Research Square

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Social alienation among patients with head and neck cancer : A latent profile analysis

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Abstract

Background

Head and neck cancer (HNC) patients frequently experience post-treatment complications, including dysphagia, speech impairment, and facial disfigurement. These complications may reduce their willingness to participate in social activities and contribute to feelings of social alienation. Social alienation not only adversely affects patients' physical and psychological health and quality of life, but also increases the burden on families and society.

Objective

This study aimed to explore the latent profiles of social alienation among patients with HNC and to identify factors influencing membership in different latent profiles.

Methods

In this study, A total of 317 patients with head and neck cancer who had completed radiotherapy at least 6 months previously were recruited from a tertiary Grade A hospital in Guangxi, China, using convenience sampling between March and May 2026. Data were collected using the General Information Questionnaire, the General Social Alienation Scale(GAS), the MD Anderson Symptom Inventory–Head and Neck Module (MDASI-HN), the Generalized Anxiety Disorder-7 (GAD-7), and the Perceived Social Support Scale (PSSS). Latent profile analysis(LPA) was conducted to identify the latent classes of social alienation among HNC patients, and ordinal logistic regression analysis was performed to examine the influencing factors.

Results

Three latent profiles of social alienation were identified among HNC patients: the low-alienation group–well-adapted type (n = 112,35.33%), the moderate-alienation group–interpersonal alienation type (n = 138,43.53%), and the high-alienation group–social isolation type (n = 67,21.14%). Monthly income of 1000–5000 yuan Symptom burden, anxiety, and social support were identified as significant influencing factors of the latent profiles of social alienation among HNC patients ($P < 0.05$).

Conclusions

Social alienation among patients with HNC demonstrated substantial heterogeneity. Patients in different latent profiles exhibited distinct patterns of symptom experience, psychological status, and perceived social support, suggesting differences in their social adaptation needs. Healthcare professionals should

develop targeted nursing interventions based on patients' latent profile membership and associated characteristics to alleviate social alienation and facilitate their reintegration into social life.

1 Introduction

Head and neck cancer (HNC) is a group of malignant tumors arising in the oral cavity, pharynx, and larynx[1]. In 2020, approximately 890,000 new cases and 400,000 deaths related to HNC were reported worldwide, ranking it as the seventh most common cancer globally[2]. Due to its insidious onset, most HNC patients are diagnosed at a locally advanced stage[3]. In addition, because the anatomical structures of the head and neck region are highly complex and are responsible for essential physiological functions such as swallowing and speech, multidisciplinary treatment centered on radiotherapy is commonly adopted in clinical practice to improve local tumor control while preserving organ function as much as possible. Among these approaches, surgery combined with radiotherapy and chemotherapy is the most commonly used treatment modality[1]. However, owing to treatment-related adverse effects, patients frequently experience persistent symptom burdens during the rehabilitation period, including dysphagia, speech impairment, and facial disfigurement[4, 5]. These impairments restrict patients' daily activities, seriously affect their physical functioning and psychological well-being, weaken their sense of social acceptance, and reduce their willingness to participate in social activities[6, 7].

Social alienation(SA) refers to a state in which individuals experience reduced social connections, inadequate social support, and diminished social role functioning, either subjectively or objectively[8]. Previous studies have shown that patients with head and HNC undergoing radiotherapy experience a moderate-to-high level of SA[9]. Owing to treatment-related impairments such as dysphagia, speech difficulties, and changes in appearance, HNC patients often encounter restrictions in social participation and interpersonal interactions, placing them at increased risk of social alienation. Severe SA not only adversely affects patients' physical and psychological well-being but also increases family caregiving burden and broader social costs.

Previous research has reported that most patients with nasopharyngeal carcinoma are diagnosed at a locally advanced stage, resulting in more intensive radiotherapy and chemotherapy. Consequently, patients frequently experience symptom burdens such as xerostomia, nasal obstruction, tinnitus, and trismus, which negatively affect their recovery and quality of life while increasing caregiving demands[3]. In addition, studies have shown that HNC patients often experience shame and loneliness resulting from body image disturbances, leading them to avoid social situations and reduce interpersonal contact[10]. Anxiety associated with appearance changes and functional impairments may further decrease patients' willingness to engage in social interactions[11]. The American Society of Clinical Oncology (ASCO) guideline, *Management of Anxiety and Depression in Adult Survivors of Cancer*, highlighted anxiety as a key psychological outcome requiring ongoing assessment and management throughout cancer survivorship because of its persistent impact on psychological well-being, adaptation to illness, and quality of life [12]. Beyond psychological distress, social support has also been identified as an

important determinant of social adaptation. For patients with HNC, support from family members, friends, and healthcare professionals may help maintain social connections and enhance adaptation to the disease[13].

In China,The Outline of the *"Healthy China 2030" Plan*[14] clearly proposes the implementation of chronic disease management across the entire population and throughout the life course by 2030, while highlighting the importance of strengthening mental health services and promoting the early identification and intervention of psychological problems among vulnerable populations. Patients with HNC, who often experience long-term functional impairment, psychological distress, and difficulties in social adaptation, warrant particular attention regarding SA.

