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Impact of pharmaceutical care interventions on the occurrence and resolution of side/adverse drug effects associated with antiretroviral drug therapy

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Abstract

Pharmaceutical care (PC) has been shown to improve the outcome of drug therapy in many disease conditions. HIV/AIDS is one of the disease conditions that are fraught with many problems that can benefit from this new emphasis of pharmacy practice also known as 'pharmacists care'. Adverse drug reactions or effects are unintended and undesirable effects of drugs other than their known and expected actions which can be unpleasant and sometimes fatal. This study is designed to evaluate the impact of pharmaceutical care activities on the occurrence of side/adverse drug reactions in HIV/AIDS patients receiving antiretroviral drugs. The components of the American society of health-system pharmacists (ASHP) guidelines on 'standardized method for pharmaceutical care' was used as a data collection instrument to evaluate, document and intervene in the antiretroviral therapy of about one thousand four hundred and seventy three (1,473) patients. The study identified about sixty (60) different types of side/adverse effects occurring among these patients through observation and patient complaints. The study also showed significant reduction in the incidence of side/adverse drug effects following the Pharmacist's intervention activities, $p \geq 0.5$. The study showed that pharmacists' interventions in antiretroviral drug therapy through Pharmaceutical care can significantly reduce the incidence of side/adverse drug effects in HIV/AIDS patients receiving antiretroviral drugs.

Keywords: Pharmaceutical care, HIV/AIDS, Side/adverse drug effects, Pharmacist interventions, Hospital pharmacy

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1. Introduction

Pharmaceutical care (PC) has been defined as the responsible provision of drug therapy for the purpose of achieving definite outcomes that improves or maintains a patient's quality of life (Hepler & Strand, 1990) as modified by (FIP, 1998). The concept of the pharmaceutical care is about pharmacists taking more responsibility for the outcome of drug therapy. HIV/AIDS on the other hand is possibly the biggest challenge facing the healthcare system today. It is a condition that occurs when the HIV organism (a retrovirus) weakens the human immune system. Infection with the virus is a dynamic process characterized by vigorous viral replication, CD4 lymphocyte depletion and profound immune deficiency.

The concept and philosophy of pharmaceutical care has been adopted and implemented in many developed countries for many years now. It has achieved great successes in the care of patients in the US, UK and other developed countries of the world as patients in these places now get better care from Pharmacists who alongside the patients and healthcare managers are delighted about the initiative (Erah and Nwazuoke, 2002). Antiretroviral drug therapy (ART) has faced serious challenges despite much progress and many patients still do not benefit from it due to viral resistance, adverse effects of chronic therapy , lack of adherence to complex regimens, unavailability of current agents in the developing countries (where the pandemic has its greatest impact). The consequences of these have been devastating to the patients, healthcare system and many countries. Controlling the disease will involve ensuring that the patients receiving treatment get the maximum benefits of drug therapy. Thus the management of HIV/AIDS infection is one situation that has brought to the front burner the issue of establishing pharmaceutical care in healthcare systems [world over] (Obodozie, 2006). Hence the role of the Pharmacist in healthcare through the concept of pharmaceutical care has become imperative in the global struggle to save humanity from extinction due to HIV/AIDS.

2. Methods

This is part 1 of 4 from a study carried out using the method described below. The other parts will be subsequently published in this journal. Before the study, an application for ethical approval of the study was sent to the management of the Federal medical centre Owerri, Imo state, Nigeria where the study was carried out and the approval was granted.

The components of the American society of health-system pharmacists (ASHP) guidelines on 'standardized method for pharmaceutical care' (ASHP,1996) was used as a data collection instrument to evaluate, document and intervene in the antiretroviral therapy of about one thousand four hundred and seventy three (1,473) patients.

Data was collected from the patients' prescription sheets, laboratory report forms, care/ART cards, and other relevant forms in their treatment folders. Other relevant information was also obtained from the patients through oral interview. The data collected at this stage formed the base-line/ pre - intervention data for the study.

After documentation of these base-line data, pharmaceutical care interventions were implemented where necessary and this included:

1. Patient education using a validated educational material applied uniformly to all the patients in the study.
2. Healthcare personnel education, counseling and discussions.
3. Recommendations for changes of drugs/regimens change of drug dose interval, duration or dosage form, addition of more drugs, treatment of untreated conditions, implementation of non-drug therapy, patient referral.
4. Ensuring that patients do their laboratory tests.
5. Monitoring the laboratory test results and carrying out interventions where necessary.
6. Giving patients access to pharmacists any time they needed it i.e. maintaining constant communication between the patients and the pharmacists.

Then a repetition of the data collection and documentation above was done nine (9) months after the implementation of the pharmaceutical care interventions mentioned above. This data represents the post - intervention data. The two data sets (baseline / pre-intervention & post-intervention data) were then be collated, analyzed and compared to see if the interventions resulted in any significant differences in the occurrence of drug therapy problems. Appropriate statistical analysis was also applied to the data using Microsoft Excel and SPSS tools. Inclusion and exclusion criteria used for the study were;

1. New patients were excluded from the study since they will have had no previous encounter with the system and so no existing data on them.
2. Patients selected were those who have received treatment, drugs and counseling from the hospital for at least nine (9) months (i.e. who have visited the hospital for at least three (3) times).
3. Both adults and children as well as males and females were involved in the study.
4. Patients whose medications will last for less than three (3) months will be excluded from the study. This is to give the interventions enough time to make impacts and produce the possible results and to ensure uniformity of treatment duration and contact with the pharmacist in all the participating patients.

