



ONCOLOGY

# Return to work of head and neck cancer patients after curative radiotherapy

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## Abstract

**Background.** Our objective was to evaluate the rate of reemployment after having curative radiotherapy for head and neck cancer and to identify the barriers of successful return to work in this patient population.

**Methods.** The study was retrospective, cross-sectional, analytical and cohort type, it included 52 consecutive patients attending follow-up visits after curative radiotherapy for head and neck cancer at a single tertiary center. Participants completed a survey to assess demographics, tumor characteristics, lifestyle choices and quality of life questionnaires. We analyzed the rate of reemployment and the association with different parameters.

**Results.** At the time of the survey, the successful return to work rate among head and neck cancer survivors was 55.8%. Most of the returners, 93%, started to work within 14 months from the time of the diagnosis. Educational level, work type and tumor stage were predictive for successful return to work. The main barriers for reemployment were physical symptoms such as fatigue, speech disorders and eating problems. **Conclusions.** Head and neck cancer survivors who manage to return to work have a better quality of life and global health status than those who could not return. The most vulnerable patients are those with lower education, doing manual work and with advanced stage cancer. Optimized radiotherapy planning to reduce radiation induced late effects in conjunction with coordinated rehabilitation programs are needed to facilitate head and neck cancer survivors' reemployment.

**Keywords:** head and neck neoplasms, return to work, radiotherapy, cancer survivors, quality of life

## Introduction

According to the latest International Association of Cancer Registries (IACR) report, the incidence of cancer is rising worldwide with a predicted incidence of over 35 million new cases by 2050, a 77% increase from the 20 million cases estimated in 2022.

For those aged 30-69 years, cancer is one of the most important cause of premature death in 177 out of 185 countries [1]. This age group is important from an economic point of view since it constitutes the working majority of any country. On a macroeconomic level, cancer causes reduced productivity, unemployment, loss of labor force and decreased capital

investments. This economic burden can be reduced by prevention and screening strategies and by increasing the survival rates with successful return to work of the cancer survivors [2].

Return to work rates were reported in several studies at an average of 65%. These rates vary according to cancer type, gender, socioeconomic environment [3]. Survivors not reentering the workforce cause financial losses not just on the individual and family level but also on the social level. The loss of productivity was shown to cause economic impact in several studies [4,5].

The incidence of head and neck cancers in Romania is the highest in Europe

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with an estimated 19 new cases per 100.000 population [6]. Despite the improvement in surgical and radiotherapy techniques, with the introduction of robotic surgery and intensity modulated radiotherapy (IMRT), still a significant percentage of patients experience late side effects of their treatment which affects quality of life and prevents socio-professional reintegration [7].

The aim of the present study was to evaluate the factors associated with reemployment after having curative radiotherapy for head and neck cancer. Our secondary objective was to evaluate the quality of life of survivors and to identify actionable barriers of successful return to work.

### Methods

The study was observational, retrospective, transversal, analytical and cohort type. It included 52 consecutive patients attending follow-up visits after curative radiotherapy for head and neck cancer between December 2022 - August 2023, at a single tertiary center. The study was approved by the University ethics committee (Ethics Committee Approval No. 302/7. December 2022). All study participants provided written informed consent.

Eligible participants were aged 18 to 65 years at diagnosis, employed at or within 3 months before the start of the treatment and had at least 12 months of follow-up with complete remission of their cancer. We have excluded patients with non-head and neck cancers, those who were not actively working at the time of diagnosis, who did not complete at least 12 months follow-up after radiotherapy, and those who were treated with palliative intent.

Clinical data were retrieved from patient records. Participants completed a paper-based survey to assess baseline demographics, education, work type, employment status and lifestyle choices such as smoking, alcohol consumption, and physical activity.

