

# Trends in Racial/Ethnic Disparity of Health-Related Quality of Life in Older Adults with and without Cancer (1998–2012)

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## ABSTRACT

**Background:** Non-White cancer survivors often report poorer health compared with Non-Hispanic Whites. Whether those disparities are changing over time is unknown. We examined changes in health-related quality of life (HRQOL) by race/ethnicity from 1998 to 2012 among older adults with and without cancer.

**Methods:** Data from Medicare Advantage beneficiaries were obtained from the linkage between the Medicare Health Outcomes Survey and Surveillance, Epidemiology, and End Results cancer registry data (SEER-MHOS). HRQOL was assessed with the SF-36/VR-12 Physical and Mental Component Scores (PCS/MCS) and 8 scales (Physical Functioning, Role-Physical, Bodily Pain, General Health, Vitality, Social Functioning, Mental Health, Role-Emotional). Annual average HRQOL scores, adjusting for age at survey, gender, number of comorbidities, education, and SEER registry, were compared over time. Absolute (between-group variance;

BGV) and relative (mean log deviation; MLD) indices of disparity were generated using the National Cancer Institute's health disparities calculator (HD\*Calc). Joinpoint was used to test for significant changes in the slopes of the linear trend lines.

**Results:** Racial/ethnic disparities in MCS increased in absolute and relative terms over time for those with [BGV = 15.8 (95% confidence interval [CI], 10.2–21.6); MLD = 16.2 (95% CI, 10.5–22.1)] and without [BGV = 19.3 (95% CI, 14.9–23.8); MLD = 19.6 (95% CI, 15.2–24.0)] cancer. PCS disparities over time did not significantly change. Changes in disparities in 5 of 8 HRQOL scales were significant in those with and without cancer.

**Conclusions:** Older adults with cancer show increasing racial/ethnic disparities in HRQOL, particularly in mental health status.

**Impact:** Future research should evaluate trends in HRQOL and explore factors that contribute to health disparities.

## Introduction

In 2019, over 1.76 million new cancer cases are projected to be diagnosed in the United States (1). The number of cancer survivors is also rising and estimated to increase to over 20 million by 2026 (2). The incidence of cancer for individuals 65 years and older, accounting for just over half of the diagnoses in 2009, is predicted to rise to 70% by 2030 (3). Given the increase in cancer prevalence, studies examining factors that influence health-related quality of life (HRQOL) warrant attention. Social determinants of health, such as socioeconomic conditions and access to quality health care, comprise a set of factors known to affect HRQOL with differences identified across racial/ethnic groups (4, 5), and have become a focus of Medicare Advantage (MA) health plan management (6, 7).

Older adults have a greater prevalence of disability, multimorbidity, and poorer HRQOL compared with other age groups (8). Physical functioning is often compromised among older adults due to increasingly sedentary behavior and declining physical health (9). Studies of HRQOL also consistently report the relevance of maintaining inde-

pendence and sustaining social relationships to preserve the socio-emotional functioning in older adults (10). The aging of the population and changing demographic trends, including increased geographic mobility and growing social (e.g., racial/ethnic and wealth) inequalities (11), underlie the importance of population surveillance of changes in physical and mental health of older adults (12). Despite the implementation of programs in MA plans to narrow racial/ethnic disparities in care quality (13), heterogeneity in the quality and access to preventative and clinical care continue to disproportionately affect some racial minorities and underserved groups. Previous work has shown that racial/ethnic minorities report more physical limitations (14), limitations in daily activities, and poorer employment-related outcomes compared with whites. A comprehensive examination of health disparities, including differences in self-reported health over time has the potential to contribute to future interventions that address the diversity of patient needs.

Patient-reported outcome (PRO) data provide reports on HRQOL directly from patients themselves (15). While several studies have reported on the HRQOL of cancer survivors, longitudinal population-based surveillance PRO data is sparse, limiting the examination of any trends over time (12). The assessment of HRQOL over time, particularly in populations prone to declining health, can also help predict patient survival (16, 17).

The objectives of this study were to examine trends over time in HRQOL among older adults with and without cancer and to determine whether differences by race/ethnicity increased, decreased or remained stable over the observed time period (1998–2012).

## Materials and Methods

Our study used data from the Surveillance, Epidemiology, and End Results-Medicare Health Outcomes Survey (SEER-MHOS) linked data resource. SEER includes incidence and survival data from cancer

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**Note:** Supplementary data for this article are available at Cancer Epidemiology, Biomarkers & Prevention Online (<http://cebp.aacrjournals.org/>).

