

## Strategies to Improve on adherence to Treatment, Appointment Keeping and Viral Suppression in HIV Care at Mpumudde, Bugembe, Budondo, and Walukuba Health Centre in Jinja District- Uganda

Article by Balidawa John

A Senior HIV Program Manager, Affiliation: District health officer –Jinja Uganda

E-mail: balidawajohn@gmail.com

### Abstract

*The Uganda National HIV viral load suppression prevalence of 59.6% is below the 95% target. The study conducted in in four health facilities of Jinja district, on 437 files of adult HIV clients with; missed appointments of more than two weeks, poor adherence to treatment of < 85%, and unsuppressed viral load of  $\geq 1000$  viral copies per milliliter, between January and July 2019, was aimed at determining change packages to improve HIV care in the study health facilities. Data was analyzed using Microsoft excel and the following tested changes using the Deming PDSA cycles were used; Intensified health education, and adherence counseling to all patients with poor adherence, pill counting to harmonize the pills supplied with the appointment date, follow up phone calls to patients who miss appointment, creation of a one stop centre for HIV care, and increased staffing of HIV clinic. Study results showed a 13.6% prevalence of the study HIV care poor outcomes at baseline assessment. 11.8%, 65.2%, and 46.5% of the study client files were due to poor adherence to treatment, two weeks missed appointments, and unsuppressed viral load respectively at baseline assessment and 4.7%, 25.1%, and 31.5% respectively at end line assessment. 80% of the studied clients were retention in care between baseline and end line assessments. In conclusion, there was a positive effect on the patient HIV care out comes.*

**Keywords:** Adherence to treatment, appointment keeping, and viral suppression in HIV care.

### Introduction

Viral load testing is the preferred method of monitoring the clinical response to HIV treatment, as it helps in early diagnosis and confirmation of treatment failure for appropriate actions during patient management, [1&2]. Viral suppression reduces HIV transmission, associated morbidity, and mortality [3]. The Uganda Ministry of Health adopted the UNAIDS 2014 targets to end the HIV epidemic globally. The third ambitious target was to achieve a 90% viral suppression by 2020 among HIV clients on treatment, [2]. Uganda AIDS Country Progress Report estimated that by June 2018, 87% of people living with HIV and on treatment had viral suppression, [4]. The report findings are similar to those of Kolab Chhim *et al* [5] who observed that 76.8% of their participants had achieved viral suppression. A report on HIV drug resistance prevention, monitoring and surveillance activities noted that all HIV-infected patients are currently required to receive a viral load test 6 months after initiating treatment, and the viral load coverage among HIV patients on treatment has increased from 47% in 2016 to 75% in 2017, however only 51.1% of patients with a 12-month viral load test had result available, [6]. This means that access to bleeding for viral load test exists but the getting of results to the service providers and the clients is still a challenge. A study conducted by Katharina K. *et al* [7], revealed that viral load measurements conducted on 219 individuals had 33.9% of them with undetectable values. Bonner K, *et al* [8], noted that 70% of clients re-suppressed after adherence interventions, however Nasuna E. *et al* [9], noted a 23% re-suppression after 3 sessions of intensive adherence counselling among children under 20 years of age. Martin C. *et al* [10], noted a 79% coverage of viral load monitoring to clients on treatment 12 months after initiation. This means that 21% did not access viral load monitoring even when they were due.

It is evidenced that good adherence to ART promotes viral load suppression and that it is an important predictor of survival for individuals with HIV, [11]. A good adherence of at least 95% is required below which resistance is most likely to occur [12]. Health care System factors such as ARVs stockouts, long waiting time, congestion at health facilities, and poor attitude of health care providers have been

attributed to poor adherence to ART, [13, 14, & 15]. The optimal adherence to treatment to achieve viral load suppression is noted to be 95%, however in a study conducted in India, it was observed that 9.5% of patients had a poor adherence to HIV treatment of less than 80%, [16]. In a study to determine the prevalence of adherence to treatment, a patient self-reported adherence to HIV treatment of 50.4% was noted in Nigeria, associated with busy schedules of patients, simply forgetting to take their pills and religious constraints as major challenges to adherence, [17].

