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# Relationship between loneliness and post-traumatic growth in patients with gynecologic malignancies: the mediating role of self-disclosure and psychological resilience

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## Abstract

**Background** To explore the relationship between loneliness and post-traumatic growth, with a focus on the mediating role of psychological resilience and self-disclosure.

**Methods** This study was a cross-sectional survey using the Loneliness Scale for Cancer Patients, the Distress Expression Index Scale (for measuring self-disclosure), the Psychological Resilience Scale, and the Posttraumatic Growth Scale on 215 inpatients with gynecologic malignancies at a tertiary care hospital in Guangzhou. Subsequently, Correlation, regression, and mediation analyses were performed using SPSS to test the relationships between the variables.

**Results** The results showed that loneliness was negatively correlated with posttraumatic growth ( $r = -0.261$ ,  $P < 0.001$ ), self-disclosure was positively correlated with posttraumatic growth ( $r = 0.360$ ,  $P < 0.001$ ), and psychological resilience was positively correlated with posttraumatic growth ( $r = 0.475$ ,  $P < 0.001$ ); loneliness was correlated with self-disclosure ( $r = -0.194$ ,  $P < 0.01$ ), loneliness was negatively correlated with psychological resilience ( $r = -0.287$ ,  $P < 0.001$ ), self-disclosure was correlated with psychological resilience ( $r = 0.287$ ,  $P < 0.001$ ); loneliness was significantly correlated with self-disclosure ( $r = -0.314$ ,  $P < 0.001$ ); loneliness was not a direct predictor of posttraumatic growth ( $\beta = -0.108$ ,  $t = 1.734$ ,  $P > 0.05$ ), but could influence posttraumatic growth through the mediated effect of self-disclosure and psychological resilience, where the total indirect effect of self-disclosure and psychological resilience was  $-0.155$  (95% CI:  $-0.236$ ,  $-0.081$ ,  $P < 0.001$ ).

**Conclusions** The mechanism of loneliness on post-traumatic growth in patients with gynecologic malignancies is mainly through the indirect effect of self-disclosure and the indirect impact of psychological resilience. Great attention should be paid to patients' loneliness, to find factors promoting patients' self-disclosure, to improve the level of patients' psychological resilience, and promote post-traumatic growth of gynecologic malignant tumors.

**Keywords** Gynecologic malignancy, Post-traumatic growth, Loneliness, Psychological resilience, Self-disclosure, Chain mediation

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## Introduction

Cancer is a public health issue of global concern. According to the Global Cancer Report 2020, 1.33 million new cases of gynecologic malignancies were reported worldwide [1]. The incidence of gynecologic tumors in China is on the rise in 2022. Taking ovarian cancer as an example, the number of new cases is 57,000, and the number of death cases is 27,000 [2]. Globally, the incidence of cervical cancer and endometrial cancer is showing a trend of younger population, which is a serious threat to women's lives.

Cancer is a traumatic event for patients, but researchers have found that cancer brings negative emotional experiences to patients, but also prompts them to show positive changes related to growth. Tedeschi defined the positive psychology of an individual's struggle with traumatic events or situations as Posttraumatic Growth (PTG) [3]. Currently, PTG has been shown to exist in cancer patients. And different degrees of PTG exist in patients with different tumor types [4]. Studies have shown that ovarian cancer survivors have mean scores ranging from 41.9 to 68.1 in PTG [5, 6]. Studies have found that PTG not only allows cancer patients to overcome trauma, but also allows them to move beyond their pre-cancer state, enhancing resilience, health, and well-being [7]. Given the significance of PTG for cancer patients, further research is necessary on the potential mechanisms that influence posttraumatic growth.

Patients with gynecological malignant tumors usually undergo surgery, radiotherapy, and other treatments, and may experience changes such as fear of cancer recurrence, concern about prognosis, and self-image disorders, which can easily trigger negative emotions [8]. Among them, loneliness is a common negative psychological experience for patients. According to previous studies, patients with malignant tumors tend to have high levels of loneliness due to the stigma and social restrictions of cancer. And female patients had significantly higher levels of loneliness than males [9]. Women with gestational cancer reported a sense of isolation and loneliness resulting from diagnosis and treatment, making it difficult to obtain information about their condition and treatment and support from peers [10].

Previous research has suggested a possible association between loneliness and posttraumatic growth [11]. Social contact was strongly associated with lower PTG. Kim et al. [12] showed that loneliness was a mediating variable between individuals' adaptation to stress and posttraumatic growth, and that community cohesion moderated the relationship between stress and loneliness. Henson et al. [13] combed through the previous literature and found that loneliness, narrative disorders, and interpersonal trauma were factors that hindered an individual's posttraumatic growth. Empirical research also suggests

that interventions for lonely individuals may help reduce PTSD and enhance PTG [14]. Therefore, we hypothesized that loneliness is negatively associated with post-traumatic growth.

