A Retrospective Analysis of Gender-Based Difference in Adherence to Initial Colon Cancer Screening Recommendations

Jose Raul Valery[1] [iD], Andres Applewhite[1], Alyssa Manaois[2], John Dimuna[2], Taimur Sher[1], Michael G. Heckman[1], Danielle E. Brushaber[3], and Fernando Stancampiano[1] [iD]

Abstract

Background: Colorectal cancer (CRC) is the fourth leading cause of cancer-related death in the United States, despite being largely preventable and treatable. Improving overall screening rates among both men and women is considered an important and effective strategy toward reducing morbidity and mortality from CRC. In order to optimize screening strategies, factors associated with decreased compliance need to be understood. This study aimed to compare initial CRC screening rates between males and females in a population of patients who presented for an annual physical examination. **Methods:** A retrospective chart review study of 380 patients designed to compare rates of initial CRC screening between males and females was conducted. Patients who were seen at our institution for an annual physical examination and were between 51 and 60 years of age were included. **Results:** There was no evidence of a difference in the rate of initial colon cancer screening between females (83.0%) and males (80.9%) in either unadjusted analysis (odds ratio = 1.16, P = .59) or in multivariable analysis adjusting for potential confounding variables (odds ratio = 1.16, P = .61). **Conclusions:** There was no significant difference in the rate of initial CRC screening between males and females who presented for an annual physical examination. This suggests that designing interventions to improve screening specific to gender may not be needed in a population of patients who attend routine preventive health examinations. Further study is needed in the general population to examine for gender-based differences in initial CRC screening among patients who do not regularly follow up for preventive examinations.

Keywords

colorectal cancer screening, gender-based difference, preventive health

Dates received 15 April 2020; revised 6 May 2020; accepted 7 May 2020

Background

The US Preventive Services Task Force (USPSTF) recommends colorectal cancer (CRC) screening for patients between the ages of 50 and 75 years (a recommendation).[1] Fortunately, CRC is a preventable and treatable cancer if found early, but continues to be the fourth leading cause of cancer-related death in the United States.[2,3] Therefore, strategies for optimizing adherence to screening recommendations are needed.

To help inform strategies aiming to improve CRC screening adherence, it is important to understand differences in screening recommendation uptake among patient groups. The literature suggests there may be a discrepancy in CRC screening rate between genders.

For example, a 2013 retrospective chart review study done using the Iowa Research Network (IRENE) found that male gender was an independent factor associated with completion of CRC screening with an odds ratio of 0.4 after a recommendation to do so was provided by a physician.[4] A 2004 medical record review from 8 community centers including over 1100 patients found that CRC screening was

[1]Mayo Clinic Florida, Jacksonville, FL, USA
[2]Mayo Clinic School of Health Sciences, Jacksonville, FL, USA
[3]Mayo Clinic Rochester, Rochester, MN, USA

Corresponding Author:
Jose Raul Valery, Division of Community Internal Medicine, Mayo Clinic Florida, 4500 San Pablo Road, Jacksonville, FL 32224, USA.
Email: valery.jose@mayo.edu

predicted by male gender.[5] A systemic review of barriers to and facilitators of CRC screening for patients age ≥65 years published in 2010 found female gender to be a frequently reported barrier to CRC screening.[6]

Results of population-based survey studies also point toward a difference in CRC screening between genders although not on a consistent basis. A 2014 review of over 28 000 patients in California using National Health Interview Survey (NHIS) data found that women had lower CRC screening rates.[7] A 2012 US study of over 33 000 subjects using the Medical Expenditure Panel Survey (MEPS) found no significant difference between genders regarding CRC screening.[8] Data published by the Centers for Disease Control and Prevention (CDC) obtained from household surveys found the reported rate in 2015 of having had any CRC screening test or procedure to be 61.6% for males and 63.1% for females.[9] Potential changes over time in behavior toward CRC screening and geographical differences could account for these inconsistent findings.

