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Colorectal Cancer in the Older Adults: Incidence, Clinical Characteristics, and Comparative Outcomes in Patients Aged 75 and Above

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ISBN

9798171612368

Author

Li, Jinyi

Publication Date

2026-10-26

Peer reviewed|Thesis/dissertation

UNIVERSITY OF CALIFORNIA,
IRVINE

Colorectal Cancer in the Older Adults: Incidence, Clinical Characteristics, and
Comparative Outcomes in Patients Aged 75 and Above

THESIS

submitted in partial satisfaction of the requirements
for the degree of

MASTER OF SCIENCE
IN EPIDEMIOLOGY

by Jinyi Li

Thesis Committee:
Professor Joel milam, Chair
Professor Luohua Jiang
Visiting Professor Samah Hayek

2026

Dedication

To my parents,

Thank you for your love and encouragement. None of these would have been possible without you.

To my friends,

Thank you for standing beside me, and for making this journey a little less lonely.

To my cutest cat,

Thank you for the companionship during long nights.

And to JYPE artists, whose music inspired me to keep moving forward, thank you for giving me strength on the days when motivation was hard to find.

This thesis is dedicated to all of you.

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Acknowledgement

I would like to express my sincere gratitude to my committee members, Dr. Joel Milam, Dr. Luohua Jiang, and Dr. Samah Hayek, for their guidance, thoughtful feedback, and support throughout this research. Their expertise and valuable insights greatly contributed to the development and completion of this work.

I am especially grateful for their time, encouragement, and suggestions, which helped strengthen both the direction and quality of this study. It has been a privilege to learn from and work with them throughout this process.

Abstract

Colorectal Cancer in the Older Adults: Incidence, Clinical Characteristics, and Comparative Outcomes in Patients Aged 75 and Above

by

Jinyi Li

Master of Science in Epidemiology

University of California, Irvine, 2026

Professor Joel Milam, Chair

Background: Colorectal cancer (CRC) is a major health problem globally. Among older adults, the burden is particularly substantial, yet there is a lack of evidence comparing clinical presentation, comorbidity burden, and treatment patterns between older-onset colorectal cancer (OLDCRC) and late-onset colorectal cancer (LOCRC).

Methods: This study used electronic health record (EHR) data from the University of California Health Data Warehouse (UCHDW). Late-onset CRC patients (50–74 years) and older CRC patients (75–90 years) were identified and matched at a 1:2 ratio based on gender, year of diagnosis, and UCHDW enrollment duration before cancer diagnosis. A secondary 1:2 matched cohort compared older CRC patients to individuals without CRC (NOCRC). Demographic characteristics, tumor location, comorbidity profiles, diagnostic and surgical procedures, and treatment patterns were compared using descriptive statistics and chi-square tests. A loglinear regression was performed to evaluate the association between age cohort and acute clinical presentation, using emergency room visits and inpatient admissions as proxies.

Results: Compared with late-onset CRC patients, older CRC patients had a greater burden of several age-related comorbidities but were less likely to undergo diagnostic screening and cancer treatment. Compared with patients without CRC, older CRC patients demonstrated a greater utilization of CRC-related diagnostic screenings. Although no significant difference in acute healthcare utilization was observed between age cohorts after adjusting for comorbidities, several chronic comorbidities, including type II diabetes, obesity, hypertension, hyperlipidemia, myocardial infarction, and stroke were independently associated with increased healthcare utilization, highlighting the importance of overall medical complexity rather than CRC age alone.

Conclusion: Older adults with CRC exhibit distinct epidemiologic and clinical characteristics compared with patients with late-onset CRC. These findings improve understanding of CRC in older adults and provide real-world evidence to support more age-appropriate screening, diagnostic evaluation, and treatments.

(275 words)

Introduction

Colorectal cancer (CRC) remains a major public health challenge and one of the leading causes of cancer-related mortality worldwide.^{1,2} The risk of CRC increases with age, particularly after age 50.³ Current U.S. Preventive Services Task Force guidelines recommend routine CRC screening for adults aged 50 to 74 years, and a decline of incidence rate has been observed in some populations.^{4,5} This decline has been attributed to the widespread CRC screening programs, which facilitate earlier detection and polyp removal.^{6,7,8} However, screening for individuals aged 75 to 85 years is more selectively offered based on individual health status and prior screening history.^{9,10} Screening may only be appropriate for older adults who remain in good health and have adequate life expectancy to realize potential benefits.^{11,12} Less attention has been given to CRC diagnosed in older adults, particularly those aged 75 years and above (OLDCRC).

This knowledge gap is concerning, as aging is often accompanied by comorbid conditions and functional decline, and physiological changes. These together may have increased implications for cancer care. The burden of cancer in older adults has intensified over the past decade, with mortality rates rising by approximately 15% between 2010 and 2024.¹³ Beyond the index cancer, older adults frequently present with cardiovascular disease, metabolic disorders, depressive symptoms, and functional impairments that accumulate with age.^{14,15} Frail patients are at greater risk for severe treatment-related toxicity, requiring careful balancing of oncologic efficacy against potential harms.^{16,17} These age-related conditions may complicate cancer detection, clinical management, and treatment decisions.^{16,18} Overall,

limited evidence exists regarding how these factors vary between late-onset and older CRC populations. As the U.S. population continues to age at an unprecedented rate, there is a growing need to better characterize CRC in the oldest adults and to generate robust evidence that can support more nuanced, individualized clinical decision-making.

