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***Retrospective Study***

**Elevated cardiovascular risk and acute events in hospitalized colon cancer survivors: A decade-apart study of two nationwide cohorts**

Desai R *et al*. Cardiovascular risk, acute events - colon cancer

Rupak Desai, Avilash Mondal, Vivek Patel, Sandeep Singh, Shaylika Chauhan, Akhil Jain

**Rupak Desai,** Independent Researcher, Atlanta, GA 30079, United States

**Avilash Mondal, Vivek Patel,** Department of Internal Medicine, Nazareth Hospital, Philadelphia, PA 19152, United States

**Sandeep Singh,** Department of Clinical Epidemiology, Biostatistics and Bio-informatics, Amsterdam UMC, Amsterdam 7057, Netherlands

**Shaylika Chauhan,** Department of Internal Medicine, Geisinger Health System, Wikes-Barre, PA 18702, United States

**Akhil Jain,** Division of Leukemia, The University of Texas MD Anderson Cancer Center, Houston, TX 77079, United States

**Author contributions:** Desai R, Singh S and Chauhan S conceptualized the methodology of manuscript; Desai R and Mondal A collected resources to write the manuscript; Desai R, Patel V, Singh S, Chauhan S and Jain A reviewed and edited the manuscript; Desai R analyzed the manuscript with software; Desai R, Mondal A, Singh S, Chauhan S and Jain A visualized the results; Singh S, Chauhan S and Jain A supervised the manuscripts. All authors have read and approved the final manuscript.

**Corresponding author: Shaylika Chauhan, MD, FACP, Clinical Assistant Professor (Honorary),** Department of Internal Medicine, Geisinger Health System, 1000 E Mountain Blvd, Wikes-Barre, PA 18702, United States. drshaylikachauhan@gmail.com

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**Abstract**

BACKGROUND

Over the years, strides in colon cancer detection and treatment have boosted survival rates; yet, post-colon cancer survival entails cardiovascular disease (CVD) risks. Research on CVD risks and acute cardiovascular events in colorectal cancer survivors has been limited.

AIM

To compare the CVD risk and adverse cardiovascular outcomes in current colon cancer survivors compared to a decade ago.

METHODS

We analyzed 2007 and 2017 hospitalization data from the National Inpatient Sample, studying two colon cancer survivor groups for CVD risk factors, mortality rates, and major adverse events like pulmonary embolism, arrhythmia, cardiac arrest, and stroke, adjusting for confounders *via* multivariable regression analysis.

RESULTS

Of total colon cancer survivors hospitalized in 2007 (*n* = 177542) and 2017 (*n* = 178325), the 2017 cohort often consisted of younger (76 *vs* 77 years), male, African-American, and Hispanic patients admitted non-electively *vs* the 2007 cohort. Furthermore, the 2017 cohort had higher rates of smoking, alcohol abuse, drug abuse, coagulopathy, liver disease, weight loss, and renal failure. Patients in the 2017 cohort also had higher rates of cardiovascular comorbidities, including hypertension, hyperlipidemia, diabetes, obesity, peripheral vascular disease, congestive heart failure, and at least one traditional CVD (*P* < 0.001) *vs* the 2007 cohort. On adjusted multivariable analysis, the 2017 cohort had a significantly higher risk of pulmonary embolism (PE) (OR: 1.47, 95%CI: 1.37–1.48), arrhythmia (OR: 1.41, 95%CI: 1.38–1.43), atrial fibrillation/flutter (OR: 1.61, 95%CI: 1.58–1.64), cardiac arrest including ventricular tachyarrhythmia (OR: 1.63, 95%CI: 1.46–1.82), and stroke (OR: 1.28, 95%CI: 1.22-1.34) with comparable all-cause mortality and fewer routine discharges (48.4% *vs* 55.0%) (*P* < 0.001) *vs* the 2007 cohort.

CONCLUSION

Colon cancer survivors hospitalized 10 years apart in the United States showed an increased CVD risk with an increased risk of acute cardiovascular events (stroke 28%, PE 47%, arrhythmia 41%, and cardiac arrest 63%). It is vital to regularly screen colon cancer survivors with concomitant CVD risk factors to curtail long-term cardiovascular complications.

