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Pre-Diagnosis Health-Related Quality of Life, Surgery, and Survival in Women with Advanced Epithelial Ovarian Cancer: A SEER-MHOS Study

Kemi M. Doll, MD, MSCR[1,2,3], **Laura C. Pinheiro, MPH**[2], and **Bryce B. Reeve, PhD**[2,3]

[1]Division of Gynecologic Oncology, University of North Carolina School of Medicine, Chapel Hill, NC

[2]Department of Health Policy and Management, Gillings School of Global Public Health, University of North Carolina, Chapel Hill, NC

[3]Lineberger Comprehensive Cancer Center, University of North Carolina, Chapel Hill, NC

Abstract

Objective—Health-related quality of life (HRQOL) has been found to be associated with overall survival in women with ovarian cancer. However, previous studies assessed HRQOL after surgery within clinical trial populations only. The study goal was to determine the association of pre-cancer diagnosis HRQOL with the likelihood of receiving surgery and with overall survival in a national, population-based cohort of older women with advanced ovarian cancer.

Methods—The Surveillance, Epidemiology, and End Results (SEER)-Medicare Health Outcomes Survey (MHOS) database was queried to identify 374 women aged 65 years and older with advanced stage epithelial ovarian cancer from 1998 to 2011. Responses to the Short Form 36 (SF-36) and Veterans-RAND-12 (VR-12), two single-item global health questions, and Activities of Daily Living (ADLs) were abstracted. Multivariable models were used to quantify associations of HRQOL and ADL assessments with surgery and overall survival, adjusted for demographic and clinical characteristics.

Results—Of 374 women with a HRQOL assessment prior to diagnosis, 199 (53%) underwent surgery. Increases in physical and mental HRQOL domains were significantly associated with receipt of surgery. The relationship between HRQOL domains and overall survival were not statistically significant. For ADLs, only difficulty in toilet use was significantly associated with survival.

Conclusion—In this population-based sample of older women with advanced epithelial ovarian cancer, pre-diagnosis HRQOL was predictive of receiving surgery, but not of overall survival.

Corresponding Author: Kemi M. Doll, MD, MSCR, Department of Obstetrics and Gynecology, University of Washington, 1939 NE Pacific Street, Box 356460, Seattle, WA 98195, P: 206-543-3669, F: 206-543-3915, kdoll@uw.edu.

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Keywords

Ovarian cancer; Health-related quality of life; surgery; survival

Introduction

Health-related quality of life (HRQOL) is a patient-reported construct that can be influenced by a patient's clinical status and demographic background.[1, 2] In ovarian cancer, measures of HRQOL[3, 4] have been shown to be associated with overall survival in clinical trial populations. With respect to HRQOL in ovarian cancer, previous studies have used HRQOL data collected from newly enrolled, post-operative clinical trial patients. As this time point is both after diagnosis and initial surgery, it may not reflect true baseline HRQOL. Cancer clinical trial populations are also limited by underrepresentation of racial/ethnic minorities,[5] low-income populations,[6, 7] and older adults[5] – three demographic factors that are significantly associated with HRQOL. As the incorporation of patient-reported outcomes becomes more important in cancer care,[8] population-based data may improve generalizability of the relationships between HRQOL and outcomes.

To date, whether pre-diagnostic and pre-treatment patient-reported HRQOL is associated with overall survival among ovarian cancer patients is unknown. The relationship between pre-diagnosis HRQOL and whether or not surgery is performed is also unknown. Given that surgery is the strongest mediator of overall survival in ovarian cancer, the relationship between HRQOL and surgery may help explain how HRQOL relates to survival. The objective of our study was to use a nationally representative, population-based sample to evaluate associations between pre-cancer diagnosis HRQOL and patient-reported functional status with receipt of surgery and with overall survival in older women with advanced epithelial ovarian cancer in the United States (U.S.).

