Disparities in HRQOL of Cancer Survivors and Non-Cancer Managed Care Enrollees

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Health plan member survey and cancer registry data were analyzed to understand differences in health-related quality of life (HRQOL) among cancer survivors and those without a cancer diagnosis enrolled in Medicare managed care. HRQOL was measured by the physical component summary score (PCS) and mental component summary score (MCS) of the Medical Outcomes Study SF-36®, version 1.0. Cancer survivors enrolled in Medicare managed care have lower PCS and MCS scores than those enrollees who have never been diagnosed with cancer. PCS scores are worse than the MCS scores, and lowest for cancer survivors who are Hispanic, Medicaid enrollees, and those who have low income or education. HRQOL disparities are greatest among cancer survivors diagnosed with lung cancer and those with multiple primary cancer diagnoses. The influence of these variables persists when controlling for multiple variables including comorbidity status. Health plans should focus on addressing these disparities.

INTRODUCTION

Advances in cancer screening and treatment enable many elderly cancer patients to survive their diagnosis and live much longer than their peers 10-20 years ago. However, increased survival brings new challenges and implications for older cancer patients. A diagnosis of cancer in older adults is often superimposed on existing comorbid conditions, and can exacerbate acute and chronic, physical, and emotional effects of the disease and treatment (Garman, Pieper, and Seo, 2003; Smith et al., 2008). Research suggests that unless many of these sequellae are promptly identified and effectively managed by individuals, families, and health care providers, these factors can negatively influence the HRQOL of cancer survivors for years after treatment (Bellizzi and Rowland, 2007).

This article addresses the issue of disparities in HRQOL among cancer and non-cancer survivors in Medicare managed care plans. Disparities are defined as differences in the burden of cancer (as measured by HRQOL) that exist among specific population groups in these plans, including groups characterized by age, sex, ethnicity, education, and income[1]. Little population-based information is available to document the differences in HRQOL among older cancer survivors and those who have never been diagnosed with cancer to assist health care providers in addressing this issue. One study Baker and colleagues (2003), based on data from the late 1990s, showed in a managed care setting that

[1] NCI's definition of health disparities includes other elements of cancer burden not measured in this article, such as the incidence, prevalence, and mortality of disease, and other population characteristics not captured in the Medicare Health Outcomes Survey, such as children.

cancer survivors had lower physical and mental health as measured by the SF-36® than enrollees who did not report a cancer diagnosis. Bierman and colleagues (2001) and Cooper and Kohlman (2001) found that chronic diseases had a large impact on self-reported health although other evidence suggests the burden of cancer may not be as great as other comorbid conditions (Ko and Coons, 2005). However, with the exception of Baker's study, research has not focused on the HRQOL of cancer survivors compared with individuals without a history of cancer in managed care organizations.

Evidence also exists that significant differences in cancer outcomes are associated with age, race, poverty, insurance status, and education, although findings are inconsistent across studies. A population-based study of 703 breast cancer patients in California found significant ethnic differences in HRQOL, with the Latino population reporting greater role limitations and lower emotional well-being than the White, African-American, and Asian-American populations (Ashing-Giwa et al., 2007). A study of 804 females with breast cancer who participated in the Health, Eating, Activity and Lifestyle study found that Black females reported statistically significantly lower physical functioning, but higher mental health than White and Hispanic females (Bowen et al., 2007).

Another study, focused on long-term breast cancer survivors, found socioeconomic, but not ethnicity differences in HRQOL outcomes (Ashing-Giwa, Ganz, and Peterson, 1998). Ganz and colleagues (1998) studied 864 breast cancer survivors in the District of Columbia and Los Angeles and found significant increases in emotional functioning and decreases in physical functioning with age. Knight and colleagues (2007) found that lower education was associated with poorer emotional

well-being in 248 prostate cancer patients cared for in the U.S. Department of Veterans Affairs, after controlling for demographic and other factors. A cancer registry-based study of 1,307 females with breast cancer from Detroit and Los Angeles found that among females with advanced breast cancer, those who were more highly educated felt better emotionally and were better able to function socially than were females with low education (Lanz et al., 2005). Penson and colleagues (2001) found that inadequate or lack of insurance had a strong negative effect on physical functioning and emotional well-being among prostate cancer patients (Penson et al., 2001). Despite the contribution of these studies to our understanding of the HRQOL impacts of cancer in older survivors, they are mostly confined to survivors of breast or prostate cancer, do not typically include non-cancer controls, and do not examine HRQOL disparities in the context of specific health care delivery systems accountable for the health of cancer survivors.

To further clarify the relationships between demographic and socioeconomic variables with HRQOL among cancer survivors and those without a cancer diagnosis in Medicare managed care, we linked patient survey data collected from Medicare managed care enrollees with population-based cancer registry data containing clinical information on those with cancer. The objectives of this study were to examine whether the findings in these smaller studies would be replicated in a large population-based sample of Medicare managed care enrollees, and specifically test: (1) to what extent HRQOL among cancer survivors is lower than in individuals who have never been diagnosed with cancer, (2) whether physical and mental health varies in cancer survivors based on their cancer status (i.e., type of diagnosis and number of primary cancer diagnoses),

and (3) whether age, race/ethnicity, sex, marital status, education, income, and severity of cancer (i.e., stage of disease) and comorbidity, are associated with reduced HRQOL.

METHODS

Study Design

Data for this study were collected as part of a larger national study of HRQOL in cancer patients, called the Surveillance Epidemiology, and End Results (SEER)—Medicare Health Outcomes Survey (MHOS) study, undertaken by NCI (2007) and CMS. This study examined the HRQOL of more than 170,000 enrollees of Medicare managed care who resided in 1 of 13 SEER cancer registry regions from 1998-2001. Data were collected from two sources, including the MHOS (Jones, Jones, and Miller, 2004), which randomly surveys 1,000 health plan members annually in each participating Medicare Advantage plan, and SEER, which is a standardized population-based cancer registry that documents detailed clinical and histological characteristics of individuals newly diagnosed with cancer in the region, as well as information on their initial treatment (Ries et al., 2007). The data set represents 27 percent of all Medicare Advantage enrollees.

The methods for linking the SEER and MHOS data have been described by Ambs and colleagues (2008). SEER registries in San Francisco (California), Connecticut, Michigan, Hawaii, Iowa, New Mexico, and Utah link cancer diagnoses back to 1973; Atlanta (Georgia) back to 1975; rural Georgia back to 1992; Los Angeles and San Jose (California) back to 1988; and the expansion registries in Greater California, Kentucky, Louisiana, and New Jersey that were added to SEER in 2000, link cancer diagnoses back to 1988, 1995, 1995, and 1979, respectfully. MHOS response rates averaged 67 percent over the four cohorts and all MHOS respondents were successfully linked either as cancer survivors (SEER) or non-cancer controls, with the exception of 719 cases that were eliminated because their date of death was prior to the date of survey administration.

The study was approved by NCI's Institutional Review Board and both participating government agencies[2]. These analyses use data from both sources.