**Key Words:** Colon cancer; Colorectal cancer; Cardiovascular diseases; Cardiovascular disease risk; Cardiac events; Stroke

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**Core Tip:** Colon cancer survivors hospitalized 10 years apart in the United States showed an increased cardiovascular disease risk with an increased risk of acute cardiovascular events (stroke 28%, pulmonary embolism 47%, arrhythmia 41%, and cardiac arrest 63%). Increased screening in this cohort is important.

**INTRODUCTION**

Cardiovascular disease (CVD) and cancer remain the leading causes of death in the United States, with colon cancer being the third leading cause of all cancer-related deaths in both men and women. According to 2017 Global Burden of Disease data, there were 1.8 million incident colon cancer cases with an age-standardized incidence rate of 23.2 per 100000 person-years[1]. However, with improvements in screening strategies, early detection and treatment, and better lifestyle modifications, the survival rates have improved significantly[2].

Studies have shown increased CVD risk in cancer survivors which includes heart failure, stroke and coronary artery disease[3]. This is explained by the fact that CVD and colon cancer survivors both share risk factors such as age, obesity, a sedentary lifestyle, and smoking. Patients after cancer chemo and radiotherapy enter a chronic inflammatory state secondary to the cancer burden and the treatment effects. These lead to the development of new chronic conditions such as diabetes, hypertension, and hyperlipidemia, which in themselves increase adverse cardiovascular event risk[4-6]. There is also increased cardiotoxicity from these treatments, which is understudied in colon cancer survivors. The risk of CVD has been well described for breast[7], lung[8,9], lymphoma/leukemias[10] and prostate cancers[11] amongst various population groups however for colon cancer, it is understudied. There has been a paucity of data regarding the CVD burden and trend in colon cancer in the last decade. Hence, it is imperative to understand the CVD risk and how it has varied over time. We therefore performed a retrospective analysis of colon cancer survivors and compared the CVD risk and adverse cardiovascular outcomes in current colon cancer survivors compared to a decade ago.

**MATERIALS AND METHODS**

We conducted a retrospective analysis of hospitalizations among colon cancer survivors in the years 2007 and 2017 using the National Inpatient Sample (NIS) from the Agency for Healthcare Research & Quality-supported Healthcare Cost Utilization Project[12]. The records of NIS comprise demographics of patients, hospital characteristics, several diagnoses, procedures, and comorbidities with pertinent International Classification of Diseases Clinical Modification, Ninth Revision (ICD-9-CM), or Tenth Revision (ICD-10-CM) codes. As the datasets are publicly available and de-identified, they were exempt from institutional review board approval.

The study included patients from January 1st to December 31st in 2007 and 2017. Using the ICD-9-CM and ICD-10-CM code V10.05 and Z85.038 respectively, we identified patients aged 18 or older who were admitted to the hospital with a prior history of colon cancer. Hospitalization with information missing on age, race, gender, length of stay, cost of a stay, or in-hospital death were excluded. The primary outcomes were major adverse cardiovascular and cerebrovascular events and healthcare resource utilization. Secondary outcomes included the prevalence of CVD risk factors. The ICD-9 and ICD-10 codes for complications are listed in Supplementary Table 1, and the comorbidities were determined using the Elixhauser software.

We performed multivariable regression analysis, adjusting for sociodemographic confounders such as age, sex, median household income, type of admission, teaching facility, and comorbid conditions, to assess the risk of cardiovascular events across these two cohorts a decade apart. We also compared the CVD risk factors and in-hospital outcomes, including all-cause mortality, PE, arrhythmia, atrial fibrillation/flutter, cardiac arrest, including ventricular tachyarrhythmias, stroke, and patient disposition (routine, short-term rehabilitation, including skilled nursing facilities, intermediate care facility, home health, and leaving against medical advice). Categorical and continuous data were assessed using Pearson’s chi-square test and the Mann-Whitney U test for non-normally distributed continuous data. Statistical significance was measured at a two-sided *P* value of 0.05. All analyses were conducted using weighted data and complex survey modules in IBM SPSS Statistics version 25.0 (IBM Corp., Armonk, NY, United States).

