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Research Article

Level of adherence and associated factors among HIV-positive adolescents on antiretroviral therapy in Cameroon

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Aim: Globally, there were over 250 000 new HIV infections among adolescents in 2017, with a higher proportion of these in sub-Saharan Africa. In Cameroon, UNICEF estimated over 4 200 new HIV infections in adolescents in 2015; by 2016, there were over 40 000 adolescents who had HIV. Given that the number of adolescents living with HIV in Cameroon is on the increase, there is a need to better understand the factors influencing adherence to treatment. The objective of this study was to assess the factors associated with adherence among adolescents in Cameroon.
Methods: A cross-sectional study was conducted. A total of 460 HIV+ adolescents who were receiving antiretroviral therapy were sampled randomly from nine health facilities. Questionnaires and data extraction forms were used to collect data. Descriptive (frequencies and proportions) and inferential (chi-square and multivariate logistic regression) statistical analyses methods were used to analyse the data. Statistical significance was set at *p* = 0.05 and 95% confidence level.
Results: The level of adherence to antiretroviral therapy among the adolescents was 83%. Twelve out of 30 independent variables examined showed significant statistical association with adherence at the bivariate level. In the multivariable logistic regression analyses, however, only two variables significantly predicted adherence — experiencing side effects (AOR = 2.63; 95% CI = 1.14, 6.09; *p* = 0.02), and internalized stigma (AOR = 2.51; 95% CI = 1.04, 6.04; *p* = 0.04).
Conclusion: Adherence to treatment among adolescents in Cameroon was found to be suboptimal. There is a need for more individualized, targeted medication counselling for adolescents and their guardians as well as strategies to reduce internalized stigma and improve adherence to antiretroviral treatment.

Keywords: ARVs, internalised stigma, medication counselling, side effects, sub-optimal

Introduction

Despite over three decades of HIV, its prevalence — especially among adolescents — remains a public health concern. By 2017, there were over 250 000 new HIV infections among adolescents globally, with a higher proportion among those living in sub-Sahara Africa (UNAIDS, 2019). In Cameroon, UNICEF estimated over 4 200 new HIV infections in adolescents by 2015; by 2016, there were over 40 000 adolescents who had HIV (UNICEF, 2018). In 2012, the prevalence of HIV among adolescents in Cameroon was 2%, with 4 000 new infections anticipated annually (UNICEF, 2015). The rising number of HIV positive adolescents is perhaps due to the increase in incidence of horizontally acquired HIV as well as increase in the survival rates of children who acquired the virus through mother-to-child transmission of HIV (Maskew et al., 2016). Despite this upsurge in the number of HIV-positive adolescents, research in this area, especially in Cameroon, has been limited.

Therefore, this study bridges this knowledge gap by studying adherence levels and predictors among adolescents there.

Furthermore, adolescents have for some time been trapped between child and adult services that do not meet their particular needs, such as HIV status disclosure, adherence support mechanisms, issues of stigma and discrimination, sexual and reproductive health, mental health care, legal and social support (Ferrand et al., 2009). The situation is not very different in Cameroon where there were over 7 100 children and adolescents enrolled on antiretroviral therapy (ART) treatment by the end of 2015 (Ministry of Health, Cameroon 2015). Despite this, research interest has not been focused on this area and hence the need for this study.

Recent treatment protocols require early initiation of ART and a huge number of HIV-positive adolescents are now being enrolled into treatment as a result (MacDonell et al., 2013). Evidence from research done on adherence to ART among adolescents has shown that it is lower than in adults (Kim et al., 2014; WHO, 2013). Adherence has been

reported in a previous study among adults in Cameroon to be above 90% (Mbuagbaw et al., 2011). However, adherence among adolescents in Cameroon is still under researched as most studies about adherence have been in adults and hence this study will fill this gap.

Over the years, there has been developments in HIV treatment, with improvements in regimens and reductions in the frequency of pills to a once-daily regimen. In Cameroon, there have been improvements lately in counselling programs with efforts from Catholic relief services, a youth champion programme and other NGO projects that support adolescents to adhere to treatment. This study has hence measured adherence among adolescents as a way of assessing the effect of these programs on adherence in this age group.