3. Results

The study showed significant reduction in the incidence of side/adverse drug effects following the Pharmacist's intervention activities. It identified about sixty (60) different types of side/adverse effects through observation and patient complaints. These included weakness/fatigue, Nausea, Vomiting, Abdominal pain, Anorexia (loss Appetite), Sudden weight Loss, Muscle weakness, Jaundice, Skin rashes, Lipodystrophy, Extremity wasting/thin legs and arms, Facial thinning, Increased urination, Excessive thirst/hunger, Headaches, Peripheral neuropathy, Dry mouth, Dizziness, Insomnia, Nightmares, Anemia, Excessive weight gain, Cough, Boils, Cataract, Ovulation irregularities, Fever, Diarrhea, Palpitation, Watery stool, Pruritus, Excessive sweating, Salivation, Tinnitus, Black spots on skin, Spots on palm , Excessive sleep, Visual disturbances, Painful menstruation, Loss of menstruation, Internal heat, Constipation, Nail thickening, Breast size increase, Bloating of entire body, Bloating of entire body, Swelling of hands & legs, Dry lips, Palm discoloration, Blistered lips, Spots on tongue, Nail discoloration, Restlessness, increased blood pressure, Indigestion, Tongue swelling, Rigor, Flatulence and Facial swelling. These are shown in tables below;

Table 1. Age distribution

Age Range	**Number of Patients**		Difference (A – B)	% of total = A or B/T x 100
	Pre - intervention evaluation (A) (% of total).	Post - intervention evaluation (B) (% of total).		
2 yrs – 15 yrs	146	146	0	10
15 yrs above	1327	1327	0	90
Total (T)	1473	1473	0	100

Table 1 shows that 90% of patients involved in the study were adults (18years and above) while 10% of the patients were children (2yrs – 15yrs).

Table 2 shows that most of the patients in the study were females (65%) while the male patients accounted for 35% of the study population.

Table 2. Sex (gender) distribution

sex	Number of Patients		Difference (A - B)	% of total = A/T or B/T x 100
	Pre - intervention evaluation (A) (% of total)	Post - intervention evaluation (B) (% of total)		
Male	513	513	0	35
Female	960	960	0	65
Total (T)	**1473**	**1473**	**0**	**100**

Table 3. Distribution of drug regimens

Regimen	**Number of Patients**		Difference (A - B)	% of total = A/T or B/T x 100
	Pre -intervention evaluation (A) (% of total).	Post - intervention evaluation (B) (% of total).		
AZT/3TC/NVP	339	339	0	23.01
D4T/3TC/NVP	948	948	0	64.3
AZT/3TC/EFV	36	36	0	2.4
D4T/3TC/EFV	105	105	0	7.13
3TC/ABC/NVP	5	5	0	0.34
LPV+r /TDF+ FTC	11	11	0	0.8
D4T/3TC/ABC	3	3	0	0.2
TDF+FTC/LPV+ r/AZT+3TC	3	3	0	0.2
TDF+FTC/LPV+ r/AZT	3	3	0	0.2
TDF+FTC /NVP	6	6	0	0.41
AZT+3TC /TDF /LPV+r.	2	2	0	0.14
TDF+FTC/EFV	11	11	0	0.8
LPV+r/EFV	1	1	0	0.07
TOTAL (T)	**1473**	**1473**	**0**	**100**

Table 3 shows that most of the patients (64.3%) are on the D4T/3TC/NVP regimen while 23.01% of them are on the AZT/3TC/NVP regimen. Others are D4T/3TC/EFV (7.13%), TDF+FTC / NVP (0.41%), AZT/3TC/EFV (2.4%), LPV+r / TDF+FTC and TDF+FTC / EFV (0.8%), (0.41%), D4T/3TC/ABC, LPV+r /

TDF+FTC / AZT and LPV+r / TDF+FTC/AZT+3TC (0.2%), ABC/3TC/NVP (0.34%), TDF/LPV+r / AZT+3TC (0.14%) and LPV+r / EFV (0.07).

