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Factors influencing self-concept among adolescents infected with HIV: A cross-sectional survey in China

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Abstract

Purpose

The purpose of this study was to determine the factors influencing self-concept among human immunodeficiency virus (HIV) infected adolescents in China, and to analyze the risk and protective factors.

Methods

A questionnaire was distributed among two groups totaling to 290 adolescents. The Piers-Harris Children's Self-concept Scale, the Perceived Stress Scale, the Perceived Social Support Scale, and the Simplified Coping Style Questionnaire were adapted for a Chinese population. Differences between the groups were tested for significance using the Student's t-test, and ANOVA was used to test continuous variables. The relationship between environmental personality factors and adolescent self-concept

was examined by Pearson correlation analysis. Hierarchical linear regression analysis was used to model the effects of environmental personality factors on self-concept.

Results

The self-concept total score among HIV-infected adolescents was significantly lower than normal adolescents ($p < 0.05$). Hierarchical regression analysis indicated that age ($\beta = -0.19$, $t = -2.16$, $p = 0.03$), perceived stress ($\beta = -0.19$, $t = -2.22$, $p = 0.03$), perceived social support ($\beta = 0.26$, $t = 3.25$, $p = 0.00$), positive coping ($\beta = 0.50$, $t= 5.75$, $p = 0.00$), and negative coping ($\beta = -0.45$, $t= -5.33$, $p = 0.00$) were significantly associated with self-concept total scores.

Conclusions

The self-concept of HIV-infected adolescents is related to perceived stress, perceived social support, and coping style. These findings underline the significance of self-concept among adolescents infected with HIV.

Strengths and limitations of this study

1. This is the first study to determine the factors influencing self-concept among HIV-infected adolescents in China.

2. Although HIV-infected adolescents are a special group, the sample size was suitably powered to allow statistical analysis including hierarchical linear regression.

3. This was a cross-sectional study and thus causal relationships between the self-concept of HIV-infected adolescents and influencing factors require further

exploration.

Keywords: adolescents; self-concept; HIV; influencing factors

Introduction

Over the years, AIDS has spread throughout the world at an extremely rapid rate. In 1985, AIDS began to prevail in a few African countries. By 2005, AIDS had affected nearly all countries and regions worldwide [1]. As a result of AIDS, the mortality rate of the adult population has increased significantly [2]. The inevitable consequence is that a large number of adolescents lose their parents because of AIDS. The typical socioeconomic status of families and individuals in communities with a high incidence of AIDS means that these orphans have a visible vulnerability in terms of physical, psychological, and social adaptation [3]. At present, the number of adolescents affected by AIDS in China is large and rapidly increasing. Living conditions, social environment, and mental health difficulties are serious problems that have had an enormous impact on the growth and development of adolescents affected by AIDS. A qualitative study in China reported that prejudice and discrimination have a substantial negative impact on the health of adolescents with AIDS. The mental health difficulties experienced by AIDS orphans are mainly due to decrease in self-concept and increase in depression [4-6]. All the difficulties described above impact on self-concept among adolescents with AIDS, and we predict that self-concept in adolescents with AIDS is lower than in healthy adolescents.

Self-concept is a cognitive assessment of one's own abilities and weaknesses [7] and

plays an important role in mental health. Low levels of self-concept are a risk factor affecting social function, and problems in adolescents, thus resulting in different types of mental health problems. High levels of self-concept are considered to be a protective factor that hinders the development of psychological problems and promotes general health [8-11]. An individual's perception of himself/herself changes significantly during adolescence, or even undergoes a dramatic reversal [12]. In the early stages of puberty, adolescents are more likely to compare themselves with others, and to understand the comparisons and judgment of others to themselves. Adolescents also begin to give higher value to these judgments [13]. Social psychology studies have shown that during and after puberty, children become more self-conscious, more receptive, and more concerned about the opinions of others [14 15]. One developmental psychology study has shown that during and after puberty, an adolescent's self-evaluation becomes more comprehensive and changes from that held previously [16]. Previous studies have shown that specific groups of adolescents may be vulnerable to lower levels of self-concept than found in normal groups. For example, studies of adolescents with chronic diseases have shown that their level of self-concept is significantly lower than healthy adolescents. Adolescents with chronic diseases often feel insecure, lonely, isolated, and controlled by changes resulting from chronic disease[17 18]. Therefore, we suggest that chronic diseases such as AIDS, will have a serious impact on the self-concept of adolescents. To date, no studies have investigated the self-concept of Chinese adolescents with AIDS. In China, adolescents infected with AIDS represent a large but specific group who have experienced

multiple losses throughout their lives, thus increasing their risk of psychopathology [19]. Therefore, studying the development of self-concept among HIV-infected adolescents, and identifying methods to help them maintain psychological well-being and healthy growth is of clear importance.

The formation and development of self-concept is influenced by many factors. It has been shown that teacher-student relationships, peer relationships, parent-child relationships, parenting patterns, perceived stress, perceived social support, and individual coping styles, are all likely to have an impact on self-concept among adolescents [20]. The current study explored the factors which influence the self-concept of HIV-infected adolescents, focusing on both risk and protective factors, and external environment-individual internal characteristics.

A large amount of research data suggest that factors such as perceived stress and perceived social support in the external environment have a significant impact on the formation and development of self-concept. Perceived stress is the result of the perceptual assessment of an individual's own experience of stress resulting from specific situations or events [21]. People have different perceptions about events that occur, and their psychological response differs. Differences in psychological response will have different effects on mental health. In Africa, the incidence of AIDS is extremely high and adolescents are often in a high-crime and precarious environment. Such an environment may aggravate their sense of pressure, and thus affect their self-concept.

Social support is considered to be an important factor affecting psychological stress and physical health. From a psychological perspective, Cobb suggests that social support includes the following: emotional support; respect and support; and member attribution [22]. Social support can significantly predict the emotional behavior of adolescents, and higher social support has a protective effect on adolescent mental health [23]. Researchers have shown that the relationship between social support and self-concept is stable and positively correlated. There is a difference between social support factors and the correlation between the fractal dimensions of self-concept. Social support for adolescents is primarily derived from parents, teachers, classmates, and friends. Michelle et al. [24] report that the relationship between the frequency of social support and self-concept is significant. Rubin et al. [25] have shown that social support may prevent teenagers with LD (learning disabilities) from mood disorders. LD adolescents who receive more social support from their parents, teachers, and peers, have higher levels of self-concept than adolescents who receive less social support [25]. Barroso [26] concluded that social support is an important factor for adults who are long-term survivors of AIDS. Lack of social support may also cause adolescents with AIDS to have lower levels of self-concept. Cluver et al. [27] report that orphans in particular may have a lack of social support due to illness or death of family members, thereby distorting their cognitions about themselves and others.

An adolescent's self-concept is not only affected by external environmental factors, but their own internal factors. Individual coping styles and other factors have a significant impact on the emergence and development of self-concept. Coping style

refers to the change in cognition and/or or behavior utilized by an individual in a particular stressful situation, with the aim of managing emotions and improving the problem [28]. Individuals adopt specific coping styles and measures according to their own experiences after cognitive assessment of the response process. Coping style has an important impact on the status of an individual's environmental adaptation and mental health [29]. At present, an important research aspect in clinical psychology is the study of the relationship between an individual's coping style, and physical and mental health. Sarah et al. [30] have shown that the clarity of self-awareness or self-concept is related to more active coping behavior. Studies of individuals with AIDS and their coping styles suggest that a high level of active coping is positively related to immunization measures, and may indirectly affect the self-concept of the AIDS patient [31].

This study was designed to explore the factors which influence the self-concept of adolescents with AIDS. We investigated the self-concept of HIV-infected adolescents, considered the environmental and individual levels, and analyzed the relationship between perceived stress, perceived social support, and coping style, and self-concept, in order to better understand the role of self-concept among adolescents with AIDS. We believe this is the first study of this kind.

Methods

Sample size and sampling technique

The current study was conducted in a rural county in Henan province, China, where

many residents were infected with HIV through blood collection using inadequate hygiene techniques. This rural county has the highest prevalence of HIV infection in the area. We obtained village-level HIV surveillance data from the anti-epidemic station in each of the counties to identify the villages with the highest number of AIDS-related deaths and confirmed HIV infections.

A questionnaire was distributed among two groups of adolescents; 140 questionnaires were distributed in the case group (HIV-infected adolescents) and 139 valid questionnaires were returned response rate of 99.3%). Among the adolescents in the case group, there were 88 boys (63.3%) and 51 girls (36.7%), and the average age was 15.89 ± 2.8 years. The control group (healthy adolescents) was issued 150 questionnaires, and 144 valid questionnaires were returned (response rate of 96.0%). Among the adolescents in the control group, there were 91 boys (63.2%) and 53 girls (36.8%), and the average age was 13.85 ± 1.2 years. The total number of participants in this study was therefore 283 adolescents aged 10–20 years and of Han ethnicity. Participation of the adolescents was voluntary, and all provided informed consent.

Procedure

To recruit adolescents with AIDS, we worked with the town leaders to generate lists of adolescents with confirmed diagnoses of HIV/AIDS. We approached the adolescents on the lists and invited them to participate in the study. After the eligibility of an adolescent was confirmed, the interviewer(s) provided him/her with a detailed description of the study design, potential benefits and risks, confidentiality

issues and invited him/her to participate. When an adolescent agreed to be included in the study, the parents of the person were invited to participate by means of letters.

HIV-infected adolescents 10–20 years of age (inclusive) comprised the case group. The survey was conducted in the first half of the adolescents who resided in the county. The exclusion criteria were as follows: HIV infection not confirmed; or physical illness which would hinder participation (such as encephalopathy or epilepsy).

The research met ethical guidelines according the to the Declaration of Helsinki, and approval was granted by the Ethics Committee of Harbin Medical University. All participants signed informed consent forms after receiving explanations of the research purpose, meaning, and content. All of the adolescents participated voluntarily.

Measures

Demographic characteristics

Adolescents were asked to report on individual and family characteristics including age, gender, family economic status (i.e., good, moderate, and poor), and family structure (intact/non-intact).

Outcome measures

The Piers-Harris Children's Self-concept Scale is a paper-and-pencil test consisting of 80 items which are scored as true or false. The items are self-descriptive declarative

statements. The scores range from 1–80; higher scores indicate higher levels self-concept. The statements are worded in both positive and negative language to control for social desirability responding. The scale has good reliability and validity and the Cronbach's alpha of the scale was 0.858 in the current study.

Stress related to interpersonal stressors was assessed by the Perceived Stress Scale. The scale consists of ten items. Each item has a score range of 0–4, with a possible total score of 40 overall. Higher scores indicate higher levels of stress. The internal consistency measured by Cronbach's alpha in this study was 0.847.

The Perceived Social Support Scale (PSSS), developed by Zimet et al. consists of 12 items that were revised from three subscales (family, friend, and other support). Participants responded to the items on a 7-point Likert-type scale indicating disagreement/agreement. Each item was divided into a total score for social support. Items were adjusted to be more appropriate for children affected by AIDS in the current study. The items "leaders, relatives and colleagues" were changed to "teachers, relatives and students. Cronbach's alpha was 0.887 in this study. We used the Simplified Coping Style Questionnaire (SCSQ) to measure coping style. The SCSQ includes 20 items that contain two dimensions of coping (positive and negative). Each dimension consists of 10 items, and each item is scored on a 5-point scale, where 1 indicates 'certainly not' and 5 indicates 'certainly.' A higher score on one dimension indicates that the individual is more likely to utilize this type of coping style. The questionnaire is highly reliable and suitable for a Chinese population. The Cronbach's alpha for the two independent dimensions of coping were 0.70 and 0.69.

Data analysis

The Statistical Package for Social Sciences 19.0 (SPSS 19.0) program (IBM, Armonk, NY, USA) was used for statistical analysis. All tests were two-tailed and the significance level was set at a $p < 0.05$. Differences between the groups were tested using the Student's t-test and ANOVA was used to test continuous variables. The relationship between environmental personality factors and adolescent self-concept was examined with Pearson correlation analyses. Hierarchical linear regression analysis was used to model the effects of environmental personality factors on self-concept in adolescents. In the regression model, gender, age, family economic status, and family structure were entered in the first block to control for potential confounding variables. In the second block, perceived stress factors were entered into the model. Third, after controlling for sociodemographic variables and perceived stress factors, perceived social support was entered into the model. Finally, after controlling for sociodemographic variables, perceived stress factors, and perceived social support, coping style was entered into the model.

Results

Comparison of the levels of self-concept between HIV-infected adolescents and control adolescents

The self-concept levels of HIV-infected adolescents were significantly lower than healthy adolescents ($p < 0.05$; Table 1).

Table 1. Comparison of the levels of self-concept between HIV-infected and control adolescents

	HIV-infected adolescents (N = 139)	Healthy adolescents (N = 144)	t	p
Self-concept score	51.55	60.22	−9.37	0.00**

Sociodemographic data and self-concept total scores by different sociodemographic variables

Of the 139 participants, 88 were males and 51 were females. The number of participants in each age group was as follows: 8–13 years, 28; 13–16 years, 80; and 16–18 years, 31. The family economic status was as follows: good, 48; moderate, 79; and poor, 12. Fifty-seven and eighty-two adolescents with AIDS did and did not have an intact family structure, respectively. No significant differences in self-concept total scores existed between gender, age, family economic status, or family structure (Table 2).

Table 2. Participants' socio-demographic data and self-concept total scores by socio-demographic variables

	Group	N (%)	Self-concept score	F/t	p
Gender				0.08	0.78
	Male	88 (63.3)	52.08 ± 10.71		
	Female	51 (36.7)	50.65 ± 11.27		
Age				1.44	0.24
	8-13	28 (20.1)	53.43 ± 11.86		

	13-16	80 (57.6)	50.21 ± 10.67		
	16-18	31 (22.3)	53.32 ± 10.44		
Family economic status				2.74	0.07
	Good	48 (34.5)	50.46 ± 10.03		
	Moderate	79 (56.8)	51.18 ± 11.38		
	Poor	12 (8.6)	58.42 ± 10.90		
Family structure				0.18	0.67
	Intact	82 (59.0)	52.63 ± 10.46		
	Non-intact	57 (41.0)	50.00 ± 11.42		

Relationship between perceived stress, perceived social support, coping style factors, and self-concept total scores

We collected self-concept total scores for perceived stress, perceived social support, and coping style factors in adolescents with AIDS (Table 3). Statistically significant linear relationships existed among perceived stress, perceived social support, coping style factors, and the self-concept total scores of adolescents with AIDS ($p < 0.05$). Among these variables, perceived stress ($r = –0.23$, $p<0.05$) and negative coping ($r = –0.26$, $p < 0.05$) were negatively related to the self-concept total scores. Conversely, perceived social support ($r = 0.28$, $p < 0.05$) and positive coping ($r = 0.25$, $p <0 .05$) were positively associated with self-concept total scores.

Table 3. Correlations among perceived stress, perceived social support, coping style factors, and self-concept total scores

	Perceived stress	Perceived	Positive coping	Negative

		social support		coping
Self-concept	−0.23**	0.28**	0.25**	−0.26**

Hierarchical linear regression analysis of the relationship among perceived stress, perceived social support, coping style factors, and self-concept total scores

Eight variables accounted for 37.0% of the total variance of the self-concept total scores (Table 4). The control variables accounted for 7% of the variance in the self-concept total scores (F change = 2.46), and among the control variables, age (β = −0.19, t = −2.16, p = 0.03) was significantly associated with the self-concept total scores. With inclusion of the perceived stress variable, the variance which could be explained increased to 10%. The variance in self-concept total scores (F change = 4.91) and perceived stress (β = −0.19, t = −2.22, p = 0.03) was significantly associated with the self-concept total scores. Adding the perceived social support factor contributed to an additional 7% of the variance in the self-concept total scores (F change = 10.55), and perceived social support (β = 0.26, t= 3.25, p = 0.00) was significantly associated with the self-concept total scores. Finally, adding the positive and negative coping factors contributed to an additional 20% of the variance in the self-concept total scores (F change = 21.00). Positive (β = 0.50, t= 5.75, p = 0.00) and negative coping (β = −0.45, t= −5.33, p = 0.00) were significantly associated with the self-concept total scores.