Worldwide, there was a 50% rise in HIV/AIDS related deaths among young people and adolescents between the ages 10 to 24 years. This indicates a need to improve HIV treatment, care and retention among this age group (Lall et al., 2015). However, ART drugs are known for their complications, special dosing requirements and side effects (Brogly et al., 2005). HIV+ adolescents face different adherence barriers compared to adults including health facility issues, demographic and socio-cultural factors, as well as difficulties at the individual level (Buchanan et al., 2012). Moreover, adolescents with HIV have a higher potential for non-adherence to ART due to their biological development, which is characterized by reduced inhibition, increased risk-taking and reduced support from parents or caregivers (Reisner et al., 2009). The PEPFAR-funded strategic report for Cameroon indicates that there were 17 557 youth (over 5000 of these are adolescents) receiving ARV drugs with an estimated viral load suppression of 69% (Population-based HIV Impact Assessment (PHIA) Project, 2018). This lower viral load suppression indicates that there are issues relating to ARV adherence. Given that poor adherence is the main predictor of low viral load suppression and possible mortality, this study sought to assess some of the determinants of adherence, especially as they relate to adolescents with HIV and their adherence to ART in Cameroon.

Methods
Study setting
The study was carried out in the North-West and South-West Regions of Cameroon, which constitute the English-speaking part of Cameroon. A total of nine health facilities that offer HIV treatment services were selected based on their case load of adolescents living with HIV.

Study population
Adolescents aged 10–19 years who were HIV positive, registered as being on ART, and had been on treatment for at least six months. Adolescents who were critically ill were excluded from the study.

Study design and data collection
The design for the study was cross-sectional. Health facilities that had the highest number of adolescents receiving care were selected. At the site level, systematic random sampling was used to select the participants. A total of 455 adolescents were sampled. Quantitative data was collected using questionnaires administered to individual respondents. The adolescents were recruited as they reported to the treatment centres for their drug refill. Data on the demographic characteristics of the participants was obtained. The second part of the questionnaire elicited information on the number of pills or drugs missed in the last 30 days and this was used to calculate self-reported adherence. The questionnaire also had a section to evaluate medication interruptions. Participants were asked to give reasons for missing medications. A data extraction form was also used to obtain data on the patient's clinical factors.[1]

Variable measurements
Adherence was the dependent variable and was measured through self-report based on a 30-day recall. It was calculated as the proportion of pills taken to the number prescribed within 30 days. Respondents with a self-report score of ≥95% were considered adherent. The independent variables were the socio demographic, cultural and other factors which could determine adherence.

Data analysis
The data were analysed using univariate, bivariate and multivariate statistical methods. Univariate analysis was used to describe important characteristics of respondents as well as quantify adherence levels. Bivariate analysis using chi-square test was used to assess associations between independent variables and adherence. For the multivariate logistic regression analysis, all the variables that showed statistical association with the outcome in the bivariate analysis were used. Adjusted odd ratios were reported and a p-value of <0.05 was considered statistically significant at a 95% confidence level. All the quantitative analysis was done using STATA 15.

Ethical considerations
Ethical approval was received from the Cameroon Baptist Convention Ethical Review Board (IRB2018-41). Administrative approval was obtained from the Regional Delegation of Health in the North-West and South-West Regions of Cameroon where the study was carried out. Approval was also obtained from health facility authorities before commencing the study.

Informed consent was obtained from adolescents 18 years and above as well as from the parents or guardians of adolescents younger than 18. Assent was then obtained from adolescents whose parent or guardian had consented.

Results

Table 1 shows essential socio-demographic characteristics of respondents. The mean age of the participants was 14.79 (SD = ±2.92) years and the majority (43%) were aged between 10 and 14 years.

Table 2 shows respondents' clinical characteristics. The mean age at initiation into treatment was 9.27 (SD = ±5.12) months. The majority of the respondents (82%) were on first-line ARV regimens while 18% were on second-line. The average duration of treatment was 67.3 months (SD = ±46.6) and about three quarters of the adolescents had been on treatment for at least 24 months.