Methods

Data

The study used the SEER-MHOS dataset (Surveillance, Epidemiology, and End Results (SEER)-Medicare Health Outcomes Survey (MHOS), a publically available linked resource of patient-reported HRQOL indicators and cancer outcomes, starting with cohorts from 1998 through 2013. The SEER program includes 18 cancer registries collecting information on newly diagnosed cases within SEER geographic regions including 26% of the U.S. population.[9] The Medicare Health Outcomes Survey (MHOS) is a questionnaire distributed annually to 1,000 to 1,200 randomly selected individuals from each managed care organization in the Medicare Advantage Program.[9] A baseline MHOS along with a follow-up survey two years later is administered if beneficiaries remain in the same managed care organization.[9] This study included 14 MHOS cohorts from 1998 to 2013. As Medicare Advantage plans are not represented in all SEER regions, the SEER-MHOS dataset includes representations of beneficiaries from Connecticut, Hawaii, Iowa, New Mexico, Utah, Kentucky, Louisiana, New Jersey, California, Detroit, Atlanta, Seattle-Puget Sound, and

rural Georgia..[9] Institutional Review Board permission was obtained from the University of North Carolina at Chapel Hill.

Participants

We identified 588 women with ovarian cancer, diagnosed between 1998 and 2011, whose first SEER-confirmed cancer diagnosis occurred after completing a baseline or follow-up MHOS. Of these women, we excluded 110 (18%) who did not have epithelial histology. Histology classifications included were 'epithelial neoplasm', 'adenocarcinoma', and 'serous, mucinous, or cystic' types. Of the remaining 478 women, 12 (2.5%) were excluded due to lack of diagnostic confirmation of ovarian cancer in SEER and 97 (20%) were excluded because they did not have advanced (distant) stage disease. As such, the final sample included 374 diagnostically confirmed women with incident advanced stage ovarian cancer 65 years and older.

Covariates

Self-reported covariates included age at diagnosis, race, marital status, highest level of education completed, smoking status, SEER geographic region, household income, whether or not they owned a home, and pre-existing comorbid conditions. Comorbid conditions included hypertension, heart disease, stroke, chronic obstructive pulmonary disease, inflammatory bowel disease, arthritis, sciatica, and diabetes. We controlled for whether the MHOS was completed by a proxy (e.g., spouse or caregiver), as this may indicate poor health status or low literacy. In addition, we adjusted for MHOS mode of administration (paper or telephone) and year of diagnosis. Due to reporting restrictions as outlined by the SEER-MHOS data use agreement, cell sizes below 11 are suppressed.

Outcomes Measures

Surgery—Receipt of surgery (as reported in SEER) was classified as yes or no. Surgery was chosen as a measurable outcome due to the known strong association between receipt of surgery and overall survival and the lack of data on how HRQOL may relate to who receives surgery. *Overall Survival:* Whether or not a woman died was reported via SEER as determined from her death certificate. Survival was calculated as the numbers of months between the most recent MHOS she completed before cancer diagnosis and date of death.

SF-36/VR-12—HRQOL measures came from the Medical Outcomes Trust SF-36, which was included in the MHOS from 1998–2005.[10] If a woman completed more than one MHOS, the closest MHOS before the date of diagnosis was selected. There are 8 subscales in the SF-36: Physical Functioning, Role-Physical, Bodily Pain, General Health, Vitality, Mental Health, Role-Emotional, and Social Functioning.[2] The instrument also has two summary scores: the Physical Component Summary (PCS) and Mental Component Summary (MCS), which were created from the 8 subscales described above. Both summary and subscale scores were normed with means of 50 and standard deviation (SD) of 10 in the U.S general population[2, 11, 12]

MHOS cohorts from 2006–2013 completed the Veterans RAND-12 (VR-12) instrument, which includes 12 items reflecting the same 8 SF-36 subscales and PCS and MCS described

above.[11, 12] Using an NCI-provided algorithm to create comparable subscale and summary scores (Selim, A., Rogers, W., Qian, S., Rothendler, J. A., Kent, E. E., Kazis, L. E. A New Algorithm to Build Bridges Between two Patient-Reported Health Outcome Instruments: The MOS SF-36® and the VR-12 Health Survey (under review)), we combined data for women who completed the SF-36 in 1998–2005 with women who completed the VR-12 in 2006–2013. Higher SF-36/VR-12 scores across all 10 scales indicate better HRQOL.[2]

Global Health—We included two single-item global health questions in our study. The first asked, “In general, would you say your health is: excellent, very good, good, fair, or poor?” The second question was, “In general, compared to other people your age, would you say that your health is: excellent, very good, good, fair or poor?” Excellent was used as the reference category for all models.