**RESULTS**

Of the total hospital admissions among colon cancer survivors in 2007 (*n* = 177542) and 2017 (*n* = 178325), the 2017 cohort often consisted of younger [median age: 76 (65–84) *vs* 77 (67–84) years], black (12.2% *vs* 9.6%), Asian or Pacific Islander (2.9% *vs* 2.2%), and Hispanic (7.3% *vs* 5.4%), males (50.2% *vs* 48.9%) (*P* < 0.001) and a lower median household income quartile (26.4% *vs* 25.6%). There were also more non-elective admissions (82.9% *vs* 76.9%) from urban teaching facilities (53.2%) *vs* 50.9% (*P* < 0.001) (Table 1).

Furthermore, the 2017 cohort had higher rates of smoking (40.9% *vs* 17.6%), alcohol abuse (2.2% *vs* 1.7%), drug abuse (1.5% *vs* 0.7%), coagulopathy (6.5% *vs* 3.2%), liver disease (3.8% *vs* 1.9%), weight loss (8.6% *vs* 3.4%), and renal failure (19.7% *vs* 10.9%). The 2017 cohort of colon cancer survivors also had higher rates of cardiovascular comorbidities, including hypertension (73.9% *vs* 61.8%), hyperlipidemia (43.5% *vs* 26.4%), diabetes (29.7% *vs* 25.0%), obesity (11.1% *vs* 4.5%), peripheral vascular disease (6.7% *vs* 6.4%), congestive heart failure (14.3% *vs* 10.3%), and at least one traditional CVD (89.5% *vs* 77.9%) (*P* < 0.001).

Comparing colon cancer survivors from 2007 and 2017, the 2017 cohort had a significantly higher risk of PE (1.4% *vs* 1.3%, OR: 1.47, 95%CI: 1.37–1.48), arrhythmia (30.6% *vs* 23.6%, OR: 1.41, 95%CI: 1.38–1.43), atrial fibrillation/flutter (25.2% *vs* 17.6%, OR: 1.61, 95%CI: 1.58–1.64), cardiac arrest, However, there was no significant difference in all-cause mortality (2.9% *vs* 3.0%, OR: 0.99, 95%CI: 0.95–1.04, *P* = 0.77) (Table 2)**.**

**DISCUSSION**

In this nationwide study, we compare cardiovascular risk factors and outcomes among colon cancer survivors in 2017 with those in 2007. Cardiovascular risk has been shown to be elevated in patients diagnosed with colon cancer in several studies[13-15]. However, CVD risk in survivors hasn’t been extensively studied[16]. In an era with an increasing prevalence of both colon cancer survivors and cardiovascular disease, it is paramount to explore cardiovascular morbidity and mortality. The key findings from our study were: (1) The number of colon cancer survivors has almost remained the same, but they are younger; (2) CVD risk factors were significantly higher in the 2017 cohort; (3) The 2017 cohort also had higher rates of in-hospital complications such as PE, atrial and ventricular tachyarrhythmias, cardiac arrest, and stroke; and (4) Despite increased complication rates and overall CVD morbidity, all-cause mortality was not significant in the 2017 cohort.

With improvements in screening criteria and advancements in treatment modalities, colon cancer is being diagnosed earlier. In one of the studies from the National Cancer Database (2004–2015), it was found that cancer is being diagnosed at a much younger age compared to 2005[17]. This is also concerning, as there has been an increase in colon cancer incidence in the younger population (50 years old)[18]. This warrants further exploration to see if this is due to early diagnosis and effective therapeutics that has developed in the past decade[19], or if it is due to rising sedentary lifestyles, obesity, and alcohol use, which are co-existent with cardiovascular diseases[20]. It is already established that cardiovascular risk is high[13,14], and with the increased pool of colon cancer survivors cardiovascular disease risk factors would be expected to be high. Our study supported this by demonstrating that the 2017 cohort of colon cancer survivors had a higher prevalence of the current increase in CVD risk factors, such as obesity, hypertension, diabetes, and hyperlipidemia.

