



ORIGINAL ARTICLE

# Relationship between stressful life events, coping styles, and schizophrenia relapse

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**ABSTRACT:** *This study aimed to explore the relationship between stressful life events, coping styles, and schizophrenia relapse. The sample for this study included 248 patients with schizophrenia from a psychiatric outpatient clinic in Hunan Province, China. Stressful life events, occurrence of schizophrenia relapse, and coping style were assessed by the Scale for the Social Readjustment Rating, Brief Psychiatric Rating Scale, and Simplified Coping Style Questionnaire, respectively. Spearman correlation analysis and binary logistic regression analysis were adopted to explore the relationships among coping styles, schizophrenia relapse, and stressful life events. Stressful life events and negative coping exhibited significant positive association with schizophrenia relapse, while positive coping exhibited a significant negative association with schizophrenia relapse. Stressful life events and positive coping exerted significant effects on schizophrenia relapse, while negative coping did not. We also found that both positive coping and negative coping have moderating effects on the relationship between stressful life events and schizophrenia relapse, but the relationship is weak. The study highlighted the importance of interventions designed to reduce stressful life events, promote positive coping, and address negative coping in patients with schizophrenia.*

**KEY WORDS:** *coping styles, schizophrenia relapse, stressful life events.*

## INTRODUCTION

Schizophrenia is known to affect multiple domains including perception, thought, emotion, and behaviour; however, its pathogenesis remains unknown. The

relapse rate in people with schizophrenia has remained high, despite the wide use of antipsychotics (Xu *et al.* 2018), suggesting that more attention is needed to improve treatment strategies. The evidence suggests that high levels of stressful life events can increase the risk of relapse in people with schizophrenia (Egbe *et al.* 2014). However, similar life events can lead to different outcomes in different individuals (Dong 2020), suggesting that other variables can moderate the outcome of stress. In this study, we examined the relationship among stressful life events, coping styles (divided into positive coping and negative coping), and rates of relapse in schizophrenia patients. Specifically, we assessed whether coping styles can moderate the relationship between stressful life events and schizophrenia relapse. The moderating roles of coping styles are examined in the framework presented by Pearlin (1999).

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## BACKGROUND

One meta-analysis has reported that the average relapse rates for positive symptoms in patients with schizophrenia are approximately 28%, 43%, and 54%, respectively, at the 1-year, 1.5-year, and 3-year follow-up (Alvarez-Jimenez *et al.* 2012). Recurrent illness and frequent hospitalization can severely impact social functioning and decrease quality of life in patients with schizophrenia (Wu *et al.* 2017). Previous studies have found that people who have relapsed with schizophrenia tend to experience stressful life events (Sariah *et al.* 2014), which may be because schizophrenia patients are less likely to take the positive approach to coping with stress. However, as stressful life events are inevitable, other measures are needed to help patients to minimize the perceived negative impact of stressful events. Therefore, investigating the relationships among factors that influence stress coping style may help to reduce relapse rate and improve the quality of life for these patients.

Previous studies have demonstrated over-exposure to stressful life events in individuals suffering psychosis, with consequently higher sensitivity of the hypothalamic–pituitary–adrenal axis (Aiello *et al.* 2012). Similarly, negative life events (e.g. inadequate nutrition, verbal/physical abuse) are risk factors for schizophrenia relapse (Myin-Germeys *et al.* 2005). For example, stressful events occurring within the preceding 3 weeks are known to significantly influence the risk of relapse (Kazadi *et al.* 2008). Furthermore, the proportion of patients who experience psychiatric relapse is higher among patients who face constant criticism than among those who more regularly receive encouragement (Sofi *et al.* 2002). However, reducing stressful life events alone is inadequate to reduce the risk of relapse. Haque *et al.* (2018) also highlighted the importance of examining the influence of multiple factors when investigating schizophrenia relapse, given that previously neglected relationships may become important in certain situations or for certain groups of people, necessitating changes to the treatment plan.

There are also some studies on the relationship between coping styles and schizophrenia relapse. To cope with dealing with problems, some patients with schizophrenia may develop hobbies (such as exercise) as a positive strategy to help stabilize the disease (Bueno-Antequera & Munguía-Izquierdo 2020). Personalized treatment with the goal of enhancing positive coping can buffer against symptoms and promote disease stability in patients with schizophrenia (Chen *et al.* 2019). However,

few studies have investigated the associations between negative coping and schizophrenia relapse. Even fewer have investigated interactions among various factors in moderating these associations. Zhu *et al.* (2019) reported that coping style exerts a moderating effect on the relationship between stress and cognitive dysfunction in patients with schizophrenia; however, no effect was found on schizophrenia relapse.

