

ORIGINAL ARTICLE

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# Cut-off points to classify numeric values of quality of life into normal, mild, moderate, and severe categories: an update for EORTC-QLQ-H&N35

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## Abstract

**Background** Quality of life (QoL) is an important determinant of physical and mental health. QoL in head and neck cancer tends to deteriorate due to changes in the physical, functional, psychological aspects. EORTC-QLQ-H&N35 is an instrument that measure the QoL specifically in head and neck cancer patients. EORTC-QLQ-H&N35 give a numeric value to QoL of patients with high value correspond to better QoL.

**Objective** The aim of present study was to find out the cut-off points of numeric values of EORTC-QLQ-H&N35 to categorize QoL impairment into different categories (normal, mild, moderate, and severe). Present study also aims analyze the QoL among head and neck cancer patients under these new categories.

**Methodology** Total 205 patients of head and neck cancer visiting to the outpatient unit were enrolled in this study. Hindi version of EORTC-QLQ-H&N35 was used to evaluate the QoL. Total 9 classification schemes were created with different cut-off points to classify the global QoL score into normal, mild, moderate and severe categories. QoL data was then analyze using the scheme having highest F value in ANOVA test.

**Results** Classification scheme having cut-off values 76–100 for normal QoL, 51–75 for mild QoL impairment, 26–50 for moderate and 0–25 for severe QoL impairment found to have highest F value (729.915) in ANOVA test. The mean QoL score among total 205 patients were  $60.08 \pm 19.06$ . Based on the new classification scheme, QoL was normal in 46 (22.4%) patients whereas QoL was impaired to mild level in 76 (37.1%) patients, to moderate level in 76 (37.1%) and to severe level in 7 (3.4%) patients. Role functioning, emotional functioning and social functioning was impaired to severe level in 4 (2.0%), 13 (6.3%) and 3 (1.5%) patients respectively.

**Conclusion** EORTC-QLQ-H&N35 offer a comprehensive review of QoL in head and neck cancer patients. By designating the QoL score into different categories, it will become easier for clinician to have a better idea of QoL of head and neck cancer patients.

**Keywords** Quality of life, Head and neck cancer, Surgery, Treatment, Psychology

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## Introduction

The European Organization for Research and Treatment of Cancer (EORTC) Quality of Life Core Questionnaire (QLQ-C30) is specifically designed to evaluate the quality of life (QoL) of the cancer patients. The psychometric properties of the EORTC-QLQ were originally described in 1992 [1]. In the year 1994, the first version of the EORTC-QLQ module for head and neck cancer patients (H&N37) was published [2], which is revised (H&N35) and validated in 1999 [3], and again tested on large sample of 622 head and neck cancer patients from 12 different countries in year 2000 [4]. As per the recently published systemic review, studies on EORTC QLQ-H&N35 were conducted in 28 countries and questionnaire was validated in 21 different languages [5]. Chaukar et al. in 2005, translated and validated the EORTC QLQ-H&N35 questionnaire into Hindi language for India population by testing it on 200 patients of head and neck cancer [6].

EORTC QLQ-H&N35 measure QoL on numerical rating scale and give QoL a number ranging from 0 to 100. A higher number correspond to the higher QoL. The classifications of numerical score of a questionnaire into normal, mild, moderate, and severe are often used by clinicians and psychologists to facilitate communication between patients and medical specialists. However, converting the numerical rating scale score into the discrete categories is not a simple task. If the numerical score being simply divide into four or more equal portions, it may be falsely represented the actual state of disease. To convert numerical score into discrete categories, some statistical approach must be followed to capture appropriate cutoff points [7].

Serlin et al. (1995) tried to solve this problem for visual analogue scale (VAS) using a specific statistical technique by calculating the proportion of the variation in pain-related disability that may be accounted for various pain intensity categories [8]. Same statistical method has been used to various patient groups and also replicated for the cancer patients [7]. In addition, Hirschfeld and Zernikow (2013) used a bootstrap resampling procedure and found a very large variability in the cut-off points in their sample of children and adolescents with chronic pain. They recommended that the researchers who are trying define cut-off points for a numeric score must include measures of variability to find the optimal cut-off points [9].