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registries and covers approximately 30% of the U.S. population (18). The MHOS collects patient-reported data from Medicare Advantage beneficiaries aimed at surveying and improving health plan performance. SEER-MHOS is the result of a collaboration between the National Cancer Institute (NCI) and Center for Medicare & Medicaid Services (CMS; ref. 19). Since 1998, a baseline survey has been fielded each year, and surveyed beneficiaries receive a follow-up survey 2 years after baseline (20). Each group of baseline and follow-up assessments represents a single cohort. For our study, we included data from cohorts 1 through 13 (1998–2012), limiting our analysis to data from the first returned survey following a primary cancer diagnosis recorded in SEER for the cancer sample and the first completed survey for the noncancer sample.

All individuals with a primary diagnosis of any cancer site except nonmelanoma skin cancer were included. Cancer stage at the time of diagnosis included *in situ*, local, regional, and distant. For patients with prostate cancer, sites included local and regional unstaged, unknown or missing. Most beneficiaries returned at least one MHOS survey 5 years or more after their initial cancer diagnosis. Individuals with and without cancer were required to be residing in a SEER region at the time of survey. SEER-MHOS data, classified as a limited data set by HIPAA, allows for the release of data through the completion of a Data Use Agreement. Because of such classification, patients are not contacted individually for authorization of data usage.

### Outcome measures

Our analysis uses two aggregate measures of physical and mental health to capture HRQOL: The Physical Component Summary (PCS) and Mental Component Summary (MCS) scores from the 36-Item Short Form Survey (SF-36, v1) for surveys administered between 1998 and 2006 (21), and the Veteran's RAND 12-Item Short Form Survey (VR-12) from 2006 to 2012 (22). Scores are standardized to U.S. 1990 norms (22). Survey responses from 8 individual scales (bodily pain, general health, mental health, physical functioning, role emotional, role physical, social functioning and vitality) are summarized and normed to the U.S. general population to generate aggregate scores (23). To account for the transition between survey instruments in 2006, algorithms correcting for response shifts between the SF-36 and VR-12 for the PCS, MCS, and the 8 individual scales included in each measure were developed to harmonize the scores over the different survey instrument administration eras (24).

To better understand what aspects of the physical and mental health scores might drive these disparities, we analyzed 8 scales [Physical Functioning (PF), Role-Physical (RP), Bodily Pain (BP), General Health (GH), Vitality (VT), Social Functioning (SF), Mental Health (MH), Role-Emotional (RE)], utilized in the calculation of aggregated scores (PCS and MCS). The individual scales provide information on the following domains: physical functioning (PF), assessing physical limits in performing activities; role-physical (RP), measuring the extent in which physical limitations affect or delay work inside or outside the home; bodily pain (BP), to identify the severity in pain level and how this factor affects tasks inside and outside the home; general health (GH), assessing perceived overall current health and perceptions of future health; vitality (VT), rating levels of energy and fatigue; social functioning (SF), which evaluates limitations in social functioning, particularly when related to health; mental health (MH), assessing 4 major mental dimensions based on their frequency and; role-emotional, appraising the level of interference that emotional problems cause to the time and performance of everyday activities (21, 24).

### Race/ethnicity

Our analysis included respondents who reported four race/ethnicity classifications: Non-Hispanic White, Non-Hispanic Black, Non-Hispanic Asian/Pacific Islander and Hispanic. These race/ethnicity classifications are included in the MHOS survey (1998–2012). Approximately 2.5% of cancer cases ( $n = 2,064$ ) and 2.6% of noncancer cases ( $n = 9,356$ ) with unknown or other race/ethnicity were excluded from the following analysis.

### Covariates

All multivariable regression models in the cancer and noncancer samples were adjusted by several covariates, including: age at survey, gender (male/female), number of self-reported comorbidities (0, 1, 2+, missing), SEER registry area region (South, Midwest, Northeast, West), highest educational level attained (less than high school, high school and some college, college graduate or higher), smoking status, income level, health insurance status based on Medicare and/or Medicaid eligibility and count of activities of daily living (ADL) limitations. Regression models in the cancer sample were further adjusted by months from cancer diagnosis to survey and cancer stage at diagnosis (*in situ*, local, regional, distant, unstaged, unknown/missing). In addition, recognizing that overall, individuals with an *in situ* cancer diagnosis have demonstrably higher cancer survival rates, we conducted a sensitivity analysis removing all *in situ* cases to examine whether HRQOL trends would differ with and without inclusion of these individuals.