Table 4. Distribution of frequencies of side effects

S/N	Side Effects	Frequency		Difference (A - B)	% Difference (A-B)/A x 100
		Pre-ntervention (% of total)	Post-intervention (% of total)		
1	Weakness/fatigue	200(13%)	51(3.2%)	149	75
2	Nausea	29(2%)	9(0.6%)	20	69
3	Vomiting	68(4%)	12(0.8%)	56	82
4	Abdominal pain	62(4%)	21(1.3%)	41	66
5	Anorexia (loss Appetite)	50(3%)	5(0.3%)	45	90
6	Sudden weight Loss	20(1%)	3(0.2%)	17	85
7	Muscle weakness	10(0.6%)	1(0.1%)	9	90
8	Jaundice	5(0.3%)	0(0%)	5	100
9	Skin rashes	327(21%)	97(6.1%)	230	70
10	Lipodystrophy	21(1%)	6(0.4%)	15	71
11	Extremity wasting/thin legs and arms.	1(0.1%)	0(0%)	1	100
12	Facial thinning	3(0.2%)	1(0.1%)	2	67
13	Increased urination	10(0.6%)	5(0.3%)	5	50
14	Excessive thirst/hunger	36(2.3%)	6(0.4%)	30	83
15	Headaches	102(6.4%)	36(2.3%)	66	65
16	Peripheral neuropathy	118(7.5%)	41(2.6%)	77	65
17	Dry mouth	8(0.5%)	2(0.1%)	6	75
18	Dizziness	182(11.5%)	31(2.%)	151	83
19	Insomnia	39(2.5%)	19(1.2%)	20	51
20	Nightmares	15(0.9%)	2(0.1%)	13	87
21	Anaemia	6(0.4%)	2(0.1%)	4	67
22	Excessive weight gain	3(0.2%)	1(0.1%)	2	67
23	Cough	10(0.6%)	2(0.1%)	8	80
24	Boils	3(0.2%)	0(0%)	3	100
25	Cataract	2(0.1%)	0(0%)	2	100
26	Ovulation irregularities	3(0.2%)	0(0%)	3	100
27	Fever	49(3.1%)	18(1.1%)	31	63
28	Diarrhoea	4(0.3%)	1(0.1%)	3	75
29	Palpitation	6(0.4%)	0(0%)	6	100
30	Watery stool	2(0.1%)	0(0%)	2	100
31	Pruritus	70(4.4%)	39(2.5%)	31	44
32	Excessive sweating	4(0.3%)	0(0%)	4	100
33	Salivation	3(0.2%)	0(0%)	3	100
34	Tinnitus	6(0.4%)	2(0.1%)	4	67
35	Black spots on skin	4(0.3%)	2(0.1%)	2	50
36	Spots on palm	3(0.2%)	0(0%)	3	100
37	Excessive sleep	3(0.2%)	2(0.1%)	1	33
38	Visual disturbances	8(0.5%)	3(0.2%)	5	65

39	Painful menstruation	4(0.3%)	1(0.1%)	3	75
40	Loss of menstruation	9(0.6%)	3(0.2%)	6	67
41	Internal heat	16(1%)	7(0.4%)	9	56
42	Constipation	4(0.3%)	0(0%)	4	100
43	Nail thickening	3(0.2%)	2(0.1%)	1	33
44	Breast size increase	2(0.1%)	1(0.1%)	1	50
45	Bloating of entire body	3(0.2%)	1(0.1%)	2	67
46	Swelling of hands & legs	4(0.3%)	1(0.1%)	3	75
47	Dry lips	3(0.2%)	1(0.1%)	2	67
48	Palm discoloration	2(0.1%)	1(0.1%)	1	50
49	Blistered lips	3(0.2%)	1(0.1)	2	67
50	Spots on tongue	2(0.1%)	1(0.1%)	1	50
51	Nail discolouration	3(0.2%)	1(0.1%)	2	67
52	Restlessness	4(0.3%)	0(0%)	4	100
53	Increased blood pressure	7(0.4%)	1(0.1%)	6	86
54	Indigestion	2(0.1%)	1(0.1%)	1	100
55	Tongue swelling	2(0.1%)	1(0.1%)	1	50
56	Rigour	2(0.1%)	1(0.1%)	1	50
57	Flatulence	6(0.4%)	2(0.1%)	4	67
58	Facial swelling	7(0.4%)	3(0.2%)	4	57
Total		**1,583**	**450**	**1133**	**72%**

Table 4 shows that about 58 different types of side effects were identified. The most prominent of these side/adverse effects (and their pre and post - intervention incidence trequences) were skin rashes (21% & 6%), weakness/fatigue (13% & 3.2%), dizziness (11.5% & 2%), peripheral neuropathy (7.5% & 2.6%), headache (6.4% & 2.3%) vomiting (4% & 0.8%), abdominal pain (4% % 1.3%), anorexia/loss of appetite (3% & 0.3%), fever (3.1% % 1.1%), insomnia (2.5% & 1.2%), nausea (2% & 0.6%), Lipodystrophy (1% & 0.4%), sudden weight loss (1% & 0.2%), excessive thirst/hunger (2.3% & 0.4%), and pruritus (4.4% & 2.5%).

Generally, there were 1,583 incidences of side effects prior to interventions. This reduced to 450 incidents after the interventions representing a decrease of 72%.

Table 5. Summary of incidence of side effects

Variable	**No. of patients**		Difference (A – B)	% Difference (A–B)/A x 100
	Pre-intervention (% of total)	Post- intervention (% of total)		
No side - effects	705 (48%)	1156 (78%)	451	64
Experienced side effects	768 (52%)	317 (22%)	451	59
Total	1473	1473	0	0

Table 5 shows that there was a 64% increase in the number of patients not experiencing side effects and a decrease of 59% in the number of patients experiencing side effects.