Till date, no study is available which defined the cut-off value of numerical rating scale of EORTC QLQ-H&N35 to classify the QoL into discrete categories. Present study is the first in which classification method describe by Serlin et al. [8] and bootstrap resampling procedure defined by Hirschfeld and Zernikow [9] was used to find

out the optimum cut-off point of QoL score to designate the score into simple discrete categories. Present study also aims to analyzed the QoL in head and neck cancer patients into different categories of normal, mild, moderate and severe by using the new classification scheme.

## Methods

### Study design

Present study was a prospective, observational, descriptive, hospital-based study that was conducted over a period of three years. Total 205 patients of head and neck cancer were included in this study who were visited the outpatient unit of Department of Otolaryngology and Head & Neck Cancer. Only preoperative adult patients with any subtype of head and neck cancer, and any gender were included in this study; whereas patients with recurrence of disease or patients previously obtaining treatment from outside the host institute were excluded from the study.

### EORTC-QLQ-H&N35

The QoL was analyzed using the Hindi version of EORTC-QLQ-H&N35. The questionnaire has two modules among which the general QLQ30 module have total 30 items, and H&N35 module have 35 items. All items of the QLQ30 module are rated on the Likert scale whereas 30 items in H&N35 module are rated on Likert scale and 5 items have binary choices. The QLQ30 module have three scale including the global health status (single subscale), functional scale (five subscales) and symptoms scale (nine subscales). The H&N35 module have 18 symptoms scale.

### Scoring of EORTC-QLQ-H&N35

The scores on all subscales range from 0 to 100. A higher response level is indicated by a high score. Accordingly, a high score on the global health status indicates a good QoL, a high score on the functional subscales indicates a healthy level of functioning, and a high score on the symptom subscales indicates a high degree of symptomatology. The raw score for the respective subscale was obtained by taking the average score of items of belong to the respective subscale.

$$RawScore = RS = \frac{(I_1 + I_2 + I_3 + \dots + I_n)}{n}$$

The raw score (RS) is then transformed into the linear score (S) using the formula mentioned below. The range of item was calculated using the rating range of the item values. For items which is rated from 1 to 4 will have a range 3, and items which are rated from 1 to 7 will have a range 6.

$$Functional\ scales = S = \left\{ 1 - \frac{(RS-1)}{Range} \right\} \times 100$$

$$Symptom\ scales\ \&\ Global\ health\ status = S = \left\{ \frac{(RS-1)}{Range} \right\} \times 100$$

**Cut-off points for numerical QoL score**

The final global QoL score on the numerical rating scale was classified into four categories, viz. normal, mild, moderate, and severe interference. We analyzed total 9 possible classification schemes. In order to determine which classification schemes best distinguished between normal, mild, moderate and severe categories, we used the method introduced by Serlin et al. [8]. We conducted one-way ANOVAs for each of the 9 classification schemes, using numerical scores of global QoL. The variability of the optimal classification scheme was quantified using a bootstrap resampling procedure defined by Hirschfeld and Zernikow [9]. In this procedure the distribution is estimated using the information based on a number of resamples from the total sample. To get estimates of the variability of the ideal cut-off points that were sufficiently stable, patient samples were repeated a thousand (1000) times. For every one of the 1000 randomly selected samples, the best classification scheme was identified. A significant F-value of the classification scheme indicated that there were significant differences between the four categories in terms of QoL-related interference. As per Serlin et al. [8], the classification scheme that maximised the differences between the groups was regarded as having the greatest F-value, meaning it was the most

effective in differentiating between QoL-related interference that was normal, mild, moderate, and severe (Table 1).

