Health-related quality of life and associated factors among non-melanoma skin cancer patients: a cross-sectional study

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Background: Non-melanoma skin cancer (NMSC) is a common malignant tumor that can lead to disability and a high recurrence rate, thus affecting the health-related quality of life (HRQoL) of patients. However, the HRQoL and its associated factors among Chinese patients with NMSC remain unknown. Considering HRQoL is a comprehensive indicator to assess an individual's health and well-being, as well as to provide a basis for future treatment decisions and care interventions, we investigated Chinese NMSC patients to assess the status of HRQoL, and to explore the associated factors of HRQoL.

Methods: This cross-sectional study was conducted at the largest dermatology hospital in China from November 2017 to February 2022. Participants were over 18 years, diagnosed with NMSC by pathological examination, and able to provide informed consent. A consecutive sampling technique was used and 202 eligible patients with NMSC were surveyed. Dermatology Life Quality Index, general information questionnaire, Athens Insomnia Scale, and Self-rating Anxiety Scale were used to measure their HRQoL and relevant information. Descriptive statistics, non-parametric test and Spearman's correlation analyses were used to compare the differences and assess the relationships between participants' demographic and clinical factors, sleep, anxiety, and HRQoL. Multiple linear regression analysis was performed to identify factors associated with HRQoL.

Results: A total of 176 NMSC patients (mean age 66 years, including 83 males and 93 females) were included. The median score of HRQoL was 3 [1, 7], and 116 (65.9%) NMSC patients' HRQoL was negatively affected. The score of the symptom and feeling domain was the highest 2 [1, 3], NMSC patients with squamous cell carcinoma and extramammary Paget disease had a significantly lower HRQoL than patients with basal cell carcinoma (P<0.05). Primary skin diseases, long-term history of mechanical stimulation, poor sleep, and anxiety were the associated factors of the HRQoL, comprising 43.5% of the total variance.

Conclusions: Most patients with NMSC live with poor HRQoL in China. It is necessary to provide timely assessment and develop targeted strategies to improve NMSC patients' HRQoL, such as multiple forms of health education, psychological care for the target population, and effective measures to improve patients' sleep.

Keywords: Non-melanoma skin cancer (NMSC); health-related quality of life (HRQoL); associated factors

Introduction

Skin cancer is the most common malignant tumor, which can occur in men and women of all ethnicities (1). Non-melanoma skin cancer (NMSC) accounts for about 95% of skin cancers, mainly including basal cell carcinoma (BCC), squamous cell carcinoma (SCC), extramammary Paget disease (EMPD), and Bowen's disease (2). Over the past decade, the incidence of NMSC has been increasing worldwide to approximately 50–100% (3-5). A survey showed that the incidence of NMSC in people over 60 years old was 0.64% in China in 2013 (6). The development of NMSC is considered a chronic and disabling process (7). NMSC usually occurs in exposed areas of the body such as the face and neck, and is often associated with symptoms of pain, discharge, and bleeding (8-10). The localized destructive growth pattern and subsequent treatment of NMSC may lead to scar formation, physical deformities, and functional impairment (11). Moreover, the recurrence rate of NMSC is extremely high, with approximately 40% of patients developing new tumors within 2 years (12). All these factors will lead to anxiety and distress in patients, which in turn affects their quality of life (2,13).

Health-related quality of life (HRQoL) refers to patients' perception of the physical, psychological, and social impact of disease and treatment (14). Evaluation of HRQoL is a useful way to elucidate the impact of the disease on skin cancer patients and to evaluate the effectiveness of treatment (15,16).

Highlight box

Key findings
- The majority of patients with NMSC lived with poor HRQoL in China. Primary skin diseases, long-term history of mechanical stimulation, poor sleep and anxiety were the associated factors of the HRQoL.

What is known and what is new?
- NMSC had considerable negative impact on HRQoL in patients living in countries outside of China, and age, gender and disease category were the associated factors of the HRQoL.
- Here, we reported that, in China, 65.9% of patients' HRQoL was negatively affected by NMSC, with 32.4% having moderately to severely impacted HRQoL, and primary skin diseases, long-term history of mechanical stimulation, poor sleep and anxiety were the associated factors of the HRQoL.