To address these knowledge gaps, this study had three primary objectives. First, we aimed to estimate the incidence rate of colorectal cancer among older adults, with a particular focus on those aged 75 and above. Second, we seek to compare demographic characteristics and comorbidity profiles between patients with late-onset colorectal cancer (LOCRC, age 50–74) and those older patients with CRC. Third, we evaluated age-specific differences in clinical presentation, using emergency healthcare visits as a proxy for presentation acuity. By leveraging a large real-world electronic health record (EHR) dataset, we seek to improve understanding of age-related differences in the incidence and to inform age-appropriate CRC management for older adults.

We hypothesized that older CRC patients would differ significantly from LOCRC across multiple domains. First, we anticipated that OLDCRC patients would present with a higher comorbidity burden, particularly with respect to cardiovascular and metabolic conditions. Second, we expected that that older CRC patients would receive less aggressive treatment, including lower rates of surgery and chemotherapy. Third, we hypothesized that older CRC patients would be more likely to present acutely, as reflected by a higher frequency of emergency department visits and unplanned hospitalizations around the time of diagnosis.

Methods

Data Sources

This study was conducted using data from University of California Health Data Warehouse (UCHDW), which aggregates EHR data from all six UC academic health centers. It is designed to support clinical and translational research and enable population health analysis. The data are standardized using the Observational Medical Outcomes Partnership (OMOP) Common Data Model, allowing consistent collaboration across state and national institutions.¹⁹

Study Population

The study population selection process was described in **Figure 1**. A total of 11,196,199 individuals were identified from UCHDW. Individuals with a prior diagnosis of inflammatory bowel disease (IBD) were excluded to reduce potential confounding due to underlying chronic gastrointestinal conditions associated with CRC risk.^{20,21,22} In addition, patients with missing demographic information and diagnosis record were excluded. Based on age of diagnosis, 24,486 eligible patients with CRC were included in the study and classified into the LOCRC (n = 14,880) and OLDCRC (n = 5,348) cohorts.

For the primary analysis, older patients with CRC cohort were matched to those in the late-onset CRC cohort at a 1:2 ratio based on gender, year of CRC diagnosis, and duration of enrollment before diagnosis. In a separate analysis, patients in OLDCRC were matched to individuals without CRC (NOCRC) at a 1:2 ratio based on gender, year of birth, enrollment

start year, and enrollment period. Consequently, the final matched cohorts consisted of 12,048 individuals in the primary analysis and 12,444 individuals in the secondary analysis.

Study Variables

Demographic characteristics included gender, race/ethnicity, year of birth, and age at CRC diagnosis. Clinical characteristics included tumor location and a history of selected comorbidities: type II diabetes, obesity, hypertension, hyperlipidemia, myocardial infarction, and stroke. All comorbidities were required to be documented prior to CRC diagnosis.

Screening and diagnostic procedures captured included endoscopy (includes colonoscopy, sigmoidoscopy, and biopsy), fecal immunochemical test (FIT), and CT colonography.

Surgical interventions included colectomy and colostomy. Diagnostic procedures were included if they occurred within the 24 months preceding CRC diagnosis. Procedures on the diagnosis date were also included, as they were considered part of the diagnostic workup.

Surgeries were included if they were done after CRC diagnosis. Cancer treatments were included if they were initiated on or after the CRC diagnosis date. Treatments started on the same day as diagnosis were included, since these typically represent immediate adjuvant or neoadjuvant therapy.

To evaluate the association between age cohort and clinical presentations, we used acute healthcare utilization as the outcome proxy. Acute healthcare utilization was defined as the number of emergency department visits and unplanned hospitalizations occurring within 12 months before the CRC diagnosis. More frequent acute care visits reflect a more severe or complex clinical presentation at diagnosis.

All study variables were identified using standardized concept definitions and concept IDs within the Observational Medical Outcomes Partnership (OMOP) Common Data Model. Concept definitions were obtained from the OHDSI Athena vocabulary website (<https://athena.ohdsi.org>). Diagnosis were identified using standardized SNOMED, ICD-9-CM, and ICD-10-CM codes, while procedures and treatments were identified using the corresponding OMOP vocabularies.

Statistical Analysis

Annual incidence rates of CRC were calculated from 2013 to 2024 by dividing the number of newly diagnosed CRC cases by the annual eligible enrolled population. Incidence rates were stratified by sex and race/ethnicity. Baseline characteristics were summarized using descriptive statistics. Categorical variables were reported as frequencies and percentages, and differences between cohorts were compared using the chi-square test. Multivariable loglinear regression models were fit adjusting for demographic characteristics and comorbidities.

Adjusted IRR with 95% confidence intervals (CIs) were reported.

All statistical tests were two-sided, and a P value < 0.05 was considered statistically significant. Analysis was performed using R (version 4.3.2) on Databricks.

Results

Annual incidence rates of older CRC patients are summarized in **Table 1a-b**. Throughout the study period, incidence rates remained consistently higher among males than females. By race/ethnicity, Non-Hispanic White contributed the greatest number of incident cases, whereas Non-Hispanic Black had the smallest population. However, Non-Hispanic Asian consistently experienced the highest incidence rates per 100,000 population, exceeding those observed in all other racial and ethnic groups. Across both gender, incidence rates decreased during 2020–2022, followed by a modest rebound in 2023 and 2024.

