

# Sustaining Improvements in Colorectal Cancer Across Delaware:

## A Look at Racial Disparities a Decade Later

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### Abstract

A previously initiated statewide effort in Delaware improved outcomes in colorectal cancer (CRC) racial disparities. **Objective.** To examine whether improvements in racial disparities for CRC have been sustained a decade later and the status of Delaware's current cancer burden. **Methods.** Cancer incidence data from the Delaware Cancer Registry, mortality data from the Centers for Disease and Control and Prevention (CDC)'s National Center for Health Statistics, and cancer screening data from CDC's Behavioral Risk Factor Surveillance System were analyzed. Five-year age-adjusted incidence and mortality rates were calculated, and comparisons were made between non-Hispanic Black and non-Hispanic White groups using rate ratios. Distributions by cancer stage were compared between time periods by race/ethnicity utilizing chi-square statistical tests. The prevalence of Delawareans meeting recommendations for CRC screening was compared between time points for each race/ethnicity group using the Rao-Scott Modified chi-square test. **Results.** Comparing 2006-2010 and 2015-2019, CRC incidence rates decreased for non-Hispanic Black Delawareans from 51.0 to 39.6 per 100,000 population and decreased for non-Hispanic White Delawareans from 46.6 to 37.6 per 100,000 population. Between 2006-2010 and 2015-2019, CRC mortality rates decreased for non-Hispanic Black Delawareans from 16.8 to 15.1 per 100,000 population and decreased for non-Hispanic White Delawareans from 16.8 to 13.3 per 100,000 population. There were no significant differences in CRC incidence or mortality rates by race/ethnicity in either period. The distribution of cases by stage comparing 2006-2010 and 2015-2019 were not significantly different for either race/ethnicity group. There were no significant differences in meeting CRC screening recommendations comparing 2010 and 2018 by race/ethnicity or directly comparing

race/ethnicity groups in either year. **Conclusions.** Delaware has sustained improvements in CRC incidence, mortality rates, and disparities between non-Hispanic Black and non-Hispanic White groups but will continue to monitor CRC trends and outcomes to ensure early diagnosis and that disparities are eliminated.

## Background

Colorectal cancer (CRC) is the second highest cause of cancer mortality for men and women combined in the United States (U.S.).<sup>1</sup> According to the Centers for Disease Control and Prevention (CDC), from 2016-2020 in the U.S., non-Hispanic Blacks (41.4 per 100,000 population) had a higher age-adjusted incidence rate compared to non-Hispanic Whites (36.7 per 100,000 population). In terms of mortality, non-Hispanic Blacks (17.6 per 100,000 population) die from CRC at a higher rate compared to non-Hispanic Whites (13.1 per 100,000 population). According to the most recent Behavioral Risk Factor Survey (BRFS) (2022), 75.3% of non-Hispanic Blacks reported being up to date with CRC screening compared to 74.6% of non-Hispanic Whites in the U.S.<sup>1</sup> Up-to-date CRC screening is based on the United States Preventive Services Task Force (USPSTF) recommendations.

In 2013, the authors Grubbs et al. published the actions taken by the Delaware Cancer Consortium (DCC) to close the racial disparity in CRC mortality among non-Hispanic Black and non-Hispanic White Delawareans.<sup>2</sup> Beginning in 2002, Delaware created a comprehensive statewide CRC screening program that included coverage for screening and treatment, patient navigation for screening and care coordination, and case management. These programs include the Delaware Cancer Treatment Program (DCTP) and Screening for Life (SFL), which are managed and guided by DCC members.<sup>3,4</sup> Through the efforts of the Consortium, improvements in CRC racial disparities from 2002 to 2009 included: the elimination of screening disparities, equalization of incidence rates, reduction in the percentage of Black Delawareans with regional and distant disease from 79% to 40%, and most importantly a near elimination of mortality differences.<sup>2,5</sup>

This article examines whether racial disparities in incidence, mortality, cancer staging, and screening still exist ten years after the Grubbs et al., publication based on current metrics including recommended screening.

