

# Structural equation modeling analysis of social support, coping strategies, depression and suicidal ideation among people living with HIV/AIDS in Changsha, China

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**Introduction:** People living with HIV/AIDS (PLWHA) have a higher rate of suicide compared to the general population. Psychosocial factors closely correlate with suicidal ideation and it is essential to explain the relationships between related factors among PLWHA.

**Objectives:** To establish a structural equation model and examine direct and indirect effects of social support, coping strategy, depression symptoms and suicidal ideation among PLWHA.

**Patients and methods:** A total of 504 PLWHA completed a set of questionnaires in the HIV clinic of Changsha Infectious Disease Hospital between December 2015 and January 2016.

**Results:** Among the 504 respondents, a total of 27.2% (n=137) had experienced suicidal ideation in their lifetime. The goodness of fit for the two structural equations model was highly satisfactory. Depression symptoms had a significant direct impact on suicidal ideation ( $\beta_1=0.401$ ,  $\beta_2=0.422$ ), while problem-focused coping ( $\beta=-0.067$ ), emotion-focused coping ( $\beta=-0.081$ ) and social support ( $\beta=-0.137$ ) had a significant indirect effect with suicidal ideation via depression symptoms. Factors of total effects were ranked from large to small as follows: depression, social support, emotion-focused coping and problem-focused coping.

**Conclusion:** Findings provide more understanding of direct and indirect associations between variables, suggesting that depression screening services, and the strengthening of social support and psychological care services among PLWHA can potentially prevent suicide.

**Keywords:** SEM, PLWHA, depression, problem-focused coping, emotion-focused coping

## Introduction

Suicidal ideation is considered as the explicit desire for killing oneself.<sup>1</sup> People living with HIV/AIDS (PLWHA) have an elevated rate of suicide and accounts for twice mortality rates compared to the general population, based on a national cohort in England and Wales between 1997 and 2012.<sup>2</sup> The rate of suicidal ideation in newly diagnosed PLWHA is high up to 27.5% in Changsha and 12.4% of those with lifetime suicidal ideation attempt suicide,<sup>3</sup> which may lead to irreversible loss of life.

Psychosocial factors such as low social support, negative coping strategies and psychological status are closely related with suicidal ideation among PLWHA.<sup>4,5</sup> A considerable amount of research showed that PLWHA had low social support worldwide which was an independent risk factor for suicidal ideation. Adequate social support could moderate the impact of stress, whereas poor social support can adversely influence psychological condition.<sup>3,6,7</sup>

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Coping refers to cognitive and behavioral efforts made to deal with stress.<sup>8</sup> PLWHA might take the following coping strategies including denial, concealment of their health status from others, isolation from others and crying after learning the diagnosis of HIV infection to cope with the impact of stressors.<sup>9</sup> Previous researches reported that there are two major coping strategies that have a significant association with less depression: emotion-focused coping (to regulate distressing moods) and problem-focused coping (to solve the troublesome situation).<sup>10</sup> Moreover, emotion-focused coping reduces depression if social support is available to PLWHA; however, if people with poor social support,<sup>11,12</sup> emotional coping aggravates depression.

Depression is a typical mental disorder which increases the risk of suicide ideation and suicide attempt among PLWHA.<sup>13</sup> Only limited literature showed the direct and indirect relationship between the factors among PLWHA, especially the relationship between social support and coping strategies in regard to suicidal ideation.

The purpose of this research was to establish a structural equation model (SEM) and examine the direct and indirect effects of social support, coping strategies, depression symptoms and suicidal ideation among PLWHA. SEM allows for dealing with complicated relationships between multiple factors which can provide theory-based models for understanding interrelationships between these factors. According to previous studies, we hypothesized the following: 1) social support has a direct impact on problem-focused coping and depression; 2) problem-focused coping might play a mediating role between social support and depression and suicidal ideation; 3) problem-focused coping, emotion-focused coping and depression have a direct impact on suicidal ideation, with depression possibly playing an intermediary role between coping strategies and suicidal ideation.

## Methods

### Study population

This cross-sectional design was used to study and 504 PLWHA who visited the HIV clinic in the Changsha Infectious Disease Hospital, China, were enrolled for the survey between December 2015 and January 2016. Participants who were recruited fulfilled the following inclusion criteria: 1) confirmed diagnosis of HIV-positive status by Centers for Disease Control of Hunan Province and 2) registered resident of Changsha. Meanwhile, cases who were unable to communicate were excluded. All eligible patients received anonymous questionnaires through face-to-face interviews by trained interviewers.