Table 1: Socio-demographic characteristics of participants

Characteristics	Total	Male n (%)	Female n (%)
Age in years, *M* (SD)	14.79 (±2.92)	14.39 (±2.91)	15.10 (±2.99)
Age categories			
10–14	197 (43.3)	101 (22.2)	96 (21.2)
15–17	139 (30.7)	58 (12.7)	81 (17.9)
18–19	118 (25.8)	45 (9.9)	73 (15.9)
Missing	1 (0.2)	1 (0.2)	0
Total	455 (100)	205 (45)	250 (55)
Level of education			
None	33 (7.3)	13 (2.9)	20 (4.4)
Primary	130 (28.5)	72 (15.8)	58 (12.7)
Secondary	268 (58.9)	112 (24.6)	156 (34.3)
Tertiary	14 (3.1)	6 (1.3)	8 (1.8)
Missing	10 (2.2)	3 (0.6)	7 (1.6)
Total	455 (100)	206 (45.2)	249 (54.8)
Residence			
Urban	333 (73.1)	152 (33.4)	181 (39.8)
Rural	114 (25.1)	48 (10.5)	66 (14.5)
Missing	8 (1.8)	3 (0.7)	5 (1.1)
Total	455 (100)	203 (44.6)	252 (54.4)
Occupation			
In school	365 (80.2)	179 (39.3)	186 (40.9)
Working	22 (4.8)	6 (1.3)	16 (3.5)
Missing	68 (15)	20 (4.4)	48 (10.6)
Total	455 (100)	205 (45)	250 (55)
Religion			
None	20 (4.4)	10 (2.2)	10 (2.2)
Christian	408 (89.7)	179 (39.3)	229 (50.3)
Islam	16 (3.5)	10 (2.2)	6 (1.3)
Others	8 (1.8)	4 (0.9)	4 (0.9)
Missing	3 (0.6)	2 (0.4)	1 (0.3)
Total	455 (100)	205 (45)	250 (55)
Living with			
Parents	295 (64.8)	139 (30.5)	156 (34.3)
Guardians	144 (31.6)	59 (13)	85 (18.7)
By myself	8 (1.8)	3 (0.6)	5 (1.1)
Missing	8 (1.8)	5 (1.1)	3 (0.7)
Total	455 (100)	206 (45.2)	249 (54.8)
Transport means			
Walking	35 (7.8)	18 (3.8)	17 (3.8)
Commercial transport	418 (91.8)	187 (41)	231 (50.7)
Missing	2 (0.4)	1 (0.2)	1 (0.2)
Total	455 (100)	205 (45)	248 (55)
Distance to hospital			
<30 minutes	150 (33)	78 (17.1)	72 (15.9)
30 minutes	84 (18.4)	30 (6.7)	54 (11.7)
31 minutes to 1 hour	140 (30.8)	61 (13.6)	79 (17.2)
>1 hour	78 (17.1)	34 (7.5)	44 (9.6)
Missing	3 (0.7)	1 (0.2)	2 (0.2)
Total	455 (100)	204 (45)	251 (55)

Adherence levels

Of the 455 adolescents studied, 405 responded to the question on self-report adherence. ARV treatment was adhered to by 336 (83%) participants while the remaining 69 (17%) were non-adherent.

Determinants of adherence

The factors influencing adherence among adolescents were categorised into socio-demographic, clinical, socio-cultural, health service, patient, and other factors. For the demographic variables, only educational level ($p < 0.001$) and religion ($p = 0.03$) were significantly associated with adherence to ARV treatment. The relevant health service factors were long waiting time and poor attitude of hospital staff. Both factors were significantly associated with adherence ($p < 0.01$) in the bivariate analysis.