Theoretical models of stress are primarily used to study interactions among various factors in relation to disease (Pearlin 1999). Such models may provide a valuable framework for examining the mechanisms through which factors interact to influence the risk of schizophrenia relapse (Tyler 1983). While stress is thought to contribute to mental illness or psychosomatic dysfunction, theoretical models argue that this relationship must be moderated by certain factors (Copper & Payne 1991). This stress model has been widely used in the study of mental illness (Dadi *et al.* 2020). Previous studies have used this theory to explore mediating factors and develop interventions to effectively optimize responses to stress (Crum *et al.* 2020). Indeed, stress theory has been used to compare psychotherapy approaches (Marcovitz *et al.* 2020) and examine factors influencing schizophrenia relapse and treatment outcomes (Zhu *et al.* 2019). Therefore, this model was adopted for the present study.

This research was conducted in a hospital of Hunan Province (a province in China with a population of 67 million), one of the largest psychiatric hospitals in the province, integrating medical treatment, teaching, scientific research, rehabilitation, medical appraisal, and preventive health care. The hospital has an emergency department, outpatient department, inpatient department, and rehabilitation centre. It is committed to developing disease management and health management services to transform ‘simple treatment’ into ‘treatment + prevention’ medical services. Currently, it is the first online hospital in Hunan Province, where patients can make free appointments and avail of various medical services using a mobile application without queuing. This improves medical efficiency and continuously provides more convenient and efficient services for patients.

In the present study, we aimed to explore the relationship between stressful life events, coping styles, and schizophrenia relapse. We hypothesized that stressful life events are associated with schizophrenia relapse. We further hypothesized that coping styles play a significant role in moderating the relationship between stressful life events and schizophrenia relapse.

## 0METHODS

The present cross-sectional, correlational study was conducted at the psychiatric outpatient clinic of a hospital in China. A convenience sampling method was adopted to survey 248 patients with schizophrenia treated from June 2019 to December 2019.

### Participants and procedure

Inclusion criteria were as follows: (a) age between 18 and 60 years; (b) confirmed diagnosis of schizophrenia based on criteria outline in the 10th Revision of the International Classification of Diseases and Related Health Problems (ICD-10) (Sheehan *et al.* 1998); (c) duration of treatment with antipsychotic medication of >6 months; (d) the Clinical Global Impression-Severity score (CGI-S) of <6 points (Leucht *et al.* 2019); (e)  $\geq 9$  years of education. Exclusion criteria were as follows: patients with other mental illnesses based on ICD-10 criteria (Sheehan *et al.* 1998); those with confirmed diagnoses of severe somatic or infectious diseases; those with a history of substance abuse; and pregnant/lactating patients.

The assessment was performed by three investigators (a psychiatrist and two trained researchers). All investigators were registered psychological counsellors who had received identical training regarding inclusion and exclusion criteria, evaluation order, informed consent, and evaluation methods prior to the study. The psychiatrist only made sure that the patients were eligible for the study and did not participate in the investigation. The two investigators were not hospital staff and had no conflict of interest with the patients. A researcher collected general information about the patients, and another collected the stressful life events and coping styles. In addition, the researchers were not involved in any clinical treatment and care of the patients. Patients with schizophrenia were first screened based on inclusion and exclusion criteria, following which they were evaluated by a psychiatrist to determine whether relapse had occurred and to ensure that patients were capable of completing the study. Subsequently, the researchers provided patients' informed consent and read the instructions before the questionnaire survey was administered. Finally, the researchers checked the completed questionnaires for omissions and errors.

### Measures

We collected general information related to age, gender, place of residence, marital status, education level,

occupation, monthly household income per capita, medication adherence, duration of disease, medications, family history, and payment method.

### Variables and instruments

#### *Definition of relapse in schizophrenia*

Although there is currently no gold standard for assessing schizophrenia relapse (Porcelli *et al.* 2016), previous studies have emphasized the importance of three criteria (Porcelli *et al.* 2016): (a) determining the threshold of relapse severity, (b) determining the duration for which symptoms must be present to signify relapse, and (c) determining the most appropriate psychological assessments for use.