Study Population

From the SEER-MHOS files, we created a pooled cross-sectional data set that includes all survey respondents from 1998-2001. For the single cancer and tumor specific analyses, we restricted the cancer sample to the four cancer types with the highest incidence: breast, colorectal, prostate, and lung. These four cancers account for more than 50 percent of all incident cancers in the U.S. and more than one-half of incident cancers in males and females over age 65 (Surveillance, Epidemiology, and End Results-Medicare Health Outcomes Survey, 2007). We also identified and examined individuals who had multiple primary cancer diagnoses— that is, people originally diagnosed with one cancer type (e.g., breast cancer) and then later diagnosed with a second or even third cancer (e.g., colorectal cancer and/ or lung cancer). In all analyses, cancer survivors are defined as individuals who were diagnosed with cancer (as verified in the SEER cancer registry) before they took the MHOS. We did not use the self-report survey responses on whether or not an individual had been ever diagnosed with cancer or whether they were under active

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[2] The National Institute of Health, Office of Human Subjects Research approval number is OHSR 2620, February 19, 2004.

treatment for breast, colorectal, prostate, or lung cancer because the samples are not equivalent, since some survey respondents were diagnosed with cancer before they moved into the SEER region or before SEER began collecting diagnosis data and because of our interest in multiple primary cancer diagnoses, which are not captured in the MHOS. These decisions resulted in 21,504 incident cancers in the analytic data set, with 4,549 breast cancer cases, 5,422 prostate cancer cases, 968 lung cancer cases, and 2,916 colorectal cancer cases. Of these incident cancers, 2,810 survey respondents had multiple primary cancer diagnoses.

The sample of survey respondents without cancer included individuals in the same health plans as the cancer respondents (i.e., from the 13 SEER regions) who self-reported no previous cancer diagnosis (other than non-skin melanoma) and had no record of a cancer diagnosis in the SEER registry or were diagnosed with cancer after their first MHOS as reported by the SEER registry. All study respondents appear only once in the data set; we took the first completed MHOS in instances where individuals appear in multiple MHOS cohorts. There were 150,766 survey respondents who did not have a cancer diagnosis and serve as controls in the analytic data set. Approximately 12 percent of surveys were answered by proxies, such as family or caregivers living in the same household.

Measures

We describe the HRQOL of survey respondents with and without cancer using the Medical Outcomes Study SF-36®, version 1.0 PCS and MCS scores (Ware and Kosinski, 2001). The PCS and MCS are scored on a T-score metric such that a score of 50 represents the U.S. general population average. A score that is 10-points above or below the mean score of 50 represents a difference of one standard deviation (SD) from the national average.

We evaluated the associations of the PCS and MCS with respondent age, race/ethnicity, sex, marital status, educational attainment, income, and poverty status (Table 1). Respondent's age was derived by subtracting date of birth in the Medicare Enrollment Files from the date of the MHOS. Age was categorized into three groups: (1) 65-74 years, (2) 75-84 years, and (3) 85 years or over. Race/ethnicity was organized into five mutually exclusive categories: (1) White, (2) Black or African-American, (3) Hispanic, (4) Asian-American, (5) other. Sex was coded as a dummy variable (male = 1; female = 0) for all analyses. Marital status had four categories: (1) married, (2) divorced/separated, (3) widowed, and (4) single and never married). Education had four categories: (1) 8th grade or less, (2) high school graduate, (3) some college, and (4) college graduate with 4 or more years of college education. Four income categories were used: (1) <$10,000, (2) $10,000-$19,999, (3) $20,000-$49,999, and (4) $50,000 or more. Poverty status was measured by whether the respondent was enrolled in both Medicare and Medicaid, the Medical assistance program for the poor. Many of these variables were selected not only because of their importance in HRQOL research, but also because of their past associations with disparities in cancer treatment and mortality in the Medicare Program (Shavers and Brown, 2002).

We further classified cancer respondents by whether they had one cancer diagnosis or multiple primary cancer diagnoses, and by whether they had one of the four leading cancer diagnoses—breast, prostate, colorectal cancer, or lung cancer. We also created a comorbidity index for use in the

Table 1

Demographic and Socioeconomic Characteristics of Medicare Advantage Enrollees, by Cancer Status

Characteristic	Grouping*	No Cancer Diagnosis[1] Mean Age = 74 N	No Cancer Diagnosis[1] Mean Age = 74 Percent	Single Cancer Diagnosis[2] Mean Age = 76 N	Single Cancer Diagnosis[2] Mean Age = 76 Percent	Two or More Cancer Diagnosis[3] Mean Age = 77 N	Two or More Cancer Diagnosis[3] Mean Age = 77 Percent
Age	65-74 (Mean: 70)	89,054	59.1	9,432	50.5	1,203	42.7
	75-84 (Mean: 79)	50,045	33.2	7,534	40.3	1,286	45.6
	85 or Over (Mean: 89)	11,667	7.7	1,728	9.2	331	11.7
Race	White	118,304	78.5	15,188	81.2	2,409	85.4
	African-American	9,271	6.1	1,117	6.0	122	4.3
	Hispanic	12,385	8.2	1,064	5.7	116	4.1
	Asian	7,224	4.8	878	4.7	115	4.1
	Other	3,582	2.4	447	2.4	58	2.1
Sex	Male	62,864	41.7	9,542	51.0	1,336	47.4
	Female	87,902	58.3	9,152	49.0	1,484	52.6
Marital status	Unknown	2,748	1.8	413	2.2	53	1.9
	Married	85,430	56.7	10,976	58.7	1,635	58.0
	Divorced/Separated	14,724	9.8	1,741	9.3	242	8.6
	Widowed	43,838	29.1	5,077	27.2	801	28.4
	Single/Never Married	4,026	2.7	487	2.6	89	3.2
Education	Unknown	3,508	2.3	445	2.4	60	2.1
	<High School (HS)	42,786	28.4	4,937	26.4	743	26.3
	HS or GED Graduate	48,098	31.9	5,837	31.2	905	32.1
	Some College	33,366	22.1	4,271	22.8	678	24.0
	College Graduate	23,008	15.3	3,204	17.1	434	15.4
Household Annual Income	Unknown	31,752	21.1	3,824	20.5	597	21.2
	< $10, 000	19,199	12.7	2,010	10.8	301	10.7
	$10,000 - $19,999	33,316	22.1	4,158	22.2	638	22.6
	$20,000 - $49,999	50,527	33.5	6,575	35.2	967	34.3
	$50,000 >	15,972	10.6	2,127	11.4	317	11.2
Poverty Status	Medicare Only	145,377	96.4	18,165	97.2	2,739	97.1
	Medicare/Medicaid	5,389	3.6	529	2.8	81	2.9

* p value <0.0001 from the chi-square statistics on all sociodemographic characteristics by cancer status.

[1] Individuals linked to Surveillance, Epidemiology, and End Results (SEER), diagnosed with cancer after all surveys, or not linked to SEER, but lived in SEER area at the time of survey and answered no to question: Have you ever been diagnosed with cancer?

[2] Individuals linked to SEER, diagnosed with single cancer before the first baseline survey.

[3] Individuals linked to SEER, diagnosed with 2 or more cancers before the first baseline survey.

NOTE: GED is general educational development.