After matching, the primary cohort consisted of 4,016 older CRC patients and 8,032 late-onset CRC patients. For the secondary analysis, 4,148 older CRC patients were matched to 8,296 non-CRC individuals. Baseline demographic and clinical characteristics of the primary cohort are shown in **Table 2a**. The two cohorts had identical gender distributions, with females accounting for 50.1% of both cohorts. Differences were observed in race and ethnicity, in the older CRC cohort including a higher proportion of Hispanic patients (13.2% vs. 7.8%) and the older CRC cohort including a slightly higher proportion of non-Hispanic Asian patients (14.6% vs. 12.7%).

Table 2b presents the demographic and clinical characteristics of older patients with CRC and the matched non-CRC cohort. Compared with the non-CRC cohort, patients with older CRC had a slightly higher proportion of non-Hispanic Asian (15.1% vs. 9.9%) individuals and a lower proportion of patients with unknown race/ethnicity (10.5% vs. 20.4%). Tumor location differed between the two cohorts. Compared with late-onset CRC patients, older patients with CRC had a higher proportion of right-sided tumors (14.5% vs. 9.5%) and a

lower proportion of left-sided tumors (30.6% vs. 44.5%). Rectal cancer remained the most common left-sided tumor in both cohorts, whereas right-sided lesions, were more frequently observed in older patients with CRC.

The prevalence of pre-existing comorbidities differed significantly between older CRC patients and late-onset CRC patients. Overall, older patients with CRC exhibited a greater burden of chronic conditions than those with late-onset CRC in **Table 3a**. Specifically, the prevalence of diabetes was higher among older patients with CRC than those with late-onset CRC (36.5% vs. 33.3%). Similarly, hypertension (68.4% vs. 53.5%), hyperlipidemia (57.8% vs. 48.4%), myocardial infarction (12.0% vs. 7.3%), and stroke (20.1% vs. 8.9%) were more common among older patients with CRC. In contrast, obesity was more prevalent among patients with late-onset CRC than those older patients with CRC (19.6% vs. 11.0%). All comparisons were statistically significant ($P < 0.05$).

When compared with non-CRC individuals, older patients with CRC demonstrated a consistently higher prevalence of all evaluated comorbidities in **Table 3b**. Hypertension and hyperlipidemia were the most prevalent comorbidities in both cohorts, with higher frequencies among older vs. late onset CRC patients (70.5% vs. 48.1% and 60.2% vs. 42.9%, respectively). All observed differences were statistically significant ($P < 0.05$).

Table 3a presents significant differences in diagnostic and surgical management between older patients with CRC and late-onset CRC patients. Compared with late-onset CRC patients, older patients with CRC were less likely to undergo endoscopy (71.1% vs. 84.7%). CT colonography was also performed less frequently among older patients with CRC than late-onset CRC patients (35.9% vs. 43.8%). In contrast, fecal immunochemical testing (FIT)

was slightly more common among older patients with CRC (16.0% vs. 13.4%). Differences in surgeries were observed as well. Older patients with CRC were less likely to undergo colectomy than those with late-onset CRC patients (30.7% vs. 41.9%). Similarly, colostomy was performed less frequently among older patients with CRC (20.0% vs. 25.4%). All comparisons were statistically significant ($P < 0.05$).

Diagnostic procedures and surgical interventions between older patients with CRC and non-CRC individuals were shown in **Table 3b**. Endoscopy was performed in 72.0% of patients with older patients with CRC compared with 26.7% of individuals without CRC. Likewise, FIT (17.7% vs. 9.8%) and CT colonography (53.3% vs. 19.0%) were significantly more common among older patients with CRC. Furthermore, surgical procedures are more frequent among older patients with CRC, with colectomy performed in 31.5% of patients compared with 3.8% of individuals without CRC and colostomy performed in 20.4% and 0.5% of the two cohorts, respectively. All differences were statistically significant ($P < 0.05$).

Table 3a also demonstrated cancer treatment differences between patients for both analyses. Overall, older patients with CRC were less likely to receive systematic cancer treatments than those with late-onset CRC. Chemotherapy was administered to 22.6% of older patients with CRC compared with 34.1% of late-onset CRC patients, while radiotherapy was received by 14.2% and 18.7% of patients, respectively. Older patients with CRC consistently had lower utilization of commonly prescribed cancer-related drugs (all $P < 0.05$).

Table 5 presents the multivariable log-linear regression analysis evaluating factors associated with acute healthcare utilization. After adjustment for race/ethnicity and comorbidities, age cohort (OLDCRC vs. LOCRC) was not significantly associated with acute healthcare

utilization (adjusted IRR = 0.932, 95% CI: 0.851–1.019, $P = 0.125$). In contrast, several comorbidities were independently associated with greater acute healthcare utilization.

Patients with hypertension had the strongest association, with a 2.60-fold higher rate of acute healthcare utilization (adjusted IRR = 2.600, 95% CI: 2.327–2.904, $P < 0.05$). Myocardial infarction was strongly associated with increased utilization (adjusted IRR = 2.341, 95% CI: 2.013–2.711, $P < 0.05$), followed by stroke (adjusted IRR = 1.631, 95% CI: 1.413–1.874, $P < 0.05$). Diabetes (adjusted IRR = 1.216, 95% CI: 1.089–1.358, $P < 0.05$) and obesity (adjusted IRR = 1.234, 95% CI: 1.081–1.406, $P < 0.05$) were independently associated with increased acute healthcare utilization too.

