

## *Full Length Research Paper*

# **The Effect of Community Based Non-Communicable Disease Services on the Quality of Life of People Living with HIV in Uganda: A Randomized Controlled Trial**

**Christopher Ddamulira\*, Norman Nsereko, and Miph Musoke**

School of Post Graduate Studies and Research, Nkumba University, Entebbe, Uganda.

\*Corresponding author E-mail: [chris\\_ddamulira@yahoo.co.uk](mailto:chris_ddamulira@yahoo.co.uk)

Received 5 August 2020; Accepted 29 September, 2020

**ABSTRACT:** A comprehensive and culturally applicable community based Non Communicable Diseases (NCD) services package was implemented with an aim to test the effectiveness of the community based NCD services that integrate HIV and Non-Communicable Diseases in communities to improve the quality of life (QoL) of people with HIV living with NCDs in Uganda. The Randomized Controlled Trial (RCT) was conducted to compare the efficacy of the community based NCD services as intervention. The control group received the usual HIV services in the community by the HIV expert clients in Uganda. Participants were randomly allocated to receive weekly and monthly intervention sessions by village health teams (VHTs), expert clients and community volunteers or standard care in the community ARV drug distribution points. Independent t-tests were performed to compare changes in the QoL scores at the baseline and the endline. The effect of the intervention on the QoL was tested using Pearson correlation and linear regression analysis. Between November and December 2018, 1076 individuals were screened, of whom 438 were randomly assigned to

either the intervention or control group in the ratio of 1:1. The post intervention results revealed that the community based NCD services were effective and contributed 31.9% to the overall improved the QoL in all the three domains; the physical, environmental and social relationship domains. Therefore, designing such interventions in all community HIV drug distribution points would reduce the co-morbidities related to NCDs and HIV, and improve the overall quality of life. Furthermore, it could be useful to reduce stigma and increase their social support network. Findings could be utilized at regular community service settings for its sustainability and long-term effect. The intervention created improved understanding of HIV and NCD integration health promotion strategies and community support systems activities by the VHT, ART expert clients and the community volunteers.

**Keywords:** Community, Non-Communicable Diseases, Services, Quality of Life, HIV, People Living with HIV, Uganda

## **INTRODUCTION**

There was an indication in 2012 that Non-Communicable Diseases (NCDs) were responsible for 38 million (68%) of community service delivery models of ART do not include the integrated community management and prevention of Diabetes Mellitus (DM) and hypertension as co-morbidities in SSA (Grimsrud *et al.*, 2017). The lack of the NCD services affects the prevention programmes for the co-morbidities among the HIV patients receiving Anti-

Retroviral the world's 56 million deaths (World Health Organization, 2015). Almost three quarters of all NCD (28 million) and the majority of premature deaths (82%) occur in low and middle income countries mainly in Asia and Sub-Saharan African (SSA) countries (World Health Organization, 2015). Yet, the published evidence showed that, the current Therapy (ART) in the communities.

Globally, deaths from NCDs are projected to reach 52

million by 2030 (World Health Organization, 2016). The deaths related to hypertension and diabetes among HIV patients on Antiretroviral Therapy (ART) increased due to scale up of the treatment and aging with HIV (Peck *et al.*, 2014). Most deaths occurred among HIV people with Hypertension (HT) and Diabetes Mellitus (DM) conditions that needs daily medication and or to make life style changes to ensure they can live as well as possible with their condition (World Health Organization, 2015). Therefore, the individual and family support systems are important in reducing the burden of HIV and NCDs.

Sub-Saharan Africa has undergone epidemiological transitions that included an epidemic of Non-Communicable Diseases (NCDs) with an estimated prevalence of hypertension of 26.5% and 12.6% for Diabetes Mellitus in South, Central and East African regions (Bahendeka *et al.*, 2016; Oni *et al.*, 2014). The prevalence of hypertension and diabetes among adult people living with HIV (PLHIV) in Uganda is increasing with an estimated prevalence of hypertension of 20.9% and 10.4% for diabetes (Kalyesubula *et al.*, 2016; Bahendeka *et al.*, 2016). Thus, understanding the strategies for early detection and treatment would be important for improving health services and the quality of life of HIV patients.

Uganda like other sub-Saharan African countries now faces the double burden of HIV and Non-Communicable Diseases due to the profound effects HIV, ART and the growing population of people aging with HIV (Temu *et al.*, 2014; Oni *et al.*, 2014). With a prevalence of hypertension and Diabetes Mellitus of 28.7% and 20.9% respectively among HIV patients on ART in Uganda (Kalyesubula *et al.*, 2016), the country has approximately two hundred fifty thousand people with a double burden of HIV and NCD. The Ministry of Health recognized that Non-communicable diseases (NCDs) and their risk factors were increasing in Uganda among patients with HIV on Anti-Retroviral Therapy (ART) (Ministry of Health, 2005).

