

# Family Functioning and Depressive Symptoms Among HIV-Positive Men Who Have Sex with Men: Mediating Roles of Stigma and Resilience

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**Background:** Depressive symptoms are common among HIV-positive men who have sex with men (MSM). This study aims to explore (1) the relationship between family functioning and depressive symptoms and (2) the mediating roles of stigma and resilience in the relationship among HIV-positive MSM.

**Methods:** We used data from a cross-sectional study of a convenience sample in Hunan Province, China, conducted in 2019. The data analysis included 191 HIV-positive MSM with an average age of 26.98 years. All participants completed self-report questionnaires on demographic variables, family functioning, stigma, resilience, and depressive symptoms.

**Results:** Better family functioning was significantly associated with lower depressive symptoms. Both stigma (Indirect effect =  $-0.04$ , 95% CI,  $-0.10 \sim -0.001$ ) and resilience (Indirect effect =  $-0.06$ , 95% CI,  $-0.12 \sim -0.01$ ) were significant partial mediators in the relationship between family functioning and depressive symptoms. A parallel and chain mediating role of stigma and resilience in the relationship between family functioning and depressive symptoms was also supported (Indirect effect =  $-0.03$ , 95% CI,  $-0.08 \sim -0.01$ ).

**Conclusion:** Improving family functioning is crucial for alleviating depressive symptoms among HIV-positive MSM in China. Depression assessment and reduction should be an integral part of prevention and treatment programs targeting stigma and resilience.

**Keywords:** HIV, men who have sex with men, family functioning, stigma, resilience, depressive symptoms

## Introduction

Extensive evidence indicates a rising prevalence of HIV among men who have sex with men (MSM).<sup>1</sup> For example, although MSM accounts for 2% of the population in the United States, they represented a staggering 69.9% of new HIV diagnoses in 2017,<sup>2</sup> which are 87.9 times as likely as behaviorally heterosexual men to ever be diagnosed with HIV infection.<sup>3</sup> A recent review of 47 studies conducted in 17 countries in Latin America and the Caribbean revealed that MSM, especially young MSM, constitute high-risk groups for HIV infection, with a pooled prevalence ranging from 1.2% to 32.6%.<sup>4</sup> Liu et al summarized the positive rate of HIV antibodies to be 26% among older MSM in Western and Central Europe and North America. They also noted that the prevalence among this group has been continuously increasing over the past two decades, rising from 16% to 33%.<sup>5</sup> In China, a review of 355 surveys across 59 cities in 30 provinces and municipalities documented an overall prevalence of HIV among MSM of 5.7%, with rapid year-over-year increases.<sup>6</sup> This increasing number of HIV-positive MSM presents significant public health challenges, including, but not limited to, higher disease burden and risk of transmission, as well as greater incidence of mental illness. Depressive symptoms are one of the common mental disorders among HIV-positive MSM.<sup>7</sup> Previous studies suggested that compared with HIV-negative MSM, HIV-positive MSM have a higher risk of depressive symptoms (23.2% vs

33.1%).<sup>8</sup> Another study conducted with a Chinese sample has demonstrated that 36% of HIV-positive MSM suffer from depression, a significantly higher percentage compared to the general population.<sup>9</sup> Depressive symptoms not only impair the quality of life of HIV patients,<sup>10</sup> but also affect their adherence to antiretroviral therapy, increasing HIV-related morbidity and mortality.<sup>11</sup> Consequently, exploring influential factors of depressive symptoms can shed valuable insights into preventing mental disorders and improving the quality of life among HIV-positive MSM.

Family functioning reflects the extent to which a family operates as a unit to cope with stressors<sup>12</sup> and may be a powerful protective factor against depression.<sup>13</sup> According to the Circumplex model of marital and family systems,<sup>14</sup> better family functioning means greater family cohesion and family resilience, which can effectively alleviate an individual's post-traumatic psychological problems. A developing body of research supports the protective role of family functioning; for example, a cross-sectional study of 435 HIV-positive patients found that increased family functioning predicted a subsequent decrease in depression.<sup>15</sup> Influenced by traditional Chinese cultural values, prejudice from family members and rejection of family relationships might adversely affect MSM.<sup>16</sup> However, data remains limited regarding the relationship between family functioning and depression in the context of sexual minorities. It would be worthwhile, therefore, to examine the pathways that connect these two elements to understand their impacts among HIV-positive MSM. Finally, knowledge about various mediators could also provide useful information for targeted clinical interventions.

