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Determinants of Non-Observance to Antiretroviral Therapy in the Mayo-Louti Division of the North Region of Cameroon

Déterminants de la Non-Observance aux Antirétroviraux dans le Département de Mayo-Louti au Nord-Cameroun

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ABSTRACT

Introduction. The combination of antiretroviral therapy (cART) leads to decrease viral replication and the restoration of immunity, thus improving vital prognosis. Treatment adherence is essential to control HIV infection and avoid complications and the occurrence of resistance. This study aimed at identifying the factors associated with non-adherence to antiretroviral therapy in three health districts of the North region of Cameroon. **Methods.** This is a cross-sectional study conducted in three health districts of the North region of Cameroon from July to September 2022. Adherence to cART was assessed among Peron Living with HIV (PLHIV) who were followed up at the different treatment centers using a standardized questionnaire. Sociodemographic, clinical and therapeutical data were recorded. Data were analyzed using EPI info 7.2.5.0. Software. Univariate and multivariate analyses were performed to identify factors associated with HAART non-adherence. **Result.** During the study, 393 patients were recruited and eligible for this study. The average age was 41.3 ± 10.2 with a female predominance of 63.36%. Non-adherence was found among 200 (50.9%) participants. Factors associated with non-adherence included: age below 30 (OR: 2.24, p=0.016), coming from a rural area (OR: 2.24, p=0.042) and illiteracy (OR: 2.87, p=0.002). **Conclusion.** PLHIVs in the North region of Cameroon have a very poor adherence to HAART. Young age, geographical location, and illiteracy were associated with non-adherence. There is a need for more education for improving HAART adherence among these populations.

RÉSUMÉ

Introduction. Les antirétroviraux (ARV) entraînent une diminution de la réplication virale et la restauration de l'immunité, améliorant ainsi le pronostic vital. Ainsi, l'observance thérapeutique est essentielle pour contrôler l'infection par le VIH et éviter les complications et les résistances aux ARV. L'objectif principal était d'évaluer les facteurs associés à la non-observance aux ARV dans trois Districts de Santé du Nord-Cameroun. **Méthodologie.** Il s'agissait d'une étude transversale descriptive et analytique menée au Nord-Cameroun, durant la période de 3mois (juillet à septembre 2022). Un questionnaire standardisé nous a permis d'évaluer l'adhérence aux ARV chez les patients suivis dans les différentes Unités de Prise en Charge. Les données sociodémographiques, cliniques et thérapeutiques ont été recodées et analysées à l'aide du Logiciel EPI info version 7.2.5.0. L'analyse univariée et multivariée ont permis d'identifier les facteurs associés à la non-observance aux ARV. **Résultat.** 393 patients étaient éligibles. L'âge moyen était de 41,3 ±10,2 avec une prédominance féminine à 63,36 %. La non-adhérence a été retrouvé chez 200 (50,9%) des participants. Les facteurs associés à la non-adhérence incluaient l'âge inférieur à 30 ans (OR: 2.24, p=0.016), la provenance d'une zone rurale (OR: 2.24, p=0.042) et l'analphabétisme (OR: 2.87, p=0.002). **Conclusion.** Les Personnes vivant avec le VIH au Nord-Cameroun ont une faible adhérence aux ARV. Les sujets jeunes, l'origine géographique et l'analphabétisme étaient associés à la non-observance thérapeutique. Il serait essentiel d'insister sur une éducation thérapeutique appropriée afin d'améliorer leur observance thérapeutique aux ARV.

HIGHLIGHTS OF THE STUDY

What is already known on this topic
The North region of Cameroon has the lowest HIV viral load suppression. The achievement of the third target of the control goal of the «95-95-95» initiative is passing through a good therapeutic adherence to antiretroviral therapy.

What question this study addressed
Prevalence of non-adherence to cART and associated factors among PLHIV.

