

Use of Colorectal Cancer Screening Among People With Mobility Disability

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Goals: We aimed to assess use of colorectal cancer screening (CRCS) as per United States Preventive Task Force guidelines among people with mobility disability using a nationally representative data set.

Background: Individuals with mobility disability have decreased access to health care services, but the impact of mobility disability on CRCS has not been investigated.

Study: Data from the 2013 National Health Interview Survey were used to estimate sociodemographic characteristics of adults with mobility disability, prevalence of CRCS, and odds of CRCS given mobility disability among Americans aged 50 to 75.

Results: In total, 56.8% of the entire sample ($n = 81,953,585$) were up-to-date with CRCS. Mobility disability was not associated with CRCS status on univariable analysis but was significantly associated after adjustment for covariates including age and comorbidities, with an inverse relationship between the degree of mobility disability and odds of CRCS. Odds ratio for CRCS given progressively severe disability were 0.78 (0.66 to 0.93), 0.71 (0.53 to 0.94), 0.65 (0.31 to 1.19).

Conclusions: The present study indicates reduced CRCS among people with mobility disability and highlights the need for CRCS to be especially targeted toward this group. Future research should identify the specific systemic, social, and/or physical barriers to CRCS for this subgroup so that they can be addressed.

Key Words: aging, disabled persons, epidemiology, screening, cancer, colorectal neoplasms

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Colorectal cancer (CRC) is the second leading cause of cancer-related death in the United States¹ and the third-leading cause worldwide.² Colorectal cancer screening (CRCS) is an effective tool to reduce the number of deaths from CRC. The US Preventive Services Task Force (USPSTF) and the Centers for Disease Control and Prevention (CDC) recommend CRCS for adults between ages 50 and 75 using colonoscopy, sigmoidoscopy, or fecal occult blood testing (FOBT).³ However, CRCS is underutilized by American adults, with only 65% of eligible adults being up-to-date with CRCS in 2012.^{4,5} Further, traditionally underserved populations, such as people in lower socioeconomic positions,⁶ those in rural areas,^{7,8} immigrants,^{6,9} the homeless,¹⁰ and racial minorities^{9,11–13} experience particularly low rates of CRCS.^{9,13,14}

People with disabilities experience barriers to accessing primary health care services, including preventive cancer screening.^{15–22} A complex set of reasons, including inaccessible architecture; providers' low prioritization of medical needs unrelated to the disability; and inaccessible or inconvenient transportation are responsible for this finding.^{22,23} Insufficient family and staff awareness of preventative screening needs for people with disabilities is another reason.²⁴ One study found that clinics frequently have insufficient numbers of staff members who can provide extra assistance with screening activities to people with disabilities.²³

To our knowledge, there has been no nationally representative analysis of CRCS among people with mobility disability in the United States using current data. We aimed to measure CRCS rates in this population using the same methodology as performed by CDC when measuring CRCS rates in the general population.⁵

MATERIALS AND METHODS

Data Source

We analyzed data from the 2013 National Health Interview Survey (NHIS),²⁵ extracting all variables from the Sample Adult Core file. NHIS is an annual cross-sectional household interview survey performed by the National Center for Health Statistics (NCHS) at the CDC. The data are provided for public use and do not require Institutional Review Board approval before analysis. The study uses a multistage area probability design to permit representation of the civilian, noninstitutionalized United States population.^{26,27} Sample weights adjusted for age, sex, race, and ethnicity²⁷ were applied to create nationally representative estimates.

Study Population

We restricted the population to individuals between ages 50 to 75, in accordance with CDC/USPSTF guidelines.²⁸ Individuals who mentioned having ever had colon cancer were excluded from the sample (unweighted $n = 89$). Those whose answers to “have you ever had a colonoscopy?”; “have

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The authors declare that they have nothing to disclose.

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you ever had a sigmoidoscopy?”; and “have you ever had a blood stool test, using a home test kit?” were not ascertained due to incomplete interviews were excluded from the sample (unweighted $n = 258$). Those who had colonoscopy, flexible sigmoidoscopy (FS), and FOBT all for nonscreening reasons (“because of a problem,” “follow-up test of an earlier test or screening examination” “other reason”) (unweighted $n = 59$) were also excluded from the analysis.