**Sample size calculations**

The sample size of 205 patients could be justified based upon the prevalence level of head and neck cancer. According to WHO Global cancer observatory cancer today (GLOBOCAN 2020), the prevalence of head and neck cancer in India was 10.3%. Considering the prevalence (p) level of 10.3%, precision level (d) of 5%, CI (z) of 95%; the sample size (n) comes to be 142. We have taken a larger sample size of 205 patients as compared to the minimum required sample. (<https://sampsizе.sourceforge.net/iface>)

$$n = \frac{Z^2 P(1-P)}{d^2}$$

where n = sample size  
 Z = Z statistic for level of confidence  
 P = expected prevalence  
 d = precision level

**Statistical analysis**

IBM SPSS® Statistics 27.0 was used for the statistical analysis of data. Mean ± SD was used for quantitative data and qualitative data was presented as number and fraction of total. One way ANOVA was used to compare more than two means. All statistical tests are carried out at 95% of confidence taking the p value < 0.05 as statistically significant.

**Table 1** Classification schemes indicating various categories for numerical rating score of EORTC-QLQ-H&N35

Classification scheme	Categories for global health status and functional scale				F-Value
	Severe	Moderate	Mild	Normal	
CP1	0-5	6-30	31-55	56-100	378.131
CP2	0-10	11-35	36-60	61-100	521.991
CP3	0-15	16-40	41-65	66-100	521.991
CP4	0-20	21-45	46-70	71-100	515.409
CP5	<b>0-25</b>	<b>26-50</b>	<b>51-75</b>	<b>76-100</b>	<b>729.915</b>
CP6	0-30	31-55	56-80	81-100	729.810
CP7	0-35	36-60	61-85	86-100	477.904
CP8	0-40	41-65	66-90	91-100	477.904
CP9	0-45	46-70	71-95	96-100	477.365
Classification scheme	Normal	Mild	Moderate	Severe	F-Value
	Categories for symptoms scale				

## Results

Based upon the final transformed linear score of global QoL, the highest F value to differentiate between the normal, mild, moderate and severe QoL was achieved in the classification scheme 5, and the QoL score was categorized into four categories based upon the scoring system of classification scheme 5. For the global health status and functional scale, the QoL impairment is denoted as normal (76–100), mild (51–75), moderate (26–50) and severe (0–25). Since symptom scale has reverse order of scoring in original EORTC-QLQ-H&N35, the QoL impairment is denoted as normal (0–25), mild (26–50), moderate (51–75) and severe (76–100) for symptom scale (Table 1).

The mean global QoL score among total 205 patients were  $60.08 \pm 19.06$ . Based upon new classification scheme, QoL was normal in 46 (22.4%) patients whereas QoL was impaired to mild level in 76 (37.1%) patients, to moderate level in 76 (37.1%) and to severe level in 7 (3.4%) patients. The mean score of physical function was  $91.83 \pm 12.41$  with 23 (11.2%) and 3 (1.5%) patients having their physical functioning impaired to mild and moderate level respectively. Role functioning score was  $91.46 \pm 20.18$  and role functioning was impaired to mild, moderate and severe level in 22 (10.7%), 8 (3.9%), and 4 (2.0%) patients respectively. Emotional functioning score was  $64.10 \pm 25.82$  with 82 (40.0%), 54 (26.3%), 13 (6.3%) patients having their emotional functioning impaired to mild, moderate and severe level respectively. Mean cognitive functional score was  $90.40 \pm 15.83$  and cognitive functioning was normal in all

205 (100.0%) patients. The social functioning was impaired to mild, moderate and severe level in 25 (12.2%), 4 (2.0%) and 3 (1.5%) patients respectively with having a mean score of  $90.89 \pm 16.78$  (Table 2).

