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Quality of Life in Thyroid Cancer is Similar to That of Other Cancers with Worse Survival

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Abstract

Background   The incidence of thyroid cancer is increasing. As such, the number of survivors is rising, and it has been shown that their quality of life (QOL) is worse than expected. Using results from the North American Thyroid Cancer Survivorship Study (NATCSS), a large-scale survivorship study, we aim to compare the QOL of thyroid cancer survivors to the QOL of survivors of other types of cancer.

Methods   The NATCSS assessed QOL overall and in four subcategories: physical, psychological, social, and spiritual well-being using the QOL-Cancer Survivor (QOL-CS) instrument. Studies that used the QOL-CS to evaluate survivors of other types of cancers were compared to the NATCSS findings using two-tailed t tests.

Results   We compared results from NATCSS to QOL survivorship studies in colon, glioma, breast, and gynecologic cancer. The mean overall QOL in NATCSS was 5.56 (on a scale of 0–10, where 10 is the best). Overall QOL of patients with thyroid cancer was similar to that of patients with colon cancer (mean 5.20, $p = 0.13$), glioma (mean 5.96, $p = 0.23$), and gynecologic cancer (mean 5.59, $p = 0.43$). It was worse than patients surveyed with breast cancer (mean 6.51, $p < 0.01$).

Conclusions   We found the self-reported QOL of thyroid cancer survivors in our study population is overall similar to or worse than that of survivors of other types of cancer surveyed with the same instrument. This should heighten awareness of the significance of a thyroid cancer diagnosis and highlights the need for further research in how to improve care for this enlarging group of patients.

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Introduction

Health-related quality of life (QOL) measurement in cancer patients allows physicians to better understand the complexity of taking care of patients with cancer [1]. With validated QOL assessment tools, the patient can be evaluated from the perspective of not only physical well-being, but also psychological, social, and spiritual well-being [2, 3]. Preliminary findings from The North American Thyroid Cancer Survivorship Study (NATCSS), our study of thyroid cancer survivorship, found that poor QOL outcomes for thyroid cancer survivors are common and are observed for many years post treatment [4]. These results are consistent with other studies reporting decreased postoperative

QOL in thyroid cancer survivors [1, 5–8]. The NATCSS findings are particularly relevant at this time as incidence of thyroid cancer has been increasing worldwide across most populations since 1973 [9] and a decrease in QOL has been observed in these patients [10–12]. In the United States, thyroid cancer is currently the fifth leading cause of cancer in women, accounting for 6 % of new cancer diagnoses. With an overall five-year survival rate of 98 % [13], the number of thyroid cancer survivors is also increasing rapidly.

Given the relatively good prognosis for thyroid cancer, we were interested in comparing the NATCSS findings to QOL results for other cancer types with worse survival in an effort to determine if there is a correlation between prognosis and QOL [13]. The NATCSS survey was conducted using the general QOL-cancer survivor (QOL-CS) instrument integrated with thyroid-specific questions (QOL-CS Thyroid) to evaluate the QOL of thyroid cancer patients in a cross-sectional study. The QOL-CS was developed at the City of Hope National Medical Center to evaluate QOL in the general population of cancer survivors. This instrument was validated in 1995 and, in 2000, additional items were added to adapt it for use in thyroid cancer patients [14]. This was one of the only thyroid cancer-specific tools available at the time of our study initiation. Papers that fit the criteria for comparison investigated the QOL of colon [15], glioma [16], breast [17], and gynecologic cancer [18] survivors. The 5-year survival of colon cancer is 65 %, brain cancer is 35 %, breast cancer is 81 %, and gynecologic cancers range from 45 to 82 % [13]. The aim of this study is to compare the QOL of thyroid cancer survivors from the NATCSS to the QOL reports available in the literature for survivors of other cancer evaluated with the QOL-CS.

Materials and methods

Literature search

A PubMed search was conducted between November and December of 2014 to identify cancer survivorship studies that utilized the QOL-CS in order to compare overall QOL across different cancer types. Search criteria used included: "quality of life", "City of Hope quality of life", and "QOL-CS" in conjunction with "thyroid cancer", "colon cancer", "glioma", "breast cancer", and "gynecologic cancer", as well as a comprehensive list of other types of cancer including: prostate, lung, bladder, uterine, melanoma, renal, pancreas, and hepatobiliary. The initial search resulted in 14,460 papers. Of these, 14,405 were excluded because they did not utilize the QOL-CS instrument. Of the remaining 45 papers, 41 were excluded because they were

either not in the English language, they had incomplete data from the QOL-CS survey, or the focus of the study was not exclusively to evaluate QOL using the QOL-CS instrument. The remaining four papers were individual studies on colon, glioma, breast, and gynecologic cancers.