## Measurements

Suicidal ideation was assessed by the Chinese version of the Beck Scale for Suicide ideation which included 19 items in two domains: the intensity of suicidal attitudes and suicidal tendency. Each item assessed for symptoms at two periods of time: in the preceding week and at the most depressive moments and was rated on a 3-point scale ranging from 0 to 2 (no ideation to strong ideation). The scale was well validated in China (Cronbach's  $\alpha=0.87$  for the most depressive moments/Cronbach's  $\alpha=0.68$  for the preceding week).<sup>14</sup> Any respondents would be recognized as having suicidal ideation if their answers were "a little bit" or "medium to strong" to item 4 "How about your willingness to commit suicide?" or item 5 "To what extent would you end your life passively?" if not, they did not continue to finish the following 14 items.

Depression was assessed using the 20-item Zung Self-Rating Depression Scale (SDS). The instruments were proved with good validity and reliability in China<sup>15</sup> and were scored on a four-point Likert scale from 1 to 4 ("Seldom [1]," "Sometimes [2]," "Usually [3]," "Always [4]"). Some items were reversely scored. The standard score equaled the total raw score timing 1.25 (ranging from 25 to 100), with a higher score indicating severe symptomatology. Cut points were used to determine the status. Participants had the standard score  $>53$  for SDS manifested positive symptoms of depression.

Coping strategy was assessed using a simplified coping style questionnaire (SCSQ) with a Cronbach's  $\alpha=0.90$  in China.<sup>15</sup> The questionnaire measured the ways how the participants dealt with negative life events which consisted of five dimensions: emotion-focused coping (active and passive), problem-focused coping (active and passive) and psychological counseling.<sup>16</sup> Twenty items were rated on a four-point Likert scale from 0 to 3.

Social support rate scale (SSRS) was implemented to assess social support states of participants and had been well validated in suicide-related research in China with a Cronbach's  $\alpha=0.762$ .<sup>17</sup> The subscales included subjective support, objective support and availability of support. Higher total score indicated better social support. The norm score for this scale in the Chinese population was  $44.38 \pm 8.38$ .

HIV/AIDS-related information was also assessed. Participants were asked how long they had been diagnosed with HIV infection and whether their spouses or sexual partners had HIV infection. In addition, the clinical information, including CD4 cell count, viral load and treatment regimen, was switch from medical records with the patients' and physicians' permission.

Sociodemographic characteristics, including gender, education level, marital status and monthly average income, were self-reported through a questionnaire. Sexual orientation and self-perceived health status were obtained via interview. Furthermore, they were asked if they ever committed suicide.

**Ethical considerations:** This research was approved by the Human Research Ethics Committee of Xiangya Hospital Central South University. A written informed consent was acquired from all participating adults and legal guardians of each participant under the age of 18 years. We kept the content of this research completely confidential, and the data were kept in the file cabinet of the locked project office or in the computer with password protection. The answer was not seen by anyone other than the staff of the survey. We also contacted each of the family members of the study and identified emergency contacts and reported to doctors and security departments especially for the patients who had strong suicidal ideation to ensure safety.

## Statistical analysis

Data were analyzed using SPSS 22.0 and SEM analysis was run using AMOS 22.0. Descriptive statistics were used to describe the sample characteristics. The correlation among factors associated with suicidal ideation was conducted using bivariate Pearson correlation analysis, which was prepared for building model. And then the relationship of model fitting among factors for suicidal ideation was analyzed using SEM.

## Structural equation model

All missing values of factors (less than 5% of data) associated with suicidal ideation were replaced by series mean method using SPSS 22.0 before starting the analysis. According to the results of bivariate Pearson correlation analysis and previous studies, we decided to set a path analysis with mixed variables including two exogenous latent variable (social support and suicidal ideation) and two endogenous observation variable (coping strategies and depression).