Retention of HIV clients in care is determined by regular and scheduled visits by the patient and it is affected by missed appointments, [18]. It is also important to note that adherence to clinic appointments is a predictor to adherence to treatment, [19&20]. Studies have also shown a positive association of missing appointments with poor adherence to HIV treatment, [21], failure to suppress viral load, [22&23], and drug resistance, [24&25]. Moore CG. et al, [26], also noted other implications of missed appointments as; increased costs to service provision and access, and wastage of time for both the service provider and the client. It is noted that appointment keeping is one of the early warning indicators of HIV drug resistance being monitored by looking at the proportion of patients picking up all prescribed drugs on time, before the previously prescribed and dispensed drugs have run out, [6]. The study by Shumba C. et al [28] showed that 7% of HIV clients in care missed their appointment in the last three months. Relatedly, a study in three settings of Cameroon, observed that 49% of children in HIV care missed their appointment schedules and this was attributed to longer follow up appointments, [28]. The findings are contrary to those by Setor Kunutsor et al [29] who observed that only 1.8% of scheduled clients in a district-based hospital in Uganda missed their visits for refills in a period of 28 weeks of follow up study. The Uganda Virus Research Institute report on HIV drug resistance monitoring noted that 65.2% of patients will keep their appointment at least within two days after the appointment date, [6].

### **Study objectives**

- 1 To determine the prevalence of poor adherence to HIV treatment, missed appointment, and unsuppressed viral load.
- 2 To determine the change packages to improve on adherence to HIV treatment, appointment keeping and viral suppression.

### **Methodology**

The study was conducted at Bugembe, Budondo, Walukuba and Mpumudde health centres that were purposively selected. 437 files of active clients in HIV care for the period of October to December 2018 were identified with; missed appointments for > 2 weeks, poor adherence to treatment of <85%, and unsuppressed viral load of  $\geq 1000$  viral copies per milliliter. The study took 7 months with baseline and end-line assessments in January 2019 and July 2019 respectively. Baseline assessment results were shared with health facility management for action. Management used the Deming Plan-Do-Study-Act (PDSA) cycle, and appropriate tools like; brain storming, cause effect, the 5 why, flow charts, and documentation journals to test, monitor and document changes aimed at improving on adherence to treatment, appointment keeping and viral suppression. The application of moral rules and professional codes of conduct to the collection, analysis, reporting, and publication of information about research subjects, was followed in an acceptable manner including; observing subjects' right to privacy, confidentiality, and informed consent.

## Results

### Prevalence of the study HIV care outcomes

**Table 1.** shows the number of client files evaluated for the study outcomes at both baseline assessment and end line assessment

Results element	Budondo health centre	Bugembe health centre	Mpumudde health centre	Walukuba health centre	Totals
Percentages of Client files identified with any of the HIV care outcomes studied at baseline assessment.	7.3% (54)	14.8% (158)	13.4% (74)	17.9% (151)	13.6% 437
Client files evaluated for the HIV care outcomes at both baseline assessment and end line assessment.	44 (81.5%)	119 (75.3%)	54 (73%)	133 (88%)	350 (80%)
Number of client files reported that the client is lost to care since baseline assessment study	6 (11.1%)	15 (9.5%)	11 (14.9%)	13 (8.6%)	45 (10.3%)
Number of client files reported that client died since baseline assessment study	3 (5.5%)	1 (0.6)	2 (2.7%)	0 (0%)	6 (1.3%)
Number of client files reported that client was transferred out since baseline assessment	1 (5.5%)	8 (0.5%)	3 (4%)	3 (2%)	15 (3.4%)
Number of client files reported to be lost at end line assessment	0 (0%)	15 (9.5%)	0 0 (0%)	2 (1.3%)	17 (3.9%)
Number of client files awaiting current viral load results at end line assessment	0 (0%)	0 (0%)	4 (5.4%)	0 (0%)	4 (0.9%)

