Original Article

Health-Related Quality of Life in Older Adult Survivors of Selected Cancers: Data From the SEER-MHOS Linkage

Erin E. Kent, PhD[1]; Anita Ambs, MPH[1]; Sandra A. Mitchell, PhD, CRNP[1]; Steven B. Clauser, PhD[1]; Ashley Wilder Smith, PhD, MPH[1]; and Ron D. Hays, PhD[2]

BACKGROUND: Research on health-related quality of life (HRQOL) among older adult cancer survivors is mostly confined to breast cancer, prostate cancer, colorectal cancer, and lung cancer, which account for 63% of all prevalent cancers. Much less is known about HRQOL in the context of less common cancer sites. **METHODS:** HRQOL was examined with the 36-Item Short Form Health Survey, version 1, and the Veterans RAND 12-Item Health Survey in patients with selected cancers (kidney cancer, bladder cancer, pancreatic cancer, upper gastrointestinal cancer, cancer of the oral cavity and pharynx, uterine cancer, cervical cancer, thyroid cancer, melanoma, chronic leukemia, non-Hodgkin lymphoma, and multiple myeloma) and in individuals without cancer on the basis of data linked from the Surveillance, Epidemiology, and End Results cancer registry system and the Medicare Health Outcomes Survey. Scale scores, Physical Component Summary (PCS) and Mental Component Summary (MCS) scores, and a utility metric (Short Form 6D/Veterans RAND 6D), adjusted for sociodemographic characteristics and other chronic conditions, were calculated. A 3-point difference in the scale scores and a 2-point difference in the PCS and MCS scores were considered to be minimally important differences. **RESULTS:** Data from 16,095 cancer survivors and 1,224,549 individuals without a history of cancer were included. The results indicated noteworthy deficits in physical health status. Mental health was comparable, although scores for the Role–Emotional and Social Functioning scales were worse for patients with most types of cancer versus those without cancer. Survivors of multiple myeloma and pancreatic malignancies reported the lowest scores, with their PCS/MCS scores less than those of individuals without cancer by 3 or more points. **CONCLUSIONS:** HRQOL surveillance efforts revealed poor health outcomes among many older adults and specifically among survivors of multiple myeloma and pancreatic cancer. ***Cancer* 2015;121:758-65.** *© 2014 American Cancer Society.*

KEYWORDS: epidemiology, neoplasms, older adult, quality of life, rare diseases.

INTRODUCTION

Health-related quality of life (HRQOL) measures can provide important information to clinicians on treatment sequelae and may guide treatment decision making.[1] HRQOL assessment offers insights that may represent or complement primary outcomes, provide information about a patient's experience of treatment, identify subgroups for further monitoring,[2] and suggest approaches to tailoring and targeting patient-centered interventions.[1] In addition to monitoring HRQOL in clinical trials, surveillance of HRQOL and predictive modeling of trends over time can yield important information about disease burden and its correlates.[3] The importance of outcome surveillance research in geriatric populations is underscored by the fact that older cancer patients tend to weigh HRQOL more importantly than survival gains when they are making decisions about cancer treatment.[4]

Most studies of HRQOL among cancer patients and survivors have been limited to breast cancer[5] and, to a lesser extent, prostate,[6] colorectal,[7] and lung cancer,[8,9] and even fewer studies have examined HRQOL among older long-term survivors.[10] For example, previous HRQOL research found significantly lower vitality and physical and emotional role functioning among individuals with prostate cancer,[6] and colorectal cancer survivors reported immediate declines in physical functioning after surgery.[7] Because together these 4 cancer sites represent approximately 63% of prevalent cancer cases in the 65-year-old and older population,[11] this emphasis is unsurprising. However, much less is known about the HRQOL experiences of individuals with one of the less common malignancies. Such information could generate

Corresponding author: Erin E. Kent, PhD, National Cancer Institute, 9609 Medical Center Drive, Rockville, MD 20850; Fax: (240) 276-7906; erin.kent@nih.gov

[1]Applied Research Program, National Cancer Institute, Rockville, Maryland; [2]Division of General Internal Medicine and Health Services Research, University of California Los Angeles, Los Angeles, California.

