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Analysis of PLWH switching to medical insurance ART: a cross-sectional study in six Chinese provinces

Jingkun Hu¹, Wenting Kang², Jiahuan Guo¹, Jie Xu¹, Houlin Tang¹, Decai Zhao¹, Xinlun Wang², Peng Xu^{1*}, Fan Lyu^{1*} and Guang Zhang^{1*}

Abstract

Background Antiretroviral therapy (ART) security policy in China has entered a new stage of diversification, and there are free ART, medical insurance ART, self-funded ART. In recent years, some people living with human immunodeficiency virus (PLWH) have switched to medical insurance ART from free ART. Therefore, this study analyzed the information of those PLWH to provide reference for improving ART security policy in China.

Methods A cross-sectional survey was used to collect the general characteristics, economic status, and ART status of PLWH from 18 cities in 6 provinces. The Chi-square test was used to analyse whether the differences between PLWH who switched to medical insurance ART and those who did not were statistically significant. Multivariable logistic regression was used to analyse the factors associated with switching to medical insurance ART.

Results Among the 1371 participants, 17.3% switched to medical insurance ART. The differences between PLWH who switched to medical insurance ART and those who did not were statistically significant ($p < 0.05$) in education, occupation, type of basic medical insurance, average annual income of family members, personal annual income, changes in personal annual income, whether is the government medical aid recipient or households registered as living under the poverty line, year of initiating ART, level of ART hospital, distance to ART hospital, and whether adverse medicine reactions occur. Government agency/public institution/state-owned enterprise employees ($aOR = 2.34$, 95% CI : 1.29–4.26), basic medical insurance for urban employed ($aOR = 1.93$, 95% CI : 1.28–2.90), average annual income of family members were \geq \$13,972 ($aOR = 2.12$, 95% CI : 1.27–3.54), personal annual income were \geq \$13,972 ($aOR = 2.39$, 95% CI : 1.43–4.00), initiated ART before 2012 ($aOR = 1.67$, 95% CI : 1.02–2.75), provincial hospitals ($aOR = 2.00$, 95% CI : 1.30–3.09) were factors associated with switching to medical insurance ART.

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Conclusions 17.3% PLWH switched to medical insurance ART, indicating the attractiveness of medical insurance ART. The characteristics of PLWH who switched to medical insurance ART and the factors associated with switching should be fully considered, so as to provide targeted ART services and improve ART security policy in China.

Keywords People living with human immunodeficiency virus, Medical insurance, Antiretroviral therapy, Cross-sectional study

Background

Since the advent of antiretroviral therapy (ART) for acquired immune deficiency syndrome (AIDS) in 1996, ART is playing an increasingly important role in the prevention and control of AIDS [1, 2]. In addition to extending the life expectancy of people living with human immunodeficiency virus (PLWH) and lowering mortality, ART also inhibits the spread of the virus and is crucial in lowering the number of new HIV infections [3–5]. ART is also highly valued in China, with 1.135 million detected HIV infections under treatment and 92.8% treatment coverage by the end of 2022 [6], meeting the Joint United Nations Programme on HIV/AIDS (UNAIDS) target of 90% of detected HIV infections receiving ART [7].

China's ART security policy has entered a new stage of diversification as HIV prevention and control enters a phase of high-quality development [8], and the healthcare security system undergoes a comprehensive, deepening transformation that was initiated in 2020 [9]. There are free ART (PLWH get ART medicines through the national free ART policy), medical insurance ART (PLWH get ART medicines in the list of *National Basic Medical Insurance Drug Catalog*), self-funded ART (PLWH get ART medicines in the market at full price), and the advantages of them complement each other. The primary component that guarantees all PLWH have access to basic treatment is free ART. In addition to the basic treatment, medical insurance ART enables PLWH to obtain several ART medicines. And, self-funded ART gives PLWH additional alternatives for their ART regimen [10].

China's free ART policy has developed into a mature standard and practice after 20 years of implementation, development, and refinement. The *Four Frees and One Care* program was introduced by the Chinese government countrywide in 2003 [11, 12]. In 2016, ART standards were changed to promote *treat all* across the country, and anyone who wants to have therapy can get free ART [13]. Lamivudine (3TC), tenofovir disoproxil fumarate (TDF), zidovudine (AZT), abacavir (ABC), efavirenz (EFV), nevirapine (NVP), lopinavir/ritonavir (LPV/r), rilpivirine (RPV), and dolutegravir (DTG) are among the free ART medicines listed in China's recently released *China Free Antiretroviral Treatment Manual, 5th edn* [14]. Free ART medicines must be taken with two or three other drugs. The incidence and mortality of AIDS-related complications have decreased, PLWH's

life expectancy has increased, their quality of life has improved, HIV transmission has decreased, mother-to-child HIV transmission has been curbed, and social stability has been preserved in China thanks to free ART [15–17].