There have also been studies attempting to clarify gender-specific barriers to CRC screening. In 2013, a qualitative Canadian study of unscreened individuals suggested that procrastination was a more significant barrier in males than females against CRC screening.[10] A 2006 US study suggested that females perceived preparation for endoscopic procedures as a major barrier to CRC screening and also viewed CRC as a male disease, feeling less vulnerable to it.[11]

Further evaluation of any gender-based differences in CRC screening is needed to enhance the existing literature. Our study aimed to compare the rate of initial CRC screening between males and females in a population of patients aged 51 to 60 years, who presented for an annual preventive health examination.

Methods

This study was reviewed and approved by our institutional review board (study # 19-000450).

Study Patients

Of 580 patients aged 51 to 60 years who underwent a preventive health physical examination in the Division of Community Internal Medicine at Mayo Clinic in Jacksonville, Florida between October 2018 and April 2019, 380 patients (218 female and 162 male) met criteria for inclusion in this retrospective study. All providers were English-speaking. Primary language for patients was not recorded. Exclusion criteria were personal or family history of CRC, personal or family history of familial adenomatous polyposis syndrome, personal or family history of lynch syndrome, and history of inflammatory bowel disease. Patients were also excluded who had a history of a colonoscopy for an alternative indication prior to age 50 years.

Information was collected by study staff trained for data abstraction regarding age at physical examination, sex, race, ethnicity, body mass index (BMI), insurance type, Charlson Comorbidity Index, CRC screening, and type of test for CRC screening.

Statistical Analysis

Continuous variables were summarized with the sample median and range. Categorical variables were summarized with number and percentage of patients. Comparisons of characteristics between males and females were made using a Wilcoxon rank sum test (continuous variables) or Fisher's exact test (categorical variables). The proportion of patients who underwent CRC screening (the dependent variable) was compared between males and females (sex was the independent variable) using single-variable (ie, unadjusted) and multivariable logistic regression models. Multivariable models were adjusted for all characteristics that differed between males and females with a P value <.05. Odds ratios (ORs) and 95% confidence intervals (CIs) were estimated. P values <.05 were considered as statistically significant and all statistical tests were 2-sided. With an 82% rate of CRC screening in our study, we had 80% power at the 5% significance level to detect an OR of 2.30 regarding the association between CRC screening and sex. Statistical analyses were performed using SAS (version 9.4; SAS Institute, Inc).

Results

A comparison of patient characteristics between females and males is shown in Table 1. Compared with males, females had a significantly lower BMI (median: 25.7 vs 28.6 kg/m², P < .001) and a significantly lower Charlson Comorbidity Index (score >1: 20.2% vs 32.7%, P = .005). There were no other dramatic differences in patient characteristics between females and males (all Ps ≥ .27, Table 1).

The proportion of patients who underwent initial CRC screening is compared between females and males in Table 2. There was no evidence of a difference in the rate of initial CRC screening between females (83.0%) and males (80.9%) in either single-variable analysis (OR = 1.16, P = .59) or multivariable analysis adjusting for BMI and Charlson Comorbidity Index (OR = 1.16, P = .61). This lack of difference was consistent when examining the separate subgroups of patients aged 51 to 55 years, and those aged 56 to 60 years (all Ps ≥ .16, Table 2). Of the 312 patients who underwent CRC screening in our study, 306 (98.1%) did so with colonoscopy, and this was similar for females and males (98.3% vs 97.7%, P = .70).

Discussion

Our study showed that in patients who attended appointments for routine physical exams, no significant

Table 1. Comparison of Patient Characteristics Between Males and Females.[a]

