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ORIGINAL ARTICLE

Follow-up Colorectal Cancer Screening After Negative-Result and Positive-Result Multitarget Stool DNA Tests: A Population-Based Study in Southeast Minnesota

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Abstract

Objective: To provide contemporary data on subsequent screening after negative-result multitarget stool DNA (mt-sDNA) tests and follow-up colonoscopy after positive-result mt-sDNA tests.

Patients and Methods: Negative-result mt-sDNA tests (for patients aged 50-72 years) and positive-result mt-sDNA tests (for patients aged 50-75 years) were identified among average risk patients from a 9-county region in Southeast Minnesota from January 1, 2016 to December 31, 2022. Competing risks models of time to subsequent colorectal cancer (CRC) screening were modeled separately for the negative mt-sDNA and positive mt-sDNA cohorts. Multistate Cox proportional hazards models compared rates of CRC screening modality by patient demographic characteristics.

Results: At 3.5 years after a negative-result mt-sDNA test (n=18,739 tests), 55.0% (95% CI, 53.9%-56.3%) of patients were rescreened, which increased to 81.0% (95% CI, 80.0%-82.1%) at 5 years. Most tests were repeat mt-sDNA tests (48.3% at 3.5 years; 95% CI, 47.2%-49.5%). Rescreening with any modality was more likely with older age and among females and less likely among Black persons, Asian persons, and those with other or mixed race. After a positive-result mt-sDNA test (n=2863 tests), 80.9% (95% CI, 79.6%-82.6%) and 84.4% (95% CI, 83.2%-86.0%) of patients completed follow-up colonoscopy by 6 months and 1 year, respectively. Those of other or mixed race had lower rates of follow-up colonoscopy compared with White persons.

Conclusion: Although rates of overall rescreening after a negative-result mt-sDNA test and follow-up colonoscopy after positive-result mt-sDNA tests were high, racial disparities were apparent. Targeted interventions are needed to improve equity in CRC screening adherence and follow-up care across diverse patient populations.

Colorectal cancer (CRC) is the second most common cause of cancer-related deaths in the United States.[1] Several CRC screening tests are available and recommended by the US Preventive Services Task Force (USPSTF); however, rates of CRC screening are well below national recommendations, with 26% of eligible adults in the United States never having received screening and 31% not up-to-date on screening.[2] Patient concerns and barriers to colonoscopy include the bowel preparation regimen, a lengthy clinical encounter with sedation/anesthesia, fear of discomfort, invasiveness of the procedure, concerns about procedural risks, and shame or embarrassment.[3] Stool-based screening tests, such as multitarget stool DNA (mt-sDNA), fecal immunochemical test (FIT), and fecal occult blood test (FOBT), offer an alternative screening option to colonoscopy that addresses many of the aforementioned barriers to screening.

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A recent survey evaluated patient preference among the US Multi-Society Task Force recommended CRC screening tests and found that most persons favored stool-based screening over colonoscopy.[4] Previous data from Olmsted County, Minnesota indicate that rates of mt-sDNA stool testing for CRC screening have increased but have been countered by a decrease in colonoscopies, with overall rates of CRC screening remaining constant.[5] However, this previous study included data from a single county and from a 3-year period (2016-2018). Furthermore, mt-sDNA was approved as a screening option in 2014, and it is unknown whether the trends observed during this previous evaluation reflect early adoption of a novel screening modality versus a sustained shift in screening preferences. A more comprehensive understanding of population-level patterns in CRC screening in a larger community and including more recent data is needed to more thoroughly understand trends in CRC screening rates overall and by screening modality.