The medical insurance ART policy and the social medical insurance system in China were formed nearly simultaneously and have been continuously enhanced [18]. The *National Basic Medical Insurance Drug Catalog* now includes ten types of ART medicines from 2017 to 2023 [19, 20]. These include azvudine (FNC), ainovirine (ANV), albuvirtide for injection (ABT), zidovudine/lamivudine (AZT/3TC), emtricitabine/tenofovir (FTC/TDF), elvitegravir/cobicistat/emtricitabine/tenofovir alafenamide (E/C/F/TAF), nevirapine/zidovudine/lamivudine (NVP/AZT/3TC), bicitgravir/emtricitabine/tenofovir alafenamide (B/F/TAF), dolutegravir/lamivudine (DTG/3TC), doravirine/lamivudine/tenofovir disoproxil fumarate (DOR/3TC/TDF). The majority of these medicines are recently marketed single-tablet regimens that have the advantages of good treatment efficacy, good compliance, low adverse reactions, and easy to take [21, 22]. PLWH only have to pay a portion of the cost of ART medicines that are listed in the *National Basic Medical Insurance Drug Catalog*, which is approximately \$42–70 each month (1 USD=7.148 CNY, this exchange rate applies to the entire article). The national medical insurance fund will cover the remaining amount.

In China, there are few studies on free ART and medical insurance ART. Some researchers have analyzed the relevant policies and implementation of free ART and medical insurance ART, the basic demographic characteristics and the ART situation of medical insurance ART patients [23, 24]. On the advice of physician or if they choose to do so on their own initiative, PLWH have the option to switch between free ART and medical insurance ART. Some PLWH have been switching from free ART to medical insurance ART in recent years, but researchers have not conducted research into these patients.

This study was conducted in six Chinese provinces to analyse the differences between PLWH who switched to medical insurance ART and those who did not, and analyse the factors associated with switching to medical insurance ART. In this way, we will be able to understand more about the PLWH who switched to medical

insurance ART, which will help us to improve ART security policy in China.

Methods

Study sites

Considering the differences in the level of regional economic development and the *Reform Plan for the Division of Fiscal Authority and Expenditure Responsibility between the Central and Local Governments in the Field of Medical and Health Care* [25] which stipulated the proportion of the central government's share of basic public health service expenditures, Sichuan and Chongqing (80% shared by the central government), Hunan, Liaoning (60%, 50% shared by the central government respectively), Jiangsu and Guangdong (30% shared by the central government) were selected as the surveyed provinces. In each province, three cities with well-established medical insurance policies for ART and a high patient volume were selected, and then one major designated hospital for ART was selected in each city.

18 cities were selected as study sites, including Chengdu, Leshan and Mianyang in Sichuan province; Shapingba, Yubei and Nanan districts in Chongqing municipality; Changsha, Hengyang and Chenzhou in Hunan province; Shenyang, Tieling and Yingkou in Liaoning province; Nanjing, Nantong and Changzhou in Jiangsu province; and Guangzhou, Huizhou and Meizhou in Guangdong province.

Study participants

We chose the participants based on the sequence in which PLWH visited the designated hospitals for ART in the chosen cities to get ART medicines by using the inclusion and exclusion criteria. Inclusion criteria: (i) 18 years or older, (ii) PLWH who switched to medical insurance ART from free ART (got ART medicines through the national free ART policy after diagnosis of HIV infection, and then switched to get ART medicines in the list of *National Basic Medical Insurance Drug Catalog*) or PLWH who did not switch to medical insurance ART (got ART medicines through the national free ART policy after diagnosis of HIV infection up to now). (iii) Those who signed informed consent and completed the investigation successfully. Exclusion criteria: (i) Under the age of 18, (ii) PLWH who switched to medical insurance ART or received free ART for less than six months, (iii) Those who failed to sign informed consent and complete the investigation successfully.

The sample size was computed via the formula $N = \frac{Z_{1-\alpha/2}^2 \times pq}{d^2}$, where $\alpha = 0.05$ and $Z_{1-\alpha/2} = 1.96$. the estimated acceptable margin of error for proportion $d = 0.15p$, and the proportion of PLWH who switched to medical insurance ART from free ART was estimated at 15%. Finally, the minimum sample size was estimated at

about 1008. In this study, 1371 qualified questionnaires were obtained.