The mean fatigue score was  $45.25 \pm 27.85$  with 54 (26.3%), 68 (33.2%), and 26 (12.7%) patients facing the mild, moderate and severe fatigue respectively. The nausea and vomiting score were  $4.06 \pm 12.22$  with 12 (5.9%) and 2 (1.0%) patients having mild and severe nausea and vomiting respectively. The mean pain score was  $28.69 \pm 25.91$  and pain was present at mild, moderate and severe level in 76 (37.1%), 14 (6.8%), and 15 (7.3%) patients respectively. Mean dyspnoea score was  $12.84 \pm 21.96$  with 37 (18.0%), 10 (4.9%) and 2 (1.0%) patients facing the mild, moderate and severe dyspnoea respectively. The mean insomnia score was  $24.39 \pm 32.02$  with mild, moderate and severe insomnia observed in 44 (21.5%), 32 (15.6%), and 14 (6.8%) patients respectively. The appetite loss score was  $18.37 \pm 27.48$  with 43 (21.0%), 26 (12.7%) and 6 (2.9%) patients facing the mild, moderate and severe appetite loss respectively. Mean constipation score was  $10.24 \pm 24.65$  with presence of mild, moderate and severe constipation in 19 (9.3%), 10 (4.9%), and 8 (3.9%) patients respectively. Mean diarrhoea score was  $1.62 \pm 8.57$  with 52 (25.4%), 12 (5.9%), and 11 (5.4%) patients having the mild, moderate and severe diarrhoea respectively. The mean financial difficulties score was  $14.14 \pm 23.11$  with 48 (23.4%), 15 (7.3%), and 3 (1.5%) patients encountered the mild, moderate and severe level of financial difficulties respectively (Table 3).

**Table 2** Functional scale of EORTC QLQ-H&N35 with five subscales

Functional scale	Mean $\pm$ SD	Normal	Mild	Moderate	Severe
Physical functioning (PF2)	$91.83 \pm 12.41$	179 (87.3%)	23 (11.2%)	3 (1.5%)	0
Role functioning (RF2)	$91.46 \pm 20.18$	171 (83.4%)	22 (10.7%)	8 (3.9%)	4 (2.0%)
Emotional functioning (EF)	$64.10 \pm 25.82$	56 (27.3%)	82 (40.0%)	54 (26.3%)	13 (6.3%)
Cognitive functioning (CF)	$90.40 \pm 15.83$	205 (100.0%)	0	0	0
Social functioning (SF)	$90.89 \pm 16.78$	173 (84.4%)	25 (12.2%)	4 (2.0%)	3 (1.5%)

**Table 3** Symptoms scale of EORTC QLQ-H&N35 with nine subscales

Symptom scale	Mean $\pm$ SD	Normal	Mild	Moderate	Severe
Fatigue (FA)	$45.25 \pm 27.85$	57 (27.8%)	54 (26.3%)	68 (33.2%)	26 (12.7%)
Nausea and vomiting (NV)	$4.06 \pm 12.22$	191 (93.2%)	12 (5.9%)	0	2 (1.0%)
Pain (PA)	$28.69 \pm 25.91$	100 (48.8%)	76 (37.1%)	14 (6.8%)	15 (7.3%)
Dyspnoea (DY)	$12.84 \pm 21.96$	156 (76.1%)	37 (18.0%)	10 (4.9%)	2 (1.0%)
Insomnia (SL)	$24.39 \pm 32.02$	115 (56.1%)	44 (21.5%)	32 (15.6%)	14 (6.8%)
Appetite loss (AP)	$18.37 \pm 27.48$	130 (63.4%)	43 (21.0%)	26 (12.7%)	6 (2.9%)
Constipation (CO)	$10.24 \pm 24.65$	168 (82.0%)	19 (9.3%)	10 (4.9%)	8 (3.9%)
Diarrhoea (DI)	$1.62 \pm 8.57$	130 (63.4%)	52 (25.4%)	12 (5.9%)	11 (5.4%)
Financial difficulties (FI)	$14.14 \pm 23.11$	139 (67.8%)	48 (23.4%)	15 (7.3%)	3 (1.5%)

The mean head and neck specific pain score was  $31.38 \pm 26.75$  and mild, moderate and severe level of pain was present in 45 (22.0%), 34 (16.6%), and 10 (4.9%) patients respectively. Mean swallowing score was  $25.16 \pm 27.41$  with 49 (23.9%), 27 (13.2%), and 8 (3.9%) patients having the mild, moderate and severe level of swallowing difficulties respectively. The mean score for senses problem was  $21.21 \pm 25.42$  with 53 (25.9%), 18 (8.8%) and 5 (2.4%) patients having the mild, moderate and severe level of senses problems respectively. The mean score for speech problems was  $24.87 \pm 23.27$  with 52 (25.4%), 12 (5.9%) and 11 (5.4%) patients having the mild, moderate and severe level of speech problems respectively. The mean score for trouble with social eating was  $25.16 \pm 26.49$  with 56 (27.3%), 26 (12.7%), and 6 (2.9%) patients having the mild, moderate and severe level of trouble with social eating respectively. The mean score for trouble with social contact was  $18.40 \pm 18.04$  with 59 (28.8%), 11 (5.4%) and 2 (1.0%) patients having the mild, moderate and severe level of trouble with social contact respectively. The mean score for less sexuality was  $10.65 \pm 24.00$  with 26 (12.7%), 7 (3.4%), and 8 (3.9%) patients having the mild, moderate and severe level of sexual problems respectively (Table 4).