### The mediating role of self-disclosure in the relationship between Loneliness and post-traumatic growth

Self-disclosure is the process of informing others about oneself and honestly sharing one's personal, intimate thoughts and emotions and feelings with others [15]. It occurs between people and is a communicative, dynamic process. Loneliness is associated with a lower willingness to express negative events. Lonely people perceive self-disclosure as risky because it can cause potential social exclusion. Another study also noted that lonely individuals' positivity, accuracy, and quantity of expressions in I seek you (ICQ) chat software were negatively correlated [16]. That is, the lonelier an individual is, the more dishonest, negative, and reluctant they are in self-disclosure in ICQ interactions. At the same time, self-disclosure is an important influencing factor on post-traumatic growth, and one of the important needs of individuals after developing malignancy [17]. When individuals reveal about trauma-related events, ambiguous events and perspectives are transformed into clear and concrete information, which helps individuals to express their negative emotions. Thus, we hypothesized a mediating role for self-representation between loneliness and post-traumatic growth.

### The mediating role of psychological resilience in the relationship between loneliness and post-traumatic growth

Psychological resilience is an important evaluation indicator of psychological health and can better predict the level of psychological health of individuals after experiencing stressful events [18]. A series of studies on the psychological resilience of patients with malignancies found that psychological resilience is an important influencing factor in the coping with traumatic events and emotional states of patients with malignancies, and individuals with high psychological resilience have a greater ability to cope with traumatic events [19]. In a study of colorectal cancer survivors [20], psychological resilience was significantly and positively correlated with PTG, and psychological resilience mediated the relationship between perceived social support and PTG. Patients with high psychological resilience can adjust the negative emotions caused by trauma in a timely manner, better adjust their mindset and face trauma positively [21]. Therefore, we hypothesized that psychological resilience mediates the relationship between loneliness and post-traumatic growth.

### Chain-mediating role of self-disclosure and psychological resilience

Feeney and Collins proposed a model of interpersonal facilitation of growth on how it contributes to an individual's growth [22]. The theory suggests that good interpersonal relationships can increase people's support for individuals, promote positive coping with trauma-related events, divert individuals' attention, encourage them to think positively about the traumatic event, and reconstruct their perceptions of the traumatic event, which can reduce individuals' psychological stress levels and enhance their PTG levels [23]. On the contrary, in an environment where there is a lack of interpersonal communication and loosening of interpersonal relationships, that is, in social isolation, an individual has difficulty in obtaining the support and help of others to effectively cope with trauma-related events, hindering their positive perceptions of their post-traumatic selves, others, and the world, which may reduce their PTG levels. Thus, social isolation, which is an important indicator of interpersonal relationships and communication, may reduce PTG. Studies have shown a link between self-expressive behaviors and increased psychological resilience [13]. By confiding their true thoughts and expressing their needs to others, patients can gain positive social support, reduce negative emotions, and help reduce worry. Psychological resilience buffers the perception of stress and helps to alleviate an individual's internal stress and promote mental health [24]. The act of self-disclosure can change the way individuals think about the event of exposure, thereby increasing their psychological resilience. We hypothesized that loneliness affects an individual's posttraumatic growth through self-disclosure and psychological resilience.

### The current study

Based on the theoretical framework of thriving through relationships and literature review, the mediating role of self-disclosure and psychological resilience in loneliness

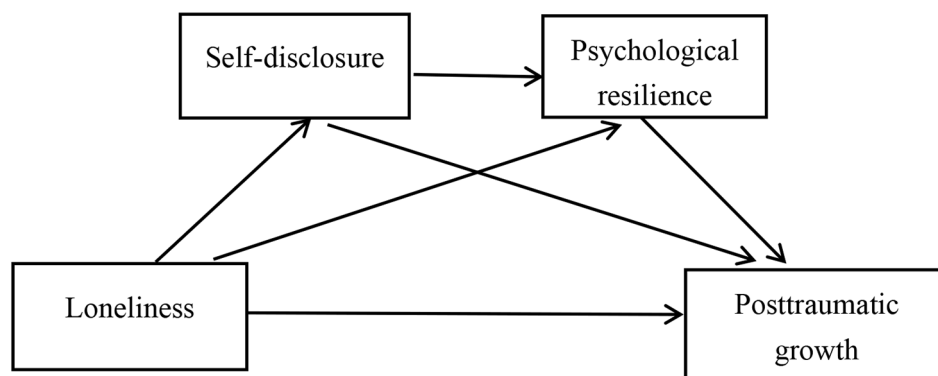
and post-traumatic growth was explored in this study. The model hypothesis diagram is shown in Fig. 1.

## Methods

### Study design and participants

In this study, gynecologic malignant tumor patients hospitalized in a tertiary general hospital in Guangzhou City, Guangdong Province, China, from January 2022 to December 2022 were selected as participants using a cross-sectional study design with a convenience sampling method. Inclusion criteria included: ① age  $\geq 18$  years old; ② patients with pathologic diagnosis of cervical malignancy, uterine body malignancy, ovarian malignancy, gestational trophoblastic disease, fallopian tube malignancy, vulvar malignancy, and vaginal malignancy with clear disease stage; ③ patients who met the permissible conditions, gave informed consent, and were able to cooperate. The exclusion criteria were as follows: ① Cognitive and communication impairment: participants were required to pass the Mini-Mental State Examination (MMSE) and a self-made communication ability assessment. ② Individuals with psychiatric disorders and other major organ or infectious diseases: Participants with a history of psychiatric disorders or with major organ or infectious diseases confirmed by physical examination and laboratory tests (including hematology, biochemistry, and infectious disease indicators). ③ Gynecological malignant tumors that are metastatic rather than primary cancers of other malignant tumors: participants whose tumors were confirmed to be metastatic rather than primary by pathological examination and imaging tests (CT, MRI or PET-CT) will be excluded. Face-to-face interviews using a structured questionnaire were conducted with all participants in the hospital wards. It usually took 20–30 min. Each participant was informed of the details of the study and gave consent to participate in the study.