Activities of Daily Living (ADLs)—We assessed associations between performance on Katz’s basic ADLs (e.g., dressing, bathing, eating, getting in or out of chairs, walking and using the toilet) and survival.[13] Each question was worded as, “Because of a health or physical problem, do you have any difficulty doing the following activities without special equipment or help from another person?” and response options included, “No, I do not have difficulty,” “Yes, I have difficulty,” and “I am unable to do this activity.” ADLs were evaluated in separate models, adjusting for demographic, comorbid, and treatment characteristics. “No, I do not have difficulty,” was the reference category for all models, and “Yes, I have difficulty,” and “I am unable to do this activity” were collapsed into one group given the very small proportion of women in the last group.

Statistical Analysis

Unadjusted comparisons of demographic, socioeconomic, comorbid, and treatment characteristics between women who did and did not have surgery were assessed using t-test and chi-square tests. Multivariable logistic regression was used to calculate associations between pre-diagnosis HRQOL (using the 10 SF-36 measures) and the odds of receiving surgery, adjusting for covariates listed in Table 1. For survival analyses, unadjusted comparisons were performed between those who died and those who were alive at the end of follow-up (results not shown). Multivariable Cox-Proportional hazards models were used to examine associations between pre-diagnosis HRQOL (using the 10 SF-36 measures, two single-item HRQOL measures and 6 ADLs) and survival, adjusting for covariates listed in Table 1, including whether or not surgery was performed. For all models, SF-36 HRQOL scores were analyzed in 5-point increments, which are considered clinically meaningful for the instrument. For each outcome, models were stratified by time between the HRQOL survey and cancer diagnosis: less than and greater than 2 years.

Our sample included 199 women who received surgery and 295 deaths. Given the standard of 10 or more events per covariate included in a multivariable Cox Proportional Hazards model, our models with 18 covariates were appropriate.[14] We performed sensitivity analyses reducing the number of socioeconomic factors and comorbidities adjusted for in both models, which yielded similar results. We computed adjusted odds ratios (OR), hazard ratios (HR) and 95% confidence intervals (CI) for each estimate. With our sample size we had an

80% power to detect an effect size of 0.53 for the outcome of surgery, and a HR of 2.8 or greater for the outcome of survival. Analyses were performed in SAS 9.3 with 2-tailed statistical tests.

Results

Participant characteristics

Demographics characteristics and comorbidities, overall and by receipt of surgery are presented in Table 1. All women had advanced stage (SEER 'distant': stage 3–4) disease. The surgery group had a greater proportion of women who were younger, married, and had college level or higher education. Hypertension and heart disease were also less common in the surgery group.

We compared women who were alive at the end of follow-up to those who had died. Race, geographic region, education, comorbidity and marital status were similarly distributed. Women alive at the end of follow up unsurprisingly had lower rates of smoking (18% vs 32%, $p<.01$), higher rates of surgery (80% vs. 46%, $p<.01$), and were younger at the time of diagnosis (76 vs 79 years, $p<.04$).

Median time from HRQOL assessment to date of cancer diagnosis was 33 months with an interquartile range of 13 to 68 months. There were 216 (58%) women with HRQOL assessments more than 2 years prior to cancer diagnosis and 158 (42%) women with assessments occurring within 2 years of diagnosis.

