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Revealing the complexity of depression configurations in HIV-positive men who have sex with men: a fuzzy-set qualitative comparative analysis

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Abstract

Background Previous studies have explored the mental health of HIV-positive people. However, research specifically focusing on HIV-positive men who have sex with men (MSM) is relatively limited. From the configuration perspective, this study explored different combines influencing depression in HIV-positive MSM using fuzzy-set qualitative comparative analysis (fsQCA).

Methods Data was collected from April to July 2023. A total of 551 HIV-positive MSM served as valid samples. Participants completed electronic questionnaires, including information such as Family APGAR Index, Sense of Coherence Scale-13, Simplified Coping style Questionnaire, Templar's Death Anxiety Scale, Patient Health Questionnaire-9. This study simultaneously used two different analysis methods — linear regression model and fsQCA.

Results In the regression model, this study found that the sense of coherence has the greatest impact on depression. Through fsQCA, this study identified four configurations that may contribute to depression in HIV-positive MSM. The sense of coherence was a core condition in each configuration. In the configuration 1a most associated with depression, the sense of coherence was absent as a core condition, death anxiety and stigma were present as core conditions, and positive coping style was absent as a peripheral condition.

Conclusions A higher sense of coherence is an important protective factor in reducing the risk of depression in HIV-positive MSM. Configurations formed by different variables all have a significant impact on depression in this study. In clinical intervention for depression of HIV-positive MSM, attention should be simultaneously paid to both internal psychological characteristics and external factors such as family environment.

Keywords Fuzzy-set qualitative comparative analysis, HIV-positive men who have sex with men, Sense of coherence, Configurations, Depression

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Introduction

According to UNAIDS reported, by 2022, there were approximately 39 million people living with HIV worldwide, with key populations including transgender persons, gay men and other MSM, people who inject drugs, sex workers and people in prisons. In 2022, the median HIV prevalence among gay men and other MSM was 7.5%, 11 times higher than the general adult population [1].

Studies have confirmed that the mental health problems of HIV-positive MSM are worthy of attention [2]. Depression is a common mental disorder. Many previous studies have found that the prevalence of depression in MSM is much higher than the general population [3]. A Meta-analysis confirmed that HIV-positive MSM are more likely to be depressed compared to HIV-negative MSM [4]. In addition, depression have multiple adverse effects on HIV-positive MSM. A longitudinal study of randomized controlled trial showed that depression and anxiety in MSM with newly diagnosed HIV-positive are risk factors for "imperfect" treatment adherence [5]. In terms of the course of the disease, depression can significantly increase plasma viral load of HIV-positive people and accelerate the decline of $CD4^+$ cell counts, which further causes impaired cellular immune functions [6]. A study on HIV-positive males found that depression and hypogonadism interact with each other and also affect their sexual function [7]. Given the various damages that depression brings to the well-being and quality of life of HIV-positive people, it is necessary to further explore the effect of different combinations of variables on depression to take targeted interventions.

Depression in HIV-positive MSM is the result of the complex interaction of multiple physiological, psychological, and social factors. In previous studies, it has been found that variables such as family environment, stigma and psychological resources all have significant impacts on depression in HIV-positive people [8–10]. The family, as an important environmental system, plays an important role in influencing the mental health and quality of life of HIV-positive MSM. According to the McMaster Model of Family Functioning [11], good family function can provide more emotional support, understanding, and help for individuals, thereby reducing the risk of mental problems such as depression. Especially for HIV-positive MSM, more understanding and support from families are needed to reduce the stress and burden of HIV and homosexual acts [12]. Additionally, according to the Minority Stress Theory, HIV-positive MSM may face both distal stressors (e.g. social discrimination and isolation) and proximal stressors (e.g. self-stigma and internalized homophobia), which increase the risk of mental health disorders like depression and anxiety [13]. Due to the fear of exposure or rejection, HIV-positive MSM may intentionally distance themselves from their social circles, leading to a reduction in available support resources. The decrease in social support is a significant risk factor for depression [14]. Furthermore, internalized homophobia may cause individuals to internalize societal prejudice as self-denial, triggering feelings of shame and low self-esteem, which directly exacerbates depression [15]. The presence of shame easily induces chronic stress, potentially causing HIV-positive people to experience negative emotions. Previous research has also found that the duration of infection is an important factor influencing depression in HIV-positive people. However, these studies have not reached consistent conclusions [16, 17].

Previous studies have also found a positive correlation between death anxiety and depression, with the two influencing each other [18]. According to the Terror Management Theory [19], when HIV-positive MSM believe the disease is endangering their lives, they may consciously or unconsciously think about death, resulting in psychological phenomena such as death anxiety and fear. The Terror Management Theory emphasizes on the influence of mortality on people's emotions, mental health and behaviors. Moreover, the Broaden-and-Build Theory of Positive Emotions [20] states that positive emotions can help people increase their personal psychological resources and adopt positive coping style, thus reducing the occurrence of psychological distress. In contrast, negative emotions (such as death anxiety) tend to increase the risk of mental problems such as depression and anxiety.

Positive psychological resources are important protective factors for the mental health of HIV-positive MSM. The Salutogenic Model of Health, proposed by Antononsky, is an important part of positive psychology [21]. Sense of coherence, as the core concept of the model, refers to a generalized and meaningful confidence tendency that individuals maintain in the face of both internal and external stressors. Based on the Salutogenic Model of Health [22], in the face of stress and stimulation, HIV-positive MSM can rely on their own psychological protective factors like the sense of coherence to better maintain mental wellbeing and reduce the occurrence of mental problems. Previous studies on patients of other disease have found that the sense of coherence, as a positive psychological resource, can play a significant buffering role in the occurrence of depression [23, 24]. To date, research on the impact of the sense of coherence on depression in HIV-positive MSM is still relatively limited. In addition, HIV-positive people with higher sense of coherence are more likely to view stressful events as less distressing and it can help patients to better understand, and solve problems. This enables them to adopt more proactive approaches to dealing with stressful events, thereby reducing the risk of mental health problems. A

longitudinal study conducted in South Africa confirmed that increased positive coping with HIV is associated with a reduction in internalized stigma and depression levels [25].