Previous data collection (NATCSS)

The NATCSS study focused on short- and long-term (greater than five years) thyroid cancer survivors recruited from a multicenter clinical collaboration led by the University of Chicago, from thyroid cancer survivor support groups, and from social media. We used a mixed-methods approach that combined quantitative elements of the QOL-CS Thyroid [14] with qualitative elements of open-ended questions and narrative data. All eligible participants volunteered during a clinic visit or by filling out an online interest form. Following informed consent, participants completed a survivorship assessment survey that included basic demographics as well as outcome measures to assess overall QOL, and health concerns and challenges. Thyroid-specific questions included on this QOL instrument pertained to: weight gain, heat/cold tolerance, skin or hair changes, voice changes, motor skills/coordination, swelling/fluid retention, distress of surgery, radioactive iodine (RAI) ablation, whole body scan, thyroglobulin testing, thyroid hormone withdrawal, as well as questions relating to how illness and treatment interfered with employment and activities of daily living.

Variables examined

Basic participant demographics were obtained from each study as well as cancer-related questions including age, gender, marital status, education level, recruitment source, cancer stage, and treatment type. Results of the QOL-CS from each study were collected including individual QOL question as well as subscale QOL (physical, psychological, social, and spiritual) and overall QOL. QOL was scored on a Likert scale of 0–10 with our results reflecting an inverted scale when appropriate to consistently assign 0 as the worst score and 10 as the best score.

Data analysis

In order to perform an equivalent comparison between cancer types, thyroid-specific questions were not included in the analysis of the overall and subcategory QOL in the NATCSS population. We compared the mean and standard deviation (SD) from the QOL-CS subsets for the thyroid cancer survivors to the survivorship studies of colon cancer, glioma, and gynecologic cancer [15–18] using student's t tests.

Table 1 Demographics and treatment data

Cancer type	Thyroid	Colon	Glioma	Breast	Gynecologic
Citation	Aschebrook-Kilfoy et al. [4]	Sun et al. [15]	Munoz et al. [16]	Dow et al. [17]	Nazik et al. [18]
	Mean (%)				
n	1174	56	20	294	108
Age mean (±SD or range)	48 (16.9)	58.3 (11.1)	45.8 (22.9–70.6)	50.9 (9.7)	54.45(10.77)
Gender					
Female	1055 (89.9)	24 (42.9)	11 (55)	293 (99.7)	108 (100)
Male	119 (10.1)	32 (57.1)	9 (45)	1 (0.3)	–
Marital status					
Married	808 (68.7)	38 (67.9)	9 (45)	188 (64)	84 (77.8)
Other	366 (31.3)	18 (32.2)	11 (55)	106 (36 %)	24 (22.2)
Education					
Less than HS	–	–	–	–	103 (95.4)
HS	385 (32.9)	18 (32.2)	3 (15)	–	5 (4.6)
College	364 (31.4)	30 (53.6)	14 (70)	–	–
Graduate	420 (35.9)	8 (14.3)	3 (15)	–	–
Recruitment source					
Clinic	86 (7.2)	56 (100)	20 (100)	–	108 (100)
Survivorship group	943 (79.2)	–	–	294 (100)	–
Social media	28 (2.4)	–	–	–	–
Other	117 (11.2)	–	–	–	–
Time since dx n (%)					
>1 months	–	56 (100)	–	–	–
>12 months	901 (75.7)	–	–	–	40 (46.3)
Mean months (range)	60 (0.5–240)	–	34.3 (3.2–88.8)	68.5 (4–336.0)	–
Stage					
I	391 (33.9)	(I–II) 4 (7.3)	–	–	26 (24.1)
II	184 (15.7)		–	–	37 (34.3)
III	170 (14.5)	16 (29.1)	–	–	36 (33.3)
IV	95 (8.1)	35 (63.6)	–	–	9 (8.3)
Unknown	331 (28.3)	–	–	–	–
Treatment					
Surgery	1129 (94.9)	–	20 (100)	289 (98)	7 (6.5)
RT	38 (3.2)	–	16 (80)	147 (50)	16 (14.8)
Chemotherapy	8 (0.7)	–	12 (60)	211 (72)	18 (16.7)
Surgery + Chemo	–	–	–	–	67 (62)
Other[a]	919 (77.2)	–	–	124 (42)	–

Chemo chemotherapy, *HS* high school, *RT* radiation therapy, *dx* diagnosis

– Data not available or category not applicable

[a] Thyroid: radioactive iodine therapy, breast: hormone replacement therapy

We then compared how the QOL of thyroid patients changed with and without inclusion of thyroid-specific questions on the survey. The QOL (overall and subscale) scores were collected with the QOL-CS Thyroid instrument, and then compared with a *t* test to the questionnaire that included only QOL-CS questions. In all analyses, $p < 0.05$ was considered to be statistically significant.

