

# Physical Activities and Associated Factors Among HIV/AIDS Patients: A Questionnaire Survey

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**Purpose:** Regular physical activity is essential for maintaining health and improving people's overall quality of life living with HIV; improving metabolic side effects associated with taking highly active antiretroviral therapy (HAART). This study investigated physical activity levels and associated factors among HIV/AIDS patients.

**Patients and Methods:** A single-center, cross-sectional study was conducted from July to September 2021. A convenience sample of 377 HIV/AIDS patients was recruited from a medical center in Zhuhai, China. Data were collected through self-report questionnaires and patients' medical records.

**Results:** The average physical activity of HIV/AIDS patients was 1007.15±868.63 met-min/w; 53.8% of patients expressed medium-level activity, and 46.2% in low-level activity. Log-link gamma generalized linear model results showed that gender, T-CD4<sup>+</sup> at the latest visit, self-efficacy, and perceived barriers were significant predictors of assessing physical activity levels.

**Conclusion:** Nearly half of HIV/AIDS patients have low levels of physical activity. In particular, women and patients with lower CD4 cells, lower self-efficacy, and more perceived barriers had lower levels of physical activity. More knowledge is needed on the causes of physical inactivity among people with HIV, and physical activity programs need to be developed for people living with HIV in developing countries.

**Keywords:** acquired immune deficiency syndrome, AIDS, human immunodeficiency virus, HIV, physical activity, exercise

## Introduction

Acquired Immune Deficiency Syndrome (AIDS) is a chronic infectious disease that affects humans with a higher mortality risk.<sup>1</sup> According to the latest data from the World Health Organization, approximately 37.7 million people are living with HIV (PLWH).<sup>2</sup> At the end of 2020, 1.5 million people acquired HIV, and about 680,000 people died from HIV-related diseases.<sup>3</sup> In China, more than 850,000 people are living with HIV/AIDS, and it reported the highest mortality rate among infectious diseases.<sup>4</sup> Highly active antiretroviral therapy (HAART) is currently the most effective treatment for AIDS, extending the life expectancy of AIDS patients and transforming HIV infection from acute to chronic disease.<sup>5</sup> However, PLWH is prone to complications such as cardiovascular disease, musculoskeletal problems, long-term HAART-related toxicity, persistent inflammation, dyslipidemia, and insulin resistance.<sup>6</sup>

Physical activity (PA) is referred to any physical movement that causes energy expenditure due to skeletal muscle contraction, which has been shown to be a safe and healthy practice for many diseases.<sup>7,8</sup> PA can reduce damage caused by HAART, including cardiovascular disease, musculoskeletal disease, depression, and reduction of T-CD4<sup>+</sup> cells count in PLWH.<sup>9–12</sup>

Until now, there are still a considerable number of HIV/AIDS patients who are not physically active enough to meet the WHO-recommended level of physical activity.<sup>13–15</sup> Lower levels of PA may be associated with older age, lower education levels, lower T-CD4<sup>+</sup> cells count, exposure to antiviral therapy, mental state, and self-efficacy.<sup>16,17</sup> There are few studies on estimating the level of physical activity and its associated factors in Chinese HIV/AIDS patients. This

study is conducted to investigate the PA levels of Chinese HIV/AIDS patients and analyze the factors associated with the levels of PA in HIV/AIDS patients.

## Materials and Methods

### Study Design and Participants

This single-centered, cross-sectional study investigated HIV/AIDS patients visiting the AIDS clinic at a general hospital in Zhuhai through an online survey (wjx, <https://www.wjx.cn/>), which was conducted from July to September 2021. A convenient sample of HIV-infected patients who met the eligibility criteria as follows: (1) diagnosed with HIV infection, (2) age >18 years old, and (3) willing to participate in this study. Exclusion criteria: (1) people with mental illness, (2) those who cannot communicate or express their clinical condition properly.

### Sample Size Estimation

The sample size for this cross-sectional study was calculated by PASS 15.0. When the prevalence of low physical activity is 0.300,<sup>18</sup> a sample size of 341 produces a two-sided 95% confidence interval with a width equal to 0.100. Considering a non-response rate of 10%, the sample size is 378 individuals.

### Data Collection

The questionnaire included closed-ended questions and consisted of 2 parts. Part 1 consists of sociodemographic characteristics and disease-related factors questionnaire including gender, age, marital status, education, occupation, income, and condition of HIV/AIDS. And part 2 includes the social support, psychological state, exercise health beliefs, and PA levels of HIV/AIDS patients.