Furthermore, ever using traditional medicines was the socio-cultural factor that significantly predicted adherence ($p < 0.01$). For patient related factors, experiencing side effects ($p < 0.01$), internalized stigma ($p < 0.01$), being busy

Table 2: Clinical characteristics of participants

Characteristic	Total n (%)	Male n (%)	Female n (%)
Type of drug			
First-line	352 (77.4)	153 (33.6)	199 (43.7)
Second-line	75 (16.5)	39 (8.6)	36 (7.9)
Third-line	3 (0.7)	2 (0.5)	1 (0.2)
Missing	25 (5.5)	9 (2)	16 (3.5)
Total	455 (100)	203 (44.7)	252 (55.3)
Duration on treatment M (SD)	67.3 (±46.6)	66.82 (±46.3)	68.15 (±47.4)
6–12 months	34 (7.6)	14 (3.1)	20 (4.5)
13–22 months	41 (9)	23 (5)	18 (4)
24+ months	380 (83.4)	168 (36.9)	212 (46.5)
Total	455 (100)	205 (45)	250 (55)
Age (months) at first clinic visit M (SD)	9.27 (±5.12)	8.94 (±5.41)	9.57 (±4.87)
Transfer into present facility			
Yes	41 (9)	20 (4.4)	21 (4.6)
No	406 (89.2)	183 (40.2)	223 (49)
Missing	8 (1.7)	2 (0.4)	6 (1.3)
Total	455 (100)	205 (45)	250 (55)
Frequency of hospital visits			
Once a month	180 (39.6)	60 (13.1)	120 (26.4)
Every two months	212 (46.6)	115 (25.3)	97 (21.3)
Every three months	49 (10.8)	24 (5.3)	25 (5.5)
Other	8 (1.8)	3 (0.7)	5 (1.1)
Missing	6 (1.3)	2 (0.4)	4 (0.9)
Total	455 (100)	204 (44.8)	251 (55.2)

with other activities ($p < 0.01$), having comorbid conditions ($p < 0.01$), and not understanding the treatment regimen ($p = 0.02$) were significantly associated with adherence.

The variables that were significantly associated with adherence in the bivariate analysis were included in the multivariate model so as to control for possible confounding factors (Table 3). From the multivariate logistic regression analysis, only two variables significantly predicted adherence after potential covariates were adjusted for. These were medication side effects and internalised stigma. The odds of adhering to treatment were more than double among those who did not experience side effects (AOR = 2.6; 95% CI = 1.14, 6.09; $p = 0.02$). It was also observed that adolescents who did not experience internalised stigma were 2.5 times more likely to adhere to treatment (AOR = 2.66; 95% CI = 1.04, 6.04; $p = 0.04$)

Discussions

This study aimed to assess levels of ARV treatment adherence among HIV+ adolescents and the factors that could affect adherence. The average duration on treatment was 67.3 months and the average age of initiation into treatment was 9.3 months. It is therefore likely that most of the adolescents had been on treatment since birth. Findings suggest that most of the adolescents on treatment were on first-line drugs (82%) while 18% were on second-line medication. Given that a sizeable proportion of adolescents were on second-line drugs, this raises concerns of drug resistance challenges in future therapeutic options as adolescents may require durable suppressive regimens for the rest of their lives.

Results also showed that 83% of the respondents in the study were adherent to ARV treatment based on the self-report measure of adherence. The adherence level differs from a recent study in Yaounde, Cameroon, which reported a self-report adherence level of 36% among adolescents on first-line treatment (Fokam et al., 2017). Although our study and that study were similar in their design and adherence measurements, the results were very different. The relatively higher level of adherence observed in our study could indicate that counselling for adolescents has improved over time. A number of programmes like the accelerated care and treatment for children programme and the adolescents champion programme, and other non-governmental organisations (NGOs) that assist HIV-positive persons have been helpful in scaling up these counselling programmes among adolescents in Cameroon. In addition, adolescents are being treated to snacks in many of the health facilities when they visit for prescription refills, which might incentivise them to keep to their appointments and consequently improve retention rates and adherence to treatment. Some community-based organisations (CBOs) and NGOs subsidise the cost of viral-load tests, thus reducing the financial burden of paying for such tests. All these factors work as enablers which, if sustained, could motivate adolescents to adhere, especially those who have limited access to food and finances. However, most of these CBOs and NGOs depend on external funding sources and, should the funds become depleted, the programmes may not be able to support adolescents living with HIV, causing a decrease in adherence. Therefore, it is necessary for more brainstorming on how to sustain adherence in adolescents in resource-limited settings like Cameroon.