According to the rough estimation method of sample content proposed by Kendall [25], the sample content can be calculated by taking 5 to 10 times of the variable,



**Fig. 1** The hypothesized serial mediation model with self-disclosure and psychological resilience as mediators of the linkage between loneliness and post-traumatic growth

which, taking into account the 10% attrition, results in a final sample size of at least 110 cases, and ultimately, the final effective sample size included in this study is 215 cases, with an effective recovery rate of 93.5%.

## Measures

### *Demographic questionnaire*

We used a self-compiled demographic and disease-related questionnaire to survey: Age, marital status, number of children, education level, location of residence, residence, monthly per capita household income, disease diagnosis, disease staging, and duration of illness.

### *Cancer loneliness scale (CLS)*

Loneliness was measured by Cancer Loneliness Scale (CLS) for cancer patients translated by Cui [26]. The Chinese version of the CLS has 7 entries, and each entry is evaluated using a 5-point Likert scale from 1 (never) to 5 (always), with a total score of 7 to 35, with higher scores indicating higher levels of loneliness in cancer patients. The Cronbach's alpha coefficient for the Chinese version of the CLS was 0.912, and a validated factor analysis showed that each index reached the desired value and the model fit was good. The total Cronbach's alpha coefficient for the scale in this study was 0.757.

### *Posttraumatic growth inventory (PTGI)*

Posttraumatic Growth was measured using the Modified Posttraumatic Growth Inventory (PTGI) translated by Wang et al. in 2011 [27], which contains a total of 20 items with 5 dimensions, namely, life perception, personal strength, new possibilities, interpersonal relationships and self-change. A Likert 6-point scale was used, with 0 (not at all) to 5 (very much). Each entry corresponds to a score, with a total score of 100, and a higher score obtained by the respondent means a higher level of PTG. The Cronbach's alpha coefficient for the total scale was 0.874; the total Cronbach's alpha coefficient for this scale in this study was 0.890.

### *Connor-davidson resilience scale, (CD-RISC)*

Psychological resilience was measured by the Chinese version of Connor-Davidson Resilience scale, (CD-RISC), translated by Yu Xiao-nan et al. [28], which retained the 25 entries of the original scale and adjusted it into three dimensions, namely, resilience (13 entries), strength (8 entries), and optimism (4 entries), and was scored on a 5-point Likert scale, ranging from "not at all like this" to "almost always like this". The higher the score, the better the psychological resilience. The total scale Cronbach's alpha coefficient value was 0.91, and the total Cronbach's alpha coefficient for this study's scale was 0.890.

### *Distress disclosure index (DDI)*

Self-disclosure was measured by the Distress Disclosure Index (DDI), which was used to measure the degree of self-disclosure of individuals [29]. The scale consists of a total of 12 items and uses a 5-point scale, 1 (strongly disagree) to 5 (strongly agree), with higher scores indicating higher levels of individual self-disclosure, with a total score of 12 to 60. The coefficient of its scale's total Cronbach's  $\alpha$  was 0.866. The total Cronbach's  $\alpha$  coefficient of the scale in this study was 0.952, and the reliability of the scale was good enough to be used for measurement.

## Statistical analysis

Prior to data analysis, questionnaires with missing data were removed; we first analyzed the data for outliers and then conducted a preliminary analysis after excluding these outliers. This included tests of reliability, skewness, kurtosis, mean, standard deviation and normality for each variable. We tested for normality using the Shapiro-Wilk test for continuous variables. The resultant variables all met the normality test requirements. Box-and-line plots were used to identify outliers. We chose to remove data points that were clearly incorrect or unlikely. Frequencies (n) and percentages (%), means and standard deviations were used to characterize the sociodemographic characteristics of the participants, as well as scores on the Loneliness, Psychological resilience, Self-disclosure, and Post-Traumatic Growth scales. Harman's one-way tests were conducted on the four questionnaires to assess common method bias. Partial correlation analysis were used to test for correlations of key variables. Statistical analyses were conducted using IBM SPSS Statistics 27.0 and the PROCESS macro version 3.3 (Model 6) provided by Hayes, with loneliness as the independent variable, psychological resilience and self-disclosure as mediator variables, and post-traumatic growth as the dependent variable. 5,000 samples were sampled, 95% confidence intervals, and the level of the test was chosen to be  $\alpha=0.05$ . A 95% confidence interval that does not include zero, a significant mediating effect is indicated.

## Results

### *Test for common method bias*

Common method bias, which is common variance between traits that would be spurious if the same measurement instrument were used, is commonly found in data measured by self-report scales. Therefore, this study tested for Common method bias using the Harman one-factor test for all questions on the scale. The first factor explained the common variation in all items associated with each variable. These variations stemmed from the relationship between the common method bias and the study variables. The explained variance of the first factor

was 23.1%, which is below the critical criterion of 40%, thus there is no serious common method bias in this sample.

