Health-related quality of life in older adult survivors of selected cancers: data from the SEER-MHOS linked data resource

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**[3]

[1]National Cancer Institute

[2]University of California Los Angeles

Abstract

Background—Research on health-related quality of life (HRQOL) among older adult cancer survivors is mostly confined to breast, prostate, colorectal, 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—We examined HRQOL using the Short-Form-36 v1 (SF-36) and Veterans RAND 12-Item Health Survey (VR-12) in selected cancers (kidney, bladder, pancreas, upper gastrointestinal, oral cavity & pharynx, uterine, cervical, thyroid, melanoma, chronic leukemia, non-Hodgkin lymphoma, and multiple myeloma) and individuals without cancer using data linked from the Surveillance Epidemiology and End Results (SEER) cancer registry system and the Medicare Health Outcomes Survey (MHOS). We calculated scale scores, physical and mental component summary (PCS and MCS) scores, and a preference-based score (SF-6D/ VR-6D) adjusted for socio-demographic characteristics and other chronic conditions. We considered a 3-point difference on the scale scores and a 2-point on PCS/MCS as minimally important differences.

Results—Data from 16,095 cancer survivors and 1,224,529 individuals without a history of cancer were included. Results indicate noteworthy deficits in physical health status. Mental health was comparable, although role limitations due to emotional problems and social functioning scale scores were worse for most cancer sites than for those without cancer. Survivors of multiple myeloma and pancreatic malignancy reported the lowest scores, with PCS/MCS scores 1 standard deviation or more below that of individuals without cancer.

Conclusion—HRQOL surveillance efforts reveal poor health outcomes among many older adults, specifically survivors of multiple myeloma and pancreatic cancer.

Keywords

Quality of life; neoplasms; epidemiology; older adult; rare diseases

Corresponding Author: Erin E. Kent, PhD, 9609 Medical Center Drive, Rockville, MD 20850, Phone: 240-276-6776, Fax: 240-276-7906, Erin.Kent@nih.gov.

Background

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 the 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 outcomes surveillance research in geriatric populations is underscored by the fact that older cancer patients tend to weigh HRQOL more importantly than survival gains in 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, individuals with 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 following surgery.[7] Given that together these four cancer sites represent approximately 63% of prevalent cancer cases in the 65 and over 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 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 have been diagnosed with one of these less common cancers using data from U.S. population-based cancer registries linked to a patient-reported outcomes (PROs) survey in individuals aged 65 and over. HRQOL in respondents with these cancers was compared to participants with no history of cancer.

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 dataset includes PROs and cancer registry information from a nationwide sample of individuals 65 and older enrolled in Medicare Advantage Organizations (managed care health plans). The MHOS is an ongoing quality monitoring effort to collect PROs by the Centers for Medicaid and Medicare (CMS) that has been recruiting multiple cohorts since 1998. Individuals enrolled in participating Medicare Advantage Organizations are randomly sampled by health plans, administered the survey by mail or telephone, and then re-surveyed two-years later.[13, 14] The National Cancer Institute and CMS manage the linked dataset as an open-access collaborative resource, and external investigators can apply to access the data (http://appliedresearch.cancer.gov/seer-mhos/).

Sample

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

The less common cancer sites included in this analysis were selected if (1) they were a malignancy 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," as these sites may exceed reported criteria 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 [CML] and chronic lymphocytic leukemia [CLL]) , and cancers of the uterus, cervix, ovaries, kidney and renal pelvis, urinary bladder, oral cavity and pharynx, upper gastrointestinal tract (stomach and esophagus), thyroid, or pancreas. Only first primary diagnoses were included in the current analysis. Individuals with any history of cancer are referred to as "cancer survivors."

Individuals who participate in the MHOS survey give informed consent. SEER-MHOS linked data are considered to be a limited dataset, exempt from additional requirements of obtaining informed consent by the Health Insurance Portability and Accountability Act (HIPAA) of 1996. The HIPAA requirements mandate that investigators sign a data use agreement prior to receiving the data, which allows for the release of the SEER-MHOS data without obtaining authorization from survey respondents.

Measures

For cohorts 1–6, the MHOS assessed HRQOL using the SF-36® Survey, Version 1.[16] We calculated the standard eight scale scores (physical functioning, role limitations due to physical health, bodily pain, general health perceptions, emotional well-being, vitality, social functioning, and role limitations due to emotional problems) and two summary scores (physical health and mental health). The scores are normalized to the general U.S. population using a *T*-score metric, with a mean score of 50 and a standard deviation of 10; higher scores indicating better HRQOL. A 2 point (0.20 of a standard deviation) difference on the Mental Component Summary (MCS) and Physical Component Summary (PCS) scores and a 3 point (0.30 of a standard deviation) difference in scale scores represents a minimally important difference (MID).[17] We also estimated the 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 zero. The MHOS administers replaced the SF-36 with the Veterans RAND 12-item Health Survey (VR-12) in 2006, beginning with cohorts 7 and 8. The VR-12 yields physical and mental health summary scores and a health utility score, the VR-6D, that are strongly correlated with the SF-36 counterparts, the PCS, MCS, and SF-6D.[18] The MID for the SF-6D/VR-6D was considered to be 0.03 on the 0–1 scale.[19]