What this study adds to our knowledge.
1. Non-adherence was found among 200/393 (50.89%) participants.
2. The factors associated with non-adherence identified among our population study were age under 30, coming from a rural area and illiteracy

How this is relevant to practice, policy or further research.
There is a need for more extensive studies to improve the validity of this study for the appropriate management of HIV

INTRODUCTION

According to the WHO, by the end of 2021, people living with HIV was estimated at 38.4 million [33.9 to 43.8 million], of which more than two-thirds (2/3) were from Africa (1). In order to control the HIV pandemic by 2030, UNAIDS has launched, since December 2020, a new set of target to ensure that 95% of people living with HIV know their HIV status, 95% of people who know their HIV status are placed on treatment and 95% of people who receive treatment suppress their viral load (2, 3). The achievement of the third target is passing through a good therapeutic adherence to highly active antiretroviral therapy (***HAART***). This treatment led to a significantly reduced viral replication, immunity restoration and improving the vital prognosis **(3,4,5,6).** Nevertheless, to obtain such results, it is necessary to ensure good therapeutic observance. This will allow, in addition to infection control, the prevention of complications and the occurrence of resistance **(7, 8).** Hence, the commitment of the patient himself to follow his treatment as well as institutional factors such as the non-storage are determinant factors for good therapeutic observance **(2).** Recent studies in Liège, Belgium among patients living with HIV (PLHIV), showed that approximately one-third of the patients take their medication as prescribed **(2,8).** The tendency to non-adherence to treatment was due to forgetfulness, occupations, adverse effects from the medication, financial precariousness to go to the hospital, shortage of drug stock, travel, fatigue, the feeling of clinical improvement, depression, disease, stigma, the influence of churches and traditional healers **(2, 8, 9).**

In Cameroon, the prevalence of HIV infection has been decreasing since 2004, ranging from 5.5% in 2004 to 4.3% in 2011 then to 3.4% in 2017. This drop in prevalence is probably related to the improving access to antiretroviral treatments and the various intervention programs **(3, 10, 11, 12).** However, this prevalence is still high in certain regions of Cameroon. The North region has the lowest percentage of HIV viral load suppression (VLS) in Cameroon **(12).** Thus, to achieve the control goal of the 95-95-95 initiative, there is a need to determine the prevalence of non-adherence to antiretroviral therapy and identify the associated factors among PLHIV. This prompted for the conduct of this pilot study in Mayo-Louti division of the North region of Cameroon.

METHODS

Study setting

This was a cross-sectional study, that took place during a 3 months-period (from July 1st, 2022 to September 31st, 2022). It was conducted among adults living with HIV followed up in three district hospitals (Figuil, Guider and Mayo-Oulo) in the North Region of Cameroon; all housing the HIV Care Units (HCU).
Data analysis were recorded using Excel 2016 software and analyzed using EPI info 7.2.5.0 software. Categorical variables were estimated as proportions with a 95% confidence interval and continuous quantitative variables as median ± standard deviation.

Study population

This study targeted PLHIV who were being followed up in HIV treatment centers of the three district hospitals included in the study. PLHIV aged from 18 years and on HAART for 6 months or more were identified from hospital records. After a review consent, they were approached, and, enrolled to complete a pre-tested and standardized questionnaire. Clear information was given to all participants about the study purpose, adequate filling of questionnaires and participation modalities. All participants who responded to the questionnaire were included. Informed consent introduced by psyco-social agents who follow PLHIV in different HIV Care Units (HCU), was obtained from all study participants and the study was conducted according to the Helsinki Declaration.

Procedures

We were introduced to HCUs by the heads of the hospitals. Patients who sign the informed consent form from their psycho-social agents (professionals contributing to the patient's care), were included in the study. We began by analyzing the Medical records of consenting patients. Patients meeting the inclusion criteria were selected for the study. A data collection tool was designed for assessing therapeutic adherence. The questionnaire was open, bilingual and anonymous and administered during a face-to-face interview. We defined non-adherence by the fact that patient missed their treatment for a week or more during the month before the beginning of the survey or since treatment initiation (13).

Variables

The following variables were collected during this study: sociodemographic characteristics (gender, age, marital status, level of education, activity, health status, area of residence and region of residence), and therapeutic (cART, awaiting time) and explicative variables (therapeutic compliance). Therapeutic adherence was judged on the patient declarations and records of missed appointments.

