



Young-onset colorectal cancer: hospitalization trends and gender disparities in the United States 2010–2014

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Accepted: 25 July 2019 / Published online: 7 August 2019
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Abstract

Objectives Study national hospitalization trends for colorectal cancer in patients younger than 50 years of age.

Methods Patients under age 50 years hospitalized for colorectal cancer were studied using the national inpatient sample databases (2010–2014), using validated ICD-CM-9 codes and hospitalizations represented per 100,000 total inpatient population.

Results Colorectal cancer hospitalizations demonstrated a significant uptrend in the 41–50 years age group, with Caucasians and females most affected, stratifying for age and excluding those with a family history of colorectal cancer (p trend < 0.001).

Conclusions Younger colorectal cancer patients aged 41–50 years (especially younger Caucasian females) are burdened with increasing hospitalization rates.

Keywords Young-onset colorectal cancer · Hospitalizations · Gender · Race · Disparities

Introduction

Since colorectal cancer (CRC) is considered mainly a disease of the elderly, its incidence in the young (< 50 years of age) has not received much attention. However, increasing trends have been noted in the incidence of CRC in adults < 50 years (yoCRC) in whom screening has not been recommended. Limited data suggests commencing screening at age 45. in African American. Recently, yoCRC has received some notoriety and calls to lower the age for CRC screening below 50 years have received attention [1–3]. To our knowledge,

very little is known about the burden of hospitalizations associated with yoCRC in the United States (US). The goal of our study was to examine the nationwide hospitalization trends and demographic characteristics of yoCRC.

Methods

All yoCRC-related hospitalizations were studied using the National Inpatient Sample (NIS) in four different age categories (11–20, 21–30, 31–40, and 41–50 years) by gender and

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Table 1 Demographics of colorectal cancer–related hospitalizations, 11–50 years