### Statistical analysis

#### Least square means regression

We used multivariable linear regression modeling to generate adjusted, least-square means of PCS and MCS by year of survey (1998–2012) in each of four race/ethnicity categories: Non-Hispanic White, Non-Hispanic Black, Non-Hispanic Asian/Pacific Islander, and Hispanic. Mean PCS and MCS values, survey year-specific sample size, and SE values were used to generate health disparity indices, described below. All models were generated using the SAS 9.4 statistical package (SAS Institute Inc.).

#### Health disparity indices

The Health Disparities Calculator (HD\*Calc), developed by NCI (Health Disparities Calculator, Version 1.2.4), was used in our analysis to generate absolute and relative indices of disparity across racial/ethnic categories. The use of two indices to monitor health trends, an absolute measure and a relative measure, follows recommendations from a 2005 monograph on monitoring cancer health disparities, emphasizing the importance of individual group analysis as well as overall changes in disparity over time (25). Our analyses included two disparity indices appropriate for unordered social groups, the Between-Group Variance (BGV) and the Mean Log Deviation (MLD). The BGV aggregates squared deviations from a population average. This index is calculated by squaring differences in group rates from the population average and weights by population sizes, where  $p_j$  is group  $j$ 's population size,  $y_j$  is group  $j$ 's average health status and  $\mu$  is the average health status of the population (26).

$$BGV = \sum_{j=1}^J p_j (y_j - \mu)^2$$

The MLD summarizes the natural logarithm of shares of health and shares of population. In this measure,  $p_j$  is the proportion of the population in group  $j$  and  $r_j$  is the ratio of the prevalence of health in

group  $j$  relative to the total rate,  $r_j = y_j / \mu$ , where  $y_j$  is the prevalence of the outcomes in group  $j$  and  $\mu$  is the total prevalence (26).

$$MLD = \sum_{j=1}^J p_j(-\ln r_j)$$

**JoinPoint regression**

Disparity indices for each race/ethnicity category by survey year were analyzed using JoinPoint regression to determine whether significant changes in physical and/or mental health were reported over the study period (27). JoinPoint regression uses a Monte Carlo Permutation method to determine whether a point of inflection due to a change in the slope of the trend is present (28). Slope trends in the current analysis were reported as annual rates of change in outcome over the time period specified during analysis (29). Each regression contains a horizontal line set at a value of 50, representing the mean summary scores, normed to the 2000 U.S. general population. JoinPoint results for BGV and MLD are not calculated on the same scale (30). Because of the small decimal value of the MLD index, all reported values presented are raised to the power of 4, allowing comparisons between BGV and MLD scores at the same scale.

**Results**

**Demographics**

For this study, 85,583 beneficiaries with a history of cancer and 353,736 beneficiaries without cancer who responded to at least one MHOS survey between 1998 and 2012. Beneficiaries with a history of cancer had a smaller proportion of respondents between 65 to 74 years and female, compared with beneficiaries without cancer. Most respondents in the cancer and noncancer sample identified as non-Hispanic White. Most respondents reported having graduated high school and/or attended some college. Most respondents resided in the West SEER region at the time of survey (Table 1).

Table 1 also presents cancer-specific information for beneficiaries with a primary cancer diagnosis in SEER between 1998 and 2012. The three most common cancer sites, prostate, breast and colorectal, accounted for over 60% of diagnoses in beneficiaries included in the study. Distributions of sociodemographic variables varied significantly between the cancer and noncancer groups for the following variables: age, gender, race/ethnicity, education, SEER registry region, smoking status, income level, health insurance status based on Medicare and/or Medicaid eligibility, comorbidity count and count of activities of daily living (ADL) limitations. Supplementary Tables S1 and S2 contain the average MCS, PCS, and 8 scale scores by year for each racial/ethnic group. Sensitivity analyses examining exclusion of *in situ* cases revealed negligible differences (all scales <0.6 points) in average annual HRQOL scores for PCS, MCS, the 8 scale scores (Supplementary Table S1); thus, all cases were included in the final disparity and trend analyses.

**Disparity indices**

Disparity indices were generated in HD\*Calc for mean PCS and MCS scores for each race/ethnicity category by survey year, using the setting for unordered categorical data, and standard population weights available in the software. HD\*Calc outputs included weighted disparity values for the BGV and MLD, percent change from baseline, standard error and 95% confidence intervals.