As the patients enrolled on Anti-Retroviral Therapy (ART) to improve their survival, the risks of NCDs were reported to have increased with patient's duration on anti-retroviral therapy and chronological age (Peck *et al.*, 2014). Therefore, People Living with HIV (PLHIV) on ART represents a group in which prevention, screening and treatment strategies using community approach offers substantial benefits to reduce Diabetes Mellitus (DM) and hypertension co-morbidities among patients (Hyle *et al.*, 2014). This calls for a community intervention for the early screening of NCD's among PLHIV on ART in order to reduce morbidity and mortality that could rise as result of co-burden of HIV and NCD's, mainly DM and hypertension.

The design of service delivery models for PLHIV must also address co-morbidities and co-infections (Khabala *et al.*, 2015). With an aging population of PLHIV and a burgeoning epidemic of chronic diseases, services must

incorporate treatment and prevention for non-communicable diseases. The scale up of ART for people living with HIV in low- and middle-income countries has been associated with huge individual benefits and rising life expectancies (Wandeler *et al.*, 2016; Johnson *et al.*, 2013). However, the expanded access to ART has also resulted in a new global health challenge, namely, increased co-morbidity of Non-Communicable Diseases in those living and aging with HIV on ART (Narayan *et al.*, 2014; Levitt *et al.*, 2011).

The health and improved QoL gains made against HIV and AIDS are now under threat from hypertension and diabetes problems which are increasingly prevalent and documented among the HIV positive (Guaraldi *et al.*, 2011). For example; DM and hypertension diseases emerged as the leading cause of morbidity and mortality in HIV infected persons on Anti-Retroviral Therapy (ART) in developed country settings (Triant *et al.*, 2007). There is a high prevalence of NCD risk factors and unrecognized and untreated hypertension represent major problem in Uganda (Kavishe *et al.*, 2015). The high prevalence of Diabetes Mellitus (DM) and other preventable NCDs provides an opportunity for prevention.

It is well established that Hypertension and Diabetes Mellitus all have direct and indirect relationships with HIV and ART. Similarly, certain ART drugs contribute to NCDs complications through hypercholesterolemia, increased abdominal fat and the metabolic syndrome (Narayan *et al.*, 2014). People living with HIV, whether they have been initiated on ART or not, there is chronic activation of the innate immune system with excessive production of inflammatory cytokines and mediators that in turn are associated with an increased risk of atherosclerosis, coronary artery inflammation and all-cause mortality (Deeks *et al.*, 2013; Rajasuriar *et al.*, 2013). Therefore, the integrated community based HIV and NCD services are important in the monitoring and prevention of the ART related drug toxicities among patients in the community at an earlier opportunity, if implemented by the Ministry of Health (MOH).

In Uganda, major efforts are needed to strengthen health services for the prevention, early detection and treatment of chronic diseases (Kavishe *et al.*, 2015). There are many lessons from the HIV experience that are applicable to the NCD movement. These lessons included shifting tasks between cadres of Health Care Workers (HCW) that include the expert ART clients, VHTs and the community volunteers, to develop robust clinical monitoring and evaluation programs that provide patient-centered care and medication adherence support to patients (Rabkin and El-Sadr, 2011).

The Non-Communicable Diseases such as DM and hypertension have been integrated into routine HIV services at all government health facilities at facility level (Ministry of Health, 2017). However, integration of NCD services are still lacking in the Community Drug Distribution Points (Ministry of Health, 2017).

Furthermore, the existing strategies for integration of HIV services in the community with other diseases in Uganda have focused mainly on tuberculosis (TB), malaria, reproductive health and other sexually transmitted infections (Ministry of Health, 2016). Non-communicable diseases such as hypertension, diabetes mellitus, and cancer have not received the attention they deserve for prevention and management in the communities (Abrahams-Gessel *et al.*, 2016). Hence, this called for the development of innovative integrated care model that incorporates the NCDs component in the routine community HIV care, management and prevention, which is lacking in all community models where expert clients are utilized as lay health workers for service delivery.

Furthermore, 70% of the patients on ART in Uganda receive ARVs from the community drug distribution points among the various clinics for the non-government organizations and public health facilities (Ministry of Health, 2016). Therefore, integrating the NCD intervention within the current ART service structures was necessary in the Uganda to improve the quality of life of PLHIV with NCDs. Secondly, in the rural areas, the long distance to clinics can be a barrier to the access and adherence of patients on ART with NCDs in the District especially if the services are only centered at the public health facilities (Ministry of Health, 2016).