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hypotheses for continued observational research and direct the development of programs, services, or intervention research to improve clinical care outcomes.[12]

We examined the HRQOL of older individuals who had been diagnosed with one of these less common cancers with data from US population–based cancer registries linked to a patient-reported outcome (PRO) survey of individuals aged 65 years and older. The HRQOL of respondents with these cancers was compared to the HRQOL of participants with no history of cancer.

MATERIALS AND METHODS

This study analyzed data derived from a linkage of the Surveillance, Epidemiology, and End Results (SEER) national cancer registry system and the Medicare Health Outcomes Survey (MHOS). The SEER-MHOS data set includes PROs and cancer registry information from a nationwide sample of individuals 65 years old or older who are enrolled in Medicare Advantage organizations (managed care health plans). MHOS is an ongoing quality monitoring effort to collect PROs by the Centers for Medicaid and Medicare (CMS), which has been recruiting multiple cohorts since 1998. Individuals who are enrolled in participating Medicare Advantage organizations are randomly sampled by health plans, administered the survey by mail or telephone, and then resurveyed 2 years later.[13,14] The National Cancer Institute (NCI) and CMS manage the linked data set as an open-access collaborative resource, and external investigators can apply to access the data (http://appliedresearch.cancer.gov/seer-mhos/).

Sample

Ten cohorts, beginning in 1998 and ending in 2009, were included in the study sample. For cancer survivors, data from the first survey after the diagnosis were incorporated into the analysis. For individuals without cancer, data from the first survey were used. Response rates ranged from 63% to 72% across study years.[14]

The less common cancer sites included in this analysis were selected if (1) there were malignancies other than breast, colorectal, lung, or prostate cancer and (2) the SEER-MHOS data set included at least 100 cases for any given site (across all 10 cohorts). We refer to these cancer types as uncommon cancers rather than rare cancers because these sites may exceed reported threshold for rare diseases.[15] The sites chosen for the current study included melanoma of the skin; non-Hodgkin lymphoma (NHL); multiple myeloma; chronic leukemias (which include chronic myeloid leukemia and chronic lymphocytic leukemia); and cancers of the uterus, cervix, ovaries, kidney and renal pelvis, urinary bladder, oral cavity and pharynx, upper gastrointestinal tract (stomach and esophagus), thyroid, and pancreas. Only first primary diagnoses were included in the current analysis. Individuals with any history of cancer are called cancer survivors.

Individuals who participate in the MHOS survey give informed consent. SEER-MHOS linked data are considered to be a limited data set exempt from additional requirements of obtaining informed consent by the Health Insurance Portability and Accountability Act of 1996. The Health Insurance Portability and Accountability Act requirements mandate that investigators sign a data use agreement before they receive the data, and this allows the release of the SEER-MHOS data without authorization from survey respondents.

Measures

For cohorts 1 to 6, the MHOS assessed HRQOL with the 36-Item Short Form Health Survey (SF-36), version 1.[16] We calculated the 8 standard scale scores (Physical Functioning, Role–Physical, Bodily Pain, General Health, Mental Health, Vitality, Social Functioning, and Role–Emotional) and 2 summary scores (Physical Component Summary [PCS] and Mental Component Summary [MCS]).

The scores are normalized to the general US population via a T score metric with a mean score of 50 and a standard deviation (SD) of 10; higher scores indicate better HRQOL. A 2-point difference (0.20 of an SD) in the MCS and PCS scores and a 3-point difference (0.30 of an SD) in scale scores represent minimally important differences (MIDs).[17] We also estimated the Short Form 6D (SF-6D), a health utility score for the SF-36.[18] The SF-6D score ranges from 0 to 1, where full health (no impairments or limitations) is 1 and a health state equivalent to death is 0. Beginning with cohorts 7 and 8, the MHOS administrators replaced the SF-36 with the Veterans RAND 12-Item Health Survey (VR-12) in 2006. The VR-12 yields physical and mental health summary scores and a health utility score, the Veterans RAND 6D (VR-6D), that are strongly correlated with their SF-36 counterparts: PCS, MCS, and SF-6D.[18] The MID for the SF-6D/VR-6D was considered to be 0.03 on the 0 to 1 scale.[19]

Statistical Analysis

HRQOL scores were estimated for patients with all types of cancer and for individuals without a history of cancer. Mean scores were calculated with multivariate linear regression models and the predictive margins method,[20] with demographic and clinical covariates fixed at zero.[21,22] We adjusted for the age at first cancer diagnosis;