SOURCE: SEER-Medicare Health Outcomes Survey, National Cancer Institute, Bethesda, MD, 2008.

multivariate regression analyses based on a simple count of the following 12 medical conditions assessed in the MHOS: (1) hypertension or high blood pressure, (2) coronary artery disease, (3) congestive heart failure, (4) myocardial infarction or heart attack, (5) other heart conditions, (6) stroke, (7) chronic obstructive pulmonary disease, (8) inflammatory bowel disease, (9) arthritis of the hip or knee, (10) arthritis of the hand or wrist, (11) sciatica, and (12) diabetes.

Statistical Analysis

We conducted three sets of analyses. First, we calculated bivariate associations between the sociodemographic characteristics of interest and the PCS and MCS. We retained all patient variables with $p<0.01$ on bivariate testing for subsequent analyses. Large sample sizes resulted in retaining most variables in the model. We then used three-way contingency tables to estimate the associations of the PCS and MCS with respondent sociodemographic factors

and whether they had a single or multiple primary cancer diagnoses. We also used ordinary least squares regression to model whether the results of the first two analyses persisted when controlling for other patient characteristics, comorbidity, mode of survey response, and whether or not a proxy responded for the enrollee. Because we were primarily interested in the effects of aging, race/ethnicity, and educational attainment on cancer status, we ran separate regression models including a term for the two-way interactions of these variables. We calculated rates of the outcomes of interest for our patient population using SAS® Version 9.1.3, and used the SURVREG procedure to adjust standard errors for clustering of responses at the health plan level (SAS Institute, 2006). All tests of statistical significance were two-sided.

Although all results of the bivariate and multivariate analyses are reported, we characterize PCS and MCS differences of three points or more between the PCS and MCS scores of cancer survivors and controls as a disparity. This threshold of 0.30 SD was chosen because it exceeds Cohen's (1988) small effect size and is consistent with previous estimates of the minimally important statistical difference for the SF-36® in large samples (Kosinski et al., 2000), and with existing literature that concludes the minimal clinically important difference for the SF-36® is typically in the range of 3-5 points (Samsa et al., 1999).

RESULTS

The mean age of each cancer status group varies from 74 years for respondents who have never been diagnosed with cancer to 77 years for individuals diagnosed with two or more cancers (Table 1). More respondents with two or more cancers report their own race as White. Sex differences exist in the sample to the extent that the percentage of females exceeds males for two of the three groups—those who have never been diagnosed with cancer and those with two or more primary cancer diagnoses. The groups are relatively similar in their marital, educational, and income status, although the poverty status (as measured by Medicaid enrollment) is about one-quarter of the national average for Medicare beneficiaries (Lied and Haffer, 2004).

Table 2 shows the association between the sociodemographic variables of interest in the sample and PCS and MCS. All variables were statistically significant, reflecting in part, the large sample sizes in the data set. As a result, all variables were retained in the subsequent multivariate analyses.

Physical Health and Cancer Status

Noteworthy variations in PCS existed by personal characteristic and whether survivors were diagnosed with one or multiple primary cancer diagnoses (Table 3). In almost all cases, a cancer diagnosis was associated with lower PCS, with typically a 3-point or greater difference between those individuals with no cancer diagnosis and those with two or more primary cancer diagnoses. A clear gradient between HRQOL and cancer status existed, with a 4-point difference in PCS for those age 65-74 diagnosed with two or more primary cancer diagnoses. However, for those age 85 or over, the effect of cancer was attenuated.

Similar differences in PCS exist by race/ethnicity and the number of cancer diagnoses. White, Hispanic, Asian-American, and others who have two or more primary cancer diagnoses have a 4-point or greater difference in PCS; in contrast, Black beneficiaries who have never been diagnosed with cancer and those who

Table 2

Demographics of Medicare Advantage Enrollees, by the SF-36® Physical Component Summary PCS) and Mental Component Summary (MCS) Scores

Demographic	PCS		MCS	
	Mean	Confidence Interval	Mean	Confidence Interval
Age				
65-74 Years	44.1	44.1-44.2	52.1	52.0-52.1
75-84 Years	39.9	39.8-40.0	49.9	49.8-50.0
85 Years or Over	34.8	34.6-35.0	47.0	46.8-47.2
Race				
White	42.1	42.0-42.1	51.4	51.3-51.4
African-American	39.6	39.4-39.8	48.9	48.7-49.2
Hispanic	41.8	41.5-42.0	48.4	48.2-48.6
Asian	44.0	43.7-44.3	51.4	51.1-51.7
Other	41.6	41.2-42.0	49.7	49.3-50.1
Sex				
Male	43.1	43.0-43.2	51.6	51.5-51.7
Female	41.2	41.1-41.2	50.5	50.4-50.5
Marital Status				
Unknown	41.0	40.6-41.5	49.1	48.7-49.6
Married	43.0	42.9-43.0	51.8	51.7-51.9
Divorced/Separated	42.0	41.8-42.2	50.4	50.2-50.5
Widowed	40.0	39.9-40.1	49.5	49.4-49.6
Single/Never Married	43.0	42.6-43.4	51.3	51.0-51.7
Education				
Unknown	40.8	40.4-41.2	48.8	48.4-49.2
<High School (HS)	39.2	39.1-39.3	47.9	47.8-48.0
HS or GED Graduate	42.1	42.0-42.2	51.3	51.2-51.4
Some College	43.0	42.9-43.1	52.5	52.4-52.6
College Graduate	45.3	45.2-45.5	53.9	53.8-54.1
Household Income				
Unknown	42.1	42.0-42.2	51.0	50.9-51.2
<$10,000	38.1	38.0-38.3	46.9	46.7-47.1
$10,000 - $19,999	40.1	39.9-40.2	49.4	49.3-49.5
$20,000 - $49,9999	43.2	43.1-43.3	52.3	52.2-52.4
$50,000>	46.4	46.2-46.6	54.5	54.3-54.7
Poverty Status				
Medicare Only	42.2	42.2-42.3	51.2	51.2-51.3
Medicare/Medicaid	34.5	34.2-34.8	43.5	43.2-43.9

NOTE: GED is general educational development.

SOURCE: Surveillance, Epidemiology, and End Results-Medicare Health Outcomes Survey, National Cancer Institute, Bethesda, MD, 2008.

have been diagnosed with two or more primary cancers show a 2-point difference. Interestingly, Asian-American' PCS is consistently higher than any other race/ethnic group and, among those with two or more cancers, is 3-points higher than Hispanic or Black beneficiaries.

Similar results appear for sex, marital status, and income, with each category having 3-4 point deterioration or greater in PCS depending on whether they had been diagnosed with two or more primary cancers. In contrast, the data show considerable differences across cancer groups depending on educational attainment, with a 4-point or greater difference in PCS for those who did not receive a high school degree or equivalent and those who graduated college.