Existing evidence suggests that symptom burden, psychological distress, and social support are closely associated with SA among patients with HNC. However, most previous studies have examined SA at the group level and primarily focused on overall alienation scores. Such approaches may overlook variations in how patients experience social alienation. Exploring these differences may facilitate a more nuanced understanding of SA among HNC patients and provide a basis for developing individualized supportive care strategies. Latent Profile Analysis (LPA) is a person-centered statistical method that identifies latent subgroups sharing similar characteristic patterns based on multidimensional continuous variables[15]. This enables healthcare providers to deliver targeted interventions at the group level. Therefore, this study employed LPA to identify latent profiles of SA among patients with HNC. Symptom burden, anxiety, and perceived social support were selected as the primary study variables, and their relationships with different latent profiles were further examined. These findings may contribute to a more detailed understanding of social alienation among head and neck cancer survivors, provide a basis for tailored supportive care strategies.

2 Methods

2.1 Study setting and participants

This was a cross-sectional study. A convenience sampling method was used to conduct a follow-up survey between March and May 2026 among 317 patients with head and neck cancer who had completed radiotherapy at least 6 months previously at a tertiary hospital in Guangxi, China. The inclusion criteria were: (1) age ≥ 18 years; (2) pathologically diagnosed malignant HNC[16]; (3) conscious, able to comprehend the questionnaire, and willing to participate voluntarily; (4) completion of at least two treatment modalities, including radiotherapy, for ≥ 6 months; ; (5) expected survival ≥ 6 months. The exclusion criteria were: (1) presence of other severe organic diseases (e.g. severe cardiac, pulmonary, hepatic, or renal insufficiency); (2) previously diagnosed mental disorders or cognitive impairments; (3) concurrent participation in another study.

2.2 Sample Size

Based on previous literature reporting a 25% prevalence of social alienation among HNC patients[17], a two-sided α value of 0.05 was applied. Sample size estimation was performed using PASS version 15.0 software. After accounting for a 20% attrition rate, the minimum estimated sample size was 306 participants. and a total of 317 HNC patients were ultimately included in the study.

2.3 Measures

2.3.1 Questionnaire for general information

The Questionnaire for General Information was developed by the researchers based on a literature review and expert consultation. General demographic information included sex, age, marital status, educational level, occupation, monthly income, place of residence, and living status (living alone or not). Disease-related information included disease diagnosis, tumor stage, recurrence/metastasis status, and treatment modality.

2.3.2 General Alienation Scale

The General Alienation Scale (GAS) was originally developed by Jessor R et al[18] and later translated into Chinese by Wu Shuang et al[19]. The scale has previously been applied by Yuan Yuan et al[10] to assess the level of SA among HNC patients and demonstrated good internal consistency reliability, with a Cronbach's α coefficient of 0.8510. The GAS consists of 15 items across four dimensions: Social isolation (Items 1, 4, 7, 8, and 12), Powerlessness (Items 2, 5, and 13), Self-estrangement (Items 9–11), and Meaninglessness (Items 3, 6, 14, and 15). A Likert 4-level scoring method was adopted, ranging from 1 (strongly disagree) to 4 (strongly agree). Items 2, 5, and 13 were reverse scored. The total score ranges from 15 to 60, with higher scores indicating a greater degree of social alienation. The GAS demonstrated good internal consistency reliability in this study, with a Cronbach's α coefficient of 0.88.

2.3.3 M.D. Anderson Symptom Inventory-Head and Neck Module

The M.D. Anderson Symptom Inventory–Head and Neck Module (MDASI-H&N) was developed by Cleeland et al[20] to specifically assess symptom burden and its impact on daily functioning among HNC patients. The Chinese version was translated and validated by Han Yuan et al[10, 21] and demonstrated good reliability, with a Cronbach's α coefficient of 0.91. The scale consists of two parts. The first part evaluates the severity of symptoms experienced by patients during the previous 24 hours and includes 13 core symptom items (Items 1–13) and 9 HNC-specific symptom items (Items 14–22). Each item was rated using a Likert 11-level scoring method ranging from 0 (not present) to 10 (as bad as you can imagine), with scores ≥ 1 indicating the presence of symptoms. The second part contains 6 items assessing the extent to which symptoms interfere with patients' daily life. In this study, only the first part was used to evaluate symptom severity. The MDASI-H&N demonstrated good internal consistency reliability in this study, with a Cronbach's α coefficient of 0.90.

2.3.4 Generalized Anxiety Disorder-7

The Generalized Anxiety Disorder-7 (GAD-7) was developed by Spitzer et al[22] and has been widely used to assess anxiety symptoms among cancer patients[23–25]. The Chinese version was translated and culturally adapted by He Xiaoyan et al[26] and demonstrated good reliability, with a Cronbach's α coefficient of 0.86. The GAD-7 consists of 7 items, each rated using a Likert 4-level scoring method ranging from 0 (not at all) to 3 (nearly every day). The total score ranges from 0 to 21, with scores of 0–4 indicating no significant anxiety, and scores of 5, 10, and 15 representing mild, moderate, and severe anxiety, respectively. Higher scores indicate more severe anxiety symptoms. The GAD-7 demonstrated good internal consistency reliability in this study, with a Cronbach's α coefficient of 0.86.