TABLE 1. Participant Characteristics

Cancer Site	n	Age, y[a]		Sex: Female, %	Diagnosis to Survey, mo	
		Mean (SD)	Median		Mean (SD)	Median
No history of cancer	1,224,549	74.8 (6.7)	74	59.7	–	–
Bladder	3195	70.1 (8.9)	70	23.1	86.2 (76.7)	65
Melanoma	3019	68.8 (9.4)	69	40.3	90.7 (81.3)	69
Uterus	2558	65.8 (9.3)	66	100	131.9 (98.5)	113
Non-Hodgkin lymphoma	1563	69.7 (9.1)	70	50.9	75.9 (74.2)	53
Kidney	1120	68.9 (8.7)	69	42.3	76.7 (75.0)	52
Cervix	1016	55.5 (11.7)	55	100	216.7 (110.4)	214
Oral cavity and pharynx	942	67.7 (9.0)	68	40.0	92.9 (83.7)	71
Thyroid	586	63.0 (10.8)	64	72.9	132.9 (110.0)	106
Ovary	568	65.7 (10.2)	66	100	113.0 (98.0)	88
Upper gastrointestinal	530	71.1 (8.2)	70	40.4	63.7 (69.5)	37
Chronic leukemia	505	71.8 (8.2)	72	44.8	65.6 (66.5)	42
Multiple myeloma	302	72.4 (7.8)	73	48.7	43.7 (50.4)	24
Pancreas	191	72.4 (8.5)	71	56.5	37.2 (55.6)	13

Abbreviation: SD, standard deviation.
[a] Age at first cancer diagnosis or first survey (no cancer).

for the months from the first cancer diagnosis to the survey (cancer survivors only); for whether a participant had been diagnosed with multiple cancers; for sex, education (6 categories: 8th grade or less, some high school, high school graduate, some college, 4-year college graduate, or more than a 4-year degree), marital status (married, widowed, or otherwise not married), age (at diagnosis or first interview for individuals without cancer), race/ethnicity (non-Hispanic white, non-Hispanic black, non-Hispanic Asian, non-Hispanic American Indian, Hispanic, or other), and household income (<$10,000, $10,000-$19,999, $20,000-$29,999, $30,000-$39,999, $40,000-$49,999, $50,000-$79,999, $80,000+, or unknown); and for whether or not a proxy had completed the survey. We also adjusted for the study cohort year and the mode of administration (telephone or mail). Finally, similarly to previously published work using SEER-MHOS data, we adjusted for patients ever being diagnosed with each of the following chronic medical conditions: hypertension, coronary artery disease, congestive heart failure, myocardial infarction, other heart conditions, stroke, chronic obstructive pulmonary disease, inflammatory bowel disease, arthritis of the hip or knee, arthritis of the hand or wrist, sciatica, and diabetes.[23] Only cases with nonmissing data were included in the analyses. Analyses were conducted with Statistical Analysis Software 9.3 (RTI International, Research Triangle Park, NC).

RESULTS

A total of 16,095 cancer survivors and 1,224,549 individuals without a history of cancer were included in the current study (Table 1). The 3 most common malignancies were bladder cancer, melanoma, and uterine cancer. Among cancer survivors, the mean age at first diagnosis ranged from 55.5 years (SD, ±11.7) for participants with cervical cancer to 72.4 years for participants with multiple myeloma (SD, ±7.8) or pancreatic cancer (SD, ±8.5). For non–sex-specific malignancies, the proportion of participants who were female ranged from 23.1% (bladder) to 72.9% (thyroid). The mean time from diagnosis also varied across cancer types and ranged from 37 months for pancreatic cancer (SD, ±55.6) to 217 months for cervical cancer (SD, ±110.4), and this was consistent with the distinct natural history of these malignancies.