Although some existing studies have investigated the depression status of HIV-positive MSM, these studies have primarily focused on the influencing factors and pathways of depression [26, 27]. In previous studies, the single regression analysis was often used to explore influencing factors of depression in HIV-positive MSM [28]. And structural equation models were used to explore the path relationships among different variables [29]. Traditional variable-centered analysis methods (such as regression analysis) can explain the net effect between each independent variable and the dependent variable. However, it is difficult for these traditional methods to explain the interdependence between independent variables and their impacts on the study results.

Therefore, to fill the research gap of existing studies, the present study not only explore the factors of influencing depression in HIV-positive MSM using linear regression analysis, but also focus on the influence of different combinations of antecedent variables on depression from the perspective of configuration. Qualitative comparative analysis (QCA) is a research method, proposed by Charles Ragin, which considers both "configuration comparison" and "set theory" [30]. This approach tries to integrate "qualitative research (case-oriented)" and "quantitative research (variable-oriented)". The approach is based on set theory and Boolean logic to analyze the impact of the interaction among antecedent conditions on the outcome variable [31]. It can effectively compensate for the limitations of traditional methods in analyzing the net effect of depression on HIV-positive MSM. FsQCA is one of the most widely used QCA methods at present. In this study, based on the characteristics of conjunction, equifinality and causal asymmetry, fsQCA analyzes the joint effect of multiple independent variables on depression of HIV-positive MSM. The conjunction means that depression of HIV-positive MSM is generally not the result of a single factor, but is often caused by the interaction of multiple factors. Second, equifinality refers to that different combinations of antecedent conditions may lead to the same result [32]. Third, causal asymmetry refers to that the conditions leading to the emergence and absence of results are different. For example, the condition configurations leading to high job satisfaction is different from the condition configurations leading to low job satisfaction [33]. Through fsQCA, it is beneficial for us to more systematically and comprehensively explore the different combinations of antecedent conditions of depression in HIV-positive MSM.

The advantage of QCA lies in its ability to break through the assumptions of simple linear relationships and unidirectional causal conditions in traditional regression analysis. And QCA emphasizes on multiple concurrent causal relationships among variables [34], which can provide more contextual explanations for the regression analysis results of depression in HIV-positive MSM. In recent years, an increasing number of studies have combined regression models with FsQCA, which facilitates a more comprehensive and accurate understanding of the relationships between different antecedent variables and the outcome variable [35].

The aim of the present study is to explore the influence of different configurations of duration of infection, family function, sense of coherence, stigma, death anxiety and positive coping style on depression of HIV-positive MSM via linear regression models and fsQCA. According to the different roles of each factor in the configurations, targeted measures can be taken to reduce the risk of depression in HIV-positive MSM.

Materials and methods

Participants

This study was conducted from April to July 2023 at a voluntary counseling and testing clinic for HIV in a province of China. Data were collected through electronic questionnaires. First, the investigators introduced the purpose of the study to male HIV-positive individuals visiting the clinic and invited them to complete an online questionnaire. Second, volunteers invited male HIV-positive individuals who had previously visited the clinic to participate in the survey and fill out the online questionnaire via WeChat (a widely used social media platform in China). Participation was based on voluntary consent, and participants were allowed to withdraw from the study at any time during the survey. The study obtained informed consents from participants, and their personal information was strictly protected. Additionally, the study was approved by the Board of School of Public Health of Jilin University. A total of 557 HIV-positive MSM participated in the survey. After excluding invalid questionnaires due to short response times, illogical answers, and other reasons, the final valid sample size was 551 participants.

Measures

Family function

Family APGAR Index (APGAR) [36] was used to measure the family function of participants. This scale consists of 5 items, which are used to evaluate adaptation, partnership, growth, affection, and resolve in the family. For example: "When I encounter problems, I can receive satisfactory help from my family." Each question provides three options: "0 = almost rarely", "1 = sometimes" and "2 = often". Total scores ranged from 0 to 10, with higher scores indicating better family function for

the participant. In this study, the Cronbach coefficient of APGAR was 0.87.

Sense of coherence

The present study used the Sense of Coherence Scale-13 (SOC-13), developed by Antonovsky and translated by Bao Leiping, to measure participant's SOC level [37]. The scale consists of 13 items, such as "Do you often feel that you don't care about what's happening around you?" This scale uses a 7-point Likert scale. The total score ranges from 13 to 91, with higher scores indicating higher levels of sense of coherence. In this study, the Cronbach coefficient of SOC-13 was 0.88.

Death anxiety

The Templar's Death Anxiety Scale (T-DAS) [38] was used to examine participant's death anxiety status. The scale includes 15 questions, six of which are scored reversely. For example: "I don't feel nervous when people talk about death." Each question has two options: "0 = No" and "1 = Yes". The total score ranges from 0 to 15, with higher scores indicating more severe death anxiety among participants. In this study, the Cronbach coefficient of T-DAS was 0.79.

Positive coping style

In this study, the positive coping style subscale in the Simplified Coping style Questionnaire (SCSQ) [39] was used to measure the extent to which participants tended to adopt positive coping style when encountering difficulties and setbacks. The scale consists of 12 questions and uses a 4-point Likert scale. For example: "Talking to others to express inner troubles." From "0 = no use" to "3 = frequent use," with a higher total score indicates the participant is more likely to adopt positive coping style when faced with difficulties. In this study, the Cronbach coefficient of the scale was 0.88.

Depression

This study used the Patient Health Questionnaire-9 (PHQ-9) [40] to measure the depression levels of participants. The scale consists of 9 items and uses a 4-point Likert scale ranging from "0 = not at all" to "3 = almost every day". For example: "Little interest or pleasure in doing things." A higher total score indicates a higher level of depression among participants. The total PHQ-9 score of 5, 10, 15 and 20 represents mild, moderate, moderately severe and severe depression, respectively [40]. In this study, the Cronbach coefficient of PHQ-9 was 0.91.

Stigma

This study used the question "Do you feel ashamed because of being infected with HIV?" to measure participant's level of stigma. The question included five options ranging from strongly disagree to strongly agree, indicating increasing stigma among participants.

Statistical analysis

First, descriptive statistical analysis of the participants' basic information was conducted using IBM SPSS Statistics v24.0 software. Then, a linear regression model was used to examine whether the duration of infection, family function, sense of coherence, stigma, death anxiety, and positive coping style have a significant impact on the depression levels of HIV-positive MSM.

At the same time, from the configurational perspective, this study used FsQCA2.5 software to conduct fsQCA to examine the effects of different combinations of causal variables on depression in HIV-positive MSM. FsQCA is a research method that combines qualitative research with quantitative analysis, aiming to explore how multiple independent variables lead to a particular outcome (dependent variable) through different combinations. This method is especially suitable for handling "fuzzy set" data, where variables have continuous or partial membership.