2.5. Data analysis

Data were entered into Microsoft Excel 2016 and analyzed using Epi-info® software version 7.2.5.0. The results were presented in tables and figures. We compared the different variables of individuals with non-adherence to those with treatment adherence. Qualitative variables were expressed as proportions. Quantitative (continuous) variables were expressed as means ± standard deviation. Pearson's Chi-square test was performed to assess the dependence of qualitative variables on non-adherence. The Student's t-test was performed to compare means for normally distributed data. Bivariate analysis was used to search for risk factors for global non-adherence. Variables related to the non-adherence, with a p-value less than 0.25 in the bivariate analysis were included in a multivariate model. Any variable associated with non-adherence with a p-value <0.05 were retained in the final model.

RESULTS

General characteristics of the study population

During the study 393 participants were recruited and participated with 249 women (63.4%) and 144 men (36.6%). Non-adherence was found among 200 (50.89%) participants. The characteristics of the general population according to therapeutic adherence are summarized in Table 1. Concerning the non-adherence participants, the mean age was significantly higher (41.3 ± 10.2 years) than that of the adherent patients (p=0.032). Concerning the origin of the patients, the majority of them 167 (83.5%) came from the urban areas (p<0.001). Similarly, literacy participants was found majority 148 (74.0 %) (p<0.001), few participants 54 (27.0%) had no-income generating activity (p<0.001). Based on serological status of their partners, few participants 84 (42.0%) reported knowing their partners'HIV status (p<0.001)

Table 1. Characteristics of the general population according to therapeutic adherence

Variable	Terms	Taking the treatment		Total	P
		No n=200(%)	Yes n=193(%)	N=393(%)	
Sex (%)	F	120 (60.0)	129 (66.8)	249 (63.4)	0.193
	M	80 (40.0)	64 (33.2)	144 (36.6)	
Age	Medium (SD)	41.3 (10.2)	39.1(10.3)		**0.032**
Origin (%)	Urban areas	167 (83.5)	129 (66.8)	296 (75.3)	**<0.001**
	Rural areas	33 (16.5)	64 (33.2)	97 (24.7)	
Marital_status (%)	Single	118 (59.0)	114 (59.1)	232 (59.0)	0.205
	Divorce	20 (10.0)	30 (15.5)	50 (12.7)	
	Married	33(16.5)	31 (16.1)	64 (16.3)	
	free Union	29 (14.5)	18 (9.3)	47 (12.0)	
Serological status of the partners (%)	Unknown	14 (7.0)	66 (34.2)	80 (20.4)	**<0.001**
	Known	84 (42.0)	58 (30.1)	142 (36.1)	
	no answer	102 (51.0)	69 (35.8)	171 (43.5)	
Education (%)	Literacy	148 (74.0)	98 (50.8)	246 (62.6)	**<0.001**
	Illiteracy	52 (26.0)	95 (49.2)	147 (37.4)	
Income generating activity (%)	Without income	54 (27.0)	85 (44.0)	139 (35.4)	**<0.001**
	With income	146 (73.0)	108 (56.0)	254 4.6)	

Table 2: Characteristics of the acceptability of HIV serological status according to therapeutic adherence to ARVs Average of awaiting time: 60.9+/-41.4

Variable	Terms	Taking the treatment		Total	P
		No (n=200)	Yes (n=193)	N=393	
Awaiting time (mins)	Average (SD)	69.2 ±44.5	46.7 ±30.6		**<0.001**
Informed confident (%)	No	25 (12.6)	51 (26.6)	76 (19.4)	**<0.001**
	Yes	174 (87.4)	141 (73.4)	391 (80.6)	
Rejection by confident (%)	No	148 (80.4)	145 (91.77)	293 (85.7)	**0.005**
	Yes	36 (19.6)	13 (8.2)	49 (14.3)	

Table 3: Risk factors for ART non-adherence

Variable	Terms	[1]OR	[2]CI95%	p-value
AGE <30		1.98	[1.18-3.31]	0.001
Origin	Urban areas	—	—	
	Rural areas	2.5	[1.56 - 4.05]	<0.001
Stat_spouse	Unknown	—	—	
	known positive	0.18	[0.08 - 0.37]	<0.001
Instruction	Literacy	—	—	
	Illiteracy	2.75	[1.81 - 4.21]	<0.001
Income generating activity	With revenue	—	—	
	Without income	2.12	[1.40 - 3.25]	0.001
Source of information about HIV	Community	—	—	
	School	0.88	[0.14-5.53]	0.892
	Hospital	0.30	[0.14 - 0.64]	0.002
	Media	1.22	[0.50 - 2.99]	0.670
Informed confident	No	—	—	
	Yes	0.40	[0.23 - 0.67]	0.001
Awaiting time		0.98	[0.97 - 0.99]	<0.001