The data were obtained complied with relevant data protection and privacy regulations and individual identifiers were removed. The Institutional Review Board of National Center for AIDS/STD Control and Prevention, Chinese Center for Disease Control and Prevention (X220607702) gave ethical approval for all experimental protocols. All methods were performed in accordance with the Declaration of Helsinki.

Study methods

Between August 1, 2022 and February 28, 2023, a cross-sectional survey was conducted for this study. The Chinese online survey tool, *Wenjuanxing* (<http://www.wjx.cn>), was used to administer the survey. We held several discussions with experts from the center for disease control and prevention, hospitals, and medical insurance departments during the questionnaire design. The questionnaire inquired about participants' general characteristics (gender, age, ethnicity, education, marital status, occupation, type of basic medical insurance, route of transmission, etc.), economic status (average annual income of family members, personal annual income, changes in personal annual income, whether is the government medical aid recipient or households registered as living under the poverty line, etc.), ART status (year of initiating ART, level of ART hospital, distance to ART hospital, ART compliance, whether adverse medicine reactions occur). Sources of, reasons for, concerns about switching to medical insurance ART.

In order to ensure the quality of the investigation, we conduct training for on-site investigators before the investigation. During the investigation, we require investigators to make inquiries and fill in questionnaires strictly according to the corresponding standards. After the investigation, we carefully review the questionnaire, and timely fill in or delete any missing items or errors.

Changes in personal annual income

If the current personal annual income is decreased by \$1,397 or higher than the personal annual income at the beginning of ART, it is considered as a decrease in personal annual income. If the current personal annual income changes within \$1,397 compared with the personal annual income at the beginning of ART, it is considered as unchanged in personal annual income. If the current personal annual income is increased by \$1,397 or higher than the personal annual income at the beginning of ART, it is considered as an increase in personal annual income.

Government medical aid

Government medical aid is the term used to describe the extra assistance and support that the state and society provide to its poor residents who are unable to pay for medical care.

Households registered as living under the poverty line

Households registered as living under the poverty line is one way to reduce poverty in China's poverty alleviation policy. This involves creating a file and card for every poor household in order to create a national information network system for poverty alleviation and to develop support programs for impoverished households on a village-by-village and household-by-household basis.

Statistical analysis

After the data were extracted from the *Wenjuanxing*, Microsoft Excel 2021 was used for data sorting and verification, and SAS (version 9.4, SAS Institute Inc., Cary, NC, USA) was used for statistical analysis. Frequencies and percentages were used to characterize categorical data, and the median (interquartile range, IQR) was used to characterize quantitative data that did not fit into a normal distribution. The Chi-square test was used to analyse whether the differences between PLWH who switched to medical insurance ART and those who did not were statistically significant. Logistic regression was used to analyse the factors associated with switching to medical insurance ART. All variables were included in univariable logistic regression, and the forward selection was used to screen the multivariable logistic regression variables. P-value of <0.05 (two-tailed) was considered statistically significant. For brevity, only statistically significant variables in multivariable logistic regression were shown in the Table 2 in this article.

Results

General characteristics

Among the 1371 participants, the majority of them were male (83.8%), half of them were aged 18–39 (50.5%), and the majority of them were Han ethnicity (96.0%). 37.3% had undergraduate education or above, 45.3% were unmarried, and 53.9% were homosexual transmission (Table 1).

Economic status

Among the 1371 participants, the median value of average annual income of family members was \$3,493 (IQR: \$1,863–6,986), and most of average annual income of family members was \leq \$6,985 (69.6%). The median value of personal annual income was \$6,287 (IQR: \$2,794–11,177), and nearly half of the personal annual income was \leq \$6,985 (49.2%). 61.8% had no changes in personal annual income (Table 1).

ART status

Among the 1371 participants, 17.3% switched to medical insurance ART. 46.8% initiated ART between 2018 and 2022. 44.6% were at municipal hospitals, and most of the distance to ART hospitals was \leq 49 km (71.1%). There were 38 (2.8%) participants who did not get ART medicines on time, and 100 (7.3%) participants who did not strictly follow the time interval of taking ART medicines in the past 4 days. There were 298 (21.7%) participants with adverse medicine reactions (Table 1).