Discussion

In this study, we characterized the incidence trend, demographic characteristics, comorbidity profiles, diagnostic procedures, treatment patterns, and acute healthcare utilization among older adults with CRC. We observed a decline in the incidence of older patients with CRC during 2020–2022, followed by a rebound in 2023–2024. This temporary fluctuation in incidence occurred following the COVID-19 pandemic, likely reflecting government restrictions concerning CRC screening, diagnostic services, and healthcare utilization.^{23,24,25} The rebound observed after 2022 likely reflect the recovery of healthcare services following pandemic-related restrictions, with modest improvement in Q1 2023 compared with 2022 levels in Melnick and Maerki’s study.²⁶ Additionally, incidence rates remained consistently higher among males than females, consistent with published epidemiologic research.^{27,28} This gender difference in CRC risk may be mediated by behavioral factors, as males tend to have a higher prevalence of cigarette smoking and alcohol intake, both independent risk factors for CRC.^{29,30,31} There was a greater burden of chronic comorbidities among older patients with CRC. Compared with both patients with late-onset CRC and matched individuals without CRC, older patients with CRC exhibited higher prevalences of diabetes, hypertension, hyperlipidemia, myocardial infarction, and stroke. These findings are consistent with previous studies stating that multimorbidity increases with age and represents a major challenge in the management of older adults with cancer.^{32,33,34} Multimorbidity has been associated with poorer functional status and reduced tolerance to cancer therapy, emphasizing the importance of comprehensive assessment before treatment initiation.

We observed a lower application of diagnostic procedures, surgical management, and cancer treatments among older patients with CRC. Similar observations have been reported in other studies that older adults receive less intense cancer therapies because of increased frailty, a geriatric syndrome characterized by decreased physiological reserve and increased vulnerability to stressors.^{16,34} Both Ioffe and Dotan and Millan et al. demonstrated that older adults with cancer are at increased risk for treatment-related toxicity, which may contribute to the less aggressive treatment patterns observed in this population.^{35,36} Current ASCO guidelines further emphasize that treatment decisions should incorporate comprehensive geriatric assessment, including evaluation of physical function, comorbidities, cognition, nutrition, polypharmacy, and social support.³⁷ Future research on patient preferences and shared decision-making may improve the alignment between treatment intensity and individual goals of care.

Our hypothesis that older age would predict greater acute healthcare utilization was not fully supported in the adjusted model. After accounting for race/ethnicity and comorbidities, age cohort was no longer significantly associated with the outcome. Rather, diabetes, obesity, hypertension, myocardial infarction, and stroke remain significant independently. This pattern suggests that the observed increase in acute healthcare utilization among older adults is largely influenced by their higher comorbidity burden rather than age itself. Some previous studies have the similar results that cancer survivors with multiple comorbidities are at risk for various care across specialties and polypharmacy-related medications.^{38,39} Both factors may contribute to higher rates of hospital utilization and increased healthcare costs. These

findings brought important support to the geriatric oncology that treatment planning for older cancer patients should emphasize more on comorbidity assessment and functional status.

Strengths and Limitations

This study has several notable strengths. First, this is one of the few studies to specifically characterize and compare clinical presentation, comorbidity profiles, and treatment patterns between late-onset and older CRC populations using a large, real-world dataset. Second, the use of the UCHDW aggregates EHR a diverse representative patient population across California, enhancing the generalizability of our findings. Third, the detailed EHR data provided comprehensive information on comorbidities, procedures, and cancer treatments. Furthermore, the application of the OMOP Common Data Model ensured standardized data definitions across institutions. Finally, the matched study design minimized potential confounding by gender, year of diagnosis, and enrollment duration, enabling more robust comparisons between age cohorts.

This study also has several limitations. This study relied on EHR data, which are subject to incomplete documentation and potential misclassification of diagnosis, procedures, and treatments. In addition, some other confounding from unmeasured factors may remain. Important variables such as socioeconomic status, cognitive impairment, and decision-making process were not comprehensively captured and could not be incorporated into the analysis. Finally, the study population was derived from the UCHDW, so the findings may not be generalizable to healthcare systems with populations in other regions.

Conclusion

This study provides a comprehensive characterization of older adults with CRC using a large real-world EHR database. Compared with patients with late-onset CRC cancer, older patients had a greater burden of chronic comorbidities, different tumor distributions, and lower utilization of diagnostic procedures and cancer-directed therapies. After adjustment for comorbidities, age was not independently associated with acute healthcare utilization. These findings improve understanding of CRC among older adults and support the development of better screening, diagnostic, and treatment strategies for this growing population.

List of Tables

Table 1a. Incidence Rate of OLDCRC (2013-2024), Stratified by Gender			
Year	Cases	Population	IR per 100k
Male			
2013	428	82,532	518.6
2014	440	111,298	395.3
2015	381	139,072	274.0
2016	424	166,671	254.4
2017	384	194,142	197.8
2018	464	221,193	209.8
2019	454	244,686	185.5
2020	477	268,200	177.9
2021	461	300,112	153.6
2022	456	332,319	137.2
2023	535	325,655	164.3
2024	571	321,860	177.4
Female			
2013	479	106,700	448.9
2014	454	140,942	322.1
2015	394	177,342	222.2
2016	445	211,084	210.8
2017	434	243,638	178.1
2018	450	274,416	164.0
2019	467	302,062	154.6
2020	429	329,766	130.1
2021	537	368,403	145.8
2022	455	407,183	111.7
2023	515	399,276	129.0
2024	580	396,716	146.2