Table 3: Relationship between adherence and its determinants in multiple logistic regression analysis

Factor	Adherent n (%)	Non-adherent n (%)	OR	95% CI	p-value	AOR	95% CI	p-value
Education								
None (Ref)	16 (48.5)	17 (51.5)	–	–	–	–	–	–
Primary Secondary	100 (85.5)	17 (14.5)	1.26	(0.66, 2.4)	0.49	0.71	(0.26, 1.97)	0.51
Secondary	207 (88.1)	28 (11.9)	0.38	(0.11,0.38)	0.14	0.78	(0.09, 6.14)	0.81
Tertiary	9 (69.2)	4 (30.8)	0.16	(0.07, 0.38)	0.0	0.45	(0.13, 1.58)	0.21
(Age categories (years)								
10-14(Ref)	153 (87.4)	22 (12.6)	–	–	–	–	–	–
15-17	98 (82.4)	21 (17.6)	0.67	(0.35, 1.28)	0.23	1.06	(0.38, 2.97)	0.93
18-19	84 (76.4)	26 (23.6)	0.46	(0.25, 0.87)	0.02	0.67	(0.25, 1.79)	0.43
Experienced long waiting time								
Yes (Ref.)	37 (60.6)	11 (39.4)	–	–		–	–	–
No	214 (82.9)	44 (17.1)	2.75	(1.39, 5.49)	0.00	2.24	(0.81, 6.18)	0.12
Experienced poor attitude of hospital staff								
Yes (Ref.)	23 (62.7)	11 (37.3)	–	–	–	–	–	–
No	226 (80.1)	47 (19.9)	2.73	(1.2, 6.2)	0.00	1.01	(0.26, 3.84)	0.99
Ever used traditional medicines								
Yes (Ref.)	25 (69.4)	11 (30.6)	–	–	–	–	–	–
No	275 (83.3)	55 (16.7)	2.2	(1.02, 4.73)	0.00	1.00	(0.33, 3.07)	0.99
Experienced side effects								
Yes (Ref.)	45 (66.3)	22 (33.7)	–	–	–	–	–	–
No	250 (85.9)	43 (14.1)	2.96	(1.63, 5.38)	0.00	2.63	(1.14, 6.09)	0.02
Experienced internalized stigma								
Yes (Ref.)	133 (73.9)	18 (16.1)	–	–	–	–	–	–
No	188 (91.3)	47 (8.7)	3.69	(2.05, 6.64)	0.00	2.51	(1.04, 6.04)	0.04
Being Busy								
Yes (Ref.)	108 (74)	28 (26)	–	–	–	–	–	–
No	206 (88)	38 (22)	2.59	(1.51, 4.45)	0.00	1.39	(0.67, 2.89)	0.38
Had other Illness								
Yes (Ref.)	70 (70)	30 (30)	–	–	-	-	-	–
No	240 (87)	23 (36)	2.88	(1.64, 4.97)	0.00	1.53	(0.69, 3.37)	0.29
Don't understand treatment regimen								
Yes (Ref.)	30 (69.8)	13 (30.2)	–	–	–	–	–	–
No	282 (83.9)	54 (16.1)	2.26	(1.1, 4.16)	0.02	1.96	(0.71, 5.42)	0.19
Felt Stigmatised								
Yes (Ref.)	107 (72.8)	27 (17.2)	–	–	–	–	–	–
No	207 (88.5)	40 (11.5)	2.87	(1.67, 4.92)	0.00	0.92	(0.40, 2.13)	0.85
Religion								
Yes (Ref.)	307 (84.6)	56 (15.4)	–	–	–	–	–	–
Muslim	11 (84.6)	2 (15.4)	1.00	(0.22, 4.65)	0.99	1.69	(0.25, 11.08)	0.59
Others	16 (59.3)	11 (40.7)	0.27	(0.12, 0.6)	0.01	2.44	(0.16, 37.25)	0.52
Away from home								
Yes (Ref.)	131 (73.6)	47 (26.4)	–	–	–	–	–	–
No	169 (89.4)	20 (10.6)	3.03	(2.58, 9.89)	0.00	1.79	(0.83, 3.84	0.14
Ran out of pills								
Yes (Ref.)	24 (54.5)	20 (45.5)	–	–	–	-	-	–
No	273 (85.9)	45 (14.1)	5.06	(1.71, 5.37)	0.00	2.09	(0.78, 5.62)	0.14

Another contrasting result was observed in a study among Rwandan youth (Fawzi et al., 2016). The self-report adherence in that study was 63%. The lower adherence rate was attributed to the high prevalence of psychological symptoms such as deprssion in this group of adolescents. Also, Gross and colleagues reported a lower adherence of 61% among adolescents in Zimbabwe (Gross et al., 2015).