2.3.5 Perceived Social Support Scale

The Perceived Social Support Scale (PSSS) was originally developed by Zimet et alt[27] and translated and revised into Chinese by Jiang Qianjin[28]. The scale has previously been applied by Ying Zhang et al[29] to assess social support among HNC patients and demonstrated good reliability and validity, with a Cronbach's α coefficient of 0.9326. The PSSS consists of 12 items across three dimensions: family support (Items 3, 4, 8, and 11), friend support (Items 6, 7, 9, and 12), and other support (Items 1, 2, 5, and 10). Each item was rated using a Likert 7-level scoring method ranging from 1 (strongly disagree) to 7 (strongly agree). The total score ranges from 12 to 84, with higher scores indicating higher levels of perceived social support. The PSSS demonstrated good internal consistency reliability in this study, with a Cronbach's α coefficient of 0.94.

2.4 Data collection

Data were collected using a questionnaire survey. Two trained researchers distributed the questionnaires to eligible HNC patients in the outpatient department and inpatient wards and assisted participants in completing the questionnaires using standardized instructions. Disease-related information was obtained from the hospital electronic medical record system. Questionnaires with missing responses exceeding 10% of the total items or exhibiting patterned responses were excluded. All data were double-entered and verified for accuracy before analysis.

2.5 Data analysis

LPA was performed using Mplus version 8.3. The dimension scores of the GAS were used as indicator variables to classify the SA status of HNC patients. Models with one to five latent profiles were successively fitted, and model fit was evaluated using the following three categories of indices. (1) Information criteria: Akaike Information Criterion (AIC), Bayesian Information Criterion (BIC), and adjusted Bayesian Information Criterion (aBIC) were used to evaluate model fit, with lower values indicating better model fit. (2) Classification index: Entropy values closer to 1 indicated greater classification accuracy, and an entropy value > 0.80 suggested classification accuracy exceeding 90%.(3) Likelihood ratio tests: the Lo-Mendell-Rubin adjusted likelihood ratio test (LMRT) and Bootstrap likelihood ratio test (BLRT) were used to determine the optimal number of latent profiles. $P < 0.05$ indicated that the model with k profiles was significantly better than the model with k-1 profiles.

Statistical analyses were conducted using SPSS version 26.0. Normally distributed continuous variables were presented as means and standard deviation ($\bar{x} \pm s$), while non-normally distributed variables were presented as median and interquartile range [M (P25, P75)]. Categorical variables were expressed as frequencies and percentages. Between-group comparisons were performed using one-way analysis of variance (ANOVA) or the Kruskal-Wallis H test for continuous variables, and the chi-square (χ^2) test or Fisher's exact test for categorical variables. Taking the latent classes as the dependent variable, an ordinal logistic regression analysis was conducted to identify factors influencing social alienation in patients with head and neck cancer. At $P < 0.05$,The result were considered statistically significant.

2.6 Ethical considerations

This study was approved by the Ethics Committee of the People's Hospital of Guangxi Zhuang Autonomous Region (ethics approval number: ITT Research Observation [2026]008 Exemption). All participants provided written informed consent.

3 Results

3.1 Participant characteristics

Three hundred twenty questionnaires were distributed and collected, of which 317 were valid, resulting in a response rate of 99.06%.Among the participants, 230 (72.56%) were male, 145 (45.74%) were aged ≥ 60 years, 293 (92.43%) were married, and 97 (30.60%) had a middle school education. Monthly income ranged from 1,000 to 5,000 RMB in 163 cases (51.42%), 163 participants (51.42%) resided in rural areas, and 288 (90.85%) lived with others. Regarding clinical characteristics, 130 patients (41.00%) had oral cavity cancer, 130 (41.00%) had stage IV tumors, 230 (72.56%) had no secondary metastasis, and 99 (31.23%) received surgery combined with concurrent chemoradiotherapy. The median General Alienation Scale score was 38 (interquartile range, 33–44). Additional demographic and clinical characteristics are presented in Table 1.

3.2 Latent profile of social alienation

The analysis began by progressively estimating latent profile models with 1–5 classes for SA among HNC patients, and the fit indices for each model are presented in Table 2. The results showed that the AIC, BIC, and aBIC values continuously decreased as the number of classes increased. The Entropy values of both the two-class and three-class models were greater than 0.80, indicating good classification accuracy. However, the three-class model showed lower AIC, BIC, and aBIC values than the two-class model, and both the LMRT ($P = 0.037$) and BLRT ($P < 0.001$) were statistically significant, suggesting that the three-class model provided a significantly better fit than the two-class model. The LMRT was no longer significant in the four-class model ($P = 0.270$), and the five-class model contained a subgroup with an excessively small sample proportion. Model fit indices, statistical test results, and classification stability collectively supported the three-class model as the optimal solution.