Quality of Life (QoL) of people living with HIV increased due to the availability of ART and access to early HIV diagnosis (Nideröst and Imhof, 2016). People living with HIV in Uganda and other Sub-Saharan African countries enjoyed the same life expectancy and QoL as the general population (Wu, 2000). The transformation of HIV into a chronic condition through the immunological effectiveness of the treatment, health-related quality of life (HRQoL) became an important focus for HIV care (Mills *et al.*, 2011). Therefore, ART as treatment in the studies reviewed improved the physical quality of life of patients.

People Living with HIV (PLHIV) have endured the HIV and AIDS epidemic for decades, studies have been carried out to examine the effects of the disease on the quality of life (QoL) of people affected by the disease (Joint United Nations Programme on HIV/AIDS, 2014). Consequently, the expansion of ART treatment and the decline in opportunistic infections resulted into increased survival rates and disease chronicity (Domingues and Waldman, 2014). Antiretroviral Therapy (ART) and aging with HIV are risk factors associated with Non Communicable Diseases (NCDs) that affects the quality of life of patients (Domingues and Waldman, 2014). Thus, understanding the effects of community based NCD services and the QoL among patients has become one of the main objectives of HIV and AIDS research (Gaspar *et al.*, 2011).

Chronicity of AIDS was a landmark in improving the living conditions of people living with PLHIV (Oliveira *et*

*al.*, 2017). The increase in the time of living with HIV allowed infected individuals a greater possibility of acceptance, adaptation and conformation with the disease, and thus, it was important to analyze strategies to improve the QoL of PLHIV (De Sousa, 2016). The analysis of the community based NCD services as predictor of quality of life, informed policies and procedures to improve the physical health, environmental wellbeing and social relationship quality of life.

With the increase QoL as result of ART, people started to have a longer survival, which allowed the aging of PLHIV (Nideröst and Imhof, 2016). Thus, of the 36.7 million people living in 2015 with HIV and AIDS, 5.8 million were 50 years or older (Joint United Nations Programme on HIV/AIDS, 2014). However, the likelihood of a longer life is not always related to good quality of life due to co-burden of diseases related to NCDs, such as hypertension and Diabetes Mellitus (Nideröst and Imhof, 2016). The quality of life can be affected by several factors, such as level of education, age, gender, individual life styles, marital status and health services utilization (Ferreira *et al.*, 2012). Therefore, designing health services related to NCD services may impact the physical health, environmental wellbeing and social relationship domains of the quality of life.

The pursuit for QoL does not only end with the extension of the years of life, taking into account the meaning of living with HIV and NCDs, which can characterize the problems associated with the multi-comorbidities and lack of adequate health services in resource limited settings, which may compromise the physical well-being, environmental well-being and social relationships quality of life of individuals living with HIV and NCDs, especially those aged 40 or over (Oliveira *et al.*, 2017).

The existing evidence indicated that there was burden of Non Communicable Diseases (NCDs) among HIV patients on the Anti-Retroviral Therapy in Uganda (Kalyesubula *et al.*, 2016; Bahendeka *et al.*, 2016). Therefore, it is necessary to note that the community based NCD services as a precursor and effective pointer to improved quality of life of patients receiving ART services in the communities (Zhou *et al.*, 2018). Thus, the study intended to examine the effects of the community based NCD services and quality of life of people living with HIV.

## METHODS AND MATERIALS

The study used a randomized controlled trial design to determine the effectiveness of community based NCD services on the quality of life of people with NCDs living with HIV. The study was guided by the Consolidated Standards of Reporting Trials (CONSORT) guidelines (Eldridge *et al.*, 2016). The study was conducted in Wakiso District located in central Uganda. The sample

size was determined using method for designing experimental research that applied randomized controlled trial for detecting a significance difference in the group that received NCD services (Intention to Treat) and the control group that received treatment as usual (TAU) (Chan, 2003). The number of subjects per group for a two-sided significance level, using 5% and a power of 95% and effect size of 0.3 was determined.

A total of 438 HIV patients with NCDs (Diabetes or Hypertension) receiving the chronic care from the Community Drug Distribution Points (CDDP's) in Wakiso District were enrolled in the study randomly in the in a 1:1 ratio between the treatment (219) and the control groups (219). The unit of analysis was at individual level. Formally consent was sought from all eligible HIV participants aged 18 years and above receiving ART services in the communities.

The intervention group received information on NCD risk factors, health promotion and risk reduction, early detection and screening of NCD risk factors, referral for the treatment of hypertension and diabetes, ART treatment, behavioral change counselling, social support, treatment adherence, routine monitoring for blood pressure, blood sugars, viral load tests and referral for rehabilitation and psychosocial support with the aim of improving the quality of life.