The mean score for teeth problems was  $30.56 \pm 32.47$  with presence of mild, moderate and severe level of teeth problems in 73 (35.6%), 26 (12.7%) and 21 (10.2%) patients respectively. The mean score for problem with mouth opening was  $36.74 \pm 36.81$  indicating 44 (21.5%), 46 (22.4%), and 30 (14.6%) patients have mild, moderate and severe problems with mouth opening respectively. Mean score for dry mouth was  $33.00 \pm 35.23$  with 52 (25.4%), 38 (18.5%), 25 (12.2%) patients having mild, moderate and severe level mouth dryness respectively. Mean score for sticky saliva was  $31.21 \pm 28.21$  with 66

(32.2%), 31 (15.1%), and 23 (11.2%) patients having mild, moderate and severe level of sticky saliva respectively. The mean score for cough problems was  $10.24 \pm 20.29$  with presence of mild, moderate and severe level of cough in 37 (18.0%), 10 (4.9%), and 2 (1.0%) patients respectively. Mean score for feeling of illness was  $31.21 \pm 28.21$  with 91 (44.4%), 34 (16.6%) and 11 (5.4%) patients having the feeling of illness (Table 4).

## Discussion

Most of the studies available on the EORTC-QLQ-H&N35 are translation and validation studies in which the instrument is translated into local language and its validity was assessed for local population. Limited research is available in which the EORTC-QLQ-H&N35 instrument is being used to assess the QoL in head and neck cancer patients. The reason behind this due to the lengthy and complex nature of the instrument itself. The EORTC-QLQ-H&N35 overall has 65 questions to asked to the patients which is itself require at least one hour for proper administration. Also, the score obtained is the raw score which has to be translated to final score through complex formula which is also different for different subscale. At the last, the final score obtained give little idea about the overall QoL of patients. Clinicians and psychologist generally use the categories-based system to assess the clinical state of patient. Therefore, present study was conducted to statistically analyze the cut-off points for numeric QoL to classify that into simple discrete categories.

Previously, many studies have classified the numerical score into categories using the using the statistical method described by Serlin et al. [8]. In present study also, we categorize the numerical score of EORTC QLQ-H&N35 into normal, mild, moderate and severe

**Table 4** Head and neck specific symptom scale of EORTC QLQ-H&N35 with thirteen subscales

H&N Symptom scale	Mean $\pm$ SD	Normal	Mild	Moderate	Severe
Pain (HNPA)	31.38 $\pm$ 26.75	116 (56.6%)	45 (22.0%)	34 (16.6%)	10 (4.9%)
Swallowing (HNSW)	25.16 $\pm$ 27.41	121 (59.0%)	49 (23.9%)	27 (13.2%)	8 (3.9%)
Senses problems (HNSE)	21.21 $\pm$ 25.42	129 (62.9%)	53 (25.9%)	18 (8.8%)	5 (2.4%)
Speech problems (HNSP)	24.87 $\pm$ 23.27	130 (63.4%)	52 (25.4%)	12 (5.9%)	11 (5.4%)
Trouble with social eating (HNSO)	25.16 $\pm$ 26.49	117 (57.1%)	56 (27.3%)	26 (12.7%)	6 (2.9%)
Trouble with social contact (HNSC)	18.40 $\pm$ 18.04	133 (64.9%)	59 (28.8%)	11 (5.4%)	2 (1.0%)
Less sexuality (HNSX)	10.65 $\pm$ 24.00	164 (80.0%)	26 (12.7%)	7 (3.4%)	8 (3.9%)
Teeth (HNTE)	30.56 $\pm$ 32.47	85 (41.5%)	73 (35.6%)	26 (12.7%)	21 (10.2%)
Opening mouth (HNOM)	36.74 $\pm$ 36.81	85 (41.5%)	44 (21.5%)	46 (22.4%)	30 (14.6%)
Dry mouth (HNDR)	33.00 $\pm$ 35.23	90 (43.9%)	52 (25.4%)	38 (18.5%)	25 (12.2%)
Sticky saliva (HNSS)	31.21 $\pm$ 28.21	85 (41.5%)	66 (32.2%)	31 (15.1%)	23 (11.2%)
Coughing (HNCO)	10.24 $\pm$ 20.29	156 (76.1%)	37 (18.0%)	10 (4.9%)	2 (1.0%)
Felt ill (HNFI)	31.21 $\pm$ 28.21	69 (33.7%)	91 (44.4%)	34 (16.6%)	11 (5.4%)

