International Journal of Infectious Diseases and Therapy
2016; 1(1): 13-21
http://www.sciencepublishinggroup.com/j/ijidt
doi: 10.11648/j.ijidt.20160101.13

Epidemiological Study of HCV and HIV Infections in Relation to Certain Demographic Factors Among the Ante-Natal Population Within Kaduna Metropolis, Nigeria

Chanu Iliyasu[1, *], Auwalu Uba[3], Muhammad Yusha'u[2], Anthony John Dadah[1], Timothy Waje[1]

[1]Department of Microbiology, Faculty of Science, Kaduna State University, Kaduna, Nigeria

[2]Department of Microbiology, Faculty of Science, Bayero University, Kano, Nigeria

[3]Biological Sciences, Faculty of Science and Science Education, Abubakar Tafawa Balewa University, Bauchi, Nigeria

Email address:

chenuyasu@yahoo.com (C. Iliyasu)

[*]Corresponding author

To cite this article:

Chanu Iliyasu, Auwalu Uba, Muhammad Yusha'u, Anthony John Dadah, Timothy Waje. Epidemiological Study of HCV and HIV Infections in Relation to Certain Demographic Factors Among the Ante-Natal Population Within Kaduna Metropolis, Nigeria. *International Journal of Infectious Diseases and Therapy.* Vol. 1, No. 1, 2016, pp. 13-21. doi: 10.11648/j.ijidt.20160101.13

Received: October 31, 2016; **Accepted**: November 18, 2016; **Published**: December 27, 2016

Abstract: Hepatitis C and HIV are blood borne infections of the human population including pregnant women globally. These Viruses are of global concern because of the significant challenges they pose to public health with over 36.7 million people leaving with HIV around the whole world. This research determined the prevalence of HCV, HIV and HCV-HIV co infection among pregnant women attending ante-natal in selected hospitals within the Kaduna metropolis. A total of 500 samples were collected from pregnant women on ante-natal in 5 different hospitals within the metropolis. One hundred samples were collected from each of the hospitals visited. Each sample was analyzed for HCV and HIV antibodies respectively using commercially available kits. Results analysis revealed prevalence rates of 1.4% for HCV, 5.80% for HIV and 0.40% HCV-HIV co-infection among the subjects. Chi square statistics for test of independence between 2 variables showed significant associations between HCV positivity and history of more than 2 sexual partners ($P \leq 0.01$), Age group between 36-40 years ($P \leq 0.02$), Unknown gestational age and 4-6 months respectively ($P \leq 0.0002$, $P \leq 0.03$). These were identified as potential risks for HCV contraction. On the other hand, there was no significant association between any of the demographic factors and HIV positivity which showed that exposure to the HIV causes infection regardless of any demographic factor. There is low prevalence of HCV, high prevalence of HIV and low prevalence of HCV-HIV co-infection among the ante-natal population within the metropolis.

Keywords: Epidemiology, HIV, HCV, Demographic Factors, Pregnant Women, Kaduna

1. Introduction

The Hepatitis C Virus which causes a life threatening infection of the liver leading to cirrhosis or liver cancer is becoming a global health problem even among pregnant women [1, 2]. The Virus causes a blood borne infection transmitted primarily through contacts with infected blood and blood products [3, 4]. About 70-80% of acutely HCV infected persons are asymptomatic without any clinical signs [5]. Common symptoms associated with HCV infections include: fatigue, nausea, vomiting, fever, abdominal pain, dark urine, itchy skin, jaundice among others [3, 5, 6]. The Human Immunodeficiency Virus (HIV) is a known causative agent of the Acquired Immunodeficiency Syndrome popularly referred around the world to as AIDS. The HIV has continued to pose a significant threat to public health around the world with about 36.7 million people globally living with the Virus [7]. Though HCV and HIV seems to have some common routes of transmission and sometimes coexist in the same host in mixed infections, epidemiological studies have revealed HIV as an independent factor in HCV transmission and acquisition [1, 8]. In developing countries, the presence of mixed infections (HCV-HIV) and malnutrition caused by extreme poverty and food insecurity altogether pose a significant threat to the management and elimination of HIV

among patients [9, 10]. HCV and HIV which are considered blood borne infections are major causes of infectious diseases worldwide [11, 12].

Common means of transmission include: contacts with contaminated sharp objects such as blades and needles, blood and body fluids of infected persons [2]. Sexual and transplacental (Perinatal) transmissions are active means of HIV transmission but are considered inefficient modes for the transmission of HCV [2]. Various studies have reported HCV and HIV among pregnant women in different locations of the world. In a case-control study in North India, 2.8% prevalence of HCV was reported in 2014 [13]. Similarly, 8.78% prevalence has been reported among ante natal population in Pakistan, 0.21% among pregnant women in India and 6.10% among similar population in a rural area in Egypt [14, 15, 16]. In Nigeria, previous studies have also reported prevalence of HCV among pregnant women such as 1% in 2014 in Nnewi, 4.5% in Kaduna in 2012, 2.7% in Oshogbo, Southwestern, Nigeria [17, 18, 19]. Similarly, there have been several reports on HIV infections among pregnant women. These out of many include: 0.7% among young parturient women in Brazil, 30.2% in Malawi, 2.9% among similar study population at the Kabutare District Hospital Rwanda [20, 21, 22]. Also, 8.2% reported among pregnant women in Jos Plateau State, 5.93% in Port-Harcourt in 2007 and 7.8% among pregnant women in Minna, Niger state all in Nigeria [23, 24, 25]. Previous studies have documented cases of HCV-HIV co-infection among pregnant women such as: in Italy, in Saint Camille medical centre, Ouagadougou, Burkina Faso, and in Thailand [26, 27, 28]. In Nigeria, 0.00% HCV-HIV co infection has been reported in Oshogbo South West, but Positive co infection results have been documented in Benin City Edo state and in Nigeria as whole in separate studies [1, 29, 31].