They completed the European Organisation for Research and Treatment of Cancer (EORTC) quality of life core questionnaire (QLQ-C30) and the one specific for head and neck symptoms (QLQ HN35). The EORTC QLQ-C30 is a 30-item cancer-specific questionnaire and comprises a global health related quality of life scale and five functional scales: physical functioning, role functioning, emotional functioning, cognitive functioning and social functioning. There are three symptom scales: nausea, vomiting and pain and 6 single items relating to dyspnea, insomnia, loss of appetite, constipation, diarrhea and financial difficulties. The EORTC QLQ-H&N35 module covers specific head and neck cancer issues and comprises 7 subscales: pain, swallowing, senses, speech, social eating, social contact and sexuality. There are 10 single items covering problems with teeth, dry mouth, sticky saliva, cough, opening the mouth wide, weight loss, weight gain, use of nutritional supplements, feeding tubes, and painkillers. The scores of the QLQ-C30 and of the QLQ-HN35 are linearly transformed to a scale of 0-100, with a higher score indicating a higher level of functioning

or global health related quality of life, or a higher level of symptoms or problems [8].

Statistical analysis was performed using the MedCalc® Statistical Software version 22.021 (MedCalc Software Ltd, Ostend, Belgium; <https://www.medcalc.org>; 2024). Quantitative data were tested for normality of distribution and were expressed as mean and standard deviation or median and 25-75 percentiles, whenever appropriate. Qualitative data were characterized by frequency and percentage. Comparison between groups was carried out by Mann-Whitney test, Student t test or chi-square test, whenever appropriate. A p value <0.05 was considered statistically significant.

### Results

Demographic and clinical data are shown in table I. There were statistically significant differences between those who were able to reemploy and those who were not. Patients who returned to work were more likely to have higher education (p=0.001), to be non-manual workers (p=0.002) or to have a lower stage of disease (p=0.03).

All patients were employed full time at the time of the diagnosis, except one patient, who was working part-time. Forty (77%) patients worked as employees and 12 (23%) were self-employed before their diagnosis. Financial losses due to cancer were reported by 27 (52%) patients, while 25 (48%) declared receiving sick leave compensation matching their previous income.

At the time of the survey, the successful return to work rate was 55.8% (29 patients). There were 22 (75.8%) cases who returned to full time work, 7 (13.5%) part time and only one patient had to change his profession but worked full time. Only 8 (15.4%) patients returned earlier than 6 months to employment. Most of the returners, 93%, started to work within 14 months from the time of the diagnosis. Responding to the question of whether they received support from their employers or colleagues, 86.7% reported positive experience with their work environment.

At the time of the analysis 23 (44.2%) cancer survivors were not working. Of these, 18 (78.2%) chose early retirement and were not planning to return, the rest of 5 patients were still on sick leave and might plan to reemploy in the future. The main cause preventing re-employment was physical symptoms, reported by 18 (77.3%) patients. The most common reported physical complaint was fatigue in 17 (58.9%) cases, followed by difficulty speaking (52%), modified eating habits (13%), anxiety (13%) and chronic pain (13%).

All patients completed EORTC Quality of life questionnaires C30 and HN35. Patients who returned to work had statistically significant better functioning scores on all items and less general and head and neck related symptoms. Data are presented in tables II and III. A higher score indicates a higher level of functioning on the functional scales, while higher scores on the symptom scales mean more symptoms.