From the study, it was revealed that 29.3%, and 70.7% of client files identified with any of the study HIV care outcomes were for males and females respectively, with Budondo, Bugembe, Mpumudde, and Walukuba health centres having 44.4%, 20.3%, 29.7%, and 33.1% males and 55.6%, 79.7%, 70.3% and 66.9% females respectively. It is noted that more females than males were identified with any of the study HIV care out comes as more females than males are in HIV care. The majority of the client files identified with any of the study HIV care outcomes were for clients who had been in care for more than four years with Budondo, Bugembe, Mpumudde, and Walukuba health centres having 68.5%, 57.6%, 60.8%, and 55.0% respectively. There was an 80% retention of clients in care between the baseline and end line assessments with Budondo, Bugembe, Mpumudde and Walukuba health centres retaining 81.5%, 75.3%, 73%, 88% respectively.

### Adherence to HIV treatment

The findings show that a total of 52 (11.8%) client files were identified with poor adherence to treatment, with Budondo, Bugembe, Mpumudde, and Walukuba health centre IVs having 12 (22.2%), 18 (11.4%), 21 (28.4%), and 1 (0.7%), respectively at baseline assessment, and 2 (4.5%), 1 (0.8%), 2 (3.7%), and 15 (11.3%) at end line assessment respectively. Walukuba health centre having only 0.7% of its clients with a poor adherence score at base line is uncommon, and it is possible that the assessment for adherence for the HIV clients in care was being done wrongly by the service providers, as at end line assessment, the it was observed to be at 11.3%.

### **Adherence to appointment schedules**

From the study, it was observed that 285 (65.2%) of the study files identified with any of the study HIV care outcomes had more than two weeks missed appointments, with Budondo, Bugembe, Mpumudde, and Walukuba health centre having 22 (40.7%), 101 (63.9%), 32 (43.2%), and 130 (86.1%) respectively at baseline assessment. The study showed a reduction in the number of files with missed appointments for more than two weeks to 88 (25.1%), with Budondo, Bugembe, Mpumudde, and Walukuba health centre IVs having 1 (2.3%), 43 (36.1%), 13 (24.1%), and 31 (23.3%) respectively at end line assessment. The study also revealed that of the 285 client files, 266 (93.3%) had both missed appointments for more than two weeks and an adherence score of  $\geq 85\%$  at baseline assessment, with Budondo, Bugembe, Mpumudde, and Walukuba health centre IVs having 17 (77.3%), 89 (88.1%), 31 (96.9%), and 129 (99.2%) respectively. End line assessment results showed a reduction in the percentage of client files with both missed appointment of more than two weeks and an adherence score of  $\geq 85\%$  from 93.3% to 60.3% (76 client files) with Budondo, Bugembe, Mpumudde, and Walukuba health centres having; 0%, 97.6% (42), 84.6% (11), and 74.2% (23) respectively.

### **Viral load suppression**

The study revealed that at baseline assessment, 203 (46.5%) of the study client files with any of the study HIV care outcomes had unsuppressed viral load, with Budondo, Bugembe, Mpumudde, and Walukuba health centres having 36 (66.7%), 81 (51.3%), 40 (54.1%), and 46 (30.5%) respectively. 109 (31.5%) of the study client files with any of the study HIV care outcomes had unsuppressed viral load at end line assessment, with Budondo, Bugembe, Mpumudde, and Walukuba health centres having 15 (34.1%), 51 (42.9%), 11 (20.4%), and 32 (24.1%) respectively. It was revealed that 142 (70%) of all the unsuppressed client files studied were for clients who had been in care for more than four years, with 27 (75%), 60 (74%), 28 (70%), and 27 (58.7%) for Budondo, Bugembe, Mpumudde, and Walukuba health centres respectively.