Stigma, herein conceptualized as “attributes that are deeply discrediting to an individual in society creating a deviant social persona”,<sup>17</sup> may be one of the risk factors in depression among HIV-positive MSM.<sup>18,19</sup> Sexual minorities include lesbian, gay, bisexual, and transgender. HIV-positive MSM, as a part of sexual minorities, are strongly stigmatized within Chinese society. Based on the Minority Stress Model, sexual minorities experience excess stress because of their stigmatized social status compared with heterosexual individuals,<sup>20</sup> which in turn leads to depression. Several studies support the Minority Stress Model in understanding stigma and depression in Chinese sexual minorities. Gay and bisexual men who suffer from stigma were found to be at greater risk of developing depressive symptoms in four cities in northeastern China.<sup>21</sup> And in a longitudinal study of gay and bisexual men from Beijing, anticipated stigma predicted depression after 6 months.<sup>22</sup> Beyond China, empirical studies have likewise found stigma to be strongly associated with depression among people living with HIV (PLWH).<sup>23,24</sup> Related to these findings, previous studies suggest that family support is negatively related to stigma<sup>25</sup> and that strong family functioning and cohesion may have protective effects against feelings of stigma.<sup>26</sup> It is therefore plausible to hypothesize that poor family functioning increases the risk of stigma, which in turn increases the likelihood of depressive symptoms. There is, however, no study that has yet examined the mediating role of stigma in the poor family functioning to increased depressive symptoms link.

Resilience, as a modifiable characteristic and important mediator of depression, is further investigated in this article. It refers to a dynamic process wherein an individual presents a positive adaptation to stress, crisis, and adversity.<sup>27</sup> According to a typical construct of resilience,<sup>28</sup> resilience can be changed through supportive circumstances<sup>29</sup> and person-environment interactions,<sup>30</sup> such as emotional bonds between family members.<sup>31</sup> Research has found that more resilient individuals tend to present with fewer depressive symptoms compared with less resilient ones.<sup>32,33</sup> This echoes the findings of a meta-analysis showing that resilience is inversely related to depression.<sup>34</sup> Empirical studies with refugees have also found that family functioning could affect depressive symptoms through resilience.<sup>35</sup> To our knowledge, few studies have explored how resilience mediated the association of family functioning with depressive symptoms in the context of sexual minorities and HIV.

Furthermore, a developing body of research has highlighted how stigma might influence resilience.<sup>36</sup> As suggested by previous research,<sup>37</sup> resilience mediates stigma and self-esteem, which leads to depression among HIV-positive MSM. To date, the associations among family functioning, stigma, resilience, and depressive symptoms of HIV-positive MSM remain unexplored. Accordingly, the present study aimed to evaluate whether stigma and resilience served as underlying psychological mechanisms accounting for the relationship between family functioning and depressive symptoms. The first hypothesis was that higher levels of family functioning and resilience would be associated with a lower level of depressive symptoms, whereas greater stigma would be associated with elevated depressive symptoms. The second hypothesis was that stigma and resilience would mediate the association between family functioning and depressive

symptoms. Identifying factors that mediate family functioning and depression should shed light on potential interventions and social policies to reduce mental health disparities among HIV-positive MSM.

## Methods

### Setting and Participants

The cross-sectional study was carried out between March and June of 2019. A sample of HIV-positive MSM was recruited in the patient waiting room at the institute for HIV/AIDS of the First Hospital of Changsha, China. Inclusion criteria for participants were (1) male, (2) over 16 years old, (3) diagnosed with HIV due to sexual contact with men, and (4) able to read and understand the questionnaire. Exclusion criteria were (1) illiteracy, (2) disability (3) current existing severe AIDS symptoms, and (4) had a prior diagnosis of a mental disorder. We distributed survey invitations to eligible patients in the outpatient clinic who met the inclusion criteria. Those who expressed willingness to participate were requested to complete a paper questionnaire with the face-to-face guidance of a researcher. All participants and their caregivers (if under 18 years old) provided written informed consent prior to the survey. Meanwhile, this survey was completed anonymously, and participants' data was kept entirely confidential. Participants could stop participation at any time. In addition, all participants were given contact details for free mental health services and remuneration of 50 CNY. Finally, we approached 217 HIV-positive MSM, and 191 participants completed this survey voluntarily (response rate = 88.02%).