Figure 1A–D displays the average annual adjusted PCS and MCS scores in both the cancer and noncancer sample. Fig. 1A shows steady average PCS scores throughout the study period in the cancer sample, non-Hispanic Blacks and Hispanics report lower physical health

**Table 1.** Demographic information for MHOS respondents (age 65 and over) with and without cancer (1998–2012).

	<b>History of cancer<sup>a</sup></b> <b>N = 82,583</b> <b>n (%)</b>	<b>No history of cancer<sup>b</sup></b> <b>N = 353,736</b> <b>n (%)</b>
Overall	82,583 (100)	353,736 (100)
Age at survey		
65–74	39,177 (47.44)	204,837 (57.91)
75–84	33,416 (40.46)	116,195 (32.85)
85+	9,990 (12.1)	32,704 (9.25)
Gender		
Male	41,471 (50.22)	139,557 (39.45)
Female	41,112 (49.78)	214,179 (60.55)
Race/ethnicity		
Non-Hispanic White	61,676 (74.68)	239,988 (67.84)
Non-Hispanic Asian or Pacific Islander	5,676 (6.87)	32,377 (9.15)
Non-Hispanic Black	6,655 (8.06)	30,700 (8.68)
Hispanic	6,512 (7.89)	41,315 (11.68)
Other/unknown race	2,064 (2.5)	9,356 (2.64)
Education		
Less than high school	20,262 (24.54)	99,616 (28.16)
High school grad/some college	44,577 (53.98)	187,553 (53.02)
College grad or higher	15,520 (18.79)	57,310 (16.2)
Missing	2,224 (2.69)	9,257 (2.62)
SEER registry region <sup>c</sup>		
Midwest	7,589 (9.19)	28,577 (8.08)
Northeast	12,772 (15.47)	51,527 (14.57)
South	11,316 (13.7)	67,245 (19.01)
West	44,781 (54.23)	206,387 (58.34)
Other locations/missing	6,125 (7.41)	–
Smoking status		
Survey year ≤2002		
Current	2,629 (10.46)	11,760 (9.95)
Former	11,553 (45.98)	44,440 (37.59)
Never	9,308 (37.04)	53,534 (45.28)
Unknown/missing	1,637 (6.51)	8,499 (7.19)
Survey year >2002		
Current	4,847 (8.44)	21,748 (9.23)
Not current	51,245 (89.19)	207,466 (88.09)
Unknown/missing	1,364 (2.37)	6,289 (2.67)
Income		
<\$10,000	8,442 (10.22)	44,908 (12.7)
\$10,000–\$19,999	16,611 (20.11)	75,109 (21.23)
\$20,000–\$49,999	28,978 (35.09)	113,497 (32.09)
\$50,000+	11,818 (14.31)	44,966 (12.71)
Missing	16,734 (20.26)	75,256 (21.27)
Health insurance status		
Medicare only, any private	74,310 (89.98)	307,662 (86.98)
Medicare/Medicaid dual eligible	8,099 (9.81)	45,337 (12.82)
Missing	174 (0.21)	737 (0.21)
Comorbidity count		
0	3,068 (3.72)	46,513 (13.15)
1	11,120 (13.47)	72,556 (20.51)
2+	67,968 (82.3)	234,667 (66.34)
Missing	427 (0.52)	–
Count of ADL limitations		
0	47,014 (56.93)	217,078 (61.37)
1	11,851 (14.35)	45,246 (12.79)
2+	22,788 (27.59)	86,738 (24.52)
Missing	930 (1.13)	4,674 (1.32)
Cancer site		
Breast	18,627 (22.56)	

(Continued on the following page)

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**Table 1.** Demographic information for MHOS respondents (age 65 and over) with and without cancer (1998–2012). (Cont'd)

	History of cancer <sup>a</sup> N = 82,583 n (%)	No history of cancer <sup>b</sup> N = 353,736 n (%)
Prostate	21,522 (26.06)	
Colorectal	10,369 (12.56)	
Short survival <sup>d</sup>	4,633 (5.61)	
All others <sup>e</sup>	27,432 (33.22)	
Cancer stage at diagnosis		
<i>In situ</i>	6,973 (8.44)	
Local	28,260 (34.22)	
Regional	10,379 (12.57)	
Distant	3,587 (4.34)	
Local + regional (prostate only)	15,009 (18.17)	
Unstaged	7,649 (9.26)	
Unknown/missing	10,726 (12.99)	
Cancer status		
Single cancer	64,855 (78.53)	
Multiple cancers	17,728 (21.47)	
Time since first cancer diagnosis		
0–1 years	10,881 (13.18)	
>1 years to 5 years	25,024 (30.3)	
5 years+	46,678 (56.52)	

<sup>a</sup>Excluding nonmelanoma skin cancer.

