

4 **IMPROVING ADHERENCE TO ANTI-RETROVIRAL THERAPY**
5 **AMONG PERSONS LIVING WITH HIV/AIDS IN ENUGU STATE,**
6 **SOUTH EAST NIGERIA**
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10

11 **Abstract**

12 HIV/AIDS continues to be a major global public health issue, having claimed more than
13 32 million lives so far. There were approximately 37.9 million people living with
14 HIV/AIDS (PLHIV) at the end of 2018. Anti-retroviral therapy (ART) has significantly
15 reduced morbidity and mortality and improved quality of life among people with HIV
16 infection.

17 **Aims:** The study was conducted to improve the knowledge and adherence to anti-
18 retroviral therapy among PLHIV in Enugu state, southeast Nigeria.

19 **Study Design:** Interventional study

20 **Place and duration of study:** Anti-retroviral Therapy clinics within Enugu metropolis
21 in Enugu state Nigeria between June to December 2018.

22 **Methodology:** A health education intervention was carried out among 312 PLHIV
23 receiving ART in Enugu metropolis to improve their perception and adherence to
24 antiretroviral therapy. A structured questionnaire was used to collect data from 312
25 PLHIV (156 each in the study and control groups), who were selected by multistage
26 sampling. Subsequently, health education was conducted among the study group.
27 Three months after this intervention its effects were assessed through a survey using
28 the same structured questionnaires employed in the baseline survey.

29 **Result:** The most frequently occurring reason given by the respondents for poor
30 adherence to ART was forgetfulness (65.4% for study and 69.9% for control groups).
31 Knowledge of the factors and consequences of poor adherence to treatment was
32 significantly higher among the study group than the controls post-interventions $p <$
33 0.001 . Adherence to ART improved from 42.3% pre-intervention to 81.4% post-
34 intervention.

35 **Conclusion:** Intensive health education effectively improved adherence to ART among
36 persons living with HIV/AIDS, and this should be carried out regularly.

37 **Key words:** Adherence, Anti-retroviral therapy, health education, knowledge.

38

39 **Introduction**

40 HIV/AIDS continues to be a major global public health issue, having claimed more than
41 32 million lives so far. There were approximately 37.9 million people living with
42 HIV/AIDS (PLHIV) at the end of 2018, with 1.7 million people becoming newly infected
43 in 2018 globally [1]. According to the World Health Organization (WHO) sub-Saharan
44 Africa is the most affected region with 25.7 million PLWHA in 2018, an approximate
45 70% of all PLHIV in the world [1]. The African region also accounts for almost two
46 thirds of the global total of new HIV infections. Findings from 2019 National HIV/AIDS
47 indicator and impact survey (NAIIS) shows that Nigeria, Africa's most populous nation
48 with about two hundred million people has HIV prevalence of 1.5%.[2] Enugu State,
49 one of the states with the highest prevalence in Nigeria has HIV prevalence of 2.0%
50 [2].

51 Key populations including; men who have sex with men, people who inject drugs,
52 people in prisons and other closed settings, sex workers and their clients, and
53 transgender people and their sexual partners accounted for over half of all new
54 infections (54%) for the first time in 2018 [1]. These groups of persons are at increased
55 risk of HIV/AIDS irrespective of epidemic type or local context.

56
57 Antiretroviral (ARV) drugs are drugs used in the treatment of HIV/AIDS. The
58 recommended treatment for HIV/AIDS involves the use of highly active antiretroviral
59 therapy (HAART) to ensure effective reduction of viral replication [3]. It is a
60 combination of drugs acting to inhibit various steps in the HIV replication process.
61 Despite the overwhelming benefits of HAART, it is often associated with side effects.
62 About 62% of adults and 52% of children living with HIV were receiving lifelong
63 antiretroviral therapy (ART) in 2018 [1]. Global and international health initiatives in
64 response to the pandemic have targeted several countries, including Nigeria, for the
65 expansion of ART programs for the increasing number of affected persons with funding
66 through programs such as the US President's Emergency plan for AIDS Relief (PEPFAR)
67 and Global funds to fight AIDS, tuberculosis and malaria (GFATM) [4,5]. This has
68 resulted in the expansion of treatment and prevention programs that have increased
69 ART access to previously unreached and underserved population with resultant
70 remarkable decrease in HIV-related morbidity and mortality in the past fifteen years.
71 ART has been found to significantly improve the health, life expectancy and quality of
72 life of PLHIV [6].