The scores of the three classes across the four dimensions showed a gradient distribution from low to high (Fig. 1). Class 1 showed the lowest scores across all four dimensions, indicating a low risk of SA. Patients in this class generally maintained intact social functioning and were able to sustain normal interpersonal interactions and social participation. This class was therefore defined as the “low-alienation group-well-adapted type” and included 112 patients (35.33%). Class 2 demonstrated intermediate scores across all dimensions, whereas the distrust dimension approached the level observed in Class 3, suggesting that these patients generally held defensive attitudes toward others and had developed tendencies toward interpersonal alienation, although social avoidance had not yet occurred. This class was therefore defined as the “moderate-alienation group-interpersonal alienation type” and included 138 patients (43.53%). Class 3 showed the highest scores across all four dimensions, particularly in alienation from others and distrust, reflecting a pervasive pattern of alienation. These findings suggested a markedly reduced willingness to engage in social participation. This class was therefore defined as the “high-alienation group-social isolation type” and included 67 patients (21.14%).

3.3 Univariate analysis of social alienation

Significant differences among the three latent classes were observed in educational level(χ^2 = 52.962, P<0.001), occupation(χ^2 = 37.845, P<0.001), monthly income(χ^2 = 52.713, P<0.001), place of residence(χ^2 = 23.556, P<0.001), diagnosis(χ^2 = 21.621, P<0.05), tumor stage(χ^2 = 19.457, P<0.001), recurrence or metastasis, MDASI-H&N scores(H = 176.845, P<0.001), GAD-7 scores(H = 226.753, P<0.001), and PSSS scores(H = 220.001, P<0.001). No significant differences were found in sex, age, marital status, living status, or treatment modality (P > 0.05) (Table 1).

3.4 Multivariate analysis of social alienation

The latent classes of SA were treated as the dependent variable, and variables with P < 0.05 in the univariate analysis were entered into the ordinal logistic regression model as independent variables. The test of parallel lines was not statistically significant (χ^2 = 17.399, P = 0.496), indicating that the proportional odds assumption was satisfied and that ordinal logistic regression analysis was appropriate. Higher levels of the dependent variable indicated greater degrees of SA. The model fitting results showed good overall model fit (χ^2 = 447.677, P < 0.001), with a Nagelkerke R^2 value of 0.860. Variance inflation factor (VIF) values for all independent variables were below 10 (GAD-7 = 5.125, MDASI-HN = 3.067, and PSSS = 3.131), indicating the absence of severe multicollinearity. Detailed results are presented in Table 3, and the assignment of independent variables is shown in Table 4.Ordinal logistic regression analysis showed that monthly income of 1000–5000 yuan (OR = 9.890, 95% CI: 1.162–84.178, P = 0.036), MDASI-HN scores (OR = 1.026, 95% CI: 1.005–1.049, P = 0.017), and PSSS scores (OR = 0.846, 95% CI: 0.799–0.895, P < 0.001) were significant influencing factors for the latent classes of SA among HNC patients(Table 5).

Table 1
General information and latent class univariate analysis (N = 317)

Characteristic	Total (N = 317)	C1 (n = 112)	C2 (n = 138)	C3 (n = 67)	Test statistic	*P*
Gender					0.636[1]	0.728
Male	230 (72.56)	83 (74.11)	97 (70.29)	50 (74.63)		
Female	87 (27.44)	29 (25.89)	41 (29.71)	17 (25.37)		
Age (years)					8.090[1]	0.088
≤ 44	47 (14.83)	18 (16.07)	18 (13.04)	11 (16.42)		
45–59	125 (39.43)	52 (46.43)	55 (39.86)	18 (36.87)		
≥ 60	145 (45.74)	42 (37.50)	65 (47.10)	38 (56.72)		
Marital status					8.903[1]	0.109
Married	293 (92.43)	106 (94.64)	128 (92.75)	59 (88.06)		
Unmarried	15 (4.73)	6 (5.36)	4 (2.90)	5 (7.46)		
Widowed	7 (2.21)	0 (0.00)	4 (2.90)	3 (4.48)		
Divorced	2 (0.63)	0 (0.00)	2 (1.45)	0 (0.00)		
Education level					52.962[1]	< 0.001
Primary school or below	82 (25.87)	19 (16.96)	42 (30.43)	21 (31.34)		
Middle school	97 (30.60)	22 (19.64)	52 (37.68)	23 (34.33)		
High school or vocational	81 (25.55)	28 (25.00)	36 (26.09)	17 (25.37)		
Associate degree or higher	57 (17.98)	43 (38.39)	8 (5.80)	6 (8.96)		

Note:C1 = low-alienation well-adapted group; C2 = moderate-alienation interpersonal-alienation group; C3 = high-alienation social-isolation group.Values are presented as n (%) for categorical variables and as [M (P25, P75)] for continuous variables.¹ χ^2 value; ² Kruskal-Wallis H value.