This research was carried out to determine the prevalence of HCV, HIV and HCV-HIV co-infections among the ante natal population of selected Hospitals within the Kaduna Metropolis.

The relationships between positivity of these Viruses and certain demographic factors were also determined in order to assess the impact of these factors on the spread of these viruses among pregnant women within the metropolis. The need for public health improvement among the population through mitigation of risk and exposures was the major significance of this research.

2. Materials and Methods

The studied population was pregnant women attending ante-natal in some hospitals within the metropolis. Ethical approval was obtained from the ethical committee of the Kaduna State Ministry of Health to collect samples from the subjects in the selected hospitals. Participants were well informed about the study and its relevance to public health. Their consents to participate were sought through the use of consent forms. Structured questionnaires were also issued to consented subjects to obtain socio-demographic data for risk factors identification [1, 25, 31].

Five Hundred (500) samples were collected from pregnant women in five different hospitals, 100 from each sampling site [32]. About Five Milliliters of blood was collected by venipuncture from each study subject using a disposable sterile vacutainer needle and a 5ml vacutainer Ethylenediamine Tetra –Acetic acid (EDTA) bottle. The EDTA served as an anticoagulant separating the blood cells and plasma. All samples collected were taken to the Medical Microbiology Laboratory of Kaduna State University for processing.

The blood plasma of each sample was carefully separated for analysis using disposable pipettes. A portion of each sample was tested for the presence of antibody to Human Immunodeficiency Virus (HIV) and retested for confirmation using Uni Gold Test Kits in accordance with the Federal Ministry of Health 2009 Algorithm.

Another portion of each sample was also used to determine the presence of antibody to HCV using one step test kit.

Standard procedures were followed and results were all read and interpreted according to the manufacturer's instructions. Results were organized into tables according to demographic factors. Chi square statistics was used to test the associations between the respective risk factors and the spread of the Viruses respectively at a fixed level hypothesis testing of 5% significance [33].

3. Results

Among the 500 samples analyzed, 7 (1.4%) were reactive to HCV antibody while 493 (98.60%) were non reactive. This was described as hypo endemicity for HCV infections among the pregnant women within the metropolis. On the other hand, 29 (5.80%) samples were reactive to HIV antibody and 471 (94.20%) samples were non reactive to HIV antibody (Table 1).

Table 1. *Distribution of HCV and HIV among Pregnant women attending some antenatal clinics within Kaduna Metropolis.*

HCV Antibody				**HIV Antibody**		
Test Results	**Number of persons**	**Percentage%**	**Endemicity**	**Number of Persons**	**Percentage %**	**Endemicity**
Reactive	7	1.40	Low	29	5.80	High
Non-Reactive	493	98.60		471	94.20	
Total	500	100		500	100	

Table 2 shows that 2 (0.40%) out of the 500 samples analyzed were positive for both HCV and HIV revealing a mix infection on these 2 pregnant women. This was a low severity rate due to the large proportion of the pregnant women

(498/99.60%) found to be negative for mixed infection.

Table 2. *Occurrence of HCV-HIV co infection among the study subjects.*

HIV-HCV co infection	Number of subjects tested (500)	Percentage %	Severity rate
Reactive	2	0.40	Low
Non Reactive	498	99.60	
Total	500	100	

Two hundred and sixty out of the 500 pregnant women tested had a history of one sexual partner. Analysis of samples from these subjects revealed 1 (0.39%, $P \leq 0.04$) positive case for HCV antibody and 12 (4.62%, $P \leq 0.24$) positive cases for HIV antibody. Out of the 147 pregnant women with a history of two sexual partners, 2 (1.36%, $P \leq 0.87$) were reactive to HCV while 8 (5.44%, $P \leq 0.83$) were positive for HIV antibody. On the other hand, 93 subjects with a history of more than two sexual partners showed 4 (4.3%, $P \leq 0.01$) positive cases for HCV and 9 (9.68%, $P \leq 0.08$) positive cases for HIV antibody (Table 3)

Table 3. *Distribution of HCV and HIV among the study subjects in relation to number of previous sexual partners.*

Risk Factor	Number of Persons Tested	HCV Antibody			Anti HIV		
No of previous Sexual partner		Reactive Cases	% of Reactive Cases	Associated P Value ($P \leq 0.05$)	Reactive Cases	% of Reactive cases	Associated P Value ($P \leq 0.05$)
One	260	1	0.39	$P \leq 0.04$	12	4.62	$P \leq 0.24$
Two	147	2	1.36	$P \leq 0.87$	8	5.44	$P \leq 0.83$
>TWO	93	4	4.30	$P \leq 0.01$	9	9.68	$P \leq 0.08$
Total	500	7			29		