Although PCS differences for the Medicare-only enrollees is consistent with the other results (i.e., a 4-point difference for those diagnosed with two or more primary cancers), the PCS differences for those

Table 3

Demographics of Medicare Advantage Enrollees, by the SF-36® Physical Component Summary (PCS) Score, by Sample Characteristics and Cancer Status

Characteristic	No Cancer Diagnosis (N = 150,766)[1]		Single Cancer Diagnosis (N = 18,694)[2]		Two or More Cancer Diagnosis (N = 2,820)[3]	
	Mean	Confidence Interval	Mean	Confidence Interval	Mean	Confidence Interval
Age						
65-74 Years	44.4	44.3-44.5	42.3	42.0-42.5	40.3	39.6-41.0
75-84 Years	40.2	40.0-40.3	38.7	38.4-39.0	37.6	36.9-38.3
85 Years or Over	34.9	34.7-35.1	34.2	33.6-34.8	34.5	33.2-35.8
Race						
White	42.4	42.3-42.5	40.2	40.0-40.5	38.5	38.0-39.0
African-American	39.8	39.6-40.1	38.1	37.3-38.8	37.7	35.4-39.9
Hispanic	42.0	41.8-42.2	39.4	38.6-40.1	37.0	34.8-39.3
Asian	44.4	44.1-44.6	41.6	40.8-42.4	40.5	38.3-42.6
Other	41.9	41.5-42.3	39.5	38.3-40.7	36.3	33.1-39.6
Sex						
Male	43.5	43.4-43.6	40.9	40.7-41.2	38.7	38.0-39.3
Female	41.4	41.3-41.5	39.3	39.0-39.5	38.2	37.6-38.9
Marital Status						
Unknown	41.3	40.8-41.8	39.6	38.3-40.8	37.5	34.1-40.9
Married	43.3	43.2-43.4	40.9	40.6-41.1	39.1	38.4-39.7
Divorced/Separated	42.3	42.1-42.5	40.0	39.4-40.6	39.2	37.5-40.8
Widowed	40.2	40.1-40.3	38.5	38.1-38.8	37.0	36.1-37.9
Single/Never Married	43.4	43.0-43.8	40.7	39.6-41.8	38.7	36.1-41.4
Education						
Unknown	41.0	40.6-41.4	39.6	38.4-40.8	37.2	33.9-40.5
<High School (HS)	39.5	39.4-39.6	37.4	37.0-37.7	36.3	35.3-37.2
HS or GED Graduate	42.5	42.4-42.6	39.9	39.6-40.3	38.7	37.9-39.5
Some College	43.3	43.2-43.5	41.0	40.6-41.4	38.9	37.9-39.8
College Graduate	45.7	45.5-45.8	43.4	43.0-43.9	41.0	39.9-42.2
Household Income						
Unknown	42.4	42.2-42.5	40.5	40.1-40.9	38.0	37.0-39.0
< $10,000	38.4	38.2-38.5	36.3	35.8-36.9	35.0	33.5-36.4
$10,000 - $19,999	40.4	40.3-40.5	37.8	37.4-38.2	37.1	36.1-38.1
$20,000 - $49,999	43.5	43.4-43.6	41.0	40.7-41.3	39.4	38.6-40.2
$50,000 >	46.7	46.5-46.9	44.6	44.1-45.1	41.9	40.7-43.2
Poverty Status						
Medicare Only	42.6	42.5-42.6	40.3	40.1-40.5	38.6	38.1-39.0
Medicare/Medicaid	34.7	34.3-35.0	32.9	31.9-34.0	33.5	30.7-36.3

[1] Individuals linked to Surveillance, Epidemiology, and End Results (SEER), diagnosed with cancer after all surveys, or not linked to SEER, but lived in SEER area at the time of survey and answered no to the question: Have you ever been diagnosed with cancer?

[2] Individuals linked to SEER, diagnosed with single cancer before the first baseline survey.

[3] Individuals linked to SEER, diagnosed with two or more cancers before the first baseline survey.

NOTES: Overall, 96.5 percent of survey respondents have complete PCS scores, although the percent varies slightly by cancer status and characteristics group. GED is general educational development.

SOURCE: SEER-Medicare Health Outcomes Survey, National Cancer Institute, Bethesda, MD, 2008.

enrollees also receiving Medicaid benefits are much smaller, ranging less than 2-points between cancer groups. However, those with poverty status (Medicaid beneficiaries), did report 5-8 point lower levels of PCS compared to Medicare only respondents if they were diagnosed with multiple primary cancers.

Mental Health and Cancer Status

The relationship between the MCS, personal characteristics and cancer status is different than the PCS results, with mean differences being much smaller, even for survivors diagnosed with two or more cancers (Table 4). MCS scores tend to be uniformly higher than PCS scores, with some

Table 4

Demographics of Medicare Advantage Enrollees, by the SF-36® Mental Component Summary (MCS) Score, by Sample Characteristics and Cancer Status

Characteristic	No Cancer Diagnosis (N = 150,766)[1] Mean	Confidence Interval	Single Cancer Diagnosis (N = 18,694)[2] Mean	Confidence Interval	Two or More Cancer Diagnosis (N = 2,820)[3] Mean	Confidence Interval
Age						
65-74 Years	52.2	52.1-52.3	51.1	50.9-51.4	50.2	49.5-50.9
75-84 Years	50.0	49.9-50.1	49.5	49.3-49.8	48.7	47.9-49.4
85 Years or Over	47.1	46.8-47.3	47.0	46.3-47.6	46.8	45.2-48.3
Race						
White	51.5	51.5-51.6	50.5	50.3-50.7	49.4	48.9-49.9
African-American	49.0	48.8-49.3	48.4	47.6-49.2	46.4	44.1-48.8
Hispanic	48.5	48.3-48.8	47.1	46.3-48.0	46.1	43.6-48.5
Asian	51.5	51.3-51.8	50.4	49.7-51.2	50.5	48.3-52.7
Other	50.0	49.6-50.4	47.7	46.5-48.9	45.6	42.3-49.0
Sex						
Male	51.9	51.8-51.9	50.5	50.2-50.7	48.7	48.1-49.4
Female	50.5	50.5-50.6	49.8	49.5-50.0	49.4	48.8-50.1
Marital Status						
Unknown	49.2	48.7-49.7	48.7	47.4-50.0	47.8	44.3-51.3
Married	52.0	51.9-52.1	50.9	50.6-51.1	49.3	48.7-49.9
Divorced/Separated	50.5	50.3-50.7	49.4	48.7-50.0	48.1	46.4-49.7
Widowed	49.6	49.4-49.7	48.9	48.6-49.3	48.7	47.8-49.7
Single/Never Married	51.5	51.1-51.8	50.0	48.9-51.1	52.4	49.9-55.0
Education						
Unknown	48.9	48.4-49.3	48.5	47.2-49.7	45.2	41.7-48.7
<High School (HS)	48.0	47.9-48.1	47.0	46.6-47.4	46.0	45.0-47.0
HS or GED Graduate	51.4	51.3-51.5	50.3	50.0-50.6	49.6	48.8-50.4
Some College	52.7	52.6-52.8	51.5	51.2-51.9	49.6	48.8-50.5
College Graduate	54.1	54.0-54.2	52.9	52.6-53.3	52.9	51.9-53.8
Household Income						
Unknown	51.1	51.0-51.3	50.2	49.8-50.6	49.7	48.7-50.7
< $10,000	47.0	46.8-47.2	45.7	45.1-46.4	46.5	44.9-48.1
$10,000 - $19,999	49.6	49.4-49.7	48.3	47.9-48.7	46.8	45.8-47.9
$20,000 - $49,999	52.4	52.3-52.6	51.3	51.0-51.6	49.7	48.9-50.4
$50,000 >	54.6	54.5-54.8	53.9	53.5-54.3	53.1	52.1-54.2
Poverty Status						
Medicare Only	51.4	51.3-51.4	50.3	50.2-50.5	49.3	48.8-49.7
Medicare/Medicaid	43.6	43.2-44.0	42.8	41.5-44.1	42.2	38.7-45.6

[1] Individuals linked to Surveillance, Epidemiology, and End Results (SEER), diagnosed with cancer after all surveys, or not linked to SEER, but lived in SEER area at the time of survey and answered no to the question: Have you ever been diagnosed with cancer?