The investigation was carried out in accordance with the latest version of the Declaration of Helsinki and approved by the Ethics Committees of Xiangya School of Nursing of Central South University (No. 2018007).

## Measure

### Family Functioning

The family APGAR index was used to assess family functioning in this study.<sup>38</sup> It consists of 5 items, with five dimensions: adaptation, partnership, growth, affection, and resolve. Response options were based on a 3-point Likert scale, where 0 = never or rarely, 1 = sometimes, and 2 = most or all of the time. Higher scores indicated better family functioning. The family APGAR index has demonstrated acceptable reliability and validity in the Chinese population,<sup>39</sup> and the Cronbach's alpha for the current sample was 0.88.

### Stigma

The Social Impact Scale (SIS) was used to measure participants' perceived stigma.<sup>40</sup> It consists of 24 items covering four dimensional constructs: social rejection, financial insecurity, internalized shame, and social isolation. The SIS uses a 4-point Likert scale, from 1 (strongly disagree) to 4 (strongly agree). Higher scores indicated greater perceived stigma. The Chinese version of SIS was tested to be reliable and valid.<sup>41</sup> In this study, its Cronbach's alpha was 0.94.

### Resilience

The 10-item Connor-Davidson Resilience Scale (CD-RISC-10) is a self-reported scale of resilience level, proposed by Campbell-Sills et al<sup>42</sup> and originating from the 25-item CD-RISC.<sup>43</sup> Each item was rated on a five-point Likert scale, from 0 (not true at all) to 4 (true nearly all the time). Higher scores indicated an increased level of psychological resilience. The Chinese version of CD-RISC-10 has satisfactory psychometric properties,<sup>44,45</sup> and it showed a high Cronbach's alpha in the current sample (alpha= 0.97).

### Depressive Symptoms

The 9-item Patient Health Questionnaire (PHQ-9) was used to assess depressive symptoms over the past two weeks.<sup>46</sup> Responses to items range from 0 (not at all) to 3 (nearly every day); a higher total score indicated more frequent depressive symptoms. A cut-off score of 10 identified cases of clinical depression with acceptable sensitivity and specificity.<sup>47</sup> The PHQ-9 has been found to show good reliability and validity when used in the Chinese population,<sup>48</sup> and is widely employed in studies of HIV-positive MSM.<sup>7</sup> The Cronbach's alpha was 0.93 in the current sample.

## Demographic Variables

Demographic variables were collected by self-report, including age, duration of HIV infection, education level, ethnicity, residence location, marital status, single child status, caregiver's education, and family monthly income.

## Statistical Analysis

The mean (M) and standard deviation (SD) were estimated for continuous variables and the frequencies (N) and percentages (%) for categorical variables. A univariate analysis (eg, Mann–Whitney *U*-test and Chi-square test) was performed to examine the differences of demographic variables between depressed participants (PHQ-9  $\geq$  10) and non-depressed participants (PHQ-9 < 10). Meanwhile, bivariate correlations were calculated among family functioning, stigma, resilience, depressive symptoms, and other relevant variables. We also tested for potential multicollinearity by variance inflation factor (VIF).<sup>49</sup> Finally, the mediating hypotheses were conducted with PROCESS macro, providing path coefficient estimates (b) and bootstrapped 95% confidence intervals (95% CI) for indirect effects based on 5000 bootstrapping resamples.<sup>50</sup> Before path analysis, Harman's one factor test through exploratory factor analysis (EFA) was conducted to examine common method bias,<sup>51</sup> and all continuous variables were normalized. When the mediation effect (model 6) was tested, family functioning was entered as the predictor, stigma and resilience as the mediator, and depressive symptoms as the outcome. Statistically significant variables in the univariate analysis were screened and included in path analysis as covariates. All statistical analyses were performed using SPSS 23.0. A two-tailed  $p < 0.05$  was employed to indicate statistical significance.