Table 1b. Incidence Rate of OLDCRC (2013-2024), Stratified by Race/Ethnicity			
Year	Cases	Population	IR per 100k
Hispanic			
2013	75	13,287	564.46
2014	79	18,376	429.91
2015	55	23,329	235.76
2016	62	28,759	215.58
2017	70	33,820	206.98
2018	76	39,118	194.28
2019	75	43,741	171.46
2020	79	48,635	162.43
2021	72	54,932	131.07
2022	82	58,506	140.16
2023	109	57,864	188.37
2024	125	57,525	217.30
Non-Hispanic White			
2013	502	105,990	473.63
2014	479	138,124	346.79
2015	447	168,477	265.32
2016	482	198,137	243.27
2017	462	227,842	202.77
2018	519	255,644	203.02
2019	500	279,402	178.95
2020	493	302,239	163.12
2021	551	333,272	165.33
2022	515	357,398	144.10
2023	521	351,291	148.31
2024	594	351,188	169.14
Non-Hispanic Black			
2013	57	5,760	989.58
2014	37	7,395	500.34
2015	32	8,913	359.03
2016	26	10,347	251.28
2017	35	11,654	300.33
2018	34	12,998	261.58
2019	37	14,116	262.11
2020	28	15,198	184.23
2021	36	16,650	216.22
2022	18	18,012	99.93
2023	36	17,725	203.10
2024	35	17,899	195.54
Non-Hispanic Asian			
2013	153	17,444	877.09
2014	138	22,946	601.41
2015	96	29,268	328.00
2016	125	34,804	359.15

2017	108	40,375	267.49
2018	115	45,452	253.01
2019	111	50,293	220.71
2020	121	54,749	221.01
2021	137	61,541	222.94
2022	125	65,907	189.66
2023	154	65,317	235.77
2024	138	65,968	209.19

Table 2a. Demographic of Matched OLDCRC and LOCRC Cohort			
	OLDCRC (n = 4,016)	LOCRC (n = 8,032)	SMD
Gender			< 0.001
Male	2,005 (49.9%)	4,010 (49.9%)	
Female	2,011 (50.1%)	4,022 (50.1%)	
Race Ethnicity			0.183
Hispanic	314 (7.8%)	1,058 (13.2%)	
Non-Hispanic White	2,306 (57.4%)	4,463 (55.6%)	
Non-Hispanic Black	163 (4.1%)	354 (4.4%)	
Non-Hispanic Asian	585 (14.6%)	1,017 (12.7%)	
Non-Hispanic Others	196 (4.9%)	340 (4.2%)	
Unknown	452 (11.3%)	800 (10.0%)	
CRC Age			
50-54	-	1,377 (17.1%)	
55-59	-	1,431 (17.8%)	
60-64	-	1,644 (20.5%)	
65-69	-	1,895 (23.1%)	
70-74	-	1,721 (21.4%)	
75-79	2,860 (71.2%)	-	
80-85	956 (23.8%)	-	
85-89	200 (5.0%)	-	
Year of Birth			
1930-1939	2,801 (69.7%)	99 (1.2%)	
1940-1949	1,215 (30.3%)	2,207 (27.5%)	
1950-1959	-	3,448 (42.9%)	
1960-1969	-	2,023 (25.2%)	
1970-1979	-	255 (3.2%)	
Tumor location			
Left	1,230 (30.6%)	3,572 (44.5%)	
Descending colon	61 (1.5%)	116 (1.4%)	
Splenic flexure	15 (0.4%)	31 (0.4%)	
Sigmoid	244 (6.1%)	645 (8.0%)	
Rectum	738 (18.4%)	2,159 (26.9%)	
Rectosigmoid	172 (4.3%)	621 (7.7%)	
Right	582 (14.5%)	761 (9.5%)	
Hepatic flexure	50 (1.2%)	72 (0.9%)	
Ascending	355 (8.8%)	441 (5.5%)	
Cecum	177 (4.4%)	248 (3.1%)	
Others	2,204 (54.9%)	3,699 (46.1%)	
Colon (and large intestinal tract)	2,074 (51.6%)	3,493 (43.5%)	
Transverse	115 (2.9%)	167 (2.1%)	
Overlapping of rectum rectosigmoid	15 (0.4%)	39 (0.5%)	

Table 2b. Demographic of Matched OLDCRC and NOCRC Cohort			
	OLDCRC (n = 4,148)	NOCRC (n = 8,296)	SMD
Gender			< 0.001
Male	1,959 (47.2%)	3,918 (47.2%)	
Female	2,189 (52.8%)	4,378 (52.8%)	
Race Ethnicity			0.308
Hispanic	301 (7.3%)	601 (7.2%)	
Non-Hispanic White	2,453 (59.1%)	4,578 (55.2%)	
Non-Hispanic Black	164 (4.0%)	233 (2.8%)	
Non-Hispanic Asian	626 (15.1%)	822 (9.9%)	
Non-Hispanic Others	170 (4.1%)	369 (4.4%)	
Unknown	434 (10.5%)	1,693 (20.4%)	
CRC Age			
50-54	-	-	
55-59	-	-	
60-64	-	-	
65-69	-	-	
70-74	-	-	
75-79	2,818 (67.9%)	-	
80-85	1,051 (25.3%)	-	
85-89	279 (6.7%)	-	
Year of Birth			
1930-1939	3,058 (73.7%)	6,116 (73.7%)	
1940-1949	1,085 (26.2%)	2,170 (26.2%)	
1950-1959	5 (0.1%)	10 (0.1%)	
1960-1969	-	-	
1970-1979	-	-	
Tumor location			
Left	1,229 (29.6%)		
Descending colon	67 (1.6%)	-	
Splenic flexure	22 (0.5%)	-	
Sigmoid	227 (5.5%)	-	
Rectum	728 (17.6%)	-	
Rectosigmoid	185 (4.5%)	-	
Right	589 (14.2%)		
Hepatic flexure	59 (1.4%)	-	
Ascending	359 (8.7%)	-	
Cecum	171 (4.1%)	-	
Others	2,330 (56.2%)		
Colon (and large intestinal tract)	2,180 (52.6%)	-	
Transverse	1367(3.3%)	-	
Overlapping of rectum rectosigmoid	13 (0.3%)	-	