## Methods

### Data Sources and Definitions

Cancer incidence data from the Delaware Cancer Registry (DCR), mortality data from the CDC National Center for Health Statistics (NCHS), and cancer screening data from CDC Behavioral Risk Factor Surveillance System (BRFSS) were utilized for analysis. The DCR collects and reports data on all cancer cases for Delaware residents. Incidence cases were included in the analysis where the primary site was colon or rectum, the behavior was coded as malignant, and coding excluded ICD-O-3 histology codes 9050-9055, 9140, and 9590-9993 as defined by the Surveillance, Epidemiology, and End Results (SEER) Site Recode ICD-O-3/WHO 2008 Definition for the "Colon and Rectum" site group.<sup>6</sup> NCHS collects data on deaths in the United States, including cause of death.<sup>7</sup> Mortality cases were included if the cause of death was colon or rectum cancer.

The BRFSS conducts the BRFS annually, which is a random-sample telephone survey of the non-institutionalized adult population. Various survey topics include disease and conditions, cancer screening, health care utilization, behavioral risk factors, and disability. Cancer screening questions are asked biennially, in even-numbered years.<sup>8</sup> The measure of cancer screening utilized for analysis was the prevalence of respondents aged 50 to 75 who had fully met the USPSTF recommendation for CRC screening. CRC screening was defined as having a blood stool test within the past year; having a sigmoidoscopy within the past five years and a blood stool test within the past three years; or having a colonoscopy within the past ten years.

## **Data Analysis**

### ***Incidence***

CRC incidence rates and the proportion of CRC cases by stage were calculated in SEER\*Stat<sup>9</sup> using a DCR-created incidence database. Five-year age-adjusted rates were calculated for the periods of 2006-2010 and 2015-2019. These two five-year periods that are 10 years apart based on the end year of each 5-year period were chosen to provide cross-sectional analysis comparing change in rate between two time periods. Incidence rates between non-Hispanic Black and non-Hispanic White Delawareans were calculated and compared using rate ratios. In addition, trend analysis was conducted using the National Cancer Institute's Joinpoint Regression Program.<sup>10</sup> The Joinpoint Regression Program analyzes trend data (e.g., cancer rates over time) and provides an Annual Percent Change (APC). The program provides different models based on the trend, identifies joinpoints, or time points where the trend appears to change, and selects a final model. Trend analysis was conducted using 1-year rates to compare trends during the periods 2001-2010 and 2010-2019. For example, for the trend analysis for 2001-2010, 1-year rates for 2001, 2002, 2003,...2010 were plotted and modeled in the program. The Empirical Quantile method was used to calculate the APCs and to determine whether the APCs were significantly different from zero at the  $\alpha = 0.05$  level.<sup>11</sup> When APCs are not significantly different from zero, trends are considered stable. Trend analysis was conducted in addition to the cross-sectional comparison of rates in 2006-2010 and 2015-2019 to provide a more detailed analysis of trend that considers multiple time points.

### ***Stage at Diagnosis***

The DCR-created incidence database was also utilized to analyze CRC stage at diagnosis. Summary staging was used as the staging schema for the cancer cases. Over time, different summary stage variables have been used depending on the year of diagnosis. In the current analysis where stage at diagnosis was analyzed for cases diagnosed 2006-2010 and 2015-2019, the derived SEER Summary Stage 2000 variable was used to assign stage for cases in 2006-2010 and for 2015 cases; SEER Summary Stage 2000 was used for 2016 and 2017 cases; and Summary Stage 2018 was used for 2018 and 2019 cases. Each applicable summary stage variable was then used to create a merged summary stage variable across all cases, where cases were assigned to one of the following stage groups: local, regional, or distant stage. A chi-square statistical test was conducted to compare the distribution of the proportion of cases by stage at diagnosis by time period using SAS version 9.4.