Previous studies have indicated that schizophrenia relapse can be evaluated using any of the following criteria: disease status is effectively reflected by the thought disturbance factor, which is based on a combination of results on three subscales of the Brief Psychiatric Rating Scale (BPRS) – unusual thought content, hallucinations, and conceptual disorganization (Overall *et al.* 1967). Relapse is considered to have occurred (a) when any subscale score increases by at least 2 points and at least one score is 5 points, (b) when any one subscale score is 5 points for  $\geq 14$  days, or (c) when any one subscale score reaches 6 or 7 points (Csernansky *et al.* 2002; Ventura *et al.* 2004). Relapse is also indicated in cases of clinically significant deliberate self-injury or suicidal/homicidal ideation, based on the psychiatrist's judgement (Csernansky *et al.* 2002).

#### *Social Readjustment Rating Scale (SRRS)*

The SRRS is a widely utilized and standardized quantitative index designed to measure the severity of stressful life events (Holmes & Rahe 1967). The SRRS lists 43 life events (e.g. death of a spouse, lawsuit, and loss of work), each of which is associated with a stress index ranging from 11 to 100. The magnitude of stressful life events is the total score of all events that the patient experienced in the past 3 months. Severity is then categorized as follows: mild (<150), moderate (150–299) and severe ( $\geq 300$ ). This scale is widely used to assess the severity of stressful life events (Dong *et al.* 2020).

#### *Simplified Coping Style Questionnaire (SCSQ)*

The SCSQ is based on the Ways of Coping Questionnaire (WCQ) developed by Folkman and Lazarus (1988). The scale consists of 20 items related to both positive (items 1–12) and negative coping styles (items 13–20), with each item rated along a four-point scale,

as follows: 0 = never, 1 = occasionally, 2 = often, and 3 = always. In addition to good structural validity, Cronbach's  $\alpha$  values for the positive and negative coping components were 0.89 and 0.78, indicative of good reliability (Zhu *et al.* 2019).

#### *Clinical Global Impression-Severity (CGI-S)*

The CGI-S scale reflects the overall severity of a patient's symptoms and response to treatment in the context of clinical research and is completed by the clinician (Guy 1976). CGI-S scores range from 1 to 7 (i.e. no symptoms to extremely severe) (Leucht *et al.* 2019). Previous studies have documented the efficacy of the CGI-S for assessing severity in patients with mental illness (Johnstone *et al.* 2020).

#### *Morisky Medication Adherence Scales-8 (MMAS-8)*

The MMAS-8 is an effective and reliable measure for the evaluation of psychotropic drug compliance. There are eight questions, the first seven of which are divided into two options: 'Yes' and 'No' (Morisky *et al.* 1986). The total score ranges from 0 (poor medication adherence) to 8 (good adherence). The full score of the scale is 8, and a score of  $\geq 6$  indicates good medication adherence (Morisky *et al.* 2008).

### **Ethical considerations**

The study was approved by the Ethics Committee of Ningxia Medical University (2018-247). All participants provided written informed consent and had the right to withdraw unconditionally at any time, without any effect on the patients' clinical treatment and care. The study complies with the latest version of the Helsinki Declaration.

### **Data analysis**

A database was established in EpiData 3.1, and statistical analysis was performed using SPSS 22.0 software. Data are presented as the mean  $\pm$  standard deviation or as rates/percentages. Chi-square tests were used to compare data between patients with and without relapse, while Spearman correlation coefficients were used to evaluate associations between the main variables.

Previous studies have reported that the risk of relapse is increased in men (Johnstone *et al.* 2020). Age, marital status, medication, education level, and occupation can also influence rates of relapse among patients with schizophrenia (Porcelli *et al.* 2016).

Therefore, prior to our analysis of moderating effects, we screened for the control variables in the Spearman correlation and logistic regression analyses.