	Female (n = 218)	Male (n = 162)	P
Age at physical, y	57.0 (51.1, 60.9)	56.2 (51.0, 60.9)	.72
Race, n (%)			.73
White	183 (86.7)	139 (89.7)	
Black	17 (8.1)	10 (6.5)	
Other	11 (5.2)	6 (3.9)	
Ethnicity			1.00
Hispanic or Latino	13 (6.2)	10 (6.5)	
Not Hispanic or Latino	196 (93.8)	145 (93.5)	
Body mass index, kg/m^2	25.7 (14.5, 46.6)	28.6 (17.3, 42.8)	<.001
Insurance, n (%)			.27
Private	214 (98.2)	160 (98.8)	
Government	4 (1.8)	1 (0.6)	
Other	0 (0.0)	1 (0.6)	
Charlson Comorbidity Index Score, n (%)			.005
1	174 (79.8)	109 (67.3)	
2	36 (16.5)	34 (21.0)	
3	4 (1.8)	12 (7.4)	
4	4 (1.8)	4 (2.5)	
5	0 (0.0)	3 (1.9)	

[a]The sample median (minimum, maximum) is given for continuous variables. *P* values result from a Wilcoxon rank sum test (continuous variables) or Fisher's exact test (categorical variables). Race information was unavailable for 14 participants (7 female, 7 male) and ethnicity information was unavailable for 16 participants (9 female, 7 male).

Table 2. Comparison of Colon Cancer Screening Between Males and Females.[a]

	No. (%) of patients who underwent colon cancer screening		Comparison of colon cancer screening between females and males (reference group)			
			Single-variable analysis		Multivariable analysis	
Patient group	Females	Males	OR (95% CI)	P	OR (95% CI)	P
All patients	181/218 (83.0)	131/162 (80.9)	1.16 (0.68, 1.96)	.59	1.16 (0.67, 2.00)	.61
Age 51-55 years	64/89 (71.9)	55/72 (76.4)	0.79 (0.39, 1.62)	.52	0.79 (0.38, 1.63)	.52
Age 56-60 years	117/129 (90.7)	76/90 (84.4)	1.80 (0.79, 4.09)	.16	1.68 (0.69, 4.09)	.25

[a]ORs, 95% CIs, and *P* values result from logistic regression models. ORs are interpreted as the multiplicative increase in the odds of colon cancer screening for females in comparison with males. Multivariable models were adjusted for body mass index and Charlson Comorbidity Index.

gender-based difference for initial CRC screening existed. Despite female patients having a significantly lower BMI and Charlson Comorbidity Index score, the lack of difference in CRC screening rates persisted when adjusting for these variables. When interpreting and assessing the generalizability of these results, it is important to consider the overall high screening rate, relatively low age-range of patients, and insurance status of the population of patients included in this study.

The rate of CRC screening found was high at >80% for both genders when compared to CRC rates found in other studies, suggesting an overall adherent study population.[12-15] For example, in 2013 the overall rate of CRC screening in the United States for patients aged 50 to 75

years was 57.8%.[9] The high rate of CRC screening found in this study is likely in part due to selection bias. Patients included in this study were those who had completed a routine yearly physical examination and who had an established relationship with a primary care physician. This is in contrast with survey studies found in the literature on this topic that are based on data gathered from surveys in the general population.

It is worth briefly contrasting the strengths and limitations between previous survey studies and the single-center retrospective study design that was utilized in our study. Use of a survey to assess CRC screening rates in males and females would have a significant strength in the ability to capture information from the general population, though

would be limited by bias, in that the response rate of surveys is quite often fairly low, and very often the characteristics of patients who do and do not respond to the survey differ. It is easy to imagine a scenario where patients who had a family history of CRC would be more likely to respond to a survey about CRC than patients who had none. Single-center retrospective chart reviews, such as this study, have the advantage of being able to study all patients who are seen over a certain time period without the nonresponse bias that occurs for surveys. However, any retrospective study is limited by possible biases in data collection, and as a single-center study, generalizability is limited.