<sup>b</sup>Resided in SEER area at the time of survey.

<sup>c</sup>Data for some categories were suppressed for cell sizes <11.

<sup>d</sup>Cancers with short survival time (esophagus, liver, lung, pancreas, and stomach).

<sup>e</sup>All others (oral cavity, small intestine, bones and joints, eye, brain and nervous system, endocrine system, soft tissues, ovary, uterus, cervix, bladder, melanomas, kidney and renal pelvis, lymphomas, non-Hodgkin lymphomas, leukemias).

throughout the study period. Non-Hispanic Asians/Pacific Islanders and non-Hispanic Whites report higher average PCS scores on most survey years compared to non-Hispanic Blacks and Hispanics. **Figure 1B** includes PCS values over time in the noncancer sample. While the racial/ethnic categories in **Fig. 1B** show some clustering in the categories, non-Hispanic Blacks and Hispanics report lower physical health, as well as a yearly decrease in physical health from 2007 to 2012.

MCS scores from respondents with cancer are presented on **Fig. 1C**. Mental health scores in Non-Hispanic Whites appear to increase between 2004 and 2006, remaining steady through the year 2012. Non-Hispanic Blacks, non-Hispanic Asians/Pacific Islanders, and Hispanics appear to report similar scores, with Hispanics reporting the poorest mental health throughout most of the study period. Non-Hispanic Whites report the highest level of mental health by a small gap until 2005; however, the difference between scores in this group and the remaining three race/ethnicity categories widens considerably for the remainder of the study period.

**Figure 1D** presents the trends of self-reported mental health in the noncancer sample. Non-Hispanic Whites without cancer reported average MCS scores that increased over the study period, compared with the remaining three racial/ethnic categories. Non-Hispanic Asians/Pacific Islanders experience a decline in mental health scores after 2002, resembling the scores of non-Hispanic Blacks and Hispanics toward the end of the study period.

### Health disparity trend results

**Table 2** presents results from the JoinPoint regression analysis of health disparity indices, including results for physical health in the

cancer and noncancer samples, by absolute disparity (BGV) and relative disparity (MLD) by race/ethnicity, over the study period. This table also contains results for mental health in the cancer and noncancer samples, also by absolute and relative disparity. All regression models of physical and mental health disparities by race/ethnicity yielded no statistically significant joinpoints, or a lack of statistically significant slope changes over the study time.

### Physical health

Absolute disparity in physical health for individuals with cancer did not change significantly over time across by racial/ethnic groups [average annual rate of change (AARC) =  $-0.6$  (95% CI,  $-7.1$ – $6.3$ )]. Relative disparity in physical health was also steady over time [AARC =  $-0.1$  (95% CI,  $-7.0$  to  $-7.4$ )]. For noncancer beneficiaries, both absolute [AARC =  $5.5$  (95% CI,  $-7.1$ – $6.3$ )] and relative [AARC =  $-0.6$  (95% CI  $-7.1$ – $6.3$ )] disparity in physical health increased over time. However, these results were not statistically significant.