Statistical Analysis

HRQOL scores were estimated for all cancer sites and for individuals without a history of cancer. Mean scores were calculated using multivariable linear regression models and the predictive-margins method[20] with demographic and clinical covariates fixed at zero.[21,22] We adjusted for age at first cancer diagnosis, months from first cancer diagnosis to survey (cancer survivors only),whether a participant had been diagnosed with multiple cancers, gender, education (6 categories: 8th grade or less, some high school, high school graduate, some college, 4-year college graduate, more than a 4-year degree) marital status (married, widowed, 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), household income (<$10,000, $10,000-$19,999, $20,000-$29,999, $30,000-$39,999, $40,000-$49,999, $50,000-$79,999, $80,00+, or unknown), and whether a proxy completed the survey. We also adjusted for study cohort year and mode of administration (telephone or mail). Finally, we adjusted for ever being diagnosed with each 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, or diabetes) similar to previously published work using SEER-MHOS data.[23] Only cases with non-missing data were included in the analyses. Analyses were conducted using the 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 three 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) and pancreatic cancer (SD ±8.5). For non-gender specific malignancies, the proportion of participants who were female ranged from 23.1% (bladder) to 72.9% (thyroid). Mean time from diagnosis also varied across cancer types, ranging from 37 months for pancreatic cancer (SD±55.6) to 217 months (SD±110.4) for cervical cancer, 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 than individuals without cancer. However, differences in MCS scores between individuals without cancer and those with most of the cancer did not exceed the MID for a majority of sites. The lowest PCS scores were reported by survivors of multiple myeloma (31.3), pancreatic cancer (35.3), and thyroid cancer (36.7), compared to individuals without cancer (40.5). The lowest MCS scores were reported by survivors of pancreatic cancer (48.0) multiple myeloma (48.8), and ovarian cancers (49.5), compared to individuals without cancer (52.1). Figure 1 shows the mean PCS and MCS scores by cancer site and for individuals without cancer, with stars indicating differences between specific

cancer sites and individuals without cancer exceeded the MID threshold. The cancer sites with individuals reporting SF-6D/VR-6D scores exceeding 0.03 of a SD (compared to individuals without cancer) included all but melanoma. Survivors with multiple myeloma reported the lowest mean SF-6D/VR-6D scores (0.63), a 0.10 point difference from 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, ovary or upper gastrointestinal tract), deficits were reflected across several scales, particularly physical functioning, social and physical role functioning, vitality, and appraisals of general health. Mental health scale scores were mostly comparable to those without cancer for all of these cancer sites. Bodily pain, physical role functioning, and vitality were prominent concerns for respondents with multiple myeloma and pancreatic cancer. The largest between-group differences were observed in three 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)compared to no cancer (41.0). The most significant limitations in role function due to physical health problems were reported by respondents with multiple myeloma (28.9), and cancers of the pancreas (31.4) or ovaries (34.5) compared to no cancer (39.9). The lowest mean scale scores for general health were seen in survivors of multiple myeloma (36.9) and pancreatic cancer (39.3), compared to individuals without cancer (46.9). In general, survivors reported only small differences, compared to individuals without cancer, on the scales that are considered to reflect mental health, specifically the mental health and role limitations due to emotional problems scales. However, survivors with multiple myeloma, and pancreatic or upper gastrointestinal malignancies, compared to those without cancer, reported significant limitations in role function because of emotional problems (multiple myeloma [37.3], upper gastro-intestinal [39.7]), compared to individuals without cancer [45.3]).

Discussion

In this large, population-based study of health outcomes in older adults diagnosed with selected cancers, we found that the PCS was markedly lower in survivors of cancers of the oral cavity, uterus, kidney, upper gastrointestinal tract, ovaries and pancreas, and among survivors of NHL, chronic leukemias, and multiple myeloma, compared to individuals without cancer. The largest differences in HRQOL scales reported 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 two scales with the biggest score deficits between cancer survivors and individuals without a history of cancer were physical functioning and role limitations due to physical health, findings that 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 significantly different between cancer survivors and individuals without

cancer in the adjusted analyses. These results are surprising, given findings from other studies that reflect pain. The results may in part reflect between-study differences in the older adult population sampled (e.g., ambulatory or not) and cancer sites under investigation. 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] identifying and addressing pain among cancer survivors is critically important to reduce suffering.