Analysis of 46 samples from subjects within age group 16-20 revealed no (0.00%) positive case for HCV while 3 (6.52%, $P \leq 0.77$) were positive for anti-HIV. Among the 73 subjects within age group 21-25 tested, 2 (2.74%, $P \leq 0.73$) were positive for HCV while 5 (6.85%, $P \leq 0.68$) were reactive to HIV antibody. No (0.00%, $P \leq 0.17$) positive case was observed for HCV antibody among the 105 samples from subjects within age group 26-30. On the other hand, 9 samples (8.57%, $P \leq 0.17$) were positive for HIV antibody among the subjects within this age group. Analysis of 165 samples from subjects within age 31-35 showed 1 (0.61%, $P \leq 0.29$) reactive case to HCV antibody and 7 (4.24%, $P \leq 0.30$) positive cases for HIV antibody. Three pregnant women (4.41%) out of 68 subjects within age group 36-40 tested positive for HCV antibody with a significant association between this age group and HCV seropositivity ($P \leq 0.02$). On the contrary, 4 (5.88%) were reactive to HIV antibody without any significant association between this age group and HIV positivity ($P \leq 0.97$). Among the 43 samples from subjects with ages above 40 tested, 1(2.33%, $P \leq 0.58$) was positive for HCV antibody and 1(2.33, $P \leq 0.31$) was reactive to HIV antibody (Table 4)

Table 4. *Age distribution of HCV and HIV among the study subjects.*

Risk Factor	Number of Persons Tested	HCV Antibody			Anti HIV		
Age		Reactive Cases	% of Reactive Cases	Associated P Value ($P \leq 0.05$)	Reactive Cases	% of Reactive cases	Associated P Value ($P \leq 0.05$)
16-20	46	0	0.00	$P \leq 0.40$	3	6.52	$P \leq 0.77$
21-25	73	2	2.74	$P \leq 0.73$	5	6.85	$P \leq 0.68$
26-30	105	0	0.00	$P \leq 0.17$	9	8.57	$P \leq 0.17$
31-35	165	1	0.61	$P \leq 0.29$	7	4.24	$P \leq 0.30$
36-40	68	3	4.41	$P \leq 0.02$	4	5.88	$P \leq 0.97$
>40	43	1	2.33	$P \leq 0.58$	1	2.33	$P \leq 0.31$
Total	500	7			29		

Ninety one persons had no formal education. Analysis of samples from these subjects revealed no (0.00%) positive cases for HCV but 7 (7.69%) samples were reactive to HIV antibody. There were no statistically significant associations between absence of a formal education and positivity for HCV and HIV respectively ($P \leq 0.21$, $P \leq 0.39$). Out of the 119 samples tested from subjects with a primary school level of education, 2 (1.68%, $P \leq 0.87$) were positive for HCV antibody while 9 (7.56%, $P \leq 0.35$) were reactive to HIV antibody. One (0.76%) out of the 132 samples from subjects with a secondary school level of education tested positive for HCV while 5 (3.79%) were reactive to HIV antibody. There were no statistically significant associations between this level of education and positivity for HCV and HIV antibody respectively. One hundred and fifty eight subjects attended tertiary level of education. Analysis of samples from these subjects revealed 4 (2.53%, $P \leq 0.14$) positive cases for HCV antibody while 8 (5.06%, $P \leq 0.63$) were reactive to HIV antibody (Table 5)

Table 5. *Distribution of HCV and HIV among the study subjects in relation to Level of Education.*

Risk Factor	Number of Persons Tested	HCV Antibody			Anti HIV		
Level of Formal Education		Reactive Cases	% of Reactive Cases	Associated P Value ($P \leq 0.05$)	Reactive Cases	% of Reactive cases	Associated P Value ($P \leq 0.05$)
No formal Education	91	0	0.00	$P \leq 0.21$	7	7.69	$P \leq 0.39$
Primary Education	119	2	1.68	$P \leq 0.87$	9	7.56	$P \leq 0.35$
Secondary Education	132	1	0.76	$P \leq 0.46$	5	3.79	$P \leq 0.25$
Tertiary Education	158	4	2.53	$P \leq 0.14$	8	5.06	$P \leq 0.63$
Total	500	7			29		

Analysis of samples according to the gestational period of pregnancy by the subjects revealed that out of 17 subjects with unknown gestational period, 2 (11.77%) were positive for HCV and 2 (11.77%) for HIV antibodies respectively. There was a high statistically significant association between lack of knowledge of gestational period and HCV positivity ($P \leq 0.0002$). On the other hand, there was no statistically significant association between lack of knowledge of gestational period and HIV positivity ($P \leq 0.29$). Analysis of 98 samples with a gestational period of 1-3 months showed 2 (2.04%, $P \leq 0.55$) positive cases for HCV and 7 (7.14%, $P \leq 0.53$) reactive cases to HIV antibodies respectively. Out of 207 subjects with a gestational period of 4-6 months none (0.00%) was positive for HCV antibody. On the contrary, 12 (5.80%) of these subjects were positive for HIV antibody. A significant association was observed between the gestational period of 4-6 months and HCV positivity ($P \leq 0.03$). No statistically significant association was observed between this gestational period and HIV positivity. One hundred and seventy eight subjects were about 7-9 months pregnant.