What is the implication, and what should change now?
- The negative impact of NMSC on patients' HRQoL should not be ignored. Timely assessment of QOL in patients with NMSC and targeted interventions to improve patients' HRQoL are necessary.

Research showed that NMSC had more than a moderate negative impact on HRQoL in approximately 1/4–1/3 of patients (17,18). Patients with SCC had a moderate negative impact, significantly higher than the mild negative impact in patients with BCC (9). The negative impact of NMSC on patients' symptoms and sensations is significantly higher than that of melanoma (18,19).

The HRQoL of NMSC patients may be affected by demographic, clinical, and psychological factors. However, these associated factors have been shown to be inconsistent in studies from different countries. The HRQoL of young NMSC patients in Iran was shown to be lower than that of older patients (9). However, a study in Germany indicated that the HRQoL of older patients was significantly lower than that of young patients (2). In addition, NMSC may have a greater negative impact on social relationships, work, and treatment among male patients than among female patients (9). In addition, mental health status, such as anxiety, in patients with NMSC has been shown to be a predictor of HRQoL (20-22).

To date, most studies on the HRQoL of NMSC patients have been conducted in countries outside of China. However, people under different sociocultural contexts may have different standards of life satisfaction and well-being than those from other countries, which may affect the perceived HRQoL. The current status of HRQoL and its associated factors among Chinese patients with NMSC remain unknown. Quality of life is a comprehensive indicator to assess the health and well-being of individuals and an important basis for treatment decisions (14), so it is essential to conduct a study on the HRQoL of Chinese NMSC patients. Filling this gap will help identify populations with significant negative impacts on HRQoL and facilitate the design of appropriate interventions to assist healthcare providers in improving HRQoL in Chinese NMSC patients. Therefore, this study aimed to assess the status of HRQoL among Chinese NMSC patients and to explore the associated factors of HRQoL. We present the following article in accordance with the STROBE reporting checklist (23) (available at https://atm.amegroups.com/article/view/10.21037/atm-22-6654/rc).

Methods

Study design

A prospective, cross-sectional study was conducted to assess the HRQoL among Chinese NMSC patients and its associated factors.

Sample size

Multiple linear regression was used in this study. It is a general rule for multivariate analysis that the sample size is at least 5 to 10 times the number of variables studied. This research involves 12 demographic, clinical and behavioral variables as well as sleep and anxiety scales. In total, there are 14 independent variables. Therefore, the sample size needs to be 70 to 140 cases. Considering the possibility of incomplete information in the questionnaires, at least 180 subjects were included in this study.

The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Ethics Review Committee of the Hospital for Skin Diseases and Institute of Dermatology, Chinese Academy of Medical Sciences & Peking Union Medical College (No. 2017-K-Y-006) and informed consent was taken from all the patients.

Study setting and participants

The study was conducted at the Hospital for Skin Diseases and Institute of Dermatology, the largest tertiary skin disease hospital in China, which serves patients with skin diseases from all over the country (approximately 1.5 million outpatients and 2,800 inpatients per year). A consecutive sampling method was adopted, and 202 NMSC patients from this tertiary hospital were recruited between November 2017 and February 2022. Eligible participants were required to be aged over 18, diagnosed with NMSC by pathological examination, and able to provide informed consent. Patients with psychiatric disorders and cognitive impairment, with hyperthyroidism and other tumors, with a history of alcoholism or drug addiction, or combined with other serious systemic diseases were excluded. A total of 176 patients with NMSC were eventually investigated, yielding a survey response rate of 87.13%.

Measurements

General information questionnaire

Participants' demographic [gender, age, mode of payment, marital status, body mass index (BMI)] and clinical information [type of disease, tumor location, history of primary skin disease, hypertension, and history of long-term oral medication, ultraviolet (UV) exposure, mechanical stimulation] were collected using a self-developed general information questionnaire.