Data were collected using standardized WHO Quality of Life (QoL) structured questionnaire (World Health Organization, 2002) at baseline and endline after 12 months of the intervention. In the intervention group, community based NCD services were provided every month in the respective sub counties at the CDDPs or during the group meetings of the clients. The intervention and control participants were separated by a distance of at least 40 kilometers from one another, to try minimized contamination. Participant flow is shown in (Figure 1). The data was analyzed using SPSS Version 20 to generate descriptive and inferential statistics.

## RESULTS

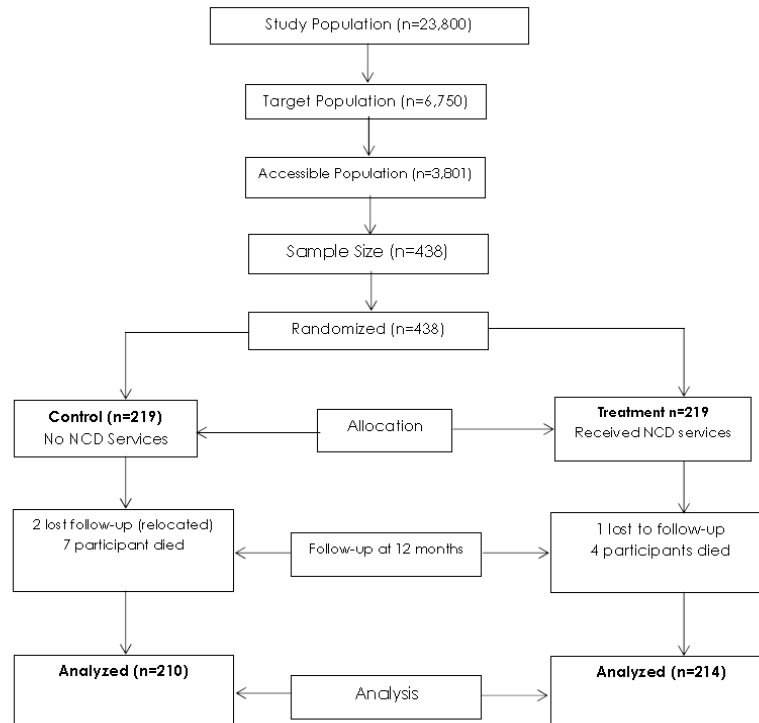
Table 1 shows that majority of the respondents were female, 55.7% in the treatment and 64.4% in the control group. The majority of the respondents were 40 years and above both in the treatment and the control group (98.6% respectively). According to the level of education, majority of the respondents in both the control and treatment were below the secondary level, 72.1% in the treatment and 76.7 in the control group. The findings showed that the majority of the respondents were married both in the treatment and control groups (57.5% and 63.5% respectively). The socio-demographic characteristics of the respondents did not significant varies at baseline both in the control and the intervention group. All the variables were statistically not significant

( $p > 0.005$ ). Therefore, there was homogeneity in terms of the individual characteristics of the respondents before the implementation of the community based NCD services within the treatment group. The findings in (Table 2) indicated a significant change in all the 4 sub-variables considered as a measure of the quality of life people with NCD living with HIV when the control and intervention groups were compared at the endline. In the study, there was a significant mean differences ( $p < 0.05$ ) in the rating scores by the general quality of life (1.75), physical health (1.39), environmental domain (1.62) and, social relationship (1.58). The findings indicated that the participants in the intervention group improved the general QoL after the implementation of the community based NCD services compared to those in the control group, where there was no improvement in the QoL. It implied that when the study participants in the intervention group adopted the community based NCD messages from the VHTs, expert clients and the community volunteers, they experienced an improvement in the overall quality of life. This means that the NCD services had the efficacy in improving the QoL of the study participants. Therefore, generalising and implementing the community based NCD services in other settings would be important in improving the quality of life of people with HIV living with NCDs.

The results in (Table 3), showed that there was a significant positive relationship between each component of the community based NCD services and each domain of the quality of life ( $p = 0.00$ ). Similarly, there exists a significant relationship between each component of the community NCD services and the total quality of life ( $p = 0.00$ ). The overall community based NCD services had a significant relationship with the total quality of life of people with NCDs living with HIV ( $r = 0.572$   $p = 0.00$ ).

The results in the (Table 4), showed that health promotion, community support systems and patient monitoring systems are combined explanatory predictors of quality of life ( $F = 34.263$ ,  $p < 0.001$ ). Health promotion ( $\beta = 0.196$ , Sig. = 0.007), community support systems ( $\beta = 0.226$ , Sig. = 0.000) and patient monitoring systems ( $\beta = 0.319$ , Sig. = 0.000). Therefore, the community based NCD services had a statistically significant positive effect on the quality of life of people with NCDs living with HIV with change in effect size of 31.9% as a contribution of the different community based NCD services on the overall quality of life.