Table 6. Distribution of side effects incidence in correlation with drug regimen and gender (single side effect)

S/N	REGIMEN	MALE				FEMALE			
		PRE-INTERV	POST - INTERV	DIFF	% DIFF	PRE – INTERV	POST – INTERV	DIFF	% DIFF
1	AZT/3TC/NVP	12	4	8	67	35	24	11	31
2	3TC/D4T/NVP	69	54	15	22	131	97	34	26
3	AZT/3TC/EFV	2	2	0	0	1	0	1	100
4	3TC/D4T/EFV	9	9	0	0	17	17	0	100
5	LPV+ r/TDF + FTC	2	0	2	100	2	2	0	100
6	AZT/LPV + r	1	1	0	0	0	0	0	0
7	TDF + FTC/ NVP	0	0	0	0	1	1	0	0
8	AZT+3TC/TDF/LPV+ r	1	1	0	0	0	0	0	0
9	TDF + FTC /EFV	1	1	0	0	0	0	0	0
	Total	**97**	**72**	**25**	**26**	**187**	**141**	**46**	**25**

Table 6 shows that 70% of incidence of single side effects occurred in patients of the 3TC/D4T/NVP regimen, the AZT/3TC/NVP regimen accounted for 16% of the side effects, the 3TC/D4T/EFV accounted for 9% of the side effects while the AZT/3TC/EFV accounted for 1% of the side effects. These four regimens accounted for 96% of the side effects. Also the side effects occurred more in the females (65%) than in male (35%). The table also shows that generally the incidences of these side effects were reduced by 58% from 534, to 309 cases after the interventions.

Table 7. Distribution of side effects incidence in correlation with drug regimen and gender (multiple side effects)

S/N	REGIMEN	MALE				FEMALE			
		PRE – INTERV.	POST – INTERV.	DIFF	% DIFF	PRE – INTERV.	POST – INTERV.	DIFF	% DIFF
1	AZT/3TC/NVP	6	1	5	83	34	8	26	76
2	3TC/D4T/NVP	67	18	49	73	105	48	57	54
3	AZT/3TC/EFV	2	2	0	0	2	2	0	0
4	3TC/D4T/EFV	5	5	0	0	18	8	10	56
5	LPV + r/TDF + FTC	1	1	0	0	4	2	2	50
6	TDF + FTC/NVP	0	0	0	O	2	0	2	100
7	TDF + FTC / EFV	3	1	2	67	0	0	0	0
8	AZT / TDF + FTC / LPV + r	1	0	1	100	0	0	0	0
Total		**85**	**28**	**57**	**67**	**165**	**68**	**97**	**59**

Table 7 above shows the distribution of the incidence of multiple side effects in correlation with drug regimen and gender. The trend here is the same as the trend in the distribution for single side affects as shown in table 6 above.

Table 8. Combination of Tables 6 & 7 (single plus multiple side effects)

S/N	REGIMEN	MALE				FEMALE			
		PRE – INTERV.	POST – INTERV.	DIFF	% DIFF	PRE – INTERV.	POST – INTERV.	DIFF	% DIFF
1	AZT/3TC/NVP	18	5	13	72	69	42	27	39
2	3TC/D4T/NVP	136	72	64	47	236	145	91	39
3	AZT/3TC/EFV	4	4	0	0	3	2	1	33
4	3TC/D4T/EFV	14	14	0	0	35	25	10	29
5	LPV + r/TDF + FTC	3	1	2	67	6	4	2	33
6	AZT/ LPV + r/ TDF + FTC	2	1	1	50	0	0	0	0
7	TDF + FTC/NVP	0	0	0	0	1	1	0	0
8	AZT+3TC/TDF/LPV + r	1	1	0	0	0	0	0	0
9	TDF + FTC /EFV	4	2	2	50	0	0	0	0
Total		**182**	**100**	**82**	**45**	**352**	**209**	**143**	**41**

Table 8 is combination of table 6 and 7 above to give an overall picture of the correlation of side/adverse effects with drug regimen and gender.

Table 9. Distribution of side effect incidence in correlation with drug regimen and age (single side effect)

S/N	REGIMEN	CHILDREN				ADULT			
		PRE – INTERV.	POST – INTERV.	DIFF	% DIFF	PRE – INTERV.	POST – INTERV.	DIFF	% DIFF
1	AZT/3TC/NVP	5	4	1	20	42	24	18	43
2	3TC/D4T/NVP	11	6	5	45	186	145	41	22
3	AZT/3TC/EFV	0	0	0	0	2	2	0	0
4	3TC/D4T/EFV	0	0	0	0	28	26	2	7
5	LPV + r/ TDF + FTC	0	0	0	0	2	2	0	0
6	AZT/LPV + r/ TDF + FTC	0	0	0	0	1	1	0	0
7	TDF + FTC/NVP	0	0	0	0	1	1	0	0
8	AZT+3TC/TDF/LPV+ r	0	0	0	0	1	1	0	0
9	TDF + FTC /EFV	0	0	0	0	1	1	0	0
Total		**16**	**10**	**61**	**38**	**264**	**203**	**61**	**23**

Table 9 shows the distribution of the incidence of single side effects correlated with drug regimen and age. The trend is the same as the trend tables 6 and 7above in terms of incidence per regimen. However most of the side effects occurred in adults (95%) while the paediatric cases accounted for only 5% of the side effects.