The rise in the prevalence of cardiovascular risk factors over time may help to explain why we are seeing an increase in complication rates for cardiovascular end-points like PE, cardiac arrhythmia, stroke, and cardiac arrests in our study. Colon cancer itself is a risk factor for the development of these complications, and it has been studied for other cancers as well. Hence, it is particularly important to identify at-risk population groups and control these risks to prevent worse outcomes.

Despite increasing cardiovascular morbidity and complication rates, overall mortality was not found to be significantly higher in the 2017 cohort compared to 2007. This provides an opportunity to shed more light on the fact that in the past decade, the intensive management of cardiovascular issues has changed[23,24]. With improved cardiac critical care management, including the implementation of evidence-based protocols[25], rapid recognition of life-threatening conditions, and attention to patient safety, we have been able to reduce cardiovascular mortality in the past decade[24].

We used the data from a publicly accessible database, which has limited applicability since cancer-related information like the stage of colon cancer, any second incident malignancies, the exact type of chemotherapy, and the history of past treatment are not specified. Additionally, there was conflicting information regarding the number of years that patients survive after receiving a cancer diagnosis and whether they are still battling the disease or have it in remission. The cohorts were sampled from patients all over the United States, and our analysis requires external validation from other regions. Also, there is unclear data on whether these patients had any previous cardiovascular diseases before a diagnosis of colon cancer. Apart from that, there might be inherent errors in coding. And lastly, no associations can be made between cardio-cerebrovascular outcomes and a previous history of colon cancer.

**CONCLUSION**

With increasing cardiovascular risk factors in the general population and increasing cancer survivorship, we have found that the prevalence of CVD and its complications is higher than ever. With improvements in acute cardiovascular treatment, we haven’t seen an improvement in mortality, which we would expect. Hence, we need better control of the cardiovascular risk factor from a primary care standpoint as well to prevent worse outcomes in colon cancer survivors. We need further studies comparing cardiovascular morbidity and outcomes in colon cancer survivors with other cancer survivors, which are more extensively studied, and how they have evolved in the past years.

**REFERENCES**

1 **GBD 2017 Colorectal Cancer Collaborators**. The global, regional, and national burden of colorectal cancer and its attributable risk factors in 195 countries and territories, 1990-2017: a systematic analysis for the Global Burden of Disease Study 2017. *Lancet Gastroenterol Hepatol* 2019; **4**: 913-933 [PMID: 31648977 DOI: 10.1016/S2468-1253(19)30345-0]

2 **Howlader N**. SEER Cancer Statistics Review; 2019 [cited 2019 April]. Database: SEER Cancer Statistics Review [Internet]. Available from: https://seer.cancer.gov/csr/1975\_2016/

3 **Florido R**, Daya NR, Ndumele CE, Koton S, Russell SD, Prizment A, Blumenthal RS, Matsushita K, Mok Y, Felix AS, Coresh J, Joshu CE, Platz EA, Selvin E. Cardiovascular Disease Risk Among Cancer Survivors: The Atherosclerosis Risk In Communities (ARIC) Study. *J Am Coll Cardiol* 2022; **80**: 22-32 [PMID: 35772913 DOI: 10.1016/j.jacc.2022.04.042]

4 **Goldman JW**, Mendenhall MA, Rettinger SR. Hyperglycemia Associated With Targeted Oncologic Treatment: Mechanisms and Management. *Oncologist* 2016; **21**: 1326-1336 [PMID: 27473045 DOI: 10.1634/theoncologist.2015-0519]

5 **Guo X**, Qian X, Jin Y, Kong X, Qi Z, Cai T, Zhang L, Wu C, Li W. Hypertension Induced by Combination Therapy of Cancer: A Systematic Review and Meta-Analysis of Global Clinical Trials. *Front Pharmacol* 2021; **12**: 712995 [PMID: 34552487 DOI: 10.3389/fphar.2021.712995]

6 **Tian W**, Yao Y, Fan G, Zhou Y, Wu M, Xu D, Deng Y. Changes in lipid profiles during and after (neo)adjuvant chemotherapy in women with early-stage breast cancer: A retrospective study. *PLoS One* 2019; **14**: e0221866 [PMID: 31465521 DOI: 10.1371/journal.pone.0221866]