Surgery

In the overall cohort, better HRQOL was significantly associated with increased odds of receiving surgery with adjusted ORs ranging from 1.05 to 1.72 (Table 2). As higher scores on SF-36/VR-12 measures indicate better HRQOL, all ORs were above 1.0. That is, 5-point increases in HRQOL were associated with increased odds of receiving surgery. We observed statistically significant associations between surgery and better PCS, and SF-36 subscales of Physical Function, General Health, Mental Health, and Vitality. For example, adjusting for patient demographics, comorbidities and treatment characteristics, a 5-point increase in patient-reported Vitality was associated with a 21% increase in the odds of receiving surgery. In general, the magnitude of adjusted ORs were larger among individuals with HRQOL assessed more than two years before diagnosis, particularly for the General Health domain with an adjusted OR of 1.72 (95% CI 1.29–2.30). Among the statistically significant measures, those with the most consistent estimates regardless of time between survey and diagnosis were the subscales of Mental Health and Vitality.

Of note, in the multivariable models, no comorbid conditions were significantly associated with surgery with the exception of inflammatory bowel disease, which was negatively associated with the odds of receiving surgery (OR: 0.14, 95% CI 0.03–0.72) and was very rare in our cohort.

Overall Survival

Adjusted HRs for 5-point increments in PCS, MCS and the 8 SF-36 subscales are shown in Table 3. Most HR estimates were below 1.0. That is, as HRQOL increased, hazards of death decreased. No HRs were statistically significant at the 0.05 level. Results were similar when stratified by time between survey and diagnosis, with no statistically significant associations. When we stratified survival analyses by receipt of surgery, HRs were similar in magnitude to overall analyses with the exception of Physical Function (results not shown). That is, among women who received surgery, a 5-unit increase in Physical Function was significantly associated with a 2.2% decrease in the hazard of death (p=0.03). In this stratified analysis, most SF-36 measures had a similar direction of effect, but associations were non-significant.

The first single-item global health measure, poor health (compared to excellent) was associated with a 59% increase in the hazard of death, but this was not statistically significant (p=0.39). Reporting fair, good or very good health (compared to excellent) demonstrated a similar relationship with increased hazards of death (HRs of 1.36, 1.01 and 1.05, respectively), but these were also not statistically significant. Similar HRs were seen for the other single-item question - comparing one's health to others. Reporting poor (compared to excellent) health was associated with a 52% increase in the hazard of death (p=0.44). Reporting fair, good or very good health was not significantly associated with increased hazard of death, with HRs of 1.35, 1.00 and 1.03, respectively. As worse health was associated with increased hazard of death, both global HRQOL questions had HRs above 1.0.

Self-reporting that one experienced "some difficulty" in completing any of the 6 ADLs compared to having "no difficulty" was associated with increases in the hazard of death. For example, reporting some difficulty dressing oneself or eating was associated with adjusted HRs of 1.72 (95% CI: 0.99–2.96) and 1.75 (95% CI: 0.76–4.06), respectively. Once we collapsed the two ADL difficulty response categories (i.e., some difficulty and unable to do), HRs remained large in magnitude, but statistically non-significant (Table 3). However, reporting any difficulty using the toilet was associated with nearly twice the hazard of death with an adjusted HR of 1.81 (95%CI 1.03–3.19, p=0.04), which was statistically significant (Table 3).

Discussion

We sought to determine the relationship of self-reported HRQOL measures assessed prior to cancer diagnosis with likelihood of receiving surgery and with overall survival among a cohort of Medicare beneficiaries with advanced stage epithelial ovarian cancer. Higher HRQOL scores on SF-36/VR-12 measures were associated with higher likelihood of undergoing surgery. The relationship between higher HRQOL measures and survival was not statistically significant, although likely underpowered. Estimates of difficulty with ADLs and shorter overall survival were also not statistically significant, with the exception of difficulty using the toilet.

This study is population-based and fills an important gap by including individuals who are generally underrepresented in ovarian cancer HRQOL studies. Compared to the two GOG

trials, where at least 80% of the populations were younger than 70 years, in this cohort 94% of patients are over 70 years. As the incorporation of patient-reported data becomes more important in cancer care,[8] data from older populations who make up an increasing proportion of cancer patients is vital. Our cohort also contained twice the proportion of racial/ethnic minorities included in GOG trials and a higher percentage of low-income women.