Results

Thyroid cancer

Demographic and disease-related data are provided in Table 1. A total of 1174 participants were completed the NATCSS questionnaire. Females comprised 1042 (88.7 %)

Table 2 Comparison of overall and subscale QOL with and without the thyroid-specific questions included in the analysis for both the complete thyroid cancer survivor group as well as the female only group

QoL variable	Thyroid: all patients			Thyroid: female patients only		
	n = 1174			n = 1042		
	Mean	SD	p value	Mean	SD	p value
To what extent are the following a problem?						
Fatigue	4.16	3.21		4.03	3.13	
Appetite changes	6.41	3.23		6.30	3.20	
Aches of pain	5.23	3.34		5.14	3.32	
Sleep changes	4.81	3.5		4.80	3.50	
Constipation	6.92	3.34		6.90	3.36	
Menstruation changes or fertility	7.58	3.48		7.34	3.00	
Nausea						
Overall physical health	4.93	2.71		4.94	2.69	
Weight gain	5.12	3.83		4.99	3.81	
Tolerance to cold or heat	4.54	3.5		4.38	3.48	
Dry skin or hair changes	4.75	3.54		4.58	3.52	
Voice changes	6.93	3.48		6.93	3.48	
Motor skills/coordination	7.54	3.04		7.48	3.05	
Swelling/fluid retention	7.34	3.15		7.28	3.14	
Total physical all questions	5.83	1.99		5.78	1.98	
Total physical QoL-CS only	5.75	1.94	0.73	5.63	1.93	0.08
How difficult is it to cope?	6.15	2.83		6.05	2.82	
How good it QoL?	7.03	2.34		7.01	2.35	
How much happiness?	6.93	2.27		6.95	2.27	
Do you feel like you are in control?	6.01	2.63		6.01	2.63	
How satisfying is your life?	6.93	2.27		6.94	2.27	
How is your ability to concentrate/remember things?	5.31	2.64		5.23	2.62	
How useful do you feel?	6.72	2.67		6.72	2.66	
Has illness caused changes in appearance?	5.12	3.31		4.95	3.30	
Has illness changed your self-concept?	4.9	3.43		4.76	3.42	
How distressing were the following?						
Initial diagnosis	2.35	2.67		2.31	2.65	
Time since my treatment was completed	5.1	2.85		5.03	2.85	
Surgery	3	2.69		2.97	2.66	
Initial RAI ablation/treatment	2.84	2.82		2.09	2.9	
Whole body scanning	4.7	3.3		3.83	3.61	
Thyroglobulin testing	6.4	3.15		6.37	3.15	
Withdrawal from thyroid hormone	3.78	3.99		3.68	3.98	
How much anxiety do you have?	5.05	2.96		5.02	2.93	
How much depression do you have?	6.16	2.96		6.12	2.96	
To what extent are you fearful of:						
Diagnostic tests	4.89	3.14		4.86	3.13	
A second cancer	3.77	3.11		3.67	3.08	
Recurrence of your cancer	4.17	3.23		4.08	3.17	
Spreading/metastases	4.46	3.39		4.41	3.36	
Total psychological all questions	5.03	1.78		5.05	1.73	
Total psychological QOL-CS only	5.27	1.89	<0.01	5.16	1.85	0.01
How distressing has this illness been for family?	4.13	2.77		4.03	2.78	
Amount of support you receive from others sufficient?	7.1	2.89		7.15	2.87	

Table 2 continued

| QoL variable	Thyroid: all patients			Thyroid: female patients only		
	n = 1174			n = 1042		
	Mean	SD	p value	Mean	SD	p value
Interfering with your personal relationships?	7.04	3.18		6.95	3.21	
Is sexuality impacted by illness?	5.89	3.7		5.80	3.70	
To what degree has illness interfered with employment?						
Motivation to work	5.93	3.48		4.14	3.45	
Time away from work	6.32	3.44		6.22	3.41	
Productivity at work	6.28	3.34		6.16	3.33	
Quality of work	6.77	3.24		6.65	3.26	
Driving a car	8.29	2.63		8.27	2.63	
Household chores	6.53	3.24		6.4	3.22	
Preparing meals	7.18	3.01		7.03	3.05	
Leisure activities	6.55	3.25		6.46	3.24	
Feeling of isolation	6.52	3.39		6.43	3.40	
Financial burden	5.44	3.68		5.32	3.67	
Total social all questions	6.48	2.29		6.37	2.28	
Total social QOL-CS only	6.18	2.26	<0.01	6.06	2.24	<0.01
Importance of religious activities?	4.91	4.07		5.02	4.06	
How important are spiritual activities?	4.01	3.62		4.20	3.65	
How much has your spiritual life changed?	4.79	3.53		4.98	3.53	
How much uncertainty do you feel about your future?	4.8	3.12		4.71	3.09	
To what extent has illness positively changed your life?	4.62	3.16		4.74	3.15	
To what extent has illness given purpose to your life?	6.04	3.22		6.10	3.19	
How hopeful do you feel?	6.82	2.46		6.89	2.44	
Total spiritual all questions	5.16	2.01		5.23	1.99	
Total spiritual QoL-CS only	5.16	2.01	1	5.23	1.99	1
Overall QoL all questions	5.56	1.59		5.49	1.58	
Overall QoL QoL-CS only	5.53	1.58	0.95	5.47	1.56	0.77

