

## Health-Related Quality of Life and Disease-Specific Symptoms Among Persons with Thyroid Cancer After Surgery in Yunnan Province, the People's Republic of China

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### ABSTRACT

**OBJECTIVE** To examine health-related quality of life (HRQOL), disease-specific symptoms, and relationships between HRQOL and disease-specific symptoms among thyroid cancer patients after surgery in Yunnan Province, the People's Republic of China.

**METHODS** Participants in this cross-sectional study included 333 persons with thyroid cancer after surgery receiving care at the First Affiliated Hospital of Kunming Medical University. The HRQOL was assessed using the European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire. The Thyroid Cancer Specific HRQOL questionnaire was used to measure the disease-specific symptoms.

**RESULTS** The mean global health score was  $75.00 \pm 17.09$ . The mean score of role, social, physical, cognitive, and emotional function were  $95.10 \pm 14.32$ ,  $92.67 \pm 16.12$ ,  $92.00 \pm 8.94$ ,  $82.83 \pm 16.15$  and  $81.11 \pm 16.47$ , respectively. The top three disease-specific symptoms experienced by thyroid cancer patients after surgery were psychological symptoms ( $18.74 \pm 17.16$ ), problems with scars ( $17.77 \pm 24.18$ ) and throat/mouth symptoms ( $17.07 \pm 16.64$ ). There were statistically significant negative correlations between dimensions of disease-specific symptoms and dimensions of HRQOL.

**CONCLUSIONS** This study revealed negative relationships between HRQOL and disease-specific symptoms experienced by thyroid cancer patients after surgery. Health care providers caring for thyroid cancer patients, especially those in China, could use these findings as a basis for further enhancing the quality of care for patients with thyroid cancer after surgery.

**KEYWORDS** health-related quality of life, quality of life, symptoms, thyroid cancer

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### INTRODUCTION

The incidence of thyroid cancer is increasing worldwide (1). In the past decades, the incidence of thyroid cancer has continued to rise (2). It is the fourth most common type of cancer found among women in China (3). According to the American Thyroid Association Guidelines, surgery is the recommended treatment for thyroid cancer (4).

Shortly after surgery, risk assessment is normally adjusted based on surgical and pathological findings and a determination is made whether radioactive iodine (RAI) ablation and/or thyroid stimulating hormone (TSH) inhibition is required (5). The main adjuvant therapy after surgery is TSH suppression, which can significantly reduce recurrence and cancer-related mortality in patients with differentiated thyroid cancer (6,7). Patients receiving TSH

suppression therapy can experience fatigue, insomnia, flushes, anxiety, irritability, muscle weakness, sweating, and palpitations (8-10), and those receiving RAI therapy may experience salivary gland pain and xerostomia from sialoadenitis (10). Those symptoms may persist for an unpredictable period of time, which may significantly affect the patient's quality of life after surgery.

After surgery, the patient may also experience many disease-specific symptoms. Some patients may suffer from neuromuscular symptoms caused by hypoparathyroidism resulting from parathyroid injury or inadvertent resection during thyroid surgery (11). These symptoms are directly related to thyroid cancer surgery and may include muscle cramping, twitching and spasms, circumoral and acral numbness and paresthesias, laryngospasm and bronchospasm. In addition, patients may experience hoarseness because of recurrent laryngeal nerve injury (9). Patients can also experience pain and tightness in their neck because of scars left by surgery (12).

Postoperative thyroid cancer patients usually need long-term or even lifelong adjuvant therapy. Although adjuvant therapy prevents the recurrence of the disease, it can produce many undesirable symptoms. These symptoms may persist for an unpredictable period of time after surgery, and may make a significant difference in the patient's quality of life after surgery. Many studies have shown that long-term or lifelong adjuvant therapy and disease-specific symptoms after thyroid cancer surgery can affect patients' health-related quality of life (HRQOL) (8,12,13).

HRQOL is a term derived from the development of quality of life. In oncology, quality of life is often described as various aspects of health, such as physical symptoms, daily activity levels, psychological well-being, and social functioning (14). According to the European Organisation for Research and Treatment of Cancer (EORTC), HRQOL refers to the subjective perceptions of the positive and negative aspects of cancer patients' symptoms, including physical function, emotional function, social function, cognitive functions, role function and symptoms (15).