[2] Individuals linked to SEER, diagnosed with single cancer before the first baseline survey.

[3] Individuals linked to SEER, diagnosed with 2 or more cancers before the first baseline survey.

NOTE: Overall, there are 96.5 percent of survey respondents with complete MCS scores, although the percent varies slightly by cancer status and characteristics group. GED is general educational development.

SOURCE: SEER-Medicare Health Outcomes Survey, National Cancer Institute, Bethesda, MD, 2008.

of the single cancer diagnosis groups (e.g., age 65-74, White, Asian-American, males, high school degree or higher, income groups exceeding $20,000 annually, Medicare-only group) having MCS meeting or slightly exceeding the general U.S. population mean of 50. MCS is higher for those single people with multiple primary cancer diagnoses than those with a single cancer—in all other categories MCS goes down as the number of cancer diagnoses increases. Interestingly, MCS disparities within cancer status category are greater for some sociodemographic characteristics than across cancer diagnoses, with racial differences between Hispanic, Asian, or White cancer survivors equaling or exceeding 3-points. Education and income

disparities within cancer status categories are even greater, with MCS differences exceeding 6-points between those with less than a high school degree or income below $20,000 and those with a college degree or incomes in excess of $50,000. The disparity in MCS between poor Medicare health plan enrollees (as measured by enrollment in Medicaid), and enrollees only enrolled in Medicare exceeds 7-points.

Multivariate Analyses of Sociodemographic Variables

The results reported in Tables 5 and 6 confirm the relationship between cancer status, age, education, income, poverty status, and MCS and PCS. All coefficients are in the same direction as the three-way contingency table analyses and are of similar relative magnitude.[3] However, the influence of race/ethnicity on HRQOL was moderate in the multivariate model, with only Asian Americans having significantly higher PCS (0.91) than White and Hispanic beneficiaries having lower PCS (-0.70) and MCS (-1.05) compared to White beneficiaries.

Comorbidity was highly negatively associated with PCS (-3.13) and MCS (-1.30) compared to those without comorbidity. Further, it appeared that proxy respondents were significantly more likely to report poor physical and mental functioning for cancer survivors (-3.80 and -4.48, respectively) than were cancer survivor respondents themselves. Finally, in a separate model, we added two-way interaction effects for age, race, education, and cancer status.[4] The interaction terms were in the correct direction and in the same relative magnitude of the differences

observed in the main effects model. They suggest that although Asian-Americans report better HRQOL than other race/ethnicity groups overall, younger Asian Americans have higher PCS (1.50) and younger African-Americans have lower PCS (-1.19) than older Asian-Americans or African-Americans, respectively. Also, cancer survivors who are younger than age 85 and have one or more cancers have significantly lower PCS than their older counterparts; confirming the contingency table analyses comparing age, cancer status, and HRQOL.

Regarding mental health, Asian-Americans who are educated at the college level or higher, have much lower MCS than their counterparts who have not gone to college.

Tumor Type

Cancer status based on number of diagnoses appears to be a useful factor in explaining differences in HRQOL within the sample. However, for the cancer status group, we also examined differences by tumor type to see if these relationships could be explained in part by differences in the type of cancer. Tables 7 and 8 present relationships between respondent sociodemographics, tumor type, and PCS and MCS for the four most prevalent cancers— breast, prostate, colorectal, and lung. Although PCS and MCS scores for health plan cancer survivors diagnosed with breast, prostate, colorectal, or lung cancer tend to be substantially lower than U.S. population norms of 50, the differences across tumor types appear to be small (i.e., less than a 2-point PCS difference). In contrast, several MCS scores equal or exceed U.S. population norms of 50 with the highest scores for cancer survivors who had gone to college or had incomes exceeding $50,000 annually. The major exception are

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[3] Although not reported in this article, sex and marital status were not significantly associated with either PCS or MCS.

[4] Again, we did not estimate interaction effects for sex and marital status because they were not significantly associated with either PCS or MCS in the main effects models.

Table 5

Multiple Regression Results for Physical Component Summary

Model for Physical Function	Beta Estimate	p Value	Confidence Intervals
Cancer Status			
Multiple Cancers	-2.79	0.0001	-3.36, -2.23
Single Cancer	-1.6	0.0001	-1.80, -1.40
No Cancer Diagnosis	—	—	—
Comorbidity	-3.13	0.0001	-3.16, -3.09
No Comorbidity	—	—	—
Age			
65-74 Years	6.6	0.0001	6.35, 6.86
75-84 Years	3.86	0.0001	3.60, 4.12
85 Years or Over	—	—	—
Race			
American Indian	0.09	0.80	-0.66, 0.85
Asian or Pacific Islander	0.91	0.0001	0.59, 1.23
Black or African-American	-0.25	0.10	-0.55, 0.05
Hispanic	0.71	0.0001	0.40, 1.02
White	—	—	—
Education			
<High School	-1.8	0.0001	-2.03, -1.58
High School Graduate	-1.23	0.0001	-1.40, -1.05
Some College	-0.65	0.0001	-0.83, -0.46
College Graduate	—	—	—
Annual Income			
<$10,000	-3.46	0.0001	-3.74, -3.18
$10,000 - $19,999	-2.99	0.0001	-3.20, -2.77
$20,000 - $49,999	-1.61	0.0001	-1.80, -1.42
$50,000>	—	—	—
Poverty Status			
Medicare Only	2.88	0.0001	2.49, 3.28
Medicare/Medicaid	—	—	—
Proxy Respondent – Other Than Enrollee	-3.8	0.0001	-4.50, -3.54
Respondent Completes Survey	—	—	—
Survey Completed by Mail	-0.44	0.0001	-0.66, -0.23
Survey Completed by Mail/Telephone Followup	—	—	—
Interaction Effects[1]			
Age Group 65-74 and Asian/Pacific Islander	1.5	0.005	0.48, 2.33
Age Group 65-74 and Black or African-American	-1.19	0.05	-2.26. 0.03
Age 65-74 and Multiple Cancers	-3.21	0.0003	-4.92, -1.46
Age 75-84 and Multiple Cancers	-2.15	0.01	-3.94, -0.36
Age 65-74 and Single Cancers	-0.79	0.04	-1.54, -0.03
Age 75-84 and Single Cancers	-0.27	0.43	-0.96, 0.40

[1] Interaction effects were calculated in separate regression models from main effects summarized in this table. Only the results significant at $p < 0.05$ were reported, with the exception of age interaction for illustrative purposes.