[1]OR = Odds Ratio, [2]CI = Confidence Interval

Table IV: Factors associated with follow-up treatment

Variable	Terms	OR [1]	95% CI [2]	p-value
<30 years old		2.24	[1.17 – 4.31]	0.016
Origin	Rural area	—	—	
	Rural area	1.93	[1.02 – 3.63]	0.042
Instruction	literate	—	—	
	Illiterate	2.87	[1.46 – 5.65]	0.002
Spouse statut	Unknown	—	—	
	Known Positive	0.20	[0.04 - 0.25]	< 0.001

[1]OR = Odds Ratio, [2]CI = Confidence Interval

Acceptability of HIV status

The estimated median waiting time for follow-up appointments was significantly longer for those who were non-adherent to ART (69.2 ± 44.5 minutes), p<0.001.

Based on sharing their HIV status with a confidant, non-adherent participants who did not are more numerous 174 (87.4%), p<0.001. Thirty-six (19.6%) of non-adherent participants were more rejected by their confidants, p= 0.005**.**

Characteristics of the acceptability of HIV serological status according to ARV treatment adherence are summarized in Table 2.

Analytical study

Bivariate analysis

The following factors were associated, in bivariate analysis, with non-adherence. These are : age under 30 years [OR :1.98 (95% CI:1.18-3.31), p=0.01]; coming from the rural area [OR : 2.5 (95% CI:1.56 - 4.05 , p<0.001]; illiteracy [2.75 (1.81 - 4.21) , p<0.001], non-income generating activity [2.12 (1.40 - 3.25) , p=0.001]. Risk factors for ART adherence are summarized in Table 3.

Multivariate analysis

In multivariate analysis, the factors associated with non-adherence were: age under 30 years [OR: 2.24 (95% CI: **1.17 – 4.31**), p=0.016], coming from a rural area [OR: 1.93 (95% CI: **1.02 – 3.63**), p=0.042] and illiteracy [OR: 2.87 (95% CI: **1.46 – 5.65**), p=0.002].

DISCUSSION

Adherence to ART remains an important problem among the population of PLHIV in sub-Saharan Africa (SSA). The risk factors for non-adherence differ from any population to the other. This study aimed to establish the prevalence of non-adherence to ART and identify its determinants in a population already known as poorly observant (12). This study shows a higher prevalence of non-adherence to ART and that the main risk factors were sociodemographic (age under 30 years, coming from a rural area and illiteracy).

The prevalence of ART non-adherence was 50.89%. This result was higher than those of Buh et *al. 2023*, who recently found almost 40% of non-adherence among the PLHIV population of three regions of Cameroon (26). This significant difference could be due to the isolation, poverty, conflicts and illiteracy which are much more found in this region and make it the one with the least controlled HIV viral load (12).

Our study population shows a female predominance. Several studies have shown this trend toward the feminization of HIV infection **(4, 14, 15, 16, 17, 18).** This could be explained by the non-use of condoms, women's vulnerability to sexually transmitted infections, gender-based violence and multiple sexual partners, poverty, difficulties in accessing care, early sexual activity with cervical trauma, forgetfulness linked to HIV-related neuropsychiatric disorders **(16, 19, 20, 21, 22)**.

Economic precariousness increases the risk of non-adherence to treatment. Some authors **(4, 21, 22)** have found that difficulties related to transport, debts contracted by husbands and which leads the woman to become a sex worker, were factors associated with poor adherence to antiretroviral treatment.

Young age referred to as under 30 or childbearing age was associated with non-adherence to ART. This result is in accordance with that found in other studies **(4, 9, 15, 16, 23, 24)**. Indeed, young people tend to overlook HIV infection and drop out of treatment once they have a clinical improvement **(15, 21).** Poor adherence was mostly found among adolescents in other studies **(27).**

Being from a rural area was associated with non-adherence. Subsequent studies in the Districts could explain this. However, some studies **(4, 22, 16)** have shown that living close to a clinic is associated with good adherence to ART. Also, the distance for rural patients complicates follow-up and adherence to treatment**.** This shows the importance of decentralization and proximity to HIV care sites.