The addition of thyroid-specific questions changed the outcome of the in both the psychological and social QOL parameters. Variables in italics are the thyroid-specific questions included on the QOL-CS Thyroid, but not included in the QOL-CS general questionnaire. Responses are measured on a Likert scale, with 0 BEING the worst and 10 being the best

of the group. The mean age of the study cohort was 48 years, with a range of 18–88 years. The majority of participants were non-Hispanic Whites (95.9 %), with 68.7 % of participants being currently married, and 67.5 % being never smokers. In the United States, 75 % of thyroid cancer diagnoses are in women and the median age at diagnosis is 50 years old [19].

Sixty-nine percent of participants reported having the papillary subtype, compared to 15.8 % mixed tumor type, 5.6 % follicular, 3.9 % medullary, and <1 % anaplastic. Time since diagnosis was <1 year in 289 pts (24.6 %), 1–5 years in 506 patients (43.1 %), and >5 years in 395 (33.6 %) patients. The participants were recruited largely from survivorship groups (943 participants, 79.2 %), but also from clinics (86 participants, 7.2 %), social media

sources (28 participants, 2.4 %) as well as from other sources (referrals, etc.) (117 participants, 11.2 %).

Overall QOL score, QOL subscale scores, and individual questions for thyroid cancer survivors (all patients and female only) are shown in Table 2. QOL scores were calculated for the QOL-CS alone as well as the QOL-CS Thyroid versions of the instrument in order to determine if thyroid-specific questions changed the outcome of the survey. Physical, spiritual, and overall QOL parameters did not change when the thyroid-specific questions were included in the analysis (all subjects: $p = 0.73$, 1, and 0.95; female only: $p = 0.08$, 1, and 0.77). The psychological subscale was significantly worse in both groups when thyroid-specific questions were included in the questionnaire (all patients: $p < 0.01$, female only: $p = 0.01$). The
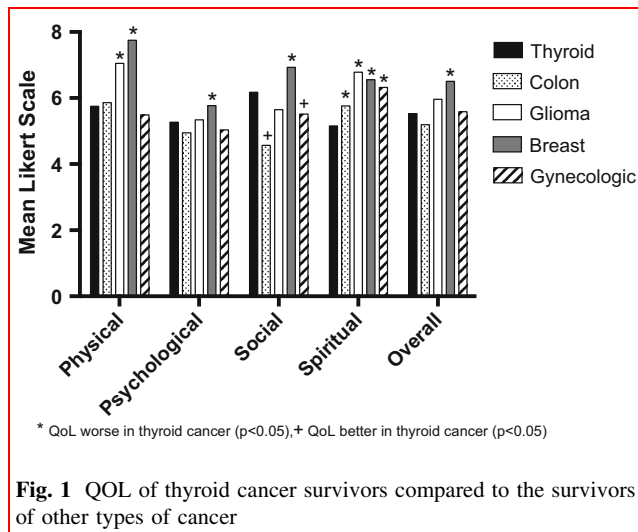
Fig. 1 QOL of thyroid cancer survivors compared to the survivors of other types of cancer

social QOL subscale was significantly better in the group that included the thyroid-specific questions (all: $p < 0.01$, female only: $p < 0.01$).

The lowest individual QOL scores were observed for distress of initial diagnosis, RAI ablation, surgery, withdrawal from thyroid hormone, and fear of a second cancer. A lower mean score is observed for all subscores for <1 year from treatment compared to 5+ years. In addition, the mean subscores were consistently higher for the papillary type compared to the other thyroid cancer subtypes.

The QOL responses from thyroid cancer survivors are compared with the responses of survivors of other types of cancer in Fig. 1, Tables 3, and 4.

Colon cancer

To evaluate QOL in thyroid cancer survivors compared to colon cancer survivors, the NATCSS QOL outcomes were compared to the findings of a group of 56 people with colon cancer that were administered the QOL-CS in a medical oncology clinic [15]. The mean age of the colon cancer survivors was 58 years, and 57 % of the participants were males. 92.7 % of patients had stage III or IV disease and 94.6 % were undergoing treatment at the time of the study. Karnofsky Performance Status (KPS) score ranged from 100 to 60 in participants. All participants were greater than 1 month from diagnosis.

Overall QOL between colon and thyroid groups was similar ($p = 0.13$). QOL of the subcategories was similar between the two groups in both the physical and psychological ($p = 0.68$ and $p = 0.22$). However, total social QOL was lower in the colon cancer group ($p < 0.01$), and total spiritual well-being was lower in the thyroid group ($p = 0.03$).