Given that mt-sDNA testing is recommended every 3 years, studying adherence to repeat testing and outcomes over multiple rounds is crucial to gage its long-term effectiveness and to inform the clinical guidelines for interval screening and patient recommendations. Additionally, adherence to follow-up colonoscopy after a positive mt-sDNA test is essential for early intervention. Understanding repeat testing and follow-up to colonoscopy patterns can shed light on potential gaps and disparities in care and inform strategies to improve follow-up adherence. Thus, the aims of our study were to determine, among average risk screen-eligible residents of a 9-county region in Southeast Minnesota between 2016 and 2022, CRC screening adherence. Unique to this study, subsequent screening rates and type of subsequent test completed among people with negative-result mt-sDNA tests was evaluated in addition to follow-up colonoscopy rates among people with positive-result mt-sDNA tests.

PATIENTS AND METHODS

Study Population

This study was conducted in Southeast Minnesota, constituting a unique research environment because of the linkage of comprehensive medical record data from multiple providers through the expanded Rochester Epidemiology Project (E-REP).[6] The E-REP captures patients residing in a 27-county region in Minnesota and Wisconsin incorporating data from 2010 forward from Mayo Clinic, Olmsted Medical Center and its satellite clinics, and Mayo Clinic Health System clinics and hospitals. To improve the generalizability of our findings, we focused our analyses on a 9-county region in Minnesota (Olmsted, Goodhue, Wabasha, Waseca, Steele, Dodge, Freeborn, Mower, and Fillmore counties), with a high population capture of 96% of persons residing in these counties.

Patients aged 50 to 75 years residing in the 9-county region who were at average risk for CRC and underwent mt-sDNA test (Cologuard test) were identified. All mt-sDNA tests between January 1, 2016 and December 31, 2022 were retrieved from Mayo Clinic, Mayo Clinic Health System, and Olmsted Medical Center and categorized as having a negative or positive result. Tests with insufficient sample that could not be processed, that were cancelled, or that did not have a positive or negative result were excluded. In addition, tests were excluded for persons who were considered at high risk for CRC before the tests, which included those with previous CRC diagnosis, polyps, familial adenomatous polyposis, inflammatory bowel disease, genetic susceptibility to malignant neoplasm including Lynch syndrome, and abnormal symptoms (including blood in the stool) (Supplemental Table 1, available online at http://www.mcpiqojournal.org). Other exclusions included patients with previous therapeutic or diagnostic procedures through a stoma, procedures to control bleeding or for removal of foreign body, and procedures for placement of endoscopic stents, as described in Supplemental Table 1. Patients with screening before age 40 years were also excluded, considering this as a proxy for high risk for CRC. Finally, although the USPSTF issued new recommendations in 2021 recommending CRC screening starting at age 45 years,[2] because of the period of our study, we included patients starting at age 50 years, which reflected the guideline recommendations for the most of our study period. This study was approved by the Mayo Clinic institutional

review board. The study was considered minimal risk by the institutional review board; therefore, the requirement for informed consent was waived. However, records of any patient who had not provided authorization for their medical records to be used for research, as per Minnesota statute 144.335, were excluded.

Data Collection

Two cohorts were created: (1) patients with a negative-result mt-sDNA test between 2016 and 2022 and (2) patients with a positive-result mt-sDNA test between 2016 and 2022. All negative-result mt-sDNA and positive-result mt-sDNA tests among persons who were average risk were included. Thus, some individuals were included in both cohorts (n=513), and some tests were excluded for a given person after they became high risk (as defined earlier). Negative-result mt-sDNA tests were included through age 72 years to allow sufficient follow-up for subsequent CRC screening, whereas positive-result mt-sDNA tests were included through 75 years.

Other CRC screening modalities, including colonoscopy, sigmoidoscopy, FIT, FOBT, barium enema, and computed tomography (CT) colonography were identified using ICD9 and ICD10 procedure codes and Current Procedural Terminology codes (Supplemental Table 2, available online at http://www.mcpiqojournal.org). Subsequent mt-sDNA tests were identified as described previously. The outcome of interest was the first screening event occurring after the mt-sDNA test (and the time to subsequent screening). In addition, the development of CRC or other events indicating high risk for CRC (as defined earlier and in Supplemental Table 1) was ascertained over follow-up.

