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The Impact of Structured Treatment Preparation on Depression, Anxiety, and Stress Symptoms
of HIV + Patients Initiating ART

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Abstract

Nigeria has one of the largest global HIV burdens of disease. Structured Treatment Preparation (STP) is required of all newly diagnosed HIV+ individuals initiating Antiretroviral Therapy (ART) at AIDSRelief Local Partner Treatment Facilities (LPTFs), yet no information exists on whether STP has any effect on a patient's mental health. We believe that STP may be related to improvement in depression, anxiety, and stress scores of these individuals. A depression, anxiety, and stress measurement tool, (DASS) 21, was administered to patients from 6 randomly selected AIDSRelief LPTFs before and after the mandated 3-week STP preceding ART. Paired t-tests were used to compare pre- and post-intervention depression, anxiety, and stress scores of all participants. An analysis of variance was conducted to evaluate differences in score changes between LPTFs, and simple linear regressions were used to measure the correlations between age and (DASS) 21 score change and HIV knowledge and (DASS) 21 score change. We observed significant (DASS) 21 score changes for depression ($p < 0.001$), anxiety ($p < 0.001$), and stress ($p < 0.001$). Results remained significant when stratifying for gender. LPTFs DOC Kubwa [95% CIs: (3.42, 16.41), (2.50, 15.17), (2.22, 15.75)] and St. Gerard's Hospital [95% CIs: (3.28, 14.51), (2.59, 13.54), (3.81, 15.49)] demonstrated significantly greater degrees of change in depression, anxiety, and stress compared to St. Francis Jambutu. This study demonstrates that STP is associated with statistically significant changes in depression, anxiety, and stress scores of HIV + individuals initiating ART in Northern Nigeria.

Keywords: Depression, Anxiety, Stress, HIV, Structured Treatment Preparation, (DASS) 21, Nigeria

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Introduction

Nigeria has the second highest HIV-related burden of disease in Africa and globally, and the number of individuals living with the virus is increasing. Nigeria has a 4% national prevalence rate of HIV, and 500,000 more Nigerians are living with the virus today than were three years ago (Josiah, 2013). Death rates attributed to the disease also increased over the same timeframe. Mother to child transmission accounts for approximately 10% of new cases. Rural residents in the Northcentral region of the country are disproportionately affected by the disease. Unsafe sexual practices, inept medical services, poverty, inequality, and stigma have all exacerbated an already grave problem (Editor [Nigeria Intel], 2014).

Only one third of those who need treatment for HIV in Nigeria are currently receiving it. A mere 18% of women who are HIV positive are receiving preventive treatment for mother to child transmission of the disease. Over 40% of HIV infected individuals in Nigeria do not know they are infected (Josiah, 2013).

For those who are diagnosed with HIV, financial hardship is unavoidable. Morbidity, treatment, loss of work, and the need for increased caregiving all come with significant costs. Studies indicate that costs related to HIV represent from 32%-84.1% of the yearly income of affected households (Adedigba et al., 2009; Mahal, Canning, Odumosu, & Okonkwo, 2008). Costs associated with HIV extend beyond financial considerations. Emotional costs likely exist for infected individuals in Nigeria, as they experience large amounts of stigma and discrimination (Mahal et al., 2008).

Because HIV can be catastrophic in many facets of the lives of sufferers and their families, it is important to consider the mental health of infected individuals and those who care for them. The link between compromised mental health and HIV is undeniable (Adewuya et al.,

2007; Brandt, 2009). Mental health services have not only proven to be beneficial psychologically, but they may also help HIV positive individuals comply with treatment (Reece, 2003).

Depression and anxiety are more likely in individuals infected with HIV compared to those in the general community. Progression of HIV may be negatively affected by depression (Leserman, 2008). Though the origins of mental distress amongst this population have been debated, it is clear that emotional distress negatively impacts an individual's capacity to adhere to treatment (Burnam et al., 2001). Depression is strongly associated with medical treatment non-adherence, while associations between anxiety and non-adherence to medical care are not statistically significant (DiMatteo, Lepper, & Croghan, 2000). Stress, also, may more strongly exacerbate HIV treatment non-adherence amongst those with depression compared to non-depressed individuals (Bottonari, Safren, McQuaid, Hsiao, & Roberts, 2010). Other research suggests that the association between depression and non-adherence extends beyond generalized medical care to HIV treatment (Gonzalez, Batchelder, Psaros, & Safren, 2011).