## **Mortality**

CRC mortality rates were calculated similarly to incidence rates in SEER\*Stat using a mortality database made available by the National Cancer Institute's SEER Program.<sup>12</sup> The mortality database contains data aggregated by state and includes mortality data from 1990 to 2020 provided by NCHS. The same statistics that were calculated for CRC incidence were calculated for CRC mortality (i.e., age-adjusted rates by race/ethnicity in 2006-2010 and 2015-2019, and trend analysis for 2001-2010 and 2010-2019).

## **CRC screening**

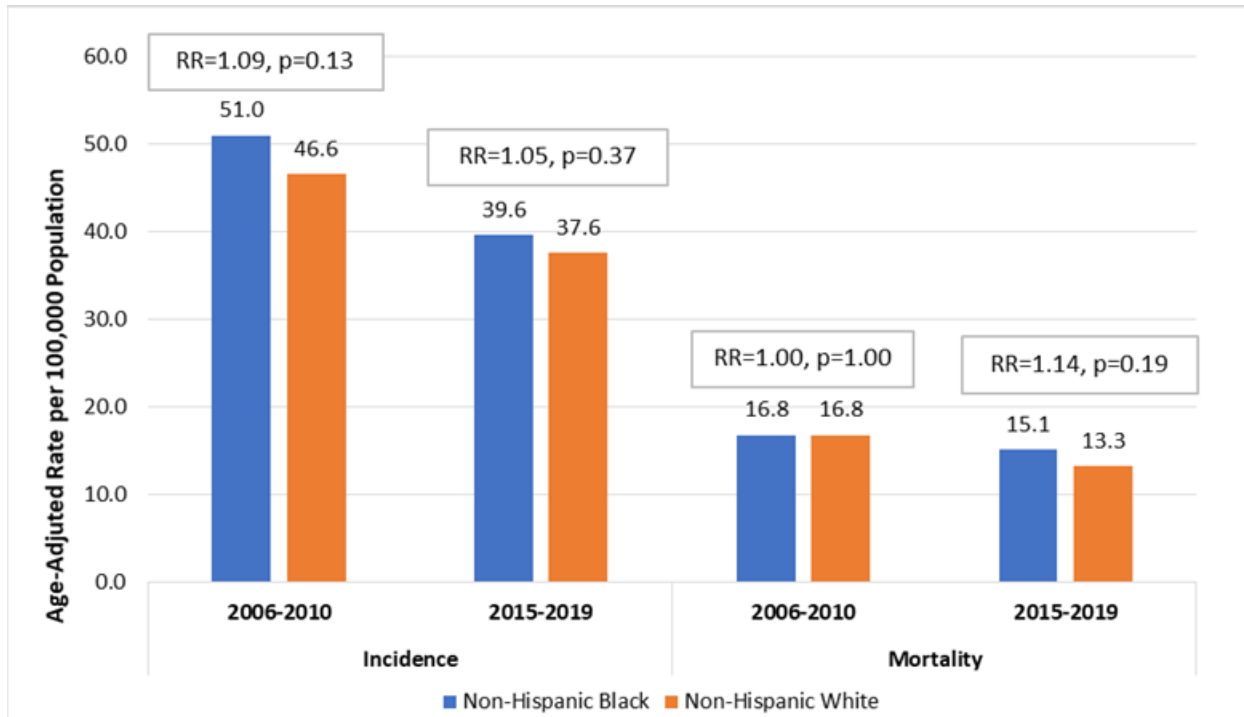
Prevalence of respondents meeting the USPSTF recommendation for CRC screening was provided by the CDC in the BRFSS dataset for 2018.<sup>13</sup> The algorithm for this variable was adapted and applied to 2010 BRFSS data to create a consistent variable for comparison in the current analysis, since the measure for CRC screening has changed over time. The percentage that fully met the USPSTF recommendation for CRC screening was compared between 2010 and 2018 for non-Hispanic Black and non-Hispanic White groups. The difference in proportion between 2010 and 2018 was calculated, and significance testing was conducted between the two time points for each race/ethnicity group using the Rao-Scott Modified chi-square test.