Characteristic	Total (N = 317)	C1 (n = 112)	C2 (n = 138)	C3 (n = 67)	Test statistic	*P*
Occupation					37.845[1]	< 0.001
Farmer	80 (25.24)	20 (17.86)	43 (31.16)	17 (25.37)		
Employee	45 (14.20)	30 (26.79)	12 (8.70)	3 (4.48)		
Retired	71 (22.40)	34 (30.36)	24 (17.39)	13 (19.40)		
Other	121 (38.17)	28 (25.00)	59 (42.75)	34 (50.75)		
Monthly income (RMB)					52.713[1]	< 0.001
< 1000	119 (37.54)	22 (19.64)	57 (41.30)	40 (59.70)		
1000–5000	163 (51.42)	62 (55.36)	76 (55.07)	25 (37.31)		
> 5000	35 (11.04)	28 (25.00)	5 (3.62)	2 (2.99)		
Place of residence					23.556[1]	< 0.001
Rural	163 (51.42)	37 (33.04)	86 (62.32)	40 (59.70)		
Urban	154 (48.58)	75 (66.96)	52 (37.68)	27 (40.30)		
Living alone					2.056[1]	0.358
Yes	29 (9.15)	8 (7.14)	12 (8.70)	9 (13.43)		
No	288 (90.85)	104 (92.86)	126 (91.30)	58 (86.57)		
Diagnosis					21.621[1]	0.001
Nasopharyngeal carcinoma	124 (39.11)	49 (43.75)	53 (38.41)	22 (32.84)		

Note:C1 = low-alienation well-adapted group; C2 = moderate-alienation interpersonal-alienation group; C3 = high-alienation social-isolation group.Values are presented as n (%) for categorical variables and as [M (P25, P75)] for continuous variables.¹ χ^2 value; ² Kruskal-Wallis H value.

Characteristic	Total (N = 317)	C1 (n = 112)	C2 (n = 138)	C3 (n = 67)	Test statistic	*P*
Laryngeal cancer	25 (7.89)	5 (4.46)	6 (4.35)	14 (20.90)		
Oral cancer	130 (41.01)	45 (40.18)	59 (42.75)	26 (38.81)		
Other	38 (11.99)	13 (11.61)	20 (14.49)	5 (7.46)		
Tumor stage					19.457[1]	0.001
Stage I/II	60 (18.93)	35 (31.25)	18 (13.04)	7 (10.45)		
Stage III	127 (40.06)	43 (38.39)	58 (42.03)	26 (38.81)		
Stage IV	130 (41.01)	34 (30.36)	62 (44.93)	34 (50.75)		
Secondary metastasis					42.889[1]	< 0.001
Yes	87 (27.45)	10 (8.93)	41 (29.71)	36 (53.73)		
No	230 (72.56)	102 (91.07)	97 (70.29)	31 (46.27)		
Treatment modality					6.723[1]	0.574
Surgery + radiotherapy	49 (15.46)	22 (19.64)	19 (13.77)	8 (11.94)		
Surgery + chemoradiotherapy	99 (31.23)	28 (25.00)	50 (36.23)	21 (31.34)		
Surgery + chemoradiotherapy + targeted/immunotherapy	8 (2.52)	3 (2.68)	4 (2.90)	1 (1.49)		
Concurrent chemoradiotherapy	94 (29.65)	35 (31.25)	40 (28.99)	19 (28.36)		
Concurrent chemoradiotherapy + targeted/immunotherapy	67 (21.14)	24 (21.43)	25 (18.11)	18 (26.86)		

Note:C1 = low-alienation well-adapted group; C2 = moderate-alienation interpersonal-alienation group; C3 = high-alienation social-isolation group.Values are presented as n (%) for categorical variables and as [M (P25, P75)] for continuous variables.¹ χ^2 value; ² Kruskal-Wallis H value.

Characteristic	Total (N = 317)	C1 (n = 112)	C2 (n = 138)	C3 (n = 67)	Test statistic	*P*
MDASI-H&N score	53.00 (35.00, 77.50)	32.00 (25.00, 42.25)	59.00 (46.00, 74.75)	92.00 (77.50, 112.00)	176.845[2]	< 0.001
GAD-7 score	5.00 (2.00, 8.00)	2.00 (1.00, 3.00)	6.00 (4.00, 8.00)	11.00 (10.00, 11.50)	226.753[2]	< 0.001
PSSS score	48.00 (38.00, 61.00)	63.00 (60.00, 68.00)	44.00 (39.00, 51.00)	34.00 (30.00, 38.50)	220.001[2]	< 0.001

Note:C1 = low-alienation well-adapted group; C2 = moderate-alienation interpersonal-alienation group; C3 = high-alienation social-isolation group.Values are presented as n (%) for categorical variables and as [M (P25, P75)] for continuous variables.[1] χ^2 value; [2] Kruskal-Wallis H value.