In addition, the negative experiences of HIV infected individuals may lead to behaviors that increase the risk for HIV transmission and lower the quality of life of infected patients. Studies suggest that social anxiety is associated with behavioral risk factors for HIV transmission (Hart, James, Purcell, & Farber, 2008). A similar relationship has been observed between depression and HIV risk behaviors (Hutton, Lyketsos, Zenilman, Thompson, & Erbeding, 2004). HIV/AIDS risk is also closely linked to poverty-related stressors (Kalichman et al., 2006). Understanding how HIV infection affects mental health is critical to providing optimal care to HIV positive individuals and ensuring the best health outcomes for them (Whetten, Reif, Whetten, & Murphy-McMillan, 2008).

There is considerable evidence to suggest that mental health treatment is a sensible component of HIV Therapy. Although mental healthcare has proven to be an effective piece of HIV treatment in developed countries and the World Health Organization recommends its inclusion as part of care, studies concerning the link between HIV and mental illness in developing countries are few (Collins, Holman, Freeman, & Patel, 2006). Interventions utilizing social support to target depressive symptoms and increase HIV therapy adherence have been attempted with little effect (Simoni, Pantalone, Plummer, & Huang, 2007). HIV positive individuals undergoing interpersonal psychotherapy and supportive psychotherapy with imipramine experienced better improvement in depression than HIV positive individuals who were exposed to supportive psychotherapy and cognitive behavioral therapy (Markowitz et al., 1998). Antidepressants have been shown to be useful in treating depressed HIV positive individuals, though the generalizability of these findings has been called into question (Himelhoch & Medoff, 2005). There is a paucity of literature on interventions targeting anxiety or stress in HIV positive individuals.

Individuals with mental health issues face much of the same stigma and negative perceptions experienced by individuals infected by HIV. These attitudes are very common in low and middle income countries, and Nigeria is no different (Iheanacho, Marienfeld, Stefanovics, & Rosenheck, 2014). Because of this, the potential for a double stigmatization is conceivable when considering the prevalence of HIV patients with mental health morbidity. Incorporation of mental health treatment into HIV therapy has the potential to mitigate a double burden of stigma.

Nigeria's HIV-related burden of disease makes it critical that we assess the effectiveness of various strategies to mitigate mental distress in HIV positive populations in the country. The lack of research concerning mental health and HIV in developing settings makes this evaluation

imperative. In this study, we aimed to evaluate the effectiveness of Structured Treatment Preparation (STP) on depression, anxiety, and stress in HIV + individuals starting antiretroviral therapy (ART) in northcentral and northeastern Nigeria. STP is a three-week, four course ART curriculum focusing on HIV transmission, Antiretroviral drugs (ARV), ARV resistance, and side effects to the medication regimen. STP is required in all AIDSRelief supported LPTFs before patients initiate ART, so understanding exactly what implications the intervention has on depression, anxiety, and stress is critical, as increased numbers of newly diagnosed HIV positive individuals are exposed to it. AIDSRelief is a PEPFAR sponsored consortium that aims to provide HIV/AIDS therapy and preventive services to those in developing countries.

Data on any pre-treatment period preceding ART is extremely limited, and, to our knowledge, analysis of the effect of STP on the depression, anxiety, and stress of HIV + individuals is non-existent. The need for understanding the effect of STP is especially important among a population with a high likelihood of compromised emotion state. Although the use of educational programs has been shown to be ineffective in treating depression (Gilbody, Whitty, Grimshaw, & Thomas, 2003), other studies indicate that psycho-educational interventions may lead to decreases in depression of HIV positive individuals starting highly active antiretroviral therapy (HAART) (Balfour et al., 2006). Contradictory findings created enough equipoise for us to evaluate the effect that STP had on the mental health of our sample, and we were encouraged by the psycho-educational outcomes. With these results in mind, we hypothesized that STP would lower depression, anxiety, and stress symptom scores in HIV+ individuals initiating antiretroviral therapy in Northern Nigeria.