Exposure: Physical Capacity

Mobility disability was operationalized based on a validated, ordinal measure of self-reported physical capacity developed by Freedman et al²⁹ through the National Health and Aging Trends Study (NHATS). The original measure by Freedman et al²⁹ assesses physical capacity using 6 pairs of more challenging and less challenging physical tasks. NHIS only collects data on the 6 less challenging tasks. Thus, a 4-level physical capacity scale using the 6 less challenging tasks was created, replicating the physical capacity scale developed by Gell et al.³⁰ This 4-level physical capacity scale was created using the following tasks: (1) walking a quarter of a mile—about 3 city blocks; (2) climbing 10 steps without resting; (3) lifting or carrying something as heavy as 10 pounds such as a full bag of groceries; (4) stooping, bending, or kneeling; (5) reaching up over (one’s) head; and (6) using (one’s) fingers to grasp or handle small objects. Those who answered “not at all difficult,” “only a little difficult,” “somewhat difficult,” or “very difficult” were categorized as able to do the task; those who responded “can’t do at all” were categorized as unable to do the activity. Those who refused to answer, answered “do not do this activity,” “don’t know,” or whose answer was not ascertained due to incompleteness of the study were excluded from the study (unweighted $n = 523$). The 4 levels of physical capacity, ranging from highest physical capacity to lowest physical capacity, were: able to perform all 6 tasks; able to perform 4 to 5 tasks; able to perform 2 to 3 tasks; and able to perform 0 to 1 tasks. The data set was restricted to respondents who had responses for all 6 variables.

Outcome: CRCS

Participants were asked in separate questions whether they had ever had a colonoscopy, sigmoidoscopy, or FOBT. Short descriptions of colonoscopy, sigmoidoscopy, and FOBT were provided. Those who affirmed receipt of any of these screenings provided the date of the examination and reported the amount of time that had elapsed since the last screening. The reason for each screening was recorded as well. NHIS uses a variety of methods to calculate time-since-event; the most recently implemented method (from 2005) was used in this analysis.²⁷

The binary outcome of being up-to-date with CRCS was designed according to current CDC/USPSTF guidelines.²⁸ Individuals were considered up-to-date with CRCS if they filled at least one of the following 3 criteria: had screening colonoscopy within the last 10 years; had screening sigmoidoscopy within the past 5 years and screening FOBT within the past 3 years; and/or had screening FOBT within the past 1 year. Individuals who answered “no” to “have you ever had a colonoscopy?” and “have you ever had a sigmoidoscopy?” and “have you ever had a blood stool test, using a home test kit?” or whose colonoscopy, FS, and/or FOBT were all not within the timeframe recommended by CDC/USPSTF guidelines comprised the comparator group, that is, not up-to-date with CRCS. Those who selected “because of a routine examination” as the reason for having one of these examinations were

considered to have received screening according to USPSTF guidelines.

Covariates

Race and Ethnicity

A 4-level race category was created: white; black/African American only; Asian only; and “other” (ie, American Indian/Alaska Native only, multiple race, or race group not releasable due to confidentiality reasons). Hispanic ethnicity was operationalized into a separate binary category, with the following groups included in the “Hispanic” category: multiple Hispanic; Puerto Rico; Mexican; Mexican American; Cuban/Cuban American; Dominican (Republic); Central or South American; Other Latin American, type not specified; Other Spanish; Hispanic/Latino/Spanish, nonspecific type; Hispanic/Latino/Spanish, type refused; Hispanic/Latino/Spanish, type not ascertained.

Obesity

Given the documented effect of obesity on access to CRCS,^{19,31,32} obesity was dichotomized as per World Health Organization guidelines³³ into nonobese [body mass index (BMI) < 29.9] versus obese (BMI ≥ 30.0).

Health Insurance

A binary variable assessed whether or not participants were covered by a health insurance plan. Those who were insured reported having health insurance from private health insurance, Medicare, Medicaid, State Children’s Health Insurance Program, a state-sponsored health plan, other government plans, and/or military plans at the time of the interview. A minority of individuals had missing data (0.1%), which were coded as “unknown” and were combined with “no health insurance” for all analyses.