Glioma

To evaluate QOL in thyroid cancer survivors compared to glioma survivors, the NATCSS QOL outcomes were compared to the findings of 20 individuals with glioma who were recruited to complete the QOL-CS from a neuro-oncology clinic [16]. Inclusion requirements included life expectancy >3 months and KPS of ≥70. Those with significant aphasia and low scores on the Mini Mental State Exam were excluded. The mean age was 45.83 years and 55 % of patients were females. The predominant tumor type was glioblastoma multiforme. Mean years since diagnosis was 2.86 with a range 0.27–7.34 years.

Overall QOL was similar between glioma and thyroid cancer survivors ($p = 0.23$). When the subcategories are analyzed, psychological and social well-being were similar between the groups ($p = 0.87$ and $p = 0.3$), while total physical and spiritual well-being was worse in the thyroid cancer survivors (both $p < 0.01$).

Breast cancer

To evaluate QOL in thyroid cancer survivors compared to breast cancer survivors, the NATCSS QOL outcomes were compared to a study wherein 294 participants with breast cancer were recruited from the National Coalition for Cancer Survivorship, which is a peer network and support group for individuals living with cancer [17]. Participants completed mailed surveys addressing QOL utilizing the QOL-CS in addition to another scale. Women made up 99.66 % of the group and the mean age was 50.9 years. Mean number of months from diagnosis at the time of the survey was 68.5 with a range of 4–336 months.

Overall QOL scores were better in breast cancer survivors when compared to thyroid cancer survivors ($p < 0.01$). Additionally, breast cancer survivors had worse QOL in all four of the subcategories: physical, psychological, social, and spiritual well-being (all $p < 0.01$).

Gynecologic cancer

To evaluate QOL in thyroid cancer survivors compared to gynecologic cancer survivors, the NATCSS findings were compared to a group of 108 patients who were recruited from a gynecologic oncology clinic at a university hospital [18]. The average age of patients was 41 years and the breakdown of gynecologic malignancies was ovarian 65.4 % cervical cancer 19.4 %, and endometrial 14.8 %. Of these patients, 68.5 % underwent surgery and/or chemoradiation, with the remaining 31.5 % of patients having nonoperative management (chemotherapy and/or radiation) alone. Time from diagnosis at the time of the

Table 3 QOL comparison of thyroid cancer to colon cancer and to glioma including overall, subcategory, and individual variables

QoL variable	Thyroid cancer		Colon cancer			Glioma		
	n = 1174 (all)		n = 56			n = 20		
	mean	SD	mean	SD	p value	mean	SD	p value
To what extent are the following a problem?								
Fatigue	4.16	3.21	3.55	1.7	0.08	6.2	3.47	0.01
Appetite changes	6.41	3.23	5.58	2.85	0.08	6.7	3.59	0.67
Aches of pain	5.23	3.34	6.02	2.64	0.06	6.75	3.43	0.03
Sleep changes	4.81	3.5	5.22	2.87	0.37	6.8	3.53	0.01
Constipation	6.92	3.34	6.79	2.7	0.98	7.7	3.13	0.22
Menstruation changes or fertility	7.58	3.48	5.15	3.02	<0.01	7.62	3.43	0.96
Nausea	–	–	7.3	2.42	–	8.15	2.82	–
Overall physical health	4.93	2.71	5.45	1.99	0.22	6.5	2.21	0.01
Total physical subscale	5.75	1.94	5.86	1.38	0.68	7.05	2.38	<0.01
How difficult is it to cope?	6.15	2.83	5.21	2.69	0.17	5.75	3.26	0.95
How good it QoL?	7.03	2.34	5.82	2.16	<0.01	6.75	2.53	0.82
How much happiness?	6.93	2.27	6.11	2.24	0.02	6.15	2.94	0.19
Do you feel like you are in control?	6.01	2.63	5.32	3.05	0.16	4.95	3.56	0.14
How satisfying is your life?	6.93	2.27	6.13	2.64	0.03	6.15	3.18	0.19
How is your ability to concentrate/remember things?	5.31	2.64	6.55	2.23	<0.01	6	3.29	0.18
How useful do you feel?	6.72	2.67	4.95	2.73	<0.01	5.5	3.12	<0.05
Has illness caused changes in appearance?	5.12	3.31	4.3	3.1	0.09	5.05	3.3	1
Has illness changed your self-concept?	4.9	3.43	4.23	2.95	0.57	5.4	3.28	0.21
How distressing were the following?								
Initial diagnosis	2.35	2.67	2.04	2.73	0.55	2.63	3.32	0.48
Time since my treatment was completed	5.1	2.85	4.68	2.69	0.7	6.44	2.94	<0.01
Cancer treatment	–	–	2.73	2.49	–	3.84	3.55	–
How much anxiety do you have?	5.05	2.96	5.05	2.95	0.81	5	3.4	0.94
How much depression do you have?	6.16	2.96	6.43	2.65	0.36	5.6	3.12	0.51
To what extent are you fearful of:								
Diagnostic tests	4.89	3.14	5.61	3.26	0.07	6.15	3.96	0.05
A second cancer	3.77	3.11	4.84	3.76	<0.01	5	3.7	0.02
Recurrence of your cancer	4.17	3.23	3.88	3.62	0.8	4.1	3.34	0.85
Spreading/metastases	4.46	3.39	–	–	–	5.5	3.79	0.11
Total psychological subscale	5.27	1.89	4.95	1.8	0.22	5.34	2.13	0.87
How distressing has this illness been for family?	4.13	2.77	2.34	2.49	<0.01	3	3.15	0.18
Amount of support you receive from others sufficient?	7.1	2.89	8.38	2	<0.01	7.95	3.14	<0.01
Interfering with your personal relationships?	7.04	3.18	4.76	3.1	<0.01	6.35	2.22	0.93
Is sexuality impacted by illness?	5.89	3.7	3.4	3.34	<0.01	5.56	4.06	0.77
Time away from work	6.32	3.44	4.32	4.42	<0.01	3.75	4.04	0.01
Interference with activities at home	–	–	2.82	2.44	–	6.6	3.54	–
Feeling of isolation	6.52	3.39	5.63	2.9	0.08	6.9	2.95	0.44
Financial burden	5.44	3.68	4.3	3.45	<0.01	5	4.41	0.39
Total social subscale	6.18	2.26	4.57	1.82	<0.01	5.65	2.87	0.3
Importance of religious activities?	4.91	4.07	6.27	4.03	0.02	7.6	3.56	<0.01
How important are spiritual activities?	4.01	3.62	5.71	4.07	<0.01	5.85	4.06	<0.01
How much has your spiritual life changed?	4.79	3.53	5.93	3.66	0.02	7.65	3.6	<0.01
How much uncertainty do you feel about your future?	4.8	3.12	3.3	3.21	<0.01	4.16	3.96	0.7
To what extent has illness positively changed your life?	4.62	3.16	4.75	3.49	0.64	6.55	3.32	0.02