73 Adherence to HIV treatment refers to the process of choosing, starting, managing and
74 maintaining a given therapeutic medication regimen to control HIV viral replication and
75 improve function of the immune system. Lack of strict adherence to HAART is
76 considered to be one of the key challenges to AIDS care worldwide [7]. Inability to cope
77 effectively with the side effects of ARV results in non-adherence to medication. To be
78 most effective, HIV therapy requires a near perfect level of adherence [8]. Less than

79 95% adherence to regimen can lead to viral resistance and ultimately treatment failure.
80 Non adherence to medications is characterized by increased morbidity, mortality and
81 great economic loss [9].

82 In resource-constrained settings where healthcare services are not well developed, poor
83 adherence to treatment and defaulting from treatment are the two major challenges
84 faced by ART programmes. Poor adherence compromises treatment effectiveness,
85 making this a critical public health issue [10]. If adherence falters, resistance to ARV
86 may develop, thus rendering the treatment regimen ineffective and possibly requiring a
87 more costly and potentially more toxic regimen change. This is one of the strongest
88 predictors of progression to AIDS and death among PLHIVs and is also associated with
89 the development of drug-resistant viral strains [11]. The resulting virological failure
90 diminishes the potential for long-term clinical success. This is a potential hazard to the
91 community because ARV-resistant strains of HIV could then be transmitted to HIV naïve
92 individuals [12,13].

94 The magnitude of HIV epidemic and the complexity of its chronicity represent major
95 challenges to healthcare delivery systems in developed and developing countries. The
96 large-scale effect of the AIDS epidemic in Nigeria transcends the healthcare sector and
97 impact upon virtually all aspects of the society [14]. The epidemic has further
98 weakened the already overwhelmed Nigerian health care system, by increasing the
99 number of orphans and vulnerable children and the cost of achieving set developmental
100 goals. This study was conducted to improve the knowledge and adherence to
101 antiretroviral therapy among PLHIV receiving ART in Enugu State, South East Nigeria.

102

103 **MATERIALS AND METHODS**

104 Enugu State is one of the five States in the Southeast geopolitical zone of Nigeria. The
105 State has seventeen local government areas and is bounded in the east by Ebonyi
106 State, in the West by Anambra State, the North by Kogi and Benue States and in the
107 South by Abia State. The population of the State is about 3.32 million according to the
108 last national population census in 2006; with a growth rate of 2.83% and an estimated
109 population of 3.8 million in 2012 [15]. The inhabitants are mainly of Igbo tribe and are
110 predominantly Christians. Most of the urban dwellers are civil servants, traders or
111 artisans while rural dwellers are mainly farmers.

112 **Sample Size Estimation**

113 The sample size was estimated using the formula below.

114

$$115 \quad n/\text{group} = \frac{(Z\alpha + Z\beta)^2 \{(\pi_1(1 - \pi_1) + \pi_2(1 - \pi_2))\}}{\delta^2}$$

117 n/group = desired sample size per group.

118 $Z\alpha$ and $Z\beta$ = are ordinates for the normal deviation.

119 Π_1 = response rate in the control group (77% patients
 120 from previous study attained 95% adherence)¹⁶
 121 Π_2 = anticipated adherence rate from patients who
 122 receive health education put at 90%

123 $\delta = \Pi_2 - \Pi_1$

124 With 80% power at 5% significance level, the patients required at each group was
 125 calculated as follows:

126
$$n = \frac{(0.842 + 1.960)^2 \cdot \{(0.77 \times 0.23 + 0.90 \times 0.10)\}}{(0.90 - 0.77)^2}$$

128
 129
$$= \frac{7.849 \times 0.2671}{0.0169}$$

130
 131
 132
$$= 124$$

133
 134
$$n/\text{group} = 124$$

135 With 80% estimate response rate, each group sample size was:

136
$$\frac{124}{0.8} = 155$$
, giving a total of 310 for both groups. However 156
 138 respondents were selected for each group to avoid sample fractions. Thus a total of 312
 139 respondents were studied.