| Variables | 11–20 years (n = 1766) | 21–30 years (n = 13,621) | 31–40 years (n = 201,267) | 41–50 years (n = 57,092) | Overall (n = 273,746) |
|--|------------------------|--------------------------|---------------------------|--------------------------|-----------------------|
| Age (years) at hospitalization (mean ± SD) | 17.4 ± 2.6 | 26.7 ± 2.7 | 36.3 ± 2.9 | 46.4 ± 2.8 | 43.1 ± 6.6 |
| Sex | | | | | |
| Male | 46.3% | 48.8% | 50.7% | 52.2% | 51.7% |
| Female | 53.7% | 51.2% | 49.3% | 47.8% | 48.3% |
| Race | | | | | |
| White | 57.4% | 56.7% | 61.4% | 65.9% | 64.4% |
| Black | 17.2% | 18.6% | 16.4% | 17.1% | 17.0% |
| Hispanic | 19.1% | 15.9% | 14.4% | 10.3% | 11.5% |
| Asian or Pacific Islander | 2.7% | 3.7% | 3.4% | 3.2% | 3.2% |
| Native American | <11 | 1.2% | 0.5% | 0.7% | 0.7% |
| Others | 3.2% | 3.9% | 3.8% | 2.9% | 3.1% |
| Median household income quartile for | | | | | |
| 0–25th | 34.0% | 25.1% | 28.2% | 28.5% | 28.3% |
| 26–50th | 27.8% | 28.0% | 24.8% | 24.6% | 24.9% |
| 51–75th | 18.2% | 26.7% | 24.4% | 24.3% | 24.4% |
| 76–100th | 19.9% | 20.2% | 22.5% | 22.6% | 22.5% |
| Primary expected payer | | | | | |
| Medicare | 0.9% | 5.5% | 10.5% | 13.8 | 12.6% |
| Medicaid | 39.3% | 34.9% | 26.4% | 21.6% | 23.4% |
| Private including HMO | 49.6% | 45.6% | 51.8% | 53.9% | 53.1% |
| Self-pay | 5.3% | 8.4% | 6.6% | 5.9% | 6.2% |
| No charge | <11 | 0.8% | 0.8% | 0.8% | 0.8% |
| Others | 4.6% | 4.8% | 3.9% | 3.9% | 3.9% |
| Type of admission | | | | | |
| Non-elective | 52.7% | 64.7% | 63.8% | 61.4% | 62.0% |
| Elective | 47.3% | 35.3% | 36.2% | 38.6% | 38.0% |
| Control/ownership of the hospital | | | | | |
| Government, nonfederal | 17.6% | 18.4% | 16.3% | 14.8% | 15.3% |
| Private, nonprofit | 76.9% | 73.1% | 72.9% | 74.6% | 74.2% |
| Private, invest-own | 5.6% | 8.4% | 10.8% | 10.6% | 10.5% |
| Small | 11.6% | 10.9% | 11.1% | 11.7% | 11.5% |
| Medium | 22.7% | 21.3% | 22.3% | 23.3% | 23.0% |
| Large | 65.7% | 67.8% | 66.6% | 65.0% | 65.5% |
| Rural | 3.5% | 6.6% | 6.4% | 7.7% | 7.4% |
| Urban nonteaching | 17.0% | 25.5% | 27.4% | 30.1% | 29.2% |
| Urban teaching | 79.5% | 67.9% | 66.2% | 62.2% | 63.4% |
| Northeast | 20.7% | 18.9% | 19.3% | 20.5% | 20.2% |
| Midwest | 23.6% | 22.3% | 20.0% | 21.9% | 21.5% |
| South | 38.7% | 37.9% | 41.3% | 39.5% | 39.8% |
| West | 17.0% | 20.9% | 19.5% | 18.1% | 18.5% |
| 2010 | 25.5% | 20.3% | 20.5% | 21.6% | 21.3% |
| 2011 | 21.8% | 18.5% | 21.1% | 21.0% | 20.9% |
| 2012 | 22.1% | 20.3% | 19.5% | 19.5% | 19.6% |
| 2013 | 17.8% | 21.2% | 19.2% | 19.3% | 19.4% |
| 2014 | 12.7% | 19.6% | 19.7% | 18.6% | 18.9% |
| Comorbidities | | | | | |
| Coronary atherosclerosis | 0.8% | 0.8% | 1.4% | 4.5% | 3.7% |
| Alcohol abuse | <11 | 1.7% | 1.7% | 3.3% | 2.9% |
| Drug abuse | 4.4% | 5.7% | 4.8% | 4.0% | 4.2% |
| Acquired immune deficiency syndrome coagulopathy | <11 | 1.4% | 1.9% | 1.8% | 1.8% |
| Coagulopathy | 3.8% | 4.1% | 4.5% | 5.0% | 4.8% |
| Diabetes, uncomplicated | 1.7% | 2.5% | 6.2% | 11.5% | 9.9% |
| Diabetes with chronic complications | <11 | 0.3% | 1.0% | 1.8% | 1.6% |
| Hypertension | 3.7% | 8.4% | 17.3% | 30.5% | 26.5% |

Table 1 (continued)