Methods

Setting:

Researchers from the Centre for Clinical Care and Clinical Research in Nigeria (CCCRN) oversaw administration of The Depression, Anxiety, and Stress Scale (DASS) 21 in six AIDSRelief local partner treatment facilities (LPTFs) in Northern Nigeria. Six facilities were randomly chosen from a list of 16, but data was not included from two of the LPTFs because of lack of integrity. (DASS) 21 was administered along with an HIV knowledge test before newly diagnosed HIV+ individuals initiated ART. Participants at each of the sites then underwent a three week, four course curriculum of STP before being administered (DASS) 21 and the HIV knowledge test again. As part of treatment protocol at all AIDSRelief (PEPFAR) supported facilities, all patients newly diagnosed as HIV positive are required to undergo STP. Selection criteria included being diagnosed as HIV + in one of the six LPTFs. Everyone who participated in the STP curriculum agreed to take the (DASS) 21 assessment. Counselors at each of the treatment facilities were trained in (DASS) 21 and STP administration by the lead researcher from CCCRN. Analysis was conducted on information returned from the 4 treatment centers returning complete data.

Sample:

Our sample consists of 138 recently-diagnosed HIV + individuals who were recruited from treatment facilities in Kaduna State, Abuja FCT, Benue State, and Adamawa State in northcentral and northeastern Nigeria. The sample consisted of all patients newly diagnosed as HIV + in the six LPTF's randomly chosen from the 16 AIDSRelief supported facilities in the region. These individuals were scheduled to initiate ART for HIV in their respective LPTF. As part of enrollment into care at the facility, permission for the study was obtained from each

patient who signed a consent form. Participation in the study was voluntary and instruments were completed anonymously. The participants were asked not to put their names anywhere on the questionnaire.

Data collection:

(DASS) 21 was administered to the participants before a three-week, four-session STP for ART and again after completion of the curriculum. Researchers compared the pre-test and post-test scores of all of the participants.

Data Analysis:

A paired t-test was used to compare pre- and post-intervention (DASS) 21 scores. Results were stratified by gender and test site. An analysis of variance was conducted to determine if the degree of change observed at each center was the same, and simple linear regressions were run to analyze the association between age and (DASS) 21 score change and HIV Knowledge Score and (DASS) 21 score change. All data was analyzed using SAS 9.3 (SAS Institute).

Results

We evaluated our data descriptively in order to understand more about their study population and identify possible results confounders and effect modifiers. The average age of the study population was 34.01 years old (SD = 10.2), and included participants ranged in age from 12 to 64 years old (see Table 1). The 98 female participants represented 71.01 % of the study population (see Table 2).

From the four LPTFs included this study's analysis, 54 individuals (39.13%) participated from St. Gerard's Hospital. Another 40 Individuals (28.99%) from St. Francis Jambutu

participated in the study, while 30 (21.74%) and 14 (10.14%) from DOC Kubwa and St. Mary's Okpogba respectively contributed to study data (see Table 2).

Overall Change in Depression, Anxiety, and Stress Scores

The study's primary analysis was concerned with evaluating the change in depression, anxiety, and stress scores after participation in STP preceding ART (see Table 1). The pre-intervention average (DASS) 21 depression score was 13.17 (SD = 11.43). The post-intervention average DASS-21 depression score was 5.68 (SD = 7.88). These scores were statistically significantly different ($p < 0.001$) and represent a categorical change in depression severity from mild to normal. The pre-intervention average (DASS) 21 anxiety score was 12.13 (SD = 11.02). The post-intervention average (DASS) 21 anxiety score was 5.77 (SD = 7.52). These scores were statistically significantly different ($p < 0.001$) and represent a categorical change in anxiety severity from moderate to normal. The pre-intervention average (DASS) 21 stress score was 13.80 (SD = 11.29). The post-intervention average (DASS) 21 stress score was 6.29 (SD = 7.99). These scores were statistically significantly different ($p < 0.001$), but they do not represent a categorical change in stress severity. Average pre and post-intervention depression, anxiety, and stress scores were statistically significantly different at each of the local partner treatment facilities (see Table 4).