Our results are also in contrast to earlier findings in western Kenya showing 96% adherence (Vreeman et al., 2014). The higher adherence observed in that study could be because most of the participants were below age 14 years and, hence, perhaps receiving support such as reminders to take medication from parents/guardians. Another study in Uganda reported a high level of adherence in adolescents of 90.4% (Nabukeera-Barungi et al., 2015). According to the authors of that study, the higher adherence might have been due to an overestimation of adherence rates in hospital records used because some health workers might not have been in position to count pills for an accurate measure.

The observed adherence in the Uganda study was limited by the use of the self-report method for measuring adherence which may overestimate adherence. From the results, two variables were associated with adherence — experiencing side effects and internalised stigma. Our findings that

medication-related side effects negatively affected adherence is consistent with some earlier studies in Cameroon and Kenya (Fonsah et al., 2017; Wambugu et al., 2018). Mabunda and others, however, had contrasting findings with the authors showing that side effects had no association with adherence in adolescents (Mabunda et al., 2019).

The high proportion of adolescents in this study who reported medication-related site effects is not surprising given that most of them were on efavirenz-based medications. These medications are associated with side effects such as sleep abnormalities, dizziness, headaches and skin rashes. Side effects, particularly those that are easily visible and attract attention, could hamper their efforts to adhere to treatment. This suggests a need for proper counselling at treatment initiation on possible drug side effects so that patients are not caught unaware if they arise. Such counselling will help adolescents to understand that the changes or challenges they encounter on treatment are normal and, in many instances, these reduce over time.

The experience of internalised stigma also significantly predicted non-adherence. Generally, experiences of internalised stigma lead to self-imposed isolation and exclusion from social situations (Kalichman, 2013). This may cause reduced self-efficacy and contribute to depressive symptoms such as disempowerment, helplessness, inability to concentrate and feelings of negativity and anguish (Turan et al., 2016). It is likely that these symptoms decrease HIV-positive adolescents' adherence to treatment. These experiences may also cause depression, which has been shown in some studies to predict poor adherence (Fonsah et al., 2017; Wambugu et al., 2018). Although the relationship between ARV adherence and internalised stigma has not been extensively studied especially among adolescents, there is a need to critically consider the subject — especially in the Cameroonian context where HIV/AIDS-related stigma is still pervasive.

The other possible determinants of adherence that were considered in the study but did not significantly predict adherence were socio-demographic, socio-cultural and health service factors. Clinic visits for adolescents are arranged in smaller groups so long waiting time is not a factor, which could explain why health service factors did not show up as significant to adherance as in earlier studies (Croome, Ahluwalia, Hughes, & Abas, 2017; Wambugu et al., 2018).

Conclusion

Adherence among adolescents studied was suboptimal. Internalised stigma and medication-related side-effects were found to influence adherence. Inclusion of medication adherence counselling as part of individual counselling sessions for adolescents and their guardians is essential. In addition, HIV-positive adolescents should receive counselling against self-imposed or internalised stigma as part of their care.

Note

[1.] The data sets used in this study are available from the corresponding author on reasonable request

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References

Brogly, S., Williams, P., Seage, G. R., Oleske, J. M., Van Dyke, R., McIntosh, K., & Team, P. C. (2005). Antiretroviral treatment in pediatric HIV infection in the United States: From clinical trials to clinical practice. *Journal of the American Medical Association, 293*(18), 2213–2220. https://doi.org/10.1001/jama.293.18.2213

Buchanan, A. L., Montepiedra, G., Sirois, P. A., Kammerer, B., Garvie, P. A., Storm, D. S., & Nichols, S. L. (2012). Barriers to medication adherence in HIV-infected children and youth based on self-and caregiver report. *Pediatrics, 129*(5), e1244–e1251. https://doi.org/10.1542/peds.2011-1740