Table 4. Hierarchical linear regression analysis of the relationships among perceived stress,

perceived social support, coping style factors, and self-concept total scores

		β	t	p	F change	R^2	R^2 change
Step 1					2.46	0.07	0.07
	Gender	−0.08	−0.98	0.33			
	Age	−0.19	−2.16	0.03			
	Family economic status	0.10	1.10	0.27			
	Family structure	0.11	1.31	0.19			
Step 2					4.91	0.10	0.03
	Gender	−0.10	−1.17	0.24			
	Age	−0.12	−1.37	0.17			
	Family economic status	0.10	1.19	0.24			
	Family structure	0.10	1.14	0.26			
	Perceived stress	−0.19	−2.22	0.03			
Step 3					10.55	0.17	0.07
	Gender	−0.11	−1.36	0.18			
	Age	0.13	−1.55	0.12			
	Family economic status	0.06	0.73	0.47			
	Family structure	0.09	1.16	0.25			
	Perceived stress	−0.18	−2.12	0.04			
	Perceived social support	0.26	3.25	0.00			
Step 4					21.00	0.37	0.20
	Gender	−0.13	−1.76	0.08			
	Age	−0.15	−1.98	0.05			
	Family economic status	0.05	0.64	0.52			
	Family structure	0.07	0.91	0.36			
	Perceived stress	−0.17	−2.20	0.03			
	Perceived social support	0.15	2.06	0.04			
	Positive coping	0.50	5.75	0.00			
	Negative coping	−0.45	−5.33	0.00			

Discussion

This study is the first to explore the factors which influence self-concept among adolescents in China infected with HIV. We selected a group of adolescents with AIDS, and analyzed the risk and protective factors. The purpose of this study was to determine whether perceived stress, perceived social support, and coping style are related to the self-concept of adolescents with HIV. The overall results confirmed that age, perceived stress, perceived social support, and coping style factors are associated with self-concept in adolescents with HIV. Specifically, younger age, lower perceived stress, and lower levels of negative coping were associated with higher levels of self-concept among adolescents with HIV. Conversely, higher perceived social support and more positive coping were positively correlated with the self-concept of adolescents with HIV. These findings highlight the significance of these factors on the self-concept of adolescents with HIV.

Our results showed that age significantly influenced the self-concept of adolescents with HIV. Developmental psychology research has shown that the older the age, the higher the self-concept of adolescents. Our findings showed that the older the adolescents with HIV, the lower the level of self-concept. We conclude that for this group of adolescents, with age, some drop out of school due to illness, face the change in the behavior of their parents, and even death. Adolescents lose confidence as part of their experience of disease along with increased social stress, thus older adolescents

with HIV have lower self-concept levels.

Our findings showed that perceived stress is negatively related to self-concept in adolescents with HIV. This finding was similar to previous studies. At present, there is no research on the relationship between self-concept and perceived stress of adolescents with HIV. Cohen et al. [32] and Hoffman et al. [33] report high negative correlations between self-concept and perceived stress in adolescents. A study in China also showed that the intensity of perceived stress was significantly correlated with the level of self-concept, which was consistent with the results of our study conducted in adolescents with HIV [34]. Because of the lethality of AIDS and disease-related social discrimination, HIV infections are often subject to great psychological stress [35 36]. Adolescents with HIV not only face the long-term psychological pain of losing parents, but also continue to face a variety of external stressors. These causes can lead to higher perceived stress of adolescents with HIV than experienced by healthy adolescents, thus their self-concept tends to be low. Therefore, in the education of families and schools with HIV-infected adolescents, we should teach them how to best manage and deal with stress, and how to increase their level of self-concept.

We found that perceived social support was positively related to self-concept among adolescents infected with HIV. The existing literature also suggests that adolescents infected with HIV who receive more perceived social support report higher levels of self-concept. A survey involving 21 HIV-positive patients in a southern U.S. city reported that a high level of self-concept largely depends on positive social support

and interactions [37]. In a 5-year follow-up longitudinal study, Haven et al. found that the greater the perceived social support among adolescents infected with HIV, the higher the psychological adaptation and the higher the self-concept. An international study showed that social support from teachers, classmates, and parents increases the self-concept of HIV-infected adolescents. This is consistent with the findings of our study [38]. In some areas, HIV knowledge is not adequate, and HIV-infected adolescents are often subjected to discrimination and indifference from others, resulting in their fear of being rejected. As a result, HIV-infected adolescents lose self-confidence and their sense of self-concept. Support and care from teachers, classmates, and parents play important roles on the sense of self-concept in HIV-infected adolescents. Therefore, we should increase awareness of how to treat and manage AIDS patients. We should encourage HIV-infected adolescents to interact with others, enhance self-confidence, and actively participate in social activities.

Correlation analyses showed that there was a significant positive correlation between self-concept, positive coping style, and problem-solving among HIV-infected adolescents, which was negatively correlated with negative coping style, such as escape, withdrawal, and inferiority. There are many studies that confirm our conclusion. Thoits et al. [39] reported that individuals with active coping strategies acquire a high self-concept, whereas individuals with passive-avoidant coping styles will have low self-esteem. In a northern California adolescent sample, Mantzicopoulos et al. [40] found that high self-concept was correlated with active-positive coping styles. HIV-infected adolescents are a specific group and they

face many more pressures than healthy adolescents. Such pressures will necessitate facing problems, which may result in a negative coping style, such as escapism. The development of a long-term negative coping style is associated with a variety of psychological problems, which affect ones' own evaluation and understanding. Therefore, the development of positive or negative coping style for self-concept is very important. HIV-infected adolescents should be encouraged to adopt positive and active coping strategies which will improve self-confidence, the ability to face setbacks, and self-concept.

We identified four factors which influence the self-concept of HIV-infected adolescents and discussed two aspects of the risk and protective factors, so that future work can develop a two-way intervention. Our findings suggest that we should provide more social support to adolescents so that they can cope with difficulties in a positive way and reduce their feelings of stress, which may contribute to development of the self-concept.

Study Limitations

Some limitations of this study must be acknowledged. First, the sample size of this study was small. HIV-infected adolescents reside in widely dispersed areas. The survey was conducted in a county of China in Henan province where HIV-infected adolescents are relatively concentrated. Therefore, the findings of the survey can only represent the self-concept of adolescents infected with HIV, but does not represent the entire Henan province or even the entire country. Second, this study was a

cross-sectional survey. After investigating the self-concept of HIV-infected adolescents, we also investigated the perceived stress, social support, and coping styles of adolescents infected with HIV. This study only analyzed the relevance between HIV-infected adolescents and self-concept, and cannot explain the deeper causal relationship among variables; further research and analysis are warranted for validation. Third, the assessment of self-concept was carried out using the scale evaluation method, and for HIV-infected adolescents the differences in individual language and verbal cognitive abilities may interfere with the final findings.

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Contributors

YJY and SYK conceived and designed the study, supervised the analysis, and interpreted the data. XXY and XHQ supervised the analysis, interpreted the data, and

wrote the preliminary manuscript. ZXQ and LW supervised the data collection by JWZ, WBW, and YWC. SYK performed the test administration, compiled the data, and wrote the preliminary manuscript. All authors contributed to the writing and review of the manuscript and approved the final version. We wish to thank International Science Editing for their help in editing the language of the manuscript.

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Competing interests

The authors declare that there are no competing or potential conflicts of interest. No conflict of interest exists in the submission of the manuscript, and the manuscript was approved by all authors for publication. The work described is original research that has not been published previously, and is not under consideration for publication elsewhere, in whole or in part.

Ethical considerations

The research was conducted in accordance with the ethical guidelines of the Declaration of Helsinki and was approved by the Ethics Committee of Harbin Medical University. All participants provided written informed consent having after being informed of the research purpose, meaning, and content. All the adolescents participated voluntarily.

Data sharing statement

No additional data are available.

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1-2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	4-7
Methods			
Study design	4	Present key elements of study design early in the paper	8-9
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	9
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	9
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	9
Bias	9	Describe any efforts to address potential sources of bias	*8*

Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10-11
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	12
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	13
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	14
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	15-16
		(*b*) Report category boundaries when continuous variables were categorized	

		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	19
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	17
Generalisability	21	Discuss the generalisability (external validity) of the study results	18
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	21

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Factors influencing self-concept among adolescents infected with HIV: A cross-sectional survey in China

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Factors influencing self-concept among adolescents infected with HIV: A cross-sectional survey in China

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Abstract

Objective We found that HIV-infected adolescents are much less self-concept than healthy adolescents. This study aimed to determine the factors influencing self-concept among human immunodeficiency virus (HIV) infected adolescents in China.

Setting: Henan Province, China.

A questionnaire was distributed among two groups totaling to 290 adolescents. The Piers-Harris Children's Self-concept Scale, the Perceived Stress Scale, the Perceived Social Support Scale, and the Simplified Coping Style Questionnaire were adapted for a Chinese population. Differences between the groups were tested for significance using the Student's t-test, and ANOVA was used to test continuous variables. The relationship between environmental personality factors and adolescent self-concept

was examined by Pearson correlation analysis. Hierarchical linear regression analysis was used to model the effects of environmental personality factors on self-concept.

Results

1. The self-concept total score among HIV-infected adolescents was significantly lower than normal adolescents ($p < 0.05$).

2. Hierarchical regression analysis indicated that age ($\beta = -0.19$, $t = -2.16$, $p = 0.03$), perceived stress ($\beta = -0.19$, $t = -2.22$, $p = 0.03$), perceived social support ($\beta = 0.26$, $t = 3.25$, $p = 0.00$), positive coping ($\beta = 0.50$, $t = 5.75$, $p = 0.00$), and negative coping ($\beta = -0.45$, $t = -5.33$, $p = 0.00$) were significantly associated with self-concept total scores.

Conclusions The self-concept of HIV-infected adolescents is related to perceived stress, perceived social support, and coping style. These findings underline the significance of self-concept among adolescents infected with HIV.

Strengths and limitations of this study

1. This is the first study to determine the factors influencing self-concept among HIV-infected adolescents in China.

2. Although HIV-infected adolescents are a special group, the sample size was suitably powered to allow statistical analysis, including hierarchical linear regression.

3. This was a cross-sectional study, and thus causal relationships between the self-concept of HIV-infected adolescents and influencing factors require further

exploration.

Keywords: adolescence; self-consciousness; AIDS; hierarchical regression analysis

Introduction

Over the years, AIDS has spread throughout the world at an extremely rapid rate. In 1985, AIDS began to prevail in a few African countries. By 2005, AIDS had affected nearly all countries and regions worldwide [1]. As a result of AIDS, the mortality rate of the adult population has increased significantly [2]. The inevitable consequence is that a large number of adolescents lose their parents because of AIDS. The typical socioeconomic status of families and individuals in communities with a high incidence of AIDS means that these orphans have a visible vulnerability in terms of physical, psychological, and social adaptation [3]. At present, the number of HIV-infected adolescents in China is large and rapidly increasing. Living conditions, social environment, and mental health difficulties are serious problems that have had an enormous impact on the growth and development of HIV-infected adolescents. The 2007 study conducted by Qian and Wang in China reported that prejudice and discrimination have a substantial negative impact on the health of HIV-infected adolescents [4]. The mental health difficulties experienced by AIDS orphans are mainly due to decrease in self-concept and increase in depression [5-7]. All the difficulties described above impact on self-concept among HIV-infected adolescents, and we predict that self-concept in HIV-infected adolescents is lower than in healthy adolescents.

Self-concept is a cognitive assessment of one's own abilities and weaknesses [8] and plays an important role in mental health. Low levels of self-concept are a risk factor of mental health problems. High levels of self-concept are considered to be a protective factor that hinders the development of psychological problems and promotes general health [9-12]. Susan Harter, a Professor of Psychology at DU, proposed a multi-dimensional model of self-concept from the perspective of developmental psychology and believed that adolescence is a critical period for the development of self-concept [13]. An individual's perception of himself/herself changes significantly during adolescence, or even undergoes a dramatic reversal [14]. In the early stages of puberty, adolescents are more likely to compare themselves with others, and to understand the comparisons and judgment of others to themselves. Adolescents also begin to give higher value to these judgments [15]. Social psychology studies have shown that during and after puberty, children become more self-conscious, more receptive, and more concerned about the opinions of others [16 17]. One developmental psychology study has shown that during and after puberty, an adolescent's self-evaluation becomes more comprehensive and changes from that held previously[18]. Previous studies have shown that specific groups of adolescents may be vulnerable to lower levels of self-concept than found in normal groups. For example, studies of adolescents with chronic diseases have shown that their level of self-concept is significantly lower than healthy adolescents. Adolescents with chronic diseases often feel insecure, lonely, isolated, and controlled by changes resulting from chronic disease[19 20]. Therefore, we suggest that chronic diseases such as AIDS,

will have a serious impact on the self-concept of adolescents. To date, no studies have investigated the self-concept of Chinese HIV-infected adolescents. In China, HIV-infected adolescents represent a large but specific group who have experienced multiple losses throughout their lives, thus increasing their risk of psychopathology [21]. Therefore, studying the development of self-concept among HIV-infected adolescents, and identifying methods to help them maintain psychological well-being and healthy growth is of clear importance.

The formation and development of self-concept is influenced by many factors. It has been shown that teacher-student relationships, peer relationships, parent-child relationships, parenting patterns, perceived stress, perceived social support, and individual coping styles, are all likely to have an impact on self-concept among adolescents [22]. The current study explored the factors which influence the self-concept of HIV-infected adolescents, focusing on both risk and protective factors, and external environment-individual internal characteristics.

A large amount of research data suggest that factors such as perceived stress and perceived social support in the external environment have a significant impact on the formation and development of self-concept. Perceived stress is the result of the perceptual assessment of an individual's own experience of stress resulting from specific situations or events[23]. People have different perceptions about events that occur, and their psychological response differs. Differences in psychological response will have different effects on mental health. In Africa, the incidence of AIDS is extremely high and adolescents are often in a high-crime and precarious environment

[24]. Such an environment may aggravate their sense of pressure, and thus affect their self-concept.

Social support is considered to be an important factor affecting psychological stress and physical health. From a psychological perspective, Cobb suggests that social support includes the following: emotional support; respect and support; and member attribution[25]. Social support can significantly predict the emotional behavior of adolescents, and higher social support has a protective effect on adolescent mental health [26]. Researchers have shown that the relationship between social support and self-concept is stable and positively correlated. There is a difference between social support factors and the correlation between the fractal dimensions of self-concept. Social support for adolescents is primarily derived from parents, teachers, classmates, and friends. Michelle et al. [27] report that the relationship between the frequency of social support and self-concept is significant. Rubin et al. [28] have shown that social support may prevent teenagers with LD (learning disabilities) from mood disorders. LD adolescents who receive more social support from their parents, teachers, and peers, have higher levels of self-concept than adolescents who receive less social support[29]. Barroso [30] concluded that social support is an important factor for adults who are long-term survivors of AIDS. Lack of social support may also cause HIV-infected adolescents to have lower levels of self-concept. Cluver et al. [31] report that orphans in particular may have a lack of social support due to illness or death of family members, thereby distorting their cognitions about themselves and others.

An adolescent's self-concept is not only affected by external environmental factors, but their own internal factors. Individual coping styles and other factors have a significant impact on the emergence and development of self-concept. Coping style refers to the change in cognition and/or or behavior utilized by an individual in a particular stressful situation, with the aim of managing emotions and improving the problem [32]. Individuals adopt specific coping styles and measures according to their own experiences after cognitive assessment of the response process. Coping style has an important impact on the status of an individual's environmental adaptation and mental health [33]. At present, an important research aspect in clinical psychology is the study of the relationship between an individual's coping style, and physical and mental health. Xinyi HU et al. [34] have shown that the clarity of self-awareness or self-concept is related to more active coping behavior. Studies of HIV-infected individuals and their coping styles suggest that a high level of active coping is positively related to immunization measures, and may indirectly affect the self-concept of the AIDS patient [35].

This study was designed to explore the factors which influence the self-concept of HIV-infected adolescents. We investigated the self-concept of HIV-infected adolescents, considered the environmental and individual levels, and analyzed the relationship between perceived stress, perceived social support, and coping style, and self-concept, in order to better understand the role of self-concept among HIV-infected adolescents. We believe this is the first study of this kind.

Methods

Sample size and sampling technique

The current study was conducted in a rural county in Henan province, China, where many residents were infected with HIV through blood collection using inadequate hygiene techniques. This rural county has the highest prevalence of HIV infection in the area. We obtained village-level HIV surveillance data from the anti-epidemic station in each of the counties to identify the villages with the highest number of AIDS-related deaths and confirmed HIV infections.