Change in Depression, Anxiety, and Stress Scores by Gender

We also conducted secondary analysis to evaluate pre- and post-intervention scores of depression, anxiety, and stress by gender (see Table 5). Participating females (N = 98) had an average pre-intervention depression score of 13.20 (SD = 11.02). Their average post-intervention depression score was 5.57 (SD = 8.21). These results were statistically significantly different (p

< 0.0001) and represent a categorical change in depression severity from mild to normal.

Participating males (N = 40) had an average pre-intervention depression score of 13.10 (SD = 12.51). Their average post-intervention depression score was 5.95 (SD = 7.07). These results were statistically significantly different ($p = 0.0005$) and represent a categorical change in depression severity from mild to normal.

Participating females had an average pre-intervention anxiety score of 11.71 (SD = 10.30). Their average post-intervention anxiety score was 5.57 (SD = 8.00). These results were statistically significantly different ($p < 0.0001$) and represent a categorical change in anxiety severity from moderate to normal. Participating males had an average pre-intervention anxiety score of 13.15 (SD = 12.69). Their average post-intervention anxiety score was 6.25 (SD = 6.25). These results were statistically significantly different ($p = 0.0007$) and represent a categorical change in depression severity from moderate to normal.

Participating females had an average pre-intervention stress score of 13.84 (SD = 10.97). Their average post-intervention stress score was 6.41 (SD = 8.30). These results were statistically significantly different ($p < 0.0001$) but do not represent a categorical change in stress severity. Participating males had an average pre-intervention stress score of 13.70 (SD = 12.20). Their average post-intervention stress score was 6.00 (SD = 7.29). These results were statistically significantly different ($p = 0.0004$) but do not represent a categorical change in stress severity. Both male and female study participants presented with pre-intervention (DASS) 21 stress scores within the normal range.

Absolute change in depression, anxiety, and stress scores was not statistically significantly different between males and females.

Change in Depression, Anxiety, and Stress Scores by LPTF

We also evaluated the differences in pre- and post-intervention change in depression, anxiety, and stress scores according to center (see Table 7). The change in depression, anxiety, and stress scores at LPTF DOC Kubwa was 9.92, 8.83, and 8.98 points higher than at St. Francis Jambutu respectively [95% CIs: (3.42,16.41), (2.50, 15.17), (2.22, 15.75)]. The change in depression, anxiety, and stress scores at LPTF St. Gerard's Hospital was 8.89, 8.06, and 9.65 points higher than at St. Francis Jambutu respectively [95% CIs: (3.28,14.51), (2.59, 13.54), (3.81, 15.49)] (Table 4).

Change in Depression, Anxiety, & Stress Score by HIV Knowledge

We observed a weak correlation between change in stress scores and pre-intervention HIV knowledge scores ($r = 0.07$; $SE = 0.05$), but these results were not statistically significant ($p = 0.20$). Pre-intervention HIV knowledge scores were negatively correlated with change in depression ($r = -0.01$; $SE = 0.05$) and anxiety ($r = -0.01$; $SE = 0.05$) scores, but these results were not statistically significant ($p = 0.84$; $p = 0.82$). Post-intervention HIV knowledge score is significantly associated with change in stress ($p = 0.03$), but the negative correlation was weak ($r = -0.22$; $SE = 0.10$). Depression ($r = -0.16$; $SE = 0.09$) and anxiety ($r = -0.15$; $SE = 0.09$) score changes were negatively correlated with post-intervention HIV knowledge scores, but these results were not statistically significant ($p = 0.09$; $p = 0.09$). We observed a significant negative correlation ($r = -0.11$; $SE = 0.05$) between change in stress score and change in HIV knowledge score ($p = 0.02$). There was also a negative correlation between change in depression ($r = -0.03$; $SE = 0.05$) and anxiety ($r = -0.03$; $SE = 0.04$) scores and change in HIV knowledge, but these results were not statistically significant ($p = 0.51$; $p = 0.53$) (see Table 8).

Change in Depression, Anxiety, & Stress Score by Age

We found no association between (DASS) 21 score change and age.

Overall, our results support our hypothesis that STP is associated with statistically significant changes in depression, anxiety, and stress scores of HIV + individuals initiating ART.