The effect of community based NCD services utilization on the quality of life was most significantly felt with patient monitoring systems ( $t = 4.436$ ) followed by community support systems ( $t = 3.822$ ) and least with health promotion activities ( $t = 2.720$ ). It implied that when the study participants adopted the health promotional activities, community support systems and adhering to the set patient monitoring activity schedules, they experienced an improvement in each domain of the quality of life.



**Figure 1:** Consolidated Standard Reporting for Randomized Control Trial (RCT).

**Table 1:** Patients Demographic Characteristics.

Demographics	Treatment N (%)	Control N (%)	$\chi^2$	P-value
Gender				
Male	97(44.3)	78(35.6)	3.435	0.064
Female	122(55.7)	141(64.4)		
Age				
Less than 40 years	3(1.4)	3(1.4)	-	1.000
40 years and above	216(98.6)	216(98.6)		
Education Level				
Below Secondary	158(72.1)	168(76.7)	1.200	0.273
Secondary and above	61(27.9)	51(23.3)		
Marital Status				
Married	126(57.5)	139(63.5)	1.615	0.204
Unmarried	93(42.5)	80(36.5)		

<sup>a</sup> Comparison between Treatment and comparison groups. \*Significant at 5% level

**Table 2:** Independent t-test for the Mean Scores for the Quality of Life between the Control and the Intervention Groups at Endline.

Domain	Treatment	Control	Mean Difference	t $\alpha$	p-value
General Quality of Life	4.21	2.46	1.75	21.82	0.000*
Physical Health Domain	3.92	2.53	1.39	18.22	0.000*
Environmental Domain	3.77	2.15	1.62	21.48	0.000*
Social Relationship	3.81	2.23	1.58	20.98	0.000*

Mean Range Scale: 1.00-1.79= Very Poor, 1.80-2.59= Poor, 2.60-3.39= Fair, 3.40-4.19= Good, 4.20-5.00= Very Good, \* Significant at p < 0.05

**Table 3:** Correlational Analysis for the Relationship between Community Based NCD services and Quality of Life (QoL) Domains at Endline.

		Physical Health Domain	Environmental Domain	Social Relationship Domain	Total Quality of Life
Health Promotion	Pearson Correlation	0.355	0.471	0.438	0.451
	p-value	0.000	0.000	0.000	0.000
	N	214	214	214	214
Community Support Systems	Pearson Correlation	0.380	0.301	0.335	0.361
	p-value	0.000	0.000	0.000	0.000
	N	214	214	214	214
Patient Monitoring Systems	Pearson Correlation	0.411	0.519	0.462	0.497
	p-value	0.000	0.000	0.000	0.000
	N	214	214	214	214
Community Based NCD Services	Pearson Correlation	0.500	0.566	0.539	0.572
	p-value	0.000	0.000	0.000	0.000
	N	214	214	214	214

\*Significant at 5% level ( $p < 0.05$ ).

**Table 4:** Regression Analysis for the NCD services and Quality of Life(QoL) Domains.

Model	Unstandardized Coefficients		Standardized Coefficients		t	Sig./P-Value
	B	Std. Error	Beta			
Health Promotion	0.195	0.072	0.196		2.720	0.007
Community Support Systems	0.217	0.057	0.226		3.822	0.000
Patient Monitoring Systems	0.264	0.059	0.319		4.436	0.000
R	0.573					
R Square	0.329					
Adjusted R Square	0.319					
F	34.263					
P-Value	0.000					

Dependent Variable: Quality of Life (QoL); Source: Primary data, 2019

## DISCUSSION

The significant positive effect of the different community based NCD services on each domain of the quality life change in the quality implies that when the study participants adopted the health promotional activities, community support systems and adhering to the set patient monitoring activity schedules, they experienced an improvement in each domain of the quality of life; physical health, environmental and social relationship domains. For instance, in the treatment group; health promotion, community support systems and patient monitoring systems are combined explanatory predictors of quality of life ( $F = 34.263$ ,  $p < 0.001$ ). It can be argued that the improvement in the quality of life across all the domains in this study was due to the adoption of each component of the community based NCD services.

Furthermore, the introduction of each component of the community based NCD services would bring significant improvements in the in the overall quality of life of people with NCD living with HIV, which is consistent with earlier findings by Medley *et al.* (2015) who found out that health promotional activities such as education in life style behavioural improved the quality of life of the people

living with HIV and AIDS. In addition, Bateganya *et al.* (2015) recommended randomized controlled trial as novel and rigorously designed studies to evaluate the impact of interventions on key outcomes for quality of life of HIV infected people. Hence, the design and the implementation of the trial were conducted using the health promotional activities as component of the intervention to complement the earlier results with RCT as a gold standard design. It implied that designing community systems structures to implement health promotion NCD activities and monitoring of the patients would improve the patient's outcomes.