7 **Koric A**, Chang CP, Mark B, Rowe K, Snyder J, Dodson M, Deshmukh VG, Newman MG, Fraser AM, Smith KR, Date AP, Gren LH, Porucznik CA, Haaland BA, Henry NL, Hashibe M. Cardiovascular disease risk in long-term breast cancer survivors: A population-based cohort study. *Cancer* 2022; **128**: 2826-2835 [PMID: 35561317 DOI: 10.1002/cncr.34224]

8 **Wang C**, Lu D, Cronin-Fenton D, Huang C, Liew Z, Wei D, Qin G, Yu Y, Li J. Cardiovascular disease and risk of lung cancer incidence and mortality: A nationwide matched cohort study. *Front Oncol* 2022; **12**: 950971 [PMID: 36147909 DOI: 10.3389/fonc.2022.950971]

9 **Yoon DW**, Shin DW, Cho JH, Yang JH, Jeong SM, Han K, Park SH. Increased risk of coronary heart disease and stroke in lung cancer survivors: A Korean nationwide study of 20,458 patients. *Lung Cancer* 2019; **136**: 115-121 [PMID: 31493668 DOI: 10.1016/j.lungcan.2019.08.025]

10 **Keegan THM**, Kushi LH, Li Q, Brunson A, Chawla X, Chew HK, Malogolowkin M, Wun T. Cardiovascular disease incidence in adolescent and young adult cancer survivors: a retrospective cohort study. *J Cancer Surviv* 2018; **12**: 388-397 [PMID: 29427203 DOI: 10.1007/s11764-018-0678-8]

11 **Shin DW**, Han K, Park HS, Lee SP, Park SH, Park J. Risk of Ischemic Heart Disease and Stroke in Prostate Cancer Survivors: A Nationwide Study in South Korea. *Sci Rep* 2020; **10**: 10313 [PMID: 32587285 DOI: 10.1038/s41598-020-67029-y]

12 **Healthcare Research and Quality**. Healthcare Cost and Utilization Project; 2019 [cited 2019 June]. Database: HCUP Databases [Internet]. Available from: www.hcup-us.ahrq.gov/nisoverview.jsp

13 **Hsu HY**, Chern YJ, Hsieh CT, Yeh TL, Tsai MC, Wang CC, Hsiao BY, Jhuang JR, Chiang CJ, Lee WC, Chien KL. Increased standardised incidence ratio of cardiovascular diseases among colorectal cancer patients. *Int J Colorectal Dis* 2022; **37**: 887-894 [PMID: 35301555 DOI: 10.1007/s00384-022-04129-3]

14 **Mamas MA**, Brown SA, Sun LY. Coronary Artery Disease in Patients With Cancer: It's Always the Small Pieces That Make the Bigger Picture. *Mayo Clin Proc* 2020; **95**: 1819-1821 [PMID: 32861320 DOI: 10.1016/j.mayocp.2020.07.006]

15 **Okwuosa TM**, Anzevino S, Rao R. Cardiovascular disease in cancer survivors. *Postgrad Med J* 2017; **93**: 82-90 [PMID: 28123076 DOI: 10.1136/postgradmedj-2016-134417]

16 **Baraghoshi D,** Hawkins ML, Abdelaziz S, Park J, Wan Y, Fraser AM, Smith KR, Deshmukh V, Newman M, Rowe KG, Snyder J. Long-term risk of cardiovascular disease among colorectal cancer survivors in a population-based cohort study. *J Clin Oncol* 2018; **36**: 113-113

17 **Virostko J**, Capasso A, Yankeelov TE, Goodgame B. Recent trends in the age at diagnosis of colorectal cancer in the US National Cancer Data Base, 2004-2015. *Cancer* 2019; **125**: 3828-3835 [PMID: 31328273 DOI: 10.1002/cncr.32347]

18 **Ahnen DJ**, Wade SW, Jones WF, Sifri R, Mendoza Silveiras J, Greenamyer J, Guiffre S, Axilbund J, Spiegel A, You YN. The increasing incidence of young-onset colorectal cancer: a call to action. *Mayo Clin Proc* 2014; **89**: 216-224 [PMID: 24393412 DOI: 10.1016/j.mayocp.2013.09.006]