The identified files with any of the study HIV care outcomes also had 162 (37.1%) of the study files with undetectable viral load at baseline assessment, notably; 15 (27.8%), 58 (36.7%), 22 (29.7%), and 67 (44.4%) for Budondo, Bugembe, Mpumudde, and Walukuba health centres respectively. This improved to 181 (51.7%) of the study files with undetectable viral load at end line assessment, notably; 20 (45.5%), 51 (42.9%), 29 (53.7%), and 81 (60.9%) for Budondo, Bugembe, Mpumudde, and Walukuba health centres respectively. The study also showed that 34 (7.7%) of the study files had never had a viral load done to the clients at baseline assessment, with 1 (1.9%), 13 (8.2%), 6 (8.2%), and 14 (9.3%) for Budondo, Bugembe, Mpumudde, and Walukuba health centres respectively. This reduced to 5 (1.4%) of the study files that never had a viral load done to the clients at end line assessment, all from Bugembe health centre. 30 (83.3%) files of clients who have never been done a viral load at baseline assessment were between 6 months and 2 years in care. It was not only having a viral load done when in care, but also the study looked at timeliness of doing viral loads as per Ugandan Ministry of health standards. It was observed that, 151 (34.5%) of the study client files were overdue for a viral load to be done with Budondo, Bugembe, Mpumudde, and Walukuba health centres having 6 (11.1%), 57 (36.1%), 37 (50.0%), and 51 (33.8%) respectively at baseline assessment. There was a reduction in the number of clients overdue for viral load as only 59 (16.8%) were overdue with Budondo, Bugembe, Mpumudde, and Walukuba health centres having 5 (11.4%), 35 (29.4%), 9 (16.7%), and 10 (7.5%) respectively at end line assessment. The study also showed that 192 (91%) of client files with unsuppressed viral load had adherence to treatment score of 85% and above, with Budondo, Bugembe, Mpumudde, and Walukuba health centres having 10 (83.3%), 30 (88.6%), 35 (47.3%), and 47 (100%) respectively, at baseline assessment. End line assessment results showed that; 47 (42.2%) of such files had adherence score above 85% with Budondo, Bugembe, Mpumudde, and Walukuba health centres having 0 (0%), 13 (25.5%), 10 (90.9%), 23 (71.8%) at end line assessment respectively. This could be pointing to resistance to HIV treatment, which is a challenging situation.

## Discussion

Retention in care is important for a good HIV care program. The study showed an 80% retention in care during the 6 months of study. This was higher than the 50.2% retention on HIV treatment 12 months after ART initiation, reported by Uganda Virus Institute [6]. There was a 1.3% death of the study clients during the 6 months period of study. This confirmed that retention in care is affected by death among other factors. It was also hard to get literature on the rate at which client files get lost with in the health facilities which affects the quality of HIV care as the history of the patient cannot be traced. The study revealed a 3.4% loss of files for clients studied within a period of 6 months. The loss of client files reflects a poor filing and patient information management system and service providers need to come up with strong interventions to prevent loss of client files and records.

## Adherence to HIV treatment

Adherence to HIV treatment is very key in suppressing the viral load, and studies have also shown a positive association of missing appointments with poor adherence to HIV treatment, [21]. The study revealed that 11.8% of all the clients identified with the study HIV care outcomes had a poor adherence of <85%. The finding is almost similar to a study conducted in India, observed that 9.5% of patients had a poor adherence to HIV treatment of less than 80%, [16]. The study also observed that 93.3% of patients who had missed appointment for more than two weeks were scored an adherence level of  $\geq 85\%$ . This is ridiculous and it can be attributed to knowledge gap and or non-committed service providers to score patient adherence to treatment as per national guidelines. The health facility quality improvement teams implemented majorly three tested changes, notably; Mentorship to service providers on patient adherence scoring and documentation, Intensified health education and information giving on drugs supplied, and Intensive adherence counseling to all patients with poor adherence. The interventions were noted to reduce on poor adherence to treatment from 22.2%, 11.4%, 28.4%, 0.7% at baseline assessment to 4.5%, 0.8%, 3.7%, and 11.3% for Budondo, Bugembe, Mpumudde, and Walukuba health centre IVs at end line assessment respectively.