Regular Source of Health Care

A binary variable assessed whether or not participants received health care from a regular source. Those who indicated they did not have a source of regular health care, or that they usually received health care from a hospital emergency room, hospital outpatient department, or no one particular place most often were categorized as not having a regular source of health care. Those who answered “is there a place you usually go to when you are sick or need advice about your health?” with “yes” or “there is > 1 place” were categorized as having a regular source of health care if the health care was received at a clinic or health center; doctor’s office or HMO; or some other place. Missing data (0.0096%) were coded as “unknown.” Because of low cell count, these data were combined with “no regular source of health care” for all analyses.

Comorbidities

Selection of the chronic conditions was informed by the recommendations of the US Department of Health and Human Services Interagency Workgroup on multiple chronic conditions and Office of the Assistant Secretary for Health³⁴ on standardizing definition of chronic conditions. Data on only 10 of the groups’ 20 listed chronic conditions were available in the NHIS data set. However, asthma was not included due to a high amount of missing data in the variable (88.7%).

Following the approach of Ward and Schiller³⁵ and Ward et al³⁶ a 3-level (0 to 1, 2 to 3, 4 +) multiple chronic conditions

variable was constructed. The exposure variable was not included in the count of chronic conditions. Participants who affirmed ever being told by a doctor or health professional that he or she had hypertension; coronary heart disease; stroke; diabetes; cancer or a malignancy of any kind; arthritis, rheumatoid arthritis, gout, lupus, or fibromyalgia; hepatitis; or chronic obstructive pulmonary disease were considered to have a chronic condition. Reporting weak or failing kidneys during the past 12 months was considered a proxy for having chronic kidney disease.³⁴ A minority of individuals had missing data, which were coded as “unknown” and included in the analyses.

Statistical Analyses

SAS version 9.4³⁷ was used for all analyses. Cluster, strata, and weight variables were applied to account for NHIS's complex survey design for calculation of proportions; averages; univariable and multivariable odds ratios (OR); and for all statistical tests. Statistical analyses were performed from December 2014 to May 2015.

The χ^2 tests were used to test differences between proportions. Univariable analyses of each covariate's relationship with the outcome were performed to calculate OR and 95% confidence intervals (CI). Multivariable survey logistic regression was used to assess the relationship between CRCS and mobility disability, controlling for age, sex, education, health insurance, employment status, BMI,

and comorbidities. Covariates were selected a priori and all were included in the multivariable model. All statistical tests were 2-sided and α was set to 0.05 for all analyses.

RESULTS

The weighted sample size was 81,953,585 individuals aged 50 to 75 years. The mean age in the sample was 60.4 years. Sociodemographic characteristics and other covariate information for the overall sample are presented in Table 1. Both weighted and unweighted sample sizes are presented. Three of the 8 covariates had missing data: 0.2% of data on health insurance status were missing; 0.0096% of data on regular source of health care were missing; and 2.9% of data on comorbidities were missing.

The present study used being up-to-date with any CRCS as per USPSTF guidelines as the primary outcome. Secondary outcome information stratified by type of CRCS (colonoscopy, FS, and FOBT) received are presented in the Appendix (Appendix Table 1, Supplemental Digital Content 1, <http://links.lww.com/JCG/A323>). Weighted and unweighted sample sizes, percentages, and the results of univariable analyses examining the relationship of sociodemographic characteristics and predictors of the primary outcome are presented in Table 1.

Table 2 describes the relationships between physical capacity, being up-to-date with any CRCS, and the other

TABLE 1. Sociodemographic Characteristics and the Proportion of Respondents Aged 50-75 Up-to-Date With CRCS

