

Mediating role of fear of progression between sensory processing sensitivity and stigma in lung cancer patients: a cross-sectional study[†]



Original article

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Received: 12 January 2024; Accepted: 25 March 2024; Published: 20 December 2024

Abstract: Objective: To explore the association of sensory processing sensitivity (SPS) and stigma as well as the mediating role of fear of progression (FoP) in lung cancer patients.

Methods: Two hundred and forty-two lung cancer patients completed a self-reported questionnaire, which included the highly sensitive person scale (HSPS), fear of progression questionnaire-short form (FoP-Q-SF), and the Cataldo Lung Cancer Stigma Scale (CLCSS).

Results: CLCSS was positively correlated with FoP (Pearson correlation = 0.217, $P < 0.01$) and HSPS (Pearson correlation = 0.187, $P < 0.01$). FoP was positively correlated with HSPS (Pearson correlation = 0.199, $P < 0.01$). FoP played a mediating role between SPS and stigma ($a \times b = 0.025$, 95% confidence intervals [CI] [0.004, 0.054]), and the proportion of mediating effect (ab/c) was 21% ($ab = 0.025$, $c = 0.120$).

Conclusions: Patients with higher SPS reported higher level of stigma, and FoP has a mediating role between SPS and stigma. Our discussion deemed that psychological intervention may help higher SPS patients reduce the harm of FoP and further reduce stigma.

Keywords: fear of progression • lung cancer • mediating role • sensory processing sensitivity • stigma

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[†]This project was supported by the Scientific Research Fund project of Education Department of Yunnan Province (No. 2022J0177), Yunnan Province Science and Technology Plan Project (No. 202101AY070001-178), and Topic of Nursing Psychology Professional Committee of Chinese Mental Health Association (No. 22-23-121).

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How to cite this article: Shen N, Yang J, Yang QR, et al. Mediating role of fear of progression between sensory processing sensitivity and stigma in lung cancer patients: a cross-sectional study. *Front Nurs.* 2024;4:373–378.

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1. Introduction

Lung cancer was the second most commonly diagnosed cancer with 2.2 million new cases (11.4%).¹ In China, it is estimated that the leading cancer diagnosed and deceased is lung cancer in 2022.² Because of the automatic association of lung cancer and smoking across society, lung cancer patients tend to report significant stigma.² Previous studies have shown that stigma is an important factor that influences mental health, stigma is regarded as a factor leading to high levels of psychological stress, depression, and lower quality of life.^{3,4} Fear of progression (FoP) is defined as various bio-psycho-social consequences or fear of recurrence of the disease brought by FoP.⁵ Previous studies pointed out that excessive FoP can lead to dysfunction, affecting health, quality of life, and social functioning.⁶ Previous studies pointed out that higher level of stigma was associated with high fear of cancer recurrence.⁷ Accordingly, we hypothesize that there is a positive correlation between FoP and stigma.

Sensory processing sensitivity (SPS) is a personality characteristic that describes the individual's differences in perceiving and processing positive or negative stimuli, which is conceptualized as individuals respond more to positive or negative stimuli and learn to respond better to similar situations in the future, and high sensitive person do better in environments and worse in bad environments.^{8,9} Many studies have pointed out that SPS was positively correlated with depression, anxiety, and stress as a series of negative outcomes.^{10–12} Although we did not find research about SPS, FoP, and stigma, based on the theory of SPS, we can speculate that SPS is positively correlated with FoP and stigma in a negative environment such as the hospital. In this context, this study aims to explore the personality traits that may be susceptible to stigma, as well as the factors that may be influential. Thus, we have hypothesized that FoP has a mediating role between SPS and stigma.

2. Methods

2.1 Participants

Data of a total of 242 patients with lung cancer hospitalized in Yunnan Cancer Hospital treated from August 2022 to December 2022 were collected by convenient sampling method. All participants completed the Chinese version of the Highly Sensitive Person Scale (HSPS), Fear of Progression Questionnaire-Short Form (FoP-Q-SF), and the Cataldo Lung Cancer Stigma Scale (CLCSS).

Inclusion criteria: (1) patients with pathological diagnosis of lung malignancy; (2) age ≥ 18 years; (3) normal cognition, clear language expression, able to complete

the questionnaire independently; and (4) the patients gave informed consent and volunteered to participate in the study.

Exclusion criteria: (1) the pathological stage was carcinoma *in situ* and (2) current or previous history of mental illness or family history, or substantial brain organ lesions.