There have been only limited studies exploring HRQOL and disease-specific symptoms among thyroid cancer patients after surgery in China. Since HRQOL is subjective (15), perceptions of each individual are different, thus a subjective survey of patients in other countries cannot be generalized to the Chinese population. This study was conducted to examine HRQOL, disease-specific symptoms and the relationship between HRQOL and disease-specific symptoms among thyroid cancer patients after surgery in Yunnan province, the People's Republic of China.

## OBJECTIVES

The aims of this study were to examine disease-specific symptoms, HRQOL, and the relationship between disease-specific symptoms and HRQOL among thyroid cancer patients after surgery in Kunming city, Yunnan province, the People's Republic of China.

## METHODS

A cross-sectional study was conducted at the Thyroid Surgery Clinic of the First Affiliated Hospital of Kunming Medical University. A total of 2,000 adult thyroid cancer patients were receiving care after surgery at the Thyroid Surgery Clinic of the First Affiliated Hospital of Kunming Medical University. The number of participants was calculated using Yamane's formula with a 5.0% margin of error, yielding a sample size of 333. Inclusion criteria were thyroid cancer patients aged at least 18 years old and at least 1 month after thyroid surgery. A total of 333 participants were recruited between March and April 2020. None of the identified participants were excluded.

The European Organisation for Research and Treatment of Cancer Quality of Life Questionnaire (EORTC-QLQ-C30) Chinese version was used to assess HRQOL. It consists of five functional dimensions (physical, role, cognitive, emotional, and social), three symptom dimensions (fatigue, pain, and nausea and vomiting), global health, and six single items addressing various symptoms and perceived financial impact (16). Global health was scored on a seven-point Likert scale ranging from very poor to excellent. The rest of the items were scored on

a four-point Likert scale ranging from not at all to very much. Each item score was transformed into a scale score ranging from 0 to 100. A high score for functional dimensions represents a high level of functioning, a high score for global health represents a high level of QOL, and a high score for symptom scales/items represents a high number of symptomatic problems. The Thyroid Cancer Specific HRQOL questionnaire (THYCA-QOL) (17) Chinese version (18) was used to assess the disease-specific symptoms. It consisted of seven symptom dimensions (neuromuscular, voice, concentration, sympathetic, throat/mouth, psychological and sensory problems) and six single items (problems with scar, feeling chilly, tingling hands/feet, gaining weight, headaches, interest in sex) (18). Each item was scored on a four-point Likert scale, and then transformed into scale scores ranging from 0–100. A higher score on this scale means more symptoms with the exception of the dimension of interest in sex where a higher score indicates better sexual functioning. The reliability of the EORTC-QLQ-C30 Chinese version and the THYCA-QOL Chinese version in this study was tested with 15 thyroid cancer patients after surgery who met the same inclusion criteria as the study participants. Internal consistency was examined using Cronbach's  $\alpha$ . The reliability of the EORTC QLQ-C30 Chinese version was 0.70–0.95, while the reliability of the THYCA-QOL Chinese version was 0.82–1.00.

Data collection was conducted after receipt of ethical approval from the Research Ethics Committee of the Faculty of Nursing, Chiang Mai University (research ID 2020-043, study code 2020-EXP035), and permission for data collection from the First Affiliated Hospital of Kunming Medical University. The participants were placed in a relatively private and quiet environment while answering the questionnaires.

The data were analyzed using SPSS version 23. Categorical variables are given as percentages. Continuous variables are presented as mean  $\pm$  standard deviation. The difference of scores between gender groups and between duration of treatment groups were tested by independent t-test. The Pearson correlation (r value) was used to determine positive and negative correlations.

All tests were considered statistically significant if  $p < .05$ .

## RESULTS

The characteristics of the 333 participants are presented in Table 1. Most participants were female (86.2%). Their age ranged between 20 and 74 years old with a mean of 42.63. Most (92.8%) had received levothyroxine alone and more than half (62.8%) had received treatment for more than 1 year after surgery. Most did not have a comorbidity (69.4%).

Table 2 shows HRQOL as assessed by the EORTC-QOL-C30. The mean global health score was  $75.00 \pm 17.09$ . On the five functional scales, emotional function had the lowest score ( $81.11 \pm 16.47$ ). Regarding the symptom scales, fatigue ( $19.94 \pm 17.93$ ), insomnia ( $19.94 \pm 26.88$ ) and dyspnea ( $13.58 \pm 19.03$ ) were the top three highest mean scores. The female group had higher mean score of nausea/vomiting than the male group. Patients who had received treatment for more than 1 year reported less pain than those who had received treatment for 1 year or less.

