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Relationship Between Sexual Function, Health-Promoting Behaviors, and Quality of Life in Female Patients With Pulmonary Arterial Hypertension

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ABSTRACT

Pulmonary arterial hypertension (PAH) is a chronic progressive exacerbation of cardiopulmonary vascular disease. The patients' exercise endurance decreased progressively and the survival rate was low. Current basic therapy and targeted drug therapy can improve the quality of life (QoL) of PAH patients, but the long-term efficacy and prognosis are not good. In this study, the female sexual function index (FSFI) scale, Health Promoting Life Style Profile (HPLPII), and emPHasis-10 were used to evaluate PAH patients' sexual function, health-promoting behaviors and QoL. Their correlation and the moderating effect of health promoting behavior were conducted. In total, 306 female patients responded. Age ranged from 18 to 69 years old and the mean age was (38.049 ± 10.686) . The average score of sexual function in female PAH patients was (21.703 ± 8.947) points, and the detection rate of sexual dysfunction was 51.307%. The average score of health-promoting behaviors and QoL was (121.915 ± 13.507) points and (17.992 ± 10.245) points respectively. QoL was significantly negatively correlated with sexual function and health-promoting behaviors, while sexual function was significantly positively correlated with health-promoting behaviors. The health-promoting behaviors of female patients with PAH has a moderating effect between sexual function and QoL. The sexual function, health-promoting behaviors and QoL of female PAH patients were all at an general level. Improving the level of health-promoting behaviors could reduce the negative predictive effect of sexual function on QoL.

1 | Introduction

Pulmonary hypertension (PH) refers to the pathophysiological state of abnormal increase in pulmonary vascular resistance and pulmonary artery pressure caused by changes in pulmonary vascular structure and/or function for various reasons, which then develops into right heart failure and eventually leads to

death [1, 2]. PH is divided into five different groups, where Group 1 (those with PAH) is known to predominantly affect women [3], particularly of child-bearing age [4, 5]. The study found that the number of PAH patients was increasing year by year, and the peak age of adult onset was 41–50 years old, and female patients were mainly affected compared to men [6, 7]. In recent years, targeted drug therapy has significantly

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improved the quality of life (QoL) and survival rate of patients with PAH, but the long-term efficacy and prognosis are not good [8–11]. The QoL in PAH patients was significantly lower than the norm in the Chinese general population. Women who were unemployed and live in rural areas have a worse QoL [7], need more medical assistance and social and family support, and need the attention of medical workers and society.

At present, the therapeutic effect of PAH is mostly based on objective rating indicators such as survival rate, hemodynamic parameters and biomarkers [12], and the perceived therapeutic effect of patients cannot be evaluated. The EmPHasis-10 score was found to have a significant correlation with its risk stratification [13]. In this study, the EmPHasis-10 scale was applied to assess patients' QoL, that is, patients' perceptions of their general health, focusing more on the symptoms (physical and psychological) and limitations on functioning present in the disease, which are a direct reflection of their general health status. Patients with PAH have impaired cardiorespiratory, emotional, and social function, low self-esteem, and impaired body image [14, 15], and significantly reduced sexual health related QoL [16]. At present, relevant studies are still rare. Previous study found that the average sexual function score of female patients with congenital heart disease-related pulmonary hypertension was (22.420 ± 8.347) , and the detection rate of sexual dysfunction was as high as 48.299% [17]. A study of 35 women with PAH by Debasree Banerjee et al found higher levels of sexual health impairment in PAH patients. Sexual functioning is an important pillar of QoL and poor health, especially in chronic diseases, which is accompanied by lower sexual satisfaction [15]. In addition, the World Health Organization (WHO) classifies PAH as Class IV maternal cardiac risk and avoidance of pregnancy is strongly recommended [18]. Despite significant improvements in the treatment of patients with PAH, pregnancy is still considered a contraindication, not only because of high maternal morbidity and mortality, but also because of serious fetal consequences. Right heart failure is the most common cause of death in these patients because they are unable to compensate for the physiological changes of pregnancy [19]. Recommendations that female patients should avoid pregnancy may increase negative emotions in patients [14]. Fear of pregnancy may increase the risk of sexual dysfunction and reduce the QoL related to sexual health [20].