The means and 95% confidence intervals of the PCS, MCS, and SF-6D/VR-6D scores, adjusted for covariates, are presented in Table 2 by cancer type. Most PCS scores were lower among cancer survivors versus individuals without cancer. However, differences in MCS scores between individuals without cancer and those with most types of cancer did not exceed the MID for a majority of sites. The lowest PCS scores were reported by survivors of multiple myeloma (31.3) and pancreatic cancer (35.3) in comparison with individuals without cancer (40.5). The lowest MCS scores were reported by survivors of pancreatic cancer (48.0), multiple myeloma (48.8), and upper gastrointestinal cancer (49.5) in comparison with individuals without cancer (52.1). Figure 1 shows the mean PCS and MCS scores by cancer site and for individuals without cancer, with asterisks indicating differences between patients with specific cancer sites and individuals without cancer exceeding the MID threshold. The cancer sites with individuals reporting SF-6D/VR-6D scores exceeding 0.03 of an SD (in comparison with individuals

TABLE 2. PCS and MCS Scores and Health Utility (SF-6D/VR-6D Score)

	PCS[a]		MCS[a]		SF-6D/VR-6D[b]	
Cancer Site	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)
No history of cancer	815,362	40.5 (40.5-40.5)	811,106	52.1 (52.1-52.2)	765,773	0.73 (0.73-0.73)
Bladder	2135	**38.7 (38.2-39.1)**	2122	51.2 (50.7-51.6)	2035	**0.70 (0.69-0.70)**
Melanoma	2174	40.0 (39.5-40.5)	2164	52.5 (52.1-52.9)	2077	0.71 (0.71-0.72)
Uterus	1651	**38.31 (37.8-38.9)**	1640	52.3 (51.7-52.8)	1565	**0.70 (0.69-0.71)**
Non-Hodgkin lymphoma	1035	**36.8 (36.2-37.5)**	1034	50.7 (50.1-51.4)	985	**0.68 (0.67-0.69)**
Kidney	768	**37.9 (37.2-38.7)**	762	52.0 (51.2-52.7)	727	**0.70 (0.69-0.70)**
Cervix	649	38.8 (37.9-39.6)	645	51.4 (50.5-52.2)	615	**0.70 (0.69-0.71)**
Oral cavity and pharynx	635	**38.0 (37.2-38.8)**	628	51.2 (50.4-52.0)	580	**0.69 (0.68-0.70)**
Thyroid	405	39.4 (38.4-40.4)	402	52.0 (51.1-52.9)	386	**0.70 (0.69-0.71)**
Ovary	368	**36.7 (35.6-37.8)**	364	51.0 (49.9-52.1)	344	**0.68 (0.67-0.69)**
Upper gastrointestinal	326	**37.8 (36.6-39.0)**	325	**49.5 (48.3-50.8)**	311	**0.68 (0.67-0.69)**
Chronic leukemia	347	**36.6 (35.5-37.8)**	344	51.6 (50.6-52.7)	319	**0.69 (0.67-0.70)**
Multiple myeloma	198	**31.3 (29.8-32.9)**	198	**48.8 (47.3-50.3)**	192	**0.63 (0.62-0.65)**
Pancreas	126	**35.3 (33.2-37.3)**	126	**48.0 (45.8-50.1)**	120	**0.65 (0.63-0.68)**

Abbreviations: CI, confidence interval; MCS, Mental Component Summary; PCS, Physical Component Summary; SF-6D, Short Form 6D; VR-6D, Veterans RAND 6D.

Scores were adjusted for the time from the first diagnosis to the survey (cancer sites only); for whether or not a cancer patient had multiple cancers; for continuous age at the first cancer diagnosis or the first survey if there was no cancer; for 12 chronic medical conditions; for education, sex, marital status, race/ethnicity, and income; for whether or not a proxy had completed the survey; for cohort 1 versus the others; and for the mode of administration (mail or telephone).

[a] Bolded scores represent minimally important differences (2.0 or greater) in the mean component score (PCS or MCS) between cancer survivors and individuals without cancer.

[b] Bolded scores represent minimally important differences (0.03 or greater) in the mean utility metric (SF6D/VR6D) between cancer survivors and individuals without cancer.