Discussion

This study demonstrates that STP is associated with statistically significant changes in depression, anxiety, and stress scores of HIV + individuals initiating ART. For depression and anxiety, the changes in score represented categorical changes in mental symptom severity. This was not the case for stress, however, as average pre-intervention stress scores for study participants were not elevated above the normal range. The same trends were observed when we stratified the study sample by gender. An analysis of mental health symptoms by LPTF showed that participants at Doc Kubwa and St. Gerard's Hospital had statistically significantly greater changes in mood than participants at St. Francis Jambutu.

This study helps expand the scant literature on HIV/mental health associations in the developing world. Knowing that mental health care is already recommended as critical to HIV therapy in developed countries, it stands to reason that the same would be true in countries with emerging economies. It is necessary, however, to form an evidence base to support this supposition, and this research contributes to that aim.

To our knowledge, this is the first study to examine the effect of STP on the depression, anxiety, and stress scores of HIV + individuals initiating ART. The relationship between STP and depression, anxiety, and stress is particularly important because STP is mandated in all LPTFs supported by AIDSRelief. Thus, our findings have the potential to affect hundreds of

thousands of individuals who have already learned from the curriculum. More HIV positive individuals will benefit from this information as AIDSRelief serves more patients and expands in future years. Our research also contributes to the unsubstantial literature surrounding the mental health, specifically depression, anxiety, and stress, of HIV positive individuals in developing countries.

Evidence suggests that mental health symptoms are associated with a decreased ability to adhere to HIV therapy (Mellins, Kang, Leu, Havens, & Chesney, 2003). Because of this, any efforts to minimize compromised mental health among HIV + individuals is of the utmost importance and may help reduce the chance of infected individuals progressing to AIDS development (Bangsberg et al., 2001). This trend is reversed, however, when clients undergo mental health therapy, and those being treated for mental illnesses are more likely to make use of ART (Cook et al., 2002). Finally, in sub-Saharan Africa where ART retention rates are already being targeted for improvement, any strategy that may improve retention must be thoroughly understood (Fox & Rosen, 2010; Rosen, Fox, & Gill, 2007). Thus, if STP helps alleviate depression, anxiety, and stress, then its potential for increasing adherence to ART in the region and beyond must not be understated. STP has the potential to make ART more effective for those using it, which will ultimately lead to better health outcomes for millions of potential curriculum participants.

This study has several strengths. Primarily, it contributes to the scant literature evaluating the link between mental health and HIV in the developing world. To our knowledge, this research is the first to study the effect of STP on the depression, anxiety, and stress of HIV positive individuals initiating ART. This is important in Nigeria, the country with the second highest HIV burden in the world, and our findings may be able to be generalized to individuals in

all AIDSRelief sponsored LPTFs. Our research has the potential to improve ART adherence and the health outcomes of hundreds of thousands of HIV positive individuals in Africa and other regions of the developing world.

Our study is not without limitations. First, its quasi-experimental design lacks systematic randomization, which may jeopardize its internal validity. It is also difficult to identify whether STP has a causal relationship with the decrease in depression, anxiety, and stress scores or if our results can be attributed to confounding variables. The lack of covariates and demographic information on study participants makes it difficult to conduct potentially interesting and valuable research. Next, a larger sample size would have been beneficial. Information from two of the LPTFs originally intended for analysis was discarded for lack of integrity, decreasing the study's sample size and power. There is no comparison group in our study, so it is unclear if similar improvement in mood could have resulted without STP. In addition, the researcher primarily responsible for the drafting this manuscript was not part of the team that designed the study and collected data, and this disconnect could pose obvious challenges.

Finally, this study serves as impetus for a number of future research directions. The scope of this project was limited to northcentral and northeast Nigeria. It is important to understand if STP is associated with depression, anxiety, and stress score improvement in the four remaining regions of the country and in other regions of African and the developing world. Efforts should also be made to conduct randomized research in patient populations about which we have more demographic information. Knowing more about rurality, religion, familial and employment status, income, tribal associations, etc. . . . would be beneficial beyond understanding the effect that STP has on the depression, anxiety, and stress scores of HIV +

individuals. This information would also offer a deeper understanding of the association of different demographic variables on mental health in Nigerians and, ideally, individuals from other countries in the region. It seems counterintuitive that HIV individuals would present with average stress scores in the normal range. Further investigation into the stress levels of recently diagnosed HIV positive individuals may demonstrate interesting findings for providers and policy makers pursuing the most effective mental health treatment for these patients. There are also valuable research opportunities stemming from the difference in absolute score change observed at the four LPTFs that were part of the study. It is clear that differences existed in the degree of change that the intervention provided at the treatment centers, yet the reason for these differences is unclear. Further investigation into this question would allow HIV and mental health practitioners alike to deliver the most effective care.