## Adherence to appointment schedules in HIV care

It is important that patients keep their appointment schedules if adherence to treatment is to be ensured. The study revealed that 65.2% of the studied client files at baseline were due to missed appointment for more than two weeks in the previous three months, with Budondo and Walukuba health centres having the lowest (40.7%) and highest (86.1%) respectively. The period of missed appointment for at least two weeks in the studied client files was taken by the researcher to cater for such common practices of service providers not taking into account of cumulative pill balances from their previous refills. The findings were close to the 49% of Bigna et al, [28], but too high to the 7% of Shumba C. et al [27]. The difference could be as a result of the differences in the period of review for the status of missed appointment, the duration of missed appointment and the age category of clients studied.

During a root cause analysis of the causes of missed appointments at the study sites, the service providers identified that clients were having cumulative drug balances during their visits and health workers were not doing pill counting to ensure that the drugs given balance with the date of next appointment. The cumulative balance could make patients not to keep appointments since they would not see the reason for coming back to the health facility. The clients were therefore being scored with a good adherence yet they did not keep appointment as evidenced by the 93.3% who missed appointment but were score a good adherence across all the study facilities at baseline. The service providers also observed that some clients were coming for treatment any time and day including weekends and this could affect the documentation of the services provided in the client record cards and registers as some working spaces and individuals may not be available and or accessible during such times. The third factor that was affecting appointment keeping was that some client would get excess drugs through the health facility support staff without documentation and consent of the technical service providers. Lastly, there was systemic failure of timely documentation and update of the client records. All these were the service provision challenges on adherence to appointment schedules across all the study health facilities. There was no literature accessed by the researcher that noted the above as some of the challenges to appointment keeping but the available information was related to patient and community factors only.

To improve appointment keeping, the project used a systems-thinking approach, to improve work flow, redesigned clinic work place, and used a multidisciplinary team. The interventions showed a reduction in missed appointments for more than two weeks to 25.1% with Budondo, Bugembe, Mpumudde, and Walukuba health centres having 2.3%, 36.1%, 24.1%, and 23.3% at end line assessment. However, the end line assessment results did not show much reduction in the percentage of client files with both missed appointment of more than two weeks and an adherence score of  $\geq 85\%$  from 93.3% to 60.3%. This means that the intervention of mentorship to Service providers on patient adherence scoring and documentation had less effect on adherence scoring and or over supply of drugs compared to the appointment schedules. It is therefore recommended that the study sites need to review the problem to identify other root causes such multiple site visits by the clients and develop interventions to close the gap.

### **Viral load suppression in HIV care**

The ultimate goal of the HIV treatment is to achieve a viral load suppression among patients. The third ambitious target for Uganda as adopted from UNAIDS is to achieve a 90% viral load suppression by 2020 among HIV clients on treatment. Poor viral load suppression leads to increased chances of developing resistance to treatment, opportunistic infection manifestations, HIV transmission, and eventually death. Baseline assessment results showed 46.5% of the client files with any of the study HIV care outcomes were due to unsuppressed viral load of  $>1000$  copies/ml. The results do not match with the 13% of ECASA Group of Consultants LTD, [4] who based their measure of un-suppression on the total clientele of the HIV clinic, compared to study results based on clients who had any of the HIV care outcomes studied. The findings agree with those of Bonner K, et al [8], and Nasuna E. et al [9], that re-suppression occurs after adherence interventions as it was found out that only 31.5% of the study clients files were still with un suppressed results at the end line assessment.

The study also revealed that only 7.7 of the study files had never been done a viral load test at baseline assessment, which reduced to 1.4% at end line assessment. The viral load test coverage is in agreement with the ECASA Group of Consultants LTD, [4] report with the 75% coverage in 2017. The study further revealed that 70% of all the unsuppressed client files studied were for clients who had been in care for more than four years. This may be interpreted that the more a client stays in care, the more likely that the he/she will turn unsuppressed. These findings are contrary to those by Kolab C. [5], who observed that the likelihood of having viral non-suppression was significantly lower among adolescents who had been on treatment for more than 9 years in Cambodia. The difference could be related to differences in the health care systems in the two countries but also in the age categories studied.