Characteristic	Sample		Proportion Up-to-Date With CRCS		<i>P</i> [‡]
	N	n (%)*, [†]	N	n (%)*, [†]	
Overall	12,431	81,953,585 (100.0)	58,956	39,485,786 (48.2)	—
Age (y)					
Mean (SE) = 60.4 (0.1)*					
50-59	5657	40,401,994 (49.3)	2196	15,929,679 (39.4)	< 0.0001
60-69	4809	30,296,535 (37.0)	2555	16,737,838 (55.2)	—
70-75	1965	11,255,056 (13.7)	1144	6,818,269 (60.6)	—
Sex					
Male	6789	42,336,625 (51.7)	3219	20,151,249 (47.6)	0.27
Female	5642	39,616,960 (48.3)	2676	19,334,537 (48.8)	—
Race					
White	9613	67,979,681 (82.9)	4604	33,020,315 (48.6)	0.10
Black	1885	8,604,766 (10.5)	900	4,162,079 (48.4)	—
Asian	599	3,869,689 (4.7)	258	1,686,447 (43.6)	—
Other	334	1,499,449 (1.8)	133	616,945 (41.1)	—
Ethnicity					
Non-Hispanic	10,935	73,958,229 (90.2)	5381	36,888,390 (49.9)	< 0.0001
Hispanic	1496	7,995,356 (9.8)	514	2,597,396 (32.5)	—
Obesity					
Nonobese	8160	54,341,925 (66.3)	3855	26,087,083 (48.0)	0.69
Obese	4271	27,611,660 (33.7)	2040	13,398,703 (48.5)	—
Health insurance					
No/unknown	1421	8,856,274 (10.8)	237	1,514,362 (17.5)	< 0.0001
Yes	11,010	73,097,311 (89.2)	5658	37,971,424 (51.9)	—
Regular source of health care					
No/unknown	1448	8,429,501 (10.3)	272	1,429,483 (17.0)	< 0.0001
Yes	10,983	73,524,084 (89.7)	5623	38,056,303 (51.8)	—
No. comorbidities					
0-1	7130	48,890,656 (59.7)	3719	25,552,812 (52.3)	< 0.0001
2-3	4079	25,889,642 (31.6)	2845	18,013,511 (69.6)	—
4 +	815	4,764,023 (5.8)	573	3,409,165 (71.6)	—
Unknown	407	2,409,264 (2.9)	243	1,450,193 (60.2)	—

*Weighted values.

[†]Proportions use weighted values.

[‡]Boldface indicates statistical significance ($P < 0.05$).

CRCS indicates colorectal cancer screening.

TABLE 2. Sociodemographic Characteristics and Screening Status by Level of Physical Capacity

Characteristic	<i>P</i> †	Level of Physical Capacity [n (%)]*			
		Able to Perform All 6 Tasks (Highest Physical Capacity)	Able to Perform 4-5 Tasks	Able to Perform 2-3 Tasks	Able to Perform 0-1 Tasks (Lowest Physical Capacity)
Total		73,411,683 (89.6)	5,792,355 (7.1)	2,192,252 (2.7)	557,295 (0.7)
Up-to-date with CRCs					
No	0.48	37,846,226 (89.1)	3,125,522 (7.4)	1,172,225 (2.8)	323,826 (0.8)
Yes		35,565,457 (90.1)	2,666,833 (6.8)	1,020,027 (2.6)	233,469 (0.6)
Age (y)					
Mean (SE)*		60.2 (0.1)	62.3 (0.3)	62.3 (0.5)	62.7 (1.0)
50-59	< 0.0001	37,036,855 (91.7)	2,289,594 (5.7)	857,293 (2.1)	218,252 (0.5)
60-69		26,904,765 (88.8)	2,253,413 (7.4)	909,307 (3.0)	229,050 (0.8)
70-75		9,470,063 (84.1)	1,249,348 (11.1)	425,652 (3.8)	109,993 (1.0)
Sex					
Female	< 0.0001	36,976,586 (87.3)	3,717,057 (8.8)	1,308,078 (3.1)	334,904 (0.8)
Male		36,435,097 (92.0)	2,075,298 (5.2)	884,174 (2.2)	222,391 (0.6)
			Race		
White	< 0.0001	61,232,013 (90.1)	4,726,864 (7.0)	1,529,795 (2.3)	491,009 (0.7)
Black		7,313,478 (85.0)	731,698 (8.5)	512,241 (6.0)	47,349 (0.6)
Asian		3,598,134 (93.0)	176,780 (4.6)	83,300 (2.2)	11,475 (0.3)
Other		1,268,058 (84.6)	157,013 (10.5)	66,916 (4.5)	7,462 (0.5)
Ethnicity					
Non-Hispanic	0.33	66,287,325 (89.6)	5,196,671 (7.0)	2,001,359 (2.7)	472,874 (0.6)
Hispanic		7,124,358 (89.1)	595,684 (7.5)	190,893 (2.4)	84,421 (1.1)
Obesity					
Nonobese	< 0.0001	50,228,304 (92.4)	2,784,596 (5.1)	1,020,671 (1.9)	308,354 (0.6)
Obese		23,183,379 (84.0)	3,007,759 (10.9)	1,171,581 (4.2)	248,941 (0.9)
Health insurance					
No/unknown	< 0.0001	8,083,070 (91.3)	645,318 (7.3)	82,365 (0.9)	45,521 (0.5)
Yes		65,328,613 (89.4)	5,147,037 (7.0)	2,109,887 (2.9)	511,774 (0.7)
Regular source of health care					
No/unknown	0.38	7,580,326 (89.9)	637,392 (7.6)	157,202 (1.9)	54,581 (0.6)
Yes		65,831,357 (89.5)	5,154,963 (7.0)	2,035,050 (2.8)	502,714 (0.7)
No. comorbidities					
0-1	< 0.0001	47,194,158 (96.5)	1,279,579 (2.6)	347,834 (0.7)	69,085 (0.1)
2-3		21,533,588 (83.2)	3,081,630 (11.9)	997,708 (3.9)	276,716 (1.1)
4 +		2,657,246 (55.8)	1,172,305 (24.6)	750,406 (15.8)	184,066 (3.9)
Unknown		2,026,691 (84.1)	258,841 (10.7)	96,304 (4.0)	27,428 (1.1)