### Self-Rating Depression Scale (SDS)

The SDS is a short-range self-rating scale and questionnaire, effectively reflecting the symptoms, severity, and variation of depression undergone until the last week. SDS consists of 20 statements and corresponding question items, and different things lead to related specific symptoms reflecting depression.<sup>19</sup> In this study, the Cronbach's alpha coefficient of the SDS was 0.866.

### Self-Rating Anxiety Scale (SAS)

The SAS has 20 items for adults with anxiety symptoms.<sup>20</sup> SAS has 20 items for adults with symptoms of anxiety. It can accurately and quickly reflect the subjective feelings of the respondents till the last week. In this study, the Cronbach's alpha coefficient of the SAS was 0.835.

### Social Support Scale (SSRS)

The SSRS was used to evaluate the support received by the respondents in society.<sup>21</sup> The scale was divided into 3 dimensions with 10 items. In this study, the Cronbach's alpha coefficient of the SSRS was 0.875, 0.750, 0.736, and 0.776, respectively, for all three dimensions of the SSRS.

### Health Belief Model (HBM)

We used the health belief model as the basic framework to create an exercise belief questionnaire for HIV/AIDS patients.<sup>22–24</sup> The exercise belief questionnaire for HIV/AIDS patients included six dimensions and 18 items ([Appendix 1](#)). Item options include 5 levels, using the Likert 5 scoring method, and the dimension adopts a 10-point system calculation method, the score is equal to the sum of the actual scores of all the items in this dimension/the sum of the highest scores of all items in this dimension) \*10. The scores for each dimension are between 2 and 10 points. The larger the score, the higher the cognitive level. The Cronbach's alpha coefficient of the health belief model dimensions was 0.910, 0.793, 0.911, 0.764, 0.801, and 0.869.

## Physical Activity Assessment

We used the short-format version (seven items) of the International Physical Activity Questionnaire (IPAQ), a tool originally developed for obtaining internationally comparable estimates of physical activity, to measure the physical activity levels of HIV/AIDS patients.<sup>25</sup> A short-format version of IPAQ asks participants to recall the amount of time spent in the past seven days on vigorous-intensity activity, moderate-intensity activity, walking and sitting. Answers for each activity category are weighted to calculate a total weekly metabolic equivalent of tasks (MET) score in minutes to determine the total energy cost of the participant's activities in the past week. Each participant's score was further divided into low, moderate and high levels of physical activity according to the cutoffs recommended by the IPAQ. The World Health Organization recommends that adults get at least 600 MET of physical activity per week, the equivalent of 150 minutes of brisk walking or 75 minutes of running per week.<sup>15</sup>

## Statistical Analysis

We used SPSS 21.0 software to analyze the data. The measurement data is expressed by ( $\bar{X} \pm s$ ), and the comparison between groups is by *t*-test; the count data is expressed by *n* (%), and the  $\chi^2$  test is used. Multivariate analysis was performed using logistic regression analysis. Receiver operating characteristic (ROC) curves were established.  $P < 0.05$  indicates a statistically significant difference.

## Results

Three hundred and seventy-seven patients who met the eligibility criteria were included in this study, and none refused to participate. Seven patients were excluded due to incomplete information, and 370 participants were included in the final analysis.

## Description of Physical Activity

The average IPAQ result was 1007.15 (SD =868.63) met-min/w. Of the 370 research participants, 199 cases (53.8%) engaged in a moderate level of physical activity (>600 met-min/w), and 171 cases (46.2%) had a low level of physical activity (<600 met-min/w). The average sedentary time was 370.62 (SD =176.27) min/d.

## Participants' Demographic and Clinical Characteristics

The demographic and clinical characteristics of participants in different groups were presented in Table 1. The results of the intergroup comparison and Spearman correlation analysis showed that gender ( $\chi^2=7.486$ ,  $P=0.006$ ), an education level ( $\chi^2=10.553$ ,  $P=0.014$ ), medical payment ( $\chi^2=8.234$ ,  $P=0.025$ ), monthly income ( $\chi^2=8.674$ ,  $P=0.013$ ), smoking status ( $\chi^2=4.898$ ,  $P=0.027$ ), BMI ( $\chi^2=7.912$ ,  $P=0.048$ ), sexual orientation ( $\chi^2=8.708$ ,  $P=0.013$ ), the origin of HIV infection ( $\chi^2=7.707$ ,  $P=0.021$ ), and T-CD4<sup>+</sup> ( $\chi^2=5.830$ ,  $P=0.016$ ) were significantly associated with PA levels of the HIV/AIDS patients.