#### **Demographic characteristics of the participants**

A total of 215 patients with gynecological malignancies were investigated in this study. The age distribution of the respondents was between 21 and 88 years old, with women aged 38–54 years old predominating, accounting for 40.9% of the study population; marital status was mostly married, accounting for 84.7%; most women's education level was mainly elementary school, accounting for 31.6%; in terms of diseases suffered, malignant tumor of the cervix, malignant tumor of the uterine body, and malignant tumor of the ovary accounted for the majority, accounting for 36.3%, 30.7%, and 26%; The basic characteristics of the participants are shown in Table 1.

#### **Correlations among the variables**

Means, standard deviations, and correlations for the variables are presented in Table 2. There was a significant negative correlation between loneliness and self-disclosure ( $r = -0.261, P < 0.001$ ), self-disclosure was positively correlated with posttraumatic growth ( $r = 0.360, P < 0.001$ ), and psychological resilience was positively correlated with posttraumatic growth ( $r = 0.475, P < 0.001$ ); loneliness was correlated with self-disclosure ( $r = -0.194, P < 0.01$ ), loneliness was negatively correlated with psychological resilience ( $r = -0.287, P < 0.001$ ), self-disclosure was correlated with psychological resilience ( $r = 0.287, P < 0.001$ ); loneliness was significantly correlated with self-disclosure ( $r = -0.314, P < 0.001$ );

#### **Analysis of chain mediating effects**

Based on the confirmation of previous studies and the results of one-way analysis of variance (ANOVA), literacy, monthly per capita household income was included as a control variable. According to the mediation effect test procedure proposed by Wen Zhonglin and Ye Baojuan [30] using the model 6 mediation model in the SPSS macro program PROCESS prepared by Hayes [31]. The results are shown in Table 3.

Table 3 showed that loneliness had a significant negative predictive effect on self-disclosure ( $\beta = -0.336, P < 0.001$ ); loneliness and self-disclosure had significant predictive effects on psychological resilience ( $\beta = -0.146, P < 0.01, \beta = 0.215, P < 0.01$ ), respectively; self-disclosure and psychological resilience also predicted post-traumatic growth, respectively ( $\beta = 0.200, P < 0.01, \beta = 0.405, P < 0.001$ ). However, loneliness was not a significant predictor of posttraumatic growth when both mediating variables, self-disclosure and psychological resilience, were included ( $\beta = -0.108, P > 0.05$ ).

The bias-corrected nonparametric percentile bootstrap method was used to test the mediating effect of self-disclosure and psychological resilience between loneliness and posttraumatic growth. From the results of bootstrap in Table 4, the total effect of loneliness on post-traumatic growth was significant. The direct effect of loneliness in predicting post-traumatic growth was not significant; the total indirect effect of self-disclosure and psychological resilience was significant, with a total indirect effect value of  $-0.155$ , accounting for 58.9% of the total effect ( $-0.264$ ). The chain mediating effect of self-disclosure and psychological resilience between loneliness and posttraumatic growth was significant. The coefficients of the pathways in the model are shown in Fig. 2.

#### **Discussion**

The direct effect of loneliness on post-traumatic growth in patients with gynecologic malignancies is not significant. The reason for the results may be caused by the following two factors:

On the one hand, although loneliness is considered as a risk factor for poor physical, mental and emotional health [32]. However, loneliness does not have a direct effect on an individual's posttraumatic growth. Earlier studies have shown that loneliness needs to be maintained through negative socio-cognitive biases [33]. That is, loneliness may be a susceptibility factor for posttraumatic growth that works through an individual's negative social cognitions. Hill et al. [34] reported that human study also confirmed that mental health problems exhibited by women with ovarian cancer may be exacerbated through negative cognitions associated with loneliness as well as underlying physiological changes. Another study found that that social isolation does not directly predict posttraumatic growth, but can influence individuals' post-traumatic growth through basic psychological needs, and self-disclosure [35].

According to loneliness theory, loneliness is a risk factor for overall cognitive performance, poorer executive ability, increased negative affect and depressive cognitions, exhibiting increased sensitivity to social threats, and may lead to self-protection and negative social cognitions, and differences in attention and cognition can affect mood, decision-making, and behavior [36]. Loneliness can undermine an individual's self-worth, positive evaluation of life, and optimistic view of the future, thus hindering the perception of the meaning of an individual's existence [37]. Negative perceptions do not help individuals to rethink after facing a traumatic event, and can limit the reconstruction of individuals' perceptions of their post-traumatic selves, others, and the world, preventing them from transforming into growth. Furthermore, empirical studies have confirmed that many interventions targeting potentially maladaptive social