Illiteracy also by some authors **(22)** was associated with non-adherence to treatment. Hence, the importance of communication adapted according to the level of education of the patient and the follow-up.

On the other hand, the sharing of one's serological status with one's confident of the spouse decreases by about eight times the therapeutic non-compliance (p<0.004). Authors **(22, 25)** found that non-disclosure of status to partners and stigmatization and lack of parental support were the main reasons for non-adherence. On the other hand, membership in a PLHIV support group **(22)** and status sharing **(18)** were significant predictors of good adherence.

Limitations & Strengh

The goal of this pilot study was to contribute to improve adherence to HAART. Subsidy difficulties limited the study to thee HIV care units (HCUs). This study has also experienced the the lack of consideration of viral load measures in order to show a correlation between the level of adherence to ART and the virological response of

patients. Other studies will improve the validity of this study.

CONCLUSION

Non-adherence to ART remains a great challenge in sub-Saharan Africa, particularly in Mayo-Louti division in the North Region of Cameroon with 50.89% prevalence. The factors associated with non-adherence identified among our population study were age under 30, coming from a rural area and illiteracy. These factors should be addressed, in order to reach the 95-95-95 goal. Thus, free ARTs are not enough. For these populations, there is a need to insist on the effective decentralization of care for HIV infection, as well as psychosocial care and the strengthening of appropriate therapeutic education.

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Competing interests

The authors declares no competing interests.

Authors' contributions

Concept and study design: HAS, HA;
Data collection: HAS, HA;
Data analysis: HAS, HA ;
Writing of the manuscript: HAS, HA , SRSN ;
Manuscript revision for intellectual content: FKL, CNO, TE, SPC.
All authors read and approved the final version of the manuscript