Analysis of their samples revealed 3 (1.69%) positive cases for HCV and 8 (4.49%) reactive cases for HIV antibodies respectively. There were no statistically significant associations between this gestational period and positivity for HCV and HIV antibodies respectively (Table 6)

Table 6. *Distribution of HCV and HIV among the study subjects in relation to Gestational Age.*

Risk Factor	Number of Persons Tested	HCV Antibody			Anti HIV		
Gestational Age (Months)		Reactive Cases	% of Reactive Cases	Associated P Value ($P \leq 0.05$)	Reactive Cases	% of Reactive cases	Associated P Value ($P \leq 0.05$)
Unknown	17	2	11.77	$P \leq 0.0002$	2	11.77	$P \leq 0.29$
1-3	98	2	2.04	$P \leq 0.55$	7	7.14	$P \leq 0.53$
4-6	207	0	0.00	$P \leq 0.03$	12	5.80	$P \leq 0.98$
7-9	178	3	1.69	$P \leq 0.63$	8	4.49	$P \leq 0.35$
Total	500	7			29		

Among the 389 married subjects tested, 3 (0.77%) were positive for HCV while 19 (4.88%) were reactive to HIV antibody. A significant association was observed between the married and HCV positivity ($P \leq 0.025$). On the other hand, there was no statistically significant association between the married and HIV positivity ($P \leq 0.10$). One hundred and eleven unmarried subjects were tested. Four (3.60%, $P \leq 0.025$) were positive for HCV antibody while 10 (9.01%, $P \leq 0.10$) were found reactive to HIV antibody (Table 7)

Table 7. *Distribution of HCV and HIV among the study subjects in relation to Marital Status.*

Risk Factor	Number of Persons Tested	HCV Antibody			Anti HIV		
Marital Status		Reactive Cases	% of Reactive Cases	Associated P Value ($P \leq 0.05$)	Reactive Cases	% of Reactive cases	Associated P Value ($P \leq 0.05$)
Married	389	3	0.77	$P \leq 0.025$	19	4.88	$P \leq 0.10$
Unmarried	111	4	3.60	$P \leq 0.025$	10	9.01	$P \leq 0.10$
Total	500	7			29		

Table 8 shows the distribution of HCV and HIV among the subjects according to their parity (Times of Pregnant). Analysis of 196 samples from subjects that were Para 1/Primi gravid (first time pregnancy) revealed 2 (1.02%, $P \leq 0.56$) reactive cases to HCV antibody and 11 (5.61%, $P \leq 0.89$) positive cases for HIV antibody. Three hundred and four subjects who were pregnant either for the second time or more (Para 2 and above) tested showed 5 (1.65%, $P \leq 0.56$)

positive cases for HCV antibody and 18 (5.92%, $P \leq 0.89$).

Table 8. *Distribution of HCV and HIV among the study subjects in relation to Parity.*

Risk Factor	Number of Persons Tested	HCV Antibody			Anti HIV		
Gravidity		Reactive Cases	% of Reactive Cases	Associated P Value ($P \leq 0.05$)	Reactive Cases	% of Reactive cases	Associated P Value ($P \leq 0.05$)
Primigravidae	196	2	1.02	$P \leq 0.56$	11	5.61	$P \leq 0.89$
Multigravidae	304	5	1.65	$P \leq 0.56$	18	5.92	$P \leq 0.89$
Total	500	7			29		