The disease-specific symptoms are presented in Table 3. Among the symptom scales, the

**Table 1.** Characteristics of the participants (n = 333)

Characteristics	Frequency (%)
Age (years)	
Mean $\pm$ SD	$42.63 \pm 11.16$
Range	20–74
Gender	
Male	46 (13.8)
Female	287 (86.2)
Educational status	
Below associates degree	124 (37.2)
Associates degree	69 (20.7)
Bachelor degree	125 (37.5)
Master degree and above	15 (4.5)
Marital status	
Single	32 (9.6)
Married	285 (85.6)
Divorced/separated/widowed	16 (4.8)
Type of adjuvant treatment received	
Medication (levothyroxine)	309 (92.8)
Medication + Radioactive Iodine	24 (7.2)
Duration of treatment received	
< 1 year	124 (37.2)
> 1 year	209 (62.8)
Comorbidity	
No	231 (69.4)
Yes	102 (30.6)

**Table 2.** EORTC-QOL-C30 scores among thyroid cancer patients after surgery

EORTC-QOL-C30 score	Total group (n=333)	Gender		Duration of treatment	
		Male (n=46)	Female (n=287)	< 1 year (n=124)	> 1 year (n=129)
Global health <sup>a</sup>	75.00±17.09	74.28±14.68	75.11±17.47	74.35±17.17	75.37±17.08
Functioning scales <sup>a</sup>					
1. Role function	95.10±14.32	91.30±18.51	95.70±13.47	94.35±15.16	95.53±13.82
2. Social function	92.67±16.12	91.30±14.80	92.89±16.34	92.67±14.20	92.66±17.20
3. Physical function	92.00±8.94	93.62± 8.89	91.74± 8.94	90.83± 9.68	92.69± 8.42
4. Cognitive function	82.83±16.15	84.06±15.30	82.63±16.30	82.79±16.31	82.85±16.09
5. Emotional function	81.11±16.47	82.07±15.71	80.96±16.61	80.06±15.24	81.73±17.16
Symptom scales <sup>b</sup>					
1. Fatigue	19.94±17.93	18.59±18.00	20.16±17.94	22.04±18.15	18.70±17.73
2. Insomnia	19.94±26.88	16.81±19.46	20.44±27.88	21.50±27.28	19.01±26.68
3. Dyspnea	13.58±19.03	12.32±16.27	13.78±19.45	15.05±20.98	12.70±17.76
4. Pain	8.21±12.45	8.70±12.04	8.13±12.53	11.16±13.05	6.46±11.76 <sup>**</sup>
5. Constipation	7.11±15.70	5.80±16.18	7.32±14.90	7.53±15.81	6.85±14.64
6. Financial difficulties	5.51±15.30	3.62±10.49	5.81±15.92	6.45±15.72	4.94±15.05
7. Appetite loss	4.50±12.80	2.90±9.50	4.76±13.24	5.91±13.47	3.67±12.33
8. Diarrhea	3.40±16.75	4.35±11.35	3.25±10.66	3.78±11.41	3.19±10.35
9. Nausea/vomiting	1.90±6.50	0.36±2.46	2.15±6.91 <sup>**</sup>	1.97±6.61	1.86±6.45

<sup>a</sup>higher score indicates a higher level of health-related quality of life; <sup>b</sup>higher score indicates a higher level of problems

\*\*  $p < 0.01$

psychological scale had the highest score ( $18.74\pm17.16$ ), and the concentration scale had the lowest score ( $10.46\pm16.00$ ). Among single item symptoms, problems with scar had the highest score ( $17.77\pm24.18$ ) and tingling hands/feet had the lowest score ( $9.31\pm17.07$ ). Females had more sympathetic symptoms, problems with scar, and headaches than males. Patients who received treatment for more than 1 year reported less throat/mouth symptoms and headaches than those who received treatment for 1 year or less, although they did report greater weight gain.