In this study, higher pre-diagnosis HRQOL was associated with greater odds of receiving surgery, adjusting for known indicators such as age and comorbidity. In addition, for this cohort of older women, patient-reported HRQOL was more predictive of having surgery, than comorbid conditions. It may be that patient-reported measures like Vitality more accurately align with global assessments of fitness for surgery made between patients and providers, than comorbidities alone. This may especially be the case among older women. Interestingly, the HRQOL and surgery relationship was strongest in the women where HRQOL was measured greater than 2 years before diagnosis. Given that the direction of effect was the same in both recent and older surveys, the statistical difference may be due to the larger sample size in the group with older surveys. In addition, those reporting decreased HRQOL further out from diagnosis may have experienced poor physical health for longer putting them at increased risk of death. Patient-reported HRQOL at the population-level can fill gaps to better understand treatment patterns of seemingly similar patients at the regional and national level.

We did not find statistically significant associations between pre-diagnosis HRQOL and overall survival. This is in contrast to two prior landmark studies, where women in the lowest HRQOL score quartiles experienced significantly shorter overall survival. Wenzel *et al* in 2005[15] and von Gruenigen *et al* in 2012[3] reported on the relationship between HRQOL measures and overall survival in ovarian cancer patients enrolled in two gynecologic oncology group (GOG) clinical trials. Both studies included over 400 participants. Important differences between the studies and our current study are the choices of HRQOL measures and timing of surveys. The previous studies used the Functional Assessment of Cancer Therapy-Ovarian (FACT-O), an ovarian cancer-specific instrument, and the Physical Well-Being domain of the FACT-General to measure HRQOL. Our study used the generic SF-36/VR-12 measures of HRQOL included in the MHOS. Cancer specific measures such as the FACT-O and FACT-G may be more appropriate assessments of disease and symptom burden associated with survival, compared to generic HRQOL assessments such as the SF-36/VR-12. In addition, although we had a similar sample size as these clinical trials, the effect sizes (HR0.93 – 0.99) in our model suggested we would need over 7,000 cases to find statistical significance when modeling HRQOL linearly, as we chose to do.

In addition, timing of baseline HRQOL assessments in previous studies occurred after enrollment in clinical trials, which occurred after diagnosis and initial surgery. In our study, better HRQOL was associated with going on to receive surgery and surgery is associated with improved survival. Therefore, we imagined this relationship would bolster the connection between HRQOL and survival. One potential reason this did not occur may be the longer time interval between survey and diagnosis and the greater demographic diversity of our sample. With a more heterogeneous population, the standard deviations (SD) of

SF-36/VR-12 scores were wider than those reported in clinical trials. This, along with a smaller sample size and a lack of information on extent of surgery, limits the strength of associations between HRQOL and overall survival in this study.

A notable limitation of our study is the lack of available data on extent of surgical effort or receipt of chemotherapy. SEER-MHOS participants are enrolled in Medicare Advantage plans, not fee-for-service Medicare, and therefore not linked to Medicare billing claims. Due to this, the SEER-MHOS dataset does not include treatment or comorbidity information beyond what is self-reported in SEER and the MHOS.

In addition, our sample was limited to adults diagnosed with ovarian cancer aged 65 years and older, given the Medicare framework. The convenience nature of this dataset, which combined independently collected data for original purposes not related to HRQOL and cancer research may have introduced biases we cannot control for. The MHOS randomly selects 1000–1200 from each managed care plan. Women in our study were also enrolled in managed care plans, which may not be generalizable to Medicare fee-for-service beneficiaries. Evidence comparing health status between managed care and Medicare fee-for-service beneficiaries is not consistent across previous studies.[2, 16–18] Furthermore, comorbid conditions adjusted for in our analyses were obtained by self-report in the MHOS and do not have clinical confirmation. Although confirmation of death in SEER-MHOS is considered reliable,[19] we could not determine whether death was caused by ovarian cancer, which does not allow us to evaluate associations between HRQOL and ovarian cancer-related mortality.