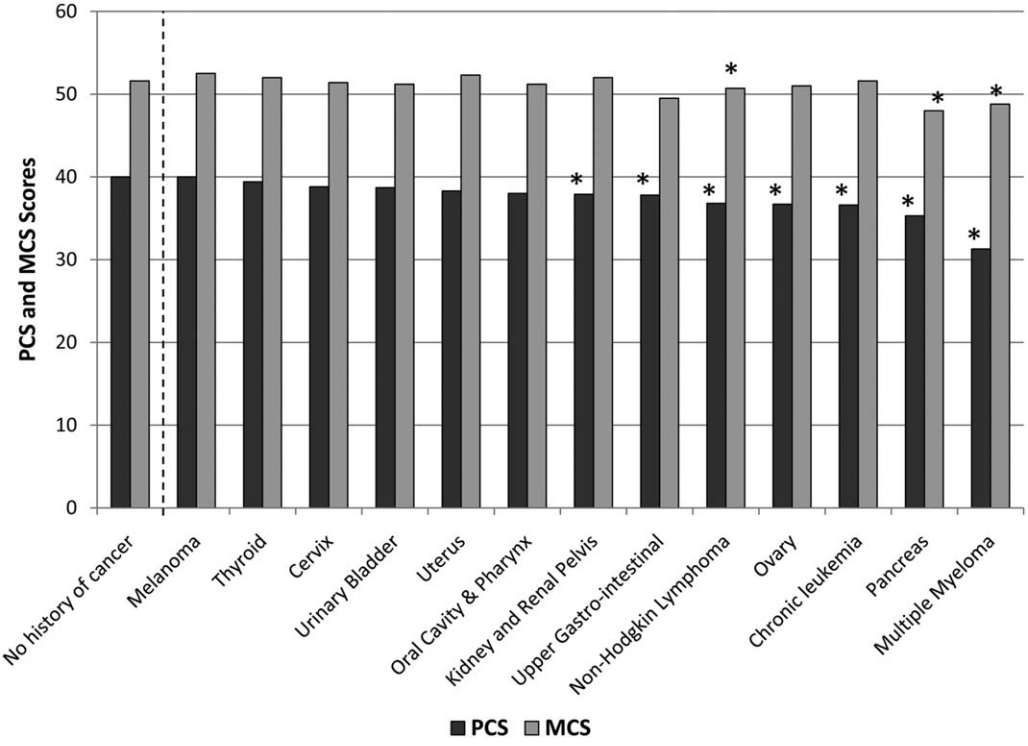

Figure 1. Average adjusted physical (PCS) and mental (MCS) and component scores by cancer site. Asterisk indicates at least a 2.0 point difference from no history of cancer.

TABLE 3. 36-Item Short Form Health Survey Physical Health Scale Scores and 95% CIs

	Physical Functioning[a]		Role–Physical[a]		Bodily Pain[a]		General Health[a]	
Cancer Site	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)
No history of cancer	488,739	41.7 (41.7-41.7)	482,639	40.7 (40.6-40.7)	485,119	46.6 (46.6-46.7)	489,890	46.9 (46.8-46.9)
Bladder	1296	40.5 (39.9-41.2)	1280	38.5 (37.6-39.4)	1290	46.1 (45.5-46.6)	1302	45.0 (44.4-45.5)
Melanoma	1157	41.9 (41.3-42.5)	1148	40.4 (39.5-41.3)	1150	46.7 (46.1-47.2)	1163	46.9 (46.3-47.4)
Uterus	1033	40.0 (39.3-40.7)	1021	**37.5 (36.4-38.5)**	1023	45.8 (45.1-46.4)	1036	45.7 (45.1-46.3)
Non-Hodgkin lymphoma	600	**38.5 (37.6-39.3)**	588	**35.5 (34.2-36.8)**	600	45.7 (44.9-46.5)	601	**42.3 (41.5-43.1)**
Kidney	439	40.4 (39.5-41.4)	433	38.0 (36.5-39.4)	435	44.4 (43.4-45.3)	440	44.1 (43.2-45.0)
Cervix	336	40.3 (39.2-41.5)	331	37.9 (36.0-39.8)	331	46.2 (45.1-47.3)	336	45.8 (44.8-46.9)
Oral cavity and pharynx	388	39.5 (38.4-40.6)	374	**37.3 (35.7-38.8)**	378	45.8 (44.8-46.9)	388	44.0 (43.1-45.0)
Thyroid	183	41.5 (40.1-42.9)	178	38.0 (35.7-40.3)	181	45.9 (44.5-47.2)	184	46.2 (44.9-47.5)
Ovary	208	39.0 (37.5-40.5)	204	**34.5 (32.3-36.7)**	204	45.2 (43.9-46.6)	209	**42.7 (41.3-44.1)**
Upper gastrointestinal	191	38.8 (37.2-40.4)	190	**35.2 (32.9-37.5)**	190	45.9 (44.2-47.3)	191	**42.2 (40.8-43.7)**
Chronic leukemia	189	40.1 (38.6-41.5)	186	**37.6 (35.2-40.0)**	186	45.6 (44.2-46.9)	189	**42.1 (40.7-43.6)**
Multiple myeloma	110	**34.4 (32.3-36.4)**	110	**28.9 (26.3-31.6)**	110	**40.0 (38.0-42.1)**	110	**36.9 (35.0-38.9)**
Pancreas	65	**38.1 (35.2-40.9)**	65	**31.4 (27.7-35.2)**	65	**43.2 (40.4-46.1)**	65	**39.3 (36.8-41.7)**