4. Discussions

Hepatitis C Virus (HCV) and the Human Immunodeficiency Virus (HIV) are among the known blood borne pathogens that cause serious infections among the Human population around the globe [34]. These infectious agents have continued to pose significant threats to public health and in some cases co-exist in the same host even among pregnant women [1, 35, 36]. The ante-natal population consisted of pregnant women attending ante-natal in the respective hospitals visited. This study revealed a prevalence rate of 1.4% for HCV among these pregnant women. This was considered low based on the HCV severity rates limits given by <1.5%= low, 1.5-3.5%=moderate and ≥3.5=high [37]. This result suggests that the spread of the Virus among women particularly pregnant women within the metropolis is low which could be attributed to less exposure of this ante-natal population to the Virus. Improvements in health care services might have probably reduced cross contamination during service delivery or awareness on personal hygiene and save lifestyles by the subjects might have contributed to this low prevalence rate. This trend is similar to previous reports among pregnant women in some locations within Nigeria such as 1% in 2014 at Nnewi and 0.5% among similar subjects in 2010 at the Niger Delta [17, 38]. On the other hand, this result contradicts some previous reports among pregnant women such as 2.7% in Oshogbo, 1.7% in Ibadan both in southwest, Nigeria with moderate endemicity [19, 39]. Also, 4.5% in Kaduna state and 5% in Benin City Edo state in Nigeria which were classified as hyper endemic [1, 18]. These fluctuations in trends could probably be not unconnected with the fact that prevalence of HCV has been reported to vary between population subgroups and from one location to another [40]. Similarly, other regions of the world have experienced the same trend. While this result is more than the 0.21% reported in 2016 among similar population subgroup in a Rural Hospital in Sangareddy, India, it is less than the 2.8% which was a moderate endemicity obtained in North India in 2014, 6.1% reported in Egypt in 2006 and 8.78% in Pakistan in 2013 classified as hyper endemic locations [13, 14; 15; 16]. These differences could be attributed to regional and location differences associated with different lifestyles and exposures [40]. On the other hand, the HIV prevalence rate of 5.80% obtained in this study was high and could be attributed to poor control and protective measures or lifestyles that predispose the subjects to the HIV infection within the metropolis. Though, the CD4+ counts of the subjects were not carried out to identify the severity of the infections, the study subjects were classically asymptomatic and belonged to category A of HIV Infection clinical categories [41]. The result obtained in this study is more than the 3% reported among pregnant women in Benin, Edo State, Nigeria [1]. This could probably be explained by lifestyles and cultural differences. On the contrary, this study revealed a prevalence rate less than the 8.2% reported in 2005 in Jos plateau state, 5.93% in 2007 in Port Harcourt, Rivers State and the 7.8% in 2010 in Minna, Niger State all in Nigeria [23, 24, 25]. These variations in trends could probably be attributed to differences in population exposures, lifestyles and location [40]. This result though higher than the 0.7% of HIV prevalence reported among parturient women in 2014 in Brazil and 2.9% in Kabutare District Hospital, Rwanda in 2013, it is less than the 30.20% reported among similar subjects in Malawi in 2010 and 62.27% in 2011 in Ouagadougou, Burkina Faso [20, 21, 22, 27]. Location impact on the outcome of studies due to the culture and lifestyles characteristics of the inhabitants. This could probably be responsible for these differences in rates. Co-infection is the presence of two different pathogens in the same host at the same time. The HCV-HIV co-infection among pregnant women can be accompanied by many social and medical needs as well as numerous personal and system-level problems [8]. The 0.40% 0f HCV-HIV co-infection obtained in this study is relatively low. This low prevalence may be attributed to less exposure of the female population to Hepatitis C Virus than males [41]. This is close to the 0.00% HCV-HIV co-infection rate reported in Oshogbo, South Western Nigeria in 2016 [29]. On the other hand, the 0.40% obtained in this study is less than the 33% HCV-HIV co-infection reported among similar subjects in Benin, Edo state Nigeria in 2009 [1]. This large disparity in rates could be attributed to location differences influenced by lifestyles and cultural factors. Probably more HIV positive pregnant women were more exposed to the Virus in these HCV-HIV hyper-endemic locations than areas with low cases of co-infection. This results is also different from the 2.9% HCV-HIV infected pregnant women reported in 2009 in Thailand and 2.38% among similar study group in Ouagadougou, Burkina Faso

in 2011 [27, 28]. Personal hygiene and available health care services varies from one location to the other and could probably contribute to variations in HCV-HIV co-infections from one country to the other.

The population was studied in relation to the history of sexual partners in order to assess the level of exposure to risk for HCV and HIV contraction. The higher prevalence for HCV (4.30%) and HIV (9.68%) recorded for subjects with a history of sexual partners greater than two suggests either cases of sexual transmission or contraction through close contacts with positive sexual partners [20]. The probability value $P \leq 0.01$ suggests a significant association between HCV positivity and multiple sexual partners greater than two. The Absence of statistically significant association between HIV positivity and number of sexual partners indicated HIV transmission through contact with the Virus regardless of the number of sexual partners ($P \leq 0.24$, $P \leq 0.83$, $P \leq 0.08$). The high HIV prevalence (9.68%) among subjects with a history of more than two sexual partners in this study agrees with a previous report of 50% of HIV among prostitutes in Benin, Nigeria [1]. This result is higher than a previous report of 2.90% among similar subjects with more than one sexual partner in Brazil in 2014 [20]. Multiple infected male sexual partners could have contributed to this high HIV seropositivity among the study subjects.

The absence of statistically significant association between the respective age groups and HIV seropositivity indicated that age is not a predisposition factor for HIV transmission, but individuals across all ages can contract the infection when exposed to the Virus. Also, the high HIV prevalence of 8.57% recorded among subjects within age group 26-30 could probably be attributed to active lifestyles influenced by youthful exuberance exposing the subjects to the Virus. On the other hand, the significant association observed between HCV positivity and subjects within age group 36-40 years (4.41%, $P \leq 0.02$) suggests that women within this age group are more exposed to the Virus than those with other ages. This is contrary to previous reports of high HCV prevalence of 4.5% among subjects within 21-26 years in 2014 in Nnewi, 58.30% among similar study group within ages 22-26 in 2012 around Abaji Area Council, Abuja all in Nigeria and 45% among pregnant women within ages 21-25 in North India in 2014 [13, 17, 36]. Regional and cultural differences could be responsible for these large differences [40].