This national, population-level data on pre-diagnosis HRQOL of women with ovarian cancer suggests baseline HRQOL is associated with who goes on to receive surgery, which is the strongest determinant of survival for this disease. Pre-diagnosis HRQOL may also be associated with survival, but we could not confirm statistical associations in our analyses. This work supports the continued integration of HRQOL information into routine clinical assessments. In ovarian cancer, this may aid in critical decision making such as initiation of neo-adjuvant chemotherapy versus upfront surgery. These results are especially important for older women, who are currently underrepresented in ovarian cancer clinical trials.

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Highlights

- SEER-MHOS is a linked national data set of cancer and HRQOL data.
- Women with ovarian cancer who had HRQOL surveys prior to diagnosis were analyzed.
- Pre-diagnosis HRQOL was predictive of receiving surgery.
- Pre-diagnosis HRQOL was not associated with overall survival.

Table 1

Cohort Characteristics by Receipt of Surgery

	Total Cohort N=374		Surgery N=199		No Surgery N=174		*P* value
	N	**%**	**N**	**%**	**N**	**%**	
Age[a]							<0.0001
65–69	23	6%	17	9%	-		
70–74	87	23%	65	33%	22	13%	
75–79	112	30%	73	37%	39	22%	
80–84	77	21%	28	14%	49	28%	
85+	75	20%	16	8%	58	33%	
Race/Ethnicity[a]							0.61
White	298	80%	160	80%	138	79%	
Black	25	7%	11	6%	14	8%	
Hispanic	25	7%	15	8%	-		
Asian/Other	26	7%	13	7%	13	7%	
Married	162	43%	99	50%	63	36%	0.009
Geographic region							0.35
West	213	57%	122	61%	91	52%	
Midwest	33	9%	17	9%	16	9%	
South	60	16%	28	14%	32	18%	
Northeast	68	18%	32	16%	35	20%	
Level of education[a]							0.02
Some high school	223	60%	≥100	≥50%	≥115	≥65%	
Some college	102	27%	65	33%	37	21%	
More than college	41	11%	23	12%	18	10%	
Missing	-		-		-		

	Total Cohort N=374		Surgery N=199		No Surgery N=174		*P* value
	N	**%**	**N**	**%**	**N**	**%**	
Household income							0.81
<$10,000	52	14%	26	13%	26	15%	
$10,000–$29,999	147	39%	80	40%	66	38%	
$30,000–$49,999	60	16%	30	15%	30	17%	
$50,000+	43	11%	26	13%	17	10%	
Missing	72	19%	37	19%	35	20%	
Home owning							
Owned by you/family	291	78%	160	80%	130	75%	0.08
Not owned/rented	66	18%	32	16%	41	24%	
Smoking status							0.52
Never	267	71%	139	70%	127	73%	
Former	59	16%	34	17%	25	14%	
Current	31	8%	19	10%	12	7%	
Proxy completed survey	27	7%	11	6%	15	9%	0.48
Completed paper survey	333	89%	178	89%	154	89%	0.77
Comorbid conditions							
Hypertension	229	61%	110	55%	118	68%	0.01
Heart disease	117	31%	51	26%	66	38%	0.01
Stroke	23	6%	11	6%	12	7%	0.57
COPD[b]	46	12%	22	11%	24	14%	0.36
IBD[c]	20	5%	-		-		-
Arthritis	182	49%	90	45%	92	53%	0.14
Sciatica	98	26%	51	26%	47	27%	0.68
Diabetes	71	19%	33	17%	38	22%	0.20

[a]Some category data suppressed due to individual cell sizes < 11, in accordance with data use agreement of SEER-MHOS dataset.