The relationships between the dimensions of disease-specific symptoms and each dimension of HRQOL in patients with thyroid cancer after surgery are presented in **Table 4**. The three disease-specific symptoms that had the strongest negative relationship with physical function were neuromuscular ( $r=-.480, p < 0.01$ ), psychological ( $r=-.393, p < 0.01$ ) and sympathetic ( $r=-.365, p < 0.01$ ). The three disease-specific symptoms that had the strongest negative relationship with role function were concentration ( $r=-.323, p < 0.01$ ), voice ( $r=-.322, p < 0.01$ ) and throat/mouth ( $r=-.301, p < 0.01$ ). The three disease-specific symptoms that had the strongest negative relationship with emotional

function were psychological ( $r=-.588, p < 0.01$ ), concentration ( $r=-.460, p < 0.01$ ) and feeling chilly ( $r=-.310, p < 0.01$ ). The three disease-specific symptoms that had the strongest negative relationship with cognitive function were concentration ( $r=-.569, p < 0.01$ ), psychological ( $r=-.465, p < 0.01$ ) and neuromuscular ( $r=-.337, p < 0.01$ ). The three disease-specific symptoms that had the strongest negative relationship with social function were concentration ( $r=-.483, p < 0.01$ ), psychological ( $r=-.476, p < 0.01$ ) and neuromuscular ( $r=-.325, p < 0.01$ ). The three disease-specific symptoms that had the strongest negative relationship with global health were psychological ( $r=-.381, p < 0.01$ ), neuromuscular ( $r=-.310, p < 0.01$ ) and voice ( $r=-.291, p < 0.01$ ).

## DISCUSSION

The most seriously affected domain of HRQOL found in this study was global health status, followed by cognitive and emotional function (**Table 2**). The mean global health score in this study was comparable to the global health score of thyroid cancer patients after surgery reported in a German study (19). The score was also similar to global health in thyroid cancer patients reported in many previous

**Table 3.** Disease-specific symptoms among thyroid cancer patients after surgery

Disease-specific symptoms	Total group (n=333)	Gender		Duration of treatment	
		Male (n=46)	Female (n=287)	≤ 1 year (n=124)	> 1 year (n=129)
Symptom scales					
1. Psychological	18.74±17.16	15.88±16.05	19.20±17.31	19.49±17.42	18.30±17.02
2. Throat/mouth	17.07±16.64	18.58±18.90	16.83±16.27	21.29±17.82	14.57±15.40**
3. Neuromuscular	15.60±13.98	13.51±13.65	15.93±14.03	15.68±14.81	15.56±13.51
4. Sympathetic	13.57±17.26	7.39±11.94	14.56±17.78**	12.59±16.51	14.15±17.70
5. Sensory problem	13.56±15.15	11.23±13.17	13.94±15.43	11.83±14.84	14.59±15.28
6. Voice	11.91±17.97	15.94±20.77	11.27±17.43	14.38±20.75	10.45±15.97
7. Concentration	10.46±16.00	11.23±14.07	10.33±16.30	11.56±16.21	9.81±15.87
Single item symptom					
1. Problem with scar	17.77±24.18	12.32±16.27	18.64±25.12*	20.97±24.22	15.87±24.01
2. Feeling chilly	16.21±21.59	13.77±21.75	16.61±21.57	16.40±20.16	16.11±22.43
3. Gaining weight	15.51±22.62	10.87±21.14	16.26±22.79	11.83±20.47	17.70±23.58*
4. Headache	12.71±17.60	7.25±13.90	13.59±17.99**	16.23±18.76	10.68±16.59**
5. Tingling hands/feet	9.31±17.07	8.70±16.38	9.41±17.20	8.87±18.09	9.57±16.47
6. (Less) interest in sex <sup>a</sup>	27.93±20.47	37.68±21.78	26.36±19.85**	26.88±20.68	28.55±20.37

<sup>a</sup>Higher scores indicate better sexual functioning; \*p < 0.05, \*\* p < 0.01