The main steps of fsQCA are as follows: (1) Calibration. In this step, raw variable values are transformed into fuzzy membership scores between 0 and 1. According to the recommendations of the method's originator, Charles Ragin, the data are calibrated according to the thresholds of 5% (Fully Out), 95% (Fully In), and 50% (Crossover Point) [41]. In the real world, the relationship between variables is often gradual rather than binary. As the value of a variable increases, its impact on the outcome may gradually strengthen. According to the gradual nature of causal relationships, Charles Ragin suggests that values below 5% indicate that the variable has almost no effect on the outcome and is considered "completely non-membership". Values above 95% suggest that the variable almost certainly has a decisive impact on the outcome and is considered "completely membership". At the 50% point, it represents a "transition" or "fuzzy" stage. (2) Necessary conditions analysis. A necessary condition is one where the outcome variable will definitely occur when the condition is present. If the consistency of a certain condition is greater than or equal to 0.90, this condition can be considered to meet the standard of a necessary condition. (3) Sufficiency analysis, including truth table refinement and standard analysis. Relevant thresholds (such as consistency threshold, case threshold, and PRI consistency) are set to pre-screen the truth table. Then, through standard analysis, three solutions are output: the parsimonious solution, intermediate solution, and complex solution. The number of configurations is determined based on the intermediate solution. Moreover, configuration variables that appear in both the intermediate and parsimonious solutions are considered

Table 1 Basic demographic characteristics of the participants ($n=551$)

Variable	*N* (%)
Age	
18–44	430 (78.0)
≥45	121 (22.0)
Residential area	
City/Town	495 (89.8)
Rural	56 (10.2)
Marital status	
Unmarried	387 (70.2)
Married	95 (17.3)
Divorced	69 (12.5)
Monthly income (yuan)	
≤2000	100 (18.2)
2001–4000	133 (24.1)
4001–6000	155 (28.1)
6001–8000	85 (15.4)
>8000	78 (14.2)
Infection period	
Acute phase	6 (1.1)
Asymptomatic phase	425 (77.1)
AIDS	120 (21.8)

core conditions, while those that appear only in the intermediate solution are regarded as peripheral conditions. (4) Robustness testing. Robustness testing includes various methods, and in this study, the robustness of the results is tested by adjusting the consistency threshold. Further information on the fsQCA used in this study can be found in the results section.

Results

Basic demographic characteristics of the participants

Basic demographic information of participants was shown in Table 1. The average age of study samples was 36.9 ± 10.2 years old. The average duration of infection was: 6.0 ± 4.0 years. Most participants lived in cites/towns (89.8%). And nearly 80% of participants were in the asymptomatic phase (77.1%). In this study, 19.2% of participants suffered from severe depression.

Linear regression analysis

The present study used the linear regression model to explore the influencing factors of depression in HIV-positive MSM (See Table 2). This study considered the duration of infection, family function, sense of coherence, positive coping style, death anxiety, and stigma as potential influencing variables. Through regression analysis, the study found that family function, sense of coherence, and positive coping style were all significantly and negatively associated with depression. Among them, the sense of coherence had the greatest effect on depression (β=-0.573). In addition, these variables explained 50.4% of the variance in depression.

Fuzzy-set qualitative comparative analysis

Calibration

Before analyzing the necessary and sufficient conditions, the raw variable values need to be calibrated. This study converted the original variable values into fuzzy membership degrees between 0 and 1. In the calibration process, three thresholds needed to be set to transform raw scales into fuzzy set scales: 95% percentile (fully affiliated), 50% percentile (may or may not be affiliated), and 5% percentile (not affiliated at all). The main descriptions and calibration values of variables were shown in Table 3.

Necessity analysis

After calibration, this study conducted a necessary condition analysis for depression in HIV-positive MSM. When the result variable appears, a condition always exists, and its consistency is equal than or greater to 0.90, then it can be considered a necessary condition of the result variable [41]. In this study, the consistency of all variables was below 0.90 (See Table 4), indicating that there is no necessary condition of depression in HIV-positive MSM.

Sufficiency analysis

In the process of sufficiency analysis, this study constructed the truth table by using Boolean logic to better present and evaluate all possible logical combinations and related results. According to Charles Ragin's recommendation [42], in order to balance the accuracy and

Table 2 Linear regressions analysis of depression in participants ($n=551$)

Variable	Depression					
Predictors	R^2	F	B	β	95% CI Upper	95% CI Lower
	0.504	92.311***				
Duration of infection			0.067	0.035	-0.048	0.183
family function			-0.371	-0.135***	-0.547	-0.195
Sense of coherence			-0.316	-0.573***	-0.356	-0.277
Positive coping style			-0.092	-0.091**	-0.160	-0.024
Death anxiety			0.129	0.060	-0.014	0.272
Stigma			0.238	0.036	-0.204	0.680

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

Table 3 Descriptive statistics and calibration values of the study variables ($n = 551$)

	Duration of infection	family function	SOC	Positive coping style	Death anxiety	Stigma	Depression
M	6.0	4.9	51.4	17.6	7.1	3.1	11.5
SD	4.0	2.8	14.0	7.7	3.6	1.2	7.7
Min	0	0	18.0	0	0	1.0	0
Max	24.0	10.0	91.0	36.0	15.0	5.0	27.0
Calibration values							
P5	1.0	0	29.0	5.0	1.0	1.0	0
P50	5.0	5.0	50.0	17.0	7.0	3.0	9.0
P95	13.0	10.0	76.4	31.0	13.0	5.0	27.0

Note: SOC, sense of coherence

Table 4 Necessity analysis for depression ($n = 551$)

	Depression		~Depression	
	Cons	Cov	Cons	Cov
Duration of infection	0.64	0.67	0.65	0.63
~ Duration of infection	0.64	0.66	0.66	0.63
Sense of coherence	0.53	0.55	0.84	0.81
~Sense of coherence	0.82	0.85	0.53	0.51
Family function	0.59	0.62	0.74	0.73
~Family function	0.74	0.75	0.62	0.58
Death anxiety	0.71	0.73	0.60	0.58
~Death anxiety	0.59	0.61	0.72	0.70
Positive coping style	0.58	0.60	0.75	0.72
~ Positive coping style	0.73	0.76	0.59	0.57
Stigma	0.74	0.73	0.64	0.58
~Stigma	0.57	0.63	0.70	0.72