Health-promoting behaviors is a kind of spontaneous, long-term and multifaceted behavior in the process of maintaining and improving one's health level and realizing self-actualization. Some scholars have divided health-promoting behaviors into the following six aspects: (1) health responsibility refers to the active behavior of consulting relevant medical institutions about individuals' health situation; (2) nutritional support means that individuals choose healthy foods according to the nature of the disease to eat a balanced diet; (3) stress management is a way to use certain skills to relieve pressure and maintain a mental dynamic balance, so as to achieve a good physical and mental state; (4) physical activity refers to regular participation in different forms of exercise that can be rehabilitated for routine ailments in daily life; (5) interpersonal relationships refers to the meaningful and satisfying relationship established through communication with others in interpersonal communication; and (6) spiritual growth refers to the development of an

individual's sense of self-worth, that is, an individual has his own purpose in life and achieves his own purpose through his own plans [21–23]. Due to impaired cardiopulmonary function and limited ability to perform daily activities, patients with PAH need long-term lifestyle changes and management to maintain their original life status [21]. Studies have shown that patients' bad living habits and poor medication compliance are related to complications [21]. A healthy lifestyle is associated with better health and QoL [24]. Health-related guidance and exercise training on the basis of existing treatment can effectively improve patients' exercise ability, increase patients' exercise tolerance, improve patients' clinical symptoms, improve their QoL, reduce mortality, and it is safe and feasible, which is beneficial for the management of patients with stable condition after drug treatment [3, 25–27]. Therefore, how to help patients with PAH cope with the disease, develop a healthy lifestyle, so that their lives disrupted by the disease can be restored, and they can cope with the disease more effectively is very important [21, 28]. A large number of studies have also shown that helping patients to enhance the performance of health-promotion behaviors can improve the QoL [21].

With the wide application of targeted drugs and the continuous optimization of treatment strategies, the QoL and prognosis of patients with PAH have been improved to some extent, but so far, PAH is still an incurable malignant disease. At present, the evaluation of patients' treatment effects lacks the evaluation of patients' subjective experience and lifestyle. Through objective understanding of the self-assessed QoL and health status of female patients with PAH in China at the present stage, understanding the relationship between sexual function, health-promotion behaviors and QoL, and identifying related risk factors, this study has important guiding significance for the formulation of clinical management strategies and later intervention.

2 | Study Design and Methods

2.1 | Study Setting and Population

This study was a cross-sectional study. 315 female PAH patients treated in the outpatient and inpatient department of Cardiology from the Second Xiangya Hospital of Central South University in China from January 2021 to December 2023 were selected by facilitating the sampling method. We did not combine men and women for this study given the marked physiologic and psychologic differences in sexual function by sex.

Inclusion criteria were as follows: (1) female patients with PAH, confirmed by right heart catheterization in accordance with the Diagnostic criteria of the European Heart Society for PAH (mean pulmonary artery pressure, determined by right heart catheterization at the sea level at rest, mean pulmonary arterial pressure > 20 mmHg, pulmonary vascular resistance (PVR) < 2 Wood units (WU) and pulmonary artery wedge pressure (PAWP) ≤ 15 mmHg); (2) 18 years \leq age \leq 75 years; (3) have basic reading comprehension ability; and (4) informed consent and voluntary participation in the study.

Exclusion criteria were as follows: (1) NYHA classification was Class IV and had symptoms of right heart failure; (2) combined

with other serious organ diseases, such as liver and kidney failure, malignant tumor end-stage and so on; (3) so far, have no sexual partner and have never had sexual activity; and (4) patients readmitted to the hospital during the study period.

The sample size was calculated by Gpower3.1 software, with an effect size = 0.2, $\alpha = 0.05$, $1 - \beta = 0.90$, and bilateral probability values. The sample size required for correlation analysis was 255. A total of 306 valid questionnaires were collected. Age ranged from 18 to 69 years old and the mean age was (38.049 ± 10.686) years.

2.2 | Tools

2.2.1 | General Information Form

The main content includes age, marital status, per capita household income, education level, occupation, and course of disease.

2.2.2 | Female Sexual Function Index (FSFI)

FSFI contains 19 items, including desire, arousal, lubrication, orgasm, satisfaction, and pain six dimensions, each dimension score for entry points and with the corresponding coefficient of the product. The score of each dimension is the product of the sum of the item scores and the corresponding coefficient, and the total score is the sum of the scores of each dimension, ranging from 2 to 36. The higher the score indicates the better sexual function, and when the FSFI total score of the tester is lower than 26.55, it is considered to have sexual dysfunction. Cronbach's α -coefficient for each dimension of FSFI was greater than 0.82 [29, 30].