**Table 4.** Relationship between disease-specific symptoms and HRQOL among thyroid cancer patients after surgery

Disease-specific symptoms	Physical function	Role function	Emotional function	Cognitive function	Social function	Global health
Neuromuscular	-.480*	-.241*	-.301*	-.337*	-.325*	-.310*
Voice	-.287*	-.322*	-.248*	-.302*	-.307*	-.291*
Concentration	-.334*	-.323*	-.460*	-.569*	-.483*	-.274*
Sympathetic	-.365*	-.190*	-.255*	-.330*	-.288*	-.237*
Throat/mouth	-.360*	-.301*	-.259*	-.255*	-.277*	-.288*
Psychological	-.393*	-.281*	-.588*	-.465*	-.476*	-.381*
Sensory problem	-.149*	-.043	-.240*	-.252	-.155*	-.232*
Problems with scar	.019	-.071*	-.228*	-.095	-.214*	-.128*
Feeling chilly	-.311*	-.148*	-.310*	-.284*	-.220*	-.208*
Tingling feet/hands	-.311*	-.148*	-.156*	-.232*	-.250*	-.195*
Gaining weight	-.293*	-.105	-.137*	-.066	-.086	.024
Headache	-.185*	-.084*	-.191*	-.184*	-.213*	-.230*
Less interest in sex	.177*	.012	.049	.037	.054	.077

HRQOL, health-related quality of life; \*p < 0.01;

studies around the world, (8,13,20,21) including a study from China (22–24). Decreased global health in thyroid cancer patients compared to that of the general population has been documented (8,20). Thyroid cancer patients after thyroidectomy require long-term treatment. Many of them encounter fears, uncertainties and symptoms from surgery or treatments after surgery (25) which could contribute to a decline in global health.

Emotional function had the lowest score among the five HRQOL functional scales in this study (Table 2). This finding was similar to many previous studies in which emotional

function score was reported as the lowest of the HRQOL dimensions (9,21,26). Emotional functions may be affected by symptoms experienced by the patient. The side effects and symptoms of all kinds of adjuvant therapy after surgery can aggravate the psychological burden of patients.

Fatigue and insomnia had the highest mean score of the symptoms dimension of HRQOL and seemed to be reported more among females than among males (Table 2), a result is similar to an earlier study (21). Fatigue and insomnia have been prominent symptoms found in patients with thyroid cancer after surgery,

not only in this study but also in previous studies from around the world (9,12,13,23,26–28). Fatigue is a common symptom in all types of cancer, and is associated with chemotherapy, radiation therapy and the treatment of primary disease processes (29). The same is true for patients after thyroid cancer surgery. Post-operative TSH suppression therapy in patients with thyroid cancer can lead to subclinical hyperthyroidism, resulting in high levels of fatigue (28). This could be a reason why the vast majority of studies on HRQOL in patients with thyroid cancer after surgery found high levels of fatigue.

Thyroid hormone dysfunction can not only cause fatigue but can also cause other symptoms such as irritability, insomnia and pain (9,17). Although all patients in this study received medication after surgery (Table 1), levothyroxine given to patients after thyroid surgery may not totally replicate their normal physiological hormone condition (8). Patients may have either hypothyroidism or hyperthyroidism during treatments, leading to the fatigue and sleep disturbances experienced by participants.

Among the disease-specific symptoms, psychological symptoms were the most common disease-specific symptoms experienced by participants in this study. These results are similar to findings from a study by Lan and colleagues (30), in which psychological symptoms were among the top three disease-specific symptoms experienced by thyroid cancer patients after surgery. Psychological symptoms included palpitations, tiredness, feeling restless or agitated and feeling anxious. Psychological symptoms experienced among thyroid cancer patients after surgery may arise from the treatment of thyroid cancer after a thyroidectomy. The TSH suppression therapy that the participants in this study received was an important treatment for avoiding recurring cancer among thyroid cancer patients (5), but it may cause palpitations, tiredness, irritability burden of the patients. TSH suppression medication can lead to hyperthyroidism, causing fatigue (31). Fatigue has been found to be associated with emotional aspects in patients with thyroid cancer receiving long-term treatment (26,28).

In addition, psychological symptoms in thyroid cancer patients after an operation may be a result of anxiety and discomfort related to concerns about the recurrence of their cancer (12,32). A previous study confirmed the existence of constant fear of recurrence among patients after thyroid cancer surgery (13). Although in Chinese culture people are reluctant to express their psychological problems to others, psychological symptoms can often be assessed by questionnaires or other research methods, which may lead to the prominent finding of psychological symptoms in this study.