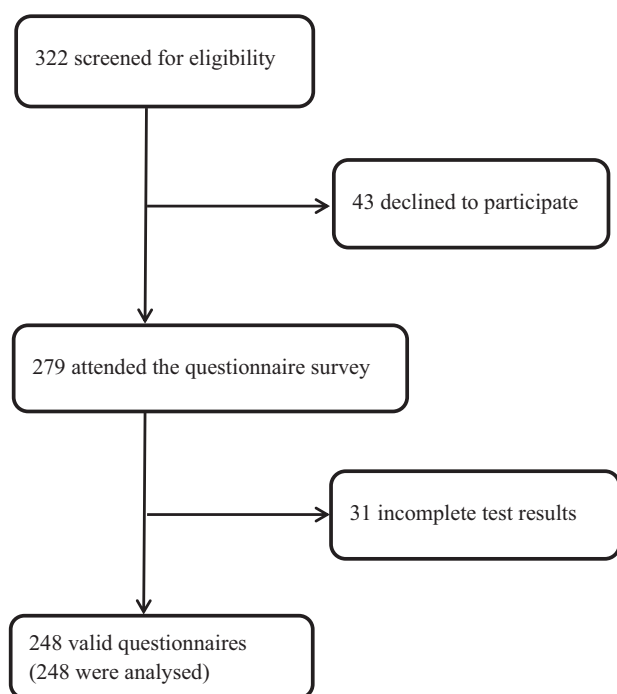
According to the requirements of the moderating effects for variables, when the dependent variable is qualitative data, logistic regression analysis should be used (Hosmer & Lemeshow 1992). To examine the predictive roles of different variables for schizophrenia relapse, the main variables were entered into the regression equation as single factors. Stressful life events were used as independent variables (X), schizophrenia relapse was used as a dependent variable (Y), and coping styles were used as moderators (M). Positive coping was taken as the moderator variable in model 1 and negative coping as the moderator variable in model 2. The control variables (all the demographic variables in the regression analysis that were associated with schizophrenia relapse [ $P < 0.05$ ]), independent variables (stressful life events), moderators (positive coping), and interaction terms (positive coping  $\times$  stressful life events) entered model 1. The control variables, independent variables (stressful life events), moderators (negative coping), and interaction terms (negative coping  $\times$  stressful life events) entered model 2. If the moderator had a significant predictive effect on schizophrenia relapse, we assumed coping style to have exerted a moderating effect. All continuous variables were zero-centred to prevent multicollinearity (Kraemer & Blasey 2004).

### **RESULTS**

Two-hundred-and-forty-eight valid questionnaires were collected during the half-year questionnaire collection (Fig. 1). The sample included 106 patients in the relapse group and 142 patients in the non-relapse group. Approximately 48.39% of patients were male, 63.71% of patients lived in cities, 59.68% of patients were unmarried, 42.74% of patients were unemployed, 50.00% of families had a per capita monthly income of more than 420 dollars, and 81.05% of patients had no family history of schizophrenia. Variables were coded for analysis according to the levels described in Table 1. Comparisons of general data revealed no significant differences between the relapse and non-relapse groups ( $P > 0.05$ ), except for place of residence ( $X^2 = 5.188$ ,  $P = 0.023$ ; Table 2).

#### **Correlations between main variables**

The mean score for stressful life events was 199.17 and the standard deviation was 118.55. There was a



**FIGURE 1** Sample flow chart.

significant positive association between stressful life events and schizophrenia relapse ( $r = 0.141$ ,  $P = 0.026$ ). SCSQ scores for positive coping ( $M = 1.66$ ,  $SD = 0.72$ ) were higher than those for negative coping ( $M = 1.32$ ,  $SD = 0.67$ ). Positive coping was negatively

associated with schizophrenia relapse ( $r = -0.449$ ,  $P < 0.001$ ). In contrast, negative coping was positively associated with schizophrenia relapse ( $r = 0.127$ ,  $P = 0.039$ ; Table 3). Among the general data, only area of residence was significantly associated with schizophrenia relapse ( $r = 0.145$ ,  $P = 0.023$ ; Table A1 in appendix).

### Effect of different variables on schizophrenia relapse

In the single-factor logistic regression analysis, stressful life events ( $\beta = 0.003$ ,  $OR = 1.003$ ,  $95\%CI [1.000-1.005]$ ,  $P = 0.049$ ) and positive coping ( $\beta = -1.516$ ,  $OR = 0.219$ ,  $95\%CI [0.136-0.354]$ ,  $P < 0.001$ ) exerted significant effects on schizophrenia relapse, while negative coping did not ( $\beta = 0.307$ ,  $OR = 1.359$ ,  $95\%CI [0.868-2.128]$ ,  $P = 0.180$ ; Table 4). These results suggested that both stressful life events and positive coping are associated with schizophrenia relapse. Our regression analysis further revealed that place of residence ( $\beta = 0.617$ ,  $OR = 1.854$ ,  $95\%CI [1.028-3.343]$ ,  $P = 0.040$ ), medication ( $\beta = -0.731$ ,  $OR = 0.419$ ,  $95\%CI [0.209-0.939]$ ,  $P = 0.016$ ), and family history ( $\beta = -0.870$ ,  $OR = 0.419$ ,  $95\%CI [0.209-0.839]$ ,  $P = 0.014$ ) were significantly associated with schizophrenia relapse (Table 4). Because these three variables (place of residence, medication, and family history) in the demographic data are related to the recurrence of schizophrenia, we used them as control variables.