Table 10. Distribution of side effect incidence in correlation with drug regimen and age (multiple side effects)

S/N	REGIMEN	CHILDREN				ADULT			
		PRE – INTERV.	POST – INTERV.	DIFF	% DIFF	PRE – INTERV.	POST – INTERV.	DIFF	% DIFF
1	AZT/3TC/NVP	4	2	2	50	36	7	29	81
2	3TC/D4T/NVP	8	1	7	88	169	66	8	61
3	AZT/3TC/EFV	0	0	0	0	3	3	0	0
4	3TC/D4T/EFV	0	0	0	0	23	13	10	43
5	LPV + r/TDF + FTC	0	0	0	0	5	3	2	40
6	AZT / LPV + r / TDF + FTC	0	0	0	0	2	0	2	100
7	TDF + FTC / NVP	0	0	0	0	3	1	2	67
8	TDF + FTC / EFV	0	0	0	0	1	0	1	100
Total		**12**	**3**	**9**	**75**	**242**	**93**	**149**	**62**

Table 10 shows the distribution of the incidence of multiple side effects as correlated with drug regimen and age. The trend is the same as the trend in the distribution for single side effects in table 9 above.

Table 11. Combination of tables 9 & 10 (single plus multiple side effects)

S/N	REGIMEN	MALE				FEMALE			
		PRE - INTER	POST - INTER	DIFF	% DIFF	PRE – INTER	POST - INTER	DIFF	% DIFF
1	AZT/3TC/NVP	9	6	3	33	78	31	47	60
2	3TC/D4T/NVP	19	7	12	63	355	211	144	41
3	AZT/3TC/EFV	0	0	0	0	5	5	0	0
4	3TC/D4T/EFV	0	0	0	0	51	39	12	24
5	LPV + r/TDF + FTC	0	0	0	0	7	5	2	29
6	AZT/LPV+r/TDF+ FTC	0	0	0	0	1	1	0	0
7	TDF + FTC/NVP	0	0	0	0	3	1	2	67
8	AZT + 3TC/TDF/LPV + r	0	0	0	0	1	1	0	0
9	TDF + FTC /EFV	0	0	0	0	4	2	2	50
Total		**28**	**13**	**15**	**54**	**506**	**296**	**210**	**42**

Table 11 is combination of table 9 and 10 above to give an overall picture of the correlation of side/adverse effects occurrence with drug regimen and age.

Table 12. Summary of side effects in correlation with gender and age

PRE - INTERVENTION		POST - INTERVENTION	
Male	Female	Male	Female
182 (35%)	352(65%)	100 (32%)	209 (68%)
PRE - INTERVENTION		**POST - INTERVENTION**	
Children	Adult	Children	Adult
28 (5%)	506 (95%)	13 (4%)	296 (96%)

Table 12 shows an abstract summary from Tables 8 and 11.

4. Statistical analysis

4.1. Hypothesis

H_0: Pharmaceutical care interventions do not reduce the occurrence of side/ adverse drug reactions in patients receiving antiretroviral drugs.

H_a: Pharmaceutical care interventions reduce the occurrence of side/ adverse drug reactions in patients receiving antiretroviral drugs.

Here we use a summarized form of table 4 shown below for statistical analysis using the Pearson's chi square (goodness of fit) test so as to validate the result of the foregoing study.

S/N	Total no of side effects	Frequency		Difference (A - B)	% Difference (A-B)/A x 100
		A = Pre-intervention (% of total)	B = Post-intervention (% of total)		
1	58	1583	450	1133	72

Here the expected frequency (Fe) is 50/50 because the chance probability is half (1/2) since we are looking at two groups of data in the table. These are the pre – intervention frequency (1583) and post – intervention frequency (450).

5. Decision rule

Accept null hypothesis if the value of the chi - square calculated is less than the chi - square table value and reject the alternative hypothesis, otherwise accept the alternative hypothesis if the value of the chi - square

calculated is greater than the chi - square table value and reject the null hypothesis. Mathematically, the above decision rule is stated as follows:

Accept H_o if X^2 (Cal) < X^2 (tab).

Accept H_a if X^2 (Cal) > X^2 (tab).

As such,

$$X^2\text{Cal} = \frac{(F_o - F_e)^2}{F_e}$$

where Fo = Observe frequency

Fe = Expected frequency

Thus,

$$X^2\text{Cal} = \frac{(1583 - 50)^2}{50} + \frac{(450 - 50)^2}{50} = 47{,}001.78 + 3{,}200 = 50{,}201.78$$

Now, degree of freedom (Df) = (R – 1) (C – 1)

= (2 – 1) (2 – 1)

= (1) (1)

= 1

Then from Chi-square table,

Df 1 at 95% confidence level = 3.84

Thus, we now have

X^2 cal = 50,201.78 and

X^2 tab = 3.84

Therefore based on our chi - square decision rule above, we reject Ho and accept Ha since X^2 cal > X^2 tab and conclude that Pharmaceutical care interventions reduce the occurrence of side/adverse drug reactions in patients receiving antiretroviral drugs.

6. Discussion

A very important discovery of the study is that 52% of the patients experienced and complained of one side effect or the other. This number was reduced to 22% after the intervention activities. About sixty (60) different types of side effects were identified during the study as shown in table 4 above. Earlier reports portrayed the general incidence of side effects as being below 5%. This has now been shown to be different for patients on chronic anti - infective therapy like antiretroviral drug therapy. Worthy of note also is the fact that the pharmacist intervention activities impacted greatly on the incidence of these side effects reducing the number experiencing them by 30%.