The differences between PLWH who switched to medical insurance ART and those who did not

Among 1371 participants, the differences between PLWH who switched to medical insurance ART and those who did not were statistically significant ($p < 0.05$) in education, occupation, type of basic medical insurance, average annual income of family members, personal annual income, changes in personal annual income, whether is the government medical aid recipient or households registered as living under the poverty line, year of initiating ART, level of ART hospital, distance to ART hospital, and whether adverse medicine reactions occur (Table 1).

Factors associated with switching to medical insurance ART

The results of the multivariable logistic regression showed that factors associated with switching to medical insurance ART were occupation, types of basic medical insurance, average annual income of family members, personal annual income, year of initiating ART, and level of ART Hospital.

Compared with unemployed/retired patients, government agency/public institution/state-owned enterprise employees were more willing to switch to medical insurance ART ($aOR = 2.34$, 95% *CI*: 1.29–4.26). Compared with basic medical insurance for urban and rural residents, basic medical insurance for urban employed were more willing to switch to medical insurance ART ($aOR = 1.93$, 95% *CI*: 1.28–2.90). Compared with those whose average annual income of family members were \leq \$6,985, \geq \$13,972 were more willing to switch to medical insurance ART ($aOR = 2.12$, 95% *CI*: 1.27–3.54). Compared with those whose personal annual income were \leq \$6,985, \geq \$13,972 were more willing to switch to medical insurance ART ($aOR = 2.39$, 95% *CI*: 1.43–4.00). Compared with those who initiated ART between 2018 and 2022, those who initiated ART before 2012 were more likely to switch to medical insurance ART ($aOR = 1.67$, 95% *CI*: 1.02–2.75). Compared with the level of ART hospitals were county hospitals or below, provincial hospitals were more willing to switch to medical insurance ART ($aOR = 2.00$, 95% *CI*: 1.30–3.09) (Table 2).

Table 1 The differences between PLWH who switched to medical insurance ART and those who did not

Variable	Participants n (%)	Switched to medical insur- ance ART n (%)	Did not switch to medical insurance ART n (%)	χ^2	p
Gender				1.087	0.297
Male	1149 (83.8)	204 (17.8)	945 (82.3)		
Female	222 (16.2)	33 (14.9)	189 (85.1)		
Age, years				3.519	0.172
18~39	692 (50.5)	122 (17.6)	570 (82.4)		
40~59	518 (37.8)	80 (15.4)	438 (84.6)		
≥60	161 (11.7)	35 (21.7)	126 (78.3)		
Ethnicity				0.833	0.361
Others	55 (4.0)	7 (12.7)	48 (87.3)		
Han	1316 (96.0)	230 (17.5)	1086 (82.5)		
Education				72.658	< 0.001
Elementary school or below	160 (11.7)	11 (6.9)	149 (93.1)		
Junior high school	377 (27.5)	29 (7.7)	348 (92.3)		
Senior high school or junior college	322 (23.5)	57 (17.7)	265 (82.3)		
Undergraduate or above	512 (37.3)	140 (27.3)	372 (72.7)		
Marital status				0.057	0.972
Divorced or widowed	238 (17.4)	42 (17.7)	196 (82.4)		
Unmarried	621 (45.3)	108 (17.4)	513 (82.6)		
Married	512 (37.3)	87 (17.0)	425 (83.0)		
Occupation				97.861	< 0.001
Unemployed/Retired	261 (19.0)	25 (9.6)	236 (90.4)		
Farming/Working outside the home	375 (27.4)	31 (8.3)	344 (91.7)		
Private/Foreign enterprise employees	468 (34.1)	102 (21.8)	366 (78.2)		
Government agency/Public institution/State-owned enterprise employees	167 (12.2)	66 (39.5)	101 (60.5)		
Others	100 (7.3)	13 (13.0)	87 (87.0)		
Type of basic medical insurance				107.894	< 0.001
Basic medical insurance for urban and rural residents	558 (40.7)	51 (9.1)	507 (90.9)		
Basic medical insurance for urban employed	648 (47.3)	183 (28.2)	465 (71.8)		
Others*	165 (12.0)	3 (1.8)	162 (98.2)		
In the last year, whether often work away from home				0.056	0.813
No	1141 (83.2)	196 (17.2)	945 (82.8)		
Yes	230 (16.8)	41 (17.8)	189 (82.2)		
Route of transmission				5.435	0.066
Heterosexual transmission	548 (40.0)	81 (14.8)	467 (85.2)		
Homosexual transmission	739 (53.9)	144 (19.5)	595 (80.5)		
Others	84 (6.1)	12 (14.3)	72 (85.7)		
Average annual income of family members, USD				123.975	< 0.001
≤ 6,985	954 (69.6)	106 (11.1)	848 (88.9)		
6,986~13,971	266 (19.4)	60 (22.6)	206 (77.4)		
≥ 13,972	151 (11.0)	71 (47.0)	80 (53.0)		
Personal annual income, USD				127.182	< 0.001
≤ 6,985	674 (49.2)	58 (8.6)	616 (91.4)		
6,986~13,971	406 (29.6)	67 (16.5)	339 (83.5)		
≥ 13,972	291 (21.2)	112 (38.5)	179 (61.5)		
Changes in personal annual income				12.622	0.002
Decreased	243 (17.7)	33 (13.6)	210 (86.4)		
Unchanged	847 (61.8)	136 (16.1)	711 (83.9)		
Increased	281 (20.5)	68 (24.2)	213 (75.8)		
Whether is the government medical aid recipient or house- holds registered as living under the poverty line				5.465	0.019
No	1226 (89.4)	222 (18.1)	1004 (81.9)		