In conclusion, STP seems effective in lowering depression, anxiety, and stress scores in HIV+ individuals initiating antiretroviral therapy in Northern Nigeria. Because mental health care is part of the international standard for HIV therapy provision, it is important to understand more about what is being done to address compromised mental health in HIV positive individuals in the developing world, where such information is severely lacking. By demonstrating that STP is associated with improved depression, anxiety, and stress scores, it seems likely the curriculum may increase adherence to HIV therapy. The potential health outcomes that could result from increased adherence will affect hundreds of thousands of HIV patients worldwide and have ability impact many more. In a country like Nigeria, with the second highest global burden of HIV, the potential upside of understanding the association between STP and mental health is invaluable. Because STP is required by all AIDSRelief-

sponsored LPTFs, the implications of this research extend well beyond Northern Nigeria and represent an important move toward meeting universal HIV therapy recommendations.

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Table 1. Distribution of Age, Pre- and Post-Intervention Depression, Anxiety, and Stress Scores in 138 HIV+ Patients.

Characteristics	Mean	Standard deviation	Median	Minimum	Maximum
Age	34.01	10.20	33.00	12.00	64.00
Pre-intervention depression score	13.17	11.43	10.00	0.00	42.00
Pre-intervention anxiety score	12.13	11.02	8.00	0.00	42.00
Pre-intervention stress score	13.80	11.29	11.00	0.00	42.00
Post-intervention depression score	5.68	7.88	2.00	0.00	42.00
Post-intervention anxiety score	5.77	7.52	4.00	0.00	42.00
Post-intervention stress score	6.29	7.99	4.00	0.00	42.00

Table 2. Distribution of Sex and Local Partner Treatment Facility in 138 HIV+ Patients.

Sex	N	%
Male	40	28.99
Female	98	71.01
LPTF	N	%
St. Gerards Hospital	54	39.13
St. Mary Okpogba	14	10.14
St. Francis Jambutu	40	28.99
DOC Kubwa	30	21.74

Table 3. Distribution of Age, Pre- and Post-Intervention Depression, Anxiety, and Stress Scores in 138 HIV+ Patients by Gender.

Characteristics (Male; N=40)	Mean	Standard deviation	Minimum	Maximum
Pre-intervention depression score	13.10	12.51	0.00	42.00
Pre-intervention anxiety score	13.15	12.69	0.00	42.00
Pre-intervention stress score	13.70	12.20	0.00	42.00
Post-intervention depression score	5.95	7.07	0.00	28.00
Post-intervention anxiety score	6.25	6.25	0.00	22.00
Post-intervention stress score	6.00	7.29	0.00	26.00
Change in depression score	-7.15	11.80	-42.00	8.00
Change in anxiety score	-6.90	11.84	-42.00	6.00
Change in stress score	-7.70	11.80	-42.00	18.00
Characteristics (Female; N=98)	Mean	Standard deviation	Minimum	Maximum
Pre-intervention depression score	13.20	11.02	0.00	42.00
Pre-intervention anxiety score	11.71	10.30	0.00	42.00
Pre-intervention stress score	13.84	10.97	0.00	42.00
Post-intervention depression score	5.57	8.21	0.00	42.00
Post-intervention anxiety score	5.77	8.00	0.00	42.00
Post-intervention stress score	6.41	8.30	0.00	42.00
Change in depression score	-7.63	10.82	-40.00	42.00
Change in anxiety score	-6.14	10.17	-38.00	42.00
Change in stress score	-7.43	11.11	-42.00	42.00

Table 4. Overall and Treatment Facility–Specific Depression, Anxiety, and Stress Score Change