### Mental health

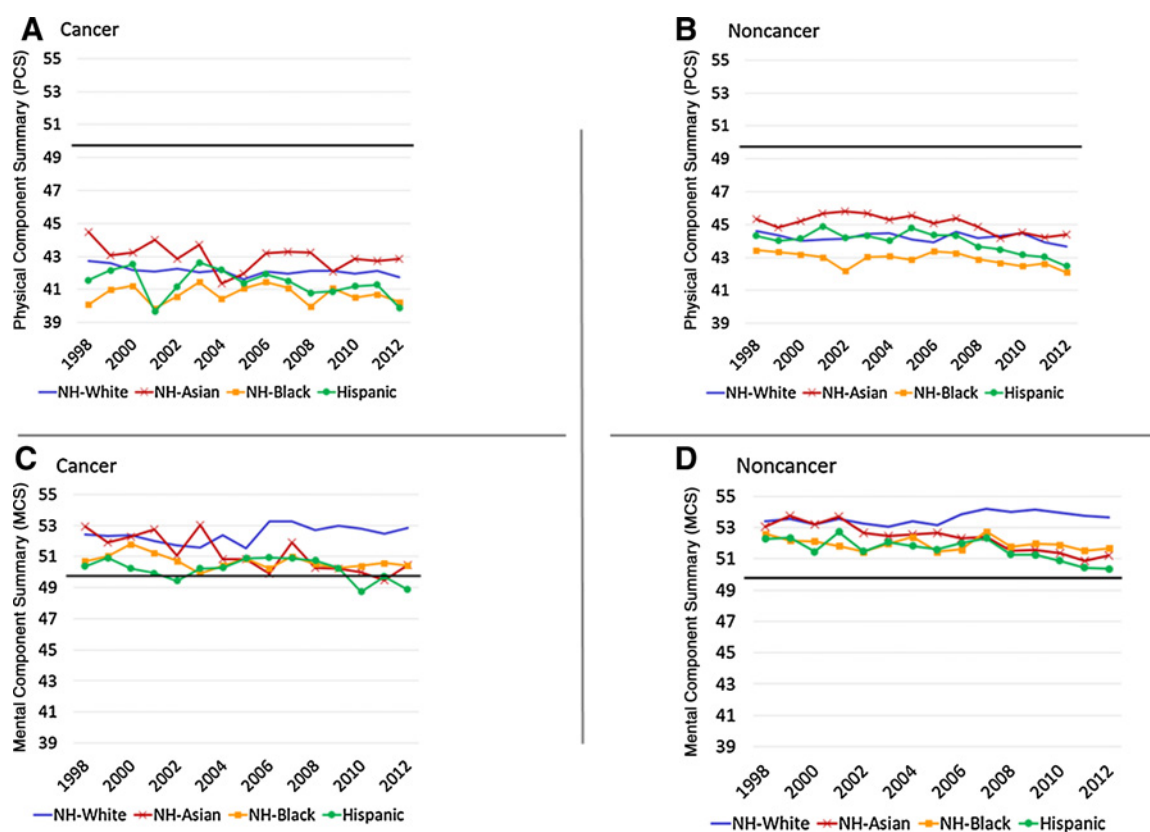
Beneficiaries with cancer show an increase in disparity of self-reported mental health, with Non-Hispanic Asians/Pacific Islanders, Non-Hispanic Blacks, and Hispanic all reporting worse mental health over time compared to Non-Hispanic Whites. Absolute disparity in mental health for individuals with a history of cancer significantly increased over the study period by racial/ethnic groups [AARC =  $15.8$  (95% C.I.  $10.2$ ,  $21.6$ )]. Relative disparity in mental health also increased over time at a similar rate [AARC =  $16.2$  (95% C.I.  $10.5$ ,  $22.1$ )]. Individuals without cancer also experienced a significant increase in mental health disparities by both absolute [AARC =  $19.3$  (95% C.I.  $14.9$ ,  $23.8$ )] and relative [AARC =  $19.6$  (95% C.I.  $15.2$ ,  $24.0$ )] disparity indices over the study period.

Analysis of scores in cancer beneficiaries show the five scales that some of the scales included in the calculation of the PCR or MCS, have a greater impact in the calculation of the global scores, compared to others (**Tables 3 and 4**). In the calculation of these aggregate scores, the items that comprise the social functioning (SF), vitality (V), role emotional (RE), mental health (MH) and general health (GH) scales significantly contribute to the average annual rate of change (AARC) reflected in the race/ethnicity categories' change in disparity across the 1998 to 2012 study period. Beneficiaries without cancer also show increased disparity by race/ethnicity of the social functioning, vitality and role emotional and general health scales. However, the mental health scale was not statistically different across racial/ethnic groups for beneficiaries without a history of cancer.

## Discussion

The primary objective of the study was to analyze changes over time in HRQOL across race/ethnicity groups of older adults with and without cancer. Our results suggest increasing mental health disparities by race/ethnicity in beneficiaries both with and without cancer. The current analysis found increasing disparities in HRQOL over time for individuals with and without a history of cancer. Analysis of beneficiaries without cancer had similar results with cancer patients from the same SEER regions, with racial/ethnic minorities reporting lower mental health scores throughout the analysis and decreasing over the study period.