Table 1 (continued)

Variable	Participants n (%)	Switched to medical insur- ance ART n (%)	Did not switch to medical insurance ART n (%)	χ^2	<i>p</i>
Yes	145 (10.6)	15 (10.3)	130 (89.7)		
Year of initiating ART				7.989	0.018
2018~2022	641 (46.8)	102 (15.9)	539 (84.1)		
2013~2017	595 (43.4)	100 (16.8)	495 (83.2)		
~2012	135 (9.9)	35 (25.9)	100 (74.1)		
Level of ART hospital				58.303	< 0.001
County hospitals or below	432 (31.5)	53 (12.3)	379 (87.7)		
Municipal hospitals	612 (44.6)	82 (13.4)	530 (86.6)		
Provincial hospitals	327 (23.9)	102 (31.2)	225 (68.8)		
Distance to ART Hospital, km				11.079	0.004
≤49	975 (71.1)	189 (19.4)	786 (80.6)		
50~99	197 (14.4)	27 (13.7)	170 (86.3)		
≥100	199 (14.5)	21 (10.5)	178 (89.5)		
Whether to get ART medicines on time				0.061	0.805
No	38 (2.8)	6 (15.8)	32 (84.2)		
Yes	1333 (97.2)	231 (17.3)	1102 (82.7)		
Whether strictly follow the time interval of taking ART medicines in the past 4 days				2.109	0.147
No	100 (7.3)	12 (12.0)	88 (88.0)		
Yes	1271 (92.7)	225 (17.7)	1046 (82.3)		
Whether adverse medicine reactions occur				11.419	< 0.001
No	1073 (78.3)	205 (19.1)	868 (80.9)		
Yes	298 (21.7)	32 (10.7)	266 (89.3)		
Total	1371 (100.0)	237 (17.3)	1134 (82.7)		

Note: *: Others include without basic medical insurance, free medical service, etc

Sources of, reasons for, concerns about switching to medical insurance ART

Among the 273 PLWH who switched to medical insurance ART, the sources of information for switching were mainly from physicians (84.0%) (Fig. 1). The reasons for switching were mostly less adverse medicine reactions (91.1%), more convenient to take medicines (64.6%), and better treatment effect (63.7%) (Fig. 2). The main concerns about switching were privacy disclosure (72.6%) and high cost of medicines and tests (59.1%) (Fig. 3).

Discussion

China's free ART policy has developed into a mature standard and practice after 20 years of implementation, development, and refinement. No matter in the past or now, free ART is the most important ART security policy for PLWH. Medical insurance policies including AIDS outpatient specific disease, dual channel, and separate payment are improving in China as HIV prevention and control enters a phase of high-quality development, which encourages some PLWH to switch to medical insurance ART [24]. The study found that 17.3% (273/1371) of PLWH switched to medical insurance ART, indicating the attractiveness of medical insurance ART. In the future, medical insurance ART will be an

important supplement to free ART to meet the diversified ART needs of PLWH in China.

There were differences in the general characteristics between PLWH who switched to medical insurance ART and those who did not. Specifically, there were differences in knowledge level, occupation, social status and economic status between those who switched to medical insurance ART and those who did not. This may be because those with more education, steady employment and decent incomes, and a higher social status are more knowledgeable about medical insurance ART and have the financial means to cover the out-of-pocket costs associated with it. As a result, a larger percentage of these patients switch to medical insurance ART.