Abbreviations: CI, confidence interval.

Scores were adjusted for the time from the first diagnosis to the survey (cancer sites only); for whether or not a cancer patient had multiple cancers; for continuous age at the first cancer diagnosis or the first survey if there was no cancer; for 12 chronic medical conditions; for education, sex, marital status, race/ethnicity, and income; for whether or not a proxy had completed the survey; for cohort 1 versus the others; and for the mode of administration (mail or telephone).

[a] Bolded scores represent minimally important differences (3.0+) in the mean subscale score between cancer survivors and individuals without cancer.

without cancer) included all but melanoma. Survivors with multiple myeloma reported the lowest mean SF-6D/VR-6D score of 0.63, which was 0.10 points different from the score for individuals without cancer.

Covariate-adjusted mean scores for all 8 scales are presented in Table 3 (4 physical health scales) and Table 4 (4 mental health scales). For individuals with the greatest impairments in PCS and MCS (respondents with multiple myeloma, chronic leukemias, NHL, and tumors of the pancreas, ovaries, or upper gastrointestinal tract), deficits were reflected across several scales (particularly Physical Functioning, Social Functioning, Role–Physical, Vitality, and General Health). Mental Health scale scores were mostly comparable to those without cancer for all of these cancer sites. Bodily Pain, Role–Physical, and Vitality were prominent concerns for respondents with multiple myeloma and pancreatic cancer. The largest between-group differences were observed for 3 scales—Physical Functioning, Role–Physical, and General Health—and exceeded the MID of 3 points for several sites. The lowest mean scores for Physical Functioning were reported by participants with multiple myeloma (34.4) in comparison with individuals with no cancer (41.7). The most significant limitations on the Role–Physical scale were reported by respondents with multiple myeloma (28.9) and cancer of the pancreas (31.4) or ovaries (34.5) in comparison with individuals with no cancer (40.7). The lowest mean scores for the General Health scale were seen in survivors of multiple myeloma (36.9) and pancreatic cancer (39.3) in comparison with individuals without cancer (46.9). In general, compared to individuals without cancer, survivors reported only small differences in the scales that are considered to reflect mental health (specifically the Mental Health and Role–Emotional scales). However, survivors with multiple myeloma or pancreatic or upper gastrointestinal malignancies reported significant limitations on the Role–Emotional scale (37.3 for multiple myeloma and 39.7 for upper gastrointestinal malignancies) in comparison with individuals without cancer (45.3).

DISCUSSION

In this large population-based study of health outcomes for older adults diagnosed with selected cancers, we found that the PCS was markedly lower for survivors of cancers of the oral cavity, uterus, kidneys, upper gastrointestinal tract, ovaries, and pancreas and for survivors of NHL, chronic leukemias, and multiple myeloma in comparison with individuals without cancer. The largest reported differences in the HRQOL scales between survivors and controls were among survivors of pancreatic cancer (12 points) and multiple myeloma (15 points). Other studies of older adults with and without cancer have shown similar patterns.[24-26] The 2 scales with the biggest score deficits between cancer survivors and individuals without a history of cancer were Physical Functioning and Role–Physical, and these findings have been demonstrated in other studies of older cancer survivors.[25,27-31]

Except for those respondents with pancreatic cancer and multiple myeloma, Bodily Pain scores were not