**Table 1** Demographic characteristics of the participants( $n=215$ )

Variables		Frequencies (n)(n)	Percentages (%)
Age	20–37 years old	21	9.8
	38–54 years old	88	40.9
	55–71 years old	86	40
	72–88 years old	20	9.3
Education level	Illiterate	26	12.1
	Elementary School	68	31.6
	Junior high school	53	24.7
	High School or Junior College	34	15.8
	College and above	34	15.8
Marital Status	Unmarried	8	3.7
	Married	182	84.7
	Divorced	9	4.2
	Widowed	16	7.4
Location of residence	Rural	91	42.3
	Urban	95	44.2
	Township	29	13.5
Number of children	0	17	7.9
	1	57	26.5
	2	78	36.3
	More than 3	63	29.3
Residency	Living with Spouse	59	27.4
	Living with children	33	15.3
	Living with spouse and children	101	47
	Living alone	22	10.2
Monthly per capita household income	< 3000Yuan	80	37.2
	3000-5999Yuan	71	33
	6000-8999Yuan	28	13
	≥ 9000Yuan	36	16.7
Disease Diagnosis	Malignant tumor of the uterine cervix	78	36.3
	Malignant tumor of uterine body	66	30.7
	Ovarian malignancy	56	26
	Gestational trophoblastic disease	7	3.3
	Other gynecologic malignant tumors	8	3.7
Disease Staging	Phase I	87	40.5
	Phase II	50	23.3
	Phase III	52	24.2
	Phase IV	26	12.1
Duration of illness	≤ 6 months	94	43.7
	7–12 months	83	38.6
	13–18 months	21	9.8
	19–24 months	5	2.3
	≥ 25 months	12	5.6

**Table 2** Descriptive statistics and correlations among the study variables.(n = 215)

	M ± SD	1	2	3	4
1. Loneliness	14.13 ± 3.89	1			
2. Self-disclosure	43.33 ± 10.81	-0.314***	1		
3. Psychological resilience	57.42 ± 10.68	-0.194**	0.287***	1	
4. Post-traumatic growth	53.22 ± 14.76	-0.261***	0.360***	0.475***	1

Note: \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$

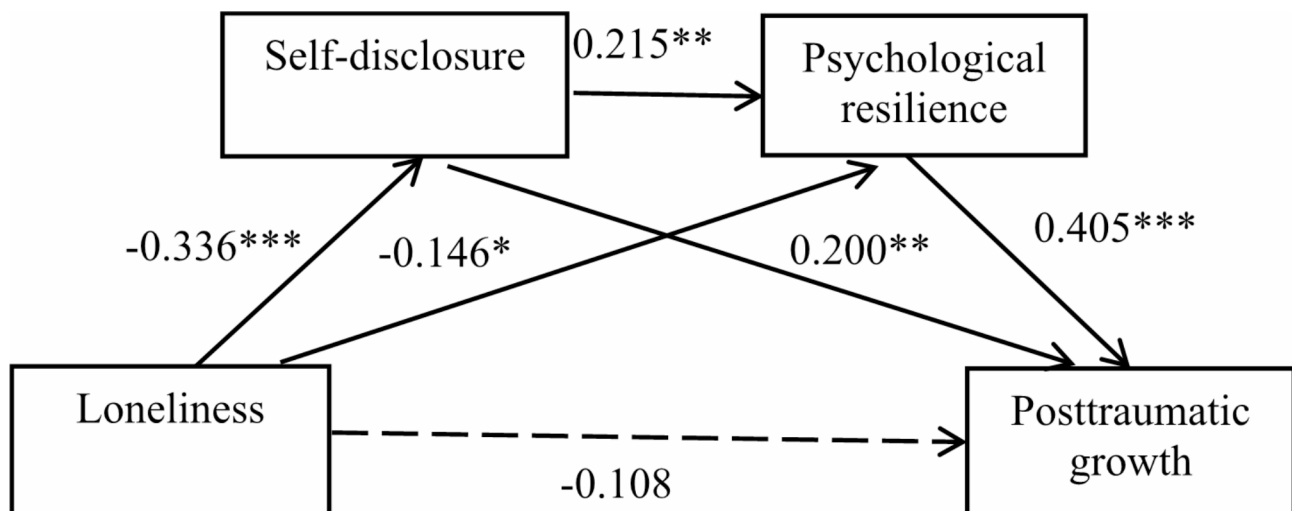
**Table 3** Regression coefficients in the serial mediation analysis

Criterion	Predictors	R	R <sup>2</sup>	F	β	t
Posttraumatic growth		0.329	0.108	8.509		
	Loneliness				-0.264	-3.963
Self-disclosure		0.339	0.115	9.148		
	Loneliness				-0.336	-5.063
Psychological resilience		0.389	0.152	9.375		
	Loneliness				-0.146	-2.119
	Self-disclosure				0.215	3.184
Posttraumatic growth		0.566	0.32	19.659		
	Loneliness				-0.108	-1.734
	Self-disclosure				0.2	3.217
	Psychological resilience				0.405	6.538

**Table 4** Bootstrap analysis of the significance test of the intermediary effect of the chain intermediary model

Model Pathways	Effect	Boot SE	Percentage	95% CI
Total effect loneliness → post-traumatic growth	-0.264 <sup>a</sup>	0.067	100.00%	(-0.395,-0.133)
Direct effect loneliness → post-traumatic growth	-0.108	0.063	41.10%	(-0.232,0.015)
Total indirect effect loneliness → post-traumatic growth	-0.155 <sup>a</sup>	0.04	58.90%	(-0.236,-0.081)
loneliness → self-disclosure → post-traumatic growth	-0.067 <sup>a</sup>	0.022	25.40%	(-0.113,-0.028)
loneliness → psychological resilience → post-traumatic growth	-0.059 <sup>a</sup>	0.029	22.40%	(-0.121,-0.005)
loneliness → self-disclosure → psychological resilience → post-traumatic growth	-0.029 <sup>a</sup>	0.013	11.10%	(-0.057,-0.009)