| Variables | 11–20 years (n = 1766) | 21–30 years (n = 13,621) | 31–40 years (n = 57,092) | 41–50 years (n = 201,267) | Overall (n = 273,746) |
|------------------------------------|------------------------|--------------------------|--------------------------|---------------------------|-----------------------|
| Liver disease | 2.4% | 1.8% | 2.4% | 3.8% | 3.4% |
| Obesity | 2.9% | 6.3% | 8.8% | 10.4% | 9.8% |
| Dyslipidemia | <11 | 1.1% | 4.8% | 12.4% | 10.1% |
| Smoking | 10.2% | 20.1% | 22.7% | 27.0% | 25.7% |
| Peripheral vascular disorders | 0.9% | 0.4% | 0.5% | 1.2% | 1.0% |
| Renal failure | 0.8% | 1.5% | 3.0% | 4.0% | 3.6% |
| Chronic pancreatitis | <11 | 0.4% | 0.4% | 0.4% | 0.4% |
| Gallstone | 1.1% | 0.8% | 1.3% | 1.5% | 1.4% |
| Family history of cancer | 4.8% | 7.2% | 5.7% | 4.5% | 4.9% |
| All-cause mortality | 1.4% | 2.0% | 2.1% | 2.1% | 2.1% |
| Length of stay days (mean ± SD) | 6.4 ± 10.4 | 6.3 ± 7.6 | 6.1 ± 7.0 | 5.8 ± 6.6 | 5.9 ± 6.8 |
| Total hospital charges (mean ± SD) | \$56,274 | \$54,565 | \$52,730 | \$50,846 | \$51,459 |
| Disposition of patient | | | | | |
| Routine | 84.0% | 75.8% | 74.6% | 72.9% | 73.5% |
| Transfer to short-term hospital | 0.8% | 1.5% | 1.8% | 1.5% | 1.6% |
| Other transfers SNF, ICF, other | 1.6% | 3.3% | 3.2% | 4.6% | 4.3% |
| Home health care | 11.9% | 16.1% | 16.8% | 17.5% | 17.3% |

All $p < 0.001$ except chronic pancreatitis $p = 0.016$, all-cause in-hospital mortality $p = 0.171$. *HMO*, health maintenance organization, *SNF*, skilled nursing facility, *ICF*, intermediate care facility. Cell counts < 11 are not reported as per HCUP's guidelines of privacy

race using the appropriate ICD-CM-9 codes. Hospitalization rates were calculated per 100,000 total inpatient population. Trends were assessed using the weighted number of discharges for a particular age/gender/race group as the numerator and the relevant US inpatient population at risk as the denominator. Categorical and continuous variables were compared between the groups using Chi-square test and ANOVA test, respectively, whereas temporal trends in the prevalence of yoCRC across various subgroups were assessed using the linear-by-linear association test, with a p value of significance level chosen to be < 0.05 . SPSS 24.0 was used for analysis.

Results

Demographics, hospital characteristics, pre-existing comorbidities, and in-hospital outcomes of the study population are detailed in Table 1.

Age-specific yoCRC hospitalizations

Age-specific yoCRC hospitalizations rates showed relative increases between 2010 and 2014 as follows: 21–30 years, 10% (from 70 to 77 per 100,000); 31–40 years, 5.8% (from 329 to 347 per 100,000); and 41–50 years, 13.4% (from 1125 to 1276 per 100,000) from 2010 to 2014. However, there was a decreasing trend of yoCRC in the 11–20 years group (from 27 to 18 per 100,000) (Fig. 1). Interestingly, we also found that 41–50 years age group without a family history of gastrointestinal malignancy showed a 12.8% relative increase (from 1073 to 1210 per 100,000) in the yoCRC-related admissions ($p < 0.001$).

Racial differences in yoCRC hospitalizations

Caucasians showed an increased rate of hospitalizations (18.6% relative increase, from 665 to 789 per 100,000), which was more pronounced than in African Americans (14.9% relative increase, from 175 to 201 per 100,000) (Fig. 1c, d).

Gender differences in yoCRC hospitalizations

Significant gender disparities in the hospitalization rates were found in the 41–50 years group. Overall, females had higher relative increase in the yoCRC-related hospitalizations during the study period (20.1% vs. 7.5% in males). Among males, the relative increase in the hospitalizations was as follows: 21–30 years, 10.5% (from 171 to 189 per 100,000); 31–40 years, 9.8% (from 590 to 648 per 100,000); and 41–50 years, 7.5% (from 1284 to 1380 per 100,000). However, there was a decrease in the trends in the 11–20 years group (from 30 to 25 per 100,000). Relative increase in yoCRC hospitalizations in females ($p < 0.001$) aged 21–30 years, 13.6% (from 44 to 50