Dermatology Life Quality Index (DLQI)

The DLQI was used to measure the HRQoL, which was adapted by Wang based on the scale developed by Finlay (24,25). This scale has been used to investigate the HRQoL of patients with skin cancer, rosacea and psoriasis (9,26,27). This 10-item scale includes 6 dimensions: symptoms and feelings (2 items), daily activities (2 items), leisure (2 items), work and study (1 item), personal relations (2 items), and treatment (1 item). The scale was measured using a 4-point Likert scale ranging from 0 to 3 with the total scores ranging from 0 to 30. Higher scores indicate a worse HRQoL (0–1= no effect, 2–5= small effect, 6–10= moderate effect, 11–20= very large effect, 21–30= extremely large effect) (28). The Cronbach's alpha of the scale was 0.875, the construct validity was 0.727 to 0.886, and the content validity was 0.402 to 0.657 (24).

Athens Insomnia Scale (AIS)

AIS was used to measure sleep quality, which was developed by Soldatos according to the International Classification of Diseases 10th Revision (ICD-10) insomnia diagnostic criteria (29). The subjective feeling of sleep is the main assessment content. The total score of this 8-item scale ranges from 0 to 24, with higher scores indicating poorer sleep quality. Scores of 4 and less suggest no sleep disorder, 4–6 suggest suspicious insomnia, and 6 and above indicate insomnia (29). The internal consistency coefficient of the scale is 0.77 to 0.86, and Cronbach's alpha is 0.89 (29).

Self-Rating Anxiety Scale (SAS)

SAS was used to measure anxiety, which was developed by Zung (30). The total score of this 20-item self-assessment scale ranges from 25 to 100, with higher scores indicating a higher level of anxiety (30). The total score was determined as the original score multiplied by 1.25 (31). The Cronbach's alpha coefficient of the SAS scale was 0.865 (30).

Date collection

The investigators were 4 nurses with more than 5 years of experience within the department. Before taking the survey, the investigators were provided standardized training to explain the aim and objectives of the study. Uniform instructions were used to introduce the purpose of the study to the participants. In addition, face-to-face interviews were conducted to explain the survey questions one by one to ensure that participants had a clear understanding of each item in the questionnaire.

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Statistical analysis

Data were analyzed using the SPSS 21.0 statistical software (IBM Corp., Armonk, NY, USA). Demographic and clinical data were analyzed descriptively. The scores of DLQI, AIS, and SAS were tested by the Shapiro-Wilk Z test. The data with normal distribution were represented by mean ± standard deviation (SD) whereas the non-conforming data were represented by the median (P25, P75). The t-test was used for normally distributed data and the non-parametric test was used for variables showing a skewed distribution (Wilcoxon rank sum test was used for 2-group comparison, and the Kruskal-Wallis H test was used for multi-group comparison). The chi-square test or Fisher's exact test was used for comparison between groups for disordered categorical data, and the Kruskal-Wallis H test was used for comparison between groups for non-normally distributed measurement data or ordinal categorical data. Pearson and Spearman's correlation analyses were used to compare the differences and assess the relationships between participants' demographic and clinical factors, sleep, anxiety, and HRQoL. Multiple linear regression analyses were performed to identify factors associated with HRQoL. Dummy variables were created for categorical variables. Variables with P<0.10 in univariate regression model were entered into the multiple linear regression model. Stepwise regression was used to identify variables that were statistically significant in the final multifactor model at P<0.05. The significance level of all analyses was set at 2-tailed P<0.05.

Results

Sample characteristics

The general demographic and clinical information of participants (mean age 66 years) is shown in *Table 1*. The majority of participants were over 60 years old (67.0%), female (52.8%), married (88.1%), held national health insurance (61.4%), and BMI ≥24 (48.3%). Most were diagnosed with BCC (47.2%) and had tumors on the face (58%). Some 35.8% of participants had a history of long-term UV exposure and 15.3% had a long history of mechanical stimulation. Participants with previous primary skin diseases accounted for 43.2% of the cohort.