Patient demographic characteristics, address, smoking status (current, former, or never), and body mass index (calculated as weight [in kilograms] divided by height [in meters] squared) were ascertained at the time of the mt-sDNA test through the resources of the E-REP. Patient addresses were linked to publicly available data on rurality and area deprivation. The Area Deprivation Index (ADI) is a neighborhood measure of socioeconomic disadvantage that includes 17 census measures capturing income, education, employment, poverty, and housing characteristics from the American Community Survey.[7] The 2020 ADI, version 4.0.1, estimates were used from the University of Wisconsin Neighborhood Atlas website.[8] The national ADI percentile rankings (1-100) were stratified into quartiles (0%-25% [ref], 26%-50%, 51%-75%, and 76%-100%) for analyses. Higher values of the ADI score indicate greater disadvantage (lower neighborhood socioeconomic status). Patient residence was also classified according to the Rural-Urban Commuting Area codes (version 2010), which classifies neighborhoods on the basis of population density, urbanization, and daily commuting.[9] There are 10 primary codes and several secondary codes; the primary codes refer to the primary commuting destination and the secondary codes to the secondary flow. We categorized patients as urban vs rural using the Rural Health Research Center of the University of Washington categorization C.[10]

Statistical Analyses

Competing risks models of time to the first event after negative-result mt-sDNA CRC screening tests were constructed with the end states of the following: mt-sDNA, colonoscopy, other CRC screen (sigmoidoscopy, FIT, FOBT, barium enema, and CT colonography), and becoming high risk for CRC (as defined earlier and in Supplemental Table 2). A separate set of models was similarly created combining all screening events such as any CRC screening and having entered the high-risk CRC cohort as a competing risk. Individuals were censored at their last known clinical encounter (ICD billing code), death, or end of surveillance period (December 31, 2022). Aalen-Johansen estimates were plotted as cumulative incidence (or rate of event); entering the high CRC risk cohort was omitted from figures because it was not informative as a CRC screening measure. Individuals may contribute multiple intervals, per multiple negative-result mt-sDNA CRC screens. Hazard ratios (HRs) comparing rates of different CRC screening (any CRC screening, mt-sDNA, colonoscopy, and other CRC screen) with demographic and area-level characteristics (age, sex, race, ethnicity, ADI, and RUCA) were estimated using multistate Cox proportional hazards models, with 95% CIs on the basis of robust standard error estimates. Time to a

TABLE 1. Characteristics of the Negative-Result and Positive-Result mt-sDNA Cohorts

Characteristic	Negative mt-sDNA cohort (n=18,739 tests[a])	Positive mt-sDNA cohort (n=2863 tests[a])
Age (y)		
50-64	13,384 (71.4)	1581 (55.2)
≥65[b]	5355 (28.6)	1282 (44.8)
Male sex	7465 (39.8)	1331 (46.5)
Race		
White	17,296 (92.3)	2730 (95.4)
Black	386 (2.1)	29 (1.0)
Asian	636 (3.4)	44 (1.5)
Hawaiian/Pacific Islander	16 (0.1)	2 (0.1)
American Indian	48 (0.3)	5 (0.2)
Other or mixed	304 (1.6)	45 (1.6)
Unknown	53 (0.3)	8 (0.3)
Hispanic ethnicity	772 (4.1)	98 (3.4)
Education		
High school or less	3190 (17.0)	625 (21.8)
Some college	5866 (31.3)	928 (32.4)
College or advanced degree	7163 (38.2)	874 (30.5)
Unknown	2520 (13.4)	436 (15.2)
Area deprivation index		
Quartile 1 (0%-25%)	2583 (13.8)	286 (10.0)
Quartile 2 (26%-50%)	7925 (42.3)	1167 (40.8)
Quartile 3 (51%-75%)	5914 (31.6)	990 (34.6)
Quartile 4 (76%-100%)	1753 (9.4)	315 (11.0)
Unknown	564 (3.0)	105 (3.7)
Rural-urban commuting area		
Urban	12,043 (64.3)	1711 (59.8)
Rural	6673 (35.6)	1147 (40.1)
Unknown	23 (0.1)	5 (0.2)
Smoking status		
Never	11,030 (58.9)	1312 (45.8)
Former	5759 (30.7)	1031 (36.0)
Current	1639 (8.7)	467 (16.3)
Unknown	311 (1.7)	53 (1.9)
Body mass index (kg/m^2)		
<25	4216 (22.5)	584 (20.4)
25 to <30	6188 (33.0)	887 (31.0)
≥30	7828 (41.8)	1325 (46.3)
Unknown	507 (2.7)	67 (2.3)