[b] chronic obstructive pulmonary disease

[c] inflammatory bowel disease

Table 2

Association between HRQOL before Cancer Diagnosis and Subsequent Receipt of Surgery

	Total Cohort N=374		More than 2 years between HRQOL survey and diagnosis N=216		Less than 2 years between HRQOL survey and diagnosis N=158	
	5pt-OR[a]	**95% CI**	**5pt-OR**	**95% CI**	**5pt-OR**	**95% CI**
MCS[b]	1.11	(0.97–1.27)	1.17	(0.96–1.44)	1.33	(1.03–1.71) *
PCS[c]	1.21	(1.04–1.40) *	1.40	(1.12–1.75) **	1.13	(0.86–1.48)
Physical Function	1.17	(1.03–1.33) *	1.30	(1.06–1.59) *	1.17	(0.92–1.49)
General Health	1.29	(1.09–1.52) **	1.72	(1.29–2.30) **	1.18	(0.85–1.62)
Role Physical	1.12	(0.99–1.26)	1.32	(1.08–1.60) **	1.07	(0.85–1.36)
Role Emotional	1.05	(0.95–1.16)	1.17	(0.95–1.43)	1.12	(0.90–1.40)
Mental Health	1.19	(1.03–1.36) *	1.31	(1.05–1.64) *	1.31	(1.03–1.68) *
Social Function	1.12	(0.98–1.27)	1.25	(1.01–1.56) *	1.22	(0.96–1.55)
Body Pain	1.12	(0.97–1.30)	1.30	(1.04–1.62) *	1.08	(0.82–1.44)
Vitality	1.21	(1.05–1.40) **	1.35	(1.08–1.68) **	1.29	(0.99–1.68)

[a] Odds ratio for every 5-point change in HRQOL score, multiple logistic regression adjusted for all variables in Table 1.

[b] MCS – Mental Component Summary of SF-36/VR-12

[c] PCS – Physical Component Summary of SF-36/VR-12;

Note:

* <0.05,

** <0.01

Table 3

Association between HRQOL before Cancer Diagnosis and Overall Survival

	Total Cohort N=374		More than 2 years between HRQOL survey and diagnosis N=216		Less than 2 years between HRQOL survey and diagnosis N=158	
	5pt-HR	**95% CI**	**5pt-HR**	**95% CI**	**5pt-HR**	**95% CI**
MCS	0.97	(0.90–2.47)	1.00	(0.90–2.46)	0.98	(0.86–1.11)
PCS	0.97	(0.90–2.46)	0.93	(0.85–2.34)	1.04	(0.90–1.21)
Physical Function	0.95	(0.89–2.43)	0.94	(0.85–2.35)	0.95	(0.84–1.07)
General Health	0.93	(0.84–2.31)	0.93	(0.84–2.31)	1.00	(0.86–1.17)
Role Physical	0.95	(0.88–2.40)	0.95	(0.88–2.40)	0.99	(0.88–1.11)
Role Emotional	1.00	(0.91–2.48)	1.00	(0.91–2.48)	0.95	(0.86–1.06)
Mental Health	0.96	(0.87–2.40)	0.96	(0.87–2.40)	1.00	(0.88–1.13)
Social Function	0.98	(0.89–2.43)	0.98	(0.89–2.43)	0.98	(0.87–1.10)
Body Pain	0.95	(0.86–2.35)	0.95	(0.86–2.35)	1.10	(0.96–1.27)
Vitality	0.94	(0.85–2.35)	0.94	(0.85–2.35)	1.01	(0.90–1.13)

[a]Hazard ratio for every 5-point change in HRQOL score, cox proportional hazard model adjusted for all variables in Table 1.

[b]MCS – Mental Component Summary of SF-36/VR-12

[c]PCS – Physical Component Summary of SF-36/VR-12;

Table 4

Association between Activities of Daily Living before Cancer Diagnosis and Overall Survival

Difficulty with Activities of Daily Living[a]			
	aHR[b]	**95% CI**	***p*-value**
Bathing	1.47	0.98–2.19	0.07
Dressing	1.55	0.96–2.49	0.08
Eating	1.53	0.74–3.13	0.25
Chair to Standing	1.31	0.93–1.85	0.12
Walking	1.11	0.79–1.55	0.54
Toilet Use	1.81	1.03–3.19	0.04

[a]Referent group for each activity of daily living is response of “no difficulty” with the designated activity, and exposure group is response of having ‘difficulty’ or being ‘unable to do’ the activity.

[b]Hazard ratio from cox proportional hazard model adjusted for all variables in Table 1.