

# Disparity of Perception of Quality of Life Between Head and Neck Cancer Patients and Caregivers

**Zachary Kassir**

University of Pittsburgh School of Medicine, Department of Otolaryngology

**Jinhong Li**

University of Pittsburgh Graduate School of Public Health, Department of Biostatistics

**Christine Harrison**

University of Pittsburgh School of Medicine, Department of Otolaryngology

**Jonas T. Johnson**

University of Pittsburgh School of Medicine, Department of Otolaryngology

**Marci L. Nilsen** (✉ [mlf981@pitt.edu](mailto:mlf981@pitt.edu))

University of Pittsburgh School of Nursing, Department of Acute and Tertiary Care

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## Research Article

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# Abstract

## Background

Caregivers are invaluable sources of support for individuals recovering from head and neck cancer (HNC). Accordingly, minimizing caregiver distress is essential to promote the well-being of both caregivers and their patients. This study assessed if psychosocial distress (i.e., anxiety and depression) among head and neck cancer caregivers is associated with a difference in how caregivers and their patients perceive patients' quality of life (QOL) after treatment completion.

## Methods

Caregivers completed the University of Washington QOL Questionnaire (UWQOL) for their patients while patients completed the survey as part of clinic intake. Linear regression was used to analyze the association between differences in caregivers' and patients' QOL scores and caregiver anxiety (Generalized Anxiety Questionnaire-7) and depression (Patient Health Questionnaire-8).

## Results

Of 47 caregivers recruited, 42.6% (n = 20) viewed patient QOL more negatively than patients themselves. These caregivers scored significantly higher on the PHQ-8 than caregivers who agreed with patients ( $p \leq .01$ ).

## Conclusion

Caregivers commonly view patients' QOL more negatively than patients themselves. These caregivers tend to have greater psychosocial distress than caregivers who agree with their patients. Interventions designed to aid at-risk caregivers are critically needed.

## Background

According to the American Society of Clinical Oncology, more than 60,000 people will develop head and neck cancer (HNC) in 2020.<sup>1</sup> HNC is often treated with multiple modalities (i.e., surgery, chemotherapy, radiation), and severe side effects often contribute to long-term morbidity in the post-treatment "survivorship" phase.<sup>1,2</sup> For example, surgical resection followed by reconstruction can result in disfigurement as well as prolonged pain and limited mobility of the shoulder and neck.<sup>2,3</sup> Additionally, radiation can destroy major salivary glands and cause oropharyngeal fibrosis, resulting in long-term dysphagia, dysphonia, and aspiration-induced pneumonia.<sup>4</sup> Deficits in sensation and taste are also common after treatment and can be permanent.<sup>2,4</sup>

For illnesses with high morbidity, the presence of an informal caregiver (e.g., a family member or friend) who provides care and assists in the recovery process improves outcomes for patients.<sup>5,6,7</sup> The existing literature has demonstrated that HNC caregivers endure higher levels of psychological distress than the general population<sup>7</sup> and patients themselves.<sup>1,8,9</sup> Moreover, HNC demands a unique array of care responsibilities, especially in the post-treatment period, in comparison to other cancers [e.g., maintaining patients' percutaneous-endoscopic-gastrostomy (PEG) tubes and tracheostomy tubes, preparing food that patients can tolerate, communicating for those patients that have speech difficulties, etc.] warranting a look at caregiver distress, specifically in the context of this disease.