TABLE 4. 36-Item Short Form Health Survey Mental Health Scale Scores and 95% CIs

	Vitality[a]		Social Functioning[a]		Role–Emotional[a]		Mental Health[a]	
Cancer Site	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)	n	Mean (95% CI)
No history of cancer	485,005	49.4 (49.3-49.4)	485,525	48.0 (48.0-48.0)	481,275	45.2 (45.2-45.3)	485,190	51.4 (51.4-51.4)
Bladder	1289	48.1 (47.5-48.7)	1289	46.3 (45.6-46.9)	1276	44.2 (43.2-45.2)	1289	50.6 (50.0-51.1)
Melanoma	1152	49.6 (49.0-50.2)	1153	47.6 (47.0-48.3)	1147	45.7 (44.8-46.7)	1153	51.8 (51.3-52.3)
Uterus	1023	48.3 (47.6-49.0)	1025	46.9 (46.2-47.7)	1019	44.8 (43.6-46.0)	1023	51.7 (51.1-52.3)
Non-Hodgkin lymphoma	598	**46.4 (45.6-47.2)**	600	**45.0 (44.1-45.9)**	591	42.5 (41.1-44.0)	599	49.9 (49.1-50.7)
Kidney	435	47.2 (46.2-48.2)	435	45.8 (44.7-46.9)	432	42.5 (40.8-44.2)	435	51.2 (50.2-52.1)
Cervix	332	48.7 (46.9-49.2)	331	46.8 (45.5-48.0)	331	43.8 (41.7-45.9)	332	50.4 (49.3-51.6)
Oral cavity and pharynx	381	47.2 (46.2-48.3)	380	45.6 (44.5-46.8)	372	44.3 (42.6-46.0)	381	50.1 (49.1-51.0)
Thyroid	180	48.5 (47.1-50.0)	181	46.5 (45.0-47.9)	179	44.0 (41.6-46.4)	180	52.2 (50.9-53.6)
Ovary	206	**45.7 (44.2-47.3)**	206	**43.5 (41.9-45.1)**	201	**43.2 (40.7-45.6)**	206	50.2 (48.9-51.6)
Upper gastrointestinal	190	**46.1 (44.6-47.6)**	190	**43.4 (41.6-45.2)**	188	**39.7 (36.9-42.5)**	190	48.7 (47.1-50.3)
Chronic leukemia	186	**46.3 (44.8-47.9)**	186	**44.9 (43.3-46.5)**	184	44.6 (42.0-47.2)	186	50.8 (49.4-52.2)
Multiple myeloma	110	**42.5 (40.7-44.4)**	110	**41.1 (38.8-43.4)**	110	**37.3 (33.7-41.0)**	110	49.5 (47.5-51.5)
Pancreas	65	**45.3 (42.7-47.9)**	65	**41.4 (38.4-44.5)**	65	40.3 (35.5-45.2)	65	50.4 (47.7-53.0)

Abbreviation: CI, confidence interval.

Scores were adjusted for the time from the first diagnosis to the survey (cancer sites only); for whether or not a cancer patient had multiple cancers; for continuous age at the first cancer diagnosis or the first survey if there was no cancer; for 12 chronic medical conditions; for education, sex, marital status, race/ethnicity, and income; for whether or not a proxy had completed the survey; for cohort 1 versus the others; and for the mode of administration (mail or telephone).

[a] Bolded scores represent minimally important differences (3.0+) in the mean subscale score between cancer survivors and individuals without cancer.

significantly different between cancer survivors and individuals without cancer in the adjusted analyses. These results are surprising in light of findings from other studies that reflect pain. The results may in part reflect between-study differences in the older adult population sampled (eg, ambulatory or not) and the cancer sites under investigation. In a study of cognitively intact nursing home residents, Drageset et al[28] found that residents with cancer reported worse pain than residents without cancer. Cancer-related pain has been shown to be associated with other aspects of HRQOL, including impairments in physical and emotional functional status,[32] so identifying and addressing pain among cancer survivors is critically important for reducing suffering.

We observed that for 8 of the cancer types, the MCS scores were not notably different from the score for those without cancer, and this finding has been documented in previous literature.[26] Exceptions include individuals diagnosed with bladder cancer, NHL, pancreatic cancer, upper gastrointestinal cancer, and multiple myeloma. Scale scores also revealed significant deficits in Role–Emotional and Mental Health scale scores among respondents with multiple myeloma or upper gastrointestinal tract or pancreatic tumors.