140
 141 **Sampling Technique**

142
 143 The study was an interventional study involving a before and after comparison of the
 144 knowledge and ART adherence pattern of PLHIVs subjected to a 3 day intensive health
 145 education training and adherence counseling on ART with those not trained. A total of
 146 312 patients participated in the study; 156 in the study group and 156 in the control
 147 group. There is a total of 21 comprehensive ART sites in Enugu state; out of which six
 148 are within Enugu metropolis. Out of these, 4 facilities offering ART services were
 149 selected for this study through balloting; University of Nigeria Teaching Hospital, Enugu
 150 State University Teaching Hospital, Annunciation Specialist Hospital and Mother of
 151 Christ Specialist Hospital. Out of the 4 selected ART hospitals in Enugu metropolis, 2
 152 served as the intervention centers while the other 2 served as the control centers. The
 153 study centers also were located on the out sketch of Enugu metropolis while the control
 154 centers were at the heart of the town again limiting the possibility of cross-interference.

155 A multistage sampling technique was applied. The sample size was proportionally
 156 allocated to the facilities based on the patient's load. A systematic sampling technique
 157 was then used to select participants as they presented for their clinic visits using the
 158 clinic, attendance register. The questionnaire was pretested in a health facility which
 159 was not selected for the main study. Ambiguities or deficiencies in the study
 160 instruments were then revised.

161 Quantitative data was collected using interviewer administered semi-structured
162 questionnaires. Responses were elicited on the socio-demographic characteristics,
163 knowledge of HIV manifestations, benefits and side effects of ART, knowledge and
164 practice of adherence to ART.

165 The research was conducted in 3 phases. The first phase was a baseline data collection.
166 The second phase was a 3 day intensive health education intervention on ART and
167 adherence counseling which involved only the study group. The third phase was the
168 post health education intervention evaluation which took place after three months of
169 the intervention. The effects were assessed using the same interviewer- administered
170 questionnaires employed in the baseline study. However, at the end of the post-
171 intervention assessment, health education on HIV/AIDS transmission and adherence
172 was provided to the control group.

173 Data entry and analysis were done using statistical package for social sciences (SPSS)
174 version 22. Frequency tables and cross-tabulations were also generated. Descriptive
175 statistics, frequencies and proportions were derived for categorical variables. Chi
176 square test of statistical significance and student t-test were used in the analysis. Level
177 of statistical significance was set at predetermined P-value of < 0.05.

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179

180 RESULTS

181

182 **Socio-demographic characteristics of the study population.**

183
184 A total of 312 PLHIV were studied, one hundred and fifty six (156) each in the study
185 and control groups.

186 The age range of the respondents was 25-44years. Majority of them were married and
187 had secondary school education. The mean age of the group was 34.1 ± 6.5 years
188 while that of the control group was 36.8 ± 9.6 years. Both the study and control groups
189 at baseline were statistically comparable ($P < 0.05$) in marital status, religion and
190 occupational characteristics. The difference observed in the age structure, sex
191 distribution and educational level between the study and control groups at baseline
192 were statistically significant ($P < 0.05$); table 1.