HRQoL

The mean score of the DLQI for the 176 participants was 3 [1, 7]. Of the 6 domains of the scale, the symptom and feelings domain had the highest mean score of 2 [1, 3] (*Table 2*). Of the 176 NMSC patients, 116 patients' HRQoL (65.9%) was impacted and 32.4% of patients' HRQoL was moderately to severely impacted. A total of 142 patients (80.7%) reported itching or pain according to DLQI.

Univariate analysis of the factors associated with HRQoL

Non-parametric test analysis revealed that type of disease, primary skin disease, history of long-term UV radiation, and history of long-term mechanical stimulation were factors associated with the HRQoL of NMSC patients (P<0.05) (*Table 3*). After the rank cases operation, the rank DLQI was obtained. The Bonferroni's post-hoc test revealed that the scores of DLQI in patients with BCC were significantly lower than those in patients with SCC (P<0.05) and patients with EMPD (P<0.05).

Correlation analysis of sleep, anxiety, and HRQoL

Among 176 NMSC patients, 15 patients had sleep problems and 47 patients had insomnia. The positive SAS score accounted for 13.1% of the respondents. Correlation analysis showed that sleep and anxiety were positively correlated with HRQoL (r=0.519, P<0.01, and r=0.509, P<0.01, respectively). There was also a positive correlation between sleep and anxiety (r=0.515, P<0.01) (*Table 4*).

Multiple linear regression analysis of HRQoL

The DLQI scores were significantly higher for the NMSC patients with primary skin disease (β=0.161, P=0.008), long history of mechanical stimulation (β=0.252, P<0.001), poor sleep (β=0.337, P<0.001), anxiety (β=0.234, P<0.001). Multiple linear regression results showed that primary skin disease, long history of mechanical stimulation, sleep, and anxiety were significant correlates explaining 43.5% of the total model variation (*Table 5*).

Discussion

In this study, the overall mean of DLQI among patients with NMSC was 3 (1,7), indicating that most patients with NMSC lived with poor HRQoL. HRQoL was negatively affected by NMSC in 65.9% of patients, with 32.4% of them having moderately to severely impacted HRQoL. This finding is consistent with studies conducted in Germany

Table 1 Sample characteristics

Variables	Frequency (n)	Percent (%)
Gender		
Male	83	47.2
Female	93	52.8
Age category (years)		
≤40	10	5.7
41–50	19	10.8
51–60	29	16.5
61–70	42	23.9
71–80	41	23.3
>80	35	19.9
Mode of payment		
Commercial insurance	5	2.8
National health insurance	108	61.4
Pay by oneself	63	35.8
Marital status		
Single	1	0.6
Married	155	88.1
Divorced	0	0.0
Widowed	20	11.4
BMI		
<18.5 (underweight)	12	06.8
18.5–23.9 (normal range)	79	44.9
24–27.9 (overweight)	68	38.6
≥28 (obese)	17	9.7
Disease category		
BCC	83	47.2
SCC	68	38.6
EMPD	17	9.7
Bowen's disease	8	4.5
Tumor location		
Face	102	58.0
Head and neck	15	8.5
Trunk	37	21.0
Arms and legs	22	12.5

Table 1 (*continued*)

Table 1 (*continued*)

Variables	Frequency (n)	Percent (%)
Long history of UV exposure		
Yes	63	35.8
No	113	64.2
Long history of mechanical stimulation		
Yes	27	15.3
No	149	84.7
Primary skin disease		
Yes	76	43.2
No	100	56.8
Hypertension		
Yes	71	40.3
No	105	59.7
History of long-term oral medication		
Yes	95	54.0
No	81	46.0

BMI, body mass index; BCC, basal cell carcinoma; SCC, squamous cell carcinoma; EMPD, extramammary Paget disease; UV, ultraviolet.