Formal education is important in the life of an individual as it determines the individual enlightenment and knowledge base upon which lifestyles and social exposures are built [33]. The large proportion of the study subjects (158 pregnant women) observed to have attended tertiary level of education suggests a significant number of the women population within the metropolis are literate. Nevertheless, a moderate endemicity (2.53%) for HCV was observed among these subjects against 0.00% prevalence rate observed among those without formal education. This could probably be due exposures to risky lifestyles and undertakings which might have increased the chances of HCV contraction among the literate. The low level of education among the 93 subjects did not impact on their HCV seropositivity. This agrees with a previous report of less impact of low levels of education (P=0.50) on HCV positivity among pregnant women in Abaji Area council, Abuja, Nigeria [36]. The various probability levels in Table 5 shows there were no statistically significant associations between HCV positivity and the subjects' levels of education respectively ($P \leq 0.21$, $P \leq 0.87$, $P \leq 0.46$, $P \leq 0.14$). This could mean that being educated does not guarantee safety from HCV even though education itself also does not predisposes one to infection without contact with the Virus. This result contradicts a previous report of 53.85% (P<0.01) among Illiterate pregnant women in Ouagadougou, Burkina Faso in 2011 [27]. This difference could probably be attributed to location differences. Similarly, the absence of statistically significant association between the subjects level of Education and HIV positivity shows that Formal education alone is not a predisposition factor for HIV contraction, but all persons at all levels of enlightenment have the same tendency of been infected when exposed to the Virus ($P \leq 0.39$, $P \leq 0.35$, $P \leq 0.25$, $P \leq 0.63$). Nevertheless, the higher HIV prevalence of 7.69% which was recorded among subjects with no formal education suggests that these subjects were more exposed to the Virus probably ignorantly through risky lifestyles. This is close to the 7.7% reported among same category of subjects in 2010 in Minna, Niger State, Nigeria [25]. Similarly, this trend agrees with 18.90% reported in 2010 among pregnant women with no formal education in the Niger delta, Nigeria and 53.85% among non-literate pregnant women in Ouagadougou Burkina Faso [27, 38]. These similarities in trends could be attributed to similarity in sub-regional location and also possibility of freedom movement of citizens from location to the other.

Gestational age as used in this study referred to the duration or stage of the pregnancy in months among the subjects. Two (11.77%) out of 17 subjects who did not know the stage of their pregnancy tested positive for HCV. The highly statistically significant association ($P \leq 0.0002$) observed between HCV positivity and ignorance (Unknown stage) of the stage of pregnancy suggests that these subjects were not careful to avoid exposures to the Virus even when they were pregnant. Similarly, subjects with gestational period of 4-6 months had no positive case, there was a significant relationship between HCV positivity and this stage of pregnancy ($P \leq 0.03$). The physiological changes associated with pregnancy might have predisposed the subjects to HCV infection on exposure to the Virus. Though high prevalence rate of 11.77% was recorded among subjects with unknown gestational age, the absence of a statistically significant association between this factor and HIV positivity ($P \leq 0.29$) suggests that ignorance of the stage of their pregnancies did impact on the positivity of HIV. Similarly, the absence of significant associations between HIV positivity and other gestational periods (1-3 months = $P \leq 0.53$, 4-6 months = $P \leq 0.98$, 7-9 months = $P \leq 0.35$) implies that the stage or age of the pregnancy among the subjects did really matter, but all subjects could contract HIV

on exposure regardless of the stage of pregnancy.

Marital status is important in this study as information regarding the status of the subjects could assist in predicting the actual sources of HCV or HIV infections on the subjects; whether they be from spouses or not. The 3 (0.77%) HCV positive cases out of 389 married women tested indicate that the prevalence of the Virus among the married was low. This also suggests possibility of absence of intra-spouse transmission. This is slightly above the 0.60% reported among similar population in the Niger delta [38]. This similar trend could be attributed to the low prevalence of Hepatitis C Virus reported among the female population [42]. The high HCV prevalence rate of 3.60% recorded among the unmarried could suggest exposure to multiple sources of HCV contraction. This trend varies with the 0.00% prevalence observed among pregnant singles in the Niger Delta and 33.3% among a similar study group in Ibadan all in Nigeria [38, 39]. This trend could be explained by geopolitical location differences. Nevertheless, the statistically significant association observed between marital status and HCV positivity ($P \leq 0.025$) in this srudy agrees with the trend previously reported in Ibadan, Nigeria ($P \leq 0.014$) [39]. These suggest that the marital status of the studied subjects played a key role on their HCV positivity. On the other hand, the probability value of $P \leq 0.10$ for HIV infection revealed no statistically significant associations between the marital status and HIV positivity. Also, higher HIV prevalence of 9.01% recorded among the unmarried subjects against 4.88% among the married could suggest promiscuous source of contraction of the Virus.

This result is similar in trend with 1.2% reported among pregnant parturient women without stable partners against 0.5% subjects with stable partners in Brazil but contrary to 30.77% (P=0.92) among singles against 61.54% (P=0.85) among the married in Ouagadougou, Burkina Faso [20, 27]. These variations could be attributed to behavioral and lifestyle differences in the different locations of studies.

Gravidity in this study referred to the number of times a subject has been pregnant. Primagravida were those women in their first pregnancy while Multigravidae were those that had been pregnant more than once. Gravidity is important in this study because it was used to determine the association between the number of time subjects were pregnant and positivity for HCV and HIV respectively. The low prevalence rate of 1.02% among the primagravidae suggests that first pregnancy did not impact heavily on the subjects HCV positivity. On the other hand, 1.65% prevalence among the multigravida which is a moderate endemicity suggests that positivity of these subjects increased with increase in the number of times some subjects were pregnant.