categories based upon the cut-off values that can explain the highest proportion of the variance as described by Serlin et al. [8]. In addition, we also perform the bootstrap resampling procedure defined by Hirschfeld and Zernikow [9]. Previously, Boonstra et al. adopted the classification and bootstrap resampling procedure to categorize the pain score into mild, moderate and severe categories [7].

The mean score obtained from each subscale in our study support values in the respective categories. For example, the mean global QoL score among all patients were  $60.08 \pm 19.06$  indicating overall average QoL among head and neck cancer patients. Based upon new classification scheme, QoL was found to normal in 46 (22.4%) patients and impaired to mild level in 76 (37.1%) patients whereas QoL impairment to severe level found in 7 (3.4%) patients which supports the findings on numerical rating scale. Similar findings could be observed for other functional and symptom subscale of EORTC-QLQ-H&N35. Previous studies also found that QoL in head and neck cancer tends to impair due to mutilation, shame and stigma, low self esteem and large size of tumor [10–13]. The QoL tends to recover postoperatively over long term survival due to better adaptation of patients with the deformities [14–16].

The EORTC-QLQ-H&N35 module was more sensitive to the detect the symptoms in head and neck cancer patients as compared to the generic QLQ-C30 [17]. This fact was supported by the findings that general pain was moderate in 14 (6.8%) patients in present study whereas the moderate head and neck specific pain was present in 34 (16.6%) patients. Certain parameters including the teeth problems, mouth opening, dry mouth, mouth dryness, sticky saliva and cough are exclusively measured by the H&N35 module of EORTC-QLQ, therefore, it is recommended to always use the H&N35 module along with the QLQ-C30 when QoL assessment is carried out for head and neck cancer patients.

In addition, Bjordal et al. noted that the QLQ-H&N35, when combined with the QLQ-C30, offers a useful instrument for evaluating health-related QoL in clinical trials involving patients with head and neck cancer both before and after the treatment. The questionnaire could be used to study the outcome of radiation therapy, surgery, or chemotherapy in head and neck cancer patients [3]. Leung et al. also reported that functional and symptomatic aspects of head and neck cancer patients could be assessed well using the EORTC-QLQ-H&N35 [18]. Additionally, Singer et al. discovered that the QLQ-H&N35, when used in conjunction with the QLQ-C30, is a trustworthy tool that can distinguish between diverse group of patients with laryngeal cancer following surgery [17]. López-Jornet also suggested that with the combined

use of QLQ-30 and H&N35 questionnaires, QoL of head and neck cancer patients can be compared from place to place and from study to study, as the questionnaires sensitivity always remains uniform [19]. Sherman et al. also reported that QLQ-H&N35 provided unique information about head and neck cancer patients [20]. However, Beck et al. reported that selected scales from the EORTC-QLQ-C30 can be used to estimate utilities for head and neck cancer using beta regression and inclusion of H&N35 scales does not improve the mapping function [21]. Parkar and Sharma also highlighted that poor performance reported across various validation studies especially for speech, the senses, swallowing, social eating, pain, and fewer sexuality scales, need to be rectified by replacing of these items with more appropriate items [5]. Degboe et al. mentioned that some items could be amended/added to ensure conceptual comprehensiveness of EORTC-QLQ-H&N35 [22].