Table 2 Median DLQI score among patients with NMSC

Variables	P25	Median	P75
Symptoms and feelings	1	2	3
Daily activities	0	0	1
Leisure	0	0	1
Work and school	0	0	0
Interpersonal relations	0	0	1
Treatment	0	0	1
Overall DLQI	1	3	7

DLQI, Dermatology Life Quality Index; NMSC, non-melanoma skin cancer

and France (10,18). Possible reasons for the low HRQoL perceived by patients with NMSC are the fact that cancer usually occurs in exposed areas. Frequent surgical treatment may lead to disfigurement and a high recurrence rate of the disease, which will lead to physical, psychological, and social

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Table 3 Univariate analysis of the demographic and clinical factors associated with DLQI

Domains variables	Symptoms and feelings	Daily activities	Leisure	Work and school	Interpersonal relations	Treatment	Overall DLQI
Gender							
Male	2.0 (2.0)	0.0 (1.0)	0.0 (1.0)	0.0 (0.0)	0.0 (1.0)	0.0 (1.0)	3.0 (6.0)
Female	2.0 (2.0)	0.0 (1.0)	0.0 (1.0)	0.0 (0.0)	0.0 (1.0)	0.0 (1.0)	3.0 (6.0)
Z value	−0.108	−0.896	−0.468	−0.017	−0.307	−0.370	−0.544
P value	0.914	0.370	0.639	0.987	0.759	0.711	0.586
Age (years)							
≤40	1.0 (3.0)	0.0 (1.8)	0.0 (0.8)	0.0 (1.3)	0.0 (1.5)	0.0 (2.0)	1.5 (10.3)
41–50	2.0 (3.0)	0.0 (1.0)	0.0 (1.0)	0.0 (0.0)	0.0 (1.0)	0.0 (1.0)	3.0 (6.0)
51–60	2.0 (2.0)	0.0 (1.0)	0.0 (1.0)	0.0 (0.0)	0.0 (1.0)	0.0 (0.5)	3.0 (5.0)
61–70	2.0 (2.0)	0.0 (2.0)	0.0 (2.0)	0.0 (0.0)	0.0 (1.3)	0.0 (1.0)	3.0 (7.3)
71–80	2.0 (2.0)	0.0 (1.0)	0.0 (1.5)	0.0 (0.0)	0.0 (1.0)	0.0 (1.0)	2.0 (5.5)
>80	2.0 (2.0)	0.0 (2.0)	0.0 (2.0)	0.0 (0.0)	0.0 (1.0)	0.0 (1.0)	3.0 (9.0)
c^2 value	1.520	0.379	1.780	1.906	3.342	3.869	1.171
P value	0.911	0.996	0.879	0.862	0.647	0.568	0.948
Mode of payment							
CI	1.0 (1.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.5)	0.0 (0.5)	2.0 (1.5)
NHI	2.0 (2.0)	0.0 (2.0)	0.0 (2.0)	0.0 (0.0)	0.0 (1.0)	0.0 (1.0)	3.5 (7.0)
Without insurance	2.0 (2.0)	0.0 (1.0)	0.0 (1.0)	0.0 (0.0)	0 (1.0)	0.0 (1.0)	2.0 (5.0)
c^2 value	1.006	7.716	5.335	2.123	3.906	1.438	2.787
P value	0.605	0.021*	0.069	0.346	0.142	0.487	0.248
Marital status							
Single	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)
Married	2.0 (2.0)	0.0 (1.0)	0.0 (1.0)	0.0 (0.0)	0.0 (1.0)	0.0 (1.0)	3.0 (6.0)
Widowed	1.5 (2.0)	0.0 (2.0)	0.0 (2.0)	0.0 (1.0)	0.0 (1.8)	0.0 (1.0)	2.0 (11.0)
c^2 value	2.395	0.588	0.726	1.377	0.915	0.779	2.414
P value	0.302	0.745	0.696	0.502	0.633	0.677	0.299
BMI							
<18.5	2.0 (2.0)	0.0 (1.8)	0.0 (0.8)	0.0 (0.8)	0.0 (0.8)	0.0 (1.0)	2.0 (8.5)
18.5–23.9	2.0 (2.0)	0.0 (1.0)	0.0 (1.0)	0.0 (0.0)	0.0 (1.0)	0.0 (1.0)	3.0 (6.0)
24–27.9	2.0 (2.0)	0.0 (1.0)	0.0 (1.0)	0.0 (0.0)	0.0 (1.0)	0.0 (1.0)	3.0 (5.8)
≥28	2.0 (3.0)	1.0 (1.0)	10.0 (2.0)	0.0 (1.0)	0.0 (1.5)	0.0 (1.0)	5.0 (9.5)
c^2 value	2.323	0.715	3.877	1.163	1.998	0.995	1.206
P value	0.508	0.870	0.275	0.762	0.573	0.803	0.751