A correlation of the incidence of side effects with the corresponding drug regimen and sex (gender) showed that most of the side effects (70%) occurred in patients on the 3TC/D4T/NVP regimen followed by the AZT/3TC/NVP regimen (16%), D4T/3TC/EFV regimen (9%) and AZT/3TC/EFV regimen (1%). This trend was the same in both the patients experiencing single side effect and those experiencing multiple side effects. These four (4) regimens accounted for 96% of the side effects. Also the side effects occurred most in the female (65%) than in the males (35%). The interventions impacted positively on the incidence of these side effects as the number of patients experiencing them reduced by 58% to 309 from 534.

Another correlation of the incidence of side effects with drug regimen and age corroborated the above incidence pattern with the regimen. The 3TC/D4T/NVP regimen had the highest incidence of 70% followed by the AZT/3TC/NVP regimen (16%), D4T/3TC/EFV (9%) and AZT/3TC/EFV (1%). Also the side effects occurred more in adults (95%) with only 5% of the incidence occurring in children. The low incidence of side effects in the children may be attributed to the fact that many of them could have been too tender to know and detect the occurrence of these in them.

Also the high incidence of these side effects in women can be attributed to their physiological configuration as they usually have more fatty/adipose tissue into which most of these drugs are distributed. They are also less tolerant to pain and discomfort and so may complain of these discomforting side effects more than the stronger and more resilient men. The high incidence with the 3TC/D4T/NVP regimen may be attributed to the stavudine component which is now being withdrawn from the Nigerian market and being replaced with zidovudine where appropriate. Also implicated is nevirapine which is known to cause skin rashes in many patients and thus is being considered for withdrawal and replacement with efavirenz. This consideration is being weighed carefully as Efavirenz has its problem of CNS problems including nightmares, hallucinations, insomnia and suicidal ideation. These improvements were significant at $p>0.5$ as shown in the statistical analysis above.

7. Conclusion

Based on the results of the study, we conclude that pharmacists' interventions in antiretroviral drug therapy through Pharmaceutical care can significantly reduce the incidence of side/adverse drug effects in HIV/AIDS patients receiving antiretroviral drugs.

8. Recommendations

Based on the results of the study above, the following policy measures are proffered.

1. Efforts should be made to increase the enrollment and care of children as the number of them enrolled is far below the number affected by the disease.
2. Efforts should also be made to encourage male enrollment since the number enrolled is far below that of females indicating a possible shortfall in their enrollment.
3. Patients should also be educated on the need to report side/adverse effect as well as other problems they may encounter in the course of treatment.
4. To be able to achieve the laudable goals of healthcare, adequate manpower should be made available. As such government should make effort to train and employ more healthcare workers especially pharmacists whose numbers in hospitals are too small compared to the number of patients that need their attention.
5. Finally, the role of the pharmacist in patient care can no longer be over emphasized. As such government should make adequate efforts to develop and utilize the abundant skills and potentials of pharmacist and pharmaceutical care.

Acknowledgement

We are very grateful to;

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2. Federal medical centre Owerri, Imo state, Nigeria (my birth and work place) for the permission to carry out this study and many other studies there and for always encouraging us the staff to carry out research studies.
3. My numerous patients who endured many months of questioning, examinations and counseling. We appreciate your patience and sacrifice. It was all for your good and better health.

References

ASHP - American Society of Health-System Pharmacists (1996), "ASHP guidelines on a standardized method for pharmaceutical care", *American Journal of Health-System Pharmacists*, Vol. 53, pp. 1713-1716.

Erah, P.O. and Nwazuoke, J.C. (2002), "Identification of standards for Pharmaceutical care in Benin city", *Tropical Journal of Pharmaceutical research",* Vol. 1, No.2, pp. 55-56.

FIP - Federation of International Pharmacists' (1998), "Pharmaceutical care", in *FIP Statement of Professional Standards* as adopted by the FIP council, Hague, Netherlands, 4th September.

Obodozie, O.O. (2006), "Pharmaceutical care in HIV/AIDS", in Obiorah, B.A. (Ed), *GHAIN'S manual for skills certification workshop on HIV/AIDS, sexually transmitted diseases and opportunistic infections for Community Pharmacists*, Mindex, Benin Nigeria, pp. 222-281.

Appendix A. Ethical approval for the study

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Head of Clinical Services
Dr. E. C. Osuagwu
M.B;B.S, FWACS
CHIEF CONSULTANT OBST. & GYNAE

23rd November, 2009

FMC/OW/HCS.11/114

Pharm. Nwaozuzu Ezeudo
Pharmacy Department
Federal Medical Centre
Owerri.

RE: PERMISSION TO CARRY OUT RESEARCH ON THE IMPACT OF PHARMACEUTICAL CARE IN THE MANAGEMENT OF PATIENTS ON ANTIBIOTICS (ANTI-INFECTIVE) THERAPY.