SOURCE: Surveillance, Epidemiology, and End Results-Medicare Health Outcomes Survey, National Cancer Institute, Bethesda, MD, 2008.

lung cancer survivors who average greater than a 5-point lower score in PCS than other tumor types depending on personal characteristic, and greater than a 3-point lower score in MCS. Part of these differences may reflect differences in severity of cancer, which is commonly reflected by the stage of cancer at diagnosis. Additional analyses (not reported here) were performed examining the relationship between tumor type, stage, personal characteristics, and HRQOL, and the results were inconsistent for both PCS and MCS. These results may reflect in part the large number of missing values for stage of disease in the SEER-MHOS data set.[5]

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[5] SEER data indicates that the cancer staging variables were not available and coded unstaged for more than 25 percent of the cancer survivors. Prostate cancer cases had large numbers of unstaged cases, which resulted in eliminating almost one-half of the cases from the stage of disease analyses.

Table 6

Multiple Regression Results for Mental Component Summary

Model for Physical Function	Beta Estimate	p Value	Confidence Intervals
Cancer Status			
Multiple Cancers	-1.55	0.0001	-2.10, -1.01
Single Cancer	-0.822	0.0001	-1.02, -0.62
No Cancer Diagnosis	—	—	—
Comorbidity	-1.3	0.0001	-1.36, -1.24
Age			
65-74 Years	2.28	0.0001	1.98, 2.57
75-84 Years	1.34	0.0001	1.05, 1.65
85 Years or Over	—	—	—
Race			
American Indian	-1.17	0.01	-2.05, -0.28
Asian or Pacific Islander	0.03	0.89	-0.50, 0.57
Black or African-American	0.001	0.99	-0.37, 0.37
Hispanic	-1.05	0.0001	-1.39, -.071
White	—	—	—
Education			
<High School	-2.4	0.0001	-2.63, -2.16
High School Graduate	-1.17	0.0001	-1.34, -0.99
Some College	-0.43	0.0001	-0.60, -0.24
College Graduate	—	—	—
Annual Income			
<$10,000	-2.58	0.0001	-2.82, -2.34
$10,000 - $19,999	-3.62	0.0001	-3.90, -3.34
$20,000 - $49,999	-1.11	0.0001	-1.28, -0.93
$50,000>	—	—	—
Poverty Status			
Medicare Only	3.46	0.0001	2.59, 4.32
Medicare/Medicaid	—	—	—
Proxy Respondent – Other Than Enrollee	-4.48	0.0001	-4.79, -4.16
Enrollee Responds to Survey	—	—	—
Survey Completed by Mail	-1.21	0.0001	-1.44, -0.86
Survey Completed by Telephone	—	—	—
Interaction Effects[1]			
Asian/Pacific Islander and Less Than			
High School Education	2.79	0.0001	2.09, 3.49
High School Education and Asian-American	1.35	0.0001	0.70, 1.99

[1] Interaction effects were calculated in separate regression models from main effects summarized in this table. Only the interactions significant at $p < 0.05$ were included in the table.

SOURCE: Surveillance, Epidemiology, and End Results-Medicare Health Outcomes Study, National Cancer Institute, Bethesda, MD, 2008.

DISCUSSION

We examined the relationship of socio-demographics, cancer status, and HRQOL among cancer survivors enrolled in Medicare managed care. HRQOL disparities were greater for PCS than for MCS, and for survey respondents with multiple primary cancer diagnoses. Research has been conducted on the HRQOL implications of recurrent cancers, very little research has focused on individuals with multiple primary cancers (Curtis et al., 2006). This study showed that more than 13 percent of cancer survivors in the sample had multiple primary diagnoses. These individuals tended to be older, White, and of lower income and educational status than individuals with a single cancer diagnosis, and consistently had lower PCS and MCS. Cancer survivors with multiple primary cancer diagnoses may differ in many important respects from other cancer survivors of a single primary incident.

Table 7

SF-36® Physical Component Summary PCS Score of Medicare Advantage Enrollees, by Sample Characteristics and Cancer Type

Characteristic	Breast Cancer[1] N = 4,777 Mean	Confidence Interval	Prostate Cancer[2] N = 5,530 Mean	Confidence Interval	Colorectal Cancer[3] N = 3,032 Mean	Confidence Interval	Lung Cancer[3] N = 1,014 Mean	Confidence Interval
Age								
65-74 Years	42.3	41.8-42.8	43.8	43.3-44.2	41.9	41.2-42.5	35.3	34.3-36.3
75-84 Years	37.9	37.3-38.5	39.7	39.2-40.2	39.5	38.8-40.2	34.1	32.8-35.4
85 Years or Over	33.8	32.7-35.0	34.4	33.3-35.5	34.7	33.5-35.9	33.5	30.4-36.6
Race								
White	39.8	39.4-40.2	41.4	41.0-41.7	40.2	39.7-40.7	34.6	33.7-35.5
African-American	37.5	35.9-39.1	39.4	38.3-40.5	37.1	35.3-38.8	35.0	31.8-38.1
Hispanic	38.7	37.1-40.3	41.1	39.9-42.3	38.0	36.0-39.9	34.8	31.3-38.4
Asian	42.2	40.7-43.7	42.9	41.5-44.3	41.4	39.7-43.1	39.0	35.5-42.6
Other	38.4	36.1-40.8	40.8	38.6-42.9	40.4	37.6-43.1	32.6	28.1-37.2
Sex								
Male	NA		41.2	40.9-41.5	41.1	40.5-41.7	34.5	33.4-35.6
Female	39.7	39.4-40.1	NA		38.8	38.1-39.4	35.0	33.8-36.1
Marital Status								
Unknown	38.9	36.5-41.3	41.2	38.9-43.5	38.4	35.2-41.6	35.2	29.8-40.6
Married	40.7	40.2-41.2	41.5	41.1-41.9	40.9	40.3-41.5	34.9	33.8-35.9
Divorced/Separated	40.4	39.2-41.5	40.4	39.2-41.7	40.6	39.1-42.2	34.4	32.1-36.7
Widowed	38.5	37.9-39.1	40.0	39.0-40.9	38.0	37.2-38.9	34.8	33.4-36.2
Single/Never Married	39.5	37.4-41.7	41.6	39.7-43.6	41.3	38.4-44.1	31.3	25.1-37.6
Education								
Unknown	37.7	35.3-40.1	40.9	38.7-43.1	38.2	35.2-41.1	30.8	25.0-36.6
<High School (HS)	36.9	36.2-37.6	38.3	37.7-39.0	37.3	36.5-38.1	33.6	32.2-34.9
HS or GED Graduate	40.1	39.5-40.7	40.6	40.0-41.2	40.5	39.7-41.3	34.0	32.7-35.4
Some College	40.7	39.9-41.4	41.8	41.2-42.5	41.5	40.6-42.5	36.0	34.2-37.7
College Graduate	42.5	41.5-43.6	44.6	43.9-45.2	42.1	41.0-43.3	38.4	36.3-40.5
Household Income								
Unknown	40.1	39.4-40.9	41.8	41.1-42.6	39.5	38.5-40.5	35.5	33.8-37.3
<$10,000	36.4	35.4-37.4	36.5	35.3-37.8	37.4	36.1-38.8	31.8	29.7-34.0
$10,000 - $19,999	38.3	37.6-39.1	38.6	37.8-39.3	38.1	37.1-39.0	33.5	32.0-35.1
$20,000 - $49,999	40.9	40.2-41.5	41.4	40.9-41.9	40.8	40.0-41.5	35.5	34.1-36.8
$50,000>	43.5	42.4-44.7	45.5	44.8-46.2	45.3	44.0-46.6	38.8	36.2-41.3
Poverty Status								
Medicare Only	40.0	39.6-40.4	41.4	41.0-41.7	40.2	39.7-40.6	34.9	34.1-35.7
Medicare/Medicaid	32.5	30.6-34.3	34.8	32.6-37.1	32.3	29.6-35.0	30.7	26.6-34.8