## **Results**

CRC incidence rates decreased for non-Hispanic Black Delawareans from 51.0 per 100,000 population in 2006-2010 to 39.6 per 100,000 population in 2015-2019 (Figure 1). CRC incidence rates decreased for non-Hispanic White Delawareans from 46.6 per 100,000 population in 2006-2010 to 37.6 per 100,000 in 2015-2019. When comparing the non-Hispanic Black and non-Hispanic White groups during 2006-2010 and 2015-2019, there were no significant differences in CRC incidence rate between the two race/ethnicity groups in either 2006-2010 (RR=1.09, p=0.13) or in 2015-2019 (RR=1.05, p=0.37) with non-Hispanic White as the reference group. In terms of trends, when analyzing APCs using 1-year rates during the two periods 2001-2010 and 2010-2019, the trends were stable for non-Hispanic Blacks during both periods (Table 1). The model for non-Hispanic Blacks that analyzed 2010-2019 identified a joinpoint in 2017, but the modeled trend in 2010-2017 and 2017-2019 were both not significant, and therefore, the trends were stable. For non-Hispanic Whites, from 2001 to 2010, CRC incidence rates decreased 2.9% per year. For 2010-2019, the model identified a joinpoint in 2012 where the modeled trend in 2010-2012 showed a decrease in CRC incidence rates of 8.6% per year. However, from 2012-2019, rates remained stable.

CRC mortality rates decreased for non-Hispanic Black Delawareans from 16.8 per 100,000 population in 2006-2010 to 15.1 per 100,000 population in 2015-2019 (Figure 1). CRC mortality rates decreased for non-Hispanic White Delawareans from 16.8 per 100,000 population in 2006-2010 to 13.3 per 100,000 in 2015-2019. Comparing the non-Hispanic Black and non-Hispanic White groups during 2006-2010 and 2015-2019, there were no significant differences in CRC mortality rate between the two race/ethnicity groups in either 2006-2010 (RR=1.00, p=1.00) or in 2015-2019 (RR=1.14, p=0.19) with non-Hispanic White as the reference group. In terms of trends, when analyzing APCs using 1-year rates during 2001-2010, the CRC mortality rates decreased by 7.9% per year for non-Hispanic Blacks and 3.0% per year for non-Hispanic Whites (Table 1). When analyzing APCs using 1-year rates during 2010-2019, the trends were stable for both non-Hispanic Blacks and non-Hispanic Whites.

Figure 1. Incidence and Mortality Rates with Rate Ratios Comparing Non-Hispanic Black and Non-Hispanic White Groups, Delaware, 2006-2010 and 2015-2019



RR = Rate Ratio; Non-Hispanic White group is the reference group in the RR calculation.

Table 1. Annual Percent Change (APC) in Colorectal Cancer (CRC) Incidence and Mortality Rates from 2001-2010 and 2010-2019 by Race/Ethnicity, Delaware

	APC 2001-2010	APC 2010-2019 <sup>^</sup>
<b>CRC Incidence Rate</b>		
Non-Hispanic Black	-3.4%	2010-2017: 0.8% 2017-2019: -18.5%
Non-Hispanic White	-2.9%*	2010-2012: -8.6%* 2012-2019: 0.3%
<b>CRC Mortality Rate</b>		
Non-Hispanic Black	-7.9%*	-0.6%
Non-Hispanic White	-3.0%*	-0.8%