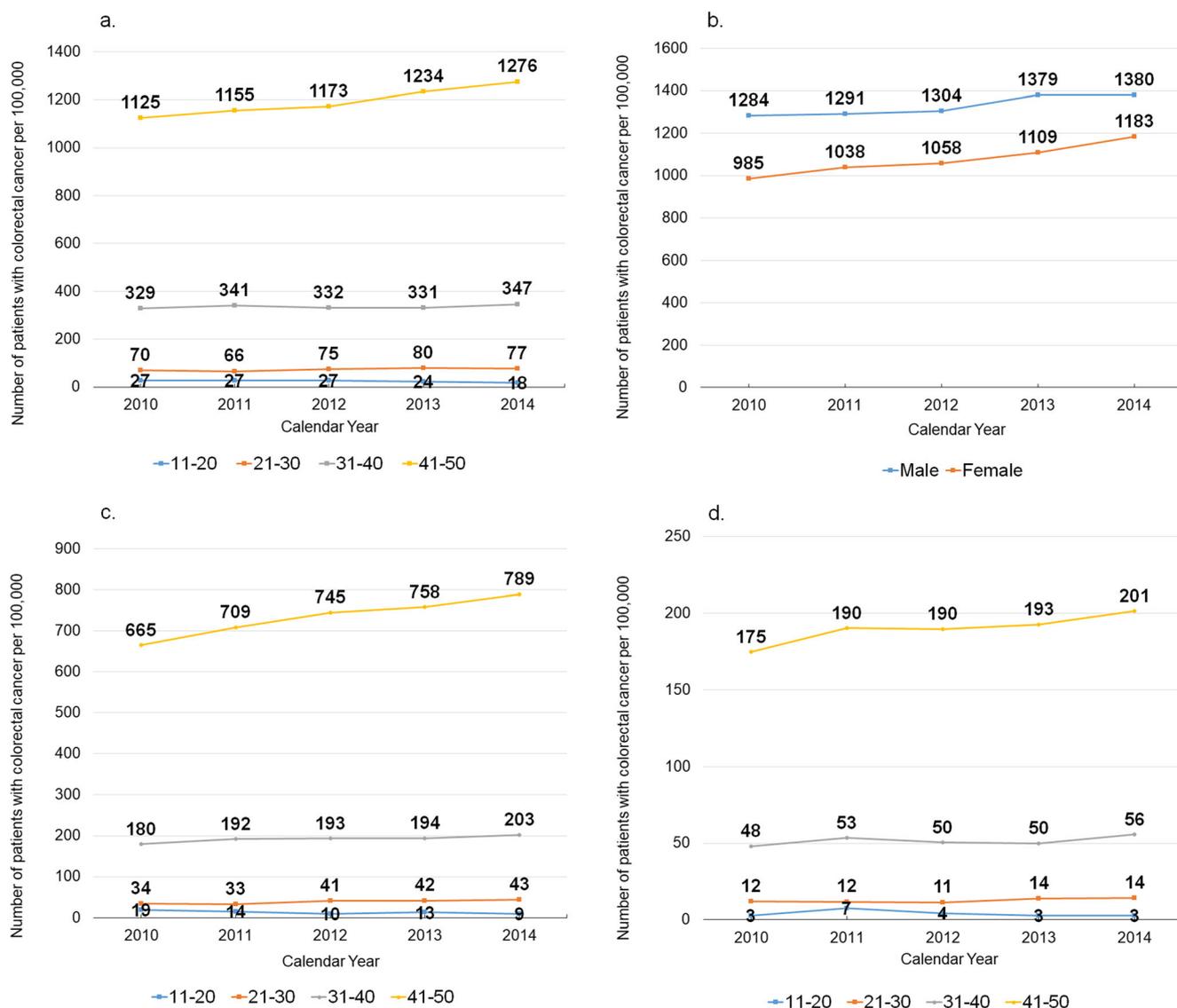


Fig. 1 a Trends in age-specific young-onset colorectal cancer hospitalizations (per 100,000 populations). **b**. Trends in gender-specific young-onset colorectal cancer hospitalizations (per 100,000