The results from our study showed a difference in some symptoms between genders (Tables 2 and 3). We also noted that females tended to report more psychological symptoms and seemed to have lower emotional function than males. The difference in HRQOL and disease-specific symptoms between genders may perhaps be due to different sex-dependent reactions to the cancer and different sex-dependent coping strategies (33). The higher problem with scar in females than in males may be a result of female concerns regarding body image (30). With respect to limitations of our cross-sectional study, we noted that patients receiving treatment for more than 1 year seemed to experience fewer symptoms than those receiving treatment for 1 year or less. A possible reason for the decrease in symptoms over time could be accommodation to the treatment and the illness by the thyroid cancer patients. However, changes in symptoms over time warrants further investigation in longitudinal studies.

In terms of the relationship between disease-specific symptoms and HRQOL, the overall results showed that each dimension of disease-specific symptoms was negatively correlated with the 5 functional dimensions and the global health dimension of HRQOL. This suggests that the more disease-specific symptoms patients experienced after thyroid cancer surgery, the lower their HRQOL levels. There has been only one study published which investigated the relationship between disease-specific symptoms and HRQOL in patients after thyroid cancer surgery (8). The results from this current study are similar to that study.

The results showed a significant negative correlation between neuromuscular symptoms and all dimensions of HRQOL and global health (Table 4). These results indicate that the more neuromuscular disease-specific symptoms a patient experienced, the lower their HRQOL. As mentioned in the literature review, problems caused by neuromuscular symptoms may be due to parathyroid injury (11). This includes the possibility that the patient may develop muscle cramping, twitching and spasms. Although most of these symptoms are temporary and some patients may recover quickly, the condition can take at least a year to fully resolve (34).

Voice specific-symptoms had the strongest negative correlation with role function ( $r=-.322, p < 0.010$ ) and social function ( $r=-.307, p < 0.010$ ) (Table 4). This could be due to hoarseness and inability to speak due to voice problems directly affecting the role and social functioning of the patient.

There was a significant negative correlation between concentration symptoms and cognitive function ( $r =-.569, p < 0.010$ ), social function ( $r = -.483, p < 0.010$ ), and emotional function ( $r =-.460, p < 0.010$ ) (Table 4). Reduced concentration in patients may lead to incomplete or faulty cognitive function (35). Concentration problems could also cause both difficulty in thinking and attention problems, which may affect family life and social activities as well as aggravate the patient's nervousness and anxiety (36). Concentration problems could stem from TSH suppression therapy following thyroid cancer surgery which the patient has to undergo for a long period of time and possibly for life (25).

Additionally, throat and mouth symptoms showed a significant negative correlation with physical function ( $r=-.360, p < 0.010$ ) and role function ( $r=-.301, p < 0.010$ ) (Table 4). Disease-specific symptoms such as dry mouth, difficulty swallowing and a foreign body sensation in the throat limited the ability to engage in some physical activities, as well as interfering with work, daily activities and leisure hobbies.

Finally, psychological symptoms had the highest correlation with HRQOL (Table 4). The more psychological symptoms, the worse the

physical, role, emotional, cognitive and social functions. There was also a significant negative correlation between psychological symptoms and global health. Many studies have reported on psychological problems of patients after thyroid cancer surgery (12,23,37-40), the same as patients after thyroid cancer surgery in this study. Since psychological symptoms are correlated with HRQOL, support for patients with postoperative psychological problems is an essential part of postoperative follow-up.

## CONCLUSION

This study revealed the existence of HRQOL and disease-specific symptoms experienced by thyroid cancer patients after surgery. There are negative relationships between disease-specific symptoms and HRQOL. Health care providers caring for thyroid cancer patients, especially those in China, could use these findings as a basis for working to further enhance the quality of care of thyroid cancer patients after surgery.

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## CONFLICT OF INTEREST

The authors declare no conflict of interest.

## REFERENCES

1. Pellegriti G, Frasca F, Regalbuto C, Squatrito S, Vigneri R. Worldwide increasing incidence of thyroid cancer: update on epidemiology and risk factors. *J Cancer Epidemiology*. 2013;2013:1-10.
2. Deng Y, Li H, Wang M, Li N, Tian T, Wu Y, et al. Global burden of thyroid cancer from 1990 to 2017. *JAMA Netw Open*. 2020;3:e208759.
3. Chen W, Sun K, Zheng R, Zeng H, Zhang S, Xia C, et al. Cancer incidence and mortality in China, 2014. *Chinese J Cancer Res*. 2018;30:1-12.
4. Haugen BR, Alexander EK, Bible KC, Doherty GM, Mandel SJ, Nikiforov YE, et al. 2015 American Thyroid Association management guidelines for adult patients with thyroid nodules and differentiated

thyroid cancer: the American Thyroid Association guidelines task force on thyroid nodules and differentiated thyroid cancer. *Thyroid*. 2016;26:1-133.