## Associations of SDS, SAS, Social Support, and Health Beliefs with PA Levels

As shown in Table 1, the mean score of social support was 27.75 (SD =7.97), and 55.1% (*n*=204) patients had depression, and 58.1% (*n*=215) had anxiety. Comparing between the groups, we found that SAS ( $t=4.656$ ,  $P=0.031$ ), SDS ( $t=4.779$ ,  $P=0.028$ ), perceived susceptibility ( $t=-3.011$ ,  $P=0.003$ ), perceived severity ( $t=-3.502$ ,  $P=0.001$ ), perceived benefits ( $t=-2.779$ ,  $P=0.006$ ), perceived barriers ( $t=4.983$ ,  $P=0.000$ ), cues to action ( $t=-3.622$ ,  $P=0.000$ ), and self-efficacy ( $t=-5.892$ ,  $P=0.000$ ) had a significant correlation with physical activity levels.

## Independently Associated Factors Affecting the PA Levels of HIV/AIDS Patients

Logistic regression analysis of the factors that may affect the physical activity of the HIV/AIDS patients showed that gender ( $P=0.025$ , 95% confidence interval (CI) 0.245–0.911), T-CD4<sup>+</sup> ( $P=0.009$ , 95% CI 1.195–3.484), self-efficacy ( $P=0.000$ , 95% CI 1.132–1.524), and perceived barriers ( $P=0.016$ , 95% CI 0.721–0.947) are independently associated factors for physical activity in HIV/AIDS patients (Table 2). The Hosmer-Lemeshow test indicated a good model fit for predicting the variables

**Table I** Analyzing Demographic, Clinical Characteristics, Social Support, SDS, SAS and Health Belief of People Living with HIV and Univariate Analysis of Patients' Physical Activity Levels (n =370)

| Characteristic                | Mean (SD) n (%) | PA (MET mins wk <sup>-1</sup> ) |              | Test Statistics | P     |
|-------------------------------|-----------------|---------------------------------|--------------|-----------------|-------|
|                               |                 | <600 (n=171)                    | >600 (n=199) |                 |       |
| <b>Age (years)</b>            | 37.92±9.71      | 37.98±9.79                      | 37.72±9.44   | 0.221           | 0.825 |
| <b>Gender</b>                 |                 |                                 |              | 7.486           | 0.006 |
| Male                          | 322 (87.0)      | 140 (43.5)                      | 182 (56.5)   |                 |       |
| Female                        | 48 (13.0)       | 31 (64.6)                       | 17 (35.4)    |                 |       |
| <b>Education level</b>        |                 |                                 |              | 10.553          | 0.014 |
| Elementary and below          | 32 (8.6)        | 17 (53.1)                       | 15 (46.9)    |                 |       |
| Middle school                 | 88 (23.8)       | 49 (55.7)                       | 39 (44.3)    |                 |       |
| High school                   | 94 (25.4)       | 48 (51.1)                       | 46 (48.9)    |                 |       |
| College and above             | 156 (42.2)      | 57 (36.5)                       | 99 (63.5)    |                 |       |
| <b>Marital status</b>         |                 |                                 |              | 0.371           | 0.543 |
| Single                        | 244 (65.9)      | 110 (45.1)                      | 134 (54.9)   |                 |       |
| Others                        | 126 (34.1)      | 61 (48.4)                       | 65 (51.6)    |                 |       |
| <b>Occupation</b>             |                 |                                 |              | 1.809           | 0.179 |
| Employed                      | 313 (84.6)      | 140 (44.7)                      | 173 (55.3)   |                 |       |
| Unemployed                    | 57 (15.4)       | 31 (54.4)                       | 26 (45.6)    |                 |       |
| <b>Medical payment</b>        |                 |                                 |              | 8.234           | 0.025 |
| Insurance                     | 189 (51.1)      | 81 (42.9)                       | 108 (57.1)   |                 |       |
| Self-paying                   | 181 (48.9)      | 90 (49.7)                       | 91 (50.3)    |                 |       |
| <b>Monthly income (yuan)</b>  |                 |                                 |              | 8.674           | 0.013 |
| <5000                         | 188 (50.8)      | 101 (53.7)                      | 87 (46.3)    |                 |       |
| 5000~9999                     | 111 (30.0)      | 43 (38.7)                       | 68 (61.3)    |                 |       |
| ≥10,000                       | 71 (19.2)       | 27 (38.0)                       | 44 (62.0)    |                 |       |
| <b>Smoking status</b>         |                 |                                 |              | 4.898           | 0.027 |
| Yes                           | 103 (27.8)      | 39 (37.9)                       | 64 (62.1)    |                 |       |
| No                            | 267 (72.2)      | 132 (49.4)                      | 135 (50.6)   |                 |       |
| <b>Drinking status</b>        |                 |                                 |              | 0.322           | 0.571 |
| Yes                           | 118 (31.9)      | 52 (44.1)                       | 66 (55.)     |                 |       |
| No                            | 252 (68.1)      | 119 (47.2)                      | 113 (52.8)   |                 |       |
| <b>BMI (kg/m<sup>2</sup>)</b> |                 |                                 |              | 7.912           | 0.048 |
| <18.5                         | 27 (7.3)        | 16 (59.3)                       | 11 (40.7)    |                 |       |
| 18.5~23.9                     | 236 (63.8)      | 105 (44.5)                      | 131 (55.5)   |                 |       |