[1] Cases are individuals with breast cancer as the most recent cancer before the first baseline survey. Only included female respondents.

[2] Cases are individuals with prostate cancer as the most recent cancer before the first baseline survey. Only included male respondents.

[3] Cases are individuals with colorectal or lung cancer as the most recent cancer before the first baseline survey. Both male and female respondents are included.

NOTES: Overall, there are 96.5 percent survey respondents with complete PCS scores, although the percent varies slightly by cancer and characteristics group. GED is general educational development. NA is not applicable.

SOURCE: Surveillance, Epidemiology, and End Results-Medicare Outcomes Survey, National Cancer Institute, Bethesda, MD, 2008.

As the elderly continue to survive longer with a diagnosis of cancer, the likelihood of multiple cancer diagnoses will increase in the elderly population. More research should be done to further investigate the reasons for these large differences in HRQOL between those with multiple cancer diagnoses and those without a cancer diagnosis and the potential for inter- ventions in health plan settings to improve their HRQOL.

One potential area to focus on is the effect of cancer diagnosis on different sociodemographic groups. These data replicate findings from the studies pre- viously described suggesting that three sociodemographic factors—(1) age, (2) education, and (3) household income—are

Table 8

SF-36® Mental Component Summary MCS Score of Medicare Advantage Enrollees, by Sample Characteristics and Cancer Type

| Characteristic | Breast Cancer[1] N = 4,549 | | Prostate Cancer[2] N = 5,422 | | Colorectal Cancer[3] N = 2,916 | | Lung Cancer[3] N = 968 | |
	Mean	Confidence Interval	Mean	Confidence Interval	Mean	Confidence Interval	Mean	Confidence Interval
Age								
65-74 Years	50.9	50.4-51.4	52.2	51.8-52.7	50.8	50.2-51.5	47.2	46.3-48.2
75-84 Years	49.6	49.0-50.2	50.1	49.6-50.6	49.3	48.6-50.1	46.9	45.5-48.3
85 Years or Over	47.0	45.6-48.4	46.3	45.1-47.5	47.5	46.0-48.9	42.5	38.7-46.3
Race								
White	50.2	49.8-50.6	51.4	51.0-51.7	50.2	49.7-50.7	47.3	46.4-48.2
African-American	48.5	46.8-50.3	49.0	47.8-50.2	46.8	44.9-48.7	43.9	40.5-47.3
Hispanic	46.3	44.5-48.0	48.0	46.7-49.4	48.5	46.4-50.7	45.3	41.4-49.2
Asian	51.5	49.9-53.0	50.0	48.5-51.4	50.6	48.9-52.4	47.7	44.0-51.3
Other	50.9	48.3-53.4	48.2	46.0-50.4	45.9	43.0-48.8	42.1	37.2-46.9
Sex								
Male	NA		50.8	50.5-51.1	50.3	49.7-50.9	46.8	45.8-47.9
Female	50.0	49.6-50.4	NA		49.2	48.6-49.9	46.9	45.7-48.1
Marital Status								
Unknown	46.6	44.0-49.2	50.7	48.3-53.1	50.3	46.9-53.6	45.7	39.8-51.5
Married	50.6	50.0-51.1	51.4	51.0-51.7	50.4	49.8-51.0	47.2	46.1-48.2
Divorced/Separated	49.6	48.4-50.8	49.6	48.4-50.9	50.0	48.4-51.6	46.0	43.7-48.4
Widowed	49.5	48.8-50.1	48.4	47.4-49.4	48.4	47.6-49.3	46.5	45.0-48.0
Single/Never Married	53.2	51.1-55.2	48.4	46.5-50.4	50.4	47.5-53.2	51.0	44.8-57.2
Education								
Unknown	46.5	43.9-49.1	49.4	47.1-51.8	49.1	46.0-52.2	47.4	41.1-53.6
<High School (HS)	47.0	46.2-47.8	47.6	46.9-48.3	46.9	46.0-47.9	43.5	42.0-45.1
HS or GED Graduate	50.6	50.0-51.2	50.3	49.7-50.9	50.4	49.6-51.2	47.7	46.4-49.0
Some College	51.2	50.5-51.9	52.4	51.8-53.0	50.6	49.7-51.4	48.4	46.8-50.0
College Graduate	52.4	51.5-53.3	53.5	52.9-54.0	53.1	52.1-54.1	50.8	48.9-52.7
Household Income								
Unknown	50.2	49.4-50.9	50.9	50.2-51.7	50.2	49.2-51.3	48.4	46.7-50.2
<$10,000	46.6	45.5-47.8	44.8	43.4-46.2	46.0	44.5-47.5	44.1	41.6-46.6
$10,000 - $19,999	48.6	47.8-49.4	48.3	47.6-49.1	48.3	47.3-49.3	44.2	42.6-45.8
$20,000 - $49,999	51.6	51.0-52.3	51.6	51.1-52.1	50.5	49.8-51.2	47.8	46.6-49.1
$50,000>	52.8	51.8-53.9	54.4	53.8-55.1	54.0	52.9-55.1	52.3	50.2-54.5
Poverty Status								
Medicare Only	50.2	49.9-50.6	51.0	50.7-51.3	50.0	49.5-50.4	47.1	46.3-47.9
Medicare/Medicaid	43.3	40.9-45.6	42.4	39.7-45.2	43.2	39.8-46.5	39.7	34.7-44.8

[1] Cases are individuals with breast cancer as the most recent cancer before the first baseline survey. Only included female respondents.

[2] Cases are individuals with prostate cancer as the most recent cancer before the first baseline survey. Only included male respondents.

[3] Cases are individuals with colorectal or lung cancer as the most recent cancer before the first baseline survey. Both male and female respondents are included.

NOTES: Overall, 96.5 percent of survey respondents have complete MCS scores. The percent completion varies slightly by cancer and characteristics group. NA is not applicable. GED is general educational development.