Table 2
Latent class model fit comparison(N = 317)

Model	AIC	BIC	aBIC	Entropy	LMRT (*P*)	BLRT (*P*)	Probability of class
1	5320.543	5350.614	5325.240	–	–	–	–
2	4718.566	4767.431	4726.198	0.866	< 0.001	< 0.001	0.502 / 0.498
3	4509.241	4576.902	4519.810	0.857	0.037	< 0.001	0.435 / 0.353 / 0.211
4	4444.655	4531.110	4458.159	0.820	0.270	< 0.001	0.196 / 0.341 / 0.306 / 0.158
5	4398.688	4503.938	4415.128	0.844	0.490	< 0.001	0.297 / 0.041 / 0.322 / 0.215 / 0.126

Note:AIC = Akaike Information Criterion. BIC = Bayesian Information Criterion. aBIC = adjusted Bayesian Information Criterion. LMR (*P*) = *P* value for the Lo-Mendell-Rubin. BLRT (*P*) = *P* value for the Bootstrapped Likelihood Ratio Test.

Table 3

Model fit summary of the ordinal logistic regression analysis

Performance	Metrics	Statistic	P
Model fitting information	-2 Log likelihood	670.849	
	Likelihood ratio χ^2	447.677	< 0.001
Pseudo R-square	Cox & Snell	0.756	
	Nagelkerke	0.860	
	McFadden	0.667	
Test of parallel lines	χ^2	17.399	0.496
VIF	MDASI -HN = MD = 3.067; GAD-7 = 5.125;PSSS = 3.131		

Note: MDASI-HN = M.D. Anderson Symptom Inventory-Head and Neck module;GAD-7 = 7-item Generalized Anxiety Disorder scale;PSSS = Perceived Social Support Scale

Table 4

Assignment of independent variables

Variable	Assignment
Education level	Primary school or below = 1, Middle school = 2, High school or vocational = 3, Associate degree or above = 4
Occupation	Farmer = 1, Employee = 2, Retired = 3, Other = 4
Monthly income (RMB)	< 1000 = 1, 1000–5000 = 2, > 5000 = 3
Place of residence	Rural = 1, Urban = 2
Diagnosis	Nasopharyngeal carcinoma = 1, Laryngeal cancer = 2, Oral cancer = 3, Other = 4
Tumor stage	Stage I/II = 1, Stage III = 2, Stage IV = 3
Secondary metastasis	No = 1, Yes = 2
MDASI-H&N score	Raw value entered
GAD-7 score	Raw value entered
PSSS score	Raw value entered

Table 5
Ordinal Logistic regression analysis of potential categories (N = 317)

Variable	β	SE	Wald χ^2	*P*	OR	95% CI
Thresholds						
low-alienation	-3.347	2.439	1.883	0.170		
moderate-alienation	4.413	2.473	3.183	0.074		
Education level (reference: ≥Junior college)						
Primary school or below	0.153	1.128	0.018	0.892	1.165	0.128–10.611
Junior high school	-0.008	1.031	0.000	0.994	0.992	0.131–7.481
Senior high/vocational	-0.223	0.753	0.088	0.767	0.800	0.183–3.499
Occupation (reference: Other)						
Farmer	-0.331	0.481	0.475	0.491	0.718	0.279–1.846
Employee	-0.644	0.809	0.633	0.426	0.525	0.107–2.567
Retired	-1.069	0.798	1.796	0.180	0.343	0.072–1.641
Monthly income (reference: >5000 RMB)						
< 1000 RMB	1.240	1.203	1.063	0.303	3.456	0.328–36.455
1000–5000 RMB	2.291	1.093	4.392	0.036	9.890	1.162–84.178
Residence (reference: Urban)						
Rural	-0.520	0.630	0.679	0.410	0.595	0.173–2.049
Diagnosis (reference: Other types)						

Note: Class 1 = low-alienation well-adapted group, Class 2 = moderate-alienation interpersonal-alienation group, Class 3 = high-alienation social-isolation group.GAD-7 = 7-item Generalized Anxiety Disorder scale; MDASI-HN = M.D. Anderson Symptom Inventory-Head and Neck module; PSSS = Perceived Social Support Scale

Variable	β	SE	Wald χ^2	*P*	OR	95% CI
Nasopharyngeal carcinoma	0.572	0.555	1.059	0.303	1.771	0.595–5.269
Laryngeal carcinoma	0.774	0.783	0.977	0.323	2.169	0.467–10.073
Oral carcinoma	0.096	0.553	0.030	0.862	1.101	0.373–3.248
Tumor stage (reference: Stage IV)						
Stage I/II	0.726	0.591	1.510	0.219	2.066	0.649–6.581
Stage III	0.643	0.410	2.464	0.116	1.903	0.850–4.262
Secondary metastasis (reference: Yes)						
No	-0.360	0.433	0.692	0.405	0.697	0.297–1.635
MDASI-HN score	0.026	0.011	5.681	0.017	1.026	1.005–1.049
GAD-7 score	0.668	0.130	26.588	< 0.001	1.951	1.513–2.516
PSSS score	-0.168	0.029	33.097	< 0.001	0.846	0.799–0.895

Note: Class 1 = low-alienation well-adapted group, Class 2 = moderate-alienation interpersonal-alienation group, Class 3 = high-alienation social-isolation group.GAD-7 = 7-item Generalized Anxiety Disorder scale; MDASI-HN = M.D. Anderson Symptom Inventory-Head and Neck module; PSSS = Perceived Social Support Scale

4 Discussion

4.1 Social alienation among head and neck cancer patients is characterized by heterogeneity

The median GAS score among the 317 HNC patients included in this study was 38 (33, 44), which was consistent with the findings reported by Yuan Yuan et al[10], indicating that SA among HNC patients remained at a moderate-to-high level. These findings suggest that healthcare professionals should attach greater importance to the early assessment of SA in this population, promptly identify high-risk individuals, and implement targeted psychological interventions.