Furthermore, the results of the trial were in agreement with Jouquet *et al.* (2009) who found out that community health workers managed antiretroviral therapy (ART) was non inferior to the health facility managed ART in urban clinics of Johannesburg and Cape town, South Africa. This was a cross-sectional study to assess the effectiveness of community health workers and ART expert clients for Highly Active Anti-Viral Therapy (HAART) delivery in sub-Saharan Africa. Hence, the community support systems using the VHT and expert

clients showed improved outcome in the quality of life among the patients that participated in the trial. Similarly, the study findings by Decroo *et al.* (2017) and Tran *et al.* (2015) showed better clinical outcomes among patients in community ART groups compared to those who were receiving individual care from the facilities. Therefore, the results of the RCT confirms that patient-driven community systems through community support groups using lay cadres would result in higher retention and better patient's quality of life among patients who are on ART.

On the contrary, the studies conducted in Tanzania by Callaghan *et al.* (2010) showed that some patients refused to be attended to by health workers of the lower cadre or non-professionals, as they believe that they will not get appropriate treatment or poor quality care. This was because, the programme was initiated in Tanzania without clear policy guidelines, sensitization of the beneficiaries, training community volunteers and lack of policies at country level to implement task shifting model are an impediment (Callaghan *et al.*, 2010). In Uganda, the policies and procedures for the training of the VHT and expert clients are in place. Therefore, the operationalization of the community based NCD strategy was accepted in the communities.

Furthermore, the results of the trial that patients monitoring systems improved the quality of life were in line with the earlier studies by Moore *et al.* (2016) and Bopp *et al.* (2004) found that the patient monitoring for the CD4 counts, viral loads and blood sugars improved the quality of life of people with HIV. In these studies, the community volunteers and expert clients were used as mobilisers for reminding the patients their appointments. This was a confirmation that the use of the VHTs or expert clients in mobilizing patients for clinic visits in the community is important. Therefore, monitoring the blood pressure, blood sugars, weight and other HIV parameters in the communities, prevents the development of complications related to NCDs, and improve the physical health domain of QoL. The routine monitoring of the patients guided early detection and treatment of the patients that yielded better clinical outcomes for the group that received the community based NCD services intervention. Therefore, based on the earlier literature and the findings of the linear regression analysis, where all the sub variable of the components of the community based NCD services showed statistically significant positive effect on the quality of life of people with NCDs living with HIV. Therefore, according to data generated in the study, the different community based NCD services had a significant positive effect with each domain of the quality of life. It implied that providing NCD services in the community would be important in improving the quality of life of PLHIV.

### Conclusion and Recommendations

In conclusion, rigorously designed intervention indicated

that the community based NCD services (health promotion, community support systems and patient monitoring systems) increased QoL of HIV infected people receiving chronic care from the communities. Therefore, designing such interventions in all community HIV drug distribution points would reduce the co-morbidities related to NCDs and HIV, and improve the overall quality of life. Furthermore, it could be useful to reduce stigma and increase their social support network. Findings could be utilized at regular community service settings for its sustainability and long-term effect. The study recommended, the Government through the Ministry of Health (MOH) to review and adopt the transformed community based HIV and NCD services in the national guidelines for management of HIV in the communities using the differentiated models.