(Continued)

Table I (Continued).

| Characteristic                                        | Mean (SD) n (%) | PA (MET mins wk <sup>-1</sup> ) |              | Test Statistics | P     |
|-------------------------------------------------------|-----------------|---------------------------------|--------------|-----------------|-------|
|                                                       |                 | <600 (n=171)                    | >600 (n=199) |                 |       |
| 24.0~27.9                                             | 86 (23.2)       | 47 (54.7)                       | 39 (45.3)    |                 |       |
| ≥28.0                                                 | 21 (5.7)        | 5 (23.8)                        | 16 (76.2)    |                 |       |
| <b>Sexual orientation</b>                             |                 |                                 |              | 8.708           | 0.013 |
| Homosexuality                                         | 172 (46.5)      | 68 (39.5)                       | 104 (60.5)   |                 |       |
| Heterosexuality                                       | 98 (26.5)       | 57 (58.2)                       | 41 (41.8)    |                 |       |
| Bisexuality                                           | 100 (27.0)      | 46 (46.0)                       | 54 (54.0)    |                 |       |
| <b>Origin of HIV infection</b>                        |                 |                                 |              | 7.707           | 0.021 |
| Sexual                                                | 287 (77.6)      | 122 (42.5)                      | 165 (57.5)   |                 |       |
| Blood                                                 | 71 (19.2)       | 42 (59.2)                       | 29 (40.8)    |                 |       |
| Unknown                                               | 12 (3.2)        | 7 (58.3)                        | 5 (41.7)     |                 |       |
| <b>T-CD4<sup>+</sup> at latest visit (cells/ μ L)</b> |                 |                                 |              | 5.830           | 0.016 |
| ≤350                                                  | 79 (21.4)       | 46 (58.2)                       | 33 (41.8)    |                 |       |
| >350                                                  | 291 (78.6)      | 125 (43.0)                      | 166 (57.0)   |                 |       |
| <b>Course of disease (years)</b>                      | 5.81±2.94       | 5.76±2.96                       | 6.00±2.89    | 0.650           | 0.516 |
| <b>Disease symptoms</b>                               |                 |                                 |              | 0.823           | 0.364 |
| Yes                                                   | 56 (15.4)       | 29 (51.8)                       | 27 (48.2)    |                 |       |
| No                                                    | 314 (84.6)      | 142 (45.2)                      | 172 (54.8)   |                 |       |
| <b>Clinical stages</b>                                |                 |                                 |              | 1.647           | 0.609 |
| Stage I                                               | 156 (42.4)      | 69 (44.2)                       | 87 (55.8)    |                 |       |
| Stage II                                              | 131 (35.1)      | 59 (45.0)                       | 72 (55.0)    |                 |       |
| Stage III                                             | 39 (10.6)       | 19 (48.7)                       | 20 (51.3)    |                 |       |
| Stage IV                                              | 44 (11.9)       | 24 (54.5)                       | 20 (45.5)    |                 |       |
| <b>Opportunistic infection</b>                        |                 |                                 |              | 2.881           | 0.090 |
| Yes                                                   | 118 (31.9)      | 97 (82.2)                       | 21 (17.8)    |                 |       |
| No                                                    | 252 (68.1)      | 187 (74.2)                      | 65 (25.8)    |                 |       |
| <b>Social support</b>                                 | 27.75±7.97      | 27.84±7.98                      | 27.67±7.87   | 0.204           | 0.838 |
| <b>SAS</b>                                            |                 |                                 |              | 4.656           | 0.031 |
| Yes                                                   | 204 (55.14)     | 84 (41.2)                       | 120 (58.8)   |                 |       |
| No                                                    | 166 (44.86)     | 87 (52.4)                       | 79 (47.6)    |                 |       |
| <b>SDS</b>                                            |                 |                                 |              | 4.779           | 0.028 |
| Yes                                                   | 215 (58.11)     | 89 (41.4)                       | 126 (58.6)   |                 |       |
| No                                                    | 155 (41.89)     | 82 (52.9)                       | 73 (47.1)    |                 |       |