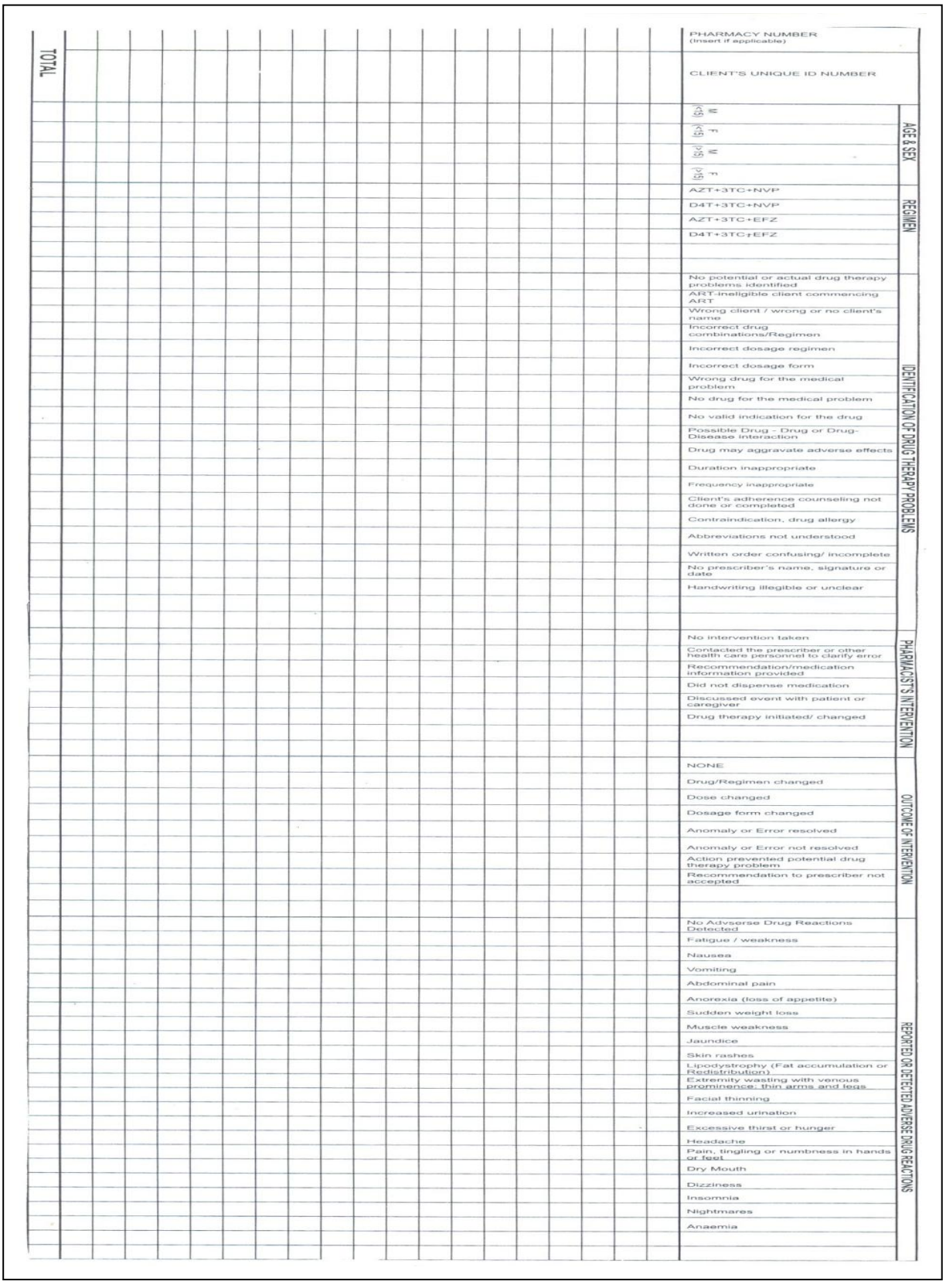
The Ethical committee acknowledges receipt of your research proposal dated 10th July 2009.

Following a meeting of the Committee held on 30th October, 2009, you have been given permission to carry out the said research.

You are also to ensure patients' confidentiality in this regard.

DR. E.C. OSUAGWU
HEAD OF CLINICAL SERVICES/CHAIRMAN ETHICAL COMMITTEE

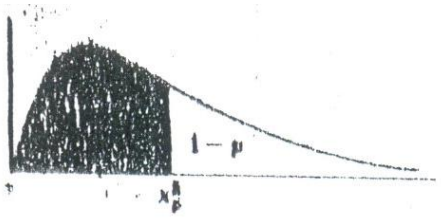
Appendix A. Data collection form



Appendix C. Chi – square distribution table

APPENDIX C

Percentile Values (χ^2_p) for the Chi-Square Distribution with ν Degrees of Freedom