*Weighted values.

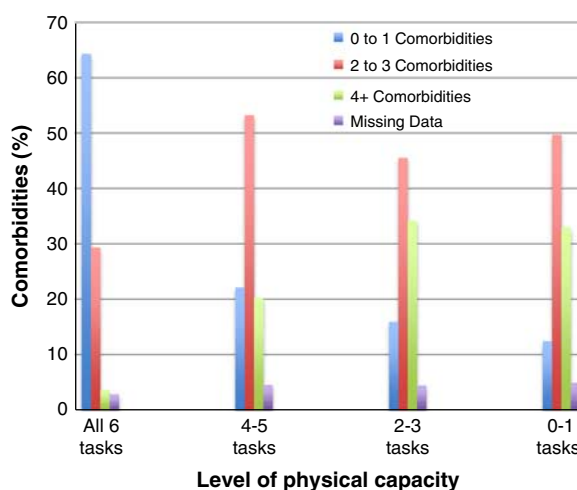
†Boldface indicates statistical significance ($P < 0.05$).

CRCs indicates colorectal cancer screening.

covariates. Weighted sample sizes, proportions, and the results of bivariate analyses are presented. Age, sex, race, obesity, health insurance status, and comorbidity status were all highly associated with physical capacity ($P < 0.0001$ for each variable). Physical capacity was not associated with CRCs status on univariable analysis ($P = 0.13$). Similarly, neither ethnicity ($P = 0.33$) nor having a regular source of health care ($P = 0.38$) was associated with physical capacity.

Decreased physical capacity was more common among the older than the younger adults in the sample. The distribution of the 3 age groups in the lowest 3 levels of physical capacity were quite similar to each other but different from the distribution of age group in the highest physical capacity level. The mean age of the category of highest physical capacity (60.2 y, SE = 0.1) was 2 years below the mean ages of the 3 categories of lower physical capacity [able to perform 4 to 5 tasks, 62.3 (0.3); able to perform 2 to 3 tasks 62.3 (0.5); able to perform 0 to 1 task, 62.7 (1.0)].

A similar pattern was observed with comorbidities (Fig. 1, number of comorbidities by level of physical capacity); as physical capacity declined, comorbidities increased. Those with the highest physical capacity primarily had 0 to 1 comorbidities

**FIGURE 1.** Number of comorbidities by level of physical capacity. full color online

(64.3%), 29.3% had 2 to 3 comorbidities, and only a minority (3.6%) had 4+ comorbidities. In contrast, a minority of those in the other 3 physical capacity categories had 0 to 1 comorbidities (22.1%, 15.9%, and 12.4%, respectively). Approximately half of those in the lower physical capacity categories had 2 to 3 comorbidities (53.2%, 45.5%, and 49.7%, respectively).

Table 3 presents OR and 95% CI for the unadjusted and adjusted association of physical capacity with CRCS status. Overall, 48.2% were up-to-date with any CRCS. On univariable analysis, age category was significantly associated with any CRCS, with 48.1% of 50 to 59 year olds, 43.5% of 60 to 69 year olds, and 70.0% of 70 to 75 year olds receiving any CRCS ($P < 0.0001$). Ethnicity, obesity, health insurance status, having a regular source of health care, and number of comorbidities were also significantly associated with CRCS status. Race ($P = 0.10$), sex ($P = 0.27$), and obesity ($P = 0.69$) were not significantly associated with the outcome (data not shown).