SOURCE: Surveillance, Epidemiology, and End Results-Medicare Health Outcomes Survey, National Cancer Institute, Bethesda, MD, 2008.

uniquely associated with HRQOL beyond cancer diagnosis in Medicare managed care enrollees. The differences in HRQOL were consistently 3 or more points after controlling for cancer status. However, the results were not uniform across physical and mental health, and differed for certain patient characteristics. For example, the data also show that when the oldest old (those age 85 or over) cancer survivors are compared to those without a cancer diagnosis, the influence of cancer on HRQOL disappears, suggesting other aspects of advancing age may overwhelm cancer in describing differences in HRQOL. MHOS respondents, whether diagnosed with one or more primary cancers, tended to consistently report higher MCS than PCS. A

potential explanation is that as individuals' age, they adjust their expectations for functional recovery from illness. As a result, they learn to adapt in terms of their mental health, despite having poor physical health (Baltes, 1997). The multivariate models also point to the importance of comorbidity in explaining differences in HRQOL among cancer survivors. This is consistent with the work of Bierman and others, who argue that factors such as chronic medical conditions and declining functional abilities play more dominant roles in physical and mental health than do factors related to the initial medical diagnosis among the elderly in advancing age (Bierman, Lawrence, Haffer and Clancy, 2001; Bierman, Haffer, and Hwang, 2001). Yet, few of these studies have samples sufficient to investigate the transitions among elderly cancer survivors as they age. How advancing age interacts with multiple cancer diagnoses, comorbidity, and other clinical characteristics of this population in explaining HRQOL merits further research.

Race or ethnicity had a somewhat limited influence on overall HRQOL in this population. The contingency table results were not consistently replicated in the multivariate models where only Hispanic respondents were found to have significantly lower PCS and MCS than other racial groups. This is consistent with the findings from Ashing-Giwa and colleagues (2007) who also found that Latino respondents as reported the lowest physical (role limitations) and mental (emotional well-being) status in a multiethnic sample of females with breast cancer. However, the PCS scores of Asian-American cancer survivors were higher than for other respondents in our sample and U.S. population norms. It is unclear from these results why certain variables are strong predictors for some groups, but not for others, and why Asian-Americans have higher PCS compared to all other race and ethnic groups. Our findings also demonstrate that the positive association of the Asian race is more pronounced among the less educated than among college graduates. Litwin and colleagues (1999) also noted that among Asians higher education was independently associated with worse HRQOL following treatment in certain disease domains. Others have hypothesized that social support, doctor-patient relationships, and the effects of differential life stress may explain some of these differences (Ashing-Giwa et al., 2007). Studies of HRQOL among multiple ethnic groups of the elderly with and without cancer are rare (Ashing-Giwa et al., 2004). More work is needed to investigate the underlying reasons for these differences, due to their potential for more effective targeting of HRQOL interventions by managed care plans to select subgroups of cancer patients.

These results also suggest that using the SF-36® to target interventions to address health outcome disparities based on specific cancer diagnoses may be challenging. The associations between tumor type and HRQOL presented in Tables 7 and 8 were inconsistent across most major tumor types. The exception was lung cancer which was often associated with much greater reductions in PCS and MCS compared to U.S. population norms than were breast, prostate, or colorectal cancer. This is consistent with the Baker (2003) study previously described and in accordance with the broader literature on lung cancer, which has found that males and females diagnosed with the disease commonly report significant distress with their diagnosis and family relationships, difficulties with sexual function, and reductions in other aspects of HRQOL (Sarna et al., 2002). Also, poor physical health may be due to the significant rehabilitation problems that survivors of lung cancer have after treatment (Schag,

Ganz, and Wing, 1994). Our knowledge of the HRQOL of lung cancer survivors beyond the treatment phase is very limited (Earle and Weeks, 2005). Medicare beneficiaries diagnosed with lung cancer appear to be at high risk of deteriorating HRQOL and merit special attention by researchers and health plans.

Previous work on social disparities in health outcome has found that those of lower socioeconomic status experience poor HRQOL outcomes and greater symptom burden (Parker, Baile, de Moor et al., 2002). These results were replicated in this study. Our study suggests that cancer survivors with low educational attainment and low incomes are a highly vulnerable group even within an equal access setting like a Medicare health plan. This suggests that socioeconomic status may have a unique effect on HRQOL among the elderly independent of insurance status.[6] Several potential explanations are possible. Knight and colleagues (2007) posit that individuals with less education may have greater difficulty understanding complex information about their cancer, its treatments, and post-treatment care. Poor understanding of the self-care instructions or poor understanding of post treatment resources available to manage symptoms and other sequelae accompanying cancer survivorship may contribute to difficulties in the management of symptoms, worry about disease burden and recurrence, and difficulty in adjusting one's lifestyle to treatment regimens and symptoms.

Low income may present transportation barriers and result in greater isolation or reduced access to services among the elderly. Because level of education is easy to ascertain in health plan records

or in the clinical setting, this could be an interventional opportunity for health plans to improve outcomes of cancer survivors. Further research is needed to understand the role of education and income as factors influencing the HRQOL of cancer survivors and potential strategies for health plans to mitigate the impact of survivorship on the lives of Medicare enrollees they serve.

This study has several limitations. First, these analyses do not include data on domains that measure the specific effects of treatments and length of survivorship on health outcomes. This may overstate the influence of diagnoses with high mortality rates like lung cancer where PCS and MCS differences among MHOS respondents may reflect more of a treatment effect than a diagnosis effect per se. Thus, it does not provide the richness of information that one would like to have in order to guide well-delineated areas for intervention. Second, because this is a pooled cross-sectional sample, relationships between variables are descriptive and do not imply causality. Future research should model how these variables affect the change in HRQOL among cancer survivors with respect to a closely matched non-cancer control group; SEER-MHOS provides such an opportunity through examination of the longitudinal cohorts of cancer survivors and those without a cancer diagnosis contained in the data set. In particular, sorting out the influence of lung cancer and possibly rarer cancers, such as bladder cancer and stomach cancer, may be useful for identifying the unique influence of tumor type on disparities in HRQOL among Medicare managed care enrollees. Third, approximately 13 percent of the sample reflects proxy responses. Proxies reported health tends to be worse than that reported directly by the elderly, especially in the area of mental health (Yip et al., 2001). A final limitation of the study design is that the survey

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[6] Low PCS and MCS scores for poor cancer survivors enrolled in both Medicare/Medicaid should be taken with caution. Extremely low HRQOL respondents enrolled in Medicaid may largely reflect their severe disability status, which is a condition of Medicaid enrollment for Medicare beneficiaries living in the community.

respondents in this sample come from health plans located in the 13 SEER regions of the U.S. Although the SEER regions account for over 25 percent of all Medicare managed care enrollment, these results may not be generalizable to all health plans in the Medicare Advantage program.

These analyses illustrate the potential for the SEER-MHOS to inform our understanding of the variation in health outcomes as reflected in HRQOL and the sociodemographic factors associated with these differences. Future work to examine these differences over time, and incorporate utilization variables such as differences in initial treatment, may suggest intervention opportunities to address these variations in health outcomes. The SEER-MHOS offers important and relevant data to facilitate the monitoring, planning and targeting of health plan intervention strategies to improve the HRQOL of cancer survivors.

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