### REFERENCES

- Abrahams-Gessel S, Denman CA, Gaziano TA, Levitt, NS, Puoane T (2016). Challenges facing successful scaling up of effective screening for cardiovascular disease by community health workers in Mexico and South Africa: Policy implications. *Health systems and policy research*, 3(1), 13-15.
- Bahendeka S, Wesonga R, Mutungi G, Muwonge J, Neema S, Guwatudde D (2016). Prevalence and correlates of diabetes mellitus in Uganda: a population-based national survey. *Tropical Medicine & International Health*, 21(3), 405-416.
- Bateganya M, Amanyeive U, Roxo U, Dong M (2015). The impact of support groups for people living with HIV on clinical outcomes: a systematic review of the literature. *Journal of acquired immune deficiency syndromes (1999)*, 68(03), S368.
- Bopp CM, Phillips KD, Fulk LJ, Dudgeon WD, Sowell R, Hand GA (2004). Physical activity and immunity in HIV-infected individuals. *AIDS care*, 16(3):387-393.
- Callaghan M, Ford N, Schneider H (2010). A systematic review of task-shifting for HIV treatment and care in Africa. *Human resources for health*, 8(1):8.
- Chan YH (2003). Randomized controlled trials (RCTs)-sample size: the magic number? *Singapore medical journal*, 44(4):172-174.
- De Sousa JCF, de Oliveira AC, Leadebal ODCP, Freitas FFQ, Holmes ES, de Albuquerque SGE, da Silva Ribeiro CM (2016). Quality of Life Evaluation of Elderly People Living with HIV/AIDS According to HAT-QoL. *International Archives of Medicine*, 9.
- Decroo T, Telfer B, Dores CD, White RA, Santos ND, Mkwamba A, Metcalf C (2017). Effect of Community ART Groups on retention-in-care among patients on ART in Tete Province, Mozambique: a cohort study. *BMJ Open*, 7(8), e016800. <http://doi.org/10.1136/bmjopen-2017-016800>
- Deeks SG, Lewin SR, Havlir DV. (2013). The end of AIDS: HIV infection as a chronic disease. *Lancet*, 382:1525±33. [https://doi.org/10.1016/S0140-6736\(13\)61809-7](https://doi.org/10.1016/S0140-6736(13)61809-7) PMID: 24152939
- Domingues CSB, Waldman EA (2014). Causes of death among people living with AIDS in the pre-and post-HAART eras in the city of São Paulo, Brazil. *PLoS One*, 9(12), e114661.
- Eldridge SM, Chan CL, Campbell MJ, Bond CM, Hopewell S, Thabane L, Lancaster GA (2016). CONSORT 2010 statement: extension to randomized pilot and feasibility trials. *bmj*, 355, i5239.
- Ferreira BE, Oliveira IM, Paniago AMM (2012). Quality of life of people living with HIV/AIDS and its relationship with CD4+ lymphocytes, viral load and time of diagnosis. *Revista Brasileira de Epidemiologia*, 15(1):75-84.
- Gaspar J, Reis RK, Pereira FMV, Neves LADS, Castrighini CDC, Gir E (2011). Quality of life in women with HIV/AIDS in a municipality in the State of São Paulo. *Revista da Escola de Enfermagem da USP*, 45(1):230-236.