## Results

### Sample characteristics

We interviewed 545 eligible patients and 41 of them could not complete the questionnaires, giving an overall response rate of 92.5%. The data were summarized in Table 1. The median age of 504 patients was 32 (range: 9–72) and the ratio of male to female was about 4:1. More than half (55%) were heterosexual and 12.1% reported their lovers/spouses suffered from HIV infection. The median of CD4 cell count was 369/ $\mu$ L ( $P_{25}$ =317,  $P_{75}$ =401).

**Table 1** Demographic characteristics, clinical characteristics and psychological factors with suicidal ideation of HIV/AIDS patients

	Total, n (%)	Suicidal ideation, n (%)
<b>Demographic characteristics</b>		
Gender		
Female	95 (18.8)	17 (17.9)
Male	409 (81.2)	120 (29.3)
Age (years)		
$\leq 32$	252 (50.0)	80 (31.7)
$> 32$	252 (50.0)	57 (22.6)
Nationality		
Han	479 (95%)	129 (26.9)
Non-han	20 (5.0)	7 (35)
Missing	5 (1.0)	
Marital status		
Unmarried	216 (42.9)	69 (31.9)
Married	220 (43.7)	48 (21.8)
Divorced	52 (10.3)	15 (28.8)
Widowed	13 (2.6)	4 (30.8)
Missing	3 (0.5)	
Sexual orientation		
Homosexual	126 (25.0)	50 (39.7)
Heterosexual	277 (55.0)	66 (23.8)
Bisexual	50 (9.9)	11 (22.0)
Education		
Senior or lower	296 (58.7)	70 (23.6)
College or higher	191 (37.9)	64 (33.5)
Missing	17 (3.4)	
Monthly income (RMB)		
$< 4,000$	376 (73.8)	107 (28.5)
$\geq 4,000$	112 (22.2)	27 (24.1)
Missing	16 (3.2)	
<b>Clinical characteristics</b>		
Course		
$\leq 1$ year	233 (46.2)	65 (27.9)
$> 1$ year	271 (53.8)	51 (26.7)
CD4 count		
$< 500$	231 (45.8)	65 (28.1)
$\geq 500$	74 (14.7)	16 (21.6)
Viral load		
No	146 (29.0)	44 (30.1)
Yes	177 (35.1)	46 (26.0)
Complications		
No	270 (53.6)	81 (30.0)
Yes	144 (28.6)	30 (20.8)
Treatment changed		
No	301 (59.7)	85 (28.2)
Yes	38 (7.5)	13 (34.2)
State of health		
Well	268 (53.2)	71 (26.5)
General	172 (34.1)	51 (29.7)
Poor	27 (5.4)	8 (29.6)
Missing	37 (7.3)	

## Suicidal ideation

Among the 504 participants, a total of 27.2% ( $n=137$ ) had experienced suicidal ideation in their lifetime, 13.9% ( $n=70$ ) had suicidal ideation in the last week and 26.6% ( $n=134$ ) were at the most depressive moments.

## Correlation analysis

Bivariate Pearson correlation analysis showed that emotion-focused coping and psychological counseling were not related to social support. As displayed in Table 2, the remaining variables were significantly correlated. We considered that emotion-focused coping and suicide ideation are closely related. Therefore, we divided two types of coping style into two separated models that one consisted of social support, problem-focused coping, depressive symptom and suicidal ideation, and the other one just included emotion-focused coping, depressive symptom and suicidal ideation without social support.

## Structural equation model

### Model testing

Since the data collected by the survey did not satisfy multiple normal distribution, two estimation methods were conducted to examine the hypotheses. Maximum likelihood and generally weighted squares methods were conducted to examine the hypotheses and indicated that the theoretical model met well with the variables demonstrating a good fit. As shown in Table 3, unstandardized (B) and standardized regression ( $\beta$ ) coefficients, along with the standard errors and *P*-values for B are reported in Table 4. Bootstrap method would be used to examine the mediating effects. As displayed in Table 4, the final models were determined (Figures 1 and 2).