Table 3 continued

QoL variable	Thyroid cancer		Colon cancer			Glioma		
	n = 1174 (all)		n = 56			n = 20		
	mean	SD	mean	SD	p value	mean	SD	p value
To what extent has illness given purpose to your life?	6.04	3.22	6.89	3.31	0.07	7	2.27	0.04
How hopeful do you feel?	6.82	2.46	7.46	2.44	<0.01	8.3	3.07	<0.01
Total spiritual subscale	5.16	2.01	5.76	2.44	0.03	6.78	2.2	<0.01
Overall QOL	5.53	1.58	5.2	1.43	0.13	5.96	1.72	0.23

Responses are measured on a Likert scale, with 0 being the worst and 10 being the best

evaluation was <1 year in 58 (53.7 %) participants and >1 year in 40 (46.3 %) participants.

Overall QOL between the two groups was similar ($p = 0.44$). Additionally, QOL was similar between the two groups in the physical and psychological subcategories ($p = 0.48$ and $p = 0.51$). QOL was significantly better in the thyroid group for the social well-being ($p = 0.02$) and significantly better in the gynecologic cancer group for spiritual well-being ($p < 0.01$).

Discussion

In this study, we found that thyroid cancer survivors report an overall similar QOL to the survivors of other cancers that were surveyed using the QOL-CS. This was a surprising finding given that colon, glioma, breast, and gynecologic cancers all carry worse 5-year survival rates [13]. This suggests that QOL in cancer patients is not predictable by prognosis alone.

There are several factors influencing the QOL of thyroid cancer survivors that have been identified in the NATCSS, as well as other studies, in the QOL literature [20–22]. Many patients feel that they have a lack of support from their families and physicians. They are frequently given the impression by healthcare providers and caregivers that thyroid cancer is the "good kind of cancer". Patients may feel that such comments trivialize the diagnosis and decreases their QOL[4]. Additionally, when undergoing RAI therapy, or when treated with an inadequate dose of levothyroxine, patients enter a hypothyroid state, which can induce a broad range of symptoms including fatigue, increased appetite, sleep changes, anxiety, and lack of usefulness, all of which affect QOL [6]. Other factors that survivors find compromises their QOL is fear of cancer recurrence, fear of a second cancer, and fear of development of metastatic disease. Routine surveillance for recurrence is a regular reminder of their disease [4]. Although thyroid cancer survivors may be free of disease

after definitive management, these ongoing concerns may account for a portion of their relatively poor long-term QOL.

Time elapsed from diagnosis is a factor that can influence QOL in cancer survivors. It has been shown in different types of cancer that QOL continues to improve after diagnosis and treatment, specifically, it improves after 5 years post-diagnosis [17, 23]. The mean time from diagnosis to survey completion was <5 years in all cancer survivors surveyed in this paper with the exception of breast cancer, where the average time from diagnosis was 5.7 years. This may explain the relative better QOL in the breast cancer survivors that were surveyed.