193

194 **Table 1. Socio-demographic characteristics of the respondents at baseline.**

Characteristics	Study group n = 156 N (%)	Control group n = 156 N (%)	χ^2	P-Value
Age				
Mean \pm SD	34.1 \pm 6.5	36.8 \pm 9.6	0.063*	0.950
Age in groups				
15 – 19	0(0.0)	3(1.9)	6.542	0.001
20 – 24	1(0.6)	7(4.5)		
25 – 29	33(21.2)	24(15.4)		
30 – 34	51(32.7)	40(25.6)		
35 – 39	40(25.6)	29(18.6)		

40 – 44	22(14.1)	17(10.9)		
45 – 49	7(4.5)	9(5.8)		
50 – 54	0(0.0)	16(10.3)		
55 – 60	0(0.0)	11(7.0)		
60 & above	2(1.3)	0(0.0)		
Sex				
Male	33(21.2)	57(36.5)	8.99	0.003
Female	123(78.9)	99(63.5)		
Marital Status				
Single	40(25.6)	59(37.8)	0.195	0.846
Married	88(56.4)	71(45.5)		
Widowed	17(10.9)	20(12.8)		
Divorced	11(7.1)	6(3.8)		
Educational Level				
Primary	19(12.2)	24(15.4)	4.942	0.001
Secondary	68(43.6)	69(44.2)		
Post secondary	67(42.9)	56(35.9)		
No formal education	2(1.3)	7(4.5)		
Religion				
Anglican	51(32.7)	14(9.0)	1.298	0.206
Catholic	48(30.8)	102(65.4)		
Pentecostal	43(27.6)	34(21.8)		
Others	14(8.9)	6(3.8)		
Occupation				
Civil servants	49(31.4)	56(35.9)	1.268	0.206
Trader/Business	39(25.0)	41(26.3)		
Farmers	14(9.0)	8(5.1)		
Artisan	54(34.6)	51(32.7)		

195 *student t-test

196 **Knowledge of nature of HIV/AIDS disease**

197 At baseline, over 80% of the study and control groups identified AIDS as a serious
 198 disease, that persons with HIV can still live active life and demonstrated the need for
 199 routine HIV screening during pregnancy. This was not statistically significant. However,
 200 knowledge of availability of drugs for HIV treatment was statistically significant among
 201 PLHIV in study group than those in the control group at baseline (P=0.042).

202 Post-intervention, there was increased knowledge of the nature of HIV/AIDS disease
 203 among the study when compared with the control group. The difference in knowledge
 204 among all variables was statistically significant (Table 2).

205 **Table 2: Respondents' knowledge of the nature of HIV/AIDS disease at baseline and post intervention.**

Knowledge	Baseline				Post Intervention			
	N = 156		X2	P	N = 156		X2	P
	Study (%)	Control (%)			Study (%)	Control (%)		
AID is a serious disease	136(87.2)	139(89.1)	0.28	0.599	156(100.0)	140(89.7)	16.86	<0.001*
Drugs available for treatment of people with HIV	88(56.4)	70(44.9)	4.15	0.042	154(98.7)	65(41.7)	121.34	<0.001*
If a person is HIV positive, he has AIDS	46(29.5)	43(27.6)	0.14	0.707	24(15.4)	46(29.5)	8.91	0.003*
All antenatal patients should be routinely tested for HIV	125(80.1)	131(84.0)	0.78	0.376	152(97.4)	120(76.9)	29.36	<0.001*
HIV person can still live active/fulfilling life	147(94.7)	150(96.2)	0.427	0.427	156(100.0)	144(92.3)	12.48	<0.001

206

207 **Knowledge of ART adherence among the respondents.**

208 At baseline between 70%-91% of the study and control groups knew about adherence
209 and its importance. One hundred and two (65.4%) and 109(69.9%) in the intervention
210 and control groups respectively identified forgetfulness as the major cause of poor
211 adherence. Also drug resistance was identified as the major consequence of poor
212 adherence by 75 (48.1%) and 89(57.1%) of the study and control groups.

213 The difference in the baseline knowledge between the two groups was not statistically
214 significant unlike post-intervention where the study group demonstrated a highly
215 statistical significant difference ($P < 0.01$) in knowledge when compared with the control
216 group (Table 3).