The results identified identified three distinct latent classes of SA among HNC patients. The first class, termed the “high-alienation group-social isolation type” (21.14%), was characterized by the highest levels of SA across all dimensions, accompanied by heavier symptom burden, higher anxiety levels, and lower social support. This finding may be associated with the persistent symptoms experienced by HNC patients following radiotherapy[25, 30], which adversely affect daily communication and social participation. These results suggest that impaired physical functioning, negative emotional states, and insufficient social support jointly contribute to the development of SA among HNC patients. This finding is consistent with previous LPA findings regarding well-being among HNC patients[31]. Nursing staff should therefore pay particular attention to the psychological status and social functional recovery of these patients.

The second class, termed the “moderate-alienation group-interpersonal alienation type”(43.53%), showed intermediate levels of anxiety and social support, with values poorer than those of the low-alienation group but less severe than those of the high-alienation group. These findings suggest that SA in this subgroup may be more closely associated with psychological maladaptation and insufficient social support. Strengthening emotional counseling and family support in clinical practice may help prevent progression toward more severe SA.

The third class, termed the “low-alienation group-well-adapted type”(35.33%), showed the lowest scores across all dimensions and relatively high levels of social support. Positive family support and stable social relationships may contribute to maintaining favorable disease adaptation in these patients.This finding is consistent with the results reported by Yu Lin et al[32], who suggested that high levels of social support may help reduce stigma and promote social reintegration among HNC patients. Nevertheless, continued attention should still be paid to their long-term social adaptation to prevent fluctuations in SA associated with disease progression.

These findings indicate substantial heterogeneity in SA among HNC patients. In addition to routine screening and monitoring, healthcare professionals should strengthen the assessment of SA, recognize differences in care needs across latent classes, and develop targeted stratified intervention strategies to reduce the risk of SA among HNC patients.

4.2 Profile characteristics and influencing factors of social alienation among patients with head and neck cancer

The social isolation type was characterized by a higher symptom burden, suggesting that symptom burden may represent an important feature of patients experiencing severe social alienation, which is consistent with the findings reported by Eden R. Brauer et al[33]. This association may be related to the persistent treatment-related complications commonly experienced by HNC patients. In the present study, xerostomia (87.4%), dysphagia (81.7%), taste alteration (76.0%), and speech difficulties (63.7%) were highly prevalent, indicating varying degrees of functional impairment among HNC patients. Similar findings were reported by Asmaa Abou-Bakr et al[34], who found that the prevalence of xerostomia among HNC patients receiving radiotherapy reached 78%. Another study[35] further showed that

symptoms such as taste alteration, xerostomia, sticky saliva, and pain became significantly more severe than other symptoms beginning in the third week of radiotherapy. These persistent symptoms not only impair physiological functioning and quality of life but also substantially restrict patients' ability to engage in social participation, thereby increasing the risk of SA.

The social isolation type was also more commonly observed among patients with monthly incomes of 1000–5000 yuan. Further analysis showed that this subgroup mainly consisted of middle-aged patients(42.3%), retired individuals(36.8%), and patients with a high school or vocational education(41.7%), suggesting that these patients still maintained certain social participation needs despite relatively limited financial resources. Compared with patients with higher income levels, this group may have had fewer coping resources and lower levels of social support. At the same time, unlike older individuals who had largely withdrawn from social roles, middle-aged patients often continued to face family financial responsibilities and interpersonal pressures after disease onset. Some patients reported that declining physical strength after illness prevented them from maintaining their previous occupational roles, forcing them to rely on temporary or unstable employment. Reduced work capacity, together with the financial burden associated with medical expenses, may further intensify psychological stress and feelings of self-blame. When functional impairments related to swallowing, speech, or appearance cannot be effectively improved because of financial limitations, stigma and social avoidance may become increasingly pronounced[36].

These findings suggest that symptom burden, economic stress, and social role disruption may be important characteristics of patients in the social isolation type and may jointly contribute to their experience of SA. Clinical care should therefore extend beyond routine symptom management to include psychological support and social adaptation interventions. Healthcare professionals should provide proactive and individualized swallowing rehabilitation before, during, and after treatment, including tongue exercises and blowing exercises to improve coordination of the swallowing muscles. Oral symptom management should also be strengthened through interventions such as oral moisturizing, acupoint massage, and tongue movement training to promote salivary secretion and improve oral comfort. In addition, healthcare professionals should pay attention to psychological distress associated with appearance changes and reduced work capacity. Family members and peers should be encouraged to provide emotional support and facilitate gradual reintegration into social activities, thereby helping patients reduce social avoidance and rebuild social confidence.