On the unadjusted analysis, physical capacity was unrelated to CRCS status ($P = 0.48$). After adjusting for age, sex, race, ethnicity, obesity, health insurance, having a regular source of health care, and level of comorbidities, physical capacity was significantly associated with CRCS ($P = 0.0046$). The odds of CRCS decreased with decreasing physical capacity. Those able to perform 0 to 1 tasks were the least likely to have been screened for CRC in comparison with those able to perform all 6 tasks (OR, 0.65; 95% CI, 0.35-1.19), though this stratum did not meet statistical significance. Those able to perform 2 to 3 tasks (OR, 0.71; 95% CI, 0.53-0.94) and 4 to 5 tasks (OR, 0.78; 95% CI, 0.66-0.93) had similarly significantly decreased odds of CRCS.

When the chronic conditions variable was removed from the multivariable model, the P -value for the physical capacity exposure variable rose to 0.04 (results not presented). When age was removed in addition to the chronic conditions variable, the P -value for the physical capacity variable increased to 0.34. This increase of the P -value past the level of statistical significance did not occur with removal of any other individual variable from the regression model or combined removal of the chronic conditions variable with another variable.

DISCUSSION

An association between mobility disability, operationalized as physical capacity, and CRCS status as per

USPSTF guidelines was the main outcome of this study. Our results indicate that when adjusted for potential confounders, reduced level of physical capacity is significantly associated with reduced odds of CRCS.

These results are congruent with other disparities in receipt of primary preventive screening,^{17-19,22-24,38-49} including CRCS,^{23,43} among people with disabilities. These results also demonstrate that disparities in access to these services increase with increasing disability severity, as previously discussed by Anderson et al.⁸

The results indicate that level of physical capacity is significantly associated with CRCS status only when adjusted for potential confounders. This pattern of negative confounding may be explained by the phenomenon of lower physical capacity with higher age and number of comorbidities but increased rates of CRCS among older patients with multiple comorbidities (Table 3).^{50,51} Lowest level of physical capacity (able to perform only 0 to 1 tasks) was not found to be associated with CRCS status. However, these nonsignificant results may be due to the low cell count for this stratum of physical capacity ($n = 557,295$) in comparison with the cell counts for the other levels of physical capacity (able to perform 2 to 3 tasks, $n = 2,192,252$; able to perform 4 to 5 tasks, $n = 5,792,355$; able to perform 6 tasks, $n = 73,411,683$). The effect of relatively small cell count may similarly explain why the 2 to 3 comorbidities level was a significant predictor of CRCS ($n = 25,889,642$, $P < 0.0001$), whereas > 4 comorbidities ($n = 4,764,023$, $P = 0.13$) was not significantly associated with the outcome.

The literature on access to cancer screening among people with disabilities focuses on women with mobility or intellectual disabilities, identifying inequalities in access to preventive cervical and breast cancer screening.^{19,22,38,41,44,47,48,52,53} The literature examining CRCS among people with disabilities is less robust than the literature on screening for cervical or breast cancer for women with disabilities.²¹ For example, previous studies on CRCS among people with disabilities used case-based methods,⁴³ Medicare data,¹³ or use older data^{42,54} whose collection preceded the present popularity of colonoscopy.^{5,55} One such study⁷ focused on urban/rural disparities, used an age range of 50 to 64 (even though the guidelines call for screening until age 75), and used a broad definition of disability. Colonoscopy questions asked by Miller et al²⁰ were limited by the authors' data set, which lacked information on the upper age limit and the timeframe of CRCS. Miller and colleagues also used a broad classification of disability, following Altman and Bernstein.⁵⁶ Wei et al¹⁷ focused on women, was limited to individuals younger than 65, and did not distinguish between screening and diagnostic colonoscopy. Although some studies have examined CRCS in people with spinal cord injuries,⁵⁷ this group is not the same as people with mobility disability, which may have been acquired in a number of ways. Given the high morbidity and mortality associated with CRC and the pattern of differential access to preventive health services among people with disabilities, our finding raises the concern that mobility disability decreases the likelihood of receiving potentially life-saving screening.