There were differences in the ART status between PLWH who switched to medical insurance ART and those who did not. The earlier the year of initiating ART, the higher the level of the ART hospital, and the closer the distance to the ART hospital, the higher the proportion of switching to medical insurance ART. The reason why PLWH who switched to medical insurance ART had lower rates of adverse medicine reactions than free ART is likely that medical insurance ART medicines were mostly single-tablet combinations that had just hit the

Table 2 Univariable and multivariable logistic regression analysis showing the factors associated with switching to medical insurance ART

Variable	Univariable logistic regression		Multivariable logistic regression	
	OR (95% CI)	P	aOR (95% CI)	P
Occupation				
Unemployed/Retired	1.00		1.00	
Farming/Working outside the home	0.85 (0.49–1.48)	0.566	0.93 (0.52–1.67)	0.816
Private/Foreign enterprise employees	2.63 (1.65–4.20)	< 0.001	1.16 (0.67–1.99)	0.605
Government agency/Public institution/State-owned enterprise employees	6.17 (3.68–10.33)	< 0.001	2.34 (1.29–4.26)	0.005
Others	1.41 (0.69–2.88)	0.345	1.28 (0.59–2.79)	0.533
Type of basic medical insurance				
Basic medical insurance for urban and rural residents	1.00		1.00	
Basic medical insurance for urban employed	3.91 (2.80–5.47)	< 0.001	1.93 (1.28–2.90)	0.002
Others*	0.18 (0.06–0.60)	0.005	0.15 (0.04–0.48)	0.002
Average annual income of family members, USD				
≤ 6,985	1.00		1.00	
6,986 ~ 13,971	2.33 (1.64–3.31)	< 0.001	1.01 (0.65–1.55)	0.981
≥ 13,972	7.10 (4.87–10.36)	< 0.001	2.12 (1.27–3.54)	0.004
Personal annual income, USD				
≤ 6,985	1.00		1.00	
6,986 ~ 13,971	2.10 (1.44–3.06)	< 0.001	1.43 (0.92–2.22)	0.115
≥ 13,972	6.65 (4.65–9.51)	< 0.001	2.39 (1.43–4.00)	< 0.001
Year of initiating ART				
2018 ~ 2022	1.00		1.00	
2013 ~ 2017	1.07 (0.79–1.44)	0.671	0.72 (0.51–1.01)	0.054
~ 2012	1.85 (1.19–2.87)	0.006	1.67 (1.02–2.75)	0.043
Level of ART hospital				
County hospitals or below	1.00		1.00	
Municipal hospitals	1.11 (0.76–1.60)	0.592	1.09 (0.73–1.63)	0.667
Provincial hospitals	3.24 (2.24–4.70)	< 0.001	2.00 (1.30–3.09)	0.002

Note: *: Others include without basic medical insurance, free medical service, etc

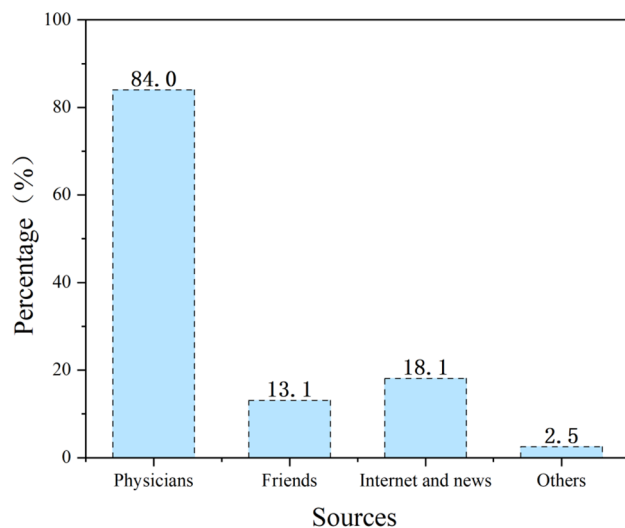


Fig. 1 Sources of switching to medical insurance ART

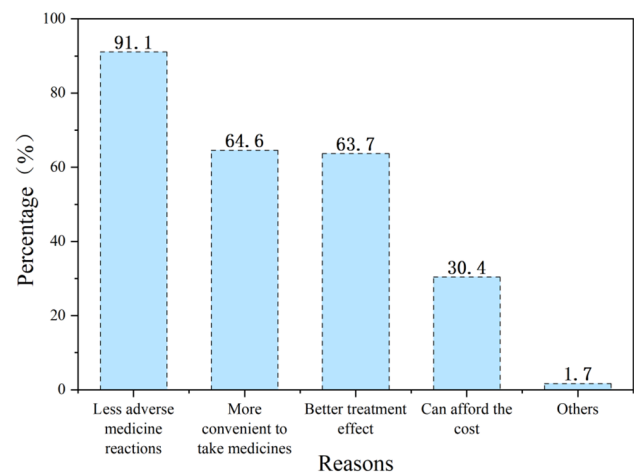


Fig. 2 Reasons for switching to medical insurance ART

market in recent years, and these medicines had fewer side effects compared to free ART medicines [21, 22].