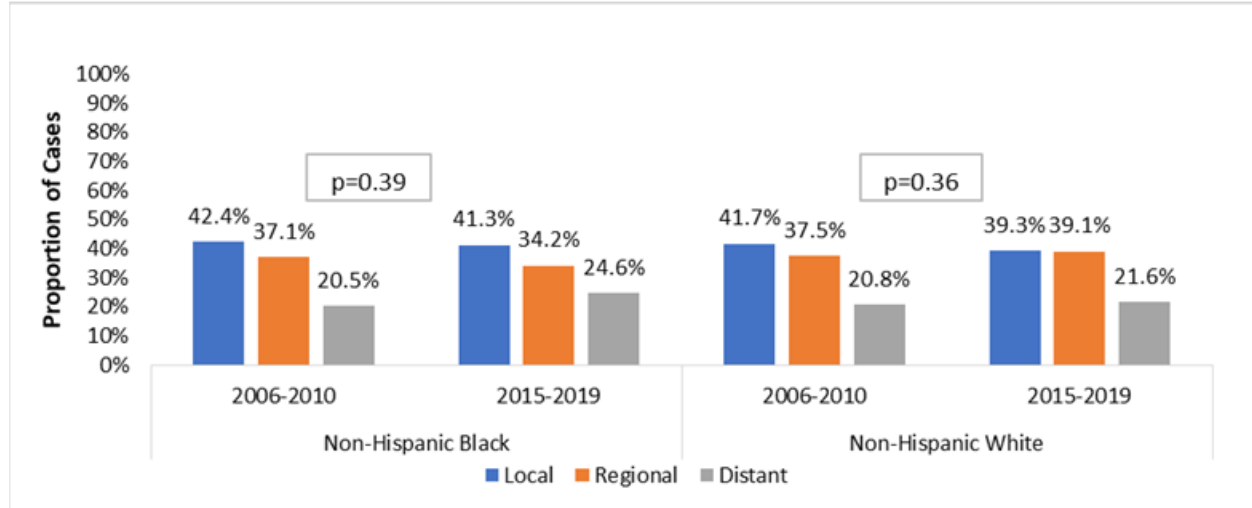
\*APC is significantly different from zero at the alpha = 0.05 level

<sup>^</sup>Joinpoints were identified in the models for CRC incidence rate trends in 2017 for non-Hispanic Black and in 2012 for non-Hispanic White groups. Therefore, APCs are reported for each period separated by the joinpoint rather than for 2010-2019.

The proportion of cases by stage at diagnosis (local, regional, distant) among non-Hispanic Black Delawareans in 2006-2010 compared to 2015-2019 were similar (Figure 2). The percentage of cases diagnosed at a distant stage among this group increased from 20.5% in 2006-2010 to 24.6% in 2015-2019, but the distribution of the proportion of cases by stage was not statistically significantly different between the two time periods (p=0.39). A similar comparison of the proportion of local and advanced (regional and distant combined) stage also did not show

statistically significant differences (results not shown). Similarly, there were no statistically significant differences between the distribution of the proportion of cases by stage at diagnosis among the non-Hispanic White group when comparing 2006-2010 and 2015-2019 ( $p=0.36$ ).

Figure 2. Percentage of Colorectal Cancer Cases by Stage at Diagnosis (Local, Regional, Distant) Comparing 2006-2010 and 2015-2019 by Race/Ethnicity, Delaware



Distributions by stage were compared between 2006-2010 and 2015-2019 and tested for significance using the chi-square statistic.

Regarding CRC screening, the percentage of non-Hispanic Black Delawareans that fully met the USPSTF recommendation for CRC screening decreased from 74.0% in 2010 to 70.6% in 2018 (Table 2). In comparison, the percentage of non-Hispanic White Delawareans who fully met the recommendation increased from 73.5% in 2010 to 75.1% in 2018. However, the percentages that met the CRC screening recommendations were not significantly different comparing 2010 and 2018 ( $p=0.31$  for non-Hispanic Black and  $p=0.36$  for non-Hispanic White). There were no significant differences between the non-Hispanic Black and non-Hispanic White groups during either year (results not shown).

Table 2. Comparison of Differences in Percentage of Non-Hispanic Black and Non-Hispanic White Residents That Met the United States Preventive Services Task Force (USPSTF) Colorectal Cancer (CRC) Screening Recommendation in 2010 and 2018, Delaware

	2010 (%)	2018 (%)	Absolute Difference (%)	P Value
<b>Fully met USPSTF recommendation for CRC Screening</b>				
<b>Non-Hispanic Black</b>	74.0	70.6	3.4	0.31
<b>Non-Hispanic White</b>	73.5	75.1	1.6	0.36

Comparisons between the 2010 and 2018 values for percentage that met the CRC screening recommendation by race/ethnicity group were tested for significance using the Rao-Scott Modified chi-square test.