Table 3a. Comorbidity Profiles of Patients with OLDCRC and LOCRC			
	OLDCRC (n = 4,016)	LOCRC (n = 8,032)	p-value
Diabetes			< 0.05
Yes	1,464 (36.5%)	2,678 (33.3%)	
No	2,552 (63.5%)	5,354 (66.7%)	
Obesity			< 0.05
Yes	443 (11.0%)	1,572 (19.6%)	
No	3,573 (89.0%)	6,460 (80.4%)	
Hypertension			< 0.05
Yes	2,748 (68.4%)	4,294 (53.5%)	
No	1,268 (31.6%)	3,738 (46.5%)	
Hyperlipidemia			< 0.05
Yes	2,320 (57.8%)	3,889 (48.4%)	
No	1,696 (42.2%)	4,143 (51.6%)	
Myocardial Infarction			< 0.05
Yes	482 (12.0%)	585 (7.3%)	
No	3,534 (88.0%)	7,447 (92.7%)	
Stroke / CVA			< 0.05
Yes	807 (20.1%)	717 (8.9%)	
No	3,209 (79.9%)	7,315 (91.1%)	

Table 3b. Comorbidity Profiles of Patients with OLDCRC and NOCRC			
	OLDCRC (n = 4,148)	NOCRC (n = 8,296)	p-value
Diabetes			< 0.05
Yes	1,562 (37.7%)	2,023 (24.4%)	
No	2,586 (62.3%)	6,273 (75.6%)	
Obesity			< 0.05
Yes	473 (11.4%)	468 (6.8%)	
No	3,675 (88.6%)	7,728 (93.2%)	
Hypertension			< 0.05
Yes	2,925 (70.5%)	3,993 (48.1%)	
No	1,223 (29.5%)	4,303 (51.9%)	
Hyperlipidemia			< 0.05
Yes	2,499 (60.2%)	3,560 (42.9%)	
No	1,649 (39.8%)	4,736 (57.1%)	
Myocardial Infarction			< 0.05
Yes	536 (12.9%)	690 (8.3%)	
No	3,612 (87.1%)	7,606 (91.7%)	
Stroke / CVA			< 0.05
Yes	882 (21.3%)	1,294 (15.6%)	
No	3,266 (78.7%)	7,002 (84.4%)	

Table 4a. Diagnostic Procedures and Treatment Patterns among OLDCRC and LOCRC

	OLDCRC (n = 4,016)	LOCRC (n = 8,032)	p-value
Endoscopy (colonoscopy, sigmoidoscopy, biopsy)			< 0.05
Yes	2,857 (71.1%)	6,800 (84.7%)	
No	1,159 (28.9%)	1,232 (15.3%)	
FIT			< 0.05
Yes	644 (16.0%)	1,077 (13.4%)	
No	3,372 (84.0%)	6,955 (86.6%)	
CT Colonography			< 0.05
Yes	1,443 (35.9%)	3,514 (43.8%)	
No	2,573 (64.1%)	4,518 (56.2%)	
Chemotherapy			< 0.05
Yes	909 (22.6%)	2,736 (34.1%)	
No	3,107 (77.4%)	5,236 (65.9%)	
Radiotherapy			< 0.05
Yes	569 (14.2%)	1,503 (18.7%)	
No	3,447 (85.8%)	6,529 (81.3%)	
Colectomy			< 0.05
Yes	1,232 (30.7%)	3,365 (41.9%)	
No	2,784 (69.3%)	4,667 (58.1%)	
Colostomy			< 0.05
Yes	804 (20.0%)	2,041 (25.4%)	
No	3,212 (80.0%)	5,991 (74.6%)	
5-Fluorouracil (5-FU)			< 0.05
Yes	645 (16.1%)	1,925 (24.0%)	
No	3,371 (83.9%)	6,107 (76.0%)	
Capecitabine (Xeloda)			< 0.05
Yes	638 (13.9%)	1,652 (17.4%)	
No	3,378 (86.1%)	6,380 (82.6%)	
Irinotecan (Camptosar)			< 0.05
Yes	186 (4.6%)	934 (11.6%)	
No	3,830 (95.4%)	7,098 (88.4%)	
Oxaliplatin (Eloxatin)			< 0.05
Yes	378 (9.4%)	1,608 (20.0%)	
No	3,638 (90.6%)	6,424 (80.0%)	
Trifluridine + Tipiracil (Lonsurf)			< 0.05
Yes	84 (2.1%)	374 (4.7%)	
No	3,932 (97.9%)	7,658 (95.3%)	