The age of patients included was in the lower range for those eligible for CRC screening (51-60 years) while previous research suggests that the patient population 65 years and older is more likely to adhere to CRC screening recommendations.[11] This age-dependent difference in behavior toward CRC screening may lead to a gender difference that is not apparent in patients aged 51 to 60 years. The lower range of the CRC screening population is important to consider given the updated 2018 American Cancer Society guideline update calling for CRC screening starting at age 45 years for average risk patients.[3]

We limited the population of patients to the age range of 51 to 60 years to include only those undergoing an initial CRC screening test. The stratification into 5-year age ranges shown in Table 2 was done to evaluate for any gender difference in CRC screening among subjects undergoing screening in the initial 5 years of eligibility versus those who wait longer. Furthermore, including an older age group may have introduced additional bias given the overall high prevalence of colon polyps at initial colonoscopy, likelihood that a history of polyps increases chances of further surveillance, the increasing prevalence of polyps with age, and the higher risk for polyps in males.[16-18]

Insurance status is also important to consider in our study population. Lack of insurance is a known barrier to CRC screening.[6] The vast majority of patients included were privately insured. This is an important factor to consider given that in 2015 data published by the National Center for Health Statistics showed that only 63.7% of the population aged 18 to 64 years carried private health insurance.[19]

Overall adherence rate may additionally play a role in any discrepancy that exits between genders toward CRC screening. The overall adherence in the population included in this study was relatively high. It is possible that a gender-based difference may become apparent in populations with overall lower adherence rates. For example, in the early 2000s, the screening rate for CRC in the general population was reported to be approximately 45%.[13-15] At that time period studies reported lower screening rates among females compared wih males by 7% to 9%.[11,20] Moreover, the median BMI for both males (28.6 kg/m^2) and females (25.7 kg/m^2) in our study population was lower than the national median BMI. According to National Health and Nutrition Examination Survey (NHANES) data, the median BMI was 29.1 kg/m^2 for adults aged 50 to 54 years and 29.2 kg/m^2 for those aged 55 to 59 years in 2015-2016.[21] This may reflect a more motivated patient group, which could also bias the results toward a higher adherence to screening recommendations.

It is difficult to draw a conclusion about the association between having an established primary care provider and the lack of difference between genders in the rate of CRC found in this study. However, it is noteworthy that a positive association seems to exist between the rate of CRC screening and the number of primary care visits.[22]

Further study is needed to evaluate for gender-based differences in CRC screening rates among the population of patients aged ≥60 years, within health systems with a baseline CRC screening rate of ≤80%, as well as in patients who do not routinely present for a preventive health examination.

The limitations of our study, as previously mentioned, include its retrospective single-center design. Additionally, the possibility of a type II error (ie, a false-negative finding) is important to consider. We cannot conclude that no true difference exists in the proportion of patients who undergo initial CRC screening between males and females, simply due to the occurrence of a nonsignificant *P* value.

Conclusions

In a population of patients who present for a preventive care annual examination, there does not appear to be a gender-based difference in initial CRC screeninsg. Factors that likely influence the lack of difference include the overall high rate of screening, insurance status, and relatively young age.

Author Contributions

JRV contributed with manuscript preparation, protocol design, and data collection supervision. AA contributed with manuscript preparation and data collection. TS contributed with protocol design and study concept. MH contributed with statistical analysis, manuscript preparation, and protocol design. DEB contributed with statistical analysis and manuscript preparation. FS contributed with manuscript preparation, protocol design, and data collection supervision.

Declaration of Conflicting Interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

ORCID iDs

Jose Raul Valery https://orcid.org/0000-0003-2671-7854
Fernando Stancampiano https://orcid.org/0000-0002-9162-1632