## Discussion

Delaware's creation of their comprehensive statewide CRC screening program has contributed to the decrease in both CRC incidence and mortality rates among non-Hispanic Black and non-Hispanic White groups that has been sustained in the last decade. Of particular note, the decline of CRC mortality rates by 7.9% per year for non-Hispanic Black Delawareans between 2001 and 2010 is an outstanding achievement. Analysis conducted in this study reveals that trends in CRC incidence and mortality have remained stable for non-Hispanic Blacks and non-Hispanic Whites for most of the last decade, following significant decreases seen in 2001-2010. Though there have not been further significant decreases during the last decade, stable lower rates attained in the previous decade are still noteworthy and show the continued success of Delaware's programs. In addition, there were no significant differences in CRC incidence or mortality between non-Hispanic Black and non-Hispanic White Delawareans in either 2006-2010 or 2015-2019. Delaware's success stands out in contrast to U.S. statistics where racial/ethnic disparities persist, with the highest CRC incidence and mortality rates among non-Hispanic Blacks that are significantly different from rates for non-Hispanic Whites.<sup>14,15</sup> The declining incidence of CRC in Delaware suggests success related to an emphasis on colonoscopy and primary prevention.

No significant differences were found in the percentage of Delawareans who met the CRC screening guidelines when comparing non-Hispanic White and non-Hispanic Black groups in 2010 or 2018. The percentage of non-Hispanic Black Delawareans who met the CRC screening guidelines in 2018 was lower than in 2010. However, these values were not found to be significantly different from each other. Delaware will continue to monitor CRC screening by race/ethnicity over time to see if any trends emerge that require additional attention to promote screening in populations where CRC screening is low. Prior analysis conducted by the Delaware Division of Public Health (DPH) (data not shown) indicates that upstream healthcare access is associated with increased screening.<sup>16</sup> Health care insurance coverage, having a personal doctor or medical home, and check-up timeliness (within the past year) were all associated with screening. When controlling for these variables and other demographic and socio-economic variables, having a check-up within the past year was consistently associated with meeting USPSTF CRC recommendations between 2010 and 2018. Future analysis and efforts could explore this topic further to identify possible interventions to increase CRC screening. Delaware continues to provide free access to colorectal and other cancer screenings to uninsured and underinsured Delaware residents through the SFL program since 1997, and expanded coverage in 2014 to include more Delaware residents through the Affordable Care Act Medicaid Expansion program.<sup>4,17</sup>

In the current study, the distribution of cases by stage at diagnosis comparing 2006-2010 and 2015-2019 did not significantly differ for non-Hispanic Black or non-Hispanic White groups. However, the proportion of cases diagnosed at more advanced stages may be on the rise. One reason for a potential rise in CRC diagnosed at advanced stages could be due to the screening disruptions from the Coronavirus 2019 (COVID-19) pandemic and decreases in expected screening rates.<sup>18,19</sup> From 2006 to 2019, the percentage of distant stage cases among both non-Hispanic Black and non-Hispanic White individuals remains unchanged at around 20%. Further exploration analyses are needed to understand the population diagnosed at late stage, with intended analyses of sociodemographic profile including residency, screening history, insurance status, and age at diagnosis. These findings can be used to identify targets for cancer prevention and screening interventions. The next few years post-pandemic will be of particular interest to

monitor cancer diagnosis by stage and, subsequently, how this will affect cancer mortality and treatment resource needs.