[a]Multiple tests per person are included. The negative-result mt-sDNA cohort included 14,914 unique persons and the positive-result mt-sDNA cohort included 2846 unique persons.
[b]Includes ages 65-72 y for negative-result mt-sDNA tests and ages 65-75 y for positive-result mt-sDNA tests.
Results are reported as number of tests (%).
mt-sDNA, multitarget stool DNA.

secondary screening method after a positive-result mt-sDNA test was modeled in a similar manner. However, in addition to censoring at last clinical encounter, death, or December 31, 2022, 7 persons were censored at a diagnosis of CRC without a screening procedure ICD code present to determine that diagnosis. Aalen-Johansen estimates were plotted as cumulative incidence, and HRs comparing screening by demographic and area-level characteristics were estimated using multistate Cox proportional hazards models. SAS v9.4 and R v.4.2.2 were used for all analyses, with the survival package v.3.6-1 used specifically for the multistate modeling.

RESULTS

Between 2016 and 2022, there were 18,739 negative-result mt-sDNA tests and 2863 positive-result mt-sDNA tests in average risk patients (Table 1). Multiple tests per person were included in the cohorts, when available. A total of 14,914 unique persons were included in the negative-result mt-sDNA cohort, and 2846 unique persons were included in the positive-result mt-sDNA cohort. Nearly three-quarters of the negative-result mt-sDNA tests were among persons aged younger than 65 years (71.4%; n=13,384), whereas just over half of the positive-result mt-sDNA tests were among persons aged younger than 65 years (55.2%; n=5355). In addition, most of the tests were performed among female patients. At 3.5 years of follow-up after a negative-result mt-sDNA test, more than half (55.0%; 95% CI, 53.9%-56.3%) of the patients were rescreened, which increased to more than three-quarters (81.0%; 95% CI, 80.0%-82.1%) at 5 years (Figure). Most subsequent CRC screening tests were repeat mt-sDNA tests (48.3% at 3.5 years; 95% CI, 47.2%-49.5%), followed by colonoscopy (6.1% at 3.5 years; 95% CI, 5.6%-6.7%), whereas very few had other screening modalities in follow-up with the most common being FIT tests (0.4% at 3.5 years; 95% CI, 0.3%-0.6%). Most of the repeat mt-sDNA tests found negative results, with 11.1% (n=527/4766) being positive.

Rescreening (any modality) was more likely with older age and in females and was less likely among Black persons, Asian persons, and those with other or mixed race (Table 2). Persons aged 65 years or older were more likely to have repeat mt-sDNA (HR, 1.12; 95% CI, 1.05-1.19) or other screening test (HR, 1.63; 95% CI, 1.04-2.55)