References

1. US Preventive Services Task Force; Bibbins-Domingo K, Grossman DC, et al. Screening for colorectal cancer: US Preventive Services Task Force Recommendation Statement. *JAMA*. 2016;315:2564-2575.
2. Centers for Disease Control and Prevention. United States Cancer Statistics: data visualizations. Accessed April 23, 2020. www.cdc.gov/cancer/dataviz
3. Wolf AMD, Fontham ETH, Church TR, et al. Colorectal cancer screening for average-risk adults: 2018 guideline update from the American Cancer Society. *CA Cancer J Clin*. 2018;68:250-281.
4. Daly JM, Xu Y, Levy BT. Patients whose physicians recommend colonoscopy and those who follow through. *J Prim Care Community Health*. 2013;4:83-94.
5. Christman LK, Abdulla R, Jacobsen PB, et al. Colorectal cancer screening among a sample of community health center attendees. *J Health Care Poor Underserved*. 2004;15:281-293.
6. Guessous I, Dash C, Lapin P, et al; National Colorectal Cancer Roundtable Screening Among the 65 Plus Task Group. Colorectal cancer screening barriers and facilitators in older persons. *Prev Med*. 2010;50:3-10.
7. Yager SS, Chen L, Cheung WY. Sex-based disparities in colorectal cancer screening. *Am J Clin Oncol*. 2014;37:555-560.
8. Vaidya V, Partha G, Karmakar M. Gender differences in utilization of preventive care services in the United States. *J Womens Health (Larchmt)*. 2012;21:140-145.
9. National Center for Health Statistics. Table 72. Use of colorectal tests or procedures among adults aged 50–75, by selected characteristics: United States, selected years 2000–2013. Accessed May 15, 2020. https://www.cdc.gov/nchs/data/hus/2015/072.pdf
10. Ritvo P, Myers RE, Paszat L, Serenity M, Perez DF, Rabeneck L. Gender differences in attitudes impeding colorectal cancer screening. *BMC Public Health*. 2013;13:500.
11. Meissner HI, Breen N, Klabunde CN, Vernon SW. Patterns of colorectal cancer screening uptake among men and women in the United States. *Cancer Epidemiol Biomarkers Prev*. 2006;15:389-394.
12. Wools A, Dapper EA, de Leeuw JR. Colorectal cancer screening participation: a systematic review. *Eur J Public Health*. 2016;26:158-168.
13. Rim SH, Seeff L, Ahmed F, King JB, Coughlin SS. Colorectal cancer incidence in the United States, 1999-2004: an updated analysis of data from the National Program of Cancer Registries and the Surveillance, Epidemiology, and End Results Program. *Cancer*. 2009;115:1967-1976.
14. Seeff LC, Shapiro JA, Nadel MR. Are we doing enough to screen for colorectal cancer? Findings from the 1999 Behavioral Risk Factor Surveillance System. *J Fam Pract*. 2002;51:761-766.
15. Smith RA, Cokkinides V, Eyre HJ; American Cancer Society. American Cancer Society guidelines for the early detection of cancer, 2003. *CA Cancer J Clin*. 2003;53:27-43.
16. Heitman SJ, Ronksley PE, Hilsden RJ, Manns BJ, Rostom A, Hemmelgarn BR. Prevalence of adenomas and colorectal cancer in average risk individuals: a systematic review and meta-analysis. *Clin Gastroenterol Hepatol*. 2009;7:1272-1278.
17. Rex DK. Colonoscopy: a review of its yield for cancers and adenomas by indication. *Am J Gastroenterol*. 1995;90:353-365.
18. Williams AR, Balasooriya BA, Day DW. Polyps and cancer of the large bowel: a necropsy study in Liverpool. *Gut*. 1982;23:835-842.
19. National Center for Health Statistics. Table 102 (page 1 of 3). Private health insurance coverage among persons under age 65, by selected characteristics: United States, selected years 1984–2014. Accessed May 15, 2020. https://www.cdc.gov/nchs/data/hus/2015/102.pdf
20. Brawarsky P, Brooks DR, Mucci LA. Correlates of colorectal cancer testing in Massachusetts men and women. *Prev Med*. 2003;36:659-668.
21. Centers for Disease Control and Prevention, National Center for Health Statistics. National Health and Nutrition Examination Survey: NHANES 2015-2016 Examination Data. Accessed May 15, 2020. https://wwwn.cdc.gov/nchs/nhanes/search/datapage.aspx?Component=Examination&CycleBeginYear=2015
22. Halm EA, Beaber EF, McLerran D, et al. Association between primary care visits and colorectal cancer screening outcomes in the era of population health outreach. *J Gen Intern Med*. 2016;31:1190-1197.