Note: Cons, consistency; Cov, coverage; ~, the absence of condition

flexibility of causal reasoning, and to ensure the identification of effective causal configurations while avoiding overly strict standards that could exclude valuable causal paths, this study set the consistency threshold at 0.8. A consistency above 0.8 indicates that the configuration has a high degree of stability and reliability in its association with the outcome, meaning that this configuration consistently produces the expected results in the majority of the sample. The case threshold ensures that the research findings are supported by a sufficient number of cases, preventing overfitting or instability of causal paths due to fluctuations from a small number of samples. Given the sample size of this study, the case threshold is set to 2. In addition, the PRI consistency should be equal or greater than 0.70. Through the computation, three solutions (parsimonious solution, intermediate solution, and complex solution) were obtained. In the present study, core and peripheral conditions were determined based on the parsimonious solution and the intermediate solution. Core conditions are the configurational variables that appear in both the parsimonious and intermediate solutions, while peripheral conditions are the configurational variables that only appear in the intermediate solution.

Based on the recommendations of existing literatures, this study used the notation for solution tables to more intuitively show the relative importance of each antecedent variable in different configurations. Table 5 presented configurations of depression in HIV-positive MSM in this study. In the sufficiency analysis, the consistency of each sub-configuration should be greater than 0.75, and the coverage should be greater than 0.25 [41]. There were four different configurations that lead to high level of

Table 5 The related configuration of depression in MSM with HIV ($n = 551$)

Condition variable	Depression					
	1a	1b	1c	2	3	4
Duration of infection			●	●		●
Family function		⊗			⊗	⊗
Sense of coherence	⊗	⊗	⊗	⊗	⊗	⊗
Stigma	●	●	●			●
Death anxiety	●	●	●	●	⊗	
Positive coping style	⊗			⊗	⊗	
Raw coverage	0.47	0.44	0.39	0.39	0.37	0.38
Unique coverage	0.02	0.02	0.01	0.01	0.06	0.02
Consistency	0.93	0.93	0.93	0.94	0.93	0.94
Solution coverage	0.67					
Solution consistency	0.90					

Note: "●", presence of core condition; "●", presence of peripheral condition; "⊗", absence of core condition; "⊗", absence of peripheral condition. The blank indicates that the variable may or may not be present in the configuration. Multiple configurations with the same core conditions can be classified into a configuration group, and based on the variations in the peripheral conditions, they can be further divided into different sub-configurations, which are named as Configuration 1a, 1b, and 1c respectively

depression, and these configurations explained 67% of high level of depression cases (Solution coverage = 0.67). The combination most associated with depression in HIV-positive MSM was Configuration 1a (Raw coverage = 0.47): the sense of coherence was absent as a core condition, death anxiety and stigma were present as core conditions, and positive coping style was absent as a peripheral condition. In addition, the sense of coherence existed as a core condition in each configuration.

The robustness testing

The present study used the method of changing the consistency threshold to check the robustness of study results. In this study, the consistency threshold was adjusted from 0.80 to 0.85 and 0.90 [43]. The results showed that the composition and parameters of depression configuration did not change. This indicated that four configurations obtained from the fsQCA have good robustness. Hence, the study results were reliable.

Discussion

This study used two distinctive research methods - the linear regression model and fsQCA - to investigate the effect of different variables on depression in HIV-positive MSM. First, through the linear regression model, the study found that family function, sense of coherence, and positive coping style were all negatively associated with depression in HIV-positive MSM. Among them, the sense of coherence had the greatest impact on depression. On the other hand, through fsQCA, the study found that the sense of coherence is a core condition in all four configurations of depression in HIV-positive MSM. This indicated that higher sense of coherence is a very important protective factor in reducing the risk of depression in HIV-positive MSM.

Using fsQCA, this study identified four configurations that influence depression in HIV-positive MSM. These four configurations explained 67% of the cases of high-level depression. In configuration 1, since core conditions were all identical, this study named them as 1a, 1b and 1c, respectively. In configuration 1, the sense of coherence was absent as a core condition, and stigma and death anxiety were present as core conditions. Their peripheral conditions were slightly different, but didn't influence the overall effect of the configuration. Moreover, configuration 1a was also the configuration most closely associated with depression in HIV-positive MSM.

Stigma and death anxiety are major psychological distress that HIV-positive people are facing after the infection. Stigma and the resulting poor mental health outcomes are one of the greatest challenges for HIV-positive MSM today. Moreover, stigma is an important risk factor for depression in HIV-positive people [44]. Negative judgments and perceptions of HIV-positive people towards themselves may lead to stigma and meaninglessness, and affect their emotional and physical wellbeing [45]. Stigma levels tend to be higher among HIV-positive MSM due to social exclusion and minority pressure. In addition, death anxiety, as one of the common psychological sequelae of HIV-positive people, often exacerbate their depression severities. When HIV-positive MSM are facing severe disease symptoms or death threats, anxiety about death and life could arise, which may further affect their mental welling. For HIV-positive people, the sense of coherence is a positive psychological resource that plays an important protective role in their mental health. Poor sense of coherence increases the risk of depression in HIV-positive people. The level of sense of coherence is often low in patients with physical and mental illness [46]. Due to the influence of various psychosocial stressors (e.g., social discrimination, economic pressure, and self-stigma) [47, 48], the confidence of HIV-positive people can be greatly reduced, which in turn affects their levels of sense of coherence. Thus, when weaker sense of coherence is coupled with the exposure to stigma and death anxiety because of HIV infection, it tends to exacerbate the risk of depression in HIV-positive MSM. In other words, when low sense of coherence, high stigma, and severe death anxiety are combined, it is more likely to cause high levels of depression.

In configuration 1a and 1b, positive coping style and family function were absent as peripheral conditions, respectively. Rejection behaviors caused by stigma and social discrimination may reduce to the self-esteem of HIV-positive MSM and even lead to inferiority complex [49]. This tends to make HIV-positive MSM more inclined to adopt negative coping style when facing stressful events. However, passive-defensive coping styles towards diseases are often associated with psychological distress such as depression and negative rumination [50]. In addition, due to negative influences from various sources, HIV-positive MSM are also often rejected by significant others such as family and friends [51]. Poor family functioning also increases the risk of developing mental problems like depression and anxiety in HIV-positive MSM. In configuration 1c, duration of infection existed as a peripheral condition. As the duration of infection increases, HIV-positive people may experience an increasing number of disease complications, and these physical changes can easily cause more psychological symptoms, such as depression and anxiety. Thus, when the peripheral conditions described above coexist with core conditions, they are more likely to exacerbate the risk of depression in HIV-positive MSM.