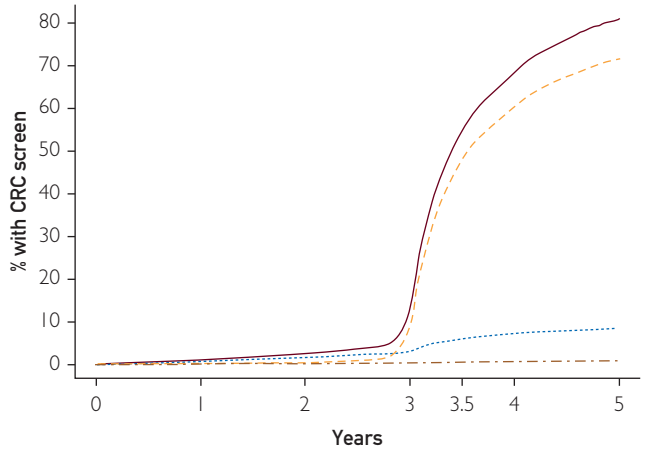
compared with those aged 50-64 years, whereas females were more likely than males to have repeat mt-sDNA tests (HR, 1.14; 95% CI, 1.07-1.21). Black persons, Asian persons, and those of other or mixed race were less likely than White persons to have repeat mt-sDNA tests. Rescreening (any modality) was more likely for those with a college or advanced degree (HR, 1.12; 95% CI, 1.05-1.19) compared with those with a high school or lower education. Persons living in neighborhoods with higher deprivation were less likely to have any rescreening and repeat mt-sDNA, but more likely to have other screening test (which include sigmoidoscopy, FIT, FOBT, barium enema, and CT colonography; HR, 3.76; 95% CI, 1.56-9.06, for ADI quartile 4 vs quartile 1). Current smokers and obese patients were less likely to be rescreened, including repeat mt-sDNA testing.

After a positive mt-sDNA test, more than half of the patients (60.2%; 95% CI, 58.7%-62.4%) had a follow-up colonoscopy within 2 months, which increased to 80.9% (95% CI, 79.6%-82.6%) at 6 months and 84.4% (95% CI, 83.2%-86.0%) at 1 year (Figure). No differences were observed across age, sex, or race for follow-up colonoscopy after a positive-result mt-sDNA test, with the exception of those of other or mixed race who had lower rates of follow-up colonoscopy compared with White persons (HR, 0.68; 95% CI, 0.49-0.95) (Table 3). Persons with college or advanced degrees were more likely to have follow-up colonoscopy, whereas rates of follow-up colonoscopy declined with increasing area deprivation. Persons residing in rural areas (HR, 0.71; 95% CI, 0.66-0.77), current (HR, 0.61; 95% CI, 0.54-0.69) and former smokers (HR, 0.85; 95% CI, 0.78-0.93), and those with obesity (HR, 0.84; 95% CI, 0.75-0.94) were less likely to have follow-up colonoscopy after a positive-result mt-sDNA test.

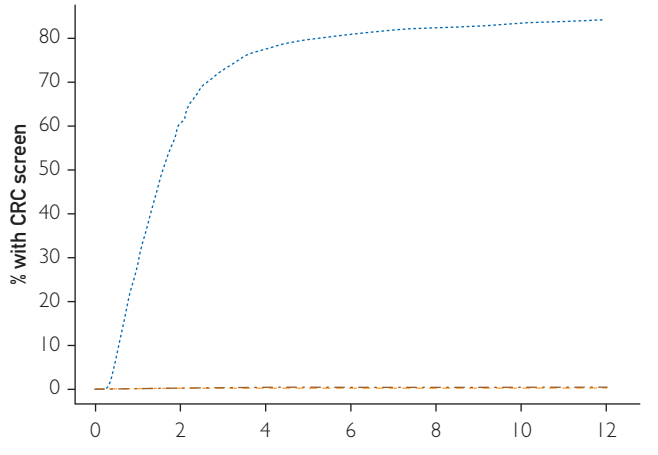
DISCUSSION

Although several stool-based and direct visualization CRC screening strategies are recommended by the USPSTF,[2] the real-world effectiveness of each of the recommended screening strategies is diminished by population underuse and suboptimal population adherence to screening recommendations. We examined recent population-level trends in CRC screening rates overall and by screening modality, to characterize CRC screening adherence among persons who completed an mt-sDNA test. In doing so, we examined subsequent screening rates and type of subsequent test completed among those with negative-result mt-sDNA tests and follow-up colonoscopy rates among those with positive-result mt-sDNA tests.