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Table 3: Knowledge of ART Adherence Among the Respondents

Knowledge	Baseline				Post Intervention			
	Study b/f (%) N=156	Control b/f (%)N=156	X ²	P	Study after (%)N=156	Control after (%)N=156	X ²	P
- Adherence is taking drug as agreed with doctor	128(82.1)	130(83.3)	0.09	0.764	156(100.0)	129(82.7)	29.56	<0.001
Excess alcohol in-take can affect ART adherence	135(86.5)	142(91.0)	1.58	0.209	156(100.0)	140(89.7)	16.86	<0.001
Adherence determine success of ART	122(78.2)	132(84.6)	2.12	0.146	154(98.7)	132(84.6)	20.31	<0.001
Adherence counseling is necessary before starting ART	142(91.0)	139(78.8)	0.32	0.570	156(100.0)	139(78.8)	17.98	<0.001
Patient is at risk of dying from HIV/AIDS if no adherence to ART	118(75.6)	109(69.9)	1.31	0.252	155(99.4)	104(66.7)	59.12	0.001
Identify causes of poor adherence:								
Forgetfulness	102(65.4)	109(69.9)	0.72	0.397	153(98.1)	102(65.4)	55.83	0.001
Away from home	9(5.8)	16(10.3)	2.13	0.144	148(94.9)	30(19.2)	182.14	0.001
Medication exhausted	14(9.0)	20(12.8)	1.19	0.276	118.(75.8)	21(13.5)	122.08	0.001
Too many pills	17(10.9)	17(10.9)	0.00	1.000	105(67.8)	35(22.4)	63.49	0.001
Drug side effects	19(12.2)	28(17.9)	2.03	0.154	108(69.2)	42(26.9)	55.93	0.001
Knowledge of consequences of poor adherence:								
Drug resistance	75(48.1)	89(57.1)	2.52	0.112	140(89.7)	101(64.7)	27.73	0.001
Treatment failure	34(21.8)	40(25.6)	0.64	0.425	152(97.4)	39(25.0)	172.38	0.001
Increased risk of death	55(35.3)	57(36.5)	0.06	0.813	154(97.4)	63(40.4)	118.50	0.001
Risk of wanderer infections	43(27.6)	49(31.4)	0.55	0.456	143(91.7)	52(33.3)	113.24	0.001
Illness may worsen	67(42.9)	63(40.4)	0.21	0.646	147(94.2)	67(42.9)	95.21	0.001

229 **Prevalence of ART adherence among the respondents.**

230 At baseline, 66 (42.3%) and 58(37.1%) of the study and control groups respectively
231 took their ART daily as prescribed with no statistically significant difference (P=0.355).

232 Post intervention, the number of respondents that took their ART daily for 30 days (a
233 month) as prescribed improved significantly (P<0.001) for the study group (81.2%)
234 when compared with the control group (32.1%) (Table 4).

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UNDER PEER REVIEW

Table 4: Prevalence of ART Adherence among the respondents.

Number of days ARVs were taken per month	Pre-intervention (N=156)				Post-intervention (N = 156)			
	Study group (%)	Control group (%)	X ²	P-value	Study group (%)	Control group (%)	X ²	P-value
30 days	66(42.3)	58(37.1)	0.86	0.355	127(81.2)	50(32.1)	77.43	0.001
10 days	20(12.8)	23(14.7)	13.56	0.000	9(5.8)	20(12.8)	4.60	0.032
4 days	34(21.8)	30(19.2)	0.315	0.576	8(5.2)	33(21.2)	17.50	0.001
2 days	23(14.8)	6(3.8)	10.99	0.001	6(3.8)	30(19.2)	18.09	0.001
1 day	13(8.3)	19(12.2)	1.25	0.263	6(3.8)	23(14.7)	10.99	0.001

240 Discussion

241 At baseline the study and control groups differed in their mean age, educational level
242 and sex distribution. The most frequent age range in the study group was 25-44years
243 corresponding to the sexually active age group mostly affected by HIV/AIDS.

244 The female respondents largely out-numbered the male respondents. This finding is in
245 line with the WHO survey study which showed that HIV/AIDS infection among females
246 in sub-Saharan Africa outnumbered that of males, were the national prevalence values
247 are estimated using women on antenatal clinic [17,18,19]. The finding may also be an
248 indication that women are assessing ART services more than men and are becoming
249 more open about the disease than men [20,21]. Also men are not frequent users of
250 health facilities; they go when illness is at terminal stage. This is quite different with
251 women, as they consult health providers whether conventional or traditional for any
252 ailment.