A questionnaire was distributed among two groups of adolescents; 140 questionnaires were distributed in the case group (HIV-infected adolescents) and 139 valid questionnaires were returned response rate of 99.3%). Among the adolescents in the case group, there were 88 boys (63.3%) and 51 girls (36.7%), and the average age was 15.89 ± 2.8 years. The control group (healthy adolescents) was issued 150 questionnaires, and 144 valid questionnaires were returned (response rate of 96.0%). Among the adolescents in the control group, there were 91 boys (63.2%) and 53 girls (36.8%), and the average age was 13.85 ± 1.2 years. The total number of participants in this study was therefore 283 adolescents aged 10–20 years and of Han ethnicity. Participation of the adolescents was voluntary, and all provided informed consent.

Procedure

To recruit HIV-infected adolescents, we worked with the town leaders to generate lists of adolescents with confirmed diagnoses of HIV/AIDS. We approached the adolescents on the lists and invited them to participate in the study. After the

eligibility of an adolescent was confirmed, the interviewer(s) provided him/her with a detailed description of the study design, potential benefits and risks, confidentiality issues and invited him/her to participate. When an adolescent agreed to be included in the study, the parents of the person were invited to participate by means of letters.

HIV-infected adolescents 10–20 years of age (inclusive) comprised the case group. The healthy children in Shangcai County who were not infected with HIV were compared as the control group. The parents are healthy and the family is complete. The inclusion criteria were as follows: 10-20 years of age; the definition of children with HIV infection was not met in this study; and in the first half of the investigation, the children resided in Shangcai County. The exclusion criteria were as follows:: unconfirmed HIV infection status; and unable to participate due to severe disease and central nervous system problems (such as encephalopathy or epilepsy).

The research met ethical guidelines according the to the Declaration of Helsinki, and approval was granted by the Ethics Committee of Harbin Medical University. All participants signed informed consent forms after receiving explanations of the research purpose, meaning, and content. All of the adolescents participated voluntarily.

Patient and Public Involvement

Self-concept is a cognitive assessment of one’s own abilities and weaknesses. Self-concept itself is the subjective and internal evaluation of one's self. Therefore, we selected the Piers-Harris Children's Self-concept Scale to measure self-concept, which

did not influence subjective preference on the results. We will forward the results to the local CDC via email. The CDC informs participants by telephone.

Measures

Outcome measures

The Piers-Harris Children's Self-concept Scale is a paper-and-pencil test consisting of 80 items which are scored as true or false. The items are self-descriptive declarative statements. The scores range from 1–80; higher scores indicate higher levels self-concept. The statements are worded in both positive and negative language to control for social desirability responding. The scale has good reliability and validity and the Cronbach's alpha of the scale was 0.858 in the current study.

Stress related to interpersonal stressors was assessed by the Perceived Stress Scale. The scale consists of ten items. Each item has a score range of 0–4, with a possible total score of 40 overall. Higher scores indicate higher levels of stress. The internal consistency measured by Cronbach's alpha in this study was 0.847.

The Perceived Social Support Scale (PSSS), developed by Zimet et al. consists of 12 items that were revised from three subscales (family, friend, and other support). Participants responded to the items on a 7-point Likert-type scale indicating disagreement/agreement. Each item was divided into a total score for social support. Items were adjusted to be more appropriate for HIV-infected children in the current study. The items "leaders, relatives and colleagues" were changed to "teachers, relatives and students. Cronbach's alpha was 0.887 in this study. We used the

Simplified Coping Style Questionnaire (SCSQ) to measure coping style. The SCSQ includes 20 items that contain two dimensions of coping (positive and negative). Each dimension consists of 10 items, and each item is scored on a 5-point scale, where 1 indicates 'certainly not' and 5 indicates 'certainly.' A higher score on one dimension indicates that the individual is more likely to utilize this type of coping style. The questionnaire is highly reliable and suitable for a Chinese population. The Cronbach's alpha for the two independent dimensions of coping were 0.70 and 0.69.

Data analysis

The Statistical Package for Social Sciences 19.0 (SPSS 19.0) program (IBM, Armonk, NY, USA) was used for statistical analysis. All tests were two-tailed and the significance level was set at a $p < 0.05$. Differences between the groups were tested using the Student's t-test and ANOVA was used to test continuous variables. The relationship between environmental personality factors and adolescent self-concept was examined with Pearson correlation analyses. Hierarchical linear regression analysis was used to model the effects of environmental personality factors on self-concept in adolescents. In the regression model, gender, age, family economic status, and family structure were entered in the first block to control for potential confounding variables. In the second block, perceived stress factors were entered into the model. Third, after controlling for sociodemographic variables and perceived stress factors, perceived social support was entered into the model. Finally, after controlling for sociodemographic variables, perceived stress factors, and perceived social support, coping style was entered into the model.

Results

Study population

Adolescents were asked to report on individual and family characteristics including age, gender, family economic status (i.e., good, moderate, and poor), and family structure (intact/non-intact).

Comparison of self-concept between the case and control groups

The self-concept levels of HIV-infected adolescents were significantly lower than healthy adolescents ($p < 0.05$; Table 1).

Table 1. Comparison of the levels of self-concept between HIV-infected and control adolescents

	HIV-infected adolescents (N = 139)	Healthy adolescents (N = 144)	t	p
Self-concept score	51.55	60.22	−9.37	0.00**

Sociodemographic data and self-concept total scores by different sociodemographic variables

Of the 139 participants, 88 were males and 51 were females. The number of participants in each age group was as follows: 8–13 years, 28; 13–16 years, 80; and 16–18 years, 31. The family economic status was as follows: good, 48; moderate, 79; and poor, 12. Fifty-seven and eighty-two HIV-infected adolescents did and did not have an intact family structure, respectively. No significant differences in self-concept

total scores existed between gender, age, family economic status, or family structure (Table 2).

Table 2. Participants' socio-demographic data and self-concept total scores by socio-demographic variables

	Group	N (%)	Self-concept score	F/t	p
Gender				0.08	0.78
	Male	88 (63.3)	52.08 ± 10.71		
	Female	51 (36.7)	50.65 ± 11.27		
Age				1.44	0.24
	8-13	28 (20.1)	53.43 ± 11.86		
	13-16	80 (57.6)	50.21 ± 10.67		
	16-18	31 (22.3)	53.32 ± 10.44		
Family economic status				2.74	0.07
	Good	48 (34.5)	50.46 ± 10.03		
	Moderate	79 (56.8)	51.18 ± 11.38		
	Poor	12 (8.6)	58.42 ± 10.90		
Family structure				0.18	0.67
	Intact	82 (59.0)	52.63 ± 10.46		
	Non-intact	57 (41.0)	50.00 ± 11.42		

Relationship between perceived stress, perceived social support, coping style factors, and self-concept total scores

We collected self-concept total scores for perceived stress, perceived social support,

and coping style factors in HIV-infected adolescents (Table 3). Statistically significant linear relationships existed among perceived stress, perceived social support, coping style factors, and the self-concept total scores of HIV-infected adolescents ($p < 0.05$). Among these variables, perceived stress ($r = –0.23$, $p<0.05$) and negative coping ($r = –0.26$, $p < 0.05$) were negatively related to the self-concept total scores. Conversely, perceived social support ($r = 0.28$, $p < 0.05$) and positive coping ($r = 0.25$, $p <0 .05$) were positively associated with self-concept total scores.

Table 3. Correlations among perceived stress, perceived social support, coping style factors, and self-concept total scores

	Perceived stress	Perceived social support	Positive coping	Negative coping
Self-concept	−0.23**	0.28**	0.25**	−0.26**

Hierarchical linear regression analysis of the relationship among perceived stress, perceived social support, coping style factors, and self-concept total scores

Eight variables accounted for 37.0% of the total variance of the self-concept total scores (Table 4). The control variables accounted for 7% of the variance in the self-concept total scores (F change = 2.46), and among the control variables, age ($\beta = −0.19$, $t = −2.16$, $p = 0.03$) was significantly associated with the self-concept total scores. With inclusion of the perceived stress variable, the variance which could be explained increased to 10%. The variance in self-concept total scores (F change = 4.91) and perceived stress ($\beta = −0.19$, $t = −2.22$, $p = 0.03$) was significantly associated

with the self-concept total scores. Adding the perceived social support factor contributed to an additional 7% of the variance in the self-concept total scores (F change = 10.55), and perceived social support (β = 0.26, t= 3.25, p = 0.00) was significantly associated with the self-concept total scores. Finally, adding the positive and negative coping factors contributed to an additional 20% of the variance in the self-concept total scores (F change = 21.00). Positive (β = 0.50, t= 5.75, p = 0.00) and negative coping (β = −0.45, t= −5.33, p = 0.00) were significantly associated with the self-concept total scores.

Table 4. Hierarchical linear regression analysis of the relationships among perceived stress, perceived social support, coping style factors, and self-concept total scores

		β	t	p	F change	R^2	R^2 change
Step 1					2.46	0.07	0.07
	Gender	−0.08	−0.98	0.33			
	Age	−0.19	−2.16	0.03			
	Family economic status	0.10	1.10	0.27			
	Family structure	0.11	1.31	0.19			
Step 2					4.91	0.10	0.03
	Gender	−0.10	−1.17	0.24			
	Age	−0.12	−1.37	0.17			
	Family economic status	0.10	1.19	0.24			
	Family structure	0.10	1.14	0.26			
	Perceived stress	−0.19	−2.22	0.03			
Step 3					10.55	0.17	0.07
	Gender	−0.11	−1.36	0.18			
	Age	0.13	−1.55	0.12			

	Family economic status	0.06	0.73	0.47			
	Family structure	0.09	1.16	0.25			
	Perceived stress	−0.18	−2.12	0.04			
	Perceived social support	0.26	3.25	0.00			
Step 4					21.00	0.37	0.20
	Gender	−0.13	−1.76	0.08			
	Age	−0.15	−1.98	0.05			
	Family economic status	0.05	0.64	0.52			
	Family structure	0.07	0.91	0.36			
	Perceived stress	−0.17	−2.20	0.03			
	Perceived social support	0.15	2.06	0.04			
	Positive coping	0.50	5.75	0.00			
	Negative coping	−0.45	−5.33	0.00			

Discussion

This study was the first to explore the factors which influence self-concept among adolescents in China infected with HIV. We selected a group of HIV-infected adolescents, and analyzed the risk and protective factors. The purpose of this study was to determine whether perceived stress, perceived social support, and coping style are related to the self-concept of adolescents with HIV. The overall results confirmed that age, perceived stress, perceived social support, and coping style factors were associated with self-concept in adolescents with HIV. Specifically, younger age, lower perceived stress, and lower levels of negative coping were associated with higher levels of self-concept among adolescents with HIV. Conversely, higher perceived social support and more positive coping were positively correlated with the

self-concept of adolescents with HIV. These findings highlight the significance of these factors on the self-concept of adolescents with HIV.

Our results showed that age significantly influenced the self-concept of adolescents with HIV. Developmental psychology has shown that the children's self-concept changes dramatically during adolescence and increases significantly with age [36]. Our findings showed that the older the adolescents with HIV, the lower the level of self-concept. We concluded that for this group of adolescents, with age, some drop out of school due to illness, face the change in the behavior of their parents, and even death. Adolescents lose confidence as part of their experience of disease along with increased social stress, thus older adolescents with HIV have lower self-concept levels.

Our findings showed that perceived stress is negatively related to self-concept in adolescents with HIV. This finding was similar to previous studies. At present, there was no research on the relationship between self-concept and perceived stress of adolescents with HIV. Civitci et al.[37] and Hoffman et al. [38] report high negative correlations between self-concept and perceived stress in adolescents. A study in China also showed that the intensity of perceived stress was significantly correlated with the level of self-concept, which was consistent with the results of our study conducted in adolescents with HIV [39]. Because of the lethality of AIDS and disease-related social discrimination, HIV infections are often subject to great psychological stress [40 41]. Adolescents with HIV not only face the long-term psychological pain of losing parents, but also continue to face a variety of external

stressors. These causes can lead to higher perceived stress of adolescents with HIV than experienced by healthy adolescents, thus their self-concept tends to be low. Therefore, in the education of families and schools with HIV-infected adolescents, we should teach them how to best manage and deal with stress, and how to increase their level of self-concept. We should mainly encourage them to develop their ability to resist pressure and self-regulation. Society should provide HIV-infected adolescents with social support from a professional psychological perspective.

We found that perceived social support was positively related to self-concept among adolescents infected with HIV. The existing literature also suggests that adolescents infected with HIV who receive more perceived social support report higher levels of self-concept. A survey involving 21 HIV-positive patients in a southern U.S. city reported that a high level of self-concept largely depends on positive social support and interactions [42]. In a 5-year follow-up longitudinal study, Haven et al. found that the greater the perceived social support among adolescents infected with HIV, the higher the psychological adaptation and the higher the self-concept. An international study showed that social support from teachers, classmates, and parents increases the self-concept of HIV-infected adolescents [43]. This was consistent with the findings of our study. In some areas, HIV knowledge is not adequate, and HIV-infected adolescents are often subjected to discrimination and indifference from others, resulting in their fear of being rejected. As a result, HIV-infected adolescents lose self-confidence and their sense of self-concept. Support and care from teachers, classmates, and parents play important roles on the sense of self-concept in

HIV-infected adolescents. Therefore, we should increase awareness of how to treat and manage AIDS patients. We should encourage HIV-infected adolescents to interact with others, enhance self-confidence, and actively participate in social activities.

Correlation analyses showed that there was a significant positive correlation between self-concept, positive coping style, and problem-solving among HIV-infected adolescents, which was negatively correlated with negative coping style, such as escape, withdrawal, and inferiority. There are many studies that confirm our conclusion. Pala et al. [44] reported that individuals with active coping strategies acquire a high self-concept, whereas individuals with passive-avoidant coping styles will have low self-esteem. In a northern California adolescent sample, Mantzicopoulos et al. [45] found that high self-concept was correlated with active-positive coping styles. HIV-infected adolescents are a specific group and they face many more pressures than healthy adolescents. Such pressures will necessitate facing problems, which may result in a negative coping style, such as escapism. The development of a long-term negative coping style is associated with a variety of psychological problems, which affect ones' own evaluation and understanding. Therefore, the development of positive or negative coping style for self-concept is very important. HIV-infected adolescents should be encouraged to adopt positive and active coping strategies which will improve self-confidence, the ability to face setbacks, and self-concept.

We identified four factors which influence the self-concept of HIV-infected

adolescents and discussed two aspects of the risk and protective factors, so that future work can develop a two-way intervention. Our findings suggest that we should provide more social support to adolescents so that they can cope with difficulties in a positive way and reduce their feelings of stress, which may contribute to development of the self-concept.

Study Limitations

Some limitations of this study must be acknowledged. First, the sample size of this study was small. HIV-infected adolescents reside in widely dispersed areas. The survey was conducted in a county of China in Henan province where HIV-infected adolescents are relatively concentrated. Therefore, the findings of the survey can only represent the self-concept of adolescents infected with HIV, but does not represent the entire Henan province or even the entire country. Second, this study was a cross-sectional survey. After investigating the self-concept of HIV-infected adolescents, we also investigated the perceived stress, social support, and coping styles of adolescents infected with HIV. This study only analyzed the relevance between HIV-infected adolescents and self-concept, and cannot explain the deeper causal relationship among variables; further research and analysis are warranted for validation. Third, the assessment of self-concept was carried out using the scale evaluation method, and for HIV-infected adolescents the differences in individual language and verbal cognitive abilities may interfere with the final findings.

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Contributors

YJY and SYK conceived and designed the study, supervised the analysis, and interpreted the data. XXY and XHQ supervised the analysis, interpreted the data, and wrote the preliminary manuscript. ZXQ and LW supervised the data collection by JWZ, WBW, and YWC. SYK performed the test administration, compiled the data, and wrote the preliminary manuscript. All authors contributed to the writing and review of the manuscript and approved the final version. We wish to thank International Science Editing for their help in editing the language of the manuscript. At the same time, we would like to thank the patient advisers for their cooperation and support in this study.

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Competing interests

The authors declare that there are no competing or potential conflicts of interest. No conflict of interest exists in the submission of the manuscript, and the manuscript was approved by all authors for publication. The work described is original research that has not been published previously, and is not under consideration for publication elsewhere, in whole or in part.

Ethical considerations

The research was conducted in accordance with the ethical guidelines of the Declaration of Helsinki and was approved by the Ethics Committee of Harbin Medical University. All participants provided written informed consent having after being informed of the research purpose, meaning, and content. All the adolescents participated voluntarily.

Data sharing statement

No additional data are available.