## Results

### Sample Characteristics

The total sample (N = 191) ranged in age from 16 to 50 years, with a mean age of 26.98 (SD=6.07) years old. Most participants were educated at or above the college level (76.4%) and were of Han ethnicity (95.3%). 57.6% (N =110) reported that their residency status is rural, 48.7% of participants (N = 93) were only child, while only 6.3% (N = 12) had married. The average time elapsed since their HIV diagnosis was 35.97 (SD = 30.30) months. Detailed sample demographic information can be found in Table 1.

**Table 1** Descriptive Statistics of Participants (N = 191)

	Overall N=191	Depression		$\chi^2/Z$	p
		PHQ-9 < 10 N=141, 73.8%	PHQ-9 $\geq$ 10 N=50, 26.2%		
Age, years	26.98(6.07)	26.49(5.69)	28.42(6.93)	-1.70	0.089
Duration of HIV infection, months	35.97(30.30)	31.87(25.93)	47.00(37.88)	-2.55	<b>0.013</b>
Participants' education				3.67	0.159
Junior high school or less	21(11.0)	15(7.9)	6(3.1)		
Senior high school	24(12.6)	14(7.3)	10(5.2)		
College or more	146(76.4)	112(58.6)	34(17.9)		
Ethnicity				3.35	0.115
Han <sup>#</sup>	182(95.3)	132(69.1)	50(26.2)		
Others	9(4.7)	9(4.7)	0(0)		
Residence location				1.14	0.320
Urban	81(42.4)	63(33.0)	18(9.4)		
Rural	110(57.6)	78(40.8)	32(16.8)		
Marital status				2.11	0.190
Unmarried	179(93.7)	130(68.1)	49(25.7)		
Married	12(6.3)	11(5.7)	1(0.5)		

(Continued)

**Table 1** (Continued).

	Overall N=191	Depression		$\chi^2/Z$	p
		PHQ-9 < 10 N=141, 73.8%	PHQ-9 ≥ 10 N=50, 26.2%		
Being a single child				0.60	0.511
Yes	93(48.7)	71(37.2)	22(11.5)		
No	98(51.3)	70(36.6)	28(14.7)		
Father's education				0.86	0.836
Primary school or less	48(25.1)	34(17.8)	14(7.4)		
Junior high school or less	66(34.6)	48(25.1)	18(9.4)		
Senior high school	56(29.3)	42(22.0)	14(7.3)		
College or more	21(11.0)	17(8.9)	4(2.1)		
Mother's education				2.73	0.436
Primary school or less	58(30.4)	40(20.9)	18(9.4)		
Junior high school or less	67(35.1)	52(27.3)	15(7.9)		
Senior high school	56(29.3)	40(20.9)	16(8.4)		
College or more	10(5.2)	9(4.7)	1(0.5)		
Family monthly income				9.47	<b>0.024</b>
3000 yuan or less	26(13.6)	13(6.8)	13(6.8)		
3000–5000 yuan	45(23.6)	33(17.3)	12(6.3)		
5000–10,000 yuan	55(28.8)	43(22.5)	12(6.3)		
10,000 yuan or more	65(34.0)	52(27.2)	13(6.8)		

Notes: #Han is the major ethnic group in China. Bold indicates statistical difference between the two groups.

Abbreviation: PHQ-9, 9-item Patient Health Questionnaire.

## Group Differences by Depression

Of the 191 participants, approximately a quarter of the participants (N = 50, 26.2%) reported clinical depression. Table 1 also illustrates the differences of sample characteristics between depressed participants and non-depressed participants. There were no significant differences observed between the two groups (all  $p > 0.05$ ) for the majority of the variables (eg, age, education level, ethnicity, residence location, marital status, single-child status, and caregiver's education). Conversely, significant differences were found regarding the duration of HIV infection ( $t = 2.55$ ,  $p = 0.013$ ). Participants in the depressed group remained HIV-positive for longer. Family income was also significantly different between the two groups ( $\chi^2 = 9.47$ ,  $p = 0.024$ ), with lower monthly family incomes reported among the depressed group.