Minimizing caregiver distress is essential not only to promote the well-being of caregivers but to ensure that they can effectively care for their patients. However, the topic remains understudied in the context of HNC. Possible contributing factors to caregiver distress that have been studied include disease characteristics (e.g., tumor site and stage), caregiver demographics, and aspects of the caregiving experience (e.g., time spent caregiving, length of time spent caregiving).<sup>2</sup>

Another factor that has been examined in prior research on caregiving in HNC is the association between caregiver distress and the correspondence in how patients and caregivers perceive patients' illness experience. For instance, it has been demonstrated that, at the time of HNC diagnosis, caregivers express greater concern about the illness and believe the illness will last longer than patients.<sup>10,11</sup> However, one aspect of illness perception that has not been examined in the context of HNC is the perception of how illness impacts patient-quality-of-life (QOL). In fields where caregiver distress is more extensively studied, including Alzheimer's disease<sup>12, 13</sup>, stroke recovery,<sup>14, 15</sup> pain management,<sup>17</sup> and other forms of cancer<sup>18, 19</sup> it has been demonstrated that caregivers who overestimate the severity of an illness's impact on patient QOL, relative to patient-reported severity, have worse psychological and physical health. Accordingly, we are interested to see if this translates to HNC as well. Specifically, we seek to examine the correspondence in how patients and caregivers perceive patients' head and neck cancer-related QOL after treatment completion and if a difference is associated with increased levels of distress in caregivers. It is our hope that an association, if identified, could serve as a potential target of future interventions to mitigate caregiver distress.

## Methods

We conducted a cross-sectional analysis of 47 patient-caregiver dyads who were recruited at the UPMC HNC Survivorship Clinic between August 2019 and April 2020. Individuals accompanying patients who had completed treatment for squamous cell carcinoma of the oral cavity, oropharynx, larynx, hypopharynx, or with an unknown primary were screened for eligibility. Both individuals had to be over 18 years of age and identify English as their primary language. Patients had to identify individuals as caregivers who "significantly assisted them during their treatment and recovery" for at least an hour a week. Additionally, patients were asked if the accompanying individual helped them fill out pre-intake surveys. If help was given, dyads were excluded. Caregivers were additionally asked if they had been

providing care to the patient since the patient completed treatment or if they started providing care at a later point in the patient's post-treatment survivorship course. All caregivers completed questionnaires in isolation to ensure that patients did not directly influence their answers.

## Caregivers Characteristics

Caregivers were asked to complete three questionnaires: Patient Health Questionnaire-8 (PHQ-8), Generalized Anxiety Disorder Questionnaire-7 (GAD-7), and the University of Washington Quality of Life Questionnaire (UWQOL). Caregivers also answered questions regarding demographics (e.g., age, gender, marital status, education, and employment) and aspects of the caregiving experience (e.g., hours a week and duration of caregiving).

The PHQ-8<sup>20</sup> and the GAD-7<sup>21</sup> were completed to assess caregivers' symptoms of depression and anxiety, respectively. The PHQ-8 is an 8-item questionnaire with scores ranging from 0–24 while the GAD-7 has 7 items with scores ranging from 0–21. Higher scores indicate greater symptoms of depression/anxiety. Both questionnaires are well-validated instruments that are used widely in oncologic practice.<sup>22, 23</sup>

The UWQOL is a validated HNC-specific health-related QOL questionnaire. It contains twelve domains and is interpreted in terms of its two composite scores: a physical QOL score (i.e., an average of chewing, swallowing, speech, taste, saliva, and appearance domains) and a social-emotional QOL score (i.e., an average of anxiety, mood, pain, activity, recreation, and shoulder domains). Scores range from 0 to 100, with higher scores indicating better QOL.<sup>24</sup> Caregivers were asked to answer this survey for their patients but were asked to select responses that they believe their patients *should* give regardless of the responses that they believe their patients *would* give.

## Patient Clinical Characteristics.

Clinical characteristics of patients, including tumor site, tumor stage, and treatment modality, were abstracted from the medical record. Patients routinely complete the UWQOL as part of the intake for the clinic. These UWQOL scores were obtained from the medical record and were subtracted from caregiver scores. Prior research has established that differences of 7 points or greater in UWQOL scores should be interpreted as clinically significant.<sup>25,26,27</sup> As such, any caregivers who reported scores at least 7 points less than their patients were identified as perceiving their patients' QOL to be worse than patients themselves.