For factors associated with switching to medical insurance ART, compared with unemployed/retired patients, government agency/public institution/state-owned

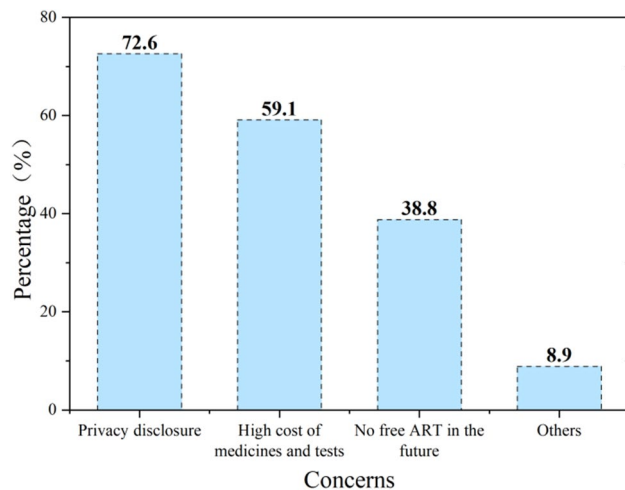


Fig. 3 Concerns about switching to medical insurance ART. Note: Percentage = The frequency of this option was selected / The number of qualified answer sheets * 100%

enterprise employees were more willing to switch to medical insurance ART. Compared with those whose average annual income of family members were \leq \$6,985, those whose average annual income of family members were \geq \$13,972 were more willing to switch to medical insurance ART. Compared with those whose personal annual income were \leq \$6,985, those whose personal annual income were \geq \$13,972 were more willing to switch to medical insurance ART. When deciding whether to switch to medical insurance ART, income is a significant aspect. The first thing that changes when PLWH switch to medical insurance ART is the expense. Free ART medicines are provided by the state at no cost, while medical insurance ART medicines cost about \$42–70 every month. Patients with stable jobs, high social class, and decent incomes are more willing to switch to medical insurance ART after comparing the cost and advantages of medical insurance ART medicines. Paying \$42–70 every month for ART is also a significant financial strain for low-income patients [26, 27]. As a result, these patients are less likely to switch to medical insurance ART.

Compared with the basic medical insurance for urban and rural residents, basic medical insurance for urban employed were more willing to switch to medical insurance ART. In China, the basic medical insurance is mainly divided into basic medical insurance for urban employed and basic medical insurance for urban and rural residents. The basic medical insurance for urban employed is for urban workers, who have stable and well-paid jobs, while the basic medical insurance for urban and rural residents is for rural residents or urban residents without jobs. And the reimbursement ratio of basic medical insurance for urban employed is higher than that of basic medical insurance for urban and rural residents

[28]. In one Chinese city, for example, the reimbursement rate is 70% for basic medical insurance for urban employed and 60% for basic medical insurance for urban and rural residents. PLWH with basic medical insurance for urban employed have better economic status and need to pay less out-of-pocket for medical insurance ART than those with basic medical insurance for urban and rural residents, so they are more willing to switch to medical insurance ART.

Compared with those who initiated ART in 2018–2022, those who initiated ART before 2012 were more willing to switch to medical insurance ART. PLWH who initiated ART before 2012 were on ART for a longer duration, so they were more likely to experience ART failure, medicine toxicities, comorbidities, and medicine resistance than PLWH on ART for a shorter duration [29–31]. Therefore, these patients are more willing to switch to medical insurance ART on the advice of their physicians or on their own initiative, in order to lessen or mitigate the negative effects of long-term ART on their health.

Compared with the county hospitals or below, PLWH receive ART in provincial hospitals were more willing to switch to medical insurance ART. Provincial hospitals are generally located in the provincial capital, and the implementation of national AIDS insurance security policies such as AIDS outpatient specific disease, dual channel, separate payment are better than county hospitals or below. Patients are able to switch to medical insurance ART more easily and efficiently at provincial hospitals. In addition, PLWH in provincial hospitals are richer than county hospitals or below generally, so they are more willing to switch to medical insurance ART.