The absence of a statistically significant association between gravidity and HCV positivity suggests that the number of times a subject was pregnant did not really matter in as much as there was no exposure to the Virus but all women had equal tendencies of contracting HCV regardless of the number of times one had been pregnant ($P \leq 0.56$). This result is contrary to a report of 1.2% among primigravidae and 0.1% among multigravidae in 2010 in the Niger Delta, Nigeria [38]. This difference in the trend of HCV prevalence among pregnant women could be due to exposure and location differences. Variations in individual immunity could also contribute to this differing trend. Similarly, there was no statistically significant association between HIV positivity and Gravidity ($P \leq 0.89$). This suggests that the gravidity of the subjects did not affect HIV contraction; rather all women had the same predisposition to HIV infection when exposed to the Virus regardless of their gravidity status. The slightly higher HIV prevalence of 5.98% among the multigravidae against 5.61% among the primigravidae suggests presence of few cases of sexual transmission on prolongs marital intimacy. This is similar to a report of less HIV prevalence among the Primigravid against multigravid subjects in Rwanda in 2013 but contrary to a previous report of 6.0% among the primigravidae against 3.1% among multigravidae in 2010 in Niger Delta, Nigeria [22, 38]. These similarities in trends could be associated with either effective protective measure among the primigravid or less risky exposures to the Virus in such locations. On the other hand, differences in trends could be influenced by cultures and differing lifestyles at different locations.

5. Conclusion and Recommendations

This study revealed low HCV prevalence rate of 1.4% and a high HIV prevalence rate of 5.80% among pregnant women attending ante-natal in some hospitals within the Kaduna metropolis. In addition, a low prevalence rate of 0.40% of HCV-HIV co-infection was recorded. Potential risk factors identified to be associated with the spread of HCV among the population studied include; history of one HCV positive sexual partner ($P \leq 0.04$) , history of more than two sexual partners ($P \leq 0.01$), women within ages 36-40 ($P \leq 0.02$), pregnant women with unknown gestational state ($P \leq 0.0002$), pregnant women at a gestational state of 4-6 months ($P \leq 0.03$), marital status particularly the unmarried ($P \leq 0.025$). All the probability values revealed no significant associations between the demographic factors and HIV positivity suggesting that these studied factors did not impact on the HIV positivity of the subjects, rather all persons had the same tendency of contracting the HIV when exposed regardless of the source.

In view of the above observations, it could be recommended that;

(1) The female population needs to be enlightened through public campaigns or health service delivery regarding personal hygiene and protective measures against viral infections particularly HCV and HIV.

(2) More research works need to be carried out on HCV, particularly on vaccine production.

(3) Governments and institutions should subsidize the drugs for the treatment of HCV infected cases.

(4) The society should uphold high moral standards to prevent contraction of infection through high leveled promiscuity.

References

[1] Duru M. U., Aluyi H. S. A., Anukam K. C. (2009). Rapid screening for co-infection of HIV and HCV in pregnant women in Benin City Edo State, Nigeria, *African Health, 9 (3), 137-142.*

[2] Levinson, W. (2013). Review of Medical Microbiology. Twelve Edition, McGraw Hill Companies Inc. pp. 324-326.

[3] Inyama P. U., Uneke O. J., Anyama G. T., Njoku O. M., Idoko J. A. (2005). Prevalence of antibody to Hepatitis C Virus among Nigerian patients with HIV infections. *Online Journal of Health and Allied Sciences*. 2:2 Volume 4, pp. 1-6.

[4] Arash Mohebati, John Mihrah Davis and Donald E. Fry (2010). Current risks of occupational blood borne viral infections. *Surgical infections* volume 11. Number 3. pp. 1-8.

[5] http://hepc.liverfoundation.org/diagnosis/symptoms-of-hep-c/.

[6] http://www.who.int/mediacentre/factsheets/fs164/en/.

[7] http://www.cdc.gov/hiv/basics/statistics.html.

[8] Lynn E. Taylor, Tracy Swan and Kenneth H. Mayer (2012). HIV Coinfection with Hepatitis C Virus: Evolving Epidemiology and Treatment. *Clinical infectious disease. Volume 55, Issue supp1. pp. S33-S42.*

[9] Negasse Berhe, Desalegu Tegabu and Mekuriaw Alemayehu (2013). Effects of nutritional factors on adherence to antiviral therapy among HIV-infected adults: a case cohort study in Northern Ethiopia. *BMC infectious diseases*: Doi 10. 1186/1471-2334-13-233.

[10] http://www.cdc.gov/hepatitis/populations/hiv.htm.