## Associations Among Main Study Variables

As shown in Table 2, family functioning was negatively associated with stigma ( $r = -0.17$ ,  $p = 0.019$ ) and depressive symptoms ( $r = -0.25$ ,  $p = 0.001$ ) and was positively associated with resilience ( $r = 0.18$ ,  $p = 0.012$ ). Stigma had a negative relationship with resilience ( $r = -0.53$ ,  $p < 0.001$ ) and a positive relationship with depressive symptoms ( $r = 0.53$ ,  $p < 0.001$ ). Resilience was negatively associated with depressive symptoms ( $r = -0.59$ ,  $p < 0.001$ ). Depressive

**Table 2** Descriptive Statistics and Correlation Matrix of Main Measures (N= 191)

	Skewness	Kurtosis	M	SD	Family Functioning	Stigma	Resilience	Depressive Symptoms
Family functioning	-0.21	-0.84	6.10	2.88	I			
Stigma	0.14	0.32	56.90	13.76	-0.17*	I		
Resilience	-0.32	-0.30	26.11	8.97	0.18*	-0.53***	I	
Depressive symptoms	1.15	1.22	7.44	6.04	-0.25**	0.53***	-0.59***	I

Notes: \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

Abbreviations: M, Mean score; SD, Standard deviation.

**Table 3** Decomposition of the Effect of Family Functioning on Depression (N= 191)

Paths	b	SE	95% CI
Family functioning-Stigma-Depressive symptoms	-0.04	0.02	-0.10, -0.001
Family functioning-Resilience-Depressive symptoms	-0.06	0.03	-0.12, -0.01
Family functioning-Stigma-Resilience-Depressive symptoms	-0.03	0.02	-0.08, -0.01

**Note:** b values were standardized coefficients.

**Abbreviation:** 95% CI, 95% bootstrapped confidence intervals.

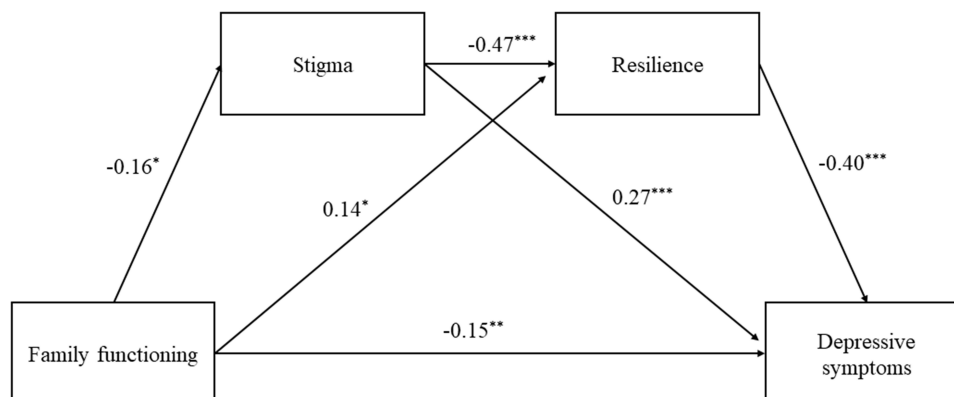
symptoms had a positive association with duration of HIV infection ( $r = 0.18, p = 0.019$ ). Lastly, family monthly income was negatively associated with depressive symptoms ( $r = -0.22, p = 0.003$ ). In addition, the VIF of family functioning, stigma, and resilience were 1.04, 1.40, and 1.41, respectively, suggesting a low possibility of multicollinearity.