## Statistical Analysis

Statistical analysis was performed using RStudio (1.1.456; RStudio, Inc, Boston, Massachusetts). In the descriptive analysis, frequencies and percentages were calculated for categorical variables and means and standard deviations for continuous variables. In univariate analysis, Wilcoxon signed-rank test and Kruskal-Wallis rank sum test were performed to determine the impact of patient clinical characteristics

and caregiver characteristics on GAD-7 and PHQ-8 scores for categorical variables with 2 categories or more than 2 categories, respectively. Characteristics that met screening criteria of  $p \leq .10$  were then considered jointly via multivariate analysis. More specifically, multivariate models were constructed: one that assessed relationships between variables of interest and GAD-7 scores and another that assessed relationships between variables of interest and PHQ-8 scores. The primary variables of interest (i.e., significant differences in perception of physical QOL and significant differences in perception of social-emotional QOL) were included in both models. Interaction plots were used to evaluate potential interactions between variables of interest (i.e., differences in social-emotional QOL and differences in physical QOL). In this way, multivariate linear regression analysis was performed to assess the relationship between significant differences in perception of QOL and GAD-7 and PHQ-8 scores while controlling for covariates that met our screening criteria.

This study was reviewed by the Human Research Protection Office of the University of Pittsburgh who granted approval of all human procedures performed (Study 19060320). All methods were performed in accordance with the Declaration of Helsinki, and all participants gave informed consent for this study.

## Results

### Patient and Caregiver Characteristics

In total, 47 patient-caregiver dyads were included. Table 1 presents caregiver characteristics, while Table 2 presents the clinical characteristics of patients. Mean [Standard deviation (SD)] ages of patients and caregivers were 66.8 (8.6) and 62.6 (10.3), respectively. Caregivers were predominantly female ( $n = 33$ , 70.2%) and spouses or partners of the patient ( $n = 39$ , 83.0%). All caregivers had been providing care to their patients since the time of treatment completion. The majority of caregivers had been providing care for more than twelve months ( $n = 33$ , 70.2%), and most caregivers were providing care for at least nine hours per week ( $n = 32$ , 68.1%).

Table 1  
Caregiver characteristics/demographics

	N(%)	Mean GAD-7 Score (SD)	P value* (GAD-7 Score)	Mean PHQ-8 Score (SD)	P value* (PHQ-8 Score)
<b>Gender</b>					
Male	14 (29.8%)	3.27 (5.40)	0.05	3.82 (5.13)	0.20
Female	33 (70.2%)	5.25 (4.39)		5.64 (5.21)	
<b>Marital Status</b>					
Married/Living with partner	39 (83.0%)	4.72 (4.47)	0.97	4.85 (4.92)	0.28
Not Married	8 (17.0%)	5.13 (5.84)		7.00 (6.41)	
<b>Education</b>					
Bachelor's or beyond	12 (25.5%)	4.92 (4.98)	0.95	4.00 (4.40)	0.30
Less than bachelors	35 (74.5%)	4.74 (4.62)		5.63 (5.44)	
<b>Employment</b>					
Working FT/PT	14 (29.8%)	5.71 (5.55)	0.15	5.07 (5.18)	0.13
Not employed or not seeking employment (homemaker or disabled)	12 (25.5%)	6.42 (5.23)		7.25 (5.69)	
Retired	21 (44.7%)	3.24 (3.19)		4.14 (4.80)	
<b>Difficulty paying for basic needs</b>					
No	36 (76.6%)	4.53 (4.67)	0.44	4.72 (5.26)	0.10

Abbreviation: GAD-7, Generalized Anxiety Disorder Questionnaire-7; PHQ-8, Patient Health Questionnaire-8

\*P-values were calculated with Wilcoxon signed-rank test for two-category data and Kruskal-Wallis rank sum test for data with more than two categories.