2.2.3 | Health Promoting Life Style Profile (HPLP II)

HPLP II was used to measure an individual's health-promoting behaviors. It contains 52 items designed in the form of a 4-point Likert scale (never 1, sometimes 2, usually 3, and always 4) including health responsibility, physical activity, spiritual growth, nutrition, interpersonal relationships, and stress management six dimensions. The total score is the sum of the scores of each dimension, ranging from 52 to 208. A score of 172–208 scores indicated that the health-promotion behaviors were “excellent”; A score of 132–171 indicated “good”; A score of 92–131 points indicated “general”; scores less than 92 indicated “poor” [31]. The revised HPLP II was adopted in this study and the Cronbach's α -coefficients was 0.932 [32].

2.2.4 | EmPHasis-10

EmPHasis-10 was developed by UK academician Janelle Yorke to assess QoL in PAH patients. It contains 10 items designed in the form of a 6-point Likert scale. The Chinese version of emPHasis-10 Cronbach's α -coefficient was 0.90 and retest reliability was 0.95. Each item is scored from 0 to 5 on a scale from

“none at all” to “always.” The full score of the total score is 50 points, and the higher the score, the worse the QoL of the patients [33].

2.3 | Statistical Analysis

IBM SPSS Statistics version 23.0 was used to analyze data. Spearman correlation and SPSS PROCESS macro program (version 3.2) were applied to correlation analysis and the moderating effect test.

3 | Results

The general information of this study is as follows (see Table 1).

TABLE 1 | General information.

| Variables | Classification | Frequency |
|------------------------------------|--|-----------|
| Age (years) | ≤ 30 | 70 |
| | 31–50 | 191 |
| | > 50 | 45 |
| Marital status | Unmarried | 22 |
| | Married | 264 |
| | Divorced | 20 |
| Per capita household income (yuan) | ≤ 2000 | 122 |
| | 2001–5000 | 136 |
| | > 5000 | 48 |
| Educational level | Primary/Junior High School | 93 |
| | High school/technical secondary school | 150 |
| | Undergraduate/Postgraduate | 63 |
| Occupation | Service staff | 89 |
| | Individual household | 9 |
| | Farmer | 57 |
| | Retirement | 10 |
| | Unemployed | 141 |
| Course of the disease (years) | < 1 | 51 |
| | 1–5 | 90 |
| | > 5 | 165 |
| Comorbidities | Yes | 201 |
| | No | 105 |
| Medications | Oral | 287 |
| | Oral and Subcutaneous pumping | 19 |

3.1 | Common Method Deviation Analysis

Harman single-factor test showed that there were 11 factors with feature roots greater than 1, and the explanatory variance of the first factor was 29.918%, indicating that there was no common method bias in the study data.

3.2 | Status of Sexual Function, Health-Promoting Behaviors and Qol in Female PAH Patients

The score of sexual function in female PAH patients was from 4.40 to 36 points, and the average score was (21.703 ± 8.947) points. 157 patients were less than 26.55 points and 149 patients were greater than or equal to 26.55 points, and the detection rate of sexual dysfunction was 51.307%. The score of health-promoting behaviors in female PAH patients was from 89 to 150 points, and the average score was (121.915 ± 13.507) points. Indicates that the female PAH patient's health-promoting behaviors was average. The score of Qol in female PAH patients was from 2 to 41 points, and the average score was (17.992 ± 10.245) points(see Table 2).

3.3 | Correlation Analysis Between Sexual Function, Health-Promoting Behaviors, and Qol of Female Patients With PAH

The sexual function, health-promoting behaviors and Qol of female patients with PAH meet the normal distribution or approximate normal distribution. Pearson correlation analysis showed that female PAH patients' Qol was significantly negatively correlated with sexual function and health-promoting behaviors, while sexual function was significantly positively correlated with health-promoting behaviors (see Table 2).

3.4 | Model Test of Moderating Effects

To further verify sexual function, health-promoting behaviors and Qol of female patients with PAH, we took age, per capita household income, marital status, education level, occupation and course of disease as the control variables, and sexual function as the independent variable (X). Health-promoting behaviors was used as the moderating variable (W) and Qol as the dependent variable (Y), respectively. Model 1 in SPSS PROCESS macro program was used to analyze the moderating effects. Data analysis was conducted using the percentile Bootstrap method with bias correction. The sample size was 5000, and 95% confidence interval (CI) was selected. If 95%CI

does not contain 0, it indicates statistical significance. As shown in Table 3, health-promoting behaviors had significant moderating effects on the path of sexual function and Qol. 95% CI of interaction items in the path of "sexual function → health-promoting behaviors → Qol" ranged from 0.005 to 0.015; 95%CI did not include 0, and the difference was statistically significant ($p < 0.01$) (see Table 3).