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1-2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	4-7
Methods			
Study design	4	Present key elements of study design early in the paper	8-9
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	9
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	9
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	9
Bias	9	Describe any efforts to address potential sources of bias	*8*

Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10-11
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	12
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	13
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	14
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	15-16
		(*b*) Report category boundaries when continuous variables were categorized	

		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	19
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	17
Generalisability	21	Discuss the generalisability (external validity) of the study results	18
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	21

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Factors influencing self-concept among adolescents infected with HIV: A cross-sectional survey in China

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Factors influencing self-concept among adolescents infected with HIV: A cross-sectional survey in China

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Abstract

Overview The mental health problems of HIV-infected adolescents are crucial. It is of great significance to explore which factors can affect the self-evaluation and understanding of HIV-infected adolescents.

Objective We found that HIV-infected adolescents have much less self-concept than healthy adolescents. This study aimed to determine the factors influencing self-concept among human immunodeficiency virus (HIV) infected adolescents in China.

Setting A questionnaire was distributed among two groups totaling to 290 adolescents in Henan Province, China. 140 questionnaires were distributed in the case group (HIV-infected adolescents) and the control group (healthy adolescents) was issued 150 questionnaires.

The Piers-Harris Children's Self-concept Scale, the Perceived Stress Scale, the Perceived Social Support Scale, and the Simplified Coping Style Questionnaire were adapted for a Chinese population. Differences between the groups were tested for significance using the Student's t-test, and ANOVA was used to test continuous variables. The relationship between environmental personality factors and adolescent self-concept was examined by Pearson correlation analysis. Hierarchical linear regression analysis was used to model the effects of environmental personality factors on self-concept.

Results The self-concept total score among HIV-infected adolescents was significantly lower than normal adolescents ($p < 0.05$). Hierarchical regression analysis indicated that age ($\beta = -0.19$, $t = -2.16$, $p = 0.03$), perceived stress ($\beta = -0.19$, $t = -2.22$, $p = 0.03$), perceived social support ($\beta = 0.26$, $t = 3.25$, $p = 0.00$), positive coping ($\beta = 0.50$, $t = 5.75$, $p = 0.00$), and negative coping ($\beta = -0.45$, $t = -5.33$, $p = 0.00$) were significantly associated with self-concept total scores.

Conclusions The self-concept of HIV-infected adolescents is related to perceived stress, perceived social support, and coping style. These findings underline the significance of self-concept among adolescents infected with HIV.

Strengths and limitations of this study

1. This is the first study to determine the factors influencing self-concept among HIV-infected adolescents in China.

2. Although HIV-infected adolescents are a special group, the sample size was

suitably powered to allow statistical analysis including hierarchical linear regression.

3. This was a cross-sectional study and thus causal relationships between the self-concept of HIV-infected adolescents and influencing factors require further exploration.

Keywords: adolescence; self consciousness; AIDS; Hierarchical regression analysis

Introduction

Over the years, AIDS has spread throughout the world at an extremely rapid rate. In 1985, AIDS began to prevail in a few African countries. By 2005, AIDS had affected nearly all countries and regions worldwide [1]. As a result of AIDS, the mortality rate of the adult population has increased significantly [2]. HIV is spread through exposure to HIV-infected blood or other body fluids. The primary transmission modes are contact with an infected person's body fluids during unprotected sex, blood-to-blood exposure (either by direct contact or through needle sharing among injection drug users), and perinatal transmission from infected mother to child. The main target of mother-to-child transmission of AIDS is children and adolescents and the inevitable consequence is that a large number of adolescents lose their parents because of AIDS. The typical socioeconomic status of families and individuals in communities with a high incidence of AIDS means that those adolescents who have acquired AIDS through mother-to-child transmission have a visible vulnerability in terms of physical, psychological, and social adaptation [3]. At present, the number of HIV-infected adolescents in China is large and rapidly increasing. Living conditions,

social environment, and mental health difficulties are serious problems that have had an enormous impact on the growth and development of HIV-infected adolescents. The study of Qian and Wang in China in 2007 reported that prejudice and discrimination have a substantial negative impact on the health of HIV-infected adolescents [4]. The mental health difficulties experienced by the children who lost their parents to HIV/AIDS are mainly due to decrease in self-concept and increase in depression [5-7]. All the difficulties described above impact on self-concept among HIV-infected adolescents, and we predict that self-concept in HIV-infected adolescents is lower than in healthy adolescents.

Self-concept is a cognitive assessment of one's own abilities and weaknesses [8] and plays an important role in mental health. Low levels of self-concept are a risk factor of mental health problems. High levels of self-concept are considered to be a protective factor that hinders the development of psychological problems and promotes general health [9-12]. Susan Harter proposed a multi-dimensional model of self-concept from the perspective of developmental psychology and believed that adolescence was a critical period for the development of self-concept [13]. An individual's perception of himself/herself changes significantly during adolescence, or even undergoes a dramatic reversal [14]. In the early stages of puberty, adolescents are more likely to compare themselves with others, and to understand the comparisons and judgment of others to themselves. Adolescents also begin to give higher value to these judgments [15]. Social psychology studies have shown that during and after puberty, children become more self-conscious, more receptive, and more concerned

about the opinions of others [16 17]. One developmental psychology study has shown that during and after puberty, an adolescent's self-evaluation becomes more comprehensive and changes from that held previously[18]. Previous studies have shown that specific groups of adolescents may be vulnerable to lower levels of self-concept than found in normal groups. For example, studies of adolescents with chronic diseases have shown that their level of self-concept is significantly lower than healthy adolescents. Adolescents with chronic diseases often feel insecure, lonely, isolated, and controlled by changes resulting from chronic disease[19 20]. Therefore, we suggest that chronic diseases such as AIDS, will have a serious impact on the self-concept of adolescents. To date, no studies have investigated the self-concept of Chinese HIV-infected adolescents. In China, HIV-infected adolescents represent a large but specific group who have experienced multiple losses throughout their lives, thus increasing their risk of psychopathology [21]. Therefore, studying the development of self-concept among HIV-infected adolescents, and identifying methods to help them maintain psychological well-being and healthy growth is of clear importance.

The formation and development of self-concept is influenced by many factors. It has been shown that teacher-student relationships, peer relationships, parent-child relationships, parenting patterns, perceived stress, perceived social support, and individual coping styles, are all likely to have an impact on self-concept among adolescents [22]. The current study explored the factors which influence the self-concept of HIV-infected adolescents, focusing on both risk and protective factors,

and external environment-individual internal characteristics.

A large amount of research data suggest that factors such as perceived stress and perceived social support in the external environment have a significant impact on the formation and development of self-concept. Perceived stress is the result of the perceptual assessment of an individual's own experience of stress resulting from specific situations or events[23]. People have different perceptions about events that occur, and their psychological response differs. Differences in psychological response will have different effects on mental health. In Africa, the incidence of AIDS is extremely high and adolescents are often in a high-crime and precarious environment [24]. Such an environment may aggravate their sense of pressure, and thus affect their self-concept.

Social support is considered to be an important factor affecting psychological stress and physical health. From a psychological perspective, Cobb suggests that social support includes the following: emotional support; respect and support; and member attribution[25]. Social support can significantly predict the emotional behavior of adolescents, and higher social support has a protective effect on adolescent mental health [26]. Researchers have shown that the relationship between social support and self-concept is stable and positively correlated. There is a difference between social support factors and the correlation between the fractal dimensions of self-concept. Social support for adolescents is primarily derived from parents, teachers, classmates, and friends. Michelle et al. [27] report that the relationship between the frequency of social support and self-concept is significant. Rubin et al. [28] have shown that social

support may prevent teenagers with LD (learning disabilities) from mood disorders. LD adolescents who receive more social support from their parents, teachers, and peers, have higher levels of self-concept than adolescents who receive less social support[29]. Barroso [30] concluded that social support is an important factor for adults who are long-term survivors of AIDS. Lack of social support may also cause HIV-infected adolescents to have lower levels of self-concept. Cluver et al. [31] report that orphans in particular may have a lack of social support due to illness or death of family members, thereby distorting their cognitions about themselves and others.

An adolescent's self-concept is not only affected by external environmental factors, but their own internal factors. Individual coping styles and other factors have a significant impact on the emergence and development of self-concept. Coping style refers to the change in cognition and/or or behavior utilized by an individual in a particular stressful situation, with the aim of managing emotions and improving the problem [32]. Individuals adopt specific coping styles and measures according to their own experiences after cognitive assessment of the response process. Coping style has an important impact on the status of an individual's environmental adaptation and mental health [33]. At present, an important research aspect in clinical psychology is the study of the relationship between an individual's coping style, and physical and mental health. Xinyi HU et al. [34] have shown that the clarity of self-awareness or self-concept is related to more active coping behavior. Studies of HIV-infected individuals and their coping styles suggest that a high level of active coping is

positively related to immunization measures, and may indirectly affect the self-concept of the AIDS patient [35].

This study was designed to explore the factors which influence the self-concept of HIV-infected adolescents. We investigated the self-concept of HIV-infected adolescents, considered the environmental and individual levels, and analyzed the relationship between perceived stress, perceived social support, and coping style, and self-concept, in order to better understand the role of self-concept among HIV-infected adolescents. We believe this is the first study of this kind in China.

Methods

Sample size and sampling technique

The current study was conducted in a rural county in Henan province, China, where many residents were infected with HIV through blood collection using inadequate hygiene techniques. This rural county has the highest prevalence of HIV infection in the area. We obtained village-level HIV surveillance data from the anti-epidemic station in each of the counties to identify the villages with the highest number of AIDS-related deaths and confirmed HIV infections. The adolescents we surveyed were all infected by mother-to-child transmission of HIV.

A questionnaire was distributed among two groups of adolescents; 140 questionnaires were distributed in the case group (HIV-infected adolescents) and 139 valid questionnaires were returned (response rate of 99.3%). Among the adolescents in the case group, there were 88 boys (63.3%) and 51 girls (36.7%), and the average age was

15.89 ± 2.8 years. The control group (healthy adolescents) was issued 150 questionnaires, and 144 valid questionnaires were returned (response rate of 96.0%). Among the adolescents in the control group, there were 91 boys (63.2%) and 53 girls (36.8%), and the average age was 13.85 ± 1.2 years. The total number of participants in this study was therefore 283 adolescents aged 10–20 years and of Han ethnicity. Participation of the adolescents was voluntary, and all provided informed consent.

Procedure

To recruit HIV-infected adolescents, we worked with the town leaders to generate lists of adolescents with confirmed diagnoses of HIV/AIDS. We approached the adolescents on the lists and invited them to participate in the study. After the eligibility of an adolescent was confirmed, the interviewer(s) provided him/her with a detailed description of the study design, potential benefits and risks, confidentiality issues and invited him/her to participate. When an adolescent agreed to be included in the study, the parents of the person were invited to participate by means of letters.

HIV-infected adolescents 10–20 years of age (inclusive) comprised the case group. The healthy children in shangcai county who were not infected with HIV were compared as the control group. The parents are healthy and the family is complete. Inclusion criteria: age 10-20 years old; It does not meet the definition of children with HIV infection in this study; In the first half of the investigation, the children have been living in shangcai county. The exclusion criteria were: unconfirmed HIV infection status; The body is unable to participate in severe diseases and cannot

participate due to central nervous system problems (such as encephalopathy, epilepsy, etc.).

The research met ethical guidelines according the to the Declaration of Helsinki, and approval was granted by the Ethics Committee of Harbin Medical University. All participants signed informed consent forms after receiving explanations of the research purpose, meaning, and content. All of the adolescents participated voluntarily.

Patient and Public Involvement

Self-concept is a cognitive assessment of one's own abilities and weaknesses. Self-concept itself is the subjective and internal evaluation of one's self. Therefore, we selected the Piers-Harris Children's Self-concept Scale to measure their self-concept, without the influence of subjective preference on the results. We will send the results to the local CDC in the form of email after we get the results. The CDC informs participants by phone.

Measures

Outcome measures

The Piers-Harris Children's Self-concept Scale is a paper-and-pencil test consisting of 80 items which are scored as true or false. The items are self-descriptive declarative statements. The scores range from 1–80; higher scores indicate higher levels self-concept. The statements are worded in both positive and negative language to control for social desirability responding. The scale has good reliability and validity

and the Cronbach's alpha of the scale was 0.858 in the current study.

Stress related to interpersonal stressors was assessed by the Perceived Stress Scale. The scale consists of ten items. Each item has a score range of 0–4, with a possible total score of 40 overall. Higher scores indicate higher levels of stress. The internal consistency measured by Cronbach's alpha in this study was 0.847.

The Perceived Social Support Scale (PSSS), developed by Zimet et al. consists of 12 items that were revised from three subscales (family, friend, and other support). Participants responded to the items on a 7-point Likert-type scale indicating disagreement/agreement. Each item was divided into a total score for social support. Items were adjusted to be more appropriate for HIV-infected children in the current study. The items "leaders, relatives and colleagues" were changed to "teachers, relatives and students. Cronbach's alpha was 0.887 in this study. We used the Simplified Coping Style Questionnaire (SCSQ) to measure coping style. The SCSQ includes 20 items that contain two dimensions of coping (positive and negative). Each dimension consists of 10 items, and each item is scored on a 5-point scale, where 1 indicates 'certainly not' and 5 indicates 'certainly.' A higher score on one dimension indicates that the individual is more likely to utilize this type of coping style. The questionnaire is highly reliable and suitable for a Chinese population. The Cronbach's alpha for the two independent dimensions of coping were 0.70 and 0.69.

Data analysis

The Statistical Package for Social Sciences 19.0 (SPSS 19.0) program (IBM, Armonk,

NY, USA) was used for statistical analysis. All tests were two-tailed and the significance level was set at a $p < 0.05$. Differences between the groups were tested using the Student's t-test and ANOVA was used to test continuous variables. The relationship between environmental personality factors and adolescent self-concept was examined with Pearson correlation analyses. Hierarchical linear regression analysis was used to model the effects of environmental personality factors on self-concept in adolescents. In the regression model, gender, age, family economic status, and family structure were entered in the first block to control for potential confounding variables. In the second block, perceived stress factors were entered into the model. Third, after controlling for sociodemographic variables and perceived stress factors, perceived social support was entered into the model. Finally, after controlling for sociodemographic variables, perceived stress factors, and perceived social support, coping style was entered into the model.

Results

Study population

Adolescents were asked to report on individual and family characteristics including age, gender, family economic status (i.e., good, moderate, and poor), and family structure (intact/non-intact).

Comparison of self-concept between the Case group and control group

The self-concept levels of HIV-infected adolescents were significantly lower than healthy adolescents ($p < 0.05$; Table 1).

Table 1. Comparison of the levels of self-concept between HIV-infected and control adolescents

	HIV-infected adolescents (N = 139)	Healthy adolescents (N = 144)	t	p
Self-concept score	51.55	60.22	−9.37	0.00**

Sociodemographic data and self-concept total scores by different sociodemographic variables

Of the 139 participants, 88 were males and 51 were females. The number of participants in each age group was as follows: 8–13 years, 28; 13–16 years, 80; and 16–18 years, 31. The family economic status was as follows: good, 48; moderate, 79; and poor, 12. Fifty-seven and eighty-two HIV-infected adolescents did and did not have an intact family structure, respectively. No significant differences in self-concept total scores existed between gender, age, family economic status, or family structure (Table 2).

Table 2. Participants' socio-demographic data and self-concept total scores by socio-demographic variables

	Group	N (%)	Self-concept score	F/t	p
Gender				0.08	0.78
	Male	88 (63.3)	52.08 ± 10.71		
	Female	51 (36.7)	50.65 ± 11.27		

Age				1.44	0.24
	8-13	28 (20.1)	53.43 ± 11.86		
	13-16	80 (57.6)	50.21 ± 10.67		
	16-18	31 (22.3)	53.32 ± 10.44		
Family economic status				2.74	0.07
	Good	48 (34.5)	50.46 ± 10.03		
	Moderate	79 (56.8)	51.18 ± 11.38		
	Poor	12 (8.6)	58.42 ± 10.90		
Family structure				0.18	0.67
	Intact	82 (59.0)	52.63 ± 10.46		
	Non-intact	57 (41.0)	50.00 ± 11.42		

Relationship between perceived stress, perceived social support, coping style factors, and self-concept total scores

We collected self-concept total scores for perceived stress, perceived social support, and coping style factors in HIV-infected adolescents (Table 3). Statistically significant linear relationships existed among perceived stress, perceived social support, coping style factors, and the self-concept total scores of HIV-infected adolescents ($p < 0.05$). Among these variables, perceived stress ($r = –0.23$, $p<0.05$) and negative coping ($r = –0.26$, $p < 0.05$) were negatively related to the self-concept total scores. Conversely, perceived social support ($r = 0.28$, $p < 0.05$) and positive coping ($r = 0.25$, $p <0 .05$) were positively associated with self-concept total scores.