The social isolation type was characterized by higher levels of anxiety, indicating that psychological distress may be a prominent feature of patients experiencing severe social alienation. This finding is consistent with previous studies conducted among HNC patients[9, 37]. Humbert et al[38] reported that 44.0% of HNC patients continued to experience varying degrees of impaired social functioning even up to 5 years after treatment completion, indicating that the negative impact of the disease on social participation may persist long after treatment. Long-term changes in appearance and physiological functioning may increase patients' sensitivity to others' attention and evaluation. When patients perceive discrimination, rejection, or social distancing from others, they may gradually develop self-denial and

distrust, ultimately leading to withdrawal from interpersonal interactions[30]. In the present study, patients in the social isolation group showed particularly high scores in the Social isolation dimension, indirectly reflecting this cognitive tendency.

In contrast, the well-adapted type was characterized by the highest level of perceived social support. Patients may be more likely to obtain emotional comfort, affirmation, and acceptance from family members, friends, and peers when facing disease-related social difficulties. Such supportive experiences may help buffer the psychological stress associated with appearance changes, improve self-acceptance, and facilitate maintenance of normal social participation. Notably, the moderate-alienation group-interpersonal alienation type already demonstrated significantly lower social support levels than the low-alienation group-well-adapted type, suggesting that insufficient social support may emerge during the early stages of SA. Patients lacking adequate emotional support may therefore be more vulnerable to self-alienation and interpersonal withdrawal[39].

Healthcare professionals should place greater emphasis on assessing patients' social support systems. For patients with limited support resources, family members should be encouraged to actively participate in the treatment and rehabilitation process and provide emotional companionship and positive feedback in daily life to help patients rebuild a sense of self-worth within familiar relationships. Peer-support activities may additionally be organized to allow well-adapted patients to share coping experiences. Healthcare professionals themselves should also serve as an important source of support. In addition to routine nursing care, health lectures and informational booklets may help patients and their families better understand disease progression and treatment expectations, thereby reducing uncertainty and anxiety caused by insufficient information. Collaborative support from family members, patients, and healthcare professionals may help patients with limited social support gradually establish new social connections and reintegrate into social life.

5 Limitations

This study has several limitations. First, the cross-sectional design precludes any causal inferences regarding the relationships among the study variables. Second, other potentially relevant psychological variables were not included in the analysis. Third, participants were recruited from a single tertiary hospital, and the use of convenience sampling may have introduced selection bias, thereby limiting the generalizability of the findings. Future studies should employ multicenter, large-sample longitudinal designs to further clarify the temporal sequence and causal relationships among factors associated with different social alienation profiles. In addition, a broader range of psychological variables should be incorporated to provide a more comprehensive understanding of factors associated with SA among patients with cancer.

6 Conclusions

In this study, three latent classes of social alienation among patients with HNC were identified using LPA, namely the well-adapted type, interpersonal alienation type, and social isolation type, indicating substantial heterogeneity in social alienation among HNC patients. The three latent classes differed in monthly income, symptom burden, anxiety, and perceived social support, suggesting that patients with similar overall levels of SA have different psychosocial adaptation statuses and supportive care needs. These findings suggest that healthcare professionals should develop targeted stratified interventions based on the characteristics and support needs of different latent classes in order to reduce SA and promote social reintegration among HNC patients.

Abbreviations

HNC: Head and Neck Cancer

SA：Social alienation

LPA: Latent Profile Analysis

GAS: General Alienation Scale

MDASI-HN: M.D. Anderson Symptom Inventory–Head and Neck Module

GAD-7: Generalized Anxiety Disorder-7

PSSS: Perceived Social Support Scale

AIC: Akaike Information Criterion

BIC: Bayesian Information Criterion

aBIC: adjusted Bayesian Information Criterion

LMRT: the Lo-Mendell-Rubin adjusted likelihood ratio test

BLRT: Bootstrap likelihood ratio test

Declarations

Ethics approval and consent to participate

This study was approved by the Ethics Committee of the People's Hospital of Guangxi Zhuang Autonomous Region (ethics approval number: ITT Research Observation [2026]008 Exemption). All participants provided written informed consent prior to participation. All methods were performed in accordance with relevant guidelines and regulations and the Declaration of Helsinki.

Consent for publication

Not applicable.

Availability of data and materials

The data that support the findings of this study are available from the corresponding author, G.F. Fu, upon reasonable request.

Competing interests

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Authors' contributions

YW contributed to conceptualization, methodology, investigation, data curation, formal analysis, software, and writing of the original draft. LS contributed to conceptualization, methodology, and writing of the original draft. JW, JC, JLi, and JLu contributed to data curation, formal analysis, and writing of the original draft. GF contributed to project administration, supervision, and manuscript review and editing. All authors read and approved the final manuscript.

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Figures



Figure 1

Potential Social alienation Trajectory in head and neck cancer patients