**Table I.** Clinicopathological characteristics and association with reemployment.

Variables	Total number of patients (%)	Not returned to work (n=23)	Returned to work (n=29)	p
Age at study (mean ± DS)	49.1(±6.2)	50.7±9.9	47.5±8.7	0.227
<b>Gender</b>				
Female	13 (25%)	6 (26.1%)	7 (24.1%)	1
Male	39 (75%)	17 (73.9%)	22 (75.9%)	
<b>Smoking history</b>				
Current/ Ex-smoker	24 (46.1%)	13 (56.5%)	11(37.9%)	0.291
Never smoker	28 (53.9%)	10 (43.5%)	18 (62.1%)	
<b>Alcohol consumption</b>				
Regular consumer	5 (9.6%)	1 (4.3%)	4 (13.8%)	0.5
Never/Occasional consumer	47 (90.4%)	22 (95.7%)	25 (86.2%)	
<b>Physical Activity</b>				
Regular activity	7 (13.5%)	3 (13%)	4 (13.8%)	1.00
Occasional or no activity	45 (86.5%)	20 (87%)	25 (86.2%)	
<b>Education level</b>				
High school or below	26 (50%)	18 (78.3%)	8 (27.6%)	<b>0.001</b>
University or higher	26 (50%)	5 (21.7%)	21 (72.4%)	
<b>Work type</b>				
Manual labor	32 (61.5%)	20 (87%)	12 (41.4%)	<b>0.02</b>
Non-manual labor	20 (38.5%)	3 (13%)	17 (58.6%)	
<b>Tumor site</b>				
Nasopharynx	20 (38.5%)	14 (60.9%)	18 (62.1%)	1
Non-nasopharynx	32 (61.5%)	9 (39.1%)	11 (37.9%)	
<b>Detailed tumor site</b>				
Nasopharynx	20 (38.5%)	9 (39.1%)	11(37.9%)	0.142
Oral Cavity	5 (9.6%)	4 (17.4%)	1 (4.3%)	
Oropharynx	13 (25%)	3 (13%)	10 (34.5%)	
Larynx	10 (19.2%)	4 (17.4%)	6 (20.7%)	
Hypopharynx	2 (3.8%)	2 (8.7%)	0	
Paranasal sinus	1 (1.9%)	0	1 (3.4%)	
Salivary glands	1 (1.9%)	1 (4.3%)	0	
<b>Stage</b>				
I+ II	10 (19.2%)	1 (4.3%)	9 (31%)	<b>0.03</b>
III+ IVA	42 (80.8%)	22 (95.7%)	20 (69%)	
<b>HPV Status</b>				
Positive	11 (21.2%)	3 (13%)	8 (27.6%)	0.35
Negative or Unknown	41 (78.8%)	20 (87%)	21 (72.4%)	

**Table II.** Median scores of the EORTC QLQ-C30 regarding patients with successful work return versus patients not able to return to work.

EORTC QOL C30	Not returned to work	Returned to work	p value
	Median score (25th, 75th percentile)	Median score (25th, 75th percentile)	
	<i>Functional scales</i>		
Physical functioning	80 (60; 86.6)	93.3 (80; 100)	<b>0.007</b>
Role functioning	66.6 (50; 100)	100 (83.3; 100)	<b>&lt;0.001</b>
Emotional functioning	66.6 (58.3; 83.3)	91.6 (83.3; 100)	<b>&lt;0.001</b>
Cognitive functioning	83.3 (66.6; 100)	100 (100; 100)	<b>&lt;0.001</b>
Social functioning	66.6 (66.6; 100)	100 (83.3; 100)	<b>0.025</b>
Global Health Status	66.6 (50; 83.3)	83.3 (79.1; 100)	<b>&lt;0.001</b>
	<i>Symptom scales</i>		
Fatigue	33.3 (22.2; 55.5)	11.1 (0; 22.2)	<b>&lt;0.001</b>
Nausea	0 (0; 16.6)	0 (0; 0)	<b>0.04</b>
Pain	33.3 (16.6; 33.3)	0 (0; 8.33)	<b>&lt;0.001</b>
Dyspnea	0 (0; 33.3)	0 (0.33.3)	0.135
Insomnia	33.3 (0; 66.6)	0 (0; 33.3)	<b>0.011</b>
Appetite loss	33.3 (0; 33.3)	0 (0; 0)	<b>&lt;0.001</b>
Constipation	0 (0; 33.3)	0 (0; 0)	<b>0.004</b>
Diarrhea	0 (0; 33.3)	0 (0; 0)	<b>0.02</b>
Financial problems	33.3 (0; 66.6)	0 (0; 33.3)	<b>0.02</b>

**Table III.** Median scores of the EORTC QLQ-HN35 regarding patients with successful work return versus patients not able to return to work.