The rate of undetectable viral load among the study files was only 37.1%, with the lowest (27.8%) at Budondo health centre at baseline assessment. The findings are similar to those of Katharina K. et al [7], study that reported a 33.9% undetectable rate for viral load. The undetectable viral load rate among the study files at end line assessment improved to 51.7%, with the highest (60.9%) for Walukuba health centre. The study also observed that, 34.5% of the study client files were overdue for a viral load to be done based on the Ugandan Ministry of health standards, however, this reduced to 16.8% at end line assessment. The findings at both baseline and end line assessments are similar to those by Martin C. et al [10], who observed that 21% of HIV positive client who were due for viral load 12 months after initiation to treatment did not have it done. The effect of the observed gap leads to poor HIV care as right decisions are delayed to be made. Health facilities need to have a mechanism of ensuring that all clients due for Viral load access the service. It is also common for patients due for viral load testing missing the service even when he/she has made a visit to the clinic.

The study further showed that 91% of client files with unsuppressed viral load had adherence to treatment score of 85% and above, at baseline assessment, which reduced to 42.2% at end line assessment. This could be pointing to resistance to HIV treatment, which is a challenging situation. During the study, it was noted by the service providers that efforts to address challenges to viral load suppression were limited. To note; there was limited access to viral testing, late return of viral load test results, documentation of the viral load results in the client care cards was inadequate, documentation of intensive adherence counselling sessions was not effective, and timeliness of the sessions was not as per ministry of health standards that guide that each session should be conducted one month apart. The

interventions to improve the situation were; Assigning of a staff responsible for viral load, Creating a viral load bleeding area within the HIV care site, Timely tracking of patients for viral load testing and the results, and Provision and documentation of intensive adherence counselling sessions to HIV clients with unsuppressed viral load.

The intervention resulted into reduction in the number of clients with unsuppressed viral load among the study clients, as at baseline assessment there was 46.5% of the study client files with unsuppressed viral load of >1000 copies/ml, which reduced to 31.5% at end line assessment. It is therefore recommended that service providers need to implement the above strategies as a bundle to ensure re-suppression.

## Conclusion

There is a positive effect on the patient HIV care outcomes of adherence to HIV treatment, appointment keeping, and viral suppression when health facility managers take lead in quality improvement initiatives. The increased staffing of the HIV clinics, designated one stop areas for HIV care, and appointment harmonization with the drug refills are key in improving the study HIV care outcomes. Health facilities need to have adequate and competent service providers to run the HIV services to improve on the quality of care. Service providers need to continue supporting all clients to adhere to HIV treatment irrespective of their duration in care.