The method in which the survey was administered could potentially impact the responses of patients. In the paper evaluating gynecologic malignancies [18], the surveys were administered in a face-to-face fashion. This may have been because about 35 % of participants in the survey were not literate. This type of survey administration could elicit a different series of answers in comparison to those who filled out the instrument either on a worksheet at home or online during a time independent of a physician appointment.

The finding that QOL in breast cancer survivors is significantly better than thyroid cancer survivors could potentially be attributed to the national recognition of breast cancer as a significant burden on society [24]. This recognition has generated a tremendous amount of literature on the QOL of breast cancer survivors (in our literature search for this investigation, of the >14,000 articles identified, 35 % were breast cancer QOL related), demonstrating that physicians and nurses who care for breast cancer patients identify attention to QOL as an important part of taking care of their patient population. It is possible that thyroid cancer survivors do not have the same sense of broad support for their diagnosis, and, therefore, do not have as good a QOL. Of note, the Dow et al. manuscript that was used to compare breast cancer survivors with NATCSS patients was published in 1996 [17], and there have been significant changes in the management of breast

Table 4 QOL comparison of thyroid cancer to breast cancer and to gynecologic malignancies including overall, subcategory, and individual variables

QoL variable	Thyroid cancer		Breast cancer			Gynecologic cancer		
	1042 (females)		n = 294			n = 108		
	Mean	SD	Mean	SD	p value	Mean	SD	p value
To what extent are the following a problem?								
Fatigue	4.03	3.13	6.89	2.91	<0.01	2.76	3.68	<0.01
Appetite changes	6.30	3.20	8.17	2.68	<0.01	4.12	3.22	<0.01
Aches of pain	5.14	3.32	7.06	2.78	<0.01	5.49	3.55	0.3
Sleep changes	4.80	3.50	7.18	2.93	<0.01	5.1	3.36	0.39
Constipation	6.90	3.36	8.54	2.43	<0.01	5.22	3.79	<0.01
Menstruation changes or fertility	7.34	3.00	7.44	3.67	0.63	7.54	4.11	0.53
Nausea	–	–	9.31	1.81	–	5.87	3.81	–
Overall physical health	4.94	2.69	7.42	2.06	<0.01	5	2.55	0.82
Total physical subscale	5.63	1.93	7.75	1.72	<0.01	5.49	2.03	0.48
How difficult is it to cope?	6.05	2.82	7.41	2.47	<0.01	4.47	3.46	<0.01
How good it QoL?	7.01	2.35	7.92	2.15	<0.01	5.19	2.53	<0.01
How much happiness?	6.95	2.27	7.66	2.04	<0.01	5.4	3.5	<0.01
Do you feel like you are in control?	6.01	2.63	6.55	2.4	<0.01	5.31	3.12	<0.01
How satisfying is your life?	6.94	2.27	7.46	1.92	<0.01	6.09	3.03	<0.01
How is your ability to concentrate/remember things?	5.23	2.62	6.74	2.31	<0.01	6.17	3.15	<0.01
How useful do you feel?	6.72	2.66	7.87	2.1	<0.01	5.38	2.1	<0.01
Has illness caused changes in appearance?	4.95	3.30	4.99	3.33	0.85	4.5	3.59	0.18
Has illness changed your self-concept?	4.76	3.42	5	3.34	0.28	5.67	3.36	<0.01
How distressing were the following?								
Initial diagnosis	2.31	2.65	1.39	2.36	<0.01	4.46	3.95	<0.01
Time since my treatment was completed	5.03	2.85	6.27	2.5	<0.01	6.59	3.69	<0.01
Cancer treatment			2.64	2.73	<0.01	3.66	3.51	<0.01
How much anxiety do you have?	5.02	2.93	5.69	2.39	<0.01	4.25	3.53	0.01
How much depression do you have?	6.12	2.96	6.82	2.63	<0.01	–	–	–
To what extent are you fearful of:								
Diagnostic tests	4.86	3.13	5.3	2.89	<0.01	5.28	3.83	0.19
A second cancer	3.67	3.08	4.79	2.96	<0.01	3.16	3.79	0.11
Recurrence of your cancer	4.08	3.17	4.5	2.98	0.04	2.76	3.68	<0.01
Spreading/metastases	4.41	3.36	4.71	3.21	0.17	2.42	3.57	<0.01
Total psychological subscale	5.16	1.85	5.77	1.59	<0.01	5.04	1.47	0.51
How distressing has this illness been for family?	4.03	2.78	3.41	2.57	<0.01	2.5	3.33	<0.01
Amount of support you receive from others sufficient?	7.15	2.87	7.98	2.37	<0.01	6.52	3.71	0.04
Interfering with your personal relationships?	6.95	3.21	8.29	2.57	<0.01	6.09	3.59	<0.01
Is sexuality impacted by illness?	5.80	3.70	5.82	3.59	0.93	5.25	4.56	0.15
Time away from work	6.22	3.41	7.42	3.34	<0.01	6.31	4.26	0.8
Interference with activities at home	–	–	7.72	2.73	–	3.08	3.64	–
Feeling of isolation	6.43	3.40	7.91	2.8	<0.01	5.99	3.81	0.21
Financial burden	5.32	3.67	6.83	3.2	<0.01	3.47	3.58	<0.01
Total social subscale	6.06	2.24	6.93	1.91	<0.01	5.52	1.71	0.02
Importance of religious activities?	5.02	4.06	6.51	3.78	<0.01	4.5	4.13	0.21
How important are spiritual activities?	4.20	3.65	5.53	3.67	<0.01	9.13	2.05	<0.01
How much has your spiritual life changed?	4.98	3.53	6.86	2.83	<0.01	6.14	3.95	<0.01
How much uncertainty do you feel about your future?	4.71	3.09	4.64	2.83	0.73	5.06	3.75	0.27
To what extent has illness positively changed your life?	4.74	3.15	7.21	2.66	<0.01	3.69	3.62	<0.01