Through the analysis of Configuration 1, this study recognized that individual psychological traits and phenomena are very important factors affecting depression in HIV-positive MSM. In the process of nursing and

caring for HIV-positive MSM, it is important to help them establish a correct view of the disease and cultivate positive psychological resources to reduce the risk of developing mental problems.

In configuration 2, the duration of infection was present as a core condition, the sense of coherence and positive coping style were absent as core conditions, and death anxiety was present as a peripheral condition. The configuration highlighted the influence of the duration of infection and positive coping style on depression of HIV-positive MSM. A longer duration of infection not only increases the risk of physical illness (such as cardiovascular disease) in HIV-positive people [52], but also may also lead to more severe depression [53]. A multicenter survey data in Nepal also showed that the course of illness and duration of treatment in HIV-positive people were significantly associated with depression [54]. As the duration of infection extends, HIV-positive people may experience many social exclusions and be affected by long-term chronic stress, all of which may have negative impacts on their mental health. In addition, individuals with higher levels of sense of coherence tend to have more confidence in themselves, and they often adopt more positive coping style in face of stressful events, thereby reducing the risk of mental problems or distress [22]. Previous studies have confirmed that the sense of coherence is significantly associated with positive coping [55], and it alleviates the relationship between HIV-related stressors and emotional distress [56]. However, the existence of death anxiety as a peripheral condition may further increase the influence of above combinations of core conditions on depression in HIV-positive MSM. HIV-positive people with death anxiety often experience many phobias, and their self-integrity is lower, which increases the risk of depression for HIV-positive people. Therefore, when the above conditions are combined (when they occur simultaneously), it is easy to lead to high levels of depression in HIV-positive MSM. The configuration suggested that it is necessary to pay more attentions to HIV-positive MSM who have been infected for a longer period. Meanwhile, it is important to improve the level of sense of coherence and cultivate positive coping styles in HIV-positive MSM to reduce the risk of developing depression.

In configuration 3, family function, sense of coherence, death anxiety, and positive coping styles were all absent as core conditions. The core role of family function was highlighted for the first time in this configuration. As one of the basic social characteristics, the family is the place most closely connected to the individual. Poor family function plays an important role in predicting depression in HIV-positive people [8]. Previous studies have found that good family function can buffer the adverse effect of HIV infection on depressive mood [57]. HIV infection may affect the daily work and study of HIV-positive people, leading to a decline in work income. Moreover, HIV infection can also increase the family burden on medical expenses [58]. All these bring considerable financial stress and care burden to the families of HIV-positive people, thereby reducing family functions. In addition, besides the external environment, psychological traits of individuals also have important impacts on depression of HIV-positive people. In the face of various stressors, individuals with a strong sense of coherence often take the initiative to mobilize general resistance resources (e.g. wealth, interpersonal relationship) and adopt appropriate coping strategies to effectively maintain mental health [22, 59]. Both higher sense of coherence and positive coping style can reduce the risk of depression in HIV-positive MSM. In this configuration, death anxiety was absent as a core condition, indicating that under other unchanged conditions, regardless of whether HIV-positive MSM have death anxiety, it may lead to high levels of depression. Therefore, when low family function, weak sense of coherence, and less use of positive coping style are combined, it is more likely to lead to high levels of depression in HIV-positive MSM. This also indicated that in the clinical intervention process for depression in HIV-positive MSM, in addition to focusing on individual psychological traits, we also need to pay attention to external environmental factors (e.g. family environment).

In configuration 4, the duration of infection and stigma were present as core conditions, while family function and the sense of coherence were absent as core conditions. Sadness, self-abasement and self-loathing are main psychological symptoms faced by HIV-positive people with different durations of infection [60]. With the increasing duration of infection, symptoms of trauma in HIV-positive people may increase, and the perceived availability of social support may decrease [61]. All these adverse psychological symptoms cause HIV-positive MSM who have been infected for a longer period to suffer from more mental disorders, such as depression. In addition, according to the Social Support Theory, family support is an important component of social support. Family function is considered to be an important factor that affects the quality of life [62]. Due to stigma and social exclusion, families affected by HIV often face greater stress compared to families with other chronic illnesses [63]. The presence of these family pressures significantly affects the family functioning of HIV-positive MSM. However, poor family functioning increase emotional distress in HIV-positive MSM, thereby raising the risk of developing psychological issues. As mentioned earlier, because HIV-positive MSM face many social discrimination and internalized homophobia, these affect the infected individual's sense of meaning and confidence, thereby reducing their level of sense of coherence. A previous longitudinal study on HIV-positive people

found that higher sense of coherence can predict fewer disease symptoms, better health, and less depression and anxiety [64]. Moreover, the presence of stigma will further exacerbate the impact of the above adverse conditions on mental problems such as depression in HIV-positive MSM. Therefore, HIV-positive MSM with longer duration of infection and weaker sense of coherence are more likely to suffer from depression when facing family dysfunction and high stigma.

Through two different analysis methods, this study found that both psychological traits and family environment have significant impacts on depression status of HIV-positive MSM. This suggests that in the process of intervention for depression in HIV-positive MSM, we should adopt diverse and targeted intervention measures based on different roles of each variable in configurations to effectively reduce the depression level of HIV-positive people. Different configurations of influencing factors identified in this study provide important practical reference significance for reducing levels of depression in HIV-positive MSM. At the policy level, the recommendations are as follows: (1) Strengthen mental health support and emotional regulation skills training. By offering training in stress management, emotional expression, and coping skills, HIV-positive people can be better equipped to cope with difficulties and setbacks, thus maintaining a sense of control and meaning. (2) Optimize family support and intervention. Provide effective family support and intervention programs for HIV-positive MSM and their families, in order to improve the environmental atmosphere. (3) Focus on the health management and psychological intervention for long-term HIV-positive people. Regular psychological assessments and interventions should be provided to reduce the psychological distress caused by long-term infection and treatment.