	N(%)	Mean GAD-7 Score (SD)	P value* (GAD-7 Score)	Mean PHQ-8 Score (SD)	P value* (PHQ-8 Score)
Yes	11 (23.4%)	5.64 (4.76)		6.82 (4.83)	
<b>Hours spent caregiving per week</b>					
8 or less hours per week	15 (31.9%)	3.20 (3.82)	0.16	4.27 (4.20)	0.77
9–39 hours per week	13 (27.7%)	6.38 (5.49)		6.38 (6.68)	
40 or more hours per week	19 (40.4%)	4.95 (4.49)		5.16 (4.87)	
<b>How long have you been giving care</b>					
< 12 months	14 (29.8%)	5.29 (5.28)	0.91	4.86 (4.91)	0.85
13 monts-5 years	14 (29.8%)	3.93 (3.29)		5.00 (3.46)	
More than 5 years	19 (40.4%)	5.05 (5.17)		5.63 (6.52)	
Abbreviation: GAD-7, Generalized Anxiety Disorder Questionnaire-7; PHQ-8, Patient Health Questionnaire-8					
*P-values were calculated with Wilcoxon signed-rank test for two-category data and Kruskal-Wallis rank sum test for data with more than two categories.					

Table 2  
Patient Clinical Characteristics

	N(%)	Mean GAD-7 Score (SD)	P value* (GAD-7 Score)	Mean PHQ-8 Score (SD)	P value* (PHQ-8 Score)
<b>Tumor Location</b>					
Oral cavity/maxillary	11 (23.4%)	3.09 (3.53)	0.26	3.73 (4.03)	0.60
Oropharynx	13 (27.7%)	7.08 (5.68)		6.77 (6.70)	
Larynx/Hypopharynx	14 (29.8%)	4.57 (4.54)		5.71 (5.20)	
Other	9 (19.1%)	3.89 (3.76)		4.00 (3.81)	
<b>Tumor Stage</b>					
Stage I-II	18 (38.3%)	4.28(4.07)	0.40	5.33 (5.59)	0.86
Stage III-IV	24 (51.1%)	5.79 (5.26)		5.50 (5.36)	
Unknown Primary	5 (10.6%)	1.80 (1.48)		3.40 (2.61)	
<b>Treatment</b>					
Surgery Alone	3 (6.4%)	2.00 (2.00)	0.11	2.67 (0.58)	0.25
RT/CRT	13 (27.7%)	7.54 (6.08)		7.00 (6.14)	
Surgery and RT/CRT	31 (65.9%)	3.90 (3.66)		4.71 (4.89)	
Abbreviation: GAD-7, Generalized Anxiety Disorder Questionnaire-7; PHQ-8, Patient Health Questionnaire-8					
*P-values were calculated with Wilcoxon signed-rank test for two-category data and Kruskal-Wallis rank sum test for data with more than two categories.					

The larynx/hypopharynx was the most common tumor site (n = 14, 29.8%), though the distribution of patients was largely equitable across all sites. Half of the patients were diagnosed with advanced-stage (III-IV) disease (n = 24, 51.1%), and most were treated with both surgery and adjuvant treatment (n = 31, 65.9%).

Mean (SD) caregiver GAD-7 and PHQ-8 scores were 4.79 (4.66) and 5.21 (5.19), respectively. Caregiver gender was the only variable that met the criteria ( $p \leq 0.1$ ) for inclusion in our multivariate model for GAD-7 scores, with female caregivers and male caregivers reporting mean (SD) GAD-7 scores of 5.25

(4.39) and 3.27 (5.40), respectively ( $p = .05$ ). Difficulty paying for basic needs was the only variable that met the criteria for inclusion in our multivariate model for PHQ-8 scores with caregivers who admitted to difficulty and caregivers denying difficulty reporting mean (SD) PHQ-8 scores of 6.82 (4.83) and 4.72 (5.26), respectively ( $p = 0.1$ ).