Table 4 continued

QoL variable	Thyroid cancer		Breast cancer			Gynecologic cancer		
	1042 (females)		n = 294			n = 108		
	Mean	SD	Mean	SD	p value	Mean	SD	p value
To what extent has illness given purpose to your life?	6.10	3.19	7.3	2.7	<0.01	7.97	2.71	<0.01
How hopeful do you feel?	6.89	2.44	7.81	2.09	<0.01	–	–	–
Total spiritual subscale	5.23	1.99	6.56	1.84	<0.01	6.32	1.47	<0.01
Overall QOL	5.47	1.56	6.51	1.35	<0.01	5.59	1.1	0.43

Responses are measured on a Likert scale, with 0 being the worst and 10 being the best

cancer since that time [25, 26]. With the dynamic nature of breast cancer therapy, patients may have a different experience if surveyed by the same questionnaire in 2015.

This study has multiple limitations. First, the majority of our patients were recruited from thyroid cancer support groups, whereas, except for the breast cancer study, the other three studies utilized in this paper all recruited patients exclusively from clinics. A dominating presence of support group members in the study population may self-select for more significant QOL reports, and introduce bias. Recruitment approach and identification of participant groups can certainly have an impact on the types of responses received [4]. Secondly, participants in these comparison studies were also at different phases of treatment and recovery when surveyed, which can also impact QOL. For example, the colon cancer subjects were almost all (95 %) still undergoing treatment at the time they completed the QOL-CS survey. About half of the participants with gynecologic malignancies were less than one year out from diagnosis, while greater than half of the breast cancer survivors and were more than 5 years out from diagnosis and the average time from diagnosis for thyroid cancer survivors was 5 years. Length of time since limits the generalizability of our findings. We also do not have baseline QOL data on these patients preoperatively, or QOL-CS data on the general population, which would help to understand how significant a change took place before and after treatment. As such, this is a cross-sectional analysis that represents QOL of these cancer survivors only after diagnosis has been made. Additionally, while we studied only a North American population in the NATCSS, the gynecologic malignancies paper by Nazik et al. [18] is a study of Turkish patients. Certainly ethnic and cultural differences can influence QOL in cancer survivors [10, 27] and should be considered, as can level of education, which was also significantly lower in the Turkish group of gynecologic patients, as greater than 95 % did not complete a high school education. Not all of the studies we included had similar numbers of patients participating. Our

glioma survivor group had only 20 participants, which can limit the statistical power and ability to make high fidelity comparisons to the thyroid group with a sample size of greater than 1100 participants. Finally, there are multiple validated instruments available to evaluate QOL in cancer patients that were not directly comparable to the City of Hope instrument that we used, therefore, data collected using the other instruments could not be incorporated into this study.

The results of this study show that QOL of thyroid cancer survivors is similar to that of survivors of other types of cancer with worse survival. This suggests that there are other components to QOL that significantly affect survivors that are unrelated to their prognosis. Understanding detailed aspects of QOL as it specifically relates to thyroid cancer improves care for individual patients, and can also aid in generating a comprehensive thyroid cancer survivorship care plan to consistently support all patients treated for thyroid cancer. Potentially, if patients were better prepared for the side effects and what to expect after surgery and RAI, they would feel better supported throughout their diagnosis and have an improved QOL. Changes in QOL after thyroid cancer treatment are significant, and future study will be beneficial in developing a thyroid-specific QOL instrument as well as a comprehensive thyroid cancer survivorship care plan to better prepare, communicate with, and support patients diagnosed with thyroid cancer.

Compliance with ethical standards

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