Croome, N., Ahluwalia, M., Hughes, L. D., & Abas, M. (2017). Patient-reported barriers and facilitators to antiretroviral adherence in sub-Saharan Africa. *AIDS (London, England), 31*(7), 995–1007. https://doi.org/10.1097/QAD.0000000000001416

Fawzi, M. C. S., Ng, L., Kanyanganzi, F., Kirk, C., Bizimana, J., Cyamatare, F., Mushashi, C., Taehoon, K., Kayiteshonga, Y., Binagwaho, A, & Betancourt, T. S. (2016). Mental health and antiretroviral adherence among youth living with HIV in Rwanda. *Pediatrics, 138*(4), 1–11. https://doi.org/10.1542/peds.2015-3235

Ferrand, R. A., Corbett, E. L., Wood, R., Hargrove, J., Ndhlovu, C. E., Cowan, F. M., Gouws, E., & Williams, B. G. (2009). AIDS among older children and adolescents in Southern Africa: Projecting the time course and magnitude of the epidemic. *AIDS (London, England), 23*(15), 2039–2046. https://doi.org/10.1097/QAD.0b013e32833016ce

Fokam, J., Billong, S. C., Jogue, F., Ndiang, S. M. T., Motaze, A. C. N., Paul, K. N., & Nlend, A. E. N. (2017). Immuno-virological response and associated factors amongst HIV-1 vertically infected adolescents in Yaoundé-Cameroon. *PLoS One, 12*(11), e0187566. https://doi.org/10.1371/journal.pone.0187566

Fonsah, J. Y., Njamnshi, A. K., Kouanfack, C., Qiu, F., Njamnshi, D. M., Tagny, C. T., Nchindap, E., Kenmogne, L., Mbanya, D., Heaton, R., & Kanmogne, G. D. (2017). Adherence to Antiretroviral Therapy (ART) in Yaoundé-Cameroon: Association with Opportunistic Infections, Depression, ART Regimen and Side Effects. *PLoS One, 12*(1), e0170893. https://doi.org/10.1371/journal.pone.0170893

Gross, R., Bandason, T., Langhaug, L., Mujuru, H., Lowenthal, E., & Ferrand, R. (2015). Factors associated with self-reported adherence among adolescents on antiretroviral therapy in Zimbabwe. *AIDS Care, 27*(3), 322–326. https://doi.org/10.1080/09540121.2014.969676

Kalichman, S. C. (2013). The harms of internalized AIDS stigma: A comment on Tsai et al. *Annals of Behavioral Medicine, 46*(3), 256–257. https://doi.org/10.1007/s12160-013-9529-z

Kim, S-H., Gerver, S. M., Fidler, S., & Ward, H. (2014). Adherence to antiretroviral therapy in adolescents living with HIV: Systematic review and meta-analysis. *AIDS (London, England), 28*(13), 1945–1956. https://doi.org/10.1097/QAD.0000000000000316

Lall, P., Lim, H. S., Khairuddin, N., & Kamarulzaman, A. (2015). Review: an urgent need for research on factors impacting adherence to and retention in care among HIV-positive youth and adolescents from key populations. *Journal of the International AIDS Society, 18*(2Supp1), 41–53. https://doi.org/10.7448%2FIAS.18.2.19393

Mabunda, K., Ngasama, E., Babalola, J., Zunza, M., & Nyasulu, P. (2019). Determinants of adherence to antiretroviral treatment among human immunodeficiency virus infected young adults attending care at Letaba Hospital HIV Clinic, Limpopo Province, South Africa. *The Pan African Medical Journal, 32*, 1–14. https://doi.org/10.11604/pamj.2019.32.37.17722

MacDonell, K., Naar-King, S., Huszti, H., & Belzer, M. (2013). Barriers to medication adherence in behaviorally and perinatally infected youth living with HIV. *AIDS and Behavior, 17*(1), 86–93. https://doi.org/10.1007/s10461-012-0364-1

Maskew, M., Fox, M. P., Evans, D., Govindasamy, D., Jamieson, L., Malete, G., Mongwenyana, C., & Technau, K. (2016). Insights into Adherence among a Cohort of Adolescents Aged 12–20 Years in South Africa: Reported Barriers to Antiretroviral Treatment. *AIDS Research and Treatment, 2016*, 1–12. https://doi.org/10.1155/2016/4161738