Among persons who received a negative-result mt-sDNA test, we observed relatively high rates of subsequent screening with more than half completing rescreening 3.5 years after the original screening and more than three-quarters completing rescreening at 5 years. Most of the subsequent CRC screen tests were repeat mt-sDNA tests. Rates of rescreening by mt-sDNA are much higher than those reported for other stool-based tests.[11,12] Rates of rescreening were lower among younger adults, men, Black persons, Asian persons, those reporting multiple races, and those living in neighborhoods with higher area deprivation. These results are consistent with the literature reporting higher rates of CRC screening with older age, among females, and with higher neighborhood socioeconomic status.[13] Racial differences in CRC screening are less consistent in the literature, with some studies reporting lower screening among Black and American Indian/Alaska Native persons, in particular, although other studies have reported greater adherence for racial minorities.[13] Although rurality has been associated with decreased likelihood of CRC screening adherence in many previously published studies,[13] our findings found no difference in rates of rescreening after negative-result mt-sDNA for those living in rural vs urban areas. After a positive-result mt-sDNA test, more than half of the patients had a follow-up colonoscopy within 2 months, and more than 80% completed colonoscopy by 6 months and 1 year. The rates of follow-up colonoscopy in our community are somewhat higher than previously reported rates from a claims database of commercially insured and Medicare Advantage enrollees, with an overall follow-up colonoscopy rate of 72% at 6 months after positive-result mt-sDNA test.[14] Rates of follow-up colonoscopy declined with increasing area deprivation and were lower for persons residing in rural areas. Finally, obesity and smoking were associated with lower rates



# at risk	18,739	14,057	9715	6287	2673	1518	597
Any screen, %	0.0	1.2	2.5	12.6	55.0	68.5	81.0
mt-sDNA, %	0.0	0.3	0.5	8.9	48.3	60.4	71.7
Colonoscopy, %	0.0	0.7	1.7	3.2	6.1	7.3	8.5
Other, %	0.0	0.2	0.3	0.4	0.6	0.7	0.8



# at risk	2863	1019	531	429	372	327	295
mt-sDNA, %	0.0	0.2	0.3	0.3	0.3	0.3	0.3
Colonoscopy, %	0.0	60.2	77.5	80.9	82.3	83.3	84.4
Other, %	0.0	0.4	0.4	0.4	0.4	0.5	0.5

FIGURE. Time to next CRC screening after negative-result mt-sDNA (top panel) and positive-result mt-sDNA (bottom panel). CRC, colorectal cancer; mt-sDNA, multitarget stool DNA.

of rescreening after negative-result mt-sDNA and follow-up colonoscopy after positive-result mt-sDNA.

IMPLICATIONS

Our findings highlight the relative effectiveness and acceptance of mt-sDNA testing for CRC screening, as well as disparities in rescreening rates on the basis of demographic factors. Efforts to improve overall screening rates and adherence, particularly among at-risk populations, are critical for effective CRC prevention and management. Engaging minoritized populations in prevention behaviors requires culturally sensitive, inclusive, and community-centered approaches that address systemic inequities and barriers to care. Community-based participatory research emphasizes shared decision making and respect for community knowledge, fostering trust and collaboration.[15] Tailoring communication to cultural and linguistic needs, while leveraging trusted messengers such as community health workers, has been shown to enhance outreach and uptake.[16,17] Addressing structural determinants of health, such as housing and access to care, alongside health literacy barriers, is critical to achieving equity[18] and understanding how these factors may influence screening behavior is critical for designing effective interventions.[19,20] Together, these evidence-based approaches provide a range of strategies for fostering prevention behaviors in minoritized populations and advancing health equity.