## References

- [1]. WHO, (2013). Consolidated guidelines on the use of antiretroviral drugs for treating and preventing HIV infection: recommendations for a public health approach. Geneva Switzerland: World Health Organization; 2013. [http://apps.who.int/iris/bitstream/10665/85321/1/9789241505727\\_eng.pdf](http://apps.who.int/iris/bitstream/10665/85321/1/9789241505727_eng.pdf).
- [2]. MoH (2016) a. Consolidated guidelines for HIV prevention, and treatment in Uganda 2016.
- [3]. Cohen MS, Chen YQ, McCauley M, et al (2011).; HPTN 052 Study Team. Prevention of HIV-1 infection with early antiretroviral therapy. *N Engl J Med* 2011; 365:493–505.
- [4]. ECASA Group of Consultants LTD, (2018). Uganda AIDS Country Progress Report July 2017-June 2018.
- [5]. Kolab Chhim<sup>1</sup>, Gitau Mburu<sup>2</sup>, Sovannary Tuot<sup>1</sup>, Ratana Sopha<sup>1</sup>, Vohith Khol<sup>3</sup>, Pheak Chhoun<sup>1</sup> and Siyan (2018). Factors associated with viral non-suppression among adolescents living with HIV in Cambodia: a cross-sectional study. *AIDS Research and Therapy*. 15:20. <https://doi.org/10.1186/s12981-018-0205-z>.
- [6]. Uganda Virus Research Institute (2018). National HIV Drug Resistance Prevention, Monitoring and Surveillance Activities, National Status Report 2018.
- [7]. Katharina Kranzer, Stephen D. Lawn, Leigh F. Johnson, Linda-Gail Bekker, and Robin Wood, (2014). Community viral load and CD4 count distribution among people living with HIV in a South African township: implications for treatment as prevention. Europe PMC Funders Group. *J Acquir Immune Defic Syndr*. 2013 August 1; 63(4): 498–505. doi:10.1097/QAI.0b013e318293ae48.
- [8]. Bonner K, et al. Viral load monitoring as a tool to reinforce adherence: a systematic review. *J Acquir Immune Defic Syndr*. 2013;64(1):74–8.
- [9]. Nasuuna Esther, Joanita Kigozi<sup>1</sup>, Lillian Babirye, Alex Muganzi, Nelson K. Sewankambo and Damalie Nakanjako, (2018). Low HIV viral suppression rates following the intensive adherence counseling (IAC) program for children and adolescents with viral failure in public health facilities in Uganda. Nasuuna et al. *BMC Public Health* (2018) 18:1048. <https://doi.org/10.1186/s12889-018-5964-x>
- [10]. Martin C., Beery M, Carmichael B, Skosana C, Pahad S, Buthelezi B, Delany-Moretlwe S, Imrie J, (2018). Reaching 90-90-90 targets amongst adolescents and young people in South Africa: A model of integrated adolescent care. 12th International Workshop on HIV Treatment, Pathogenesis, and Prevention Research in Resource-limited Settings; 29 May – 1 June 2018, Kigali, Rwanda.
- [11]. Garcí'a de Olalla P, Knobel H, Carmona A, Guelar A, López-Colomé's JL, Cayla` JA (2002). Impact of adherence and highly active antiretroviral therapy on survival in HIV-infected patients. *J Acquir Immune Defic Syndr* 2002; 30: 10510.
- [12]. MoH (2016) b. National STD/AIDS Control Program, Viral Load Monitoring Training Facilitator's
- [13]. Chalker JC, Andualet T, Gitau LN, Ntaganira J, Obua C, Tadege H, et al (2010). Measuring adherence to antiretroviral treatment in resource-poor settings: the feasibility of collecting routine data for key indicators. *BMC Health Serv Res* 2010; 10: 43.