Mbuagbaw, L., Thabane, L., Ongolo-Zogo, P., Lester, R. T., Mills, E., Volmink, J., Yondo, D., Essi, M. J., Bonono-Momnougui, R.-C., Mba, R., Ndongo, J. S., Nkoa, F. C., & Ondoa, H. A. (2011). The Cameroon mobile phone SMS (CAMPS) trial: A protocol for a randomized controlled trial of mobile phone text messaging versus usual care for improving adherence to highly active anti-retroviral therapy. *Trials, 12*(1), 1–8. https://doi.org/10.1186/1745-6215-12-5

Ministry of Public Health, Cameroon. (2015). *Acceleration plan for antiretroviral therapy in Cameroon 2016–2018: toward a generation without AIDS in Cameroon*. Ministry of Public Health.

Nabukeera-Barungi, N., Elyanu, P., Asire, B., Katureebe, C., Lukabwe, I., Namusoke, E., Musinguzi, J., Atuyambe, L., & Tumwesigye, N. (2015). Adherence to antiretroviral therapy and retention in care for adolescents living with HIV from 10 districts in Uganda. *BMC Infectious Diseases, 15*(1), 520. https://doi.org/10.1186/s12879-015-1265-5

Population-based HIV Impact Assessment (PHIA) Project. (2018). *Cameroon Population-Based HIV Impact Assesment (CAMPHIA)*. https://phia.icap.columbia.edu/wp-content/uploads/2020/10/CAMPHIA-SS_En.pdf

Reisner, M. S. L., Mimiaga, M. J., Skeer, M. M., Perkovich, M. B., Johnson, M. C. V., & Safren, S. A. (2009). A review of HIV antiretroviral adherence and intervention studies among HIV-infected youth. *Topics in HIV Medicine, 17*(1), 14–25.

Turan, B., Smith, W., Cohen, M. H., Wilson, T. E., Adimora, A. A., Merenstein, D., Adedimeji, A., Wentz, E. L., Foster, A. G, Metsch, L., Tien, P. C., Weiser, S. D., & Turan, J. (2016). Mechanisms for the negative effects of internalized HIV-related stigma on antiretroviral therapy adherence in women: the mediating roles of social isolation and depression. *Journal of Acquired Immune Deficiency Syndrome, 72*(2), 198–205. https://doi.org/10.1097/QAI.0000000000000948

UNAIDS. (2019). *Fact sheet - Latest statistics on the status of the AIDS epidemic*. Available at https://www.plataformalac.org/en/2020/04/global-hiv-aids-statistics-2019-fact-sheet/

UNICEF. (2015). *All In #EndAdolescentAIDS* (Synthesis report of the rapid assessment of adolescent and HIV programme context in five countries). https://www.unaids.org/sites/default/files/media_asset/20150217_ALL_IN_brochure.pdf

UNICEF. (2018). *Global and regional trends*. https://data.unicef.org/topic/hivaids/global-regional-trends/

Vreeman, R. C., Nyandiko, W. M., Liu, H., Tu, W., Scanlon, M. L., Slaven, J. E., Ayaya, S. O., & Inui, T. S. (2014). Measuring adherence to antiretroviral therapy in children and adolescents in western Kenya. *Journal of the International AIDS Society, 17*(1), 1–10. https://doi.org/10.7448/IAS.17.1.19227

Wambugu, N., Peter, G., Mbuthia, J., Joshua, M., & Ndwiga, T. (2018). Determinants of adherence to antiretroviral among HIV Positive Adolescents at Comprehensive Care Clinic, Gertrude's Children Hospital, Nairobi, Kenya. *American Journal of Nursing Science, 7*(1), 23–30. https://doi.org/10.11648/j.ajns.20180701.13

World Health Organization (WHO). (2013). *HIV and adolescents: Guidance for HIV testing and counselling and care for adolescents living with HIV: recommendations for a public health approach and considerations for policy-makers and managers*. https://www.who.int/hiv/pub/guidelines/adolescents/en/