We observed that for 8 of the cancer types, MCS was not notably different from those without cancer, a finding documented by 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 limitations due to emotional problems and mental health among respondents with multiple myeloma, or an upper gastrointestinal tract or pancreas tumor.

SF-6D/VR-6D score examination allow for a rapid comparison of health utilities among cancer types, and in the current study our analysis indicated that individuals with ovarian cancer (0.67), pancreatic cancer (0.65) and multiple myeloma (0.63) reported the lowest scores compared to 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 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, 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 due to its relatively rare incidence and the difficulty of recruiting sufficient sample size. The disease burden, as evidenced by the current study and a few other published reports in 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, specifically its large sample size, which enables reporting of outcomes in 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) which is a constraint of population-based research in general. One limitation of the dataset is the lack of cancer-specific measures of HRQOL which may be more sensitive to the impact of cancer on HRQOL. However the SF-36 and 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 HEDIS® effectiveness of care measures[36] including fall risk management and management of urinary incontinence,

may be able to provide information about other aspects of patient experience and should be considered in future PRO studies. In addition, cancer survivors included in the current analysis ranged widely in time since diagnosis, and this heterogeneity should be considered carefully in future analyses of the SEER-MHOS dataset.

Another limitation of the SEER-MHOS data is the lack of data on Medicare fee-for-service beneficiaries, where the majority of Medicare beneficiaries are enrolled.[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, for example 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 first course of therapy for surgery and radiation are considered to be generally reliable, but data on chemotherapy and hormonal therapy are not reported due to under-ascertainment. Thus, analyses by cancer sites that are predominantly treated by these modalities must acknowledge this limitation. Additional limitations common to survey research are healthy participant bias and the 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 comprised of data from cancer survivors can be used to identify the socio-demographic, 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 SEER-MHOS, examining changes in health status over time among individuals with specific cancer types.[39] In addition, examining healthcare provider characteristics could help inform which contexts patient-centered interventions might be most successful. Studies comparing specific age groups across the cohorts could help determine if 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.

Acknowledgments

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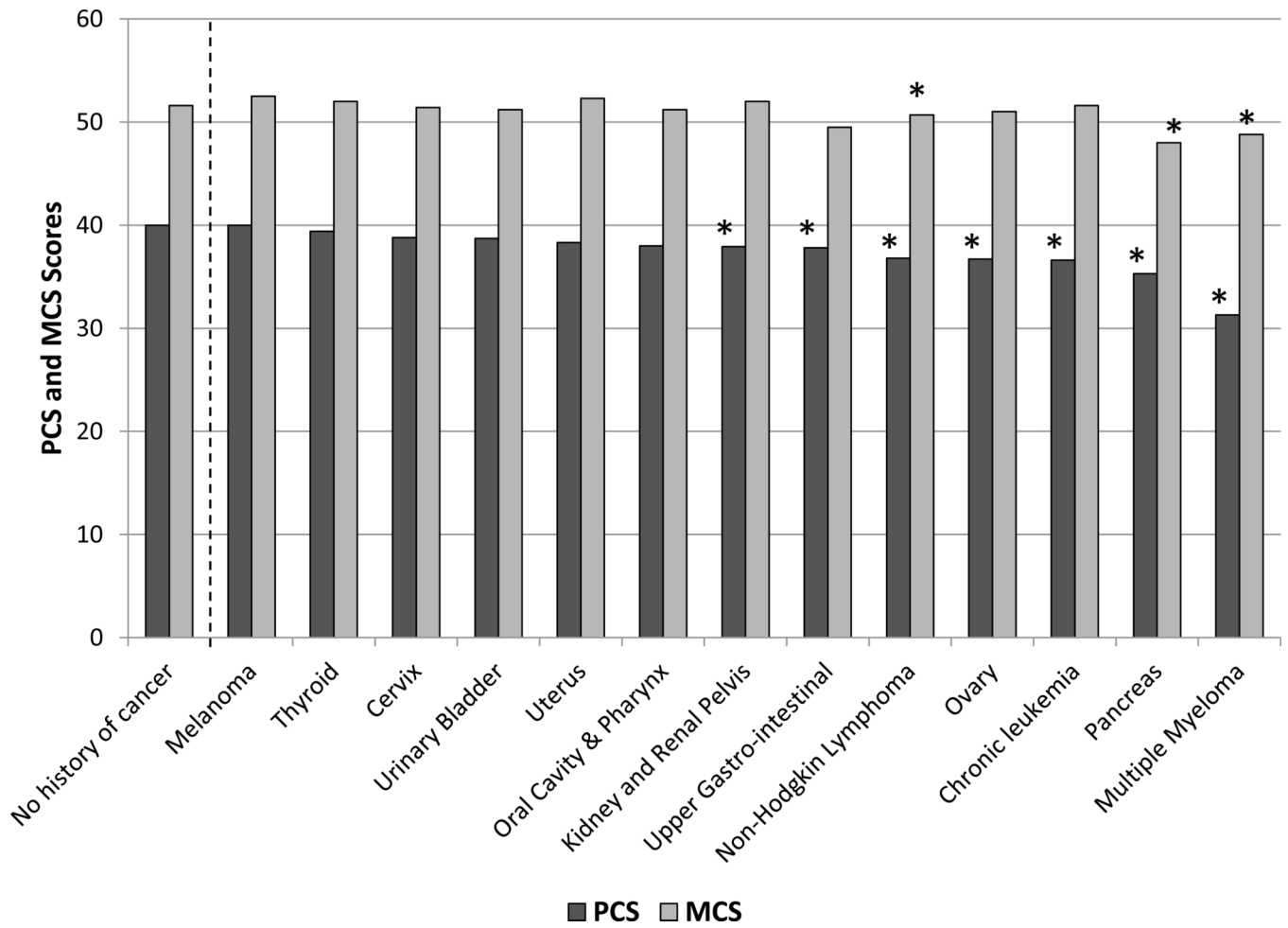
Figure 1.