- Grimsrud A, Barnabas RV, Ehrenkranz P, Ford N (2017). Evidence for scale up: the differentiated care research agenda. *Journal of the International AIDS Society*, 20(S4).
- Guaraldi G, Orlando G, Zona S, Menozzi M, Carli F, Garlassi E, Palella F (2011). Premature age-related comorbidities among HIV-infected persons compared with the general population. *Clinical Infectious Diseases*, 53(11):1120-1126.
- Hyle EP, Naidoo K, Su AE, El-Sadr WM, Friedberg KA (2014). HIV, Tuberculosis, and Non-Communicable Diseases: What is known about the costs, effects, and cost-effectiveness of integrated care? *Journal of acquired immune deficiency syndromes (1999)*, 67(0 1), S87.
- Johnson LF, Mossong J, Dorrington RE, Schomaker M, Hoffmann CJ, Keiser O, Garone DB (2013). Life expectancies of South African adults starting antiretroviral treatment: collaborative analysis of cohort studies. *PLoS medicine*, 10(4), e1001418.
- Joint United Nations Programme on HIV/AIDS. (2014). *Global AIDS update*. Geneva: UNAIDS.
- Joint United Nations Programme on HIV/AIDS. (2017). *Global AIDS update*. Geneva: UNAIDS.
- Jouquet G, Bemelmans M, Massaquoi M, Arnould L, Mwangomba B, Bauernfeind A, Philips M (2009). Cost analysis of an ARV care programme reaching universal access in Thyolo, Malawi. In *5th IAS Conference on HIV Pathogenesis, Treatment and Prevention*.
- Kalyesubula R, Kayongo A, Semitala FC, Muhanguzi A, Katantazi N, Ayers D, Mills EJ (2016). Trends and level of control of hypertension among adults attending an ambulatory HIV clinic in Kampala, Uganda: a retrospective study. *BMJ global health*, 1(3):e000055.
- Kavishe B, Biraro S, Baisley K, Vanobberghen F, Kapiga S, Munderi P, Grosskurth H (2015). High prevalence of hypertension and of risk factors for non-communicable diseases (NCDs): a population based cross-sectional survey of NCDs and HIV infection in Northwestern Tanzania and Southern Uganda. *BMC Medicine*, 13, 126. <http://doi.org/10.1186/s12916-015-0357-9>
- Khabala KB, Edwards JK, Baruani B, Sirengo M, Musembi P, Kosgei RJ, Wilkinson E (2015). Medication Adherence Clubs: a potential solution to managing large numbers of stable patients with multiple chronic diseases in informal settlements. *Tropical Medicine & International Health*, 20(10):1265-1270.
- Levitt NS, Peer N, Steyn K, Lombard C, Maartens G, Lambert EV, Dave JA (2011). Increased risk of dysglycaemia in South Africans with HIV; especially those on protease inhibitors. *Diabetes research and clinical practice*, 119, 41-47.
- Medley A, Bachanas P, Grillo M, Hasen N, Amanyeive U (2015). Integrating prevention interventions for people living with HIV into care and treatment programs: a systematic review of the evidence. *Journal of acquired immune deficiency syndromes (1999)*, 68(0 3), S286.
- Mills EJ, Bakanda C, Birungi J, Chan K, Ford N, Cooper CL, Hogg RS (2011). Life expectancy of persons receiving combination antiretroviral therapy in low-income countries: a cohort analysis from Uganda. *Annals of internal medicine*, 155(4), 209-216.
- Ministry of Health (2016). *Uganda Clinical Guidelines for National Guidelines for Management of Common Conditions*. Kampala: Ministry of Health.
- Ministry of Health (2017). *Uganda Population HIV Impact Assessment (UPHIA) Report*. Kampala: Ministry of Health.
- Ministry of Health (2005). *National antiretroviral treatment and care guidelines for adults and children*. Kampala: Ministry of Health.
- Moore G, Durstine JL, Painter P, American College of Sports Medicine (2016). *ACSM's Exercise Management for Persons with Chronic Diseases and Disabilities*, 4E. Human Kinetics.
- Narayan KV, Miotti PG, Anand NP, Kline LM, Harmston C, Gulakowski III R, Vermund SH (2014). HIV and non-communicable disease comorbidities in the era of antiretroviral therapy: a vital agenda for research in low-and middle-income country settings. *Journal of Acquired Immuno-Deficiency Syndrome*, 7:67-79.
- Nideröst S, Imhof C (2016). Aging with HIV in the era of antiretroviral treatment: living conditions and the quality of life of people aged above 50 living with HIV/AIDS in Switzerland. *Gerontology and Geriatric Medicine*, 2, 2333721416636300.
- Oliveira FBM, Queiroz AAFLN, Sousa ÁFLD, Moura ME B, Reis RK (2017). Sexual orientation and quality of life of people living with HIV/AIDS. *Revista Brasileira de Enfermagem*, 70(5):1004-1010.
- Oni T, McGrath N, BeLue R, Roderick P, Colagiuri S, May CR, Levitt NS (2014). Chronic diseases and multi-morbidity-a conceptual modification to the WHO ICC model for countries in health transition. *BMC public health*, 14(1), 575-589.
- Peck RN, Shedafa R, Kalluvya S, Downs JA, Todd J, Suthanthiran M, Kataraihya JB (2014). Hypertension, kidney disease, HIV and antiretroviral therapy among Tanzanian adults: a cross-sectional study. *BMC medicine*, 12(1), 125.
- Rabkin M, El-Sadr WM (2011). Why reinvent the wheel? Leveraging the lessons of HIV scale-up to confront non-communicable diseases. *Global Public Health*, 6(3):247-256.
- Rajasuriar R, Khoury G, Kamarulzaman A, French MA, Cameron PU, Lewin SR (2013). Persistent immune activation in chronic HIV infection: do any interventions work? *AIDS (London, England)*, 27(8):1199.
- Temu F, Leonhardt M, Carter J, Thiam S (2014). Integration of non-communicable diseases in health care: tackling the double burden of disease in African settings. *The Pan African Medical Journal*, 18.
- Tran BX, Nguyen LH, Phan HT, Nguyen LK, Latkin CA (2015). Preference of methadone maintenance patients for the integrative and decentralized service delivery models in Vietnam. *Harm Reduction Journal*, 12, 29. <http://doi.org/10.1186/s12954-015-0063-0>
- Triant VA, Lee H, Hadigan C, Grinspoon SK (2007). Increased acute myocardial infarction rates and cardiovascular risk factors among patients with human immunodeficiency virus disease. *The Journal of Clinical Endocrinology & Metabolism*, 92(7), 2506-2512.
- Wandeler G, Johnson LF, Egger M (2016). Trends in life expectancy of HIV-positive adults on antiretroviral therapy across the globe: comparisons with general population. *Current Opinion in HIV and AIDS*, 11(5), 492-500.
- World Health Organization (2002). Advancing cross-cultural research on quality of life: observations drawn from the WHOQOL development. *Quality of Life research*, 11(2), 135-144.
- World Health Organization (2015). *The global status report on non-communicable diseases*. Geneva: World Health Organization.
- World Health Organization (2016). *The global status report on non-communicable diseases*. Geneva: World Health Organization
- Wu AW (2000). Quality of life assessment comes of age in the era of highly active antiretroviral therapy. *Aids*, 14(10), 1449-1451.
- Zhou T, Guan H, Yao J, Xiong X, Ma A (2018). The quality of life in Chinese population with chronic non-communicable diseases according to EQ-5D-3L: a systematic review. *Quality of Life Research*, 27(11), 2799-2814.