19 **van Steenbergen LN**, Elferink MAG, Krijnen P, Lemmens VEPP, Siesling S, Rutten HJT, Richel DJ, Karim-Kos HE, Coebergh JWW; Working Group Output of The Netherlands Cancer Registry. Improved survival of colon cancer due to improved treatment and detection: a nationwide population-based study in The Netherlands 1989-2006. *Ann Oncol* 2010; **21**: 2206-2212 [PMID: 20439339 DOI: 10.1093/annonc/mdq227]

20 **Young JP**, Win AK, Rosty C, Flight I, Roder D, Young GP, Frank O, Suthers GK, Hewett PJ, Ruszkiewicz A, Hauben E, Adelstein BA, Parry S, Townsend A, Hardingham JE, Price TJ. Rising incidence of early-onset colorectal cancer in Australia over two decades: report and review. *J Gastroenterol Hepatol* 2015; **30**: 6-13 [PMID: 25251195 DOI: 10.1111/jgh.12792]

21 **Grothey A**, Sobrero AF, Shields AF, Yoshino T, Paul J, Taieb J, Souglakos J, Shi Q, Kerr R, Labianca R, Meyerhardt JA, Vernerey D, Yamanaka T, Boukovinas I, Meyers JP, Renfro LA, Niedzwiecki D, Watanabe T, Torri V, Saunders M, Sargent DJ, Andre T, Iveson T. Duration of Adjuvant Chemotherapy for Stage III Colon Cancer. *N Engl J Med* 2018; **378**: 1177-1188 [PMID: 29590544 DOI: 10.1056/NEJMoa1713709]

22 **Petrelli F**, Tomasello G, Borgonovo K, Ghidini M, Turati L, Dallera P, Passalacqua R, Sgroi G, Barni S. Prognostic Survival Associated With Left-Sided vs Right-Sided Colon Cancer: A Systematic Review and Meta-analysis. *JAMA Oncol* 2017; **3**: 211-219 [PMID: 27787550 DOI: 10.1001/jamaoncol.2016.4227]

23 **Roth GA**, Huffman MD, Moran AE, Feigin V, Mensah GA, Naghavi M, Murray CJ. Global and regional patterns in cardiovascular mortality from 1990 to 2013. *Circulation* 2015; **132**: 1667-1678 [PMID: 26503749 DOI: 10.1161/CIRCULATIONAHA.114.008720]

24 **Gage A**, Higgins A, Lee R. Cardiac Critical Care: The Evolution of a Novel Subspecialty. *Methodist Debakey Cardiovasc J* 2022; **18**: 24-29 [PMID: 35734159 DOI: 10.14797/mdcvj.1092]

25 **Bohula EA**, Katz JN, van Diepen S, Alviar CL, Baird-Zars VM, Park JG, Barnett CF, Bhattal G, Barsness GW, Burke JA, Cremer PC, Cruz J, Daniels LB, DeFilippis A, Granger CB, Hollenberg S, Horowitz JM, Keller N, Kontos MC, Lawler PR, Menon V, Metkus TS, Ng J, Orgel R, Overgaard CB, Phreaner N, Roswell RO, Schulman SP, Snell RJ, Solomon MA, Ternus B, Tymchak W, Vikram F, Morrow DA; Critical Care Cardiology Trials Network. Demographics, Care Patterns, and Outcomes of Patients Admitted to Cardiac Intensive Care Units: The Critical Care Cardiology Trials Network Prospective North American Multicenter Registry of Cardiac Critical Illness. *JAMA Cardiol* 2019; **4**: 928-935 [PMID: 31339509 DOI: 10.1001/jamacardio.2019.2467]

**Footnotes**

**Institutional review board statement:** As the datasets are publicly available and de-identified, they were exempt from institutional review board approval.

**Conflict-of-interest statement:** All the Authors have no conflict of interest related to the manuscript.

**Data sharing statement:** Technical appendix, statistical code, and dataset available from the corresponding author at drshaylikachauhan@gmail.com. Participants consent was not obtained but the presented data are anonymized and risk of identification is low.