## Caregivers' Perception of Patient Quality of Life

Table 3 demonstrates that of the 47 caregivers enrolled in this study, 42.6% viewed patient social-emotional QOL more negatively, and 31.9% viewed physical QOL more negatively than patients themselves (Table 3). Fisher's exact test showed that differences in perception of physical QOL and differences in perception of social-emotional QOL were significantly associated with each other ( $p < .05$ ). An interaction plot (supplemental Fig. 1) reinforces this conclusion. As such, an interaction term was incorporated into both of our multivariate models.

Table 3  
Frequency of significant differences in illness perception

	N(%)	Mean GAD-7 Score (SD)	P value* (GAD-7 score)	Mean PHQ- 8 Score (SD)	P value* (PHQ- 8 Score)
<b>Significant difference in perception of social-emotional quality of life (perceived worse by caregiver)</b>					
Yes	20 (42.6%)	5.90 (4.95)	0.11	7.10 (6.33)	0.07
No	27 (57.4%)	3.96 (4.35)		3.81 (3.69)	
<b>Significant difference in perception of physical quality of life (perceived worse by caregiver)</b>					
Yes	15 (31.9%)	6.33 (5.70)	0.21	7.33 (6.28)	0.07
No	32 (68.1%)	4.06 (3.98)		4.22 (4.36)	
Abbreviation: GAD-7, Generalized Anxiety Disorder Questionnaire-7; PHQ-8, Patient Health Questionnaire-8					
*P-values were calculated with Wilcoxon signed-rank test.					

Table 4 shows that, when controlling for caregiver gender, differences in perception of social-emotional QOL and differences in perception of physical QOL were not significantly associated with caregiver anxiety symptoms ( $p > .05$ ). However, it is worth noting that both variables were just beyond the boundary of significance ( $p = .08$  and  $p = .07$ , respectively). (Insert Table 4) Table 5 shows that, when controlling for

difficulty paying for basic needs, differences in perception of social-emotional QOL *and* differences in perception of physical QOL were significantly associated with PHQ-8 scores ( $p = .01$  and  $p = .007$ , respectively). Caregivers who reported patients to have worse social-emotional QOL than patients themselves had PHQ-8 scores 6.80 points higher than caregivers who agreed with patients (95% confidence interval [CI], 1.66, 11.49;  $p = .01$ ). Caregivers who reported patients to have worse physical QOL than patients themselves had PHQ-8 scores 6.09 points higher than caregivers who agreed with patients (95% confidence interval [CI], 1.78, 10.40;  $p < .01$ ).

Table 4  
Multivariate Linear Regression of Variables Associated with GAD-7 Score.

Variables	Coefficient (95% CI)	P value
<b>Significant difference in perception of social-emotional quality of life (perceived worse by caregiver)</b>	(Base)	0.08
No	4.40 (-0.58, 9.38)	
Yes		
<b>Significant difference in perception of physical quality of life (perceived worse by caregiver)</b>	(Base)	0.07
No	3.80 (-0.27, 7.87)	
Yes		
<b>Interaction</b>	4.62 (-1.45, 10.70)	0.13
	-4.62 (-10.70, 1.45)	
<b>Caregiver Gender</b>	(Base)	0.24
Female	-1.86 (-5.00, 1.28)	
Male		
Abbreviation: GAD-7, Generalized Anxiety Disorder Questionnaire-7; PHQ-8, Patient Health Questionnaire-8		

Table 5  
Multivariate Linear Regression of Variables Associated with PHQ-8 Score.

Variables	Coefficient (95% CI)	P value
<b>Significant difference in perception of social-emotional quality of life (perceived worse by caregiver)</b>	(Base)	0.01
No	6.80 (1.66, 11.94)	
Yes		
<b>Significant difference in perception of physical quality of life (perceived worse by caregiver)</b>	(Base)	0.007
No	6.09 (1.78, 10.40)	
Yes		
<b>Interaction</b>	6.77 (0.52, 13.02)	0.03
	-6.77 (-13.02, -0.52)	
<b>Difficulty paying for basic needs</b>	(Base)	0.08
No	2.97 (-0.41, 6.35)	
Yes		
Abbreviation: GAD-7, Generalized Anxiety Disorder Questionnaire-7; PHQ-8, Patient Health Questionnaire-8		

