)
2023	14 (2.6)	44 (8.1)	87 (16.1)	154 (28.4)	243 (44.8)
2024	16 (3.3)	50 (10.3)	80 (16.5)	150 (30.9)	190 (39.1)
2025	17 (3.2)	48 (8.9)	99 (18.4)	175 (32.5)	200 (37.1)
2026	11 (3.1)	29 (8.1)	70 (19.6)	120 (33.6)	127 (35.6)
Δ (pp)	+1.8	+3.9	**+8.1**	**+6.1**	-19.8

Percentages are based on row totals and may deviate slightly from 100 due to rounding. Δ: 2026 – 2018 percentage point difference.

Discussion

In this single-center cohort study, we detected a statistically significant decrease in colorectal cancer age at diagnosis and a marked increase in the proportion of young patients between 2018 and 2026. The decline of the mean age at diagnosis from 70.3 to 64.4 years within nine years is consistent with the early-onset colorectal cancer (EOCRC) trend re-

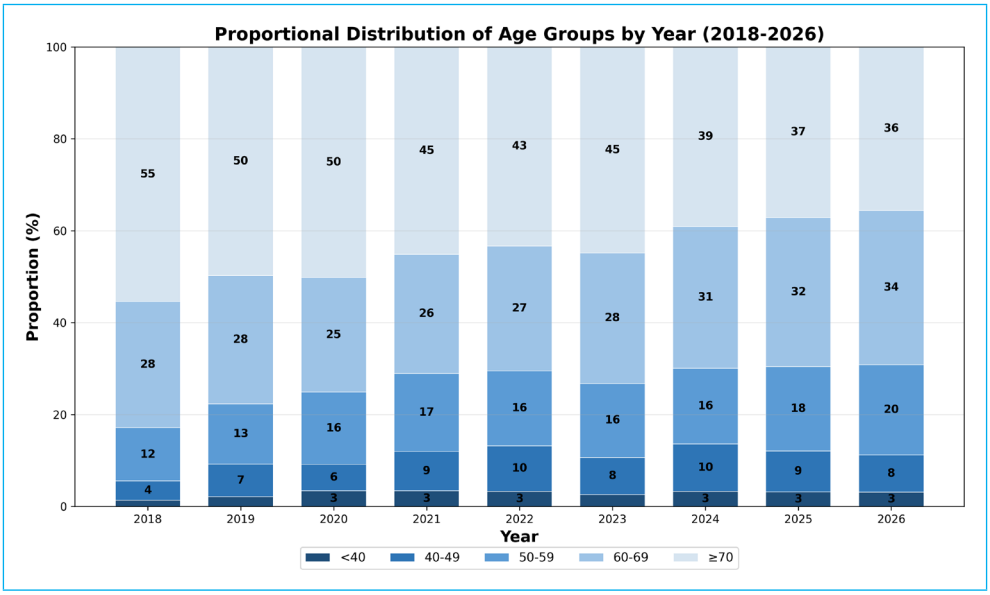

Figure 2. Proportional distribution of age groups by year (stacked bar chart, 2018–2026). The share of the ≥70 age group declined from 55.4% to 35.6%, while the proportion of the 50–69 age range increased markedly.

ported in the international literature. In the analysis by Vuik et al.[5] covering 50 countries, incidence rates in the 25–49 age group increased in 27 of the countries studied. In the United States, the CRC diagnosis rate in young patients has nearly doubled over the past 25 years.[5-7]The mean age at diagnosis detected in our study (66.6 years) is consistent with values reported from population-based SEER data in the United States (range: 65–70 years). This concordance supports the notion that our single-center data reflect the overall epidemiological trend.[16]The etiology of the increasing incidence of EOCRC is multifactorial. High consumption of ultra-processed foods, red and processed meat, and sugar-sweetened beverages have been identified as strong risk factors. The spread of Western-style dietary habits in Türkiye and declining physical activity levels may be contributing to this trend.[12,13] Obesity is an independent risk factor for both colorectal cancer risk and poor prognosis in young patients. Changes in the gut microbiome, early-life antibiotic use, and diet-induced dysbiosis may also promote mucosal inflammation.[12,13,17]Approximately 20–30% of EOCRC cases can be