Limitations

Although the present study explored different configurations that influence depression status of HIV-positive MSM from a new perspective. However, there are several limitations of this study that we must recognize. First, the survey data used in this study was from self-reported questionnaires, which may be subject to subjective bias. Second, due to the influence of stigma, some participants may not have fully and accurately reported their psychological states and related experiences, potentially leading to measurement bias. Third, this study used cross-sectional data which could not draw causal relationships among variables. Future research could adopt longitudinal designs to reveal the long-term effects of different configurations on changes in depression and provide stronger evidence for the formulation of intervention policies. Fourth, there are many factors that affect depression in HIV-positive MSM, but the study only considered variables such as family function, sense of coherence and duration of infection. Future studies could incorporate additional factors, such as physiological symptoms, behaviors and lifestyles, sociocultural factors, and access to and quality of healthcare. Given the significant impact of cultural and regional backgrounds on mental health, future research could also focus on the differences in depression among HIV-positive MSM in different cultural and regional contexts. Additionally, comparisons could be made with other HIV-positive subgroups to identify the unique social-psychological vulnerabilities of this group, providing a foundation for the development of subgroup-specific intervention programs.

Conclusion

This study explored factors that influence depression of HIV-positive MSM using two different approaches, the linear regression model and fsQCA. A higher Sense of coherence is a very important protective factor against depression. Through fsQCA, the study identified four different configurations that may lead to high level of depression in HIV-positive MSM and demonstrated them in detail. Study results suggested that while focusing on improving the psychological resources of HIV-positive MSM, we also need to improve external environment such as family function to reduce the risk of mental problems.

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Author contributions
"SM: Writing– review & editing, Writing– original draft, Methodology, Software. CZ: Writing - review & editing, Writing– original draft, Formal analysis, Conceptualization. JZ: Writing– review & editing. LL, MK and JF: Investigation, Data curation, Validation, Visualization. TY, HW, JG and XL: Project administration, Investigation. ND: Funding acquisition, Supervision, Project administration. All authors read and approved the final manuscript."

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Data availability
The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Declarations

Ethics approval and consent to participate
The study obtained approval from the Board of School of Public Health of Jilin University. Before the survey started, investigators introduced the purpose of the survey to the participants who volunteered to participate in the survey and obtained their informed consent.

Consent for publication
Not applicable.

Competing interests
The authors declare no competing interests.