Table 4b. Diagnostic Procedures and Treatment Patterns among OLDCRC and NOCRC

	OLDCRC (n = 4,148)	NOCRC (n = 8,296)	p-value
Endoscopy (colonoscopy, sigmoidoscopy, biopsy)			< 0.05
Yes	2,986 (72.0%)	2,215 (26.7%)	
No	1,162 (28.0%)	6,081 (73.3%)	
FIT			< 0.05
Yes	733 (17.7%)	815 (9.8%)	
No	3,415 (82.3%)	7,481 (90.2%)	
CT Colonography			< 0.05
Yes	2,209 (53.3%)	1,579 (19.0%)	
No	1,939 (46.7%)	6,717 (81.0%)	

Table 5. Association Between Age Group and Emergency Department Utilization Among Patients with OLDCRC and LOCRC within 12 Months Prior to CRC Diagnosis

Variable	Model 1 IRR (95%CI)	P-value	Model 2 IRR (95%CI)	P-value
Cohort Source				
OLDCRC	1.21 (1.09 – 1.33)	< 0.05	1.01 (0.91 – 1.12)	0.868
LOCRC (reference)	—	—	—	—
Race Ethnicity				
Hispanic	1.58 (1.37 – 1.81)	< 0.05	1.48 (1.28 – 1.69)	< 0.05
Non-Hispanic Asian	3.23 (2.77 – 3.75)	< 0.05	2.49 (2.13 – 2.89)	< 0.05
Non-Hispanic Black	0.90 (0.77 – 1.06)	0.210	0.95 (0.81 – 1.12)	0.564
Non-Hispanic Others	0.73 (0.54 – 0.96)	< 0.05	0.78 (0.57 – 1.02)	0.085
Unknown	0.67 (0.54 – 0.81)	< 0.05	0.71 (0.58 – 0.86)	< 0.05
Non-Hispanic White (reference)	—	—	—	—
Comorbidities				
Diabetes	—	—	1.24 (1.09 – 1.41)	< 0.05
Obesity	—	—	1.11 (0.95 – 1.30)	0.184
Hypertension	—	—	2.71 (2.39 – 3.07)	< 0.05
Hyperlipidemia	—	—	0.97 (0.85 – 1.11)	0.664
Myocardial Infarction	—	—	2.05 (1.71 – 2.45)	< 0.05
Stroke	—	—	1.33 (1.12 – 1.58)	< 0.05

Outcome: Total number of emergency department (ER) visits.

Poisson log-linear regression was used to estimate incidence rate ratios and 95% confidence intervals.

Model 1: Included cohort source and race/ethnicity.

Model 2: Further adjusted for diabetes, obesity, hypertension, hyperlipidemia, myocardial infarction, and stroke.