An examination of SF-6D/VR-6D scores allows a rapid comparison of health utility among cancer types, and in the current study, our analysis indicated that individuals with ovarian cancer (0.68), pancreatic cancer (0.65) and multiple myeloma (0.63) reported the lowest scores in comparison with individuals without cancer (0.73). These scores are comparable to those reported for Medicare Advantage enrollees who reported other chronic conditions, including stroke, chronic obstructive pulmonary disease/asthma, and coronary artery disease.[22] The SF-6D/VR-6D scores can be used for comparisons to be made over time among individuals and across disease sites and can be used to calculate quality-adjusted life years, a useful metric for health evaluation.[22]

Deficits in HRQOL scores across the PCS, MCS, and SF-6D/VR-6D were greatest for individuals with multiple myeloma and pancreatic cancer. Previous research on PROs is particularly limited for multiple myeloma, likely because of its relatively rare incidence and the difficulty in recruiting a sufficient sample size. The disease burden, as evidenced by the current study and a few other published reports of multiple myeloma[33] and pancreatic cancer,[34] suggests the need for research to identify factors that contribute to inferior outcomes among respondents with these malignancies.

Our study leverages the strengths inherent in the SEER-MHOS data resource: its large sample size, which enables the reporting of outcomes of survivors of less common cancers, and its health plan–based sampling approach, which covers wide and diverse geographic areas. The large sample size, however, was still not large enough to include individuals with even less common cancers (eg, esophageal and liver cancer), and this is a constraint of

population-based research in general. One limitation of the data set is the lack of cancer-specific measures of HRQOL that may be more sensitive to the impact of cancer on HRQOL. However, the SF-36 and the VR-12 are widely used instruments that have been evaluated in multiple disease and treatment contexts,[35] and their use in this sample permits comparisons with SEER-MHOS subgroups, including those without cancer and those with specific comorbid conditions. Other measures in MHOS, such as the Healthcare Effectiveness Data and Information Set effectiveness-of-care measures,[36] which include fall risk management and management of urinary incontinence, may be able to provide information about other aspects of the patient experience and should be considered in future PRO studies. In addition, cancer survivors included in the current analysis ranged widely in the time since diagnosis, and this heterogeneity should be considered carefully in future analyses of the SEER-MHOS data set.

Another limitation of the SEER-MHOS data is the lack of data on Medicare fee-for-service beneficiaries, who constitute the majority of Medicare beneficiaries.[14] Prior research has demonstrated that Medicare Advantage enrollees may be healthier than fee-for-service Medicare enrollees, who tend to report more risk factors and lower HRQOL.[37] Although the SEER registry covers approximately 27% of the population of Medicare Advantage enrollees,[38] it does not include certain regions such as the states of Florida and Minnesota, which have high managed care penetration. At the same time, Medicare Advantage plans are not represented in all SEER regions; thus, important geographical variations may be missed.[14] In addition, SEER-MHOS data are limited by the availability of treatment data in the SEER cancer registry: data on the first course of therapy for surgery and radiation are considered to be generally reliable, but data on chemotherapy and hormonal therapy are not reported because of underascertainment. Thus, analyses by cancer sites that are predominantly treated with these modalities must acknowledge this limitation. Additional limitations common to survey research are a healthy participant bias and an inability to draw causal inferences from cross-sectional data.

Impairments in HRQOL in survivors with uncommon cancers likely reflect a myriad of factors, including the sequelae of disease and treatment, psychosocial factors such as social isolation, and the impact of comorbidities and financial strain. The experience of having a serious and chronic illness in the context of aging may partially account for inferiorities in HRQOL.[25] Future studies of SEER-MHOS data and other population-based data resources composed of data from cancer survivors can be used to identify the sociodemographic, biological, and clinical factors that may contribute to health status impairments both across disease sites and in particular subgroups with one of these less common cancers. Moreover, future research should make use of the longitudinal data available in the SEER-MHOS data set and examine changes in health status over time among individuals with specific cancer types.[39] In addition, examining health care provider characteristics could help to inform in which contexts patient-centered interventions might be most successful. Studies comparing specific age groups across cohorts could help to determine whether there are distinct patterns of health status decline based on age strata (ie, young-old vs old-old) at diagnosis. The measurement and surveillance of these PROs should continue to inform patient-centered interventions, including those for patients with less common cancers.

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CONFLICT OF INTEREST DISCLOSURES

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