EORTC QOL HN35	Not returned to work	Returned to work	p value
	Median score (25th, 75th percentile)	Median score (25th, 75th percentile)	
Oral pain	16.6 (0; 33.3)	8.3 (0; 16.6)	<b>0.023</b>
Swallowing	16.6 (8.3; 25)	8.3 (0; 16.6)	<b>0.020</b>
Mouth Opening	33.3 (0; 33.3)	0 (0; 33.3)	<b>0.022</b>
Teeth	33.3 (0; 66.6)	0 (0; 33.3)	<b>0.002</b>
Dry mouth	66.6 (33.3; 66.6)	33.3 (16.6; 66.6)	0.167
Sticky saliva	33.3 (0; 66.6)	33.3 (33.3; 66.6)	0.535
Senses	16.6 (0; 50)	0 (0; 33.3)	0.247
Cough	33.3 (0; 33.3)	0 (0; 33.3)	<b>0.039</b>
Speech	11.1 (0; 22.2)	0 (0; 11.1)	0.161
Feeling ill	0 (0; 33.3)	0 (0; 0)	<b>0.003</b>
Social eating	8.3 (0; 33.3)	0 (0; 8.3)	<b>0.002</b>
Social contact	0 (0; 20)	0 (0; 0)	<b>0.020</b>
Sexuality	33.3 (16.6; 66.6)	0 (0; 33.3)	<b>0.000</b>
Pain killers	0 (0; 100)	0 (0; 0)	<b>0.019</b>
Oral supplements	0 (0; 0)	0 (0; 0)	0.843
Feeding tube	0 (0; 0)	0 (0; 0)	1
Weight loss	0 (0; 0)	0 (0; 0)	0.460
Weight gain	0 (0; 100)	0 (0; 100)	0.688

### Discussion

In this analysis we found that 55.8% of head and neck cancer patients treated with curative intent radiotherapy returned to work. Compared to the general cancer population, head and neck cancer survivors face a series of specific complications like sticky saliva, eating disorders, weight and muscle mass loss secondary to malnutrition, speech impairment and occasionally visible physical changes in their appearance [9]. With all these chronic symptoms we would expect a low rate of work return for these patients. Surprisingly, a meta-analysis of 21 studies reported 67% successful work return for head and neck cancer survivors, slightly higher than the general cancer population with mean return rate of 62% (range 30-93%) [3,10].

In our study the lower rate can be explained by the high proportion of more advanced stages, the current social benefit system which offers 18 months paid sick leave. Older patients can choose this option to bridge this period to their normal retirement or choose earlier retirement. Another explanation might be the fact that our cohort included a high number of nasopharyngeal cancers. Although nasopharyngeal cancer survivors are younger, with many more working years remaining, in a study of So et al., only 62% of survivors from a non-endemic region managed to return to work while in the endemic region of Taiwan the rate was even lower, 41% [11,12].

In our cohort, doing manual labor and having lower education was a negative predictive factor for return. This

was shown in previous studies as well [13,14]. Taskila-Abbrandt et al. reported that cancer survivors with high school or lower education had lower rates of reemployment than those with university degree and lower than their healthy counterparts with the same education level [14].

Unsupporting workplace was not the case in our patients, however this issue was shown to affect the return to work rates in one study [15].

Advanced stage disease was associated with lower rates of reemployment. Similar data were reported in the study of Verdonck-de Leeuw et al. They also found that patients with advanced cancer more often changed work and the median time to return to work was 6 months, ranging between 0 to 24 months, 71% of their patients returned within 6 months [16]. We have observed only 15.4% reemployed in the first 6 months after radiotherapy. The current system in our country of paid sick leave is an important factor in reducing financial burden for this patient population and an incentive to take longer time out for recovery.

We couldn't demonstrate age, gender, smoking, alcohol consumption, tumor site and HPV status to be predictive for reemployment.

Loss in income was reported by 52% of the patients during their treatment and recovery time. A study from Norway reported that HNC survivors suffer larger earning declines than other cancer survivors and that the reductions were inversely correlated with education level [17]. We consider that patients with lower education are at the

highest risk of suffering negative impacts in their socio-professional life because of their head and neck cancer.

In one study, 69% of the patients used at least one cost coping strategy such as taking out a bank loan, borrowing money, delaying or not filling prescription medications [18]. Based on our observation and these data we started a new study to evaluate the impact of the financial toxicity in this patient population.