Table 3. Correlations among perceived stress, perceived social support, coping style factors, and

self-concept total scores

	Perceived stress	Perceived social support	Positive coping	Negative coping
Self-concept	−0.23**	0.28**	0.25**	−0.26**

Hierarchical linear regression analysis of the relationship among perceived stress, perceived social support, coping style factors, and self-concept total scores

Eight variables accounted for 37.0% of the total variance of the self-concept total scores (Table 4). The control variables accounted for 7% of the variance in the self-concept total scores (F change = 2.46), and among the control variables, age (β = −0.19, t = −2.16, p = 0.03) was significantly associated with the self-concept total scores. With inclusion of the perceived stress variable, the variance which could be explained increased to 10%. The variance in self-concept total scores (F change = 4.91) and perceived stress (β = −0.19, t = −2.22, p = 0.03) was significantly associated with the self-concept total scores. Adding the perceived social support factor contributed to an additional 7% of the variance in the self-concept total scores (F change = 10.55), and perceived social support (β = 0.26, t= 3.25, p = 0.00) was significantly associated with the self-concept total scores. Finally, adding the positive and negative coping factors contributed to an additional 20% of the variance in the self-concept total scores (F change = 21.00). Positive (β = 0.50, t= 5.75, p = 0.00) and negative coping (β = −0.45, t= −5.33, p = 0.00) were significantly associated with the self-concept total scores.

Table 4. Hierarchical linear regression analysis of the relationships among perceived stress, perceived social support, coping style factors, and self-concept total scores

		β	t	p	F change	R^2	R^2 change
Step 1					2.46	0.07	0.07
	Gender	−0.08	−0.98	0.33			
	Age	−0.19	−2.16	0.03			
	Family economic status	0.10	1.10	0.27			
	Family structure	0.11	1.31	0.19			
Step 2					4.91	0.10	0.03
	Gender	−0.10	−1.17	0.24			
	Age	−0.12	−1.37	0.17			
	Family economic status	0.10	1.19	0.24			
	Family structure	0.10	1.14	0.26			
	Perceived stress	−0.19	−2.22	0.03			
Step 3					10.55	0.17	0.07
	Gender	−0.11	−1.36	0.18			
	Age	0.13	−1.55	0.12			
	Family economic status	0.06	0.73	0.47			
	Family structure	0.09	1.16	0.25			
	Perceived stress	−0.18	−2.12	0.04			
	Perceived social support	0.26	3.25	0.00			
Step 4					21.00	0.37	0.20
	Gender	−0.13	−1.76	0.08			
	Age	−0.15	−1.98	0.05			
	Family economic status	0.05	0.64	0.52			
	Family structure	0.07	0.91	0.36			
	Perceived stress	−0.17	−2.20	0.03			
	Perceived social support	0.15	2.06	0.04			
	Positive coping	0.50	5.75	0.00			

Negative coping	−0.45	−5.33	0.00

Discussion

This study was the first to explore the factors which influence self-concept among adolescents in China infected with HIV. We selected a group of HIV-infected adolescents, and analyzed the risk and protective factors. The purpose of this study was to determine whether perceived stress, perceived social support, and coping style are related to the self-concept of adolescents with HIV. The overall results confirmed that age, perceived stress, perceived social support, and coping style factors were associated with self-concept in adolescents with HIV. Specifically, younger age, lower perceived stress, and lower levels of negative coping were associated with higher levels of self-concept among adolescents with HIV. Conversely, higher perceived social support and more positive coping were positively correlated with the self-concept of adolescents with HIV. These findings highlight the significance of these factors on the self-concept of adolescents with HIV.

Our results showed that age significantly influenced the self-concept of adolescents with HIV. Developmental psychology has shown that the children's self-concept changes dramatically during adolescence and increases significantly with age [36]. Our findings showed that the older the adolescents with HIV, the lower the level of self-concept. We concluded that for this group of adolescents, with age, some drop out of school due to illness, face the change in the behavior of their parents, and even death. Adolescents lose confidence as part of their experience of disease along with

increased social stress, thus older adolescents with HIV have lower self-concept levels.

Our findings showed that perceived stress is negatively related to self-concept in adolescents with HIV. This finding was similar to previous studies. At present, there was no research on the relationship between self-concept and perceived stress of adolescents with HIV. Civitci et al.[37] and Hoffman et al. [38] report high negative correlations between self-concept and perceived stress in adolescents. A study in China also showed that the intensity of perceived stress was significantly correlated with the level of self-concept, which was consistent with the results of our study conducted in adolescents with HIV [39]. Because of the lethality of AIDS and disease-related social discrimination, people with HIV are often subject to great psychological stress [40 41]. Adolescents with HIV not only face the long-term psychological pain of losing parents, but also continue to face a variety of external stressors. These causes can lead to higher perceived stress of adolescents with HIV than experienced by healthy adolescents, thus their self-concept tends to be low. Therefore, in the education of families and schools with HIV-infected adolescents, we should teach them how to best manage and deal with stress, and how to increase their level of self-concept. We should mainly encourage them to develop their ability to resist pressure and self-regulation. The society should provide HIV-infected adolescents with social support from a professional psychological perspective.

We found that perceived social support was positively related to self-concept among adolescents infected with HIV. The existing literature also suggests that adolescents

infected with HIV who receive more perceived social support report higher levels of self-concept. A survey involving 21 HIV-positive patients in a southern U.S. city reported that a high level of self-concept largely depends on positive social support and interactions [42]. In a 5-year follow-up longitudinal study, Haven et al. found that the greater the perceived social support among adolescents infected with HIV, the higher the psychological adaptation and the higher the self-concept. An international study showed that social support from teachers, classmates, and parents increases the self-concept of HIV-infected adolescents [43]. This was consistent with the findings of our study. In some areas, HIV knowledge is not adequate, and HIV-infected adolescents are often subjected to discrimination and indifference from others, resulting in their fear of being rejected. As a result, HIV-infected adolescents lose self-confidence and their sense of self-concept. Support and care from teachers, classmates, and parents play important roles on the sense of self-concept in HIV-infected adolescents. Therefore, we should increase awareness of how to treat and manage AIDS patients. We should encourage HIV-infected adolescents to interact with others, enhance self-confidence, and actively participate in social activities.

Correlation analyses showed that there was a significant positive correlation between self-concept, positive coping style, and problem-solving among HIV-infected adolescents, which was negatively correlated with negative coping style, such as escape, withdrawal, and inferiority. There are many studies that confirm our conclusion. Pala et al. [44] reported that individuals with active coping strategies

acquire a high self-concept, whereas individuals with passive-avoidant coping styles will have low self-esteem. In a northern California adolescent sample, Mantzicopoulos et al. [45] found that high self-concept was correlated with active-positive coping styles. HIV-infected adolescents are a specific group and they face many more pressures than healthy adolescents. Such pressures will necessitate facing problems, which may result in a negative coping style, such as escapism. The development of a long-term negative coping style is associated with a variety of psychological problems, which affect ones' own evaluation and understanding. Therefore, the development of positive or negative coping style for self-concept is very important. HIV-infected adolescents should be encouraged to adopt positive and active coping strategies which will improve self-confidence, the ability to face setbacks, and self-concept.

We identified four factors which influence the self-concept of HIV-infected adolescents and discussed two aspects of the risk and protective factors, so that future work can develop a two-way intervention. Our findings suggest that we should provide more social support to adolescents so that they can cope with difficulties in a positive way and reduce their feelings of stress, which may contribute to development of the self-concept.

Study Limitations

Some limitations of this study must be acknowledged. First, the sample size of this study was small. HIV-infected adolescents reside in widely dispersed areas. The

survey was conducted in a county of China in Henan province where HIV-infected adolescents are relatively concentrated. Therefore, the findings of the survey can only represent the self-concept of adolescents infected with HIV, but does not represent the entire Henan province or even the entire country. Second, this study was a cross-sectional survey. After investigating the self-concept of HIV-infected adolescents, we also investigated the perceived stress, social support, and coping styles of adolescents infected with HIV. This study only analyzed the relevance between HIV-infected adolescents and self-concept, and cannot explain the deeper causal relationship among variables; further research and analysis are warranted for validation. Third, the assessment of self-concept was carried out using the scale evaluation method, and for HIV-infected adolescents the differences in individual language and verbal cognitive abilities may interfere with the final findings. Fourth, the adolescents we surveyed were all infected from mother-to-child transmission. This may not be representative of the self-consciousness of all HIV-infected adolescents.

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Contributors

YJY and SYK conceived and designed the study, supervised the analysis, and interpreted the data. XXY and XHQ supervised the analysis, interpreted the data, and wrote the preliminary manuscript. ZXQ and LW supervised the data collection by JWZ, WBW, and YWC. SYK performed the test administration, compiled the data, and wrote the preliminary manuscript. All authors contributed to the writing and review of the manuscript and approved the final version. We wish to thank International Science Editing for their help in editing the language of the manuscript. At the same time, we would like to thank the patient advisers for their cooperation and support in this study.

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Competing interests

The authors declare that there are no competing or potential conflicts of interest. No conflict of interest exists in the submission of the manuscript, and the manuscript was approved by all authors for publication. The work described is original research that has not been published previously, and is not under consideration for publication elsewhere, in whole or in part.

Ethical considerations

The research was conducted in accordance with the ethical guidelines of the Declaration of Helsinki and was approved by the Ethics Committee of Harbin Medical University. All participants provided written informed consent having after being informed of the research purpose, meaning, and content. All the adolescents participated voluntarily.

Data sharing statement

No additional data are available.

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1-2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	4-7
Methods			
Study design	4	Present key elements of study design early in the paper	8-9
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	9
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	9
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	9
Bias	9	Describe any efforts to address potential sources of bias	*8*

Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10-11
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	12
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	13
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	14
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	15-16
		(*b*) Report category boundaries when continuous variables were categorized	

		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	19
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	17
Generalisability	21	Discuss the generalisability (external validity) of the study results	18
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	21

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Factors influencing self-concept among adolescents infected with HIV: A cross-sectional survey in China

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Factors influencing self-concept among adolescents infected with HIV: A cross-sectional survey in China

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Abstract

Overview The mental health problems of HIV-infected adolescents are important. It is of great significance to explore which factors can affect the self-evaluation and understanding of HIV-infected adolescents.

Objective We found that HIV-infected adolescents have much less self-concept than healthy adolescents. This study aimed to determine the factors influencing self-concept among human immunodeficiency virus (HIV) infected adolescents in China.

Setting A questionnaire was distributed among two groups totaling to 290 adolescents in Henan Province, China. One hundred forty questionnaires were distributed in the case group (HIV-infected adolescents) and the control group (healthy adolescents) was issued 150 questionnaires.

The Piers-Harris Children's Self-concept Scale, the Perceived Stress Scale, the

Perceived Social Support Scale, and the Simplified Coping Style Questionnaire were adapted for a Chinese population. Differences between the groups were tested for significance using the Student's t-test, and ANOVA was used to test continuous variables. The relationship between environmental personality factors and adolescent self-concept was examined by Pearson correlation analysis. Hierarchical linear regression analysis was used to model the effects of environmental personality factors on self-concept.

Results The self-concept total score among HIV-infected adolescents was significantly lower than normal adolescents ($p<0.05$). Hierarchical regression analysis indicated that age ($\beta=-0.19$, $t=-2.16$, $p=0.03$), perceived stress ($\beta=-0.19$, $t=-2.22$, $p=0.03$), perceived social support ($\beta=0.26$, $t=3.25$, $p=0.00$), positive coping ($\beta=0.50$, $t=5.75$, $p=0.00$), and negative coping ($\beta=-0.45$, $t=-5.33$, $p=0.00$) were significantly associated with self-concept total scores.

Conclusions The self-concept of HIV-infected adolescents is related to perceived stress, perceived social support, and coping style. These findings underline the significance of self-concept among adolescents infected with HIV.

Strengths and limitations of this study

1. This is the first study to determine the factors influencing self-concept among HIV-infected adolescents in China.

2. Although HIV-infected adolescents are a special group, the sample size was suitably powered to allow statistical analysis including hierarchical linear regression.

3. This was a cross-sectional study and thus causal relationships between the self-concept of HIV-infected adolescents and influencing factors require further exploration.

Keywords: adolescence; self-consciousness; AIDS; Hierarchical regression analysis

Introduction

Over the years, AIDS has spread throughout the world at an extremely rapid rate. In 1985, AIDS began to prevail in a few African countries. By 2005, AIDS had affected nearly all countries and regions worldwide[1]. As a result of AIDS, the mortality rate of the adult population has increased significantly[2]. HIV is spread through exposure to HIV-infected blood or other body fluids. The primary transmission modes include contact with an infected person's body fluids during unprotected sex, blood-to-blood exposure (either by direct contact or through needle sharing among injection drug users), and perinatal transmission from infected mother-to-child. The main target of mother-to-child transmission of AIDS is children and adolescents and the inevitable consequence is that a large number of adolescents lose their parents because of AIDS. The typical socioeconomic status of families and individuals in communities with a high incidence of AIDS means that those adolescents who have acquired AIDS through mother-to-child transmission have a visible vulnerability in terms of physical, psychological, and social adaptation[3]. At present, the number of HIV-infected adolescents in China is large and rapidly increasing. Living conditions, social environment, and mental health difficulties are serious problems that have had an enormous impact on the growth and development of HIV-infected adolescents. The

study of Qian and Wang in China in 2007 reported that prejudice and discrimination have a substantial negative impact on the health of HIV-infected adolescents[4]. The mental health difficulties experienced by the children who lost their parents to HIV/AIDS are mainly due to decrease in self-concept and increase in depression[5-7]. All the difficulties described above impact on self-concept among HIV-infected adolescents, and we predict that self-concept in HIV-infected adolescents is lower than in healthy adolescents.

Self-concept is a cognitive assessment of one's own abilities and weaknesses[8] and plays an important role in mental health. Low levels of self-concept are a risk factor of mental health problems. High levels of self-concept are considered to be a protective factor that hinders the development of psychological problems and promotes general health[9-12]. Susan Harter proposed a multi-dimensional model of self-concept from the perspective of developmental psychology and believed that adolescence was a critical period for the development of self-concept[13]. An individual's perception of himself/herself changes significantly during adolescence, or even undergoes a dramatic reversal[14]. In the early stages of puberty, adolescents are more likely to compare themselves with others, and to understand the comparisons and judgment of others to themselves. Adolescents also begin to give higher value to these judgments[15]. Social psychology studies have shown that during and after puberty, children become more self-conscious, more receptive, and more concerned about the opinions of others[16 17]. One developmental psychology study has shown that during and after puberty, an adolescent's self-evaluation becomes more comprehensive and changes from that held

previously[18]. Previous studies have shown that specific groups of adolescents may be vulnerable to lower levels of self-concept than found in normal groups. For example, studies of adolescents with chronic diseases have shown that their level of self-concept is significantly lower than healthy adolescents. Adolescents with chronic diseases often feel insecure, lonely, isolated, and controlled by changes resulting from chronic disease[19 20]. Therefore, we suggest that chronic diseases such as AIDS, will have a serious impact on the self-concept of adolescents. To date, no studies have investigated the self-concept of Chinese HIV-infected adolescents. In China, HIV-infected adolescents represent a large but specific group who have experienced multiple losses throughout their lives, thus increasing their risk of psychopathology[21]. Therefore, studying the development of self-concept among HIV-infected adolescents, and identifying methods to help them maintain psychological well-being and healthy growth is of clear importance.

The formation and development of self-concept is influenced by many factors. It has been shown that teacher-student relationships, peer relationships, parent-child relationships, parenting patterns, perceived stress, perceived social support, and individual coping styles, are all likely to have an impact on self-concept among adolescents[22]. The current study explored the factors which influence the self-concept of HIV-infected adolescents, focusing on both risk and protective factors, and external environment-individual internal characteristics.

A large amount of research data suggest that factors such as perceived stress and perceived social support in the external environment have a significant impact on the

formation and development of self-concept. Perceived stress is the result of the perceptual assessment of an individual's own experience of stress resulting from specific situations or events[23]. People have different perceptions about events that occur, and their psychological response differs. Differences in psychological response will have different effects on mental health. In Africa, the incidence of AIDS is extremely high and adolescents are often in a high-crime and precarious environment[24]. Such an environment may aggravate their sense of pressure, and thus affect their self-concept.