According to mean \pm 1 SD (standard deviation), health-promoting behaviors was divided into low health-promoting behaviors group and high health-promoting behaviors group. As shown in Table 4, within a certain range, with the increase of health-promoting behaviors level, the negative predictive effect of sexual function on Qol gradually weakens, indicating that the predictive effect size of low health-promoting behaviors was higher (-0.815). At different levels of health-promoting behaviors, Qol decreased with the increase of sexual function. The higher the EmPHasis-10 score, the poorer the patient's Qol. That is, the better the sexual function, the higher the Qol (see Table 4; Figure 1).

4 | Discussion

The average score of sexual function and Qol was (21.703 ± 8.947) points and (17.992 ± 10.245) points of female PAH patients, indicating that the sexual function health and Qol of female PAH patients were not optimistic, which was consistent with the findings of previous study [15]. and Banerjee et al. [15] Compared with the norm of the Chinese general population, the Qol of PAH patients decreased significantly, and the self-rated Qol of female patients was significantly worse than that of the male, and the physiological function was seriously impaired. In particular, female patients without work and living in rural areas were the most severely impaired in physical health, requiring more medical assistance and social and family support [7, 34, 35]. There were 157 patients with sexual dysfunction, and the detection rate was 51.307%, which was lower than the results of Hendriks et al. (63%) [16], which may be related to the differences in the geographical environment of the study population. Due to the discomfort and treatment factors brought by PAH disease itself, patients may encounter difficulties in sexual activities. In addition, female patients often face the dilemma of marriage and childbirth due to their specific age stage and special social role, as well as the heavy economic burden, resulting in heavy physiological and psychological pressure [14, 36]. The average score of health-promoting behaviors was in the general level, which was higher than the results of Cui et al. [37] This may be related to the different subjects studied. The subjects selected in this study were all female patients with PAH. The poor level of

TABLE 2 | Correlation analysis between sexual function, health-promoting behaviors, and Qol of female patients with PAH.

| | \bar{x} | S | 1 | 2 | 3 |
|-------------------------------|-----------|--------|---------|---------|---|
| 1. Sexual function | 21.703 | 8.947 | 1 | | |
| 2. Health-promoting behaviors | 121.915 | 13.507 | 0.581* | 1 | |
| 3. Qol | 17.992 | 10.245 | -0.797* | -0.627* | 1 |

Abbreviations: PAH, pulmonary arterial hypertension; Qol, quality of life.
* $p < 0.01$.

TABLE 3 | The moderating effect of health-promoting behaviors on sexual function and Qol of female patients with PAH.

| Dependent variable | Independent variables | Coeff | SE | t | p | LLCI | ULCI | Change of R ² | F | p |
|--------------------|------------------------------|--------|-------|--------|-------|--------|--------|--------------------------|--------|-------|
| Qol | Constant | 81.939 | 6.918 | 11.845 | 0.000 | 68.323 | 95.552 | | | |
| | Sexual function X | -1.880 | 0.308 | -6.105 | 0.000 | -2.487 | -1.274 | | | |
| | Health-promoting behaviors W | -0.409 | 0.062 | -6.614 | 0.000 | -0.531 | -0.287 | | | |
| | X*W | 0.010 | 0.003 | 3.796 | 0.000 | 0.005 | 0.015 | 0.014 | 14.408 | 0.000 |

Abbreviations: LLCI, lower limit confidence interval; PAH, pulmonary arterial hypertension; Qol, quality of life; SE, standard error; ULCI, upper limit confidence interval.

TABLE 4 | The effect size of the moderating effect of health-promoting behaviors on the pathway of sexual function and Qol of female patients with PAH.

| Dependent variable | Moderating variable W | Effect | SE | t | p | LLCI | ULCI |
|--------------------|---------------------------------------|--------|-------|---------|-------|--------|--------|
| Qol | W-1SD (health-promoting behaviors) | -0.815 | 0.052 | -15.706 | 0.000 | -0.917 | -0.713 |
| | MEAN (health-promoting behaviors) | -0.682 | 0.047 | -14.409 | 0.000 | -0.776 | -0.589 |
| | W + 1 SD (health-promoting behaviors) | -0.550 | 0.065 | -8.444 | 0.000 | -0.678 | -0.422 |

Abbreviations: LLCI, lower limit confidence interval; PAH, pulmonary arterial hypertension; Qol, quality of life; SE, standard error; ULCI, upper limit confidence interval.