**TABLE 1** Factors' values assigned in statistical analysis

Variables	Value
Age	Primary Value
Gender	1 = Male, 2 = Female
Place of residence	1 = City, 2 = Rural
Marital status <sup>†</sup>	0 = Unmarried, 1 = Married, 2 = Divorce
Education level	1 = 9–11 years, 2 = 12–16 years, 3 = >16 years
Occupation <sup>†</sup>	0 = None, 1 = Manual labour, 2 = Mental labour
Monthly household income per capita	1 = <1000, 2 = 1000–3000, 3 = >3000
Medication adherence	Primary Value
Duration of disease	Primary Value
Medications	1 = Single, 2 = Multiple
Family history	0 = No, 1 = Yes
Payment method	0 = Self-paying, 1 = Medical insurance
Stressful life events	Primary Value
schizophrenia relapse	0 = Non-relapse, 1 = Relapse
Positive coping	Primary Value
Negative coping	Primary Value

<sup>†</sup>Dummy variable.

### Moderated moderation analysis

Binary logistic regression was used to examine the moderating effects of positive and negative coping on the relationship between schizophrenia relapse and stressful life events. Positive coping exerted a moderating effect on the relationship between schizophrenia relapse and stressful life events ( $\beta = -0.005$ ,  $OR = 1.005$ ,  $95\%CI [1.001-1.009]$ ,  $P = 0.008$ ). The model revealed similar results for the effect of negative coping on the relationship between schizophrenia relapse and stressful life events ( $\beta = 0.005$ ,  $OR = 1.005$ ,  $95\%CI [1.001-1.009]$ ,  $P = 0.012$ ). Furthermore, we observed a significant main effect of positive coping ( $\beta = 0.005$ ,  $OR = 1.005$ ,  $95\%CI [1.001-1.009]$ ,  $P = 0.012$ ). However, the main effect of negative coping was not significant ( $\beta = -0.709$ ,  $OR = 0.492$ ,  $95\%CI [0.204-1.186]$ ,  $P = 0.114$ ; Table 5).

**TABLE 2** The characteristics of the participants: n (%)

	Relapse (n = 106)	Non-relapse (n = 142)	Total sample (N = 248)	$\chi^2$	P
Age				0.306	0.858
18–29	56 (22.58)	70 (28.23)	126 (50.81)		
30–44	38 (15.32)	55 (22.18)	93 (37.50)		
45–60	12 (4.84)	17 (6.85)	29 (11.69)		
Gender				1.214	0.270
Male	47 (18.95)	73 (29.44)	120 (48.39)		
Female	59 (23.79)	69 (27.82)	128 (51.61)		
Place of residence				5.188	<b>0.023</b>
City	59 (23.79)	99 (39.92)	158 (63.71)		
Rural	47 (18.95)	43 (17.34)	90 (36.29)		
Marital status				0.027	0.986
Married	33 (13.31)	43 (17.34)	76 (30.65)		
Unmarried	63 (25.40)	85 (34.27)	148 (59.68)		
Divorce	10 (4.03)	14 (5.65)	24 (9.68)		
Education level				2.04	0.361
9–11	46 (18.55)	49 (19.76)	95 (38.31)		
12–16	36 (14.52)	55 (22.18)	91 (36.69)		
>16	24 (9.68)	38 (15.32)	62 (25.00)		
Occupation				0.902	0.637
None	42 (16.94)	64 (25.81)	106 (42.74)		
Manual labour	35 (14.11)	40 (16.13)	75 (30.24)		
Mental labour	29 (11.69)	38 (15.32)	67 (27.02)		
MHIPC				1.141	0.565
<1000	21 (8.47)	23 (9.27)	44 (17.74)		
1000–3000	36 (14.52)	44 (17.47)	80 (32.26)		
>3000	49 (19.76)	75 (30.24)	124 (50.00)		
Medication adherence				0.004	0.949
<6 points	31 (12.50)	41 (16.53)	72 (29.03)		
≥6 points	75 (30.24)	101 (40.73)	176 (70.97)		
Duration of disease				1.293	0.256
<5 years	54 (21.77)	62 (25.00)	116 (46.77)		
≥5 years	52 (20.97)	80 (32.26)	132 (53.23)		
Medications				3.765	0.052
Single	39 (15.73)	36 (14.52)	75 (30.24)		
Multiple	76 (30.65)	106 (42.74)	173 (69.76)		
Family history				3.748	0.053
Yes	26 (10.48)	21 (8.47)	47 (18.95)		
No	80 (32.26)	121 (48.79)	201 (81.05)		
Payment method				0.393	0.531
Self-paying	60 (24.19)	86 (34.68)	146 (58.87)		
Medical insurance	46 (18.55)	56 (22.58)	102 (41.13)		