253 The study group improved significantly in their knowledge and awareness of nature of
254 HIV/AIDS, post-intervention unlike the control group. This could be because the study
255 group received intensive training and health education intervention on the nature of
256 HIV/AIDS disease, ART and adherence counseling unlike the control group.
257 Approximately 45% and 37% of the respondents in the study and control groups
258 respectively attained 100% adherence pre-intervention. This is in contrast to the finding
259 among AIDS patients receiving HAART in Botswana where about 77% of the
260 respondents attained 95% adherence rate [22].

261 The adherence level required to ensure effective HIV/AIDS therapy is 95% as levels
262 lower than this are associated with poor viral suppression, therapeutic failure and rapid
263 disease progression [23]. Post-intervention, the study group had a great improvement
264 in adherence as 81.4% attained 100% adherence as against 32%.1% in the control
265 group. This finding is an indication that appropriate health education intervention is
266 capable of improving adherence to ARV drugs among HIV/AIDS patients. This is similar
267 to previous finding were there was significant higher adherence in the group that
268 received health education [24].

269 The factors identified by both groups that supported their adherence were attendance
270 at counseling sessions, effectiveness of ART, and membership of HIV/AIDS support
271 group. The finding of this study supports previous study where health education,
272 membership of a support group, fixed drug combination and less adverse effects were
273 found to improve adherence [16]. The groups also identified long hospital waiting
274 period, multiple ARV drugs, side effects, finance and forgetfulness as the limiting factors
275 to their adherence to therapy. Other research studies similarly reported these factors as
276 among those limiting adherence to ART [25].

277 The major source of adherence support identified by the respondents in this study is
278 the doctor or primary physician. This is not unexpected as doctors are the closest allies
279 for the patients. Other social supporters including the family members were less
280 utilized. Studies have shown that involvement of relatives, friends, family and

281 community members in supporting the patients are beneficial in improving and
282 maintaining adherence [26,27].

283 **Conclusions and Recommendations**

284 This study has demonstrated that intensive health education to PLHIV on the nature of
285 the disease, its management and the benefits of ART is the most appropriate means to
286 ensure and improve treatment adherence.

287 It is therefore recommended that all PLHIV receive regular intensive health education
288 training, and that relatives and friends are involved in patient's treatment.

289

290 **COMPETING INTERESTS**

291 Authors declare that no competing interests exist.

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REFERENCES

295

296 1. World Health Organization (WHO) HIV/AIDS Data and Statistics – WHO/
297 World Health Organization. 2019. Available at: www.who.int/hiv/data.
298 [Accessed 13/10/19](#)

299

300 2. Federal Ministry of Health (FMOH) 2019. National HIV/AIDS indicator and
301 impact survey (NAIIS) fact sheet. Abuja, Nigeria. 2019: 2

302

303 3. Galo RC, Montagnier L. The discovery of HIV as the cause of AIDS. New
304 Engl. J. Med. 2003; 514-515.

305

306 4. Federal Ministry of Health (FMOH). National Guidelines on HIV/AIDS Care and
307 Support. Abuja, Nigeria. 2014.

308

309 5. Monjok E, Smesny A, Okokon IB, Mgbere O, Essien EJ. Adherence to
310 Antiretroviral Therapy in Nigeria: An Overview of Research Studies and
311 Implications for Policy and Practice. HIV AIDS. 2010; 2: 69–76.

312

313 6. Bartlett JG, Gallant JE. Text book on medical management of HIV infection.
314 Baltimore, Johns Hopkins University, Division of Infectious Diseases; 2004

315

316 7. Smith DM, Richman DD, Little S.J. HIV super-infection. J. Infect Dis., 2005;
317 192: 438-444.