(Continued)

**Table 1** (Continued).

| Characteristic           | Mean (SD) n (%) | PA (MET mins wk <sup>-1</sup> ) |              | Test Statistics | P     |
|--------------------------|-----------------|---------------------------------|--------------|-----------------|-------|
|                          |                 | <600 (n=171)                    | >600 (n=199) |                 |       |
| Perceived Susceptibility | 8.22±1.58       | 8.09±1.57                       | 8.67±1.51    | -3.011          | 0.003 |
| Perceived severity       | 8.05±1.51       | 7.90±1.53                       | 8.54±1.30    | -3.502          | 0.001 |
| Perceived benefits       | 8.66±1.25       | 8.56±1.26                       | 8.99±1.15    | -2.779          | 0.006 |
| Perceived barriers       | 5.57±1.64       | 5.80±1.58                       | 4.82±1.62    | 4.983           | 0.000 |
| Cues to action           | 8.14±1.28       | 8.01±1.27                       | 8.57±1.22    | -3.622          | 0.000 |
| Self-efficacy            | 7.64±1.53       | 7.39±1.54                       | 8.46±1.18    | -5.892          | 0.000 |

Abbreviations: PA, physical activity; T-CD4<sup>+</sup>, CD4<sup>+</sup> T cells counts; SD, standard deviation.

**Table 2** Logistic Regression Analysis of Factors That May Affect the Physical Activity of HIV/AIDS Patients

| Variable                                                | B      | SEE   | Wals   | P     | Exp (B) | 95% CI      |
|---------------------------------------------------------|--------|-------|--------|-------|---------|-------------|
| Constant                                                | -1.323 | 0.975 | 2.773  | 0.096 | 0.266   | –           |
| Gender (ref: male)                                      | -0.751 | 0.335 | 5.011  | 0.025 | 0.472   | 0.245–0.911 |
| T-CD4 <sup>+</sup> at latest visit (ref: ≤350 cells/μL) | 0.713  | 0.273 | 6.824  | 0.009 | 2.040   | 1.195–3.484 |
| Self-efficacy                                           | 0.273  | 0.076 | 12.915 | 0.000 | 1.314   | 1.132–1.524 |
| Perceived barriers                                      | -0.191 | 0.070 | 7.481  | 0.016 | 0.826   | 0.721–0.947 |