ν	$\chi^2_{.005}$	$\chi^2_{.01}$	$\chi^2_{.025}$	$\chi^2_{.05}$	$\chi^2_{.10}$	$\chi^2_{.25}$	$\chi^2_{.50}$	$\chi^2_{.75}$	$\chi^2_{.90}$	$\chi^2_{.95}$	$\chi^2_{.975}$	$\chi^2_{.99}$	$\chi^2_{.995}$	$\chi^2_{.999}$
1	.0000	.0002	.0010	.0039	.0158	.102	.455	1.32	2.71	3.84	5.02	6.63	7.88	10.8
2	.0100	.0201	.0506	.103	.211	.575	1.39	2.77	4.61	5.99	7.38	9.21	10.6	13.8
3	.0717	.115	.216	.352	.584	1.21	2.37	4.11	6.25	7.81	9.35	11.3	12.8	16.3
4	.207	.297	.484	.711	1.06	1.92	3.36	5.39	7.78	9.49	11.1	13.3	14.9	18.5
5	.412	.554	.831	1.15	1.61	2.67	4.35	6.63	9.24	11.1	12.8	15.1	16.7	20.5
6	.676	.872	1.24	1.64	2.20	3.45	5.35	7.84	10.6	12.6	14.4	16.8	18.5	22.5
7	.989	1.24	1.69	2.17	2.83	4.25	6.35	9.04	12.0	14.1	16.0	18.5	20.3	24.3
8	1.34	1.65	2.18	2.73	3.49	5.07	7.34	10.2	13.4	15.5	17.5	20.1	22.0	26.1
9	1.73	2.09	2.70	3.33	4.17	5.90	8.34	11.4	14.7	16.9	19.0	21.7	23.6	27.9
10	2.16	2.56	3.25	3.94	4.87	6.74	9.34	12.5	16.0	18.3	20.5	23.2	25.2	29.6
11	2.60	3.05	3.82	4.57	5.58	7.58	10.3	13.7	17.3	19.7	21.9	24.7	26.8	31.3
12	3.07	3.57	4.40	5.23	6.30	8.44	11.3	14.8	18.5	21.0	23.3	26.2	28.3	32.9
13	3.57	4.11	5.01	5.89	7.04	9.30	12.3	16.0	19.8	22.4	24.7	27.7	29.8	34.5
14	4.07	4.66	5.63	6.57	7.79	10.2	13.3	17.1	21.1	23.7	26.1	29.1	31.3	36.1
15	4.60	5.23	6.26	7.26	8.55	11.0	14.3	18.2	22.3	25.0	27.5	30.6	32.8	37.7
16	5.14	5.81	6.91	7.96	9.31	11.9	15.3	19.4	23.5	26.3	28.8	32.0	34.3	39.3
17	5.70	6.41	7.56	8.67	10.1	12.8	16.3	20.5	24.8	27.6	30.2	33.4	35.7	40.8
18	6.26	7.01	8.23	9.39	10.9	13.7	17.3	21.6	26.0	28.9	31.5	34.8	37.2	42.3
19	6.84	7.63	8.91	10.1	11.7	14.6	18.3	22.7	27.2	30.1	32.9	36.2	38.6	43.8
20	7.43	8.26	9.59	10.9	12.4	15.5	19.3	23.8	28.4	31.4	34.2	37.6	40.0	45.3
21	8.03	8.90	10.3	11.6	13.2	16.3	20.3	24.9	29.6	32.7	35.5	38.9	41.4	46.8
22	8.64	9.54	11.0	12.3	14.0	17.2	21.3	26.0	30.8	33.9	36.8	40.3	42.8	48.3
23	9.26	10.2	11.7	13.1	14.8	18.1	22.3	27.1	32.0	35.2	38.1	41.6	44.2	49.7
24	9.89	10.9	12.4	13.8	15.7	19.0	23.3	28.2	33.2	36.4	39.4	43.0	45.6	51.2
25	10.5	11.5	13.1	14.6	16.5	19.9	24.3	29.3	34.4	37.7	40.6	44.3	46.9	52.6
26	11.2	12.2	13.8	15.4	17.3	20.8	25.3	30.4	35.6	38.9	41.9	45.6	48.3	54.1
27	11.8	12.9	14.6	16.2	18.1	21.7	26.3	31.5	36.7	40.1	43.2	47.0	49.6	55.5
28	12.5	13.6	15.3	16.9	18.9	22.7	27.3	32.6	37.9	41.3	44.5	48.3	51.0	56.9
29	13.1	14.3	16.0	17.7	19.8	23.6	28.3	33.7	39.1	42.6	45.7	49.6	52.3	58.3
30	13.8	15.0	16.8	18.5	20.6	24.5	29.3	34.8	40.3	43.8	47.0	50.9	53.7	59.7
40	20.7	22.2	24.4	26.5	29.1	33.7	39.3	45.6	51.8	55.8	59.3	63.7	66.8	73.4
50	28.0	29.7	32.4	34.8	37.7	42.9	49.3	56.3	63.2	67.5	71.4	76.2	79.5	86.7
60	35.5	37.5	40.5	43.2	46.5	52.3	59.3	67.0	74.4	79.1	83.3	88.4	92.0	99.6
70	43.3	45.4	48.8	51.7	55.3	61.7	69.3	77.6	85.5	90.5	95.0	100	104	113
80	51.2	53.5	57.2	60.4	64.3	71.1	79.3	88.1	96.6	102	107	113	116	125
90	59.2	61.8	65.6	69.1	73.3	80.6	89.3	98.6	108	113	118	124	128	137
100	67.3	70.1	74.2	77.9	82.4	90.1	99.3	109	118	124	130	136	140	149

Source: E. S. Pearson and H. O. Hartley, *Biometrika Tables for Statisticians*, Vol. 1 (1966), Table 8, pages 137 and 138.