The source of information for switching was mainly from physicians, indicating that physicians were important for patients to switch to medical insurance ART. In the future, training for physicians on medical insurance ART should be strengthened, so that they can guide PLWH to switch to medical insurance ART correctly and reasonably. The reasons for switching were mostly less adverse medicine reactions, more convenient to take medicines, and better treatment effect. It is evident from this that PLWH who switch to medical insurance ART with the expectation that ART medicines will not only control HIV in the body but also to simplify and improve their quality of life [32]. They also hope that the medicines will not negatively impact their bodies and will be easier to take (Free ART medicines are generally taken twice a day, taking 2–3 pills at a time, while medical insurance ART medicines are generally taken once a day, taking 1 pill at a time).

The biggest worries of PLWH regarding medical insurance ART are privacy disclosure and high cost of medicines and tests. Patients with AIDS generally do not want their HIV status to be known since it is a sensitive disease

and they are susceptible to discrimination [33, 34]. The primary worry of PLWH who have switched to medical insurance ART is privacy disclosure, which is a danger associated with the multiple departments involved in the auditing and reimbursement of medical insurance ART. In the future, the privacy protection system should be improved to reduce the risk of privacy disclosure. Although the economic status of PLWH who switch to medical insurance ART is better than those who receive free ART, money is a major concern for them. Whether to further increase the reimbursement rate of medical insurance ART and reduce the out-of-pocket payment rate to alleviate their financial burden need to be further studied.

There are some limitations in this study. Firstly, there are many provinces and cities involved in this study, and the sampling standards are difficult to be completely consistent, so there are sampling errors. Secondly, this study lacked data on treatment, such as CD4 cell count, viral load, and drug resistance. Therefore, it is impossible to compare the treatment effect of PLWH who switched to medical insurance ART and those who did not. And more studies can be carried out in the future to make up for this deficiency.

Conclusion

Among the participants in this study, 17.3% PLWH switched to medical insurance ART, indicating the attractiveness of medical insurance ART. Government agency/public institution/state-owned enterprise employees, basic medical insurance for urban employed, average annual income of family members were \geq \$13,972, personal annual income were \geq \$13,972, initiated ART before 2012, provincial hospitals were factors associated with switching to medical insurance ART. The characteristics of PLWH who switched to medical insurance ART and the factors associated with switching should be fully considered, so as to provide targeted ART services and improve ART security policy in China.

Abbreviations

ART	Antiretroviral therapy
AIDS	Acquired immune deficiency syndrome
PLWH	People living with human immunodeficiency virus
UNAIDS	Joint United Nations Programme on HIV/AIDS
3TC	Lamivudine
TDF	Tenofovir disoproxil fumarate
AZT	Zidovudine
ABC	Abacavir
EFV	Efavirenz
NVP	Nevirapine
LPV/r	Lopinavir/ritonavir
RPV	Rilpivirine
DTG	Dolutegravir
FTC	Emtricitabine
FNC	Azvidine
RPV	Rilpivirine
ANV	Ainuvirine
ABT	Albuvirtide for injection

AZT/3TC	Zidovudine/lamivudine
FTC/TDF	Emtricitabine/tenofovir
E/C/F/TAF	Elvitegravir/cobicistat/emtricitabine/tenofovir alafenamide
NVP/AZT/3TC	Nevirapine/zidovudine/lamivudine
B/F/TAF	Bictegravir/emtricitabine/tenofovir alafenamide
DTG/3TC	Dolutegravir/lamivudine
DOR/3TC/TDF	Doravirine/lamivudine/tenofovir disoproxil fumarate
IQR	Interquartile range

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Author contributions

JH designed, drafted, analyzed, and interpreted the results. WK, JG, JX, HT, DZ and XW participated in data collection, data analysis, and critically read the manuscript. PX, FL and GZ participated in designing the methodology, critically read the manuscript, and gave constructive comments for the manuscript. All authors contributed to manuscript preparation, read, and approved the final manuscript.

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Data availability

The datasets used and/or analyzed during the current study are not publicly available due to protect the privacy and confidentiality of participants in this study but are available upon reasonable request to the corresponding author.

Declarations

Ethics approval and consent to participate

The Institutional Review Board of National Center for AIDS/STD Control and Prevention, Chinese Center for Disease Control and Prevention (X220607702) gave ethical approval for all experimental protocols. All methods were performed in accordance with the Declaration of Helsinki. Signed electronic informed consent forms were obtained from all participants involved in the study.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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