2.2 Study procedure

The study was approved by the ethics committee before implementation, and all subjects were informed of the purpose and content of the study by the researcher before filling out the questionnaire. Subjects spent 10 min filling out a questionnaire that included general information, the HSPS, FoP-Q-SF, and The CLCSS. The team members who have received unified training managed the questionnaires and collected them on the spot after the subjects filled out the questionnaires. If there was any wrong selection or missing selection after inspection, the group members asked the subject to fill in again after checking.

The HSPS was developed by Aron and Aron,⁸ which has 27-item including environment stimuli, caffeine, body sense, and other moods. The 3 factors of SPS, ease of excitation (EOE) assesses an individual becoming mentally overwhelmed by external and internal; aesthetic sensitivity (AES) assesses aesthetic awareness; and low sensory threshold (LST) assesses unpleasant sensory arousal to external stimuli. In the current study, Cronbach's α was 0.89.

FOP-Q-SF is a reliable and valid instrument comprising 12 items.¹³ These use a Likert scale ranging from 1 (never) to 5 (very often), and total scores ranging from 12 to 60. Psychological dysfunction appeared in patients with total scores of >34 , indicating the necessity for corresponding intervention. The estimates of reliability have been shown to be high, with a Cronbach's α value of 0.87.

The CLCSS is a reliable and valid measure of health-related stigma in lung cancer patients,¹⁴ which has 31-item and 4 factors: stigma and shame, social isolation, discrimination, and smoking and coefficient α ranging from 0.75 to 0.97 for the subscales.

2.3 Data analysis

This study had two parts of data analysis: (1) The first section aimed to verify the association between SPS, FoP, and stigma using Pearson analysis. (2) The second section is a mediation analysis of FoP between SPS and stigma, and the hypothetical model depicted in Figure 1. We used bootstrap analysis to test the indirect effect ($a \times b$), which is significant if the 95% confidence intervals (CI) do not include 0.

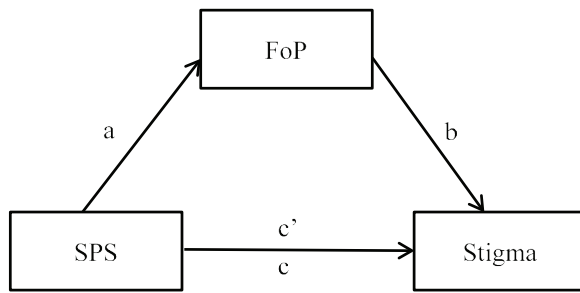


Figure 1. The coefficient “a” is the effect of the independent variable SPS on dependent variable stigma; The coefficient “b” between the mediating variable FoP on dependent variable; The coefficient “c” is the total effect between SPS and stigma; The coefficient “c'” is the direct effect between SPS and stigma without FoP.

3. Results

3.1 Descriptive analysis and correlation analysis

This study used t-test to examine the difference of all scale scores in demographic characteristics (Table 1). Nationality ($t = 2.065$, $P < 0.05$), gender ($t = -4.44$, $P < 0.001$), and smoking history ($t = -3.388$, $P < 0.01$) have differences in FoP, smoking history ($t = 3.803$, $P < 0.001$), residence ($t = 4.297$, $P < 0.001$), monthly

income ($t = 3.699$, $P < 0.001$), and education level ($t = 2.289$, $P < 0.05$) have differences in CLCSS, and only gender ($t = -2.789$, $P < 0.01$) has difference in HSPS.

The relationships between all scale scores were analyzed using Pearson correlation analysis (Table 2). CLCSS was positively correlated with FoP (Pearson correlation = 0.217, $P < 0.01$) and HSPS (Pearson correlation = 0.187, $P < 0.01$), FoP was positively correlated with HSPS (Pearson correlation = 0.199, $P < 0.01$).

3.2 Mediating role of SPS, FoP, and stigma

In this study, we used SPS as an independent variable, stigma as a dependent variable, FoP as a mediating variable. In addition, 6 demographic variables, including nationality, gender, smoking history, place of residence, monthly income, and education level were used as covariables to construct the mediating model. Figure 2 shows the mediating analysis model of SPS, FoP, and stigma. Tables 3 and 4 respectively demonstrate the analysis procedure and total, direct, and indirect effects. Bootstrap analysis showed that the indirect effect was significant ($a \times b = 0.025$, 95% CI [0.004, 0.054]), and the proportion of mediating effect (ab/c) in the relationship between independent variable and dependent variable is 21% ($ab = 0.025$, $c = 0.120$). Accordingly, FoP plays a significant mediating role in the relationship between SPS and stigma.