In our study, physical symptoms were the main barrier to return to work. Cancer-related fatigue is a common symptom in cancer patients and can be described as a feeling of physical, emotional, and cognitive tiredness. This can be caused by the cancer itself or the treatment [19].

Nearly all head and neck cancer patients report fatigue during treatment. In a longitudinal study of 311 head and neck cancer patients, Berg et colleagues found that physical fatigue was significantly worse at 3 months after treatment but it returned to similar scores at the 1- to 5-year follow-up [20]. Baxi et al. identified fatigue (29%) and cognitive impairment being the most listed reasons among those who were dissatisfied with their ability to work in a cohort of HPV positive head and neck cancer patients [21]. This resonates with our finding that fatigue was the most common reported symptom preventing return to work but the percentage complaining about this symptom was significantly higher (58.9%) in our cohort.

Some preclinical studies on fatigue caused by cancer therapy in HPV+ tumor-bearing mice demonstrate that fatigue is more physical than motivational [22]. In the PARSPORT trial, the cause of fatigue was correlated with the radiation dose received by the posterior fossa and cerebellum [23]. The study of Ferris et al. suggests that by reducing the absorbed maximum dose to the brainstem and medulla it might reduce the incidence of acute fatigue but the study doesn't give information about chronic fatigue [24].

Other barriers for non-return identified in our study include difficulty speaking, modified eating habits, anxiety and chronic pain. Fang et al. in a group of nasopharyngeal cancer reported oral dysfunction as a barrier to return to work similar to a study from the Netherlands which revealed trismus, sticky saliva, problems with teeth, problems with social eating and anxiety among those not returning to work [12,16].

The quality-of-life data of our patient population suggests that those who are not able to reemploy have lower functioning scores on all scales and significantly higher burden of symptoms. While sticky saliva and dry mouth were not significantly different among the two groups, those who did not return to work had worse oral pain, higher use of pain killers, worse social contact and social eating scores. It is difficult to determine whether those who returned are feeling better because they were able to reintegrate, or they were capable to reintegrate because they feel better and have less symptoms. To clarify

the cause effect relationship more in depth, face to face interviews are needed.

The general recommendations after treatment include adopting some lifestyle changes like maintaining a healthy weight, active exercise, eating a healthy diet, smoking cessation, limiting alcohol intake, safe sun exposure, adequate amounts of sleep and regular visits at the primary care provider. Yarlagadda et al. studied the effect of social work counseling to prepare patients for lifestyle changes before treatment. The counseling resulted in lower anxiety and stress, better motivation, improved communication and easier access to resources [25].

Surprisingly in our study only 13.5% of patients reported performing regular physical exercise. Although physical activity was not predictive for reemployment it has a positive impact on quality of life. Similar data were reported in a Taiwanese study which found that only 16.7% of head and neck cancer survivors were doing physical activity that met WHO guidelines [26]. In a systematic review on the subject of physical exercise as supportive therapy for head and neck cancer, an improvement in fatigue, lean body mass, physical functioning and overall quality of life was observed [27]. The randomized DAHANCA 25B trial studied the effect of progressive resistance training in the first 12 weeks after radiotherapy. Early exercise improved overall quality of life and cognitive function significantly more than delayed exercise as self-chosen physical activity [28].

There is no specific definition in our national guidelines regarding the responsibility of guiding and supervising the types of health interventions and rehabilitation of cancer survivors. More than three quarters of our cohort, 77% of our respondents, reported receiving no support in their reintegration from their primary care physician. Most of them reported receiving some form of support from their family and their oncologists. A structured, coordinated multidisciplinary rehabilitation program is urgently needed.

Our study is limited by the sample size and by the fact that we could not assess the separate effect of concomitant chemotherapy or surgery before radiotherapy, which can be a potential confounding factor. Another limitation is its cross-sectional nature.