5. Cabanillas ME, McFadden DG, Durante C. Thyroid cancer. *Lancet*. 2016;388:2783-95.
6. Biondi B, Cooper DS. Thyroid Hormone Suppression Therapy. *Endocrinol Metab Clin North Am*. 2019;48:227-37.
7. Mazzaferri EL, Kloos RT. Current approaches to primary therapy for papillary and follicular thyroid cancer. *J Clin Endocr Metab*. 2001;86:1447-63.
8. Husson O, Haak HR, Buffart LM, Nieuwlaat WA, Oranje WA, Mols F, et al. Health-related quality of life and disease specific symptoms in long-term thyroid cancer survivors: a study from the population-based PROFILES registry. *Acta Oncol*. 2013; 52:249-58.
9. Lee YS, Nam K-H, Chung WY, Chang H-S, Park CS. Postoperative complications of thyroid cancer in a single center experience. *J Korean Med Sci*. 2010; 25:541.
10. Van Nostrand D. Sialoadenitis secondary to  $^{131}\text{I}$  therapy for well-differentiated thyroid cancer. *Oral Dis*. 2011;17:154-61.
11. Bilezikian JP, Khan A, Potts Jr JT, Brandi ML, Clarke BL, Shoback D, et al. Hypoparathyroidism in the adult: Epidemiology, diagnosis, pathophysiology, target-organ involvement, treatment, and challenges for future research. *J Bone Miner Res*. 2011; 26:2317-37.
12. Huang SM, Lee CH, Chien LY, Liu HE, Tai CJ. Postoperative quality of life among patients with thyroid cancer. *J Adv Nurs*. 2004;47:492-99.
13. Rogers S, Mepani V, Jackson S, Lowe D. Health-related quality of life, fear of recurrence, and emotional distress in patients treated for thyroid cancer. *Brit J Oral Max Surg*. 2017;55:666-73.
14. Aaronson NK. Quality of life: what is it? How should it be measured? *Oncology*. 1988;2:69-76.
15. Aaronson NK, Ahmedzai S, Bergman B, Bullinger M, Cull A, Duez NJ, et al. The European Organization for Research and Treatment of Cancer QLQ-C30: a quality-of-life instrument for use in international clinical trials in oncology. *J Natl Cancer Inst*. 1993;85:365-76.
16. Wan C, Meng Q, Yang Z, Tu X, Feng C, Tang X, et al. Validation of the simplified Chinese version of EORTC QLQ-C30 from the measurements of five types of inpatients with cancer. *Annals of Oncology*. 2018;19:2053-60.
17. Husson O, Haak HR, Mols F, Nieuwenhuijzen GA, Nieuwlaat W-A, Reemst PH, et al. Development of a disease-specific health-related quality of life questionnaire (THYCA-QoL) for thyroid cancer survivors. *Acta oncol*. 2013;52:447-54.
18. Liu J, Gao J, Tang Y, Wu C, Jiang X, Lao Q, et al. Reliability and validity of Chinese version of thyroid cancer-specific quality of life (THYCA-QOL) questionnaire. *Tumor*. 2019;39:178-87.
19. Büttner M, Hinz A, Singer S, Musholt TJ. Quality of life of patients more than 1 year after surgery for thyroid cancer. *Hormones*. 2020;19:233-43.
20. Mols F, Schoormans D, Smit JW, Netea-Maier RT, Links TP, van der Graaf WT, et al. Age-related differences in health-related quality of life among thyroid cancer survivors compared with a normative sample: Results from the PROFILES Registry. *Head Neck*. 2018;40:2235-45.
21. Razavi Ratki SK, Fallahi B, Namiranian N, Emami-Ardekani A, Saghari M, Mirabzadeh A, et al. Factors affecting the quality of life of well-differentiated thyroid carcinoma patients: a cross-sectional study on 435 Iranian patients. *Iran J Nucl Med*. 2016;24:92-98.
22. Gou J, Cheng W, Lei J, Pan Q, You W, Cai M, et al. Health-related quality-of-life assessment in surgical patients with papillary thyroid carcinoma: a single-center analysis from Mainland China. *Medicine*. 2017;96:e8070.
23. Wang T, Jiang M, Ren Y, Liu Q, Zhao G, Cao C, et al. Health-related quality of life of community thyroid cancer survivors in Hangzhou, China. *Thyroid*. 2018;28:1013-23.
24. Li J, Zhang B, Bai Y, Liu Y, Zhang B, Jin J. Health-related quality of life analysis in differentiated thyroid carcinoma patients after thyroidectomy. *Sci Rep-UK*. 2020;10:1-7.
25. Sawka AM, Goldstein DP, Brierley JD, Tsang RW, Rotstein L, Ezzat S, et al. The impact of thyroid cancer and post-surgical radioactive iodine treatment on the lives of thyroid cancer survivors: a qualitative study. *PloS One*. 2009;4:e4191.
26. Gamper E-M, Wintner LM, Rodrigues M, Buxbaum S, Nilica B, Singer S, et al. Persistent quality of life impairments in differentiated thyroid cancer patients: results from a monitoring programme. *Eur J Nucl Med Mol I*. 2015;42:1179-88.
27. Rubic M, Kuna SK, Tesic V, Samardzic T, Despot M, Huic D. The most common factors influencing on quality of life of thyroid cancer patients after thyroid hormone withdrawal. *Psychiatr Danub*. 2014; 26:520-27.
28. Husson O, Nieuwlaat WA, Oranje WA, Haak HR, van de Poll-Franse LV, Mols F. Fatigue among short-and long-term thyroid cancer survivors: results from the population-based PROFILES registry. *Thyroid*. 2013;23:1247-55.
29. Narayanan V, and Koshy C. Fatigue in cancer: a review of literature. *Indian J Palliat Care*. 2009;15:19-25.
30. Lan Y, Luo Y, Zhang M, Jin Z, Xiao J, Yan L, et al. Quality of life in papillary thyroid microcarcinoma patients undergoing radiofrequency ablation or surgery: a comparative study. *Front Endocrinol*. 2020;11:249.
31. Kaltsas G, Vgontzas A, Chrousos G. Fatigue, endocrinopathies, and metabolic disorders. *PM R*. 2010; 2:393-98.
32. Carroll DL, Hamilton GA, McGovern BA. Changes