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**Table 1 Demographics and comorbidities of hospitalizations among colon cancer survivors a decade apart: Propensity matched analysis**

|  |  |  |  |
| --- | --- | --- | --- |
| **Variable** | **2007 (*n* = 177542)** | **2017 (*n* = 178325)** | ***P* value** |
| Age (yr) at admission, median (IQR) | 77 (67-84) | 76 (65-84) | < 0.001 |
| **Sex, *n* (%)** |  |  |  |
| Male | 86792 (48.9) | 89485 (50.2) | < 0.001 |
| Female | 90750 (51.1) | 88840 (49.8) |  |
| **Race** |  |  |  |
| White | 142763 (80.4) | 132770 (74.5) | < 0.001 |
| Black | 16975 (9.6) | 21750 (12.2) |  |
| Hispanic | 9506 (5.4) | 13045 (7.3) |  |
| Asian or Pacific Islander | 3962 (2.2) | 5140 (2.9) |  |
| Native American | 836 (0.5) | 830 (0.5) |  |
| Others | 3499 (2.0) | 4790 (2.7) |  |
| **Median household income quartile, *n* (%)** |  |  | < 0.001 |
| 0th-25th | 45378 (25.6) | 47100 (26.4) |  |
| 76th-100th | 44838 (25.3) | 41700 (23.4) |  |
| Urban teaching facility, *n* (%) | 90450 (50.9) | 94790 (53.2) | < 0.001 |
| Non-elective admission, *n* (%) | 136359 (76.9) | 147545 (82.9) | < 0.001 |
| **Comorbidities, *n* (%)** |  |  |  |
| Alcohol abuse | 3069 (1.7) | 3835 (2.2) | < 0.001 |
| Congestive heart failure | 18256 (10.3) | 25510 (14.3) | < 0.001 |
| Coagulopathy | 5738 (3.2) | 11535 (6.5) | < 0.001 |
| Hypertension | 109779 (61.8) | 131870 (73.9) | < 0.001 |
| Hyperlipidemia | 46873 (26.4) | 77505 (43.5) | < 0.001 |
| Diabetes | 44331 (25.0) | 52910 (29.7) | < 0.001 |
| Smoking | 31260 (17.6) | 72955 (40.9) | < 0.001 |
| Obesity | 8031 (4.5) | 19750 (11.1) | < 0.001 |
| At least 1 Traditional CVD risk factor | 138285 (77.9) | 159640 (89.5) | < 0.001 |
| Peripheral vascular diseases | 11370 (6.4) | 11890 (6.7) | 0.001 |
| Renal failure | 19316 (10.9) | 35075 (19.7) | < 0.001 |
| Liver disease | 3369 (1.9) | 6760 (3.8) | < 0.001 |
| Weight loss | 5993 (3.4) | 15405 (8.6) | < 0.001 |
| Drug abuse | 1165 (0.7) | 2650 (1.5) | < 0.001 |

IQR: Interquartile range; CVD: Cardiovascular disease.

**Table 2 Hospitalization outcomes among colon cancer survivors a decade apart: Propensity matched analysis**

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
|  |  |  |  |  | **Adjusted *P* value** |
| All-cause mortality | 5245 (3.0) | 5165 (2.9) | 0.32 | 0.99 (0.95-1.04) | 0.77 |
| Pulmonary embolism | 2290 (1.3) | 2470 (1.4) | 0.013 | 1.47 (1.37-1.58) | < 0.001 |
| Arrhythmia | 41948 (23.6) | 54595 (30.6) | < 0.001 | 1.41 (1.38-1.43) | < 0.001 |
| Atrial fibrillation/flutter | 31280 (17.6) | 44875 (25.2) | < 0.001 | 1.61 (1.58-1.64) | < 0.001 |
| Cardiac arrest including ventricular tachyarrhythmias | 609 (0.3) | 1065 (0.6) | < 0.001 | 1.63 (1.46-1.82) | < 0.001 |
| Stroke | 4409 (2.5) | 5675 (3.2) | < 0.001 | 1.28 (1.22-1.34) | < 0.001 |
| Routine discharge | 97712 (55.0) | 86785 (48.7) | < 0.001 |  |  |

IQR: Interquartile range; CVD: Cardiovascular disease.