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References

1. Joint United Nations Programme on HIV/AIDS. The path that ends AIDS: UNAIDS Global AIDS Update 2023. 2023. https://www.unaids.org/en/resources/documents/2023/global-aids-update -2023. Accessed 10 Apr 2024.
2. Berg MB, Mimiaga MJ, Safren SA. Mental health concerns of HIV-infected gay and bisexual men seeking mental health services: an observational study. AIDS Patient Care STDS. 2004;18(11):635–43. https://doi.org/10.1089/apc.2004.18.635.
3. Wei D, Wang X, You X, Luo X, Hao C, Gu J, et al. Prevalence of depression, anxiety and suicide among men who have sex with men in China: a systematic review and meta-analysis. Epidemiol Psychiatr Sci. 2020;29:e136. https://doi.org/10.1017/s2045796020000487.
4. Xiao L, Qi H, Wang YY, Wang D, Wilkinson M, Hall BJ, et al. The prevalence of depression in men who have sex with men (MSM) living with HIV: A meta-analysis of comparative and epidemiological studies. Gen Hosp Psychiatry. 2020;66:112–9. https://doi:10.1016/j. genhosppsych.2020.04.001.
5. Tao J, Qian H-Z, Kipp AM, Ruan Y, Shepherd BE, Amico KR, et al. Effects of depression and anxiety on antiretroviral therapy adherence among newly diagnosed HIV-infected Chinese MSM. AIDS. 2017;31(3):401–6. https://doi.org/10.1097/qad.0000000000001287.
6. Rivera-Rivera Y, Vazquez-Santiago FJ, Albino E, Sanchez MDC, Rivera-Amill V. Impact of depression and inflammation on the progression of HIV disease. J Clin Cell Immunol. 2016;7(3):423. https://doi.org/10.4172/2155-9899.1000423.
7. Lari MA, Parsa N, Marzban M, Shams M, Faramarzi H, Depression T, Concentration. Sexual dysfunction and methadone use among men with hypogonadism and HIV infection. AIDS Behav. 2012;16(8):2236–43. https://doi.org/10.1007/s10461-012-0234-x.
8. Wouters E, Masquillier C, Booysen FR. The importance of the family: A longitudinal study of the predictors of depression in HIV patients in South Africa. AIDS Behav. 2016;20(8):1591–602. https://doi.org/10.1007/s10461-016-1294-0.
9. Tao J, Wang L, Kipp AM, Qian H-Z, Yin L, Ruan Y, et al. Relationship of stigma and depression among newly HIV-Diagnosed Chinese men who have sex with men. AIDS Behav. 2017;21(1):292–9. https://doi.org/10.1007/s10461-016-1477-8.
10. Remien RH, Exner T, Kertzner RM, Ehrhardt AA, Rotheram-Borus MJ, Johnson MO, et al. Depressive symptomatology among HIV-positive women in the era of HAART: A stress and coping model. Am J Community Psychol. 2006;38(3–4):275–85. https://doi:10.1007/s10464-006-9083-y.
11. Miller IW, Ryan CE, Keitner GI, Bishop DS, Epstein NB. The McMaster approach to families: theory, assessment, treatment and research. J Fam Ther. 2000;22(2):168–89. https://doi.org/10.1111/1467-6427.00145.
12. Serovich JM, Grafsky EL, Craft SM. Does family matter to HIV-positive men who have sex with men? J Marital Fam Ther. 2011;37(3):290–8. https://doi.org/10.1111/j.1752-0606.2009.00177.x.
13. Sun S, Pachankis JE, Li X, Operario D. Addressing Minority Stress and Mental Health among Men Who Have Sex with Men (MSM) in China. Curr HIV/AIDS Rep. 2020,17(1): 35–62. https://doi.org/10.1007/s11904-019-00479-w
14. Yan H, Li XY, Li JJ, Wang W, Yang YM, Yao X, et al. Association between perceived HIV stigma, social support, resilience, self-esteem, and depressive symptoms among HIV-positive men who have sex with men (MSM) in Nanjing, China. AIDS Care. 2019;31(9):1069–76. https://doi.org/10.1080/09540121.2019.1601677.
15. Yolaç E, Meriç M. Internalized homophobia and depression levels in LGBT individuals. Perspect Psychiatr Care. 2021;57(1):304–10. https://doi.org/10.1111/ppc.12564.
16. Girma D, Assegid S, Gezahegn Y. Depression and associated factors among HIV-positive youths attending antiretroviral therapy clinics in Jimma town, Southwest Ethiopia. PLoS ONE. 2021;16(1):e0244879. https://doi.org/10.1371/journal.pone.0244879.
17. Liu H, Zhao M, Ren J, Qi X, Sun H, Qu L, et al. Identifying factors associated with depression among men living with HIV/AIDS and undergoing antiretroviral therapy: a cross-sectional study in Heilongjiang, China. Health Qual Life Outcomes. 2018;16:190. https://doi.org/10.1186/s12955-018-1020-x.
18. Grabier MR, Weyen U, Juckel G, Tegenthoff M, Mavrogiorgou-Juckel P. Death anxiety and depression in amyotrophic lateral sclerosis patients and their primary caregivers. Front Neurol. 2018;9:1035. https://doi.org/10.3389/fneur.2018.01035.
19. Greenberg J, Pyszczynski T, Solomon S. The causes and consequences of a need for self-esteem: A terror management theory. New York: Springer-; 1986.
20. Fredrickson BL. The role of positive emotions in positive psychology - The broaden-and-build theory of positive emotions. Am Psychol. 2001;56(3):218–26. https://doi.org/10.1037/0003-066x.56.3.218.
21. Antonovsky A, Health. Stress and coping: new perspectives on mental and physical Well-being. San Francisco: Jossey-Bass; 1979.
22. Antonovsky A. Unraveling the mystery of health: how people manage stress and stay well. San Francisco: Jossey-Bass; 1987.
23. Wei M, Guo L, Zhu Y, Guo Y, Yv S, Namassevayam G, et al. Type C personality and depression among newly diagnosed breast Cancer patients: the mediating role of sense of coherence. Neuropsychiatr Dis Treat. 2019;15:3519–29. https://doi.org/10.2147/ndt.S230278.
24. Guo Y, Guo L, Wang J, Zhu Y, Wei M, Yu S. Sense of coherence as a mediator between perceived stress and depression in newly diagnosed breast cancer patients: a cross-sectional study. J Public Health-Heid. 2023;31(3):489–96. https://doi.org/10.1007/s10389-021-01496-z.
25. Kotze M, Visser M, Makin J, Sikkema K, Forsyth B. Psychosocial variables associated with coping of HIV-Positive women diagnosed during pregnancy. AIDS Behav. 2013;17(2):498–507. https://doi.org/10.1007/s10461-012-0379-7.
26. Li Z, Hsieh E, Morano JP, Sheng Y. Exploring HIV-related stigma among HIV-infected men who have sex with men in Beijing, China: a correlation study. AIDS Care. 2016;28(11):1394–401. https://doi.org/10.1080/09540121.2016.1179713.
27. Mi T, Lan G, Yang X, Li X, Qiao S, Shen Z, et al. HIV-Related stigma, sexual identity, and depressive symptoms among MSM living with HIV in China: A moderated mediation modeling analysis. Am J Mens Health. 2022;16(2):15579883221087531. https://doi.org/10.1177/15579883221087531.
28. Tao J, Wang L, Kipp A, Qian H-z, Yin L, Ruan Y, et al. Stigma and depression among newly diagnosed HIV infected MSM in China. J Acquir Immune Defic Syndr. 2016;71(Suppl 1):49. https://doi.org/10.1097/01.qai.0000479593.51216.ff.
29. Yan H, Li X, Li J, Wang W, Yang Y, Yao X, et al. Association between perceived HIV stigma, social support, resilience, self-esteem, and depressive symptoms among HIV-positive men who have sex with men (MSM) in Nanjing, China. AIDS Care. 2019;31(9):1069–76. https://doi.org/10.1080/09540121.2019.1601677.
30. Benoit R, Ragin CC. Configurational comparative methods: qualitative comparative analysis (QCA) and related techniques. Beijing: China Machine; 2017.
31. Ragin CC. The comparative method: moving beyond qualitative and quantitative strategies. Berkeley: University of California Press; 1987.
32. Misangyi VF, Greckhamer T, Furnari S, Fiss PC, Crilly D, Aguilera R. Embracing causal complexity: the emergence of a Neo-Configurational perspective. J Manage. 2017;43(1):255–82. https://doi.org/10.1177/0149206316679252.
33. Gabriel AS, Campbell JT, Djurdjevic E, Johnson RE, Rosen CC. Fuzzy profiles: comparing and contrasting latent profile analysis and fuzzy set qualitative comparative analysis for Person-Centered research. Organ Res Methods. 2018;21(4):877–904. https://doi.org/10.1177/1094428117752466.
34. Sun J, Wan Y. How the entrepreneurial ecology embedded in digital technology improves youth entrepreneurial performance: an empirical study based on a mixed method. Sci Technol Prog Policy. 2023;40(21):12–22. https://doi.org/10.6049/kjjbydc.2023030262.
35. Guasp-Coll M, Navarro-Mateu D, Lacomba-Trejo L, Gimenez-Espert MC, Prado-Gasco VJ. Emotional skills in adolescents' attitudes towards diversity: regression models vs qualitative comparative analysis models. Curr Psychol. 2022;41(12):8718–31. https://doi.org/10.1007/s12144-020-01319-6.
36. Smilkstein G. The family APGAR: a proposal for a family function test and its use by physicians. J Fam Pract. 1978;6(6):1231–9.
37. Bao L, Liu J. The reliability and validity of Chinese version of SOC– 13. Chin J Clin Psych. 2005;13(4):399–401. https://doi.org/10.16128/j.cnki.1005-3611.2005.04.007.
38. Templer DI. Construction and validation of a death anxiety scale. J Gen Psychol. 1970;82(2):165–77. https://doi.org/10.1080/00221309.1970.9920634.
39. Xie Y. A preliminary study on the reliability and validity of the simplified coping style questionaire. Chin J Clin Psych. 1998;6(2):114–5. https://doi.org/10.16128/j.cnki.1005-3611.1998.02.018.
40. Kroenke K, Spitzer RL, Williams JBW. The PHQ-9 - Validity of a brief depression severity measure. J Gen Intern Med. 2001;16(9):606–13. https://doi.org/10.1046/j.1525-1497.2001.016009606.x.
41. Ragin CC. Redesigning social inquiry: fuzzy sets and beyond. Chicago: University of Chicago Press; 2008.