Table 3 (*continued*)

Table 3 (*continued*)

Domains variables	Symptoms and feelings	Daily activities	Leisure	Work and school	Interpersonal relations	Treatment	Overall DLQI
Type of disease							
BCC	1.0 (2.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	0.0 (1.0)	0.0 (1.0)	2.0 (3.0)
SCC	2.0 (2.0)	0.5 (2.0)	1.0 (2.0)	0.0 (1.0)	0.0 (2.0)	0.0 (1.0)	5.0 (9.8)
EMPD	3.0 (1.5)	1.0 (2.0)	0.0 (2.0)	0.0 (1.0)	0.0 (1.5)	1.0 (1.0)	5.0 (8.5)
Bowen's disease	2.0 (2.0)	0.5 (1.8)	0.0 (1.5)	0.0 (0.0)	0.0 (0.8)	1.0 (1.0)	3.5 (6.0)
c^2 value	24.687	17.375	16.606	5.927	4.226	11.602	22.463
P value	<0.001**	0.001**	0.001**	0.115	0.238	0.009**	<0.001**
Tumor location							
Face	2.0 (2.0)	0.0 (1.0)	0.0 (1.0)	0.0 (0.0)	0.0 (1.0)	0.0 (1.0)	2.0 (6.3)
Head and neck	1.0 (2.0)	0.0 (1.0)	0.0 (1.0)	0.0 (0.0)	0.0 (0.0)	0.0 (0.0)	1.0 (3.0)
Trunk	2.0 (1.5)	0.0 (2.0)	0.0 (1.5)	0.0 (0.0)	0.0 (1.0)	0.0 (1.0)	4.0 (5.5)
Arms and legs	1.0 (3.0)	0.5 (2.3)	0.0 (2.0)	0.0 (1.0)	0.0 (1.3)	0.0 (1.0)	4.5 (9.5)
c^2 value	11.020	5.554	1.585	6.876	6.510	6.358	7.694
P value	0.012*	0.135	0.663	0.076	0.089	0.095	0.053
UV exposure							
Yes	2.0 (2.0)	0.0 (2.0)	0.0 (2.0)	0.0 (0.0)	0.0 (1.0)	0.0 (1.0)	3.0 (7.0)
No	2.0 (2.0)	0.0 (1.0)	0.0 (1.0)	0.0 (0.0)	0.0 (1.0)	0.0 (1.0)	2.0 (5.0)
Z value	−2.208	−1.255	−1.756	−0.725	−1.631	−1.168	−2.443
P value	0.027*	0.210	0.079	0.468	0.103	0.243	0.015*
Mechanical stimulation							
Yes	3.0 (2.0)	2.0 (3.0)	1.0 (2.0)	0.0 (1.0)	2.0 (3.0)	1.0 (2.0)	9.0 (11.0)
No	2.0 (2.0)	0.0 (1.0)	0.0 (1.0)	0.0 (0.0)	0.0 (1.0)	0.0 (1.0)	2.0 (4.5)
Z value	−4.294	−4.837	−4.778	−3.463	−4.526	−4.392	−4.840
P value	<0.001**	<0.001**	<0.001**	0.001**	<0.001**	<0.001**	<0.001**
Primary skin disease							
Yes	2.0 (2.0)	1.0 (1.0)	1.0 (21.0)	0.0 (1.0)	1.0 (2.0)	1.0 (1.0)	5.0 (9.0)
No	1.5 (1.8)	0.0 (1.0)	0.0 (1.0)	0.0 (0.0)	0.0 (0.0)	0.0 (1.0)	2.0 (4.0)
Z value	−2.719	−4.080	−3.471	−2.506	−4.412	−3.946	−4.290
P value	0.007**	<0.001**	0.001**	0.012*	<0.001**	<0.001**	<0.001**
Hypertension							
Yes	2.0 (2.0)	0.0 (1.0)	0.0 (2.0)	0.0 (0.0)	0.0 (1.0)	0.0 (1.0)	2.0 (6.0)
No	2.0 (2.0)	0.0 (1.0)	0.0 (1.0)	0.0 (0.0)	0.0 (1.0)	0.0 (1.0)	3.0 (6.0)
Z value	−0.136	−0.834	−1.437	−1.085	−0.847	−0.322	−0.944
P value	0.892	0.404	0.151	0.278	0.397	0.747	0.345