populations), 41–50 years. **c** Age-specific young-onset colorectal cancer-related hospitalizations in Whites. **d** Age-specific young-onset colorectal cancer-related hospitalizations in African Americans

per 100,000); 31–40 years, 5.4% (from 221 to 233 per 100,000); and 41–50 years, 20.1% (from 985 to 1183 per 100,000). There was a decrease in the trends in the 11–20 years group similar to males (Fig. 1b).

Discussion

Our study revealed several major findings on yoCRC-related hospitalization trends. Our data show an increasing trend in age-specific inpatient hospitalizations for yoCRC from 2010 to 2014 (13.4% in the 41–50 years age group followed by 10% for 21–30 years and 5.8% for 31–40 years). These observations highlight 41–50 years as a

higher risk group requiring greater allocation of resources for hospitalizations and interventions. The higher increase in 41–50 years group could be due to an early development of symptoms from CRC and early colonoscopy. According to the National Health Interview Survey (NHIS), 13.6% of adults aged 40–49 years underwent a colonoscopy in the past decade in 2013, compared with only 6.4% in 2000 [1]. As per Silla et al. the majority of yoCRC is sporadic [5]. Liebermann et al. [4] noted that only a fraction of early colonoscopies are performed in high-risk patients with a family history of CRC or for genetic screening reasons. Otherwise, the vast majority is in symptomatic patients. However, earlier detection is likely only one factor; other younger age groups from 21 to 30 years and 31–40 years

also showed a similar, though somewhat smaller, increasing trend in CRC.

Caucasians were noted to have an increasing rate of hospitalizations (18.6% relative increase, from 665 to 789 per 100,000), more pronounced than that for African Americans (14.9% relative increase, from 175 to 201 per 100,000). These results concur with a recent SEER database analysis (1992–2014) which showed racial disparities in the incidence of yoCRC and patient survival for cancer of the colon, but minimal differences for rectal cancer [6]. These results suggest the possibility of aggressive tumor biology and/or advanced stage at diagnosis in Caucasians, leading to increasing trends in the hospitalizations.

The most striking finding of our study was accelerated increase in yoCRC-related hospitalizations in females of the 41–50 years group. It is well-known that women have higher incidence of right-sided colon cancer, which is a more aggressive form of colon cancer than the left-sided cancers. An added issue in this population is that CRC treatment can lead to amenorrhea and affect fertility in premenopausal women. It has also been shown that women experience more severe toxicity to 5-fluorouracil treatment than men, potentially reducing the duration of treatment in females [7].

Because this was a retrospective analysis of the largest all-payer inpatient database, our study had some limitations. The data was organized by administrative coding in addition to ICD-9. Hence, not all data were accessible for analysis to determine tumor characteristics, stage of disease, treatment, complications, etiological risk factors, or time course of hospitalizations.

The rise in yoCRC is not limited to the US only but is a global phenomenon [8]. The US Multi-Society Task Force of Colorectal Cancer (MSTF) suggests to start screening in African Americans at age 45 [2]. The American Cancer Society (ACS) recommends that average-risk adults aged 45 years and older should undergo regular screening [3]. Our findings further validate ACS and MSTF qualified recommendations and generate additional epidemiological data on the healthcare utilization in yoCRC.

Author contributions HG conceived the idea and designed the study. RD performed the data analysis. HG, MMA, RD, and MJ made the draft of the manuscript. GHE and PB revised the manuscript for the scientific content. All authors approved the final manuscript.

Compliance with ethical standards

Conflict of interest The authors declare that they have no conflict of interest.

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