Item	FoP			CLCSS			HSPS		
	M	SD	t	M	SD	t	M	SD	t
Nationality			2.065*			-1.159			0.35
Han (N = 209, 86.4%)	29.26	8.86		52.31	13.16		125.22	20.59	
Ethnic minority (N = 33, 13.6%)	25.88	7.89		55.3	17.4		123.88	19.63	
Gender			-4.44***			1.024			-2.786**
Male (N = 119, 49.2%)	26.34	7.79		53.64	12.76		121.37	20.12	
Female (N = 123, 50.8%)	31.17	9.08		51.82	14.75		128.59	20.16	
Smoking history			-3.388**			3.803***			-1.31
Yes (N = 97, 40.1%)	26.51	8.44		56.73	14.04		122.94	20.57	
No (N = 145, 59.9%)	30.33	8.72		50.03	13.02		126.44	20.28	
Place of residence			0.329			4.297***			-0.316
Rural (N = 111, 45.9%)	29	9.11		56.78	14.82		124.59	21.05	
City (N = 131, 54.1%)	28.63	8.55		49.27	11.9		125.42	19.95	
Month income			-0.285			3.699***			1.401
3000–3999 and below (N = 168, 39.4%)	28.69	9.05		54.84	13.98		126.26	20.65	
4000–4999 and above (N = 74, 30.6%)	29.04	8.25		47.89	12.2		122.27	19.76	
Education level			-0.016			2.289*			-1.242
Middle school and below (N = 138, 57%)	28.79	8.87		54.46	13.99		123.62	21.43	
High school and above (N = 104, 43%)	28.81	8.73		50.39	13.28		126.91	18.95	

Abbreviations: CLCSS, = Cataldo Lung Cancer Stigma Scale; FoP, = Fear of Progression Questionnaire-Short Form; HSPS, = Highly Sensitive Person Scale; SD, standard deviation.

* $P < 0.05$. ** $P < 0.01$. *** $P < 0.001$.

Table 1. Descriptive analysis and t-values of scale variables by demographic characteristics.

Scale	M	SD	α	1	2	3
1. FoP	28.80	8.80	0.87	-		
2. CLCSS	52.71	13.81	0.94	0.217**	-	
3. HSP	125.04	20.43	0.88	0.199**	0.187**	-

Note: CLCSS, = Cataldo Lung Cancer Stigma Scale; FoP, Fear of Progression Questionnaire-Short Form; HSPS, = Highly Sensitive Person Scale; SDs, standard deviations; ** $P < 0.01$.

Table 2. Correlations, means, SDs, and α coefficients of scale variables.

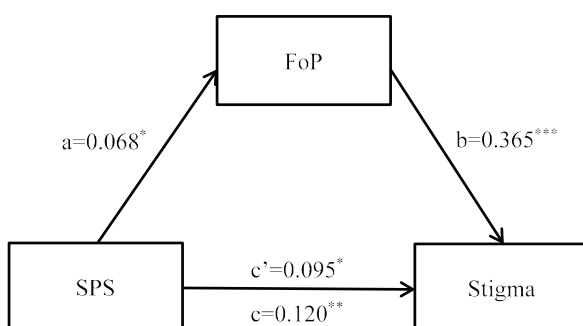


Figure 2. Mediating role of FoP between SPS and Stigma.

Note: FoP, Fear of Progression Questionnaire-Short Form; SPS, sensory processing sensitivity; * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$; the results were obtained by controlling for demographic variables.

Step	Independent variable	Dependent variable	R	R ²	F	β	t
1	SPS	Stigma	0.418	0.175	7.089***	0.120	2.882**
2	SPS	FoP	0.350	0.122	4.664***	0.068	2.490*
3	SPS	Stigma	0.472	0.222	8.327***	0.095	2.318*
	FoP					0.365	3.768***

Note: CLCSS, Cataldo Lung Cancer Stigma Scale; FoP, Fear of Progression Questionnaire-Short Form; HSPS, Highly Sensitive Person Scale; The results were obtained by controlling for demographic variables; SPS, sensory processing sensitivity; * $P < 0.05$, ** $P < 0.01$, *** $P < 0.001$.

Table 3. Analysis procedure of mediating analysis.

Effects	Effect size	Effect ratio	95% CI
Total effect	0.120		[0.038, 0.202]
Direct effect	0.095	79%	[0.014, 0.176]
Indirect effect	0.025	21%	[0.004, 0.054]

Note: CI, confidence intervals; FoP, fear of progression; SPS, sensory processing sensitivity.