Note: a Empirical 95% confidence interval does not overlap with zero



**Fig. 2** The serial mediation model with self-disclosure and psychological resilience as mediators of the linkage between loneliness and posttraumatic growth. Note: \*\*  $p < 0.01$ , \*\*\*  $p < 0.001$ .;The numbers in the figure are normalized beta coefficients

cognitions can reduce individuals' feelings of isolation [38, 39];

This result supports the theory of thriving through relationships [22], and the model suggests that self-disclosure is one of the important mediating variables of the psychological impact of interpersonal relationships on individual trauma. In patients with malignancy, self-disclosure allows individuals to provide validation when dealing with issues related to malignancy and helps to find meaning in the malignancy experience, which helps patients to make good personal adjustments [40]. Several studies have also proposed that self-disclosure is associated with better marital relationships, mental health and quality of life, and higher levels of personal growth [41, 42]. Self-disclosure helps individuals to release repressed emotions [43], change their perceptions of stressful events, enhance intimacy with others and gain social support [44, 45].

Emotional self-disclosure is also a complex process that is not only intrinsically related to the individual, but also has an impact on interpersonal and social connections. A study reported that greater self-disclosure and perceived peer expression can facilitate the formation of intimate relationships [46]. Other studies also hold that individuals who have suffered trauma may feel alienated from others in society and that the lack of reliable interpersonal relationships is perceived as an unmet need that triggers the formation, maintenance, and repair of objective social relationships [47, 48].

Previous findings suggest that psychological resilience can mediate the relationship between adversity and its outcomes and enable individuals to successfully cope with adversity to promote personal growth [49]. Researchers have found that not all chronically lonely individuals exhibit depression, anxiety, or maladjustment [50]. This is related to individuals adapting their way of being at the right time and constantly adapting to changes. One factor that plays a key role in this coping process is the level of psychological resilience of the patient. Individuals with high psychological resilience seem to be better able to reflect on their positive and negative emotions than patients with low psychological resilience, which helps to access resources and cope flexibly.

For patients with gynecologic malignancies, perceived inadequate social relationships with others, cancer stigma, and shame may constrain and hinder social interactions and limit individuals from seeking help when experiencing adversity. Individuals with high psychological resilience are more inclined to adopt positive coping styles in response to setbacks or adverse events, such as proactively adjusting emotions and finding solutions to problems, which in turn mitigate the negative effects of stressful events, and individuals are at significantly lower risk of maladjustment and psychological problems [51].

The chain mediating role of self-disclosure and psychological resilience in loneliness and post-traumatic growth in patients with gynecologic malignancies holds true, i.e., the higher the degree of loneliness of an individual, the lower his or her level of self-disclosure, and thus the weaker his or her psychological adjustment ability, which ultimately reduces the individual's post-traumatic growth.

According to thriving through relationships theory [22], lonely individuals will perceive that loose interpersonal relationships make it difficult for individuals to obtain support and help from others to effectively cope with trauma-related events, and individuals' self-disclosure or non-self-disclosure affects individuals' interpersonal relationships or interpersonal interactions, social connections and interactions with others, which can further influence individuals' adjustment, and individuals with high psychological resilience cancer patients may be more inclined to express their self-needs by talking to others through social connections to obtain various support resources, and this positive self-regulation can help reduce the stress of coping with trauma, thus affecting the individual's post-traumatic growth [52]. However, The other research reported that people with psychological distress are reluctant to actively express themselves or seek psychological and emotional support [53, 54]. Therefore, finding factors that promote positive patient expression is particularly important to promote posttraumatic growth in individuals.

In this study, we verified the mediating effect of psychological resilience and self-disclosure between loneliness and post-traumatic growth in patients with gynecologic malignancies. We found a chain mediating effect between psychological resilience and self-disclosure on loneliness and post-traumatic growth in patients with gynecologic malignancies. To our knowledge, this is the first study to explore the relationship between inpatient loneliness and post-traumatic growth. These findings provide more details about the relationship between loneliness and post-traumatic growth, which indicate that increasing patients' level of self-disclosure as well as psychological resilience may mitigate the impact of patients' loneliness on individual post-traumatic growth.

#### **Limitations and future directions**

Some limitations of this study need to be acknowledged. Since the sample size included in this study was limited and only gynecological patients from one hospital were included, the reason why self-disclosure and psychological resilience did not play a part in mediating loneliness and post-traumatic growth may be that the indirect mediating role of self-disclosure and psychological resilience masked the direct role in the model, and subsequent studies may also consider increasing the sample



size and sample scope across regions. Second, this study was a cross-sectional study that could not fully reveal the causal relationships between variables, so future studies need to fill this gap through longitudinal studies or experimental designs.

## Conclusion

Our study shows that there is a chain mediating effect between self-disclosure and psychological resilience of gynecologic malignancy patients in loneliness and post-traumatic growth, which can promote post-traumatic growth of individuals by promoting their expression and improving their psychological resilience. As the main body of treatment for gynecologic malignancy patients, medical staff should pay attention to patients' psychological responses. At the same time, they should also strengthen the communication with patients, guide them to release their personal emotions, improve their psychological resilience, and ultimately improve PTG.