## Discussion

This is the first study to demonstrate that a significant portion of HNC caregivers perceives patients' QOL more negatively than patients themselves after treatment completion and that these caregivers have greater psychological distress. According to our univariate analysis, caregiver gender and time spent caregiving were also associated with caregiver distress, and these were controlled for in our multivariate analysis. These results are consistent with the findings of Verdonck-de et al.<sup>28</sup> who found that time since treatment completion was not significantly associated with caregiver distress (as measured by the Hospital Anxiety and Depression Scale) as well as Ross et al. who examined time since cancer diagnosis.<sup>29</sup> Moreover, no significant relationships were found with tumor stage, tumor location, or treatment modality, which is also consistent with the findings of Verdonck-et al.<sup>28</sup>

Regarding significant differences in patient-reported and caregiver-reported scores of patients' QOL, a significant portion of caregivers believed their patients had worse QOL than patients themselves after treatment completion. Roughly one-third of caregivers viewed the social-emotional QOL, and almost half viewed the physical QOL of their patients more negatively than patients themselves. Disagreement

regarding physical QOL and disagreement regarding social-emotional QOL were not significantly associated with caregiver anxiety in our multivariate analysis (Table 4). However, both points of disagreement were significantly associated with caregiver depression (Table 5). It is possible that caregivers who perceive patient-QOL more negatively in turn believe that their patients require more care. Intuitively, the perceived limitations on a caregiver's life would result in depression more so than anxiety. This is consistent with the findings of Lee et al. who found that 6 months after diagnosis of HNC, 12.9% of caregivers had depressive disorders while 0% had anxiety disorders.<sup>30</sup>

Caregivers who agreed with patients regarding physical or social-emotional QOL reported average PHQ-8 scores of 4.22 and 3.81 respectively, indicating no symptoms of depression (PHQ-8 score < 5). Disagreeing caregivers reported scores of 7.33 and 7.10, indicating mild symptoms of depression (PHQ-8 score between 5 and 10). However, after controlling for relevant covariates, we found that caregivers who had negative views of patients' physical or social-emotional QOL reported average PHQ-8 scores more than 6 points higher than caregivers who agreed with their patients (Table 5), more than twice the difference in depressive symptoms observed without controlling for covariates.

Our findings are supported by prior research on caregiver burden in other medical specialties. In a 2016 study of couples living with non-small cell lung cancer, Lyons et al reported that, on average, spouses rated patients' fatigue more severely than patients themselves. Moreover, spouse mental health was worse when couples had disparate appraisals of patients' fatigue.<sup>18</sup> Similarly, in a 2015 study of stroke survivors and their spouses, McCarthy et al reported that 43% of spouses rated survivor physical-functioning (as measured by the Stroke Impact Scale) significantly more negatively than survivors themselves. Moreover, spouses who perceived their patients' physical function more negatively than patients themselves were significantly more likely to experience greater depressive symptoms as measured by the PHQ8,<sup>15</sup> an association that was also identified in our study. Indeed, we feel that this association is heavily supported because it does not appear to depend on the instrument used to measure physical function (our study used the UWQOL while McCarthy et al used the Stroke Impact Scale). Furthermore, Miaskowski et al reported on patient-caregiver dyads going through cancer treatment who were asked to rate the severity of patients' pain. According to the authors, caregivers in "non-congruent dyads" had significantly higher depression scores and caregiver strain scores than those in "congruent dyads."<sup>16</sup> This finding is in line with our own study, especially given that "pain" is one of the elements included in the social-emotional QOL score of the UWQOL questionnaire.