Poor mental health is a concern among cancer survivors overall (31). A 2011 literature review of national and international reports on quality of life between 1995 and 2009 found that Hispanics in the U.S. report more distress and poorer social and overall HRQOL



**Figure 1.** Annual average Physical Composite Summary (PCS; **A** and **B**) and Mental Composite Summary (MCS; **C** and **D**) scores in Medicare Advantage beneficiaries with and without a cancer history by race/ethnicity (1998–2012). Population norm line for the standard 1990 U.S. norm (bold black line) at a score of 50. NH, non-Hispanic.

compared to non-Hispanic Whites (32). Disparities in mental health by race/ethnicity have also been reported elsewhere. Analysis using 2005 to 2007 SEER-MHOS data found that non-Hispanic Black survivors report poorer MCS compared to non-Hispanic Whites (33). In addition, a study assessing demographic, psychosocial and clinical

characteristics associated with disparities in HRQOL in cancer survivors found race to be an important moderating factor for mental health in Black breast, prostate, and colorectal cancer survivors (34).

In this study, although lower PCS is evident for Hispanic and non-Hispanic Black survivors as compared to non-Hispanic Asians/Pacific Islanders and non-Hispanic White survivors over the time period, we did not find significant changes (including improvements) in the physical health differences across these racial/ethnic groups. This finding suggests persistence, but not worsening of disparity in physical health. Other studies have reported lower physical health in non-White as compared to White survivors. A study of breast cancer survivors reported lower levels of general health and physical functioning among Black than White survivors (35). Another study using the Function Assessment of Cancer Therapy-General (FACT-G) items found Black survivors report worse physical well-being and increased symptomology on items including malaise and ability to work compared to White respondents (36).

Our analysis of racial/ethnic disparities in composite scores and individual scales of physical and mental health suggest a need to track these disparities and explore potential interventions to prioritize quality of life as an important endpoint of care. In a previous multinational review of tools for geriatric assessment, investigators found older cancer patients often weight quality of life higher than survival, compared to younger patients (37). HRQOL has also shown to be associated with earlier prognosis independent of other outcomes, emphasizing the importance of HRQOL assessment across the cancer trajectory (38, 39).

**Table 2.** JoinPoint regression results of disparity in physical health by PCS and MCS in MA beneficiaries with and without a history of cancer.

Disparity index	AARC <sup>a</sup>	95% CI	P
<b>PCS</b>			
Cancer			
Between-group variance (BGV)	-0.6	(-7.1 to 6.3)	0.9
Mean log deviation (MLD) <sup>a</sup>	-0.1	(-7.0 to 7.4)	1.0
Noncancer			
Between-group variance (BGV)	5.5	(-0.5 to 11.7)	0.1
Mean log deviation (MLD) <sup>a</sup>	5.9	(-0.0 to 12.2)	0.1
<b>MCS</b>			
Cancer			
Between-group variance (BGV)	15.8	(10.2–21.6)	<0.01
Mean log deviation (MLD) <sup>a</sup>	16.2	(10.5–22.1)	<0.01
Noncancer			
Between-group variance (BGV)	19.3	(14.9–23.8)	<0.01
Mean log deviation (MLD) <sup>a</sup>	19.6	(15.2–24.0)	<0.01

<sup>a</sup>Average annual rate of change. MLD values (×10,000) to adjust for scale.

**Table 3.** JoinPoint regression results of disparity by individual scales in MA beneficiaries with history of cancer.

Disparity index	Bodily pain (BP)	General health (GH)	Mental health (MH)	Physical functioning (PF)	Role emotional (RE)	Role physical (RP)	Social functioning (SF)	Vitality (VT)
Between-group variance (BGV)								
AARC <sup>a</sup>	-1.1	15.8	21.6	-5.6	9.0	-2.8	14.0	93.2 -18.7
95% CI	(-7.0 to 5.3)	(11.2-20.7)	(14.0-29.7)	(-11.7 to 1.0)	(4.2-14.1)	(-9.0 to 3.9)	(8.4-19.9)	(-16.6 to 347.4) (-28.7 to -7.2)
P	0.7	<0.001	<0.001	0.1	<0.001	0.4	<0.001	0.1, <0.001
Mean log deviation (MLD)								
AARC <sup>a</sup>	0.3	16.9	23.1	-5.4	9.4	-2.3	15.7	90.1 -18.4
95% CI	(-6.6 to 7.7)	(12.0-22.1)	(15.6-31.1)	(-12.0 to 1.7)	(4.4-14.7)	(-9.0 to 5.0)	(9.4-22.3)	(-21.2 to 358.6) (-29.0 to -6.3)
P	0.9	<0.001	<0.001	0.1	<0.001	0.5	<0.001	0.1, <0.001

<sup>a</sup>Average annual rate of change.