Table 1

Participant characteristics

Cancer Site	N	Age		Gender	Diagnosis-Survey Months	
		Mean(SD)	Median	Female(%)	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 & 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

*
Age at first cancer diagnosis or at first survey (no cancer)

Table 2

Physical and Mental Component Scores and Health Utility (SF-6D/VR-6D Score).[*]

		PCS[†]		MCS[†]		SF-6D/VR-6D[‡]
	N	Mean (95% CI)	N	Mean (95% CI)	N	Mean(95% CI)
No history of cancer	815,362	40.5(40.5–40.5)	811106	52.1(52.1–52.2)	765,773	0.73(0.73–0.73)
Bladder	2,135	**38.7(38.2,39.1)**	2,122	51.2(50.7,51.6)	2,035	**0.70(0.69,0.70)**
Melanoma	2,174	40.0(39.5,40.5)	2,164	52.5(52.1,52.9)	2,077	0.71(0.71,0.72)
Uterus	1,651	**38.31(37.8,38.9)**	1,640	52.3(51.7,52.8)	1,565	**0.70(0.69,0.71)**
Non-Hodgkin Lymphoma	1,035	**36.8(36.2,37.5)**	1,034	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 & 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 Gastro-intestinal	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)**

[*] Scores are adjusted for time from first diagnosis to survey (cancer sites only), whether cancer patient had a multiple cancers (yes/no), continuous age at first cancer dx or first survey if no cancer, 12 chronic medical conditions, education, gender, marital status, race/ethnicity, income, whether or not a proxy completed the survey, cohort 1 vs others, and mode of administration (mail or telephone).

[†] Bolded scores represent a minimally important difference (2.0 or greater) between the mean component score (PCS or MCS) for cancer survivors vs. individuals without cancer.

[‡] Bolded scores represent a minimally important difference (0.03 or greater) between the mean utility metric (SF6D/VR6D) for cancer survivors vs. individuals without cancer.

Table 3

SF-36 physical health scale scores and 95% confidence intervals. [*]

	Physical Functioning[†]		Role Physical[†]		Bodily Pain[†]		General Health[†]	
	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	1,296	40.5(39.9,41.2)	1,280	38.5(37.6,39.4)	1,290	46.1(45.5,46.6)	1,302	45.0(44.4,45.5)
Melanoma	1,157	41.9(41.3,42.5)	1,148	40.4(39.5,41.3)	1,150	46.7(46.1,47.2)	1,163	46.9(46.3,47.4)
Uterus	1,033	40.0(39.3,40.7)	1,021	37.5(36.4,38.5)	1,023	45.8(45.1,46.4)	1,036	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 & 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 Gastro-intestinal	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)

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

[†] Bolded scores represent a minimally important difference (3.0+) between the mean subscale score for cancer survivors vs. individuals without cancer.

Table 4

SF-36 mental health scale scores and 95% confidence intervals. *

	Vitality†		Social Functioning†		Role Emotional†		Mental Health†	
	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	1,289	48.1(47.5,48.7)	1,289	46.3(45.6,46.9)	1,276	44.2(43.2,45.2)	1,289	50.6(50.0,51.1)
Melanoma	1,152	49.6(49.0,50.2)	1,153	47.6(47.0,48.3)	1,147	45.7(44.8,46.7)	1,153	51.8(51.3,52.3)
Uterus	1,023	48.3(47.6,49.0)	1,025	46.9(46.2,47.7)	1,019	44.8(43.6,46.0)	1,023	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 & 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 Gastro-intestinal	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)

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

†
Bolded scores represent a minimally important difference (3.0+) between the mean subscale score for cancer survivors vs. individuals without cancer.