Social support is considered to be an important factor affecting psychological stress and physical health. From a psychological perspective, Cobb suggests that social support includes the following: emotional support; respect and support; and member attribution[25]. Social support can significantly predict the emotional behavior of adolescents, and higher social support has a protective effect on adolescent mental health[26]. Researchers have shown that the relationship between social support and self-concept is stable and positively correlated. There is a difference between social support factors and the correlation between the fractal dimensions of self-concept. Social support for adolescents is primarily derived from parents, teachers, classmates, and friends. Michelle et al.[27] report that the relationship between the frequency of social support and self-concept is significant. Rubin et al.[28] have shown that social support may prevent teenagers with LD (learning disabilities) from mood disorders. LD adolescents who receive more social support from their parents, teachers, and peers, have higher levels of self-concept than adolescents who receive less social support[29].

Barroso[30] concluded that social support is an important factor for adults who are long-term survivors of AIDS. Lack of social support may also cause HIV-infected adolescents to have lower levels of self-concept. Cluver et al.[31] report that orphans in particular may have a lack of social support due to illness or death of family members, thereby distorting their cognitions about themselves and others.

An adolescent's self-concept is not only affected by external environmental factors, but their own internal factors. Individual coping styles and other factors have a significant impact on the emergence and development of self-concept. Coping style refers to the change in cognition and/or or behavior utilized by an individual in a particular stressful situation, with the aim of managing emotions and improving the problem[32]. Individuals adopt specific coping styles and measures according to their own experiences after cognitive assessment of the response process. Coping style has an important impact on the status of an individual's environmental adaptation and mental health[33]. At present, an important research aspect in clinical psychology is the study of the relationship between an individual's coping style, and physical and mental health. Xinyi HU et al.[34] have shown that the clarity of self-awareness or self-concept is related to more active coping behavior. Studies of HIV-infected individuals and their coping styles suggest that a high level of active coping is positively related to immunization measures, and may indirectly affect the self-concept of the AIDS patient [35].

This study was designed to explore the factors which influence the self-concept of HIV-infected adolescents. We investigated the self-concept of HIV-infected adolescents,

considered the environmental and individual levels, and analyzed the relationship between perceived stress, perceived social support, and coping style, and self-concept, in order to better understand the role of self-concept among HIV-infected adolescents. We believe this is the first study of this kind in China.

Methods

Sample size and sampling technique

The current study was conducted in a rural county in Henan province, China, where many residents were infected with HIV through blood collection using inadequate hygiene techniques. This rural county has the highest prevalence of HIV infection in the area. We obtained village-level HIV surveillance data from the anti-epidemic station in each of the counties to identify the villages with the highest number of AIDS-related deaths and confirmed HIV infections. The adolescents we surveyed were all infected by mother-to-child transmission of HIV.

A questionnaire was distributed among two groups of adolescents; 140 questionnaires were distributed in the case group (HIV-infected adolescents) and 139 valid questionnaires were returned (response rate of 99.3%). Among the adolescents in the case group, there were 88 boys (63.3%) and 51 girls (36.7%), and the average age was 15.89 ± 2.8 years. The control group (healthy adolescents) was issued 150 questionnaires, and 144 valid questionnaires were returned (response rate of 96.0%). Among the adolescents in the control group, there were 91 boys (63.2%) and 53 girls (36.8%), and the average age was 13.85 ± 1.2 years. The total number of participants

in this study was therefore 283 adolescents aged 10–20 years and of Han ethnicity. Participation of the adolescents was voluntary, and all provided informed consent.

Procedure

To recruit HIV-infected adolescents, we worked with the town leaders to generate lists of adolescents with confirmed diagnoses of HIV/AIDS. We approached the adolescents on the lists and invited them to participate in the study. After the eligibility of an adolescent was confirmed, the interviewer(s) provided him/her with a detailed description of the study design, potential benefits and risks, confidentiality issues and invited him/her to participate. When an adolescent agreed to be included in the study, the parents of the person were invited to participate by means of letters.

HIV-infected adolescents 10–20 years of age (inclusive) comprised the case group. The healthy children in Shangcai county who were not infected with HIV were compared as the control group. The parents are healthy and the family is complete. Inclusion criteria: age 10-20 years old; It does not meet the definition of children with HIV infection in this study; In the first half of the investigation, the children have been living in Shangcai county. The exclusion criteria were: unconfirmed HIV infection status; The body is unable to participate in severe diseases and cannot participate due to central nervous system problems (such as encephalopathy, epilepsy, etc.).

The research met ethical guidelines according the to the Declaration of Helsinki, and approval was granted by the Ethics Committee of Harbin Medical University. All participants signed informed consent forms after receiving explanations of the research

purpose, meaning, and content. All of the adolescents participated voluntarily. If a child had lost both parents (orphans), we obtained the informed consent of the himself and his guardian.

Patient and Public Involvement

Self-concept is a cognitive assessment of one's own abilities and weaknesses. Self-concept itself is the subjective and internal evaluation of one's self. Therefore, we selected the Piers-Harris Children's Self-concept Scale to measure their self-concept, without the influence of subjective preference on the results. We will send the results to the local CDC in the form of email after we get the results. The CDC informs participants by phone.

Measures

Outcome measures

The Piers-Harris Children's Self-concept Scale is a paper-and-pencil test consisting of 80 items which are scored as true or false. The items are self-descriptive declarative statements. The scores range from 1–80; higher scores indicate higher levels self-concept. The statements are worded in both positive and negative language to control for social desirability responding. The scale has good reliability and validity and the Cronbach's alpha of the scale was 0.858 in the current study.

Stress related to interpersonal stressors was assessed by the Perceived Stress Scale. The scale consists of ten items. Each item has a score range of 0–4, with a possible total score of 40 overall. Higher scores indicate higher levels of stress. The internal

consistency measured by Cronbach's alpha in this study was 0.847.

The Perceived Social Support Scale (PSSS), developed by Zimet et al. consists of 12 items that were revised from three subscales (family, friend, and other support). Participants responded to the items on a 7-point Likert-type scale indicating disagreement/agreement. Each item was divided into a total score for social support. Items were adjusted to be more appropriate for HIV-infected children in the current study. The items "leaders, relatives and colleagues" were changed to "teachers, relatives and students. Cronbach's alpha was 0.887 in this study. We used the Simplified Coping Style Questionnaire (SCSQ) to measure coping style. The SCSQ includes 20 items that contain two dimensions of coping (positive and negative). Each dimension consists of 10 items, and each item is scored on a 5-point scale, where 1 indicates 'certainly not' and 5 indicates 'certainly.' A higher score on one dimension indicates that the individual is more likely to utilize this type of coping style. The questionnaire is highly reliable and suitable for a Chinese population. The Cronbach's alpha for the two independent dimensions of coping were 0.70 and 0.69.

Data analysis

The Statistical Package for Social Sciences 19.0 (SPSS 19.0) program (IBM, Armonk, NY, USA) was used for statistical analysis. All tests were two-tailed and the significance level was set at a $p < 0.05$. Differences between the groups were tested using the Student's t-test and ANOVA was used to test continuous variables. The relationship between environmental personality factors and adolescent self-concept was

examined with Pearson correlation analyses. Hierarchical linear regression analysis was used to model the effects of environmental personality factors on self-concept in adolescents. In the regression model, gender, age, family economic status, and family structure were entered in the first block to control for potential confounding variables. In the second block, perceived stress factors were entered into the model. Third, after controlling for sociodemographic variables and perceived stress factors, perceived social support was entered into the model. Finally, after controlling for sociodemographic variables, perceived stress factors, and perceived social support, coping style was entered into the model.

Results

Study population

Adolescents were asked to report on individual and family characteristics including age, gender, family economic status (i.e., good, moderate, and poor), and family structure (intact/non-intact).

Comparison of self-concept between the Case group and control group

The self-concept levels of HIV-infected adolescents were significantly lower than healthy adolescents ($p < 0.05$; Table 1).

Table 1. Comparison of the levels of self-concept between HIV-infected and control adolescents

	HIV-infected adolescents	Healthy adolescents	t	p

	(N = 139)	(N = 144)		
Self-concept score	51.55	60.22	−9.37	0.00**

Sociodemographic data and self-concept total scores by different sociodemographic variables

Of the 139 participants, 88 were males and 51 were females. The number of participants in each age group was as follows: 8–13 years, 28; 13–16 years, 80; and 16–18 years, 31. The family economic status was as follows: good, 48; moderate, 79; and poor, 12. Fifty-seven and eighty-two HIV-infected adolescents did and did not have an intact family structure, respectively. No significant differences in self-concept total scores existed between gender, age, family economic status, or family structure (Table 2).

Table 2. Participants' socio-demographic data and self-concept total scores by socio-demographic variables

	Group	N (%)	Self-concept score	F/t	p
Gender				0.08	0.78
	Male	88 (63.3)	52.08 ± 10.71		
	Female	51 (36.7)	50.65 ± 11.27		
Age				1.44	0.24
	8-13	28 (20.1)	53.43 ± 11.86		
	13-16	80 (57.6)	50.21 ± 10.67		
	16-18	31 (22.3)	53.32 ± 10.44		
Family economic status				2.74	0.07

	Good	48 (34.5)	50.46 ± 10.03		
	Moderate	79 (56.8)	51.18 ± 11.38		
	Poor	12 (8.6)	58.42 ± 10.90		
Family structure				0.18	0.67
	Intact	82 (59.0)	52.63 ± 10.46		
	Non-intact	57 (41.0)	50.00 ± 11.42		

Relationship between perceived stress, perceived social support, coping style factors, and self-concept total scores

We collected self-concept total scores for perceived stress, perceived social support, and coping style factors in HIV-infected adolescents (Table 3). Statistically significant linear relationships existed among perceived stress, perceived social support, coping style factors, and the self-concept total scores of HIV-infected adolescents ($p < 0.05$). Among these variables, perceived stress ($r = –0.23$, $p<0.05$) and negative coping ($r = –0.26$, $p < 0.05$) were negatively related to the self-concept total scores. Conversely, perceived social support ($r = 0.28$, $p < 0.05$) and positive coping ($r = 0.25$, $p <0 .05$) were positively associated with self-concept total scores.

Table 3. Correlations among perceived stress, perceived social support, coping style factors, and self-concept total scores

	Perceived stress	Perceived social support	Positive coping	Negative coping
Self-concept	−0.23**	0.28**	0.25**	−0.26**

Hierarchical linear regression analysis of the relationship among perceived stress, perceived social support, coping style factors, and self-concept total scores

Eight variables accounted for 37.0% of the total variance of the self-concept total scores (Table 4). The control variables accounted for 7% of the variance in the self-concept total scores (F change = 2.46), and among the control variables, age (β = −0.19, t = −2.16, p = 0.03) was significantly associated with the self-concept total scores. With inclusion of the perceived stress variable, the variance which could be explained increased to 10%. The variance in self-concept total scores (F change = 4.91) and perceived stress (β = −0.19, t = −2.22, p = 0.03) was significantly associated with the self-concept total scores. Adding the perceived social support factor contributed to an additional 7% of the variance in the self-concept total scores (F change = 10.55), and perceived social support (β = 0.26, t= 3.25, p = 0.00) was significantly associated with the self-concept total scores. Finally, adding the positive and negative coping factors contributed to an additional 20% of the variance in the self-concept total scores (F change = 21.00). Positive (β = 0.50, t= 5.75, p = 0.00) and negative coping (β = −0.45, t= −5.33, p = 0.00) were significantly associated with the self-concept total scores.

Table 4. Hierarchical linear regression analysis of the relationships among perceived stress, perceived social support, coping style factors, and self-concept total scores

		β	t	p	F change	R^2	R^2 change
Step 1					2.46	0.07	0.07
	Gender	−0.08	−0.98	0.33			
	Age	−0.19	−2.16	0.03			

	Family economic status	0.10	1.10	0.27			
	Family structure	0.11	1.31	0.19			
Step 2					4.91	0.10	0.03
	Gender	−0.10	−1.17	0.24			
	Age	−0.12	−1.37	0.17			
	Family economic status	0.10	1.19	0.24			
	Family structure	0.10	1.14	0.26			
	Perceived stress	−0.19	−2.22	0.03			
Step 3					10.55	0.17	0.07
	Gender	−0.11	−1.36	0.18			
	Age	0.13	−1.55	0.12			
	Family economic status	0.06	0.73	0.47			
	Family structure	0.09	1.16	0.25			
	Perceived stress	−0.18	−2.12	0.04			
	Perceived social support	0.26	3.25	0.00			
Step 4					21.00	0.37	0.20
	Gender	−0.13	−1.76	0.08			
	Age	−0.15	−1.98	0.05			
	Family economic status	0.05	0.64	0.52			
	Family structure	0.07	0.91	0.36			
	Perceived stress	−0.17	−2.20	0.03			
	Perceived social support	0.15	2.06	0.04			
	Positive coping	0.50	5.75	0.00			
	Negative coping	−0.45	−5.33	0.00			

Discussion

This study was the first to explore the factors which influence self-concept among

adolescents in China infected with HIV. We selected a group of HIV-infected adolescents, and analyzed the risk and protective factors. The purpose of this study was to determine whether perceived stress, perceived social support, and coping style are related to the self-concept of adolescents with HIV. The overall results confirmed that age, perceived stress, perceived social support, and coping style factors were associated with self-concept in adolescents with HIV. Specifically, younger age, lower perceived stress, and lower levels of negative coping were associated with higher levels of self-concept among adolescents with HIV. Conversely, higher perceived social support and more positive coping were positively correlated with the self-concept of adolescents with HIV. These findings highlight the significance of these factors on the self-concept of adolescents with HIV.

Our results showed that age significantly influenced the self-concept of adolescents with HIV. Developmental psychology has shown that the children's self-concept changes dramatically during adolescence and increases significantly with age[36]. Our findings showed that the older the adolescents with HIV, the lower the level of self-concept. We concluded that for this group of adolescents, with age, some drop out of school due to illness, face the change in the behavior of their parents, and even death. Adolescents lose confidence as part of their experience of disease along with increased social stress, thus older adolescents with HIV have lower self-concept levels.

Our findings showed that perceived stress is negatively related to self-concept in adolescents with HIV. This finding was similar to previous studies. At present, there was no research on the relationship between self-concept and perceived stress of

adolescents with HIV. Civitci et al.[37] and Hoffman et al.[38] report high negative correlations between self-concept and perceived stress in adolescents. A study in China also showed that the intensity of perceived stress was significantly correlated with the level of self-concept, which was consistent with the results of our study conducted in adolescents with HIV[39]. Because of the lethality of AIDS and disease-related social discrimination, people with HIV are often subject to great psychological stress[40 41]. Adolescents with HIV not only face the long-term psychological pain of losing parents, but also continue to face a variety of external stressors. These causes can lead to higher perceived stress of adolescents with HIV than experienced by healthy adolescents, thus their self-concept tends to be low. Therefore, in the education of families and schools with HIV-infected adolescents, we should teach them how to best manage and deal with stress, and how to increase their level of self-concept. We should mainly encourage them to develop their ability to resist pressure and self-regulation. The society should provide HIV-infected adolescents with social support from a professional psychological perspective.

We found that perceived social support was positively related to self-concept among adolescents infected with HIV. The existing literature also suggests that adolescents infected with HIV who receive more perceived social support report higher levels of self-concept. A survey involving 21 HIV-positive patients in a southern U.S. city reported that a high level of self-concept largely depends on positive social support and interactions[42]. In a 5-year follow-up longitudinal study, Haven et al. found that the greater the perceived social support among adolescents infected with HIV, the higher

the psychological adaptation and the higher the self-concept. An international study showed that social support from teachers, classmates, and parents increases the self-concept of HIV-infected adolescents[43]. This was consistent with the findings of our study. In some areas, HIV knowledge is not adequate, and HIV-infected adolescents are often subjected to discrimination and indifference from others, resulting in their fear of being rejected. As a result, HIV-infected adolescents lose self-confidence and their sense of self-concept. Support and care from teachers, classmates, and parents play important roles on the sense of self-concept in HIV-infected adolescents. Therefore, we should increase awareness of how to treat and manage AIDS patients. We should encourage HIV-infected adolescents to interact with others, enhance self-confidence, and actively participate in social activities.

Correlation analyses showed that there was a significant positive correlation between self-concept, positive coping style, and problem-solving among HIV-infected adolescents, which was negatively correlated with negative coping style, such as escape, withdrawal, and inferiority. There are many studies that confirm our conclusion. Pala et al.[44] reported that individuals with active coping strategies acquire a high self-concept, whereas individuals with passive-avoidant coping styles will have low self-esteem. In a northern California adolescent sample, Mantzicopoulos et al.[45] found that high self-concept was correlated with active-positive coping styles. HIV-infected adolescents are a specific group and they face many more pressures than healthy adolescents. Such pressures will necessitate facing problems, which may result in a negative coping style, such as escapism. The development of a long-term negative

coping style is associated with a variety of psychological problems, which affect ones' own evaluation and understanding. Therefore, the development of positive or negative coping style for self-concept is very important. HIV-infected adolescents should be encouraged to adopt positive and active coping strategies which will improve self-confidence, the ability to face setbacks, and self-concept.