MHIPC, Monthly household income per capita.

Bold values indicates  $P < 0.05$ .

## DISCUSSION

In the present study, we observed a significant correlation between stressful life events and schizophrenia relapse, consistent with our initial hypothesis and key for verifying the moderating effect of coping strategies. This result is also consistent with those of most previous studies, which have reported a positive correlation

between negative life events and schizophrenia (Egbe *et al.* 2014; Sariah *et al.* 2014). This phenomenon may be explained by the appearance of negative emotions during stressful life events, which are not conducive to the treatment and rehabilitation of patients with schizophrenia and may even increase the probability of relapse (Sofi *et al.* 2002). In addition, repeated relapses can aggravate the symptoms of schizophrenia, result in

**TABLE 3** Inter-correlations between main variables. r(p)

	M ± SD	1	2	3	4
1. Stressful life events	199.17 ± 118.55	–			
2. Positive coping	1.66 ± 0.72	–0.017 (0.789)	–		
3. Negative coping	1.32 ± 0.67	0.239 (< <b>0.001</b> )	0.018 (0.783)	–	
4. SCH relapse	0.43 ± 0.50	0.141 ( <b>0.026</b> )	–0.449 (< <b>0.001</b> )	0.127 ( <b>0.039</b> )	–

SCH, schizophrenia relapse.  
 Bold values indicates  $P < 0.05$ .

**TABLE 4** Binary logistic regression results of the relationship between variables and schizophrenia relapse

X	$\beta$	SE	P	OR (95%CI)
(Constant)	1.264	0.525	<b>0.016</b>	3.539 (–)
Stressful life events	0.003	0.001	<b>0.049</b>	1.003 (1.000–1.005)
Positive coping	–1.516	0.244	< <b>0.001</b>	0.219 (0.136–0.354)
Negative coping	0.307	0.229	0.180	1.359 (0.868–2.128)
(Constant)	2.014	1.670	0.228	6.209 (–)
Age	–0.017	0.024	0.483	0.983 (0.938–1.031)
Gender	0.491	0.305	0.108	1.635 (0.898–2.974)
Place of residence	0.617	0.304	<b>0.040</b>	1.854 (1.028–3.343)
Marital status	–	–	0.766	–
Marital status (1)	–0.339	0.522	0.516	0.713 (0.256–1.981)
Marital status (2)	–0.372	0.530	0.483	0.689 (0.244–1.949)
Education level	–0.200	0.195	0.305	0.818 (0.558–1.201)
Occupation	–	–	0.155	–
Occupation (1)	–0.489	0.365	0.180	0.613 (0.300–1.254)
Occupation (2)	0.136	0.389	0.726	1.146 (0.534–2.458)
MHIPC	–0.152	0.188	0.420	0.859 (0.594–1.242)
Medication adherence	0.002	0.055	0.969	1.002 (0.900–1.116)
Duration of disease	0.008	0.028	0.759	1.009 (0.955–1.065)
Medications	–0.731	0.303	<b>0.016</b>	0.419 (0.209–0.939)
Family history	–0.870	0.355	<b>0.014</b>	0.419 (0.209–0.839)
Payment method	0.163	0.261	0.531	1.177 (0.707–1.962)

MHIPC, Monthly household income per capita.  
 Bold values indicates  $P < 0.05$ .

unemployment (Dunn *et al.* 2008), affect the patient’s social function, and reduce the ability to resolve stressful life events. Although the aetiology of schizophrenia remains to be determined, several studies have demonstrated that stressful life events can influence schizophrenia relapse, highlighting the potential role of stress reduction in preventing relapse.