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## Author contributions

Ting Liao: Conceptualization, methodology, data acquisition and write the main manuscript; Xiaoying Tian: Conceptualization, methodology, supervision. Tianrong Huang, Yihong Wu, Xinxia Yu and Simeng Song prepared figures and tables. All authors reviewed the manuscript.

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## Data availability

The datasets generated or analyzed during this study are available from the corresponding author on reasonable request.

## Declarations

### Ethics approval and consent to participate

This study was designed and performed in accordance with the Declaration of Helsinki and was approved by the Ethics Committee of the First Affiliated Hospital of Jinan University (approval number: No KY-2022-254). The requirements of ethics in medical research will be strictly observed. The purpose and content of the study and the use of the data were explained to the patients and their families, and all study subjects participated in the survey based on the principle of voluntary participation and after signing the informed consent form. Informed consent was also obtained from the legally authorized representatives or legal guardians of any participant that are illiterate. Anonymity will be used and all questionnaires will be numbered. Questions concerning the privacy or safety of patients and their families will be treated in full confidentiality.

### Consent for publication

Not Applicable.

### Competing interests

The authors declare no competing interests.

### Informed consent

Informed consent was obtained from all subjects involved in the study.

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## References

- Sung H, et al. Global Cancer statistics 2020: GLOBOCAN estimates of incidence and Mortality Worldwide for 36 cancers in 185 countries. *CA Cancer J Clin.* 2021;71(3):209–49.
- Qin hao G, Min Y, Xiaohua W. Progress in diagnosis and treatment of gynecological tumors in 2022. *China Oncol.* 2023;33(1):14–24.
- Tedeschi RG, Calhoun LG. The Posttraumatic Growth Inventory: measuring the positive legacy of trauma. *J Trauma Stress.* 1996;9(3):455–71.
- Menger F, et al. Post-traumatic growth after cancer: a scoping review of qualitative research. *Support Care Cancer.* 2021;29(11):7013–27.
- Oh JM, Kim Y, Kwak Y. Factors influencing posttraumatic growth in ovarian cancer survivors. *Support Care Cancer.* 2021;29(4):2037–45.
- Ziye L. *A study on the posttraumatic growth of spouses of gynecological cancer patients and its influencing factors.* 2023.
- Vrontaras N, et al. Psychosocial interventions on the posttraumatic growth of adults with cancer: a systematic review and meta-analysis of clinical trials. *Psychooncology.* 2023;32(12):1798–826.
- Ding Y, Hu Y, Hallberg IR. Chinese women living with cervical cancer in the first 3 months after diagnosis: a qualitative study. *Cancer Nurs.* 2015;38(1):71–80.
- Xiaomei W, et al. Investigation on the current situation of loneliness in patients with malignant tumors. *Mod Oncol Med.* 2021;29(04):645–9.
- Stafford L, et al. Isolation experienced by women with gestational cancer: could peer support and tailored information be the answer? *Support Care Cancer.* 2021;29(12):7135–8.
- Stein JY, et al. Growing apart: a Longitudinal Assessment of the relation between post-traumatic growth and loneliness among Combat Veterans. *Front Psychol.* 2018;9:893.
- Kim H, et al. The moderating role of neighborhood social cohesion in the mediation effects of the loneliness between acculturation stress and post-traumatic growth among female North Korean defectors. *Sci Rep.* 2023;13(1):16965.
- Henson C. The process of posttraumatic growth in firefighters: a french-american comparison. *Université Bourgogne Franche-Comté;* 2022.
- Dagan Y, Yager J. Addressing loneliness in Complex PTSD. *J Nerv Ment Dis.* 2019;207(6):433–9.
- Jourard SM, Lasakow P. Some factors in self-disclosure. *J Abnorm Psychol.* 1958;56(1):91–8.
- Leung L. Loneliness, self-disclosure, and ICQ (I seek you) use. *Cyberpsychol Behav.* 2002;5(3):241–51.
- Zhou LH et al. Post-traumatic growth and its influencing factors among Chinese women diagnosed with gynecological cancer: a cross-sectional study. (1532–2122 (Electronic)).
- Lulu C. Related investigation on Post Traumatic Stress Disorder, Mental Health, Resilience, personality and coping style of Gynecologic Cancer patients. *Army Medical University;* 2012.
- Macía P et al. Role of resilience and emotional control in relation to mental health in people with cancer. *J Health Psychol.* 2020; p. 1359105320946358.
- Dong X, et al. The mediating role of resilience in the relationship between social support and posttraumatic growth among colorectal cancer survivors with permanent intestinal ostomies: a structural equation model analysis. *Eur J Oncol Nurs.* 2017;29:47–52.
- Harms CA, et al. Quality of life and psychological distress in cancer survivors: the role of psycho-social resources for resilience. *Psychooncology.* 2019;28(2):271–7.
- Feeny BC, Collins NL. Thriving through relationships. *Curr Opin Psychol.* 2015;1:22–8.
- Xiao Z, et al. The relationship between social support and posttraumatic growth of adolescents 8.5 years after the Wenchuan earthquake: the mediating role of self-efficacy and self-esteem. *Psychol Dev Educ.* 2019;35(05):573–80.
- Ya Y, et al. The influence of Self disclosure and intimate Relationship between Husband and Wife on psychological resilience and fertility anxiety in Child-bearing Age breast cancer patients. *Chin Nurs Educ.* 2021;18(07):644–9.
- Kendall MG. A new measure of rank correlation. *Biometrika.* 1938;30(1–2):81–93.