Limitations and Strengths

Some limitations merit mention. First, our population from Southeast Minnesota, although representative of the Midwest region of the United States, has a lower proportion of racial and ethnic minorities and higher socioeconomic status than the United States overall.[6] Thus, our findings may not be representative of all patient populations. Second, the small number of tests among persons in some of the minority groups may have limited power to detect differences in rescreening among negative-result mt-sDNA tests and follow-up colonoscopy among positive-result mt-sDNA tests across the race groups. Third, we do not have information on insurance status so we could not determine how insurance status or changes in insurance over follow-up may have contributed to rescreening rates or

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TABLE 2. Hazard Ratio (95% CI) for the Association of Demographic and Other Patient Characteristics With Colorectal Cancer Rescreening Modality After Negative-Result mt-sDNA Test

Characteristic	Rescreening modality			
	Any screening test	mt-sDNA	Colonoscopy	Other screening test[a]
Age (y)				
50-64	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
65-72	1.10 (1.03-1.16)	1.12 (1.05-1.19)	0.91 (0.77-1.08)	1.63 (1.04-2.55)
Sex				
Male	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Female	1.14 (1.08-1.21)	1.14 (1.07-1.21)	1.11 (0.95-1.29)	1.70 (1.04-2.78)
Race				
White	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Black	0.75 (0.59-0.94)	0.68 (0.53-0.89)	1.08 (0.64-1.82)	1.41 (0.35-5.77)
Asian	0.85 (0.72-1.00)	0.81 (0.68-0.97)	0.98 (0.65-1.49)	2.01 (0.81-4.96)
Hawaiian/Pacific Islander	0.32 (0.07-1.55)	0.38 (0.08-1.83)	—	—
American Indian	0.60 (0.29-1.25)	0.70 (0.33-1.47)	—	—
Other or mixed	0.69 (0.54-0.87)	0.65 (0.50-0.83)	0.88 (0.49-1.58)	1.58 (0.39-6.45)
Unknown	0.57 (0.31-1.03)	0.58 (0.32-1.07)	0.49 (0.07-3.69)	—
Ethnicity				
Non-Hispanic	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Hispanic	0.86 (0.74-0.99)	0.86 (0.73-1.00)	0.82 (0.54-1.26)	1.35 (0.50-3.69)
Education				
High school or less	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Some college	0.89 (0.82-0.96)	0.89 (0.82-0.97)	0.85 (0.68-1.06)	1.37 (0.78-2.42)
College or advanced degree	1.12 (1.05-1.19)	1.13 (1.06-1.21)	1.08 (0.91-1.27)	0.74 (0.43-1.28)
Area deprivation index				
Quartile 1 (0%-25%)	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Quartile 2 (26%-50%)	0.92 (0.85-0.99)	0.90 (0.83-0.98)	1.00 (0.81-1.25)	1.14 (0.49-2.65)
Quartile 3 (51%-75%)	0.90 (0.83-0.98)	0.88 (0.81-0.96)	0.95 (0.76-1.20)	1.98 (0.87-4.52)
Quartile 4 (76%-100%)	0.83 (0.75-0.93)	0.82 (0.73-0.93)	0.71 (0.51-1.00)	3.76 (1.56-9.06)
Rural-urban commuting area				
Urban	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Rural	0.95 (0.90-1.01)	0.94 (0.88-1.00)	0.97 (0.83-1.14)	1.75 (1.12-2.71)
Smoking status				
Never	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
Former	0.97 (0.91-1.03)	0.95 (0.89-1.01)	1.05 (0.90-1.24)	1.32 (0.81-2.13)
Current	0.64 (0.57-0.71)	0.64 (0.57-0.71)	0.63 (0.46-0.87)	0.80 (0.32-2.04)
Body mass index (kg/m^2)				
<25	1.00 (ref)	1.00 (ref)	1.00 (ref)	1.00 (ref)
25 to <30	0.92 (0.86-0.99)	0.92 (0.85-0.99)	0.98 (0.81-1.19)	0.78 (0.42-1.46)
≥30	0.88 (0.82-0.94)	0.88 (0.82-0.94)	0.87 (0.72-1.05)	1.07 (0.62-1.86)

[a]Includes sigmoidoscopy, fecal immunochemical test, fecal occult blood test, barium enema, and computed tomographic colonography.
mt-sDNA, multitarget stool DNA.