## Path Analysis

An EFA found 12 factors with eigenvalues  $> 1$  and the first factor accounted for 19.60% of the total variance ( $< 40\%$ ), indicating that common method variance was not of great concern in the current study. Potentially confounding factors that were significantly associated with depressive symptoms were controlled in the model as covariates, including duration of HIV infection and family monthly income. Table 3 depicts the standardized regression results of serial mediation to test the significance of the effects of family functioning on depressive symptoms through mediators of stigma and resilience. As shown in Figure 1, family functioning had a significant negative association with stigma ( $b = -0.16, p = 0.032, 95\% \text{ CI } [-0.31, -0.01]$ ), but a positive relationship with resilience ( $b = 0.14, p = 0.031, 95\% \text{ CI } [0.01, 0.27]$ ). There was a positive association between stigma and depressive symptoms ( $b = 0.27, p < 0.001, 95\% \text{ CI } [0.14, 0.39]$ ), and the negative relationships between resilience and depressive symptoms ( $b = -0.40, p < 0.001, 95\% \text{ CI } [-0.53, -0.27]$ ) were both significant. A significant negative association between stigma and resilience was also observed ( $b = -0.47, p < 0.001, 95\% \text{ CI } [-0.60, -0.34]$ ). Moreover, the direct effect of family functioning on depressive symptoms remained significant ( $b = -0.15, p = 0.008, 95\% \text{ CI } [-0.27, -0.04]$ ). Therefore, stigma and resilience significantly mediated the relation between family functioning and depressive symptoms (Indirect effect =  $-0.03, 95\% \text{ CI, } -0.08 \sim -0.01$ ). The model explained 7.48% variances in stigma, 29.88% variances in resilience, and 45.71% variances in depressive symptoms.

## Sensitivity Analysis

We randomly selected 80% of the subjects from the full sample ( $N=150$ ) to test the mediation effects, and obtain very similar results (see Table 4). Both stigma (Indirect effect =  $-0.06, 95\% \text{ CI, } -0.13 \sim -0.01$ ) and resilience (Indirect effect =  $-0.06, 95\% \text{ CI, } -0.14 \sim -0.001$ ) were significant partial mediators in the relationship between family functioning and



**Figure 1** Standardized path coefficients for the mediating model.

**Notes:** \* $p < 0.05$ ; \*\* $p < 0.01$ ; \*\*\* $p < 0.001$ .

**Table 4** Sensitivity Analysis (N= 150)

Paths	b	SE	95% CI
Family functioning-Stigma-Depressive symptoms	-0.06	0.03	-0.13, -0.01
Family functioning-Resilience-Depressive symptoms	-0.06	0.04	-0.14, -0.001
Family functioning-Stigma-Resilience-Depressive symptoms	-0.04	0.02	-0.11, -0.01

**Note:** b values were standardized coefficients.

**Abbreviation:** 95% CI, 95% bootstrapped confidence intervals.

depressive symptoms. A parallel and chain mediating role of stigma and resilience in the relationship between family functioning and depressive symptoms was also supported (Indirect effect =  $-0.04$ , 95% CI,  $-0.11 \sim -0.01$ ). The model explained 10.89% variances in stigma, 26.49% variances in resilience, and 45.78% variances in depressive symptoms.

## Discussion

This study aimed to advance our understanding of how family functioning impacts depressive symptoms by testing the mediating roles of stigma and resilience in a sample of HIV-positive MSM. The findings demonstrated that stigma and resilience acted as a mediator between family functioning and depressive symptoms among HIV-positive MSM, respectively. Moreover, a chain mediation of stigma and resilience in the relationship between family functioning and depressive symptoms were also confirmed. By exploring the underlying mechanisms of how family functioning attenuated HIV-positive MSM' depressive symptoms, our results provide clinical practitioners with important information for intervention efforts for HIV-positive MSM.

Consistent with the Circumplex model of marital and family systems<sup>14</sup> and previous findings, the results demonstrated that family functioning was negatively associated with depressive symptoms.<sup>52,53</sup> Compared with other social relationships, the Chinese emphasize the importance of family relationships. We therefore speculated that prejudice from family members may have a significant negative impact on the mental health of HIV-positive MSM. Chinese families have low acceptance of sexual minorities,<sup>16</sup> so low levels of family support are associated with increased depression, anxiety, and loneliness.<sup>54</sup> Conversely, family acceptance protected against depression in lesbian, gay, bisexual, and transgender (LGBT) sexual minorities.<sup>55,56</sup> Meanwhile, stigma was positively associated with depressive symptoms and negatively associated with resilience. These findings were consistent with those from previous studies. HIV-positive MSM with higher resilience experienced less severe depressive symptoms.<sup>37</sup> Other studies of sexual minorities<sup>57</sup> and HIV patients<sup>58</sup> also supported our findings on the intensified effects of stigma on depressive symptoms.