We found that both positive coping and negative coping are associated with schizophrenia relapse. In other words, when patients take a positive approach to people and things, such as thinking about things optimistically and participating in social activities actively, they may reduce the risk of relapse of schizophrenia. Many studies also have shown that coping styles are

**TABLE 5** Binary logistic regression tests the results of the moderating effect of coping styles

X	$\beta$	SE	P	OR (95%CI)
<b>Model 1</b>				
(Constant)	–4.572	1.300	< <b>0.001</b>	96.721 (–)
1. Positive coping	2.694	0.539	< <b>0.001</b>	0.068 (0.024–0.194)
2. Stressful life events	0.005	0.003	0.096	0.995 (0.988–1.001)
3. PC×SLE	–0.005	0.002	<b>0.008</b>	1.005 (1.001–1.009)
4. Place of residence	0.756	0.315	<b>0.016</b>	2.129 (1.148–3.948)
5. Medications	–0.685	0.330	<b>0.038</b>	0.504 (0.264–0.962)
6. Family history	–0.553	0.386	0.168	0.587 (0.276–1.251)
<b>Model 2</b>				
(Constant)	1.540	1.057	0.145	4.666 (–)
1. Negative coping	–0.709	0.449	0.114	0.492 (0.204–1.186)
2. Stressful life events	–0.005	0.003	0.101	0.995 (0.990–1.001)
3. NC×SL/E	0.005	0.002	<b>0.012</b>	1.005 (1.001–1.009)
4. Place of residence	0.628	0.284	<b>0.027</b>	1.874 (1.073–3.273)
5. Medications	–0.634	0.295	<b>0.032</b>	0.530 (0.297–0.946)
6. Family history	–0.605	0.352	0.086	0.546 (0.274–1.089)

Interaction term is the multiplied effects of stressful life events and positive coping (Model 1) and stressful life events and negative coping (Model 2); PC, positive coping; SLE, stressful life events; NC, negative coping.

Bold values indicates  $P < 0.05$ .

key factors for schizophrenia relapse (Kylmä *et al.* 2006). When patients begin to take the initiative to enrich their lives, the risk of relapse is reduced (Tooth *et al.* 2003). Furthermore, maintaining the stability of the disease can improve the quality of life and reduce the number of hospitalizations, thereby generating a belief in positive coping. Failure to accept the disease and feelings of hopelessness for the future are also likely to exacerbate symptoms and increase the risk of relapse (Jensen & Wadkins 2007). One possible reason is that treating others or things using positive strategies imbues patients with the confidence to live. Moreover,

positive coping can create a relaxed and warm atmosphere and prevent the relapse of schizophrenia, while negative coping has the opposite effect. Frequent relapses will disrupt the normal life of patients with schizophrenia and produce negative emotions (Sofi *et al.* 2002). Once the patients experience relapse, the negative experience will likely send them into a cycle of negative coping. Additionally, we found that the place of residence, medication, and family history affected the relapse rate of schizophrenia.

Consistent with our assumptions, positive coping moderated the relationship between stressful life events and schizophrenia relapse. This finding suggests that, even under high-stress conditions, adopting positive coping strategies such as social participation and optimistic thinking can promote disease stability and reduce the risk of relapse. Previous studies have also indicated that schizophrenia treatment is more likely to be effective in patients who receive emotional management therapy (Zou *et al.* 2012), as a positive mindset (Tooth *et al.* 2003) and daily participation in social activities (Bryl *et al.* 2020) can help to reduce the impact of stressful events and promote disease stability. In addition, encouraging employment among individuals with schizophrenia may help to improve their ability to deal with stressful life events and can increase self-esteem, which has been shown to help manage the disease (Kylmä *et al.* 2006).

Patients inclined to practise positive coping strategies are also more willing to actively seek help from others, increasing the availability of support, and decreasing the stimulation of stressful events on themselves, which is critical for preventing relapse among patients with mental illness. Indeed, previous studies have reported that schizophrenia relapse is more common in patients without close family (Suttajit & Pila-kanta 2010) or social support (Chien *et al.* 2007). Taken together, these findings highlight the need to improve positive coping strategies among patients with schizophrenia, especially those who are experiencing high levels of stressful life events. In support of our conclusion, previous studies have found that interventions designed to promote positive coping (e.g. medication management, mood control, sleep monitoring, social skills) can improve patient motivation and promote social functions (Ben-Zeev *et al.* 2016).