### Direct and indirect effects of factors affecting suicidal ideation

Standardized direct and indirect effects are reported in Table 5. Depression symptom directly affected suicidal ideation ( $\beta_1=0.401$ , bootstrap 95% CI 0.294, 0.511,  $\beta_2=0.422$ , bootstrap 95% CI=0.323, 0.511) during both models. Problem-focused coping had an indirect effect ( $\beta=-0.067$ , bootstrap 95% CI=-0.117, -0.001) with suicidal ideation via depression symptom and emotion-focused coping had an indirect effect ( $\beta=-0.081$ , bootstrap 95% CI=-0.130, -0.036) manifesting a statistical mediation. Social support could directly influence the depression symptoms but could also be indirectly through problem-focused coping to depression symptoms and the value of total effects was ( $\beta=-0.137$ , bootstrap 95% CI=-0.223, -0.075) suggesting a statistical mediation between social support and suicidal ideation. Depression had the greatest direct effect on suicidal ideation and partly mediated the association of social support with suicidal ideation. Additionally, social support had the second greatest total effect on suicidal ideation with both a direct effect and indirect effect through problem-focused coping

**Table 2** Bivariate Pearson correlation analysis among variables associated with suicidal ideation

Variables	1	2	3	4	5	6	7	8	9	10
1 Depression	1.00									
<b>Social support</b>										
2 Social support	-0.247***	1.00								
3 Subjective support	-0.152**	0.911***	1.00							
4 Objective support	-0.205***	0.714***	0.461***	1.00						
5 Availability of support	-0.293***	0.554***	0.297***	0.277***	1.00					
<b>Coping strategy</b>										
6 Emotion-focused	-0.193***	0.060	-0.006	0.077	0.144**	1.00				
7 Problem-focused	-0.283***	0.219***	0.100*	0.121***	0.429***	0.618***	1.00			
8 Psychological counseling	-0.295***	0.039	-0.026	0.001	0.220***	0.525***	0.582***	1.00		
<b>Suicidal ideation</b>										
9 The preceding week	0.369***	-0.121**	-0.039	-0.158***	-0.162***	-0.111*	-0.126**	-0.127**	1.00	
10 The most depressive moments	0.369***	-0.141**	-0.101*	-0.092*	-0.164***	-0.148*	-0.146**	-0.146**	0.415***	1.00

Notes: Two-tailed \*0.01 < *P* ≤ 0.05; \*\**p* < 0.01; \*\*\**p* < 0.001.

**Table 3** Effects of structural equation model fitting

Estimation methods	$\chi^2/df$	P-value	GFI	AGFI	RMSEA	NFI	CFI
Reference standard	<3	0.05	>0.9	>0.9	<0.05	>0.9	>0.9
Maximum likelihood (model 1)	1.638	0.108	0.993	0.974	0.036	0.983	0.993
Maximum likelihood (model 2)	0.952	0.329	0.999	0.990	0.000	0.998	1.000
Generally weighted squares (model 1)	1.652	0.105	0.992	0.973	0.036	0.962	0.984
Generally weighted squares (model 2)	0.949	0.330	0.999	0.990	0.000	0.995	1.000

and depression. During the process of analysis, the observation variables of social support, problem-focused coping and emotion did not load significantly onto the latent variable of suicidal ideation ( $P>0.05$ ).

## Discussion

The main purpose of this study is to explore the relationship between suicidal ideation and its three influencing factors among PLWHA and the difference between different coping strategies using SEM. Only few such studies have been done for this population so far. The data analysis methods used for socio-psychological factors of suicidal ideation include multifactor logistic regression analysis and Path analysis. The drawback is that these methods cannot handle multiple dependent variables or estimate factor structures and factor relationships simultaneously and cannot estimate the fit of the entire model. In comparison, SEM can compensate for these flaws. Therefore, we developed models using SEM.

The annual incidence of suicidal ideation among college students in China was 6.76%.<sup>18</sup> The incidence of suicidal ideation among adolescents aged 11–16 years old was 17.4%.<sup>19</sup> The incidence of suicidal ideation in rural elderly over 60 years old was 5.6%.<sup>20</sup> In contrast, the detection rate of lifelong suicide ideation in AIDS patients in Changsha was higher, which deserves social attention.