In present study, the mouth opening and swallowing was severely impaired in 30 (14.6%) and 8 (3.9%) patients respectively. According to Hammerlid et al., head and neck cancers had considerably higher scale scores for dental problems, sticky saliva secretion, taste loss, trouble swallowing, and nausea [23]. According to a research by Campbell et al., swallowing difficulties, speech issues, and trouble with physical activity were much greater among individuals with advanced head and neck cancer [24]. Rogers et al. found that difficulties swallowing was the primary cause of worse QoL ratings for carcinomas of the posterior oropharyngeal wall carcinomas [25]. Osthus et al. discovered that dental problems and the EORTC-QLQ-H&N35 indices for mouth opening and swallowing were predictive of survival outcomes. These findings raises the possibility that oral health and/or nutritional status may be associated to survival outcomes [26].

Present study offers several advantages in terms of being first study to calculate the cut-off points for numeric QoL values of EORTC-QLQ-H&N35. We also analyze the data from 205 head and neck patients according to the new classification scheme. However, present study also has its own limitations. In present study, the questionnaire was self administered by the patients and response to some items may not be accurate due to poor understanding of question by patient. However, previous studies have proposed that there was no significant difference in the score when the questionnaire is self-administered or when administered by clinician in head and neck cancer patients [27–29]. Another usual limitation is the sample size itself. As it is a methodological study, a large sample size is requisite to validate the QoL discrete categories suggested in this study. Moreover, we have all the patients from a single center, a multicentric

study may produce more profound results in methodological research. Future studies could be carried out by taking the ample sample size from multiple centers to validate the findings of current study.

## Conclusion

By routinely administering QoL surveys to cancer patients, medical professionals can ascertain the specific regions and degree to which patients lives are impacted by treatment procedures and its aftereffects. That will enable the medical professionals to give patients information and care that is more tailored to their requirements. The necessity and methods to determine the proper cut-off values of a numeric rating scales for clinical relevance is still being debated, despite the fact that clinicians and psychologists found it simple to conduct patient assessments using discrete categories rather than numerical score. The simple division of the total score into equal categories is not an ideal method to transform numerical score into categories. In present study we statistically calculated the cut-off points for numeric QoL score to divide that into easy interactive discrete categories. The results of this study indicate that categorization of QoL score will make the EORTC QLQ-H&N35 more useful, interactive, and simple instrument for assessing health-related QoL in head and neck cancer patients.

## Acknowledgements

Authors highly acknowledged to our colleagues for reviewing the present work. Authors are also acknowledged to doc navigator@ Chandigarh for providing the proofreading services for this manuscript.

## Code availability

No Code has been used in this article.

## Authors' contributions

JB and NKP helped with the patient recruitment; MS and DV help in the collection and analysis of data, JS and AKG drafted the manuscript.

## Funding

The work in present article was funded by institute research fellowship (Letter No. A30011/Ph.D./1Trg/July2019) provided by the host institute. The work in this research is also supported by the Junior Research Fellowship (JRF) provided by ICMR, New Delhi wide Award no. 3/13/JRF -2015/HRD.

## Availability of data and materials

This manuscript has no associated data to be deposit. All data generated or analyzed during this study are included in this article.

## Declarations

### Ethics approval and consent to participate

Present study has been approved by the Institute Ethics Committee (IEC) of Post Graduate Institute of Medical Education and Research (PGIMER), Chandigarh India with the Letter No. INT/IEC/2019/002539 with Ref No. NK/5657/PhD. Permission form the copyrighted owner of Hindi version of EORTC-QLQ-HN35 was obtained.

Informed written consent to participate in the study was provided by all participants. Present study involved only adult patients therefore exempted from parent or legal guardian consent.

## Consent for publication

Participant information sheet was provided to all participants and written consent was taken from every participant. Present manuscript does not include the personal data of patients in any form (including individual details, images or videos). All authors have provided their consent for the publication.

## Competing interests

The authors declare that they have no competing interests.

Received: 17 February 2024 Accepted: 12 July 2024

Published online: 31 July 2024

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