318

- 319 8. Sarr AD, Esien G. Gueye-Ndiaya A. Viral dynamics of primary HIV 1 infection
320 in Senegal, West Africa. *J. Infectious. Dis.* 2005 191: 1460-1467.
321
- 322 9. Olaleye D. Bernstein L, Ekwezor C. Prevalence of human immunodeficiency
323 virus type 1 and 2 infection in Nigeria. *J. Infect Dis.*, 1993; 167: 710-714.
324
- 325 10. Johnson S, Baraboutis JG. Adverse effects associated with use of nevirapine
326 in HIV postexposure prophylaxis for 2 healthcare workers. *JAMA*, 2000; 284:
327 2722-2723.
328
- 329 11. Max B, Sherer R. Management of the adverse effects of antiretroviral therapy
330 and medication adherence. *Clin Infect Dis.* 2000; 30: 96-116.
331
- 332 12. Sherer R. Adherence and antiretroviral therapy in injection drug users. *JAMA*;
333 1998; 280: 567-568.
334
- 335 13. Sethi AK, Celantano DD, Gange SF, Association between adherence to
336 antiretroviral therapy and human immunodeficiency virus drug resistance.
337 *Clin. Infect. Dis*; 2003 37: 1112-1118.
338
- 339 14. Cooney EL. Clinical indicators of immune restoration following highly active
340 antiretroviral therapy. *Clinic Infect Dis*, 2002; 34: 224-233.
341
- 342 15. National Population Commission (NPC). 2006 Population and Housing Census
343 of Federal Republic of Nigeria: National and State Population Tables (Priority
344 Tables) Vol. 1. Abuja Nigeria; 2009.
- 345 16. Deolalla P. Knobel H, Carmona A. Impact of adherence on highly active
346 antiretroviral therapy on survival in HIV infected patients. *J. Acquire. Immune*
347 *Defic Syndr.* 2001; 30: 150-155.
348
- 349 17. Federal Ministry of Health National HIV seroprevalence sentinel survey Abuja
350 Federal Ministry of Health: 2010.
351
- 352 18. Federal Government of Nigeria. National Policy on HIV/AIDS. Abuja Federal
353 Government of Nigeria, 2010.
354
- 355 19. Federal Ministry of Health, HIV/AIDS Emergency Action Plan, 2001-2004.
356 Abuja Federal Ministry of Health, 2001.
357
- 358 20. United Nations. Declaration of commitment on HIV/AIDS: United Nations
359 General Assembly special session on HIV/AIDS, 25-27 June 2001 Geneva:
360 United Nations. 2001.
361

- 362 21. Tuomale RE, Shapiro D, Mofenson L.M. Antiretroviral therapy during
363 pregnancy and the risk of an adverse outcome. *N. Engl. J. Med.* 2002; 346:
364 1863-1870.
365
- 366 22. Federal Ministry of Health, National guidelines on prevention of mother to
367 child transmission (PMTCT) of HIV infection. Abuja Federal Ministry of
368 Health. 2010.
369
- 370 23. McNab J, Ross JW, Abriola K. Adherence to highly active antiretroviral
371 therapy predicts virologic outcome at an inner city human immunodeficiency
372 virus clinic. *Clin. Infect Dis.*, 2001; 33: 700-705.
373
- 374 24. Chesney MA, Factors affecting adherence to antiretroviral therapy. *Clin.*
375 *Infect. Dis.* 2000; 30: 171-176.
376
- 377 25. Sheri W, William W., David B. Barriers to antiretroviral adherence for patients
378 living with HIV infection and AIDS in Botswana. *J. Acquire-Immune. Defic.*
379 *Syndro.*, 2003; 34: 281-288.
380
- 381 26. Arnsten JH, Demas PA, Farzadegan H. Antiretroviral therapy adherence and
382 viral suppression in HIV infected drug users, comparison of self-report and
383 electronic monitoring. *Clin. Infect. Dis.*, 2001; 33: 1417-1423.
384
- 385 27. Domingo P., Torres OH, Ris J. Herpes zoster as an immune reconstitution
386 disease after initiation of combination antiretroviral therapy in patients with
387 human immunodeficiency virus type - 1 infection. *Am J. Med*; 2001; 110:
388 605-609.
389
390
391