Overall CRCS proportions reported in Table 1 are lower than those previously reported. This may be because the present study used exclusion criteria more restrictive than those in the literature; previous analyses operationalized up-to-date with CRCS according to whether or not the colonoscopy, FS, or FOBT occurred within the USPSTF timeframe guidelines but did not exclude diagnostic tests.^{4,5,9,58} We restricted analysis only to those who had

TABLE 3. Unadjusted and Adjusted Associations of Physical Capacity and Sociodemographic Variables With CRCS Status

Level of Physical Capacity	Unadjusted	Adjusted
	OR (95% CI)	OR (95% CI)
Able to perform all 6 tasks (highest physical capacity)	1.0	1.0
Able to perform 4-5 tasks	0.91 (0.77-1.07)	0.78 (0.66-0.93)
Able to perform 2-3 tasks	0.93 (0.72-1.19)	0.71 (0.53-0.94)
Able to perform 0-1 tasks (lowest physical capacity)	0.77 (0.46-1.28)	0.65 (0.35-1.19)

Adjusted for age, sex, race, ethnicity, obesity, health insurance, regular source of health care, and comorbidities.

CI indicates confidence interval; CRCS, colorectal cancer screening; OR, odds ratio.

colonoscopy, FS, and/or FOBT for screening (as opposed to diagnostic, other, or unknown) reasons. Proportions of adults between 50 and 75 who received CRCS according to exclusion criteria used in previous literature (ie, operationalizing up-to-date with CRCS without conditioning on reason for colonoscopy, FS, or FOBT) are consistent with trends reported previously in the literature⁵⁸ and are presented in the Appendix (Appendix Table 2, Supplemental Digital Content 2, <http://links.lww.com/JCG/A324>).

Limitations

The limitations of this study are worthy of attention. First, the NHIS study population does not include those in long-term care facilities.²⁶ Older adults in these facilities may be more likely to have mobility disability than those residing in noninstitutional settings. This study thus could not determine whether adults with mobility disability who reside in institutional settings experience disparities in CRCS. Second, this study's exclusion criteria relied on self-report for receipt of, timing of, and reason for colonoscopy, FS and/or FOBT. Errors in these reports could not be accounted for in this analysis. Next, educational level could not be controlled for as a potential confounder^{58,59} because the sample weight required for this variable was different from the sample weight for the other variables used in this study; using the education variable would have resulted in incorrect results.

The categorical variable for comorbidities used in this analysis introduces limitations. The variables that informed the count are solely informed by self-reported data, making misclassification likely.⁶⁰ Further, studying comorbidity via a categorical assessment of number of comorbidities is less informative than studying the interactions unique to each individual chronic condition.⁶⁰ Finally, CRCS may not be offered to certain individuals with numerous comorbidities due to limited life expectancy associated with their comorbidities. Thus, our results may reflect decreased screening due to limited life expectancy, not physical capacity status.

Because of the constraints of available variables in NHIS, our measurement of physical capacity relied on Gell and colleagues³⁰ adaptation of a validated scale. Using the original measure by Freedman et al²⁹ would have resulted in more sensitive operationalization of mobility disability. Restricting the analysis only to those who answered the 6 variables that were used to construct the physical capacity variable may have introduced bias into the results as well. Those who completed the questions about physical ability may have sociodemographic characteristics and/or likelihood of experiencing primary preventive care different from those who were disinclined to answer all of these questions. The cross-sectional design of NHIS makes it difficult to assess if physical capacity status preceded the beginning of eligibility for CRCS.

CONCLUSIONS

In conclusion, we found that decreased physical capacity was independently associated with reduced CRCS. Understanding the pattern of CRCS among people with disabilities has implications for targeting cancer screening at especially vulnerable groups. It is important to examine rates of cancer screening in specific subgroups of persons with disabilities because of the different barriers to care affecting each subgroup.^{21,22} For example, the barriers to

care and unique needs of older adults with mobility disability requiring CRCS are entirely different from those experienced by younger individuals with intellectual disability who require mammography or Pap smears. The present study calls attention to the need for CRCS to be especially targeted toward individuals with lower physical capacity. Future research should identify the specific systemic, social, and/or physical barriers to CRCS for this subgroup so that they can be addressed. Given the need to carefully articulate subgroups and the complexity of operationalizing mobility disability,²⁹ future research must ensure use of validated and sensitive measures of disability in its operationalization.

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