CRC screening modality. Finally, access to care during the COVID-19 pandemic may have affected our observed rates of rescreening. Nevertheless, a considerable strength of our study includes the comprehensive capture of medical record data for the population residing in our region through the E-REP, a medical records-linkage system including data from multiple health care providers in the region.

CONCLUSION

In conclusion, this study highlights that adherence to follow-up CRC screening after a negative-result or positive-result mt-sDNA test varies significantly by demographic factors,

TABLE 3. Hazard Ratio (95% CI) for the Association of Demographic and Other Patient Characteristics With Follow-up Screening With Colonoscopy After Positive-Result mt-sDNA Test

Characteristic	Colonoscopy
Age (y)	
50-64	1.00 (ref)
65-75	0.99 (0.92-1.08)
Sex	
Male	1.00 (ref)
Female	1.06 (0.98-1.15)
Race	
White	1.00 (ref)
Black	0.81 (0.56-1.18)
Asian	0.95 (0.67-1.35)
Hawaiian/Pacific Islander	1.22 (0.66-2.27)
American Indian	1.00 (0.19-5.18)
Other or mixed	0.68 (0.49-0.95)
Unknown	0.89 (0.40-1.95)
Ethnicity	
Non-Hispanic	1.00 (ref)
Hispanic	1.06 (0.84-1.33)
Education	
High school or less	1.00 (ref)
Some college	0.75 (0.67-0.84)
College or advanced degree	1.25 (1.13-1.38)
Area deprivation index	
Quartile 1 (0%-25%)	1.00 (ref)
Quartile 2 (26%-50%)	0.77 (0.66-0.89)
Quartile 3 (51%-75%)	0.63 (0.54-0.73)
Quartile 4 (76%-100%)	0.52 (0.43-0.62)
Rural-urban commuting area	
Urban	1.00 (ref)
Rural	0.71 (0.66-0.77)
Smoking status	
Never	1.00 (ref)
Former	0.85 (0.78-0.93)
Current	0.61 (0.54-0.69)
Body mass index (kg/m^2)	
<25	1.00 (ref)
25 to <30	1.05 (0.94-1.18)
≥30	0.84 (0.75-0.94)

mt-sDNA, multitarget stool DNA.

particularly race and age. Although rescreening rates after a negative-result mt-sDNA test reached 81% within 5 years, racial disparities persist, with Black, Asian, and other or mixed race individuals being less likely to receive repeat screening. Additionally, although follow-up colonoscopy rates after positive-result mt-sDNA tests were high, disparities remain in completion among patients of other or mixed race. These findings underscore the need for targeted interventions to improve equity in CRC screening adherence and follow-up care across diverse patient populations.

POTENTIAL COMPETING INTERESTS

Dr Ebner has a consulting agreement with Exact Sciences to provide support regarding research design and methodology, with proceeds paid to Mayo Clinic. Dr Greene is an employee of Exact Sciences. Dr Rutten had a professional services contract with Exact Sciences from September 2021 to May 2022 and was employed by Exact Sciences between May 2022 and March 2023 and owns stocks in Exact Sciences. The other authors have no other conflicts of interest.

ETHICS STATEMENT

This study was approved by the Mayo Clinic institutional review board. The study was considered minimal risk by the institutional review board; therefore, the requirement for informed consent was waived. However, records of any patient who had not provided authorization for their medical records to be used for research, as per Minnesota statute 144.335, were excluded.

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SUPPLEMENTAL ONLINE MATERIAL

Supplemental material can be found online at http://www.mcpiqojournal.org. Supplemental material attached to journal articles has not been edited, and the authors take responsibility for the accuracy of all data.

Abbreviations and Acronyms: **ADI,** area deprivation index; **CI,** confidence interval; **RC,** colorectal cancer; **E-REP,** expanded Rochester Epidemiology Project; **FIT,** fecal immunochemical test; **FOBT,** fecal occult blood test; **HR,** hazard ratio; **USPSTF,** US Preventive Services Task Force

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