We considered multiple explanations for the association between disagreement regarding patient QOL between patients and caregivers and caregiver depression. It is possible that differences in perception signify an unmet need for communication between patients and their caregivers. As reported by Fried et. al in a study of 193 severely ill patients (suffering from cancer, COPD, or congestive heart failure) and their caregivers, 39.9% of caregivers desired more communication with their patient regarding their needs and goals for treatment, and those who complained of difficulties communicating had higher caregiver burden (measured by Zarit Burden Inventory).<sup>31</sup> Simply put, we wonder if an unmet need for

communication is a prevalent problem among HNC caregivers as well. This explanation would underscore the utility of resources that facilitate communication between patients and caregivers. For example, it may be prudent to incorporate provider facilitated discussions between patients and caregivers regarding the thoughts and wellbeing of both parties at follow up appointments.

Alternatively, the extant literature supports the existence of a reciprocal relationship between differences in perception of patient QOL and caregiver depression. It is well-established that HNC caregivers experience depression more often than the general population.<sup>32,33</sup> Intuitively, coping with the illness of a loved one, in combination with the limitations placed on one's own life due to the responsibilities of caregiving, make this population highly susceptible to depressed mood. As suggested by the cognitive model of depression, depressed mood, caused by an initial trigger, begets negative cognitions (in this case the negative assessment of a patient's QOL). These negative cognitions, in turn, reinforce depressed mood, culminating in pathologic depression.<sup>34,35</sup> Cognitive-behavioral therapy works to break this vicious cycle by helping patients reconcile their negative thoughts with conflicting realities (the patient's more positive assessment of their own QOL).<sup>36,37</sup> At present, referrals for therapy as needed is a standard part of care for HNC survivors.<sup>38</sup> It stands to reason that routine assessment of mental health and subsequent referrals for caregivers are warranted as well.

Limitations of this study warrant discussion. Most notably, the sample size for this study limits its ability to determine significance, and future studies should reexamine our findings with larger cohorts. Moreover, interrelationships with variables that were not examined in this study possibly exist. Additionally, while we asked caregivers to fill out the UWQOL for their patients to gauge caregivers' perception of patient QOL, the survey is not validated for this use.

## Conclusions

At present, caregiver burden in the context of HNC remains relatively understudied. To our knowledge, this is the first study to reveal that a significant portion of HNC caregivers perceive patients' QOL more negatively than patients themselves in the post-treatment period and that these differences are significantly associated with caregiver distress. Specifically, caregivers who believe their patients' QOL is worse than patients believe themselves score significantly higher on the PHQ8 than those who do not disagree with their patients. Possible interventions include provider facilitated discussions between patients and caregivers as well as routine assessments of caregivers' mental health and referrals to mental health resources as needed; these strategies should be examined in future studies. As efforts lead to effective interventions, improvement in long-term outcomes for patients and their caregivers is likely to be seen.

## Abbreviations

HNC  
Head and Neck Cancer

QOL  
Quality of Life  
UWQOL  
University of Washington Quality of Life Questionnaire  
PHQ8  
Patient Health Questionnaire-8  
GAD7  
Generalized Anxiety Disorder Questionnaire-7

## Declarations

**Ethical approval and consent to participate:** This study was reviewed by the Human Research Protection Office of the University of Pittsburgh who granted approval of all human procedures performed (Study 19060320). All participants gave informed consent for this study.

**Consent for publication:** Not applicable

**Availability of data and materials:** The data that support the findings of this study are available on reasonable request from the corresponding author M.L.N. The data are not publicly available due to them containing information that could compromise research participant privacy/consent.

**Competing Interests:** The authors declare that they have no competing interests

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### **Author's Contributions:**

Z.K. – Contributed to the acquisition, statistical analysis, and interpretation of the data as well as the writing of the manuscript.

J.L. – Contributed to the statistical analysis and interpretation of the data.

C.H. – Contributed to the acquisition and interpretation of the data.

J.T.J – Contributed to the interpretation of the data and writing of the manuscript and provided mentorship/direction to other authors.

M.L.N – Contributed to the acquisition, statistical analysis, and interpretation of the data, writing of the manuscript and was the primary source of mentorship/direction for this study.

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