Table 4. Total, direct, and indirect effects of SPS on FoP

4. Discussion

4.1 SPS directly and indirectly affect stigma

The current study found that high level of SPS were associated with high stigma among lung cancer patients. Previous studies have shown that lung cancer stigma negatively affects psychological health and complicates doctor–patient communication,^{15,16} which is a barrier to medical help-seeking behavior in lung cancer patients.¹⁷ Other studies reported stigma strong association with adverse outcomes, such as depression, anxiety, and lower quality of life.^{18–20} For lung cancer patients, the diagnosis, treatment, and hospitalization of disease are worse experiences, according to the SPS theory, in such a poor environment, SPS is bound to be associated with negative outcomes. Thus, if we can reduce the impact of negative environment or enhance the effect of positive environment, SPS does not necessarily lead to bad outcomes.

4.2 The mediating role of FoP between SPS and stigma

The preliminary analysis of this study showed that SPS, stigma, and FoP were pairwise significantly correlated, which could be used for further mediation analysis. Mediating analysis results indicate that FoP played a mediating role between SPS and stigma, the indirect effect size of 0.025, accounting for 21% of the total effect. SPS not only directly predicts the level of stigma but also predicts stigma through FoP in lung patients. Previous studies suggested that SPS, stigma, and FoP can all reduce quality of life and mental health.^{21–26} For person with high SPS, facing great stress, such as cancer, is more likely to harm their physical health.²⁷ Thus, individuals with greater SPS may instinctively take the negative action in response to these events, such as FoP, when an individual's FoP reaches a certain level, it will harm their physical and mental health and further aggravate the stigma.

4.3 Thinking about lowering stigma from the perspective of FoP

From the characteristics of SPS, people with higher SPS are more susceptible to undesirable stimuli, moreover, diagnosis of cancer and the disturbance of the hospital environment are strong negative stimuli for them. In the face of such stimuli, cancer patients with greater SPS not only have higher stigma, but also further aggravate stigma through higher FoP.

These findings have clinic values, which help us realize the negative role of FoP among SPS and stigma,

and suggest that medical staff should identify patients who have higher SPS and help them reduce the harm caused by FoP through psychological interventions, such as resilience and mindfulness therapy, to further weaken the stigma of cancer patients, thereby to help them achieve a better quality of life and a healthier life. A study that indicated that higher SPS students reported lower well-being, but they responded more positively to the intervention of resilience.²⁸ Another study suggested that the improvement of dispositional mindfulness may be effective for the psychological and physical problems of people with high SPS.¹¹ Thus, our study deemed that psychological interventions such as resilience and mindfulness can help higher SPS patients reduce the problems associated with FoP and thus reduce stigma.

4.4 Innovation, limitation, and future direction

SPS is a relatively new theory, and researchers have not found any studies on SPS in lung cancer patients. In this study, lung cancer patients were combined with SPS. On the other hand, this study is the first to combine SPS, FoP, and stigma to construct a mediation model.

Our study has several limitations. First, our participants were recruited only from lung cancer patients in Yunnan Province, and did not include patients with other types of cancer. Future studies could segment cancer types and be implemented in different cities. It is worth mentioning that in other SPS literature, there are few studies based on cancer patient samples, our study just enriched the sample types of SPS literature. Second, this study was just a cross-sectional study, it only collected the mental state of lung cancer patients at a certain time period, and did not track them longitudinally. Accordingly, it is necessary for future studies

to longitudinally explore the relationship between SPS, FoP, and stigma.

5. Conclusions

The results of this study showed that patients with higher SPS reported higher level of stigma, and FoP has a mediating role between SPS and stigma. Our discussion suggests that based on psychological interventions such as resilience and mindfulness therapy may help higher SPS patients reduce the harm of FoP and further reduce stigma.

Author contributions

The design and conception of this study: NS, XY, YZ, and QY. Data collection and management: RW, JY, and KD. Data analysis and interpretation: NS and RW. Construct a framework or make critical suggestions for this study: NS, JY, XY, and YZ. Submit the version for final approval: SN, JY, YZ, and XY.

Ethical approval

Ethical approval was obtained from the Institutional Review Committee of Yunnan Cancer Hospital (KY2020133). All procedures performed in this study involving human participants were in accordance with the ethical standards of the institutional and/or national research committee and with the 1964 Helsinki Declaration and its later amendments or comparable ethical standards.

Conflicts of interest

All contributing authors declare no conflicts of interest.

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