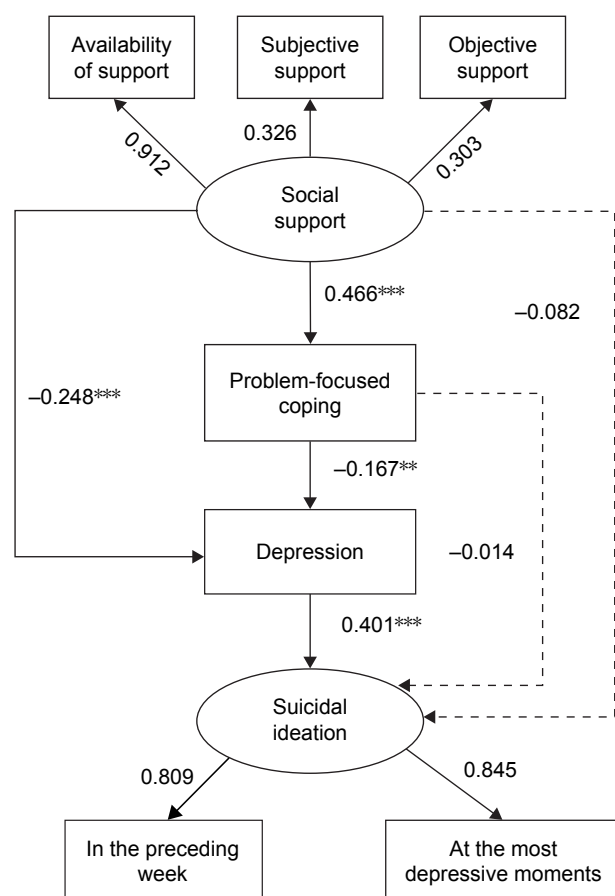
Our findings showed that depression symptoms had significant direct associations with suicidal ideation. Depression has a positive effect on suicidal ideation among PLWHA, and the effect size was the largest among the psychological factors, which is consistent with previous research among college students and which also proved to be applicable to PLWHA.<sup>21</sup> The social support and coping strategies could indirectly influence suicidal ideation by depression which confirmed the importance of depression on suicidal ideation.

Social support was second only to the effect size of depression on suicidal ideation. Model 1 shows that social

**Table 4** Standardized regression coefficients and standard errors for all pathways of the ML SEM model fitting (N=504)

Model 1		B	SE	$\beta$	P-value
Variable 1	Variable 2				
Problem-focused	Social support	3.575	0.642	0.466	***
Depression	Social support	-3.539	0.955	-0.248	***
Depression	Problem-focused	-0.311	0.105	-0.167	0.003
Suicidal ideation	Depression	0.068	0.009	-0.401	***
Suicidal ideation	Problem-focused	-0.004	0.017	-0.014	0.800
Suicidal ideation	Social support	-0.196	0.146	-0.082	0.179
Objective support	Social support	1.000		0.300	
Availability of support	Social support	2.341	0.567	0.912	***
Subjective support	Social support	2.207	0.354	0.326	***
The most depressive moments	Suicidal ideation	1.000		0.845	
The preceding week	Suicidal ideation	0.655	0.064	0.809	***
Model 2		B	SE	$\beta$	P-value
Variable 1	Variable 2				
Depression	Emotion-focused	-0.503	0.115	-0.193	***
Suicidal ideation	Depression	0.071	0.008	0.422	***
Suicidal ideation	Emotion-focused	-0.034	0.020	-0.078	0.095
The most depressive moments	Suicidal ideation	1.00		0.842	
The preceding week	Suicidal ideation	0.663	0.065	0.813	***

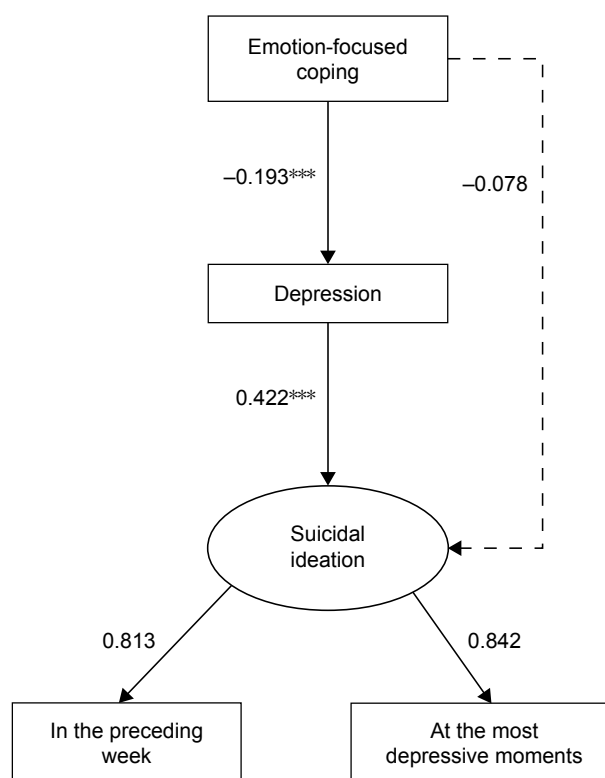
**Note:** Two-tailed \*\*\* $P<0.001$ .