Our results also indicated that negative coping moderated the relationship between schizophrenia relapse and stressful life events, but the relationship is weak. These moderating effects may be due to hormone secretion in the brain, given that dopamine is thought to play a key

role in the pathogenesis of schizophrenia (Ben-Shachar 2002). Previous imaging studies have reported that patients with schizophrenia exhibit an increased capacity for striatal dopamine synthesis (Kokkinou *et al.* 2020). Dopamine secretion is influenced by various internal and external factors, and acute stress may lead to increased dopamine release in the brain (Stelly *et al.* 2020), which may in turn increase the risk of schizophrenia relapse. Manic and/or anger states due to reliance on negative coping behaviours may increase dopamine levels in the brain (Kim *et al.* 2006), highlighting the need to promote emotional stability. In addition, negative coping can lead to other negative emotions that may decrease the patient's confidence in treatment, which can in turn affect compliance and medication adherence. Given that poor adherence to medication has been associated with an increased risk of schizophrenia relapse (Chauhan *et al.* 2019), it remains critical for healthcare and rehabilitation professionals to maintain active involvement in each patient's intervention programme. Such programmes should not only emphasize the development of positive emotions/strategies but also the reduction of negative emotions/strategies.

### Limitations

The present study possesses some limitations of note. First, this was a cross-sectional, correlational, and retrospective study, making it difficult to establish causal relationships between variables. In addition, given that our surveys were conducted in a hospital setting, our sample may not be entirely representative of all patients with schizophrenia. As assessments of stressful life events were based on self-report rather than clinical interviews, our results may have also been influenced by recall bias. Finally, there is no gold standard for assessing schizophrenia relapse, which may have skewed our findings. To ensure the accuracy of future studies, investigators should focus on developing more unified measures of schizophrenia relapse.

### CONCLUSION

Our findings demonstrate that stressful life events may precipitate schizophrenia relapse while positive coping lessens the risk of relapse. Both positive and negative coping have a moderation influence on the relationship between stressful life events and schizophrenia relapse, but the relationship is weak. Future measures to prevent the risk of relapse in patients with schizophrenia should emphasize the use of accurate assessments of



stressful life events and coping styles. Ultimately, our study highlights the importance of interventions designed to promote positive coping and address negative coping in patients with schizophrenia.

## RELEVANCE FOR CLINICAL PRACTICE

Based on the findings of this study, clinicians must pay more attention to the role of coping styles in preventing the relapse of schizophrenia. We should promote positive coping and diminish negative coping to reduce patients' chances of relapse. When patients with schizophrenia are experiencing stressful life events, psychiatric nurses should first assess negative coping in patients, and then, help can be offered to find positive coping strategies suitable for individual patients to prevent the relapse of the disease. Importantly, nursing measures should be personalized to reflect each patient's personality and hobbies. The results of this study are expected to provide references to clinicians for decreasing the relapse rate and improving the prognosis of patients with schizophrenia.

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## ETHICAL APPROVAL

The study was approved by the Ethics Committee of Ningxia Medical University of China (2018-247).

## AUTHOR CONTRIBUTIONS

Professor Juan Liu was in charge of study design, monitored the research and was accountable for all aspects of the study in ensuring that questions related to the work were appropriately resolved. Qing Wang undertook the statistical analysis, carried on interpretation of data and drafted the manuscript. Dr XD Zhu co-designed the study and revised it critically for important intellectual content in the paper. Xiaojian Jiang, Meizhi Li enrolled subjects. Ru Chang and Bing Chen

collected the data. All authors were devoted to and gave great approval to the final manuscript.

## Data Availability Statement

The raw/processed data required to reproduce these findings cannot be shared at this time as the data also form part of an ongoing study.

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## APPENDIX: I

**TABLE A1** Correlations between general variables and schizophrenia relapse

	M±SD	r	P
Age	30.53 ± 10.10	−0.039	0.539
Gender	1.52 ± 0.50	0.070	0.272
Place of residence	1.36 ± 0.48	0.145	<b>0.023</b>
Marital status	1.79 ± 0.60	−0.010	0.870
Education level	1.87 ± 0.79	−0.084	0.186
Occupation	0.84 ± 0.82	0.040	0.535
MHIPC	2.32 ± 0.76	−0.068	0.288
Medication adherence	6.01 ± 2.35	0.010	0.877
Duration of disease	7.48 ± 7.49	−0.046	0.474
Medications	1.70 ± 0.46	−0.123	0.053
Family history	1.81 ± 0.39	−0.123	0.053
Payment method	1.41 ± 0.4	0.040	0.533

MHIPC, Monthly household income per capita.

Bold values indicates  $P < 0.05$ .