Mental Health Symptom	Local Partner Treatment Facility (LPTF)	Average Health Score by LPTF			Average Overall Health Score		
				P-value			P-value
		Pre-intervention	Post-intervention		Pre-intervention	Post-intervention	
Depression	St Gerards Hosp.	9.19	9.18	<.0001	13.17	5.68	<.0001
	St Mary Okpoga	15.57	5.29	0.0002			
	St Francis Jambutu	18.60	5.15	<.0001			
	DOC Kubwa.	12.00	8.47	0.0249			
Anxiety	St Gerards Hosp.	9.07	5.03	0.0002	12.13	5.77	<.0001
	St Mary Okpoga	9.43	3.86	0.0019			
	St Francis Jambutu	18.00	5.90	<.0001			
	DOC Kubwa.	11.07	7.80	0.0125			
Stress	St Gerards Hosp.	9.07	5.07	<.0001	13.80	6.29	<.0001
	St Mary Okpoga	15.86	6.29	<.0001			
	St Francis Jambutu	19.80	6.15	<.0001			
	DOC Kubwa.	13.33	8.67	0.0054			

P value is based on t-test.

Table 5. Gender-Specific Depression, Anxiety, and Stress Score Change

	Gender	Average Health Score		P value	Change	P value
		Pre-intervention	Post-intervention			
Depression	Male	13.10	5.95	0.0005	-7.15	0.4879
	Female	13.20	5.57	<.0001	-7.63	
Anxiety	Male	13.15	6.25	0.0007	-6.90	0.2340
	Female	11.71	5.57	<.0001	-6.14	
Stress	Male	13.70	6.00	0.0004	-7.70	0.9001
	Female	13.84	6.41	<.0001	-7.43	

Table 6. Local Partner Treatment Facility Pairwise Comparison of Depression, Anxiety, and Stress Score Change

Mental Health Symptom	Local Partner Treatment Facility (LPTF)	Average Health Score by LPTF			P-value	Intra-LPTF Average Score Change		P-value
		Pre-intervention	Post-intervention					
Depression	St Gerards Hosp.	9.19	9.18	<.0001	-4.56			
	St Mary Okpoga	15.57	5.29	0.0002	-10.29			
	St Francis Jambutu	18.60	5.15	<.0001	-13.45		<.0001	
	DOC Kubwa.	12.00	8.47	0.0249	-3.53			
Anxiety	St Gerards Hosp.	9.07	5.03	0.0002	-4.04			
	St Mary Okpoga	9.43	3.86	0.0019	-5.57			
	St Francis Jambutu	18.00	5.90	<.0001	-12.10		<.0001	
	DOC Kubwa.	11.07	7.80	0.0125	-3.27			
Stress	St Gerards Hosp.	9.07	5.07	<.0001	-4.00			
	St Mary Okpoga	15.86	6.29	<.0001	-9.57			
	St Francis Jambutu	19.80	6.15	<.0001	-13.65		<.0001	
	DOC Kubwa.	13.33	8.67	0.0054	-4.67			

The second P-value is based on inter-center ANOVA

The change in depression, anxiety, and stress was highest in the LPTF St. Francis Jambutu and lowest in LPTF DOC. Kubwa.

Table 7. Significant Results of Pairwise Comparison from Table 6

LPTF Comparison	Depression			Anxiety			Stress		
	Difference	95% Confidence Interval		Difference	95% Confidence Interval		Difference	95% Confidence Interval	
DOC. Kubwa – St. Francis Jambutu	9.92	3.42	16.41	8.83	2.50	15.17	8.98	2.22	15.75
St. Gerard’s Hospital	8.89	3.28	14.51	8.06	2.59	13.54	9.65	3.81	15.49

Table 8. Change in Depression, Anxiety, and Stress by HIV Knowledge Score

Mental Health Symptom	HIV Knowledge Pre-Test		HIV Knowledge Post-Test		Change in HIV Knowledge Score	
	Score (SE)	P value	Score (SE)	P value	Score (SE)	P value
Depression	-0.01 (0.05)	0.836	-0.16 (0.09)	0.086	-0.03 (0.05)	0.507
Anxiety	-0.01 (0.05)	0.824	-0.15 (0.09)	0.093	-0.03 (0.04)	0.528
Stress	0.07 (0.05)	0.201	-0.22 (0.10)	0.026	-0.11 (0.05)	0.022