Table 3 (*continued*)

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Table 3 (*continued*)

Domains variables	Symptoms and feelings	Daily activities	Leisure	Work and school	Interpersonal relations	Treatment	Overall DLQI
Oral medication							
Yes	2.0 (2.0)	0.0 (1.0)	0.0 (1.0)	0.0 (0.0)	0.0 (1.0)	0.0 (1.0)	3.0 (6.0)
No	2.0 (2.0)	0.0 (1.0)	0.0 (1.0)	0.0 (0.0)	0.0 (1.0)	0.0 (1.0)	3.0 (6.0)
Z value	−1.098	−0.173	−0.814	−0.334	−0.365	−0.510	−0.141
P value	0.272	0.862	0.416	0.738	0.715	0.610	0.888

*, significant at $P<0.05$; **, significant at $P<0.01$. Data were presented as median (IQR). DLQI, Dermatology Life Quality Index; CI, commercial insurance; NHI, National Health Insurance; BMI, body mass index; BCC, basal cell carcinoma; SCC, squamous cell carcinoma; EMPD, extramammary Paget disease; UV, ultraviolet; IQR, interquartile range.

Table 4 Correlation analysis of AIS, SAS, and DLQI

Measure	DLQI	AIS
DLQI	–	–
AIS	0.519**	–
SAS	0.509**	0.515**

**, significant at $P<0.01$. DLQI, Dermatology Life Quality Index; AIS, Athens Insomnia Scale; SAS, Self-Rating Anxiety Scale.

dysfunction (32).

We found that the dimension of symptoms and feelings had the most significant impact on the HRQoL scale. This finding is in line with previous studies (18,19). By further analyzing the responses to the items of the DLQI scale, 80.7% of patients felt itching or pain at the lesions, which represents similar findings to the study in Brazil (78.3%) (33). This suggests that most NMSC are accompanied by objective symptoms such as pain, discharge, bleeding, and ulceration, which would increase the patients' distress, enhance their perception of skin cancer and lead to a decrease in their HRQoL (9,10).

Multiple linear regression analysis showed that primary skin disease, long history of mechanical stimulation, sleep, and anxiety were significant factors associated with NMSC patients' HRQoL. NMSC patients with primary skin disease have a lower HRQoL than those without primary skin disease, which might be due to having a primary skin disease being related to enduring the disease for a long time. In addition, primary skin diseases are often associated with negative feelings such as itching and pain increasing patient distress, which may lead to a lower HRQoL (34,35). We also found that NMSC patients with a long history

of mechanical stimulation had worse HRQoL. Most skin tumors are accompanied by itching and pain, which can lead to involuntary scratching or touching. Patients with a long history of mechanical stimulation may unconsciously associate individual active stimulation behavior with tumor diagnosis, which increases the psychological burden on the patients and lead to lower HRQoL (2).

We found that HRQoL was negatively associated with sleep, with more than 1/3 of participants having sleep problems. One study found that patients' sleep was affected by the fear that NMSC would worsen (36). Also, physical and mental fatigue caused by sleep deprivation can lead to anxiety, further reducing patients' HRQoL (37). HRQoL was also found to be negatively affected in NMSC patients with significant anxiety. The results of this study showed that 13.1% of the respondents had a positive score on the SAS. Mental health status is a predictor of HRQoL (20). Previous studies have reported that 18% of NMSC patients have clinically significant levels of distress, and a significant proportion of them may have anxiety (36). The diagnosis, treatment, and follow-up of cancer leads to the feeling of uncertainty and fear, which may decrease NMSC patients' HRQoL (38,39).