In the light of these data, we think that a comprehensive rehabilitation program should be implemented at a national level with clear definition of responsibilities for all specialists and primary care physicians to enhance full physical and social rehabilitation after treatment. These interventions should offer support especially for patients identified to be at high risk, reducing cancer and treatment related fatigue, eating disorders by adopting improved radiation techniques that can reduce late side effects. Public campaigns are essential to encourage patients to participate in such programs and to become members of support and advocacy groups.

### Conclusions

Head and neck cancer survivors who manage to return to work have a better quality of life and global health status than those who could not return. The most vulnerable patients are with lower education, doing manual work and with advanced stage cancer. Chronic fatigue, speech problems and eating disorders were identified as main barriers of reemployment. Optimized radiotherapy planning to reduce radiation-induced side effects in conjunction with further studies exploring late physical and financial toxicity for this patient population would help to implement coordinated rehabilitation programs.

### Data Availability

The datasets generated during the current study are available from the corresponding author on reasonable request.

### Institutional Review Board Statement

The study was conducted in accordance with the Declaration of Helsinki, and approved by the Institutional Ethics Committee of the Iuliu Hațieganu University of Medicine and Pharmacy, Cluj-Napoca, Romania, Approval No. 302/7.12.2022

### Informed Consent Statement

Informed consent was obtained from all subjects involved in the study.

### References

- Bray F, Laversanne M, Sung H, Ferlay J, Siegel RL, Soerjomataram I, et al. Global cancer statistics 2022: GLOBOCAN estimates of incidence and mortality worldwide for 36 cancers in 185 countries. *CA Cancer J Clin.* 2024;74:229-263.
- Chen S, Cao Z, Prettner K, Kuhn M, Yang J, Jiao L, et al. Estimates and Projections of the Global Economic Cost of 29 Cancers in 204 Countries and Territories From 2020 to 2050. *JAMA Oncol.* 2023;9:465-472.
- Spelten ER, Sprangers MA, Verbeek JH. Factors reported to influence the return to work of cancer survivors: a literature review. *Psychooncology.* 2002;11:124-131
- Pearce A, Bradley C, Hanly P, O'Neill C, Thomas AA, Molcho M, et al. Projecting productivity losses for cancer-related mortality 2011 - 2030. *BMC Cancer.* 2016;16:804.
- Pearce AM, Hanly P, Timmons A, Walsh PM, O'Neill C, O'Sullivan E, et al. Productivity Losses Associated with Head and Neck Cancer Using the Human Capital and Friction Cost Approaches. *Appl Health Econ Health Policy.* 2015;13:359-367.
- Sung H, Ferlay J, Siegel RL, Laversanne M, Soerjomataram I, Jemal A, et al. Global Cancer Statistics 2020: GLOBOCAN Estimates of Incidence and Mortality Worldwide for 36 Cancers in 185 Countries. *CA Cancer J Clin.* 2021;71:209-249.
- Alterio D, Marvaso G, Ferrari A, Volpe S, Orecchia R, Jereczek-Fossa BA. Modern radiotherapy for head and neck cancer. *Semin Oncol.* 2019;46:233-245.
- Fayers PM, Aaronson NK, Bjordal K, et al. The EORTC QLQ-C30 scoring manual. 3rd ed. Brussels: European Organisation for Research and Treatment of Cancer; 2001.
- Ringash J, Bernstein LJ, Devins G, Dunphy C, Giuliani M, Martino R, et al. Head and Neck Cancer Survivorship: Learning the Needs, Meeting the Needs. *Semin Radiat Oncol.* 2018;28:64-74.
- de Boer AGEM, de Wind A, Coenen P, van Ommen F, Greidanus MA, Zegers AD, Det al. Cancer survivors and adverse work outcomes: associated factors and supportive interventions. *Br Med Bull.* 2023;145:60-71.
- So N, McDowell LJ, Lu L, Xu W, Rock K, Waldron J, et al. The Prevalence and Determinants of Return to Work in Nasopharyngeal Carcinoma Survivors. *Int J Radiat Oncol Biol Phys.* 2020;106:134-145.
- Fang FM, Chiu HC, Kuo WR, Wang CJ, Leung SW, Chen HC, et al. Health-related quality of life for nasopharyngeal carcinoma patients with cancer-free survival after treatment. *Int J Radiat Oncol Biol Phys.* 2002;53:959-968.
- Mols F, Tomalin B, Pearce A, Kaambwa B, Koczwara B. Financial toxicity and employment status in cancer survivors. A systematic literature review. *Support Care Cancer.* 2020;28:5693-5708.
- Taskila-Brandt T, Martikainen R, Virtanen SV, Pukkala E, Hietanen P, Lindbohm ML. The impact of education and occupation on the employment status of cancer survivors. *Eur J Cancer.* 2004;40:2488-2493.
- Pryce J, Munir F, Haslam C. Cancer survivorship and work: symptoms, supervisor response, co-worker disclosure and work adjustment. *J Occup Rehabil.* 2007;17:83-92.
- Verdonck-de Leeuw IM, van Bleek WJ, Leemans CR, de Bree R. Employment and return to work in head and neck cancer survivors. *Oral Oncol.* 2010;46:56-60.
- Syse A, Tretli S, Kravdal Ø. Cancer's impact on employment and earnings--a population-based study from Norway. *J Cancer Surviv.* 2008;2:149-158.
- de Souza JA, Kung S, O'Connor J, Yap BJ. Determinants of Patient-Centered Financial Stress in Patients With Locally Advanced Head and Neck Cancer. *J Oncol Pract.* 2017;13:e310-e318.
- Berger AM, Mooney K, Alvarez-Perez A, Breitbart WS, Carpenter KM, Cella D, et al. Cancer-Related Fatigue, Version 2.2015. *J Natl Compr Canc Netw.* 2015;13:1012-1039.
- Berg M, Silander E, Bove M, Johansson L, Nyman J, Hammerlid E. Fatigue in Long-Term Head and Neck Cancer Survivors From Diagnosis Until Five Years After Treatment. *Laryngoscope.* 2023;133:2211-2221.
- Baxi SS, Salz T, Xiao H, Atoria CL, Ho A, Smith-Marrone S, et al. Employment and return to work following