We identified four factors which influence the self-concept of HIV-infected adolescents and discussed two aspects of the risk and protective factors, so that future work can develop a two-way intervention. Our findings suggest that we should provide more social support to adolescents so that they can cope with difficulties in a positive way and reduce their feelings of stress, which may contribute to development of the self-concept.

Study Limitations

Some limitations of this study must be acknowledged. First, the sample size of this study was small. HIV-infected adolescents reside in widely dispersed areas. The survey was conducted in a county of China in Henan province where HIV-infected adolescents are relatively concentrated. Therefore, the findings of the survey can only represent the self-concept of adolescents infected with HIV, but does not represent the entire Henan province or even the entire country. Second, this study was a cross-sectional survey. After investigating the self-concept of HIV-infected adolescents, we also investigated the perceived stress, social support, and coping styles of adolescents infected with HIV. This study only analyzed the relevance between HIV-infected adolescents and self-

concept, and cannot explain the deeper causal relationship among variables; further research and analysis are warranted for validation. Third, the assessment of self-concept was carried out using the scale evaluation method, and for HIV-infected adolescents the differences in individual language and verbal cognitive abilities may interfere with the final findings. Fourth, the adolescents we surveyed were all infected from mother-to-child transmission. This may not be representative of the self-consciousness of all HIV-infected adolescents.

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Contributors

YJY and SYK conceived and designed the study, supervised the analysis, and interpreted the data. XXY and XHQ supervised the analysis, interpreted the data, and wrote the preliminary manuscript. ZXQ, XJS and EYZ supervised the data collection

by JWZ, WBW, and YWC. SYK performed the test administration, compiled the data, and wrote the preliminary manuscript. All authors contributed to the writing and review of the manuscript and approved the final version. We wish to thank International Science Editing for their help in editing the language of the manuscript. At the same time, we would like to thank the patient advisers for their cooperation and support in this study.

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Competing interests

The authors declare that there are no competing or potential conflicts of interest. No conflict of interest exists in the submission of the manuscript, and the manuscript was approved by all authors for publication. The work described is original research that has not been published previously, and is not under consideration for publication elsewhere, in whole or in part.

Ethical considerations

The research was conducted in accordance with the ethical guidelines of the Declaration of Helsinki and was approved by the Ethics Committee of Harbin Medical University. All participants provided written informed consent having after being informed of the research purpose, meaning, and content. All the adolescents participated voluntarily.

Data sharing statement

No additional data are available.

License statement

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1-2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	4-7
Methods			
Study design	4	Present key elements of study design early in the paper	8-9
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	9
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	9
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	9
Bias	9	Describe any efforts to address potential sources of bias	*8*

Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10-11
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	12
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	13
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	14
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	15-16
		(*b*) Report category boundaries when continuous variables were categorized	

		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	19
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	17
Generalisability	21	Discuss the generalisability (external validity) of the study results	18
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	21

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.

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Factors influencing self-concept among adolescents infected with HIV: A cross-sectional survey in China

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Factors influencing self-concept among adolescents infected with HIV: A cross-sectional survey in China

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Abstract

Overview: The mental health problems of adolescents with human immunodeficiency virus (HIV) are important. It is of great significance to explore which factors can affect the self-evaluation and understanding of adolescents with HIV.

Objective: We found that adolescents with HIV have a lower level of self-concept than healthy adolescents. This study aimed to determine the factors influencing self-concept among adolescents with HIV in China.

Setting: A questionnaire was distributed among a total of 290 adolescents in Henan Province, China. One hundred and forty questionnaires were distributed in the case group (adolescents with HIV) and the control group (healthy adolescents) was issued 150 questionnaires.

The Piers-Harris Children's Self-concept Scale, the Perceived Stress Scale, the

Perceived Social Support Scale, and the Simplified Coping Style Questionnaire were adapted for a Chinese population. Differences between the groups were tested for significance using Student's t-test, and ANOVA was used to test continuous variables. The relationship between environmental personality factors and adolescent self-concept was examined by Pearson correlation analysis. Hierarchical linear regression analysis was used to model the effects of environmental personality factors on self-concept.

Results: The self-concept total score among adolescents with HIV was significantly lower than healthy adolescents ($p<0.05$). Hierarchical regression analysis indicated that age ($\beta=-0.19$, $t=-2.16$, $p=0.03$), perceived stress ($\beta=-0.19$, $t=-2.22$, $p=0.03$), perceived social support ($\beta=0.26$, $t=3.25$, $p=0.00$), positive coping style ($\beta=0.50$, $t=5.75$, $p=0.00$), and negative coping style ($\beta=-0.45$, $t=-5.33$, $p=0.00$) were significantly associated with self-concept total scores.

Conclusions: The self-concept of adolescents with HIV is related to perceived stress, perceived social support, and coping style. These findings underline the significance of self-concept among adolescents infected with HIV.

Strengths and limitations of this study

1. This is the first study to determine the factors influencing self-concept among adolescents with HIV in China.

2. Although adolescents with HIV are a special group, the sample size was suitably powered to allow statistical analysis including hierarchical linear regression.

3. This was a cross-sectional study and thus causal relationships between the self-concept of adolescents with HIV and influencing factors require further exploration.

Keywords: adolescence; self-concept; AIDS; hierarchical regression analysis

Introduction

Over the years, AIDS has spread throughout the world at an extremely rapid rate. In 1985, AIDS began to spread in a few African countries. By 2005, AIDS had affected nearly all countries and regions worldwide[1]. As a result of AIDS, the mortality rate of the adult population has increased significantly[2]. HIV is spread through exposure to HIV-infected blood or other body fluids. The primary transmission modes include contact with an infected person's body fluids during unprotected sex, blood-to-blood exposure (either by direct contact or through needle sharing among injection drug users), and perinatal transmission from infected mother to child. The main target of mother-to-child transmission of AIDS is children and adolescents and the inevitable consequence is that a large number of adolescents lose their parents because of AIDS. The typical socioeconomic status of families and individuals in communities with a high incidence of AIDS means that those adolescents who have acquired AIDS through mother-to-child transmission have a visible vulnerability in terms of physical, psychological, and social adaptation[3]. At present, the number of adolescents with HIV in China is large and rapidly increasing. Living conditions, social environment, and mental health difficulties are serious problems that have had an enormous impact

on the growth and development of adolescents with HIV. The study of Qian and Wang in China in 2007 reported that prejudice and discrimination have a substantial negative impact on the health of adolescents with HIV[4]. The mental health difficulties experienced by the children who lost their parents to HIV/AIDS are mainly due to a decrease in self-concept and an increase in depression[5-7]. All the difficulties described above impact on self-concept among adolescents with HIV, and we predict that self-concept in adolescents with HIV is lower than in healthy adolescents.

Self-concept is a cognitive assessment of one's own abilities and weaknesses[8] and plays an important role in mental health. Low levels of self-concept are a risk factor of mental health problems. High levels of self-concept are considered to be a protective factor that hinders the development of psychological problems and promotes general health[9-12]. Harter proposed a multi-dimensional model of self-concept from the perspective of developmental psychology and believed that adolescence was a critical period for the development of self-concept[13]. An individual's perception of himself/herself changes significantly during adolescence, or even undergoes a dramatic reversal[14]. In the early stages of puberty, adolescents are more likely to compare themselves with others, and to consider how they are perceived and judged by others. Adolescents also begin to give higher value to these judgments[15]. Social psychology studies have shown that during and after puberty, children become more self-conscious, more receptive, and more concerned about the opinions of others[16 17]. One developmental psychology study has shown that

during and after puberty, an adolescent's self-evaluation becomes more comprehensive and changes from that held previously[18]. Previous studies have shown that specific groups of adolescents may be vulnerable to lower levels of self-concept than found in normal groups. For example, studies of adolescents with chronic diseases have shown that their level of self-concept is significantly lower than healthy adolescents. Adolescents with chronic diseases often feel insecure, lonely, isolated, and controlled by changes resulting from chronic disease[19 20]. Therefore, we suggest that chronic diseases such as AIDS, will have a serious impact on the self-concept of adolescents. To date, no studies have investigated the self-concept of Chinese adolescents with HIV. In China, adolescents with HIV represent a large but specific group who have experienced multiple losses throughout their lives, thus increasing their risk of psychopathology[21]. Therefore, studying the development of self-concept among adolescents with HIV, and identifying methods to help them maintain psychological well-being and healthy growth is of clear importance.

The formation and development of self-concept is influenced by many factors. It has been shown that teacher-student relationships, peer relationships, parent-child relationships, parenting patterns, perceived stress, perceived social support, and individual coping styles, are all likely to have an impact on self-concept among adolescents[22]. The current study explored the factors which influence the self-concept of adolescents with HIV, focusing on both risk and protective factors, and external environment-individual internal characteristics.

A large body of research suggests that factors such as perceived stress and perceived

social support in the external environment have a significant impact on the formation and development of self-concept. Perceived stress is the result of the perceptual assessment of an individual's own experience of stress resulting from specific situations or events[23]. People have different perceptions about events that occur, and their psychological response differs. Differences in psychological response will have different effects on mental health. In Africa, the incidence of AIDS is extremely high and adolescents are often in a high-crime and precarious environment[24]. Such an environment may aggravate their sense of pressure, and thus affect their self-concept.

Social support is considered to be an important factor affecting psychological stress and physical health. From a psychological perspective, Cobb suggests that social support includes the following: emotional support; respect and support; and member attribution[25]. Social support can significantly predict the emotional behavior of adolescents, and higher social support has a protective effect on adolescent mental health[26]. Researchers have shown that the relationship between social support and self-concept is stable and positively correlated. There is a difference between social support factors and the correlation between the fractal dimensions of self-concept. Social support for adolescents is primarily derived from parents, teachers, classmates, and friends. Michelle et al.[27] report that the relationship between the frequency of social support and self-concept is significant. Rubin et al.[28] have shown that social support may prevent teenagers with learning disabilities (LD) from mood disorders. adolescents with LD who receive more social support from their parents, teachers, and

peers, have higher levels of self-concept than adolescents who receive less social support[29]. Barroso[30] concluded that social support is an important factor for adults who are long-term survivors of AIDS. Lack of social support may also cause adolescents with HIV to have lower levels of self-concept. Cluver et al.[31] report that orphans in particular may have a lack of social support due to illness or death of family members, thereby distorting their cognitions about themselves and others.

An adolescent's self-concept is not only affected by external environmental factors, but their own internal factors. Individual coping styles and other factors have a significant impact on the emergence and development of self-concept. Coping style refers to the change in cognition and/or behavior utilized by an individual in a particular stressful situation, with the aim of managing emotions and improving the problem[32]. Individuals adopt specific coping styles and measures according to their own experiences after cognitive assessment of the response process. Coping style has an important impact on the status of an individual's environmental adaptation and mental health[33]. At present, an important research aspect in clinical psychology is the study of the relationship between an individual's coping style, and physical and mental health. Xinyi et al.[34] have shown that the clarity of self-awareness or self-concept is related to more active coping behavior. Studies of HIV-infected individuals and their coping styles suggest that a high level of active coping is positively related to immunization measures, and may indirectly affect the self-concept of the AIDS patient [35].

This study was designed to explore the factors which influence the self-concept of

adolescents with HIV. We investigated the self-concept of adolescents with HIV, considered the environmental and individual levels, and analyzed the relationship between perceived stress, perceived social support, coping style, and self-concept, in order to better understand the role of self-concept among adolescents with HIV. We believe this is the first study of this kind in China.

Methods

Sample size and sampling technique

The current study was conducted in a rural county in Henan province, China, where many residents were infected with HIV through blood collection using inadequate hygiene techniques. This rural county has the highest prevalence of HIV infection in the area. We obtained village-level HIV surveillance data from the anti-epidemic station in each of the counties to identify the villages with the highest number of AIDS-related deaths and confirmed HIV infections. The adolescents we surveyed were all infected by mother-to-child transmission of HIV.

A questionnaire was distributed among two groups of adolescents; 140 questionnaires were distributed in the case group (adolescents with HIV) and 139 valid questionnaires were returned (response rate of 99.3%). Among the adolescents in the case group, there were 88 boys (63.3%) and 51 girls (36.7%), and the average age was 15.89 ± 2.8 years. The control group (healthy adolescents) was issued 150 questionnaires, and 144 valid questionnaires were returned (response rate of 96.0%). Among the adolescents in the control group, there were 91 boys (63.2%) and 53 girls

(36.8%), and the average age was 13.85 ± 1.2 years. The total number of participants in this study was therefore 283 adolescents aged 10–20 years and of Han ethnicity. Participation of the adolescents was voluntary, and all provided informed consent.

Procedure

To recruit adolescents with HIV, we worked with the town leaders to generate lists of adolescents with confirmed diagnoses of HIV/AIDS. We approached the adolescents on the lists and invited them to participate in the study. We contacted the headmasters of local schools with the help of the Center for Disease Control and the Prevention(CDC) officer. The headmasters in each school called the adolescents with HIV together. To protect participants' privacy, the headmasters worked with adolescents to come up with an individualized plan for assessment in terms of the preferable time and place for them to feel comfortable to meet with the researchers. After the eligibility of an adolescent was confirmed, the interviewer(s) provided him/her with a detailed description of the study design, potential benefits and risks, confidentiality issues and invited him/her to participate. On the premise of ensuring no harm to the adolescents, we first obtained the informed consent of the guardian of the teenagers, and then the informed consent of the adolescents themselves. Informed written consent was sought from the adolescents and their guardians. If a child had lost both parents (i.e. in the case of orphans), we obtained the informed consent from the child and his guardian.

Adolescents with HIV, from 10 to 20 (inclusive) years of age comprised the case

group. The healthy adolescents in Shangcai county who were not infected with HIV were used as the control group. Their parents were healthy and the family was complete. Inclusion criteria: age 10–20 years old; the patient meets the definition in this study of an adolescent with HIV; in the first half of the investigation, the adolescents have been living in Shangcai county. The exclusion criteria were: unconfirmed HIV infection status; the patient is too ill to participate in the study.

The research met ethical guidelines according to the Declaration of Helsinki, and approval was granted by the Ethics Committee of Harbin Medical University. The interviewers were trained education and psychology graduate students. It took about 1h to complete the entire assessment inventory, including taking breaks. The questionnaires were collected immediately when completed. We checked the questionnaires to avoid errors and ensure data quality and provided a gift as a token of appreciation for participation. All participants signed informed consent forms after receiving explanations of the research purpose, meaning, and content. All of the adolescents participated voluntarily.

Patient and public involvement

Self-concept is a cognitive assessment of one’ s own abilities and weaknesses. Self-concept itself is the subjective and internal evaluation of one's self. Therefore, we selected the Piers-Harris Children's Self-concept Scale to measure their self-concept, without the influence of subjective preference on the results. We have sent the results to the local CDC（Chinese Center for Disease Control and Prevention） in the form

of email after we get the results. The CDC informs participants by phone.

Measures

Outcome measures

The Piers-Harris Children's Self-concept Scale is a paper-and-pencil test consisting of 80 items which are scored as either true or false. The items are self-descriptive declarative statements. The scores range from 1–80; higher scores indicate higher levels of self-concept. The statements are worded in both positive and negative language to control for social desirability responding. The scale has good reliability and validity and the Cronbach's alpha of the scale was 0.858 in the current study.

Stress related to interpersonal stressors was assessed by the Perceived Stress Scale. The scale consists of ten items. Each item has a score range of 0–4, with a possible total score of 40. Higher scores indicate higher levels of stress. The internal consistency measured by Cronbach's alpha in this study was 0.847.

The Perceived Social Support Scale (PSSS), developed by Zimet et al. consists of 12 items that were revised from three subscales (family, friend, and other support). Participants responded to the items on a 7-point Likert-type scale indicating disagreement/agreement. Each item was divided into a total score for social support. Items were adjusted to be more appropriate for children with HIV in the current study. The items "leaders, relatives and colleagues" were changed to "teachers, relatives and students. Cronbach's alpha was 0.887 in this study. We used the Simplified Coping Style Questionnaire (SCSQ) to measure coping style. The SCSQ includes 20 items

that contain two dimensions of coping (positive and negative). Each dimension consists of 10 items, and each item is scored on a 5-point scale, where 1 indicates 'certainly not' and 5 indicates 'certainly.' A higher score on one dimension indicates that the individual is more likely to utilize this type of coping strategy. The questionnaire is highly reliable and suitable for a Chinese population. The Cronbach's alpha for the two independent dimensions of coping were 0.70 and 0.69.