One strength of our study was the use of SEER linked data, which gave us access to a population-based, high-quality source of data. The SEER-MHOS linked data resource provides the opportunity both to compare individuals with and without cancer in the same geographical areas and to compare cohorts of individuals over time. In addition, our analytic approach was robust; including both absolute and relative measures of disparities follow recommendations for the comparison of health disparities to allow for more comprehensive determination of disparity.

Despite the strengths of our study, there were some limitations. The analysis was limited to Medicare Advantage enrollees only; thus, findings cannot be generalized to individuals enrolled in fee-for-service Medicare. The MHOS is randomly sampled; however, due to the variability in the size of Medicare Advantage Organizations (MAOs), beneficiaries in smaller plans have a higher probability of being sampled than those in larger plans. Limitations in the areas

covered by SEER cancer registries make our analysis representative of SEER areas only, and do not necessarily reflect the rest of the United States. The years of our analysis were limited to 15 years (1998–2012) based on data availability. In addition, we lacked sufficient sample size to include individuals of other racial/ethnic groups, including American Indian and Alaska Natives. Finally, our cancer sample includes pooled data from all cancer sites available, which prevents detection of differences in HRQOL disparity by cancer site.

**Clinical implications**

A 2018 study on the quality of healthcare measures focused on older adults stressed the limitations of current clinical practice guidelines to address mental and physical health comprehensively in the older adults, with only a limited number of quality assurance measures deemed appropriate for use in those over 65 (40). The absence of

**Table 4.** JoinPoint regression results of disparity by individual scales in MA beneficiaries without history of cancer.

Disparity index	Bodily pain (BP)	General health (GH)	Mental health (MH)	Physical functioning (PF)	Role emotional (RE)	Role physical (RP)	Social functioning (SF)	Vitality (VT)
Between-group variance (BGV)								
AARC <sup>a</sup>	-0.7	28.6 -3.5	-0.5 94.2 8.1	-1.8	2.9 24.8 0.1	2.0	27.5 -8.7	17.6 -29.7
95% CI	(-6.5 to 5.4)	(22.7-34.9) (-28.7 to 30.7)	(-17.7 to 20.4) (-38.7 to 515.4) (-3.0 to 20.6)	(-7.6 to 4.3)	(-8.9 to 16.1) (13.1-37.7) (-9.7 to 11.0)	(-4.4 to 8.7)	(19.1-36.4) (-41.5 to 42.5)	(0.1-38.2) (-40.0 to -17.7)
P	0.8	<0.001 0.8	1.0 0.2 0.1	0.5	0.6 <0.001 1.0	0.5	<0.001 0.7	<0.001 <0.001
Mean log deviation (MLD)								
AARC <sup>a</sup>	0.5	29.5 -3.3	-0.3 96.2 8.9	-1.7	2.7 25.7 0.4	2.6	28.6 -7.1	11.3 -33.7
95% CI	(-5.4 to 6.8)	(23.3-35.9) (-29.4 to 32.4)	(-17.8 to 20.9) (-39.8 to 539.6) (-2.9 to 22.2)	(-7.4 to 4.4)	(-9.9 to 17.0) (13.0-39.8) (-10.2 to 12.3)	(-3.8 to 9.5)	(19.9-37.9) (-41.8 to 48.5)	(-2.8 to 27.5) (-46.4 to -18.1)
P	0.9	<0.001 0.8	1.0 0.2 0.1	0.6	0.6 <0.001 0.9	0.4	<0.001 0.7	0.1 <0.001

<sup>a</sup>Average annual rate of change.

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such measures is concerning as these standards can drive practice and incentivize providers to assess health more comprehensively, beyond a single disease state. The current findings demonstrating increasing racial/ethnic disparities in older adult suggests that these gaps in clinical practice guidelines are even more pressing.

## Conclusions

In summary, our study found increasing disparity in mental health by race/ethnicity groups among MA beneficiaries with and without cancer from 1998 to 2012. Further analysis into the individual scales suggests that this effect is driven by psychosocial domains of health. Our findings warrant additional research into the drivers of increasing mental health disparities among older Americans.

## Disclosure of Potential Conflicts of Interest

No potential conflicts of interest were disclosed.

## Disclaimer

The findings and interpretations in this article are those of the authors and do not necessarily represent those of the NCI or NIH.

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