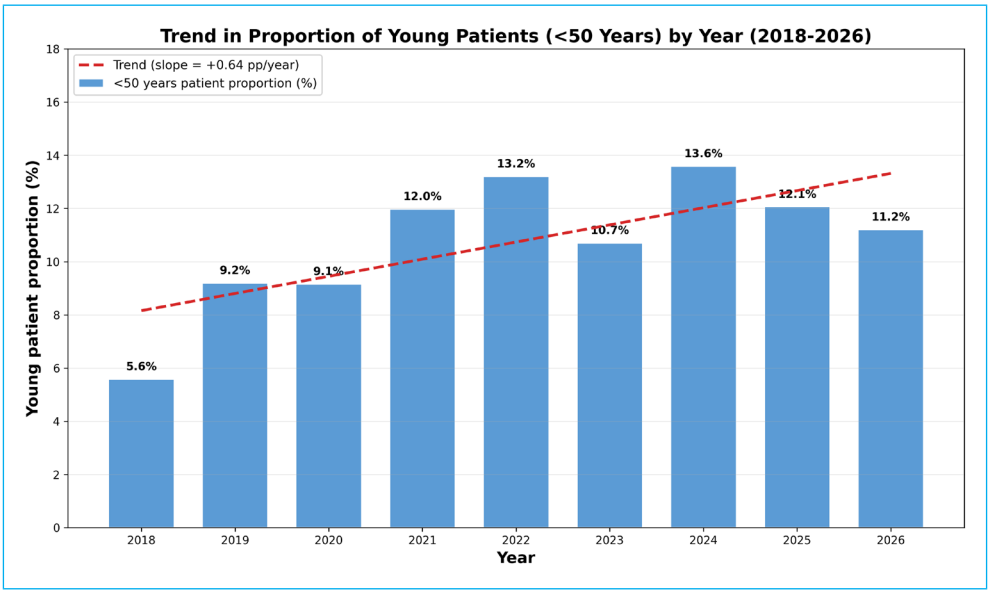

Figure 3. Trend in the proportion of young patients (<50 years) by year (2018–2026). The proportion increased from 5.6% to 11.2% (slope = +0.64 percentage points/year; $R^2 = 0.51$; p=0.031).

attributed to hereditary syndromes such as Lynch syndrome and familial adenomatous polyposis. In young patients, the prevalence of pathogenic germline variants in genes such as TP53, APC, and ATM is higher than in older patients.[18,19]

Environmental Risk Factors and Their Reflections in Türkiye

The socioeconomic transformation and urbanization observed in Türkiye over recent decades have had significant effects on dietary habits. The shift from the traditional Mediterranean diet to a Western-style diet based on high intake of processed foods and red meat is evident.[20] This dietary change parallels the increase in the prevalence of obesity and metabolic syndrome in our country; according to current data, the prevalence of metabolic syndrome has reached 43.3% (50.4% in women, 35.4% in men).[20] Declining levels of physical activity and the widespread adoption of a sedentary lifestyle further worsen this risk profile.[11] Changes in gut microbiota composition driven by a Western diet and the resulting dysbiosis are emerging as important factors in EOCRC pathogenesis.[17,21]