REFERENCES

1. *WHO: https://www.who.int/en/news-room/fact-sheets/detail/hiv-aids , July 27, 2022.*
2. *UNAIDS: https://www.unaids.org/en/goals/unitednationsdeclarationsandgoals .*
3. Baleeta K, Muhwezi A, Tumwesigye N, Kintu BN, Riese S, Byonanebye D et al. Factors that influence the satisfaction of people living with HIV with differentiated antiretroviral therapy delivery models in east Central Uganda: a cross-sectional study. BMC Health Serv Res. 2023 Feb 8;23(1):127.
4. Nouhoum T, Modibo K, Oumar S, Kassoum K, Mamadou B, Cheick AC et al. Factors Associated with HIV Treatment Failure at Center Hospitalier Universitaire du Point G, Bamako. Health Sci.Dis: Vol 23 (3) March2022pp 75-80.
5. Manga NM, Diop SA, Ndour CT, Dia NM, Mendy A, Coudec M et al. Late detection of HIV infection at the Fann infectious diseases clinic, Dakar: circumstances of diagnosis, therapeutic itinerary of patients and determining factors. Med Mal Infect. 2009 Feb;39(2):95-100.
6. Bastard M, Pinoges L, Balkan S, Szumilin E, Ferreyra C, Pujades-Rodriguez M. Timeliness of clinic attendance is a good predictor of virological response and resistance to antiretroviral drugs in HIV-infected patients. PLoS One. 2012;7(11):e49091.
7. Maria MPM, Carvalho MP, Fassa AG. Adesão à terapia antirretroviral de pessoas vivendo com HIV/aids em Florianópolis, Santa Catarina, Brasil [Adherence to antiretroviral therapy by people living with HIV/AIDS in Florianópolis, Santa Catarina State, Brazil]. Cad Saude Publica. 2023 Feb 10;39(1):e00099622.
8. Scheen AJ, Giet D. Non-observance thérapeutique : causes, conséquences, solutions. Rev Med Liège 2010; 65 : 5-6 : 239-245.
9. Kombelemba KD, Tagoto TA, Wembakoy OA, Lusamaki MF, Panda LK, Losimba LJ. (2022). Factors Associated With Non-Adherence To Antiretroviral Treatment In The City Of Kisangani In The Drc. *Journal of Pharmaceutical Negative Results , 13* , 2163–2168.
10. Laborde-Balen G, Elad O, Taverne B. "You burned your first line! ". Anthropology of therapeutic failure in the treatment of HIV in Cameroon. Anthropol Santé Rev Int Francoph Anthropol Santé. 2020;(20).
11. *https://www.unaids.org/sites/default/files/country/documents/CMR_2019_countryreport.pdf*
12. CAMPHIA-Summary-Sheet-EN_ARV-Adjusted_Mar2020.
13. Essomba EN, Adiogo D, Koum DCK, Amang B, Lehman LG, Coppieters Y. Factors associated with non-adherence to treatment in adult subjects infected with HIV on antiretrovirals in a referral hospital in Douala. PAMJ . *2015;20:412* .
14. *Abebe KB, Tegegne AS. Predictors of non-adherence to medication and time to default from treatment on HIV infected patients under HAART: a comparison of joint and separate models. Afri Health Sci. 2022;22(1):443-55.*
15. Benilde Bepouka Izizag et al. Determinants of non-adherence to antiretroviral treatment in adults in Kinshasa. Pan African Medical Journal. 2020;37(157).
16. De Las Cuevas C, Peñate W. Psychometric properties of the eight-item Morisky Medication Adherence Scale (MMAS-8) in a psychiatric outpatient setting. Int J Clin Health Psychol. 2015 May-Aug;15(2):121-129. doi: 10.1016/j.ijchp.2014.11.003. Epub 2014 Dec 25.
17. Baleeta K, Muhwezi A, Tumwesigye N, Kintu BN, Riese S, Byonanebye D, et al. Factors that influence the satisfaction of people living with HIV with differentiated antiretroviral therapy delivery models in east Central Uganda: a cross-sectional study. BMC Health Serv Res. 2023 Feb 8;23(1):127.
18. KAMATE E, DIAKITE A, CISSE M, CISSE T, BA BS, OUOLOGUEM DS et al. Impact de l'Education Thérapeutique des Patients sur l'observance des sujets séropositifs, sous traitement antirétroviral au Centre Hospitalier Universitaire du Point G à Bamako. Rev Mali Infect Microbiol 2022, 17:1.
19. Reed, E., Gupta, J., Biradavolu, M., Devireddy, V., & Blankenship, K. M. (2010). The context of economic insecurity and its relation to violence and risk factors for HIV among female sex workers in Andhra Pradesh, India. *Public health reports*, *125*(4_suppl), 81-89.
20. Estebanez, P., Fitch, K., & Nájera, R. (1993). HIV and female sex workers. *Bulletin of the World Health Organization*, *71*(3-4), 397.
21. Sarkar K, Bal B, Mukherjee R, Saha M K, Chakraborty S, Niyogi S K et al. (2006). Young age is a risk factor for HIV among female sex workers—an experience from India. *Journal of Infection*, *53*(4), 255-259.
22. Daltro ACB, Almeida CS, Unfried AGC, de Aquino TR, Travassos AGÁ (2023). Virological failure and adherence to antiretroviral therapy in adolescents and young adults living with human immunodeficiency virus. *Tropical Medicine & International Health*, *28*(3), 162-174.
23. Bastard M, Pinoges L, Balkan S, Szumilin E, Ferreyra C, Pujades-Rodriguez M (2012). Timeliness of clinic

attendance is a good predictor of virological response and resistance to antiretroviral drugs in HIV-infected patients. *PLoS One*, *7*(11), e49091.

24. Kagashe GAB, Rwebangila F (2011). Patient satisfaction with health care services provided at HIV clinics at Amana and Muhimbili hospitals in Dar es Salaam. *African health sciences* , *11* , 60-66.
25. Zoungrana-Yameogo W, Cisse K, Samadoulougou S, Traoré I, Drabo M, Bakiono F et al. (2022). Adherence to antiretroviral drugs in pregnant or breastfeeding women: an inventory in Burkina Faso. *Public Health* , 34 .
26. Buh A, Deonandan R, Gomes J, Krentel A, Oladimeji O, Yaya S (2023) Prevalence and factors associated with HIV treatment non-adherence among people living with HIV in three regions of Cameroon: A cross-sectional study. PLoS ONE 18(4): e0283991.
27. Zhou S, Cluver L, Shenderovich Y, Toska E. Uncovering ART adherence inconsistencies: An assessment of sustained adherence among adolescents in South Africa. J Int AIDS Soc [Internet]. oct 2021 [cité 14 juin 2023];24(10).

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