List of Figures

Figure 1. Flow Chart

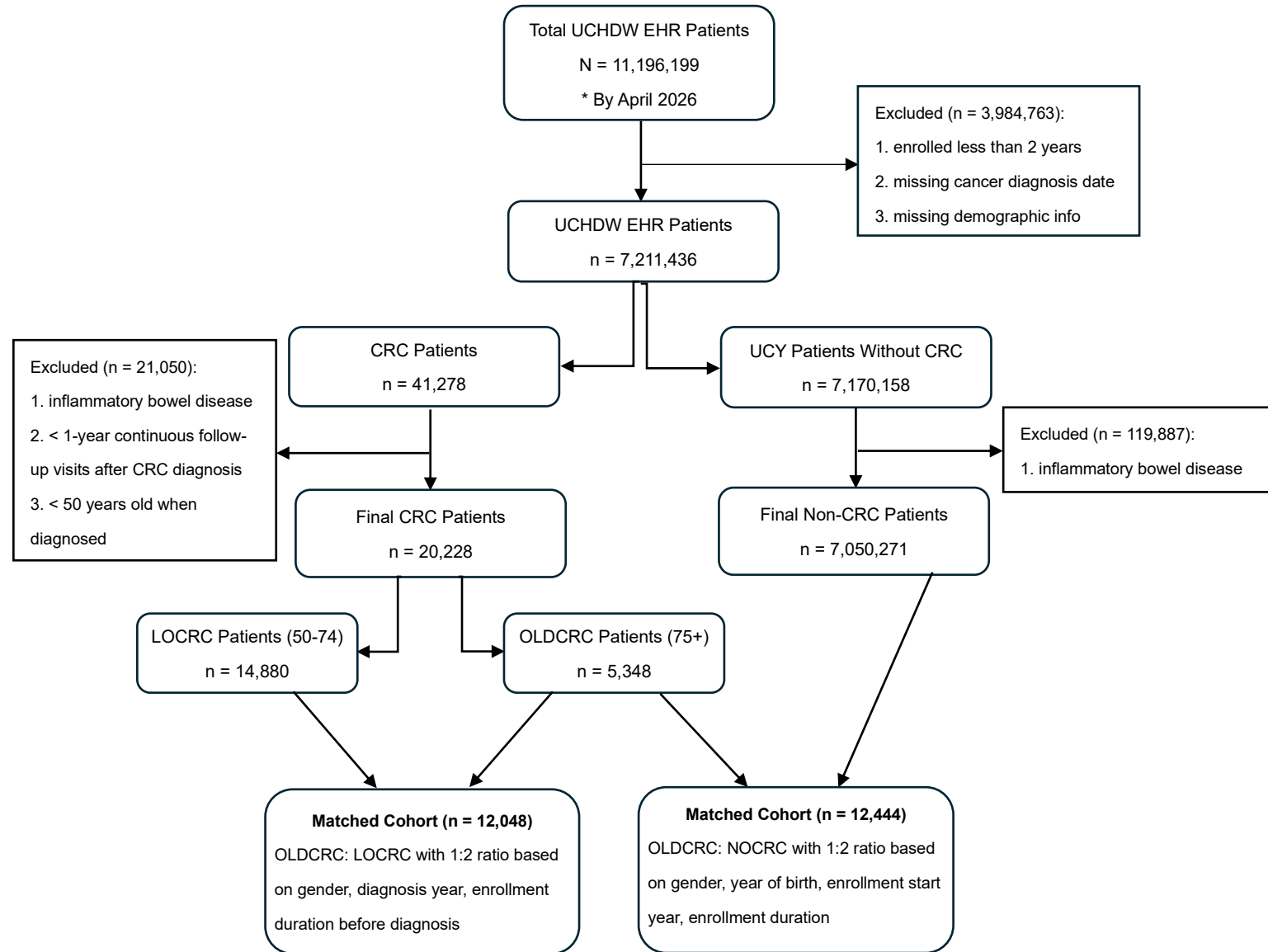
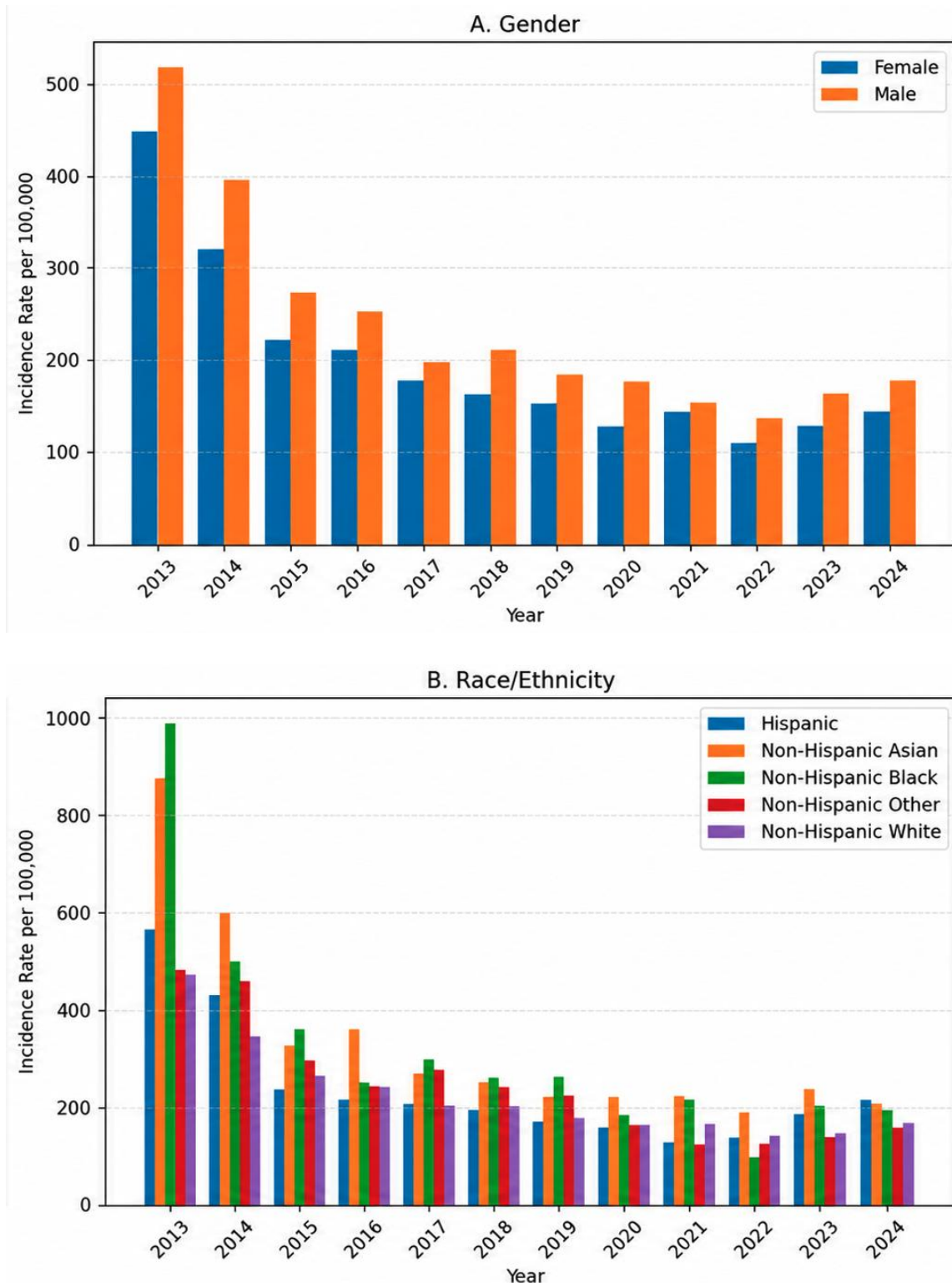


Figure 2. Incidence Rate Among Adults Aged 75+, 2013 - 2024



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