- [14]. Gusdal AK, Obua C, Andualem T, Wahlstrom R, Tomson G, Peterson S, et al (2009). Voices on adherence to ART in Ethiopia and Uganda: a matter of choice or simply not an option? *AIDS Care* 2009; 21: 13817.
- [15]. Carly Hudelson & Lucie Cluver (2015). Factors associated with adherence to antiretroviral therapy among adolescents living with HIV/AIDS in low- and middle-income countries: a systematic review, *AIDS Care: Psychological and Socio-medical Aspects of AIDS/HIV*, 27:7, 805-816, DOI: 10.1080/09540121.2015.1011073
- [16]. Bharatesh D. Basti,<sup>1</sup> Venkatesha Mahesh,<sup>2</sup> Dattatreya D. Bant,<sup>3</sup> and Geeta V. Bathija (2017). Factors affecting antiretroviral treatment adherence among people living with human immunodeficiency virus/acquired immunodeficiency syndrome: A prospective study. *Journal of family medicine and primary care*.
- [17]. Oku O. Afiong, Eme T. Owoaje, Oboko O. Oku and Emmanuel Monjok (2014). Prevalence and Determinants of Adherence to Highly Active Anti-Retroviral Therapy Amongst People Living with HIV/AIDS in a Rural Setting in South-South Nigeria. *African Journal of Reproductive Health* March 2014; 18(1): 134
- [18]. Elizabeth Horstmann, Jillian Brown, Fareesa Islam, Johanna Buck, and Bruce D. Agins, (2010). Retaining HIV-Infected Patients in Care: Where Are We? Where Do We Go from Here? *Clinical Infectious Diseases* 2010; 50:752–761
- [19]. Park WB, Choe PG, Kim SH, Jo JH, Bang JH, Kim HB, Kim NJ, Oh M, Choe KW: One-year adherence to clinic visits after highly active antiretroviral therapy: a predictor of clinical progress in HIV patients. *J Intern Med* 2007, 261(3):268–275.
- [20]. Smith E. O., J. D. Curb, and R. J. Hardy, "Clinic attendance in the hypertension detection and follow-up program," *Hypertension*, vol. 4, no. 5, pp. 710–715, 1982. View at Google Scholar · View at Scopus
- [21]. Nemes MI, Carvalho HB, Souza MF, (2004). Antiretroviral therapy adherence in Brazil. *AIDS*. <https://www.ncbi.nlm.nih.gov/pubmed/15322479>.
- [22]. Lucas GM, Chaisson RE, Moore RD, (1999). Highly active antiretroviral therapy in a large urban clinic: risk factors for virologic failure and adverse drug reactions. *Ann Intern Med*; 131(2):81–87.
- [23]. TenoRes Study Group (2016). Global epidemiology of drug resistance after failure of WHO recommended first-line regimens for adult HIV-1 infection: a multicentre retrospective cohort study. *Lancet Infect Dis*. 2016 May;16(5):565-575.
- [24]. Sethi A, Celentano D, Gange S, Moore R, Gallant J. Association between adherence to antiretroviral therapy and human immunodeficiency virus drug resistance. *Clin Infect Dis* **2003**; 37(8):1112–1118.
- [25]. Gupta RK, Gregson J, Parkin N, Haile-Selassie H, Tanuri A, Andrade Forero L, Kaleebu P, Watera C, Aghokeng A, Mutenda N, Dzangare J, Hone S, Hang ZZ, Garcia J, Garcia Z, Marchorro P, Beteta E, Giron A, Hamers R, Inzaule S, Frenkel LM, Chung MH, de Oliveira T, Pillay D, Naidoo K, Kharsany A, Kugathasan R, Cutino T, Hunt G, Avila Rios S, Doherty M, Jordan MR, Bertagnolio S. HIV-1 drug resistance before initiation or re-initiation of first-line antiretroviral therapy in low-income and middle-income countries: a systematic review and meta-regression analysis. *Lancet Infect Dis*. 2018 Mar;18(3):346-355.
- [26]. Moore CG, Wilson-Witherspoon P, Probst JC, (2001). Time and money: effects of no-shows at a family practice residency clinic. *Fam Med* 2001; 33(7):522–527.
- [27]. Shumba c., L. Atuhaire, R. Imakit, R. Atukunda, and P. Memiah. Missed Doses and Missed Appointments: Adherence to ART among Adult Patients in Uganda. Hindawi Publishing Corporation, *ISRN AIDS*, Volume 2013, Article ID 270914, 7 pages, <http://dx.doi.org/10.1155/2013/270914>
- [28]. Bigna Jean Joel R, Jean Jacques N Noubiap, Claudia S Plottel, Charles Kouanfack1, and Sinata Koulla-Shiro, (2014). Factors associated with non-adherence to scheduled medical follow-up appointments among Cameroonian children requiring HIV care: a case-control analysis of the usual-care group in the MORE CARE trial.
- [29]. Setor Kunutsor,<sup>1</sup> John Walley,<sup>1</sup> Elly Katabira,<sup>2</sup> Simon Muchuro,<sup>2</sup> Hudson Balidawa,<sup>3</sup> Elizabeth Namagala,<sup>3</sup> and Eric Ikoona<sup>3</sup>, (2010). Clinic Attendance for Medication Refills and Medication Adherence amongst an Antiretroviral Treatment Cohort in Uganda: A Prospective Study. Hindawi Publishing Corporation *AIDS Research and Treatment* Volume 2010, Article ID 872396, 8 pages doi:10.1155/2010/872396.