The current study extended previous literature to further clarify how family functioning lowers the subsequent depressive symptoms of HIV-positive MSM via stigma. As hypothesized, stigma constituted the mediating processes through which family functioning led to depressive symptoms. Some empirical studies have also supported this mediating role. The study by Lee et al showed that family functioning was negatively associated with stigma.<sup>26</sup> Individuals are less prone to perceive stigma within a well-functioning and cohesive family system. A cohesive family environment may give more opportunities for patients to openly share and discuss their fears and uncertainties, thus resulting in lower levels of felt stigma.<sup>59</sup> A study of patients with tuberculosis also supports the findings of the current study, documenting that stigma partially mediated the effect of family functioning on depressive symptoms.<sup>60</sup>

Our study has identified the positive association between family functioning and resilience. Previous theories hold that resilience is driven by both internal and external protective factors. Among external protective factors, family environment and social support can provide material or spiritual support for the individual and are considered important factors influencing resilience.<sup>61</sup> In the current study, resilience mediates the relationship between family functioning and depressive symptoms among HIV-positive MSM. Specifically, good family functioning promoted resilience and consequently relieved depressive symptoms. Our observation is in line with the findings reported in previous literature documenting how higher resilience reduced the risk of depressive symptoms in various samples. For instance, a previous work among the elderly found that depressive symptoms were significantly negatively correlated with family functioning and resilience, while resilience is significantly positively correlated with family functioning.<sup>62</sup> A survey of

refugees by Nam et al (2016) showed that family cohesion, a core component of family functioning, was significantly associated with depression, and the relationship was partially mediated by resilience.<sup>35</sup>

It is worth noting that the chain effect of stigma and resilience mediates family functioning and depressive symptoms among HIV-positive MSM. Persistent and extremely distressing stigma can trigger strong negative emotions that impair an individual's adaptive coping strategies. These maladaptive coping strategies may weaken their resilience. Another study of sexual minorities has similarly shown that stigma eroded resilience and consequently intensified depressive symptoms.<sup>63</sup> In addition, in line with previous studies,<sup>64,65</sup> we discovered multiple psychosocial factors, such as duration of HIV infection and low family income, were associated with depressive symptoms in univariate analysis ( $p < 0.05$ ). These factors should also be taken into great consideration for effective psychosocial intervention for HIV-positive MSM.

Several limitations of the present study should be acknowledged. First, although this study used highly reliable measurement variables, the self-report method may be affected by memory biases. Second, using a convenience sample from only one province may not constitute a sample representative of all Chinese HIV-positive MSM. Third, the cross-sectional design of this study restricts our ability to establish temporal relationships and make causal inferences among the variables. Thus, follow-up formative work and clinical interviews could deepen the analysis. Lastly, some important confounding factors, such as negative life events and sleep quality, were not taken into account in this study, which may also affect the study findings.

## Conclusions

This study revealed that stigma and resilience have mediating effects on the association between family functioning and depressive symptoms among Chinese HIV-positive MSM. These findings have important implications for the early detection, prevention, and treatment of depression among HIV-positive MSM. Based on our research findings, HIV-positive MSM with family dysfunction can be identified as a high-risk group for depression. Undoubtedly, early intervention is crucial for this population. When implementing interventions, the effects of stigma and resilience on depressive symptoms should be comprehensively considered.

## Data Sharing Statement

The data presented in this study are available on request from the corresponding authors (Dr. QD).

## Ethics Statement

The survey was carried out in accordance with the latest version of the Declaration of Helsinki and approved by the Ethics Committees of Xiangya Nursing School of Central South University. The survey was under the principle of voluntary participation. The participants (or their guardians, if age < 18) carefully read, signed and returned the informed consent form to the researcher. The participants were assured that the information obtained would remain confidential.

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## Disclosure

The authors declare that they have no conflicts of interest in this work.

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