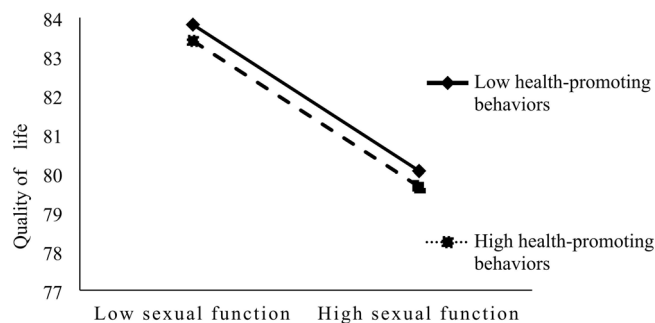


FIGURE 1 | The moderating effect of health-promoting behaviors on sexual function and quality of life (Qol).

health-promoting behaviors in patients with PAH may be related to the insufficient knowledge of PAH and the lack of preventive healthcare knowledge. Low health-promoting behaviors is not only detrimental to the prognosis of the disease, but also affects the clinical outcome. Therefore, we should strengthen disease education and improve health literacy in view of the current situation of low health-promoting behaviors in patients with PAH.

Health-promoting behaviors has a significant regulating effect on sexual function and Qol. With the increase of health-promoting behaviors level, the effect size decreases gradually. The Qol (EmPHasis-10 score) decreased with the increase of sexual function, that is, the better the sexual function, the higher the Qol. PAH is a chronic disease with high underlying consumption and a healthy lifestyle and behavior, which is closely related to the development and prognosis of the disease. Sexuality is a biopsychosocial phenomenon influenced by physical, psychological, and sociological factors. Poor health, especially for those with chronic diseases, is often associated with lower sexual satisfaction [38]. Studies have reported a significant correlation between sexual function and Qol in female PAH patients, and sexual health will affect the overall Qol of patients. The better the

sexual health, the higher the overall Qol [15]. Health-promoting behaviors is a type of lifestyle and daily activities that affect an individual's health and Qol. They take steps to maintain and promote health and prevent disease, including health responsibility, physical activity, spiritual growth, nutrition, interpersonal relationships, and stress management. Research shows that many chronic diseases are caused by problems in lifestyle and human behavior. Adopting health-promoting behaviors is an appropriate way for people to stay healthy and prevent non-communicable diseases, and has a major impact on Qol. Improving health-promoting behaviors will help maintain people's performance, independence, improve their Qol, and reduce healthcare costs [38, 39]. The higher the patient's health-promoting behaviors, the more active the exercise, the attention to nutrition supplement, and the positive response to stressful events. The more attention they pay to themselves, the more confident they are in the treatment of the disease, the better their compliance. Sexual function is improved, and the Qol is correspondingly improved [40]. Therefore, we should strengthen disease education in clinical work, improve patients' cognition, improve patients' health-promoting behaviors, improve sexual function, improve Qol, and thus improve disease prognosis.

5 | Conclusion

In the context of the prolonged survival of patients with PAH, it is necessary to pay attention to the Qol of patients during treatment and analyze related risk factors to target key populations. Provide relevant health guidance, help patients establish healthy behaviors, encourage patients to change their formed bad behaviors and living habits, consciously adopt behaviors that promote healthy development, formulate health management strategies and diagnosis and treatment measures suitable for these vulnerable groups, provide patients with family and community care in addition to routine clinical treatment, and individual functional rehabilitation training. Thereby improving their Qol.

5.1 | Limitation

This study is observational and adopts retrospective questionnaire survey, which may have the influence of recall bias. The subjects of the study were all female PAH patients, and the changes of sexual function, health-promoting behaviors and QoL in patients at different times could not be dynamically observed. At present, the main drug treatment methods in China are oral, followed by subcutaneous pumping. Population sociological variables were only used as control variables, and relevant clinical indicators such as medications and comorbidities were not included in the relevant analysis.

Author Contributions

Conceptualization: Ting Luo and Liu Xie. Data curation: Sisi Chen and Liu Xie. Formal analysis: Sisi Chen and Ting Luo. Investigation: Ting Luo and Lingzhi Huang. Methodology: Lingzhi Huang and Ting Luo. Supervision: Lingzhi Huang. Software: Sisi Chen and Ting Luo. Writing—original draft: Sisi Chen. Writing—review and editing: Sisi Chen and Ting Luo. All authors contributed to the article and approved the submitted version.

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Ethics Statement

The study was approved by the Ethics Committee of the Second Xiangya Hospital of Central South University. Ethics Approval No. 2021 and Lunshen No. Yan 157.

Consent

All participants fulfilled the informed consent.

Conflicts of Interest

Guarantor: Sisi Chen. Other authors declare no conflicts of interest.

Data Availability Statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation, to any qualified researcher.

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