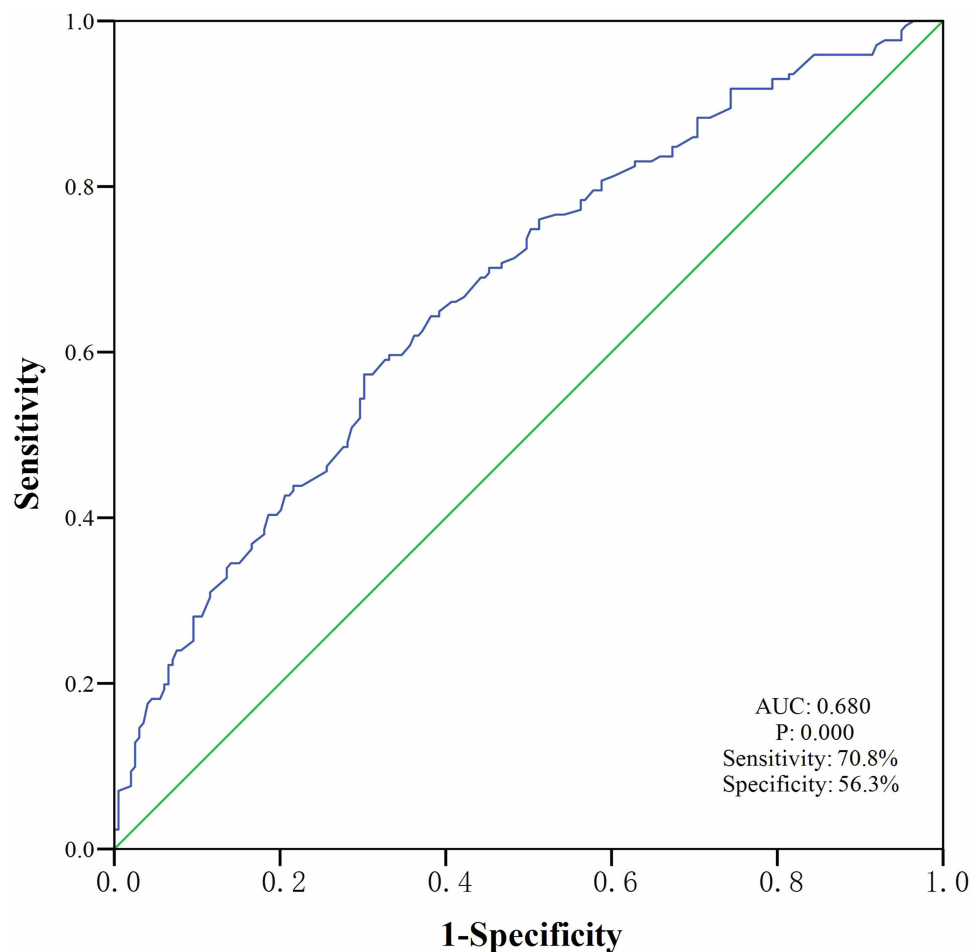
Abbreviations: SEE, standard error of estimation; CI, confidence interval.

( $P=0.200 > 0.05$ ). We combined four important variables (gender, T-CD4<sup>+</sup>, self-efficacy, and perceived barriers) into the logistic regression to calculate the probability and made the ROC curve based on the probability we obtained. The ROC curve indicated an area under the curve of 0.680. A cut-off score of 0.564 yielded the maximum sum of sensitivity (70.8%) and specificity (56.2%) (Figure 1), which has a certain predictive value for PA levels in HIV/AIDS patients.

## Discussion

Physical activity (PA) is an important role to reduce the morbidity and mortality of many diseases, people of all ages can get a range of physical, psychological, social, and emotional benefits from it.<sup>26,27</sup> The association between physical-mental health and physical activity in HIV/AIDS populations is well documented.<sup>28</sup> Encouraging physical activity is essential for the HIV/AIDS patients to combat the onset of secondary disorders such as non-communicable diseases. Our study found that 46.2% of HIV/AIDS patients still in low PA levels, which does not meet the recommendations for PA levels, as outlined in the 2020 Global Recommendations on Physical Activity for Health, and is similar to the other finding.<sup>14,15,29</sup> This shows that PA levels of HIV/AIDS patients should be taken care of, and PA levels are affected by different factors, including gender, T-CD4<sup>+</sup> cells count, self-efficacy, and perceived barriers, based on study findings.

We found that gender is an associated factor for the PA levels in HIV/AIDS patients ( $P<0.05$ , OR=0.472), and women had lower PA levels compared with men. Studies show that women are in the inactive group, with a higher incidence of physical inactivity than men.<sup>30,31</sup> Women living with HIV/AIDS often live painful and shameful life of ostracism, particularly from friends and family, social exclusion, uncertainty and loss, low self-esteem, fear, anxiety, depression, and even suicidal thoughts.<sup>32,33</sup> More attention should be paid to women HIV/AIDS patients, by observing their mental state, and imparting the benefits and necessity of PA levels in clinical nursing work.



**Figure 1** Receiver operating characteristic (ROC) curve analysis for the gender, T-CD4<sup>+</sup> at latest visit, self-efficacy, and perceived barriers in the physical activity levels of HIV/AIDS patients.