26. Haijuan C. Reliability and validity of loneliness and negative Social Expectation Scale of Cancer patients. Taishan Medical University; 2020.
27. Wang J, et al. Revision of the Posttraumatic Growth Inventory and testing its reliability and validity. *J Nurs Sci*. 2011;26(14):26–8.
28. Wu L, Tan Y, Liu Y. Factor structure and psychometric evaluation of the Connor-Davidson resilience scale in a new employee population of China. *BMC Psychiatry*. 2017;17(1):49.
29. Xinming, L. Research on the relationship between adult attachment, self-disclosure and depression of College Students. HeBei Normal University; 2009.
30. Wen Z, Ye B. Analyses of mediating effects: the development of methods and models. *Adv Psychol Sci*. 2014;22(5):731.
31. Hayes AF. In: Hayes AF, editor. *PROCESS: a versatile computational tool for observed variable mediation, moderation, and conditional process modeling*. Editor: University of Kansas, KS; 2012.
32. Holt Lunstad J, et al. Loneliness and social isolation as risk factors for mortality: a meta-analytic review. *Perspect Psychol Sci*. 2015;10(2):227–37.
33. Hawkey LC, Cacioppo JT. Loneliness matters: a theoretical and empirical review of consequences and mechanisms. *Ann Behav Med*. 2010;40(2):218–27.
34. Hill EM, Hamm A. Intolerance of uncertainty, social support, and loneliness in relation to anxiety and depressive symptoms among women diagnosed with ovarian cancer. *Psychooncology*. 2019;28(3):553–60.
35. Zhen R, Li L, Zhou X. The mediation roles of psychological needs satisfaction and self-disclosure between social isolation and PTSD/PTG among adolescents under the COVID-19 epidemic. *Chin J Clin Psychol*. 2021;29(5):967–72.
36. Cacioppo JT, Hawkey LC. Perceived social isolation and cognition. *Trends Cogn Sci*. 2009;13(10):447–54.
37. Borawski D. The mediating role of positive orientation in the relationship between loneliness and meaning in life. *Int J Environ Res Public Health*. 2022. 19(16).
38. Mann F, et al. A life less lonely: the state of the art in interventions to reduce loneliness in people with mental health problems. *Soc Psychiatry Psychiatr Epidemiol*. 2017;52(6):627–38.
39. Ohta R et al. *A Solution for Loneliness in Rural Populations: The Effects of Osekkai Conferences during the COVID-19 Pandemic*. *Int J Environ Res Public Health*. 2022. 19(9).
40. Munro H, et al. Patterns and predictors of disclosure of a diagnosis of cancer. *Psychooncology*. 2015;24(5):508–14.
41. Porter LS, et al. Disclosure between patients with gastrointestinal cancer and their spouses. *Psychooncology*. 2005;14(12):1030–42.
42. Zhaoyang R, Martire LM, Stanford AM. Disclosure and holding back: communication, psychological adjustment, and marital satisfaction among couples coping with osteoarthritis. *J Fam Psychol*. 2018;32(3):412–8.
43. Lingjing Q, et al. Qualitative study on self-disclosure intention and expectation of adolescents with non-suicidal self-injury. *Chin J Nurs*. 2023;58(02):192–7.
44. Liu X, et al. Dilemma: Disclosure Experience among Young female breast Cancer survivors in China. *J Adolesc Young Adult Oncol*. 2022;11(5):486–92.
45. Tsuchiya M, et al. Cancer disclosure to friends: Survey on psychological distress and perceived social support provision. *Eur J Cancer Care (Engl)*. 2022;31(5):e13332.
46. Manne S, et al. Interpersonal processes and intimacy among men with localized prostate cancer and their partners. *J Fam Psychol*. 2018;32(5):664–75.
47. Cacioppo JT, Cacioppo S. *Loneliness in the modern age: an evolutionary theory of loneliness (ETL)*, in *advances in experimental social psychology*. Elsevier; 2018. pp. 127–97.
48. DePrince AP, Chu AT, Pineda AS. Links between specific posttrauma appraisals and three forms of trauma-related distress. *Psychol Trauma: Theory Res Pract Policy*. 2011;3(4):430.
49. Kumpfer KL. *Factors and processes contributing to resilience: The resilience framework*. Resilience and development: Positive life adaptations, 2002: pp. 179–224.
50. Jakobsen IS, et al. The relationship between resilience and loneliness elucidated by a Danish version of the resilience scale for adults. *BMC Psychol*. 2020;8(1):131.
51. Yunling H, et al. Loneliness and associated factors among adolescents with mixed anxiety and depressive disorder. *Chin J School Health*. 2023;44(3):394–7.
52. Zhang X, et al. Relationship between infertility-related stress and resilience with posttraumatic growth in infertile couples: gender differences and dyadic interaction. *Hum Reprod*. 2021;36(7):1862–70.
53. Najmabadi KM, et al. Self-disclosure of breast cancer diagnosis by Iranian women to friends and colleagues. *Asian Pac J Cancer Prev*. 2014;15(6):2879–82.
54. Wei D, et al. Patient distress and emotional disclosure: a study of Chinese cancer patients. *J Cancer Educ*. 2013;28(2):346–51.

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