42. Ragin CC. Set relations in social research: evaluating their consistency and coverage. Polit Anal. 2006;14(3):291–310. https://doi.org/10.1093/pan/mpj019.
43. Tian X, Peng X, Ran X. How the government improve education data governance capabilities?——16 cases using qualitative comparative analysis. J Educ Stud. 2023;19(6):153–67. https://doi.org/10.14082/j.cnki.1673-1298.2023.06.013.
44. Bennett DS, Traub K, Mace L, Juarascio A, O'Hayer CV. Shame among people living with HIV: a literature review. AIDS Care. 2016;28(1):87–91. https://doi.org/10.1080/09540121.2015.1066749.
45. France NF, Byrne E, Nyamwanza O, Munatsi V, Willis N, Conroy R, et al. Wakakosha you are worth it: reported impact of a community-based, peer-led HIV self-stigma intervention to improve self-worth and wellbeing among young people living with HIV in Zimbabwe. Front Public Health. 2023;11:1235150. https://doi.org/10.3389/fpubh.2023.1235150.
46. Piegza M, Jaworska I, Bujak K, Debski P, Kunert L, Badura-Brzoza K, et al. Symptoms of anxiety and depression and sense of coherence in patients undergoing carotid artery stenting. Int J Environ Res Public Health. 2022;19(19):12222. https://doi.org/10.3390/ijerph191912222.
47. Miller AK, Lee BL, Henderson CE. Death anxiety in persons with HIV/AIDS: a systematic review and meta-analysis. Death Stud. 2012;36(7):640–63. https://doi.org/10.1080/07481187.2011.604467.
48. van der Kooij YL, Kupková A, den Daas C, van den Berk GEL, Kleene MJT, Jansen HSE, et al. Role of Self-Stigma in pathways from HIV-Related stigma to quality of life among people living with HIV. AIDS Patient Care STDS. 2021;35(6):231–8. https://doi.org/10.1089/apc.2020.0236.
49. Handayani Y, Susanti H, Mustikasari. The self-esteem of gay men with HIV/AIDS in social adaptation. Enferm Clin. 2019;29:874–8. https://doi.org/10.1016/j.enfcli.2019.04.132.
50. Vassend O, Eskild A. Psychological distress, coping, and disease progression in HIV-positive homosexual men. J Health Psychol. 1998;3(2):243–57. https://doi.org/10.1177/135910539800300208.
51. Hintze J, Templer DI, Cappelletty GG, Frederick W. Death depression and death anxiety in HIV-infected males. Death Stud. 1993;17(4):333–41. https://doi.org/10.1080/07481189308252629.
52. Park KS, Hwang SY, Choi BY, Kim J, Kim SI, Kim W-J, et al. Associations of depression and anxiety with cardiovascular risk among people living with HIV/AIDS in Korea. Epidemiol Health. 2021;43:e2021002. https://doi.org/10.4178/epih.e2021002.
53. Kelly JA, Murphy DA, Bahr GR, Koob JJ, Morgan MG, Kalichman SC, et al. Factors associated with severity of depression and high-risk sexual behavior among persons diagnosed with human immunodeficiency virus (HIV) infection. Health Psychol. 1993;12(3):215–9. https://doi.org/10.1037/0278-6133.12.3.215.
54. Kunwar D, Shrestha B, Risal A, Kunwar R, Khadka S, Depression. Alcohol use, antiretroviral therapy adherence and HIV status among HIV-infected from multiple antiretroviral therapy clinics in Nepal. Kathmandu Univ Med J (KUMJ). 2019;17(68):336–40.
55. Matacotta JJ. Aging with HIV: Sense of Coherence, Proactive Coping, and Quality of Life in Gay Men Over Fifty. PhD dissertation, Alliant International University, 2012.
56. Mukolo A, Wallston KA. The relationship between positive psychological attributes and psychological Well-Being in persons with HIV/AIDS. AIDS Behav. 2012;16(8):2374–81. https://doi.org/10.1007/s10461-011-0029-5.
57. Dyer TP, Stein JA, Rice E, Rotheram-Borus MJ. Predicting depression in mothers with and without HIV: the role of social support and family dynamics. AIDS Behav. 2012;16(8):2198–208. https://doi.org/10.1007/s10461-012-0149-6.
58. Li L, Wu S, Wu Z, Sun S, Cui H, Jia M. Understanding family support for people living with HIV/AIDS in Yunnan, China. AIDS Behav. 2006;10(5):509–17. https://doi.org/10.1007/s10461-006-9071-0.
59. Togari T, Inoue Y, Oshima G, Abe S, Hosokawa R, Takaku Y. Socioeconomic status and the sense of coherence among Japanese people living with HIV. Int J Environ Res Public Health. 2022;19(13):7673. https://doi.org/10.3390/ijerph19137673.
60. Zhu Z, Guo M, Dong T, Han S, Hu Y, Wu B. Assessing psychological symptom networks related to HIV-positive duration among people living with HIV: a network analysis. AIDS Care. 2022;34(6):725–33. https://doi.org/10.1080/09540121.2021.1929815.
61. Rzeszutek M, Oniszczenko W, Zebrowska M, Firlag-Burkacka E. HIV infection duration, social support and the level of trauma symptoms in a sample of HIV-positive Polish individuals. AIDS Care. 2015;27(3):363–9. https://doi.org/10.1080/09540121.2014.963018.
62. Rodríguez-Sánchez E, Pérez-Peñaranda A, Losada-Baltar A, Pérez-Arechaederra D, Gómez-Marcos MA, Patino-Alonso MC, et al. Relationships between quality of life and family function in caregiver. BMC Fam Pract. 2011;12:19. https://doi.org/10.1186/1471-2296-12-19.
63. Leslie MB, Stein JA, Rotheram-Borus MJ. The impact of coping strategies, personal relationships, and emotional distress on health-related outcomes of parents living with HIV or AIDS. J Soc Pers Relat. 2002;19(1):45–66. https://doi.org/10.1177/0265407502191003.
64. Langius-Eklof A, Lidman K, Wredling R. Health-Related quality of life in relation to sense of coherence in a Swedish group of HIV-Infected patients over a Two-Year Follow-Up. AIDS Patient Care STDS. 2009;23(1):59–64. https://doi.org/10.1089/apc.2008.0076.

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