Screening Programs and Clinical Importance

These findings indicate that the age thresholds of colorectal cancer screening programs in Türkiye need to be reassessed. The American Cancer Society lowered the recommended starting age for average-risk CRC screening from 50 to 45 years in 2018, and the USPSTF did the same in 2021. Following these guideline changes, CRC screening rates in the 45–49 age group in the United States increased by 62% between 2019 and 2023, and an increase in the detection of localized-stage tumors in this group was documented.[14,15]The increase in the proportion of the 40–49 age group from 4.2% in 2018 to 8.1% in 2026 in our study supports the potential benefit of lowering the screening age threshold to 45 years in Türkiye as well. The current age thresholds and coverage rates of the Cancer Early Diagnosis, Screening and Education Centers (KETEM) program of the Turkish Ministry of Health should be evaluated in light of these findings.[22]The Turkish Ministry of Health provides cancer screening services through the KETEM program; however, CRC screening rates are still far below the targeted level. According to 2023 data, the CRC screening participation rate in the target population is below 15%. This low participation rate is attributable to multifactorial causes, including access to healthcare services, lack of awareness, and cultural barriers.[22] Our findings indicate that lowering the screening age threshold to 45 years should be considered in Türkiye. However, stratified approaches must be developed to strengthen the existing screening infrastructure, increase screening participation rates, and screen individuals with risk factors (family history, obesity, metabolic syndrome, inflammatory bowel disease) at even younger ages. Increasing colonoscopy capacity, promoting non-invasive methods such as the fecal immunochemical test (FIT), and evaluating multitarget stool DNA testing are of importance. In addition, educational programs to increase awareness among physicians and the public regarding the symptoms of CRC in young individuals are critically important.

Clinical Characteristics in Young Patients and Prevention Strategies

The clinical profile of EOCRC differs from that of older adults in several respects. Young patients are more likely to be diagnosed at a regional or distant metastatic stage. Diagnostic delay is a known contributing factor: symptoms such as rectal bleeding, abdominal pain, and changes in bowel habits are frequently overlooked in young individuals. Therefore, increasing the awareness of both physicians and the public regarding colorectal cancer symptoms in young patients is of critical importance.[9,10]Primary prevention strategies are as vital as secondary prevention (screening). Obesity, physical inactivity, smoking, and alcohol use are modifiable risk factors that should be targeted through public health interventions.[23,24] Updating national nutrition policies, providing healthy nutrition education in schools, introducing regulatory measures to reduce ultra-processed food consumption (taxation, labeling), promoting physical activity through urban planning, and strengthening tobacco control programs are all necessary. Instilling healthy lifestyle behaviors in young individuals from an early age will play a key role in reducing the burden of EOCRC in future generations. Updating the Türkiye Dietary Guidelines and improving their feasibility should be a public health priority.

There is an urgent need for population-based, multicenter cohort studies from Türkiye. Increasing the comprehensiveness of the national cancer registry system and improving data quality will enable reliable monitoring of epidemiological trends. Future studies should systematically evaluate tumor localization (proximal vs. distal colon, rectum), histological subtypes, molecular characteristics (microsatellite instability, BRAF/KRAS mutations), family history, and the frequency of hereditary syndromes.[19, 25] Analysis of the causes of diagnostic delay in young patients and identification of healthcare system and patient factors are important. In addition, mechanistic studies examining the interactions between gut microbiota profile, genetic susceptibility, and environmental exposures in the Turkish population will contribute to understanding the etiology of EOCRC.[17,26]The most important limitation of this epidemiological study is that the data come from a single center and therefore do

not reflect population-based incidence rates. The observed shift in age at diagnosis may also have been shaped by factors such as referral patterns, diagnostic delay, and changes in the age-group composition of the regional population. This institutional signal warrants systematic investigation within a population-based framework.

Future research should link to Turkish cancer registry data to determine whether this institutional change reflects population incidence. In addition, systematic collection of data on hereditary syndrome status, family history, tumor localization, stage at diagnosis, and histological subtypes is important.

Conclusion

In this 9-year epidemiological cohort study (2018–2026), a statistically significant decline in colorectal cancer age at diagnosis (0.71 years per year; $p<0.001$) and an increase in the proportion of young patients were detected. These findings are consistent with the international EOCRC trend and are clinically significant. Age thresholds for colorectal cancer screening programs in Türkiye, awareness regarding young patients, and risk stratification should be reassessed. Primary prevention strategies (healthy diet, physical activity, smoking cessation) and secondary prevention (screening programs) should be strengthened.

Disclosures

Ethics Committee Approval: The study was approved by the Marmara University Clinical Research Ethics Committee (no: 09.2026.26-0324, date: 17.07.2026).

Informed Consent: The requirement for written informed consent was waived by the Ethics Committee due to the retrospective nature of the study.

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