in health status and quality of life and the impact of uncertainty in patients who survive life-threatening arrhythmias. *Heart Lung*. 1999;28:251-60.

33. Crevenna R, Zettinige G, Keilani M, Posch M, Schmidinger M, Pirich C, et al. Quality of life in patients with non-metastatic differentiated thyroid cancer under thyroxine supplementation therapy. *Support Care Cancer*. 2003;11:597-603.

34. Ritter K, Elfenbein D, Schneider DF, Chen H, Sippel RS. Hypoparathyroidism after total thyroideectomy: incidence and resolution. *J Surg Res*. 2015;197:348-53.

35. Sörqvist P, Dahlström Ö, Karlsson T, Rönnberg J. Concentration: the neural underpinnings of how cognitive load shields against distraction. *Front Hum Neurosci*. 2016;10:221.

36. Hu Y, Lei X, Smith JP, Zhao Y. Effects of social activities on cognitive functions: Evidence from CHARLS. In: Smith JP, Majmundar M, editors. *Aging in Asia: Findings From New and Emerging Data Initiatives*. Washington (DC): National Academies Press (US); 2012; p. 918.

37. Vigário PdS, Chachamovitz DSdO, Teixeira PdFdS, Rocque MdL, Santos MLD, Vaismann M. Exercise is associated with better quality of life in patients on TSH-suppressive therapy with levothyroxine for differentiated thyroid carcinoma. *Arq Bras Endocrinol*. 2014;58:274-81.

38. Tan LG, Nan L, Thumboo J, Sundram F, Tan LK. Health-related quality of life in thyroid cancer survivors. *Laryngoscope*. 2007;117:507-10.

39. Sung TY, Shin YW, Nam KH, Chang HS, Rhee Y, Park CS, et al. Psychological impact of thyroid surgery on patients with well-differentiated papillary thyroid cancer. *Qual Life Res*. 2011;20:1411-17.

40. Goswami S, Mongelli M, Peipert BJ, Helenowski I, Yount SE, Sturgeon C. Benchmarking health-related quality of life in thyroid cancer versus other cancers and United States normative data. *Surgery*. 2018;164:986-92.