Our study showed that the HRQoL were significantly lower in patients with SCC than in patients with BCC, which is consistent with previous findings (18). Compared with BCC, the aggressive nature of the disease and the more destructive treatment approach caused a greater negative impact on HRQoL in SCC patients (9). This study also found that HRQoL was significantly more negatively affected in patients with EMPD than in patients with BCC. EMPD is often associated with severe pruritus and is easily misdiagnosed as eczema (40). In addition, the long duration

Table 5 Multiple linear regression analysis of DLQI

Variables	Category	B	95% CI	β	t	P
Original skin disease	Yes (reference group = no)	1.718	0.452, 2.983	0.161	2.680	0.008*
Long history of mechanical stimulation	Yes (reference group = no)	3.695	1.935, 5.455	0.252	4.144	<0.001**
AIS		0.410	0.256, 0.564	0.337	5.255	<0.001**
SAS		0.132	0.059, 0.206	0.234	3.555	<0.001**

R^2=0.435. *, significant at $P<0.05$; **, significant at $P<0.01$. DLQI, Dermatology Life Quality Index; CI, confidence interval; β, standardized coefficients beta; AIS, Athens Insomnia Scale; SAS, Self-Rating Anxiety Scale.

of the disease, pronounced symptoms, lesions located in private areas, large surgical wounds, and difficulties in postoperative repair increase patients' psychological stress and reduce their HRQoL. Long-term UV exposure has also been shown to lower HRQoL in patients with NMSC. A possible reason for this is that when diagnosed, patients realize that a history of UV exposure is the primary cause of NMSC (41), and the recollection of previous sun exposure experiences may increase patients' fear of future skin cancers and contribute to worse HRQoL (42).

Strengths and limitations

To our knowledge, this is the first study to assess the HRQoL and its associated factors among Chinese NMSC patients. The findings of this study can provide a basis for future intervention development studies to improve the HRQoL of patients with NMSC. Several limitations of this study should be noted. First, the consecutive sampling approach may lead to selection bias and limit the representativeness of study findings. Second, the cross-sectional study design cannot assess the causality of different variables and cannot determine the changes in participants' HRQoL. A future longitudinal follow-up survey is needed. Finally, self-reported questionnaires may further limit the reliability of responses.

Conclusions

In this study, we found that most NMSC patients had poor quality of life in China. Primary skin diseases, long-term history of mechanical stimulation, sleep, and anxiety were the associated factors of the HRQoL. The HRQoL were significantly lower in patients with SCC and EMPD than in patients with BCC. Our findings emphasize the considerable negative impact of NMSC on patients' health and well-being and the need for timely assessment of the quality of life. Moreover, there is a need to raise awareness of the impact of NMSC on patients' quality of life and to develop targeted strategies to improve NMSC patients' HRQoL, such as multiple forms of health education, psychological care for the target population, and effective measures to improve patients' sleep.

Footnote

Reporting Checklist: The authors have completed the STROBE reporting checklist. Available at https://atm.amegroups.com/article/view/10.21037/atm-22-6654/rc

Data Sharing Statement: Available at https://atm.amegroups.com/article/view/10.21037/atm-22-6654/dss

Conflicts of Interest: All authors have completed the ICMJE uniform disclosure form (available at https://atm.amegroups.com/article/view/10.21037/atm-22-6654/coif). The authors have no conflicts of interest to declare.

Ethical Statement: The authors are accountable for all aspects of the work in ensuring that questions related

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to the accuracy or integrity of any part of the work are appropriately investigated and resolved. The study was conducted in accordance with the Declaration of Helsinki (as revised in 2013). The study was approved by the Ethics Review Committee of the Hospital for Skin Diseases and Institute of Dermatology, Chinese Academy of Medical Sciences & Peking Union Medical College (No. 2017-K-Y-006) and informed consent was taken from all the patients.

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