Data analysis

The Statistical Package for Social Sciences 19.0 (SPSS 19.0) program (IBM, Armonk, NY, USA) was used for statistical analysis. All tests were two-tailed and the significance level was set at a $p < 0.05$. Differences between the groups were tested using Student's t-test and ANOVA was used to test continuous variables. The relationship between environmental personality factors and adolescent self-concept was examined using Pearson correlation analyses. Hierarchical linear regression analysis was used to model the effects of environmental personality factors on self-concept in adolescents. In the regression model, gender, age, family economic status, and family structure were entered in the first block to control for potential confounding variables. In the second block, perceived stress factors were entered into the model. Third, after controlling for sociodemographic variables and perceived stress factors, perceived social support was entered into the model. Finally, after controlling for sociodemographic variables, perceived stress factors, and perceived social support, coping style was entered into the model.

Results

Study population

Adolescents were asked to report on individual and family characteristics including age, gender, family economic status (i.e., good, moderate, and poor), and family structure (intact/non-intact).

Comparison of self-concept between the case group and control group

The self-concept levels of adolescents with HIV were significantly lower than healthy adolescents ($p < 0.05$; Table 1).

Table 1. Comparison of the levels of self-concept between HIV-infected and control adolescents

	Adolescents with HIV (N = 139)	Healthy adolescents (N = 144)	t	p
Self-concept score	51.55	60.22	−9.37	0.00**

Sociodemographic data and self-concept total scores by different sociodemographic variables

Of the 139 participants, 88 were males and 51 were females. The number of participants in each age group was as follows: 8–13 years, 28; 13–16 years, 80; and 16–18 years, 31. The family economic status was as follows: good, 48; moderate, 79; and poor, 12. Fifty-seven and eighty-two adolescents with HIV did and did not have an intact family structure, respectively. No significant differences in self-concept total

scores existed between gender, age, family economic status, or family structure (Table 2).

Table 2. Participants' socio-demographic data and self-concept total scores by socio-demographic variables

	Group	N (%)	Self-concept score	F/t	p
Gender				0.08	0.78
	Male	88 (63.3)	52.08 ± 10.71		
	Female	51 (36.7)	50.65 ± 11.27		
Age				1.44	0.24
	8–13	28 (20.1)	53.43 ± 11.86		
	13–16	80 (57.6)	50.21 ± 10.67		
	16–18	31 (22.3)	53.32 ± 10.44		
Family economic status				2.74	0.07
	Good	48 (34.5)	50.46 ± 10.03		
	Moderate	79 (56.8)	51.18 ± 11.38		
	Poor	12 (8.6)	58.42 ± 10.90		
Family structure				0.18	0.67
	Intact	82 (59.0)	52.63 ± 10.46		
	Non-intact	57 (41.0)	50.00 ± 11.42		

Relationship between perceived stress, perceived social support, coping style factors, and self-concept total scores

We collected self-concept total scores for perceived stress, perceived social support,

and coping style factors in adolescents with HIV (Table 3). Statistically significant linear relationships existed among perceived stress, perceived social support, coping style factors, and the self-concept total scores of adolescents with HIV ($p < 0.05$). Among these variables, perceived stress ($r = –0.23$, $p < 0.05$) and negative coping style ($r = –0.26$, $p < 0.05$) were negatively related to the self-concept total scores. Conversely, perceived social support ($r = 0.28$, $p < 0.05$) and positive coping style ($r = 0.25$, $p < 0.05$) were positively associated with self-concept total scores.

Table 3. Correlations among perceived stress, perceived social support, coping style factors, and self-concept total scores

	Perceived stress	Perceived social support	Positive coping style	Negative coping style
Self-concept	−0.23**	0.28**	0.25**	−0.26**

Hierarchical linear regression analysis of the relationship among perceived stress, perceived social support, coping style factors, and self-concept total scores

Eight variables accounted for 37.0% of the total variance of the self-concept total scores (Table 4). The control variables accounted for 7% of the variance in the self-concept total scores (F change = 2.46), and among the control variables, age ($\beta = −0.19$, $t = −2.16$, $p = 0.03$) was significantly associated with the self-concept total scores. By including the perceived stress variable, the variance which could be explained increased to 10%. The variance in self-concept total scores (F change = 4.91) and perceived stress ($\beta = −0.19$, $t = −2.22$, $p = 0.03$) was significantly associated

with the self-concept total scores. Adding the perceived social support factor contributed to an additional 7% of the variance in the self-concept total scores (F change = 10.55), and perceived social support (β = 0.26, t= 3.25, p = 0.00) was significantly associated with the self-concept total scores. Finally, adding the positive and negative coping factors contributed to an additional 20% of the variance in the self-concept total scores (F change = 21.00). Positive (β = 0.50, t= 5.75, p = 0.00) and negative coping styles (β = −0.45, t= −5.33, p = 0.00) were significantly associated with the self-concept total scores.

Table 4. Hierarchical linear regression analysis of the relationships among perceived stress, perceived social support, coping style factors, and self-concept total scores

		β	t	p	F change	R^2	R^2 change
Step 1					2.46	0.07	0.07
	Gender	−0.08	−0.98	0.33			
	Age	−0.19	−2.16	0.03			
	Family economic status	0.10	1.10	0.27			
	Family structure	0.11	1.31	0.19			
Step 2					4.91	0.10	0.03
	Gender	−0.10	−1.17	0.24			
	Age	−0.12	−1.37	0.17			
	Family economic status	0.10	1.19	0.24			
	Family structure	0.10	1.14	0.26			
	Perceived stress	−0.19	−2.22	0.03			
Step 3					10.55	0.17	0.07
	Gender	−0.11	−1.36	0.18			
	Age	0.13	−1.55	0.12			

	Family economic status	0.06	0.73	0.47			
	Family structure	0.09	1.16	0.25			
	Perceived stress	−0.18	−2.12	0.04			
	Perceived social support	0.26	3.25	0.00			
Step 4					21.00	0.37	0.20
	Gender	−0.13	−1.76	0.08			
	Age	−0.15	−1.98	0.05			
	Family economic status	0.05	0.64	0.52			
	Family structure	0.07	0.91	0.36			
	Perceived stress	−0.17	−2.20	0.03			
	Perceived social support	0.15	2.06	0.04			
	Positive coping style	0.50	5.75	0.00			
	Negative coping style	−0.45	−5.33	0.00			

Discussion

This study was the first to explore the factors which influence self-concept among adolescents in China infected with HIV. We selected a group of adolescents with HIV, and analyzed the risk and protective factors. The purpose of this study was to determine whether perceived stress, perceived social support, and coping style are related to the self-concept of adolescents with HIV. The overall results confirmed that age, perceived stress, perceived social support, and coping style factors were associated with self-concept in adolescents with HIV. Specifically, younger age, lower perceived stress, and lower levels of negative coping styles were associated with higher levels of self-concept among adolescents with HIV. Conversely, higher perceived social support and more positive coping styles were positively correlated

with the self-concept of adolescents with HIV. These findings highlight the significance of these factors on the self-concept of adolescents with HIV.

Our results showed that age significantly influenced the self-concept of adolescents with HIV. Developmental psychology has shown that the children's self-concept changes dramatically during adolescence and increases significantly with age[36]. Our findings showed that the older the adolescents with HIV, the lower the level of self-concept. We concluded that for this group of adolescents, with age, some drop out of school due to illness, face the fear of disease, even social pressure and discrimination Adolescents lose confidence as part of their experience of disease along with increased social stress, thus older adolescents with HIV have lower self-concept levels.

Our findings showed that perceived stress is negatively related to self-concept in adolescents with HIV. This finding was similar to related previous studies, although none of which examined the relationship between self-concept and perceived stress of adolescents with HIV. Civitci et al.[37] and Hoffman et al.[38] report high negative correlations between self-concept and perceived stress in adolescents. A study in China also showed that the intensity of perceived stress was significantly correlated with the level of self-concept, which was consistent with the results of our study conducted in adolescents with HIV[39]. Because of the lethality of AIDS and disease-related social discrimination, people with HIV are often subject to great psychological stress[40 41]. Adolescents with HIV not only face the long-term psychological pain of losing parents, but also continue to face a variety of external

stressors. These factors can lead to higher perceived stress of adolescents with HIV than that experienced by healthy adolescents, thus their self-concept tends to be lower. Therefore, in the education of families and schools with adolescents with HIV, we should teach them how to best manage and deal with stress, and how to increase their level of self-concept. We should mainly encourage them to develop their resilience. The society should provide adolescents who have HIV with social support from a professional psychological perspective.

We found that perceived social support was positively related to self-concept among adolescents infected with HIV. The existing literature also suggests that adolescents infected with HIV who receive more perceived social support report higher levels of self-concept. A survey involving 21 HIV-positive patients in a southern U.S. city reported that a high level of self-concept largely depends on positive social support and interactions[42]. In a 5-year follow-up longitudinal study, Haven et al. found that the greater the perceived social support among adolescents infected with HIV, the higher the psychological adaptation and the higher the self-concept. An international study showed that social support from teachers, classmates, and parents increases the self-concept of adolescents with HIV[43]. This was consistent with the findings of our study. In some areas, HIV knowledge is not adequate, and adolescents with HIV are often subjected to discrimination and indifference from others, resulting in their fear of being rejected. As a result, adolescents with HIV lose self-confidence and their sense of self-concept suffers. Therefore, we should increase awareness of how to treat and manage AIDS patients. We should encourage adolescents with HIV to interact

with others, enhance self-confidence, and actively participate in social activities.

Correlation analyses showed that there was a significant positive correlation between self-concept, positive coping style, and problem-solving among adolescents with HIV, which was negatively correlated with negative coping style, such as escape, withdrawal, and inferiority. There are many studies that support our conclusion. Pala et al.[44] reported that individuals with active coping strategies acquire a high self-concept, whereas individuals with passive-avoidant coping styles will have low self-esteem. In a northern California adolescent sample, Mantzicopoulos et al.[45] found that high self-concept was correlated with active-positive coping styles. Adolescents with HIV are a specific group and they face many more pressures than healthy adolescents. Such pressures will necessitate facing problems, which may result in a negative coping style, such as escapism. The development of a long-term negative coping style is associated with a variety of psychological problems, which can affect an individual's self-evaluation and understanding. Therefore, the development of a positive or negative coping style for self-concept is very important. Adolescents with HIV should be encouraged to adopt positive and active coping strategies which will improve self-confidence, resilience, and self-concept.

We identified four factors which influence the self-concept of adolescents with HIV and discussed two aspects of the risk and protective factors, so that future work can develop a two-way intervention. Our findings suggest that we should provide more social support to adolescents with HIV so that they can cope with difficulties in a positive way and reduce their feelings of stress, which may lead to improvements in

their self-concept.

Study limitations

Some limitations of this study must be acknowledged. First, the sample size of this study was small. Adolescents with HIV reside in widely dispersed areas. The survey was conducted in a county of China in Henan province where adolescents with HIV are relatively concentrated. Therefore, the findings of the survey can only represent the self-concept of adolescents infected with HIV, but does not represent the entire Henan province or even the entire country. Second, this study was a cross-sectional survey. After investigating the self-concept of adolescents with HIV, we also investigated the perceived stress, social support, and coping styles of adolescents infected with HIV. This study only explored the relationship between adolescents with HIV and self-concept, and cannot explain the deeper causal relationship among variables; further research and analysis are warranted for validation. Third, the assessment of self-concept was carried out using the scale evaluation method, and for adolescents with HIV the differences in individual language and verbal cognitive abilities may interfere with the final findings. Fourth, the adolescents we surveyed were all infected from mother-to-child transmission. This may not be representative of the self-consciousness of all adolescents with HIV.

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Contributors

YJY and SYK conceived and designed the study, supervised the analysis, and interpreted the data. XXY and XHQ supervised the analysis, interpreted the data, and wrote the preliminary manuscript. ZXQ, XJS and EYZ supervised the data collection by JWZ, WBW, and YWC. SYK performed the test administration, compiled the data, and wrote the preliminary manuscript. All authors contributed to the writing and review of the manuscript and approved the final version. We wish to thank International Science Editing for their help in editing the language of the manuscript. At the same time, we would like to thank the patient advisers for their cooperation and support in this study.

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Competing interests

The authors declare that there are no competing or potential conflicts of interest. No

conflict of interest exists in the submission of the manuscript, and the manuscript was approved by all authors for publication. The work described is original research that has not been published previously, and is not under consideration for publication elsewhere, in whole or in part.

Ethical considerations

The research was conducted in accordance with the ethical guidelines of the Declaration of Helsinki and was approved by the Ethics Committee of Harbin Medical University. All participants provided written informed consent after being informed of the research purpose, meaning, and content. All the adolescents participated voluntarily.

Data sharing statement

No additional data are available.

License statement

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STROBE 2007 (v4) Statement—Checklist of items that should be included in reports of *cross-sectional studies*

Section/Topic	Item #	Recommendation	Reported on page #
Title and abstract	1	(*a*) Indicate the study's design with a commonly used term in the title or the abstract	1
		(*b*) Provide in the abstract an informative and balanced summary of what was done and what was found	1-2
Introduction			
Background/rationale	2	Explain the scientific background and rationale for the investigation being reported	3
Objectives	3	State specific objectives, including any prespecified hypotheses	4-7
Methods			
Study design	4	Present key elements of study design early in the paper	8-9
Setting	5	Describe the setting, locations, and relevant dates, including periods of recruitment, exposure, follow-up, and data collection	9
Participants	6	(*a*) Give the eligibility criteria, and the sources and methods of selection of participants	9
Variables	7	Clearly define all outcomes, exposures, predictors, potential confounders, and effect modifiers. Give diagnostic criteria, if applicable	10
Data sources/ measurement	8*	For each variable of interest, give sources of data and details of methods of assessment (measurement). Describe comparability of assessment methods if there is more than one group	9
Bias	9	Describe any efforts to address potential sources of bias	*8*

Study size	10	Explain how the study size was arrived at	9
Quantitative variables	11	Explain how quantitative variables were handled in the analyses. If applicable, describe which groupings were chosen and why	9
Statistical methods	12	(*a*) Describe all statistical methods, including those used to control for confounding	10-11
		(*b*) Describe any methods used to examine subgroups and interactions	
		(*c*) Explain how missing data were addressed	
		(*d*) If applicable, describe analytical methods taking account of sampling strategy	
		(*e*) Describe any sensitivity analyses	
Results			
Participants	13*	(a) Report numbers of individuals at each stage of study—eg numbers potentially eligible, examined for eligibility, confirmed eligible, included in the study, completing follow-up, and analysed	12
		(b) Give reasons for non-participation at each stage	
		(c) Consider use of a flow diagram	
Descriptive data	14*	(a) Give characteristics of study participants (eg demographic, clinical, social) and information on exposures and potential confounders	13
		(b) Indicate number of participants with missing data for each variable of interest	
Outcome data	15*	Report numbers of outcome events or summary measures	14
Main results	16	(*a*) Give unadjusted estimates and, if applicable, confounder-adjusted estimates and their precision (eg, 95% confidence interval). Make clear which confounders were adjusted for and why they were included	15-16
		(*b*) Report category boundaries when continuous variables were categorized	

		(*c*) If relevant, consider translating estimates of relative risk into absolute risk for a meaningful time period	
Other analyses	17	Report other analyses done—eg analyses of subgroups and interactions, and sensitivity analyses	
Discussion			
Key results	18	Summarise key results with reference to study objectives	16
Limitations	19	Discuss limitations of the study, taking into account sources of potential bias or imprecision. Discuss both direction and magnitude of any potential bias	19
Interpretation	20	Give a cautious overall interpretation of results considering objectives, limitations, multiplicity of analyses, results from similar studies, and other relevant evidence	17
Generalisability	21	Discuss the generalisability (external validity) of the study results	18
Other information			
Funding	22	Give the source of funding and the role of the funders for the present study and, if applicable, for the original study on which the present article is based	21

*Give information separately for cases and controls in case-control studies and, if applicable, for exposed and unexposed groups in cohort and cross-sectional studies.

Note: An Explanation and Elaboration article discusses each checklist item and gives methodological background and published examples of transparent reporting. The STROBE checklist is best used in conjunction with this article (freely available on the Web sites of PLoS Medicine at http://www.plosmedicine.org/, Annals of Internal Medicine at http://www.annals.org/, and Epidemiology at http://www.epidem.com/). Information on the STROBE Initiative is available at www.strobe-statement.org.