**Figure 1** Structural equation model testing the direct and indirect relationships among social support, problem-focused coping, depression and suicidal ideation. **Note:** Two-tailed \*\* $P < 0.01$ ; \*\*\* $P < 0.001$ .

support indirectly influences suicidal ideation through depression symptoms via two paths. First, social support can have a direct impact on problem-focused coping, which in turn has a direct impact on depression and hence ultimately influences suicidal ideation. Additionally, social support can directly affect depression, which again, in turn, influences suicidal ideation. Availability of support has the largest loading of the three observed variables of social support. For PLWHA, family members and friends are the main sources of social support. However, they typically do not seek support and even conceal the disease from them. This unwillingness to reach out for social support might be caused by the fear of being abandoned and being discriminated which make them unwilling to seek social support and even conceal the disease.<sup>22</sup> This unwillingness to reach out for social support might be caused by the fear of being abandoned and discriminated. Social support, a protective factor conducive to a positive response and mood improvement, enhances the faith in survival and strengthens the will to survive.

Problem-focused coping and emotion-focused coping indicating indirect effects on suicidal ideation have negative



**Figure 2** Structural equation model testing the direct and indirect relationships among emotion-focused coping, depression and suicidal ideation. **Note:** Two-tailed \*\*\* $P < 0.001$ .

associations with effects on depression symptoms, where emotional attention scores are significantly different from issues of concern ( $t = -28.849$ ,  $P < 0.05$ ). This difference might be related to the particular reality of AIDS, including infectivity, nonspecific drug treatment and HIV stigma which could mediate self-efficacy.<sup>23</sup> The patients may deal with stress by actively changing the perception of events rather than using social support coping. But in our study, we find that emotion-focused coping is not influenced by social support among PLWHA, as opposed to problem-focused coping. Hence, emotion-focused coping may play a significant role in diminishing PLWHA's suicidal ideation by reducing depression when they do not perceive a high level of social support from others. Problem-focused coping and emotion-focused coping cannot directly affect the suicidal ideation, we guess that coping strategies and suicidal ideation have an adverse correlation, only when the coping level reaches to a certain extent can improve the mood and in turn to reduce suicidal ideation.

There were several limitations to this study. This consecutive sample in the HIV clinic of Changsha may not represent other PLWHA in China. A cross-sectional data cannot explain the causal relationship between variables. In future studies, longitudinal data are needed to conduct

**Table 5** Standardized direct, indirect and total effects of all study variables on suicidal ideation

Variables	Direct effect $\beta$ (95% CI)	Indirect effect $\beta$ (95% CI)	Total effect $\beta$ (95% CI)
Depression (model 1)	0.401 (0.294, 0.511)	–	0.401 (0.294, 0.511)
Problem-focused	–	–0.067 (–0.117, –0.001)	–0.067 (–0.117, –0.001)
Social support	–	–0.137 (–0.223, –0.075)	–0.137 (–0.223, –0.075)
Emotion-focused	–	–0.081 (–0.130, –0.036)	–0.081 (–0.130, –0.036)
Depression (model 2)	0.422 (0.323, 0.511)	–	0.422 (0.323, 0.511)

the temporal analysis. Additionally, the models should be interpreted with caution because the measurement of suicidal ideation was zero-inflated, which may increase the risk of type II error. Despite limitations, our model still provided a good fit to data, interpreting the mechanism of the formation of suicidal ideation among PLWHA preliminarily. This research highlights the importance of depressive symptoms to the direct effects of suicidal ideation, suggesting that strengthening depression screening and troubleshooting timely is necessary. Meanwhile, using emotion-focused coping strategies may be the easier and more effective way when facing complicated environment. Last but not the least, enhancing information and emotional support and providing psychological care services can intervene in suicide ideation among people living with HIV effectively.

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## Disclosure

The authors report no conflicts of interest in this work.

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