**Abbreviation:** AUC, area under the curve.

T-CD4<sup>+</sup>>350 cells/ $\mu$ L was a protective factor for HIV/AIDS patients ( $P<0.05$ , OR=2.040). T-CD4<sup>+</sup> cells can be attacked by HIV in several ways to make the body's cellular immune function defective, and other immune cells are damaged to varying degrees, resulting in various opportunistic severe infections and tumors.<sup>34</sup> T-CD4<sup>+</sup> cells are a marker for monitoring AIDS progression and an important parameter for opportunistic infections and deaths.<sup>35,36</sup> Higher T-CD4<sup>+</sup> cells were independently associated with higher treatment compliance.<sup>37</sup> This may be related to the fact that patients pay more attention to their antiviral therapy and their treatment knowledge, which promotes PA levels. This study also suggests that more attention should be paid to the PA level of HIV/AIDS patients with T-CD4<sup>+</sup> cells count  $\leq$  350 cells/ $\mu$ L to improve the PA levels of patients, and ultimately improve the T-CD4<sup>+</sup> cells.

The health belief model is a useful model for improving individuals' understanding of the benefits of physical activity, which included perceived susceptibility, perceived severity, perceived benefits, perceived barriers, cues to action, and self-efficacy.<sup>38,39</sup> We found a significant effect on self-efficacy and perceived barriers in terms of health beliefs about PA levels. Self-efficacy was a protective factor for patients to engage in PA ( $P<0.05$ , OR=1.314). After HIV infection, patients are prone to mental and psychological problems, such as depression, inferiority complex, anxiety, etc., resulting in low motor efficiency and reluctance to participate in physical activities. Establishing a social support system with like-minded people and increasing family encouragement are the promoting factors for increasing self-efficacy.<sup>40</sup> It is suggested that clinical staff should make feasible plans for improving self-efficacy, and encouraging HIV/AIDS patients to participate in physical activities by holding sports lectures, mobilizing family members and social welfare

organizations to improve self-efficacy, and ultimately improve PA levels. Perceived barriers are also an associated factor for PA levels in HIV/AIDS patients ( $P<0.05$ ,  $OR=0.826$ ). The more perceived barriers, the more it lowers self-efficacy and PA levels.<sup>41</sup> At least one study has described barriers to PA in PLWH in American, including lacking of exercise guidance, fearing of falling injury, and lacking of relevant sports facilities, etc.,<sup>42</sup> which is similar to our results. And relevant departments should organize suitable equipment and places for physical activity, and clinical staff should actively carry out health education related to physical activity, such as the benefits, items, time, frequency, precautions of physical activity, and give exercise guidance or other measures to encourage HIV/AIDS patients to exercise.

Several limitations should be considered in the present study, including the sample from a single hospital. In the future, research should be conducted in multiple hospitals to better generalize the findings and compare the differences. We did not conduct face-to-face interviews, but rather an online questionnaire survey was used instead for safety and feasibility. Item response might be biased by extreme response style.

## Conclusion

Nearly half of HIV/AIDS patients are still in low PA levels and have many related factors, such as gender, T-CD4<sup>+</sup> cell counts, self-efficacy and perceived barriers in health beliefs. Further studies should investigate the effects of PA levels by targeting these factors at PA in HIV/AIDS patients. These results maybe serve as a piece of evidence for improving PA levels in HIV/AIDS patients in developing countries.

## Data Sharing Statement

The data that support the findings of this study are available for non-commercial use from the corresponding author, Ying Li, upon reasonable request.

## Ethics and Consent

The Ethics Committee has approved this study of the Fifth Affiliated Hospital of Sun Yat-sen University (Case No. K87). Subjects can withdraw from the study at any time during the study with informed consent and voluntary participation, and their right to obtain relevant knowledge will not be compromised. The researchers will keep the subjects' personal information confidential, choose the research objects fairly, and treat those who refuse to participate in the study or drop out of the study moderately. This study was conducted in accordance with the Declaration of Helsinki.

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## Author Contributions

All authors made a significant contribution to the work reported, whether that is in the conception, study design, execution, acquisition of data, analysis and interpretation, or in all these areas; took part in drafting, revising or critically reviewing the article; gave final approval of the version to be published; have agreed on the journal to which the article has been submitted; and agree to be accountable for all aspects of the work.

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## Disclosure

The authors report no conflicts of interest in this work.

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