## Limitations

There are several limitations in the current study worth noting. Delaware is a small state, and therefore, difficult to stratify for analysis and maintain high statistical power. For example, the current analysis could not reliably include Hispanic or other race/ethnicity group comparisons. In addition, the current study did not analyze sociodemographic data besides race/ethnicity. It may be that other sociodemographic factors influence CRC screening and CRC mortality that should be considered for future analysis to determine if there are disparities by other variables that can be the focus of targeted interventions. Lastly, the analyses related to stage at diagnosis and CRC screening were limited to cross-sectional analysis comparing two points in time rather than longitudinal trend analysis. Therefore, this may not provide a complete picture of what has occurred during the previous decade.

## Public Health Implications

The population of Delaware has seen reductions in CRC incidence and mortality rates, with previous gaps closing among non-Hispanic Black and non-Hispanic White groups. However, screening trends and persistence of late-stage diagnoses imply that diligence is needed to continue to sustain these life-saving outcomes. More research is needed and continued analysis will help inform programs within Delaware such as those involved with increasing CRC screening and provide areas for intervention and focus for the coming years.

With the guidance of the Delaware Cancer Consortium, in 2002, Delaware created a comprehensive statewide CRC screening program that included coverage for screening and treatment, patient navigation for screening and care coordination, and case management. These programs include Screening for Life (SFL), Delaware Cancer Treatment Program (DCTP), and Health Care Connection (HCC). The SFL and DCTP programs provide financial coverage to Delawareans who cannot afford to pay for a cancer screening or treatment. The HCC program and patient navigation provides coordinated care and case management to ensure Delawareans are connected to a health home, receive referrals to medical specialists, and recommendations for healthy behavior support services such as tobacco cessation and obesity prevention. Ensuring that a coordinated care continuum framework exists is most beneficial to those not familiar with navigating the healthcare system, especially those where English is not their first language. DPH continues to streamline processes and identify gaps within the coordinated care system, which includes SFL, HCC, DCTP, and the hospital referral system to make certain Delawareans meet timely cancer care.

Stool-based testing, such as fecal immunochemical test (FIT) or other at-home CRC screening tests, are an acceptable alternative to a colonoscopy for average-risk individuals.<sup>20</sup> Because these tests can be completed at the privacy and convenience of the individual, they provide an alternative that can address barriers to a screening, such as fear, transportation, and work obligations, which prevent individuals from getting a cancer screening.<sup>21</sup> Utilizing these at-home tests may attract more individuals to complete this noninvasive method of CRC screening than those who would elect to receive a colonoscopy. With more individuals screening earlier, the disparity gap between non-Hispanic Black and non-Hispanic White groups can be minimized.<sup>16</sup> However, it's worth noting that an overwhelming majority of Delaware adults meeting



recommendations received a colonoscopy as their most recent exam. The high prevalence of colonoscopy over other types of CRC screening provides an opportunity for primary prevention of this particular cancer type that would be beneficial to maintain.

DPH is working towards collaborations with large-scale employers to encourage employees to get their age-appropriate cancer screenings with no penalties for taking time off from work. DPH is seeking partnerships with manufacturers of either FIT or other at-home CRC screening tests to establish a work-based screening for qualified individuals. To understand individuals' perceptions, fears, and other barriers to cancer screenings, DPH is developing a survey to be conducted statewide to collect data for education and outreach planning and to mitigate barriers to cancer screening, especially non-Hispanic Black men and women. Barriers to CRC screenings exist not only at the patient-level, but also at the provider-level. Delaware is experiencing difficulty attracting and retaining healthcare providers and that challenge is widespread among medical specialties such as gastroenterology. Additional challenges for the SFL program are attracting gastroenterologists willing to see the large volume of program clients with the relatively lower Medicare reimbursement rate. The healthcare industry in the U.S. is not immune to the challenges of employee turnover.<sup>22-24</sup> This trend is evident in Delaware as well, affecting all facets of the cancer care continuum.<sup>25</sup>

## Conclusion

Delaware has sustained improvements in CRC incidence, mortality rates, and disparities between non-Hispanic Black and non-Hispanic White groups. It will be important to continue to monitor and study CRC trends and outcomes, including CRC screening, to ensure that Delawareans are being diagnosed early and that disparities are eliminated.

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