- chemoradiation in patient with HPV-related oropharyngeal cancer. *Cancers Head Neck*. 2016;1:4.
22. Phan TT, Scott KS, Chelette B, Phillip West A, Dantzer R. The fatigue-inducing effects of cancer and its therapy are characterized by decreased physical activity in the absence of any motivational deficit. *Brain Behav Immun*. 2024;117:205-214.
  23. Gulliford SL, Miah AB, Brennan S, McQuaid D, Clark CH, Partridge M, et al. Dosimetric explanations of fatigue in head and neck radiotherapy: an analysis from the PARSPORT Phase III trial. *Radiother Oncol*. 2012;104:205-212.
  24. Ferris MJ, Zhong J, Switchenko JM, Higgins KA, Cassidy RJ 3rd, McDonald MW, et al. Brainstem dose is associated with patient-reported acute fatigue in head and neck cancer radiation therapy. *Radiother Oncol*. 2018;126:100-106.
  25. Yarlagadda BB, Hatton E, Huettig J, Deschler D. Patient and staff perceptions of social worker counseling before surgical therapy for head and neck cancer. *Health Soc Work*. 2015;40:120-124.
  26. Fang YY, Wang CP, Chen YJ, Lou PJ, Ko JY, Lin JJ, et al. Physical activity and fitness in survivors of head and neck cancer. *Support Care Cancer*. 2021;29:6807-6817.
  27. Capozzi LC, Nishimura KC, McNeely ML, Lau H, Culos-Reed SN. The impact of physical activity on health-related fitness and quality of life for patients with head and neck cancer: a systematic review. *Br J Sports Med*. 2016;50:325-338.
  28. Lønbro S, Dalgas U, Primdahl H, Johansen J, Nielsen JL, Aagaard P, et al. Progressive resistance training rebuilds lean body mass in head and neck cancer patients after radiotherapy - results from the randomized DAHANCA 25B trial. *Radiother Oncol*. 2013;108:314-319.