[11] Modou Jobarteh, Marine Malfroy, Ingrid Peterson, Adam Jeng, Ramu Sarge-Njie, Abraham Alabi, 1Kevin Peterson, Matt Cotten, Andrew Hall, Sarah Rowland-Jones, Hilton Whittle, Richard Tedder, Assan Jaye and Maimuna Mendy (2010). Seroprevalence of Hepatitis B and Hepatitis C Virus in HIV-1 and HIV-2 infected Gambians. *Virology Journal doi. 1186/1743-422x-7-230.*

[12] Syed Asad Ali, Rafe M. J. Donahue, Huma Qureshi, Sten H. Vermund (2009). Hepatitis B and Hepatitis C in Pakistan: Prevalence and Risk Factors. *International Journal of Infectious Disease. 13. 9-19.*

[13] Laiya Devi Goyal, Sharanjit Kaur, Neerja Jindal and Harpreet Kaur (2014). HCV and Pregancy. Prevalence, Risk Factors and Pregnancy outcomes in North Indian Population: A case-control study. *Journal of Obstetrics and Gynecology of India. doi. 10. 1007/s13224-014-0548-x.*

[14] Rubina Sabir, Ozma Noor Osman, Tabassum Mahboob (2013). Frequency of HBsAgand Anti-HCV IN Ante-Natal population. *JUMDC Volume 4, Issue 2, pp37. 41.*

[15] Nagababu Pyaddla, Soumendra Nathmaity, Jyothnath Kothapalli, Anbreesh K. Goud, Radaneeh Borugadda, Prudhvi Chand Makepadd, Rathnagiri, Polavarapu (2016). Seroprevalence of HCV infection among pregnant women in a rural teaching hospital Sangareddy, India. *International Journal of Research Development in Pharmacy and Life Sciences. Volume 5. No 4, pp. 2251-2254.*

[16] Khamis H. H., Farghaly A. G., Shatat H. Z., El-Ghitany E. M. (2006). Prevalence of Hepatitis C Virus infections among pregnant women in a rural District in Egypt. PubMed. National Institute of of Health. doi. 10. 1177/004947551.

[17] Oluboyo, B. O., Ugochukwu V. I., Olubuyo A. O., Ihim A. C., Chukwuma G. O., Ogenyi S. I., Oyenmelukwe A. (2014). Prevalence of Hepatitis B and C Viral infections in pregnant women attending ante-natal Clinic in Nnewi, Nigeria. *European scientific Journal Volume 10, No 3, ISSBN 1857-788 pp. 434-441.*

[18] Sheyin Z, Jatau E. D., Mamman A. I., Randawa A. J. and Bugwan A. I. (2012). Detection of Hepatitis C Virus among pregnant women in Kaduna State, Nigeria. *Wudpecker Journal of Medical Sciences*. Volume 12. pp. 12-15.

[19] Opaleye O. O., Igboama M. C., Ojo J. A., Odewale G. (2016). Seroprevalence of HIV, HBV, HCV and HTLV among pregnant women in South Western Nigeria. *Journal of Immunoassay and Immunochemistry. 37 (1). 29-42Pubmed Doi. 1080/1532189-2015, 1040/60.*

[20] Angelica Espinosa Miranda, Valdir Monteiro Pinto, Willi Mc Farland and Kimberly Page (2014). HIV infection among young parturient women in Brazil: Prevalence and associated risk factors. *NCBI. National Institute of Health. doi. 10. 1007/s10461-013-0534-9.*

[21] Cynthia L. Gay, Victor Nwapasa, David M. Murdoch, Jesse J. Kwiek, Susan Fiscus, Steven R. Meshnick and Myron S. Cohen (2010). Acute HIV infection among pregnant women in walawi. National Institute of Health Diagn Microbiol Infectious Diseases. 66 (4). pp. 356-360. doi. 10. 1016.

[22] R. Kabera and L. King (2013). Prevalence of HIV infection among Pregnant women at Kabutare District Hospital Rwanda. *East and Central African Journal of Surgery. Volume 18, No 3, . 89-93.*

[23] A. S. Sagay, S. H. Kapiga, G. E. Imade, J. L. Sankale, J. Idoko (2005). HIV infection among pregnant women in Nigeria. *International Journal of Gynecology and obstetrics 99. 61-67.*

[24] Obi, R. K., Iroagba, I. I. and Ojiako, O. A. (2007). Prevalence of Human Immunodeficiency Virus (HIV) infection among pregnant women in an ante-natal clinic in Port-Harcourt, Nigeria. *African Journal of Biotechnology. Volume 6 (3). pp. 263-266.*

[25] I. S. Ndams, I. A. Joshua, S. A. Luka, H. O. Sadiq, S. B. Ayodele (2010). Human Immunodeficiency Virus seroprevalence among pregnant women in Minna, Nigeria. *Annals of Nigerian Medicine*. Volume4, Issue1 pp. 14-17.

[26] Baronceli S., Pirillo M. F., Amici R., Tamburrini E., Genovese O., Ravizza M., Maccabruni A., Masuelli G., Guaralli G., Liuzzi G., Panneti C., Glacomet V., Degli Antoni A., Vimercati A., Dalzero S., Sacchi V. and Florida M. (2016). HCV-HIV Coinfected pregnant women: Data from a multicentre study, Italy. *Nature Journal Volume 44, Issue 2. pp. 235-242.*

[27] Moctar T. A. Zeba, Simplice D. Karou, Tani Sagna, Florencia Djigma, Cyrille Bisseye, Djeneba Ouermi, Virginio Pietra, Salvatore Pignatelli, Charlemagne Gnoula, Josept D. Sia, Remy Moret, Jean-Baptiste Nikiema and Jacques Simpore (2011). HCV Prevalence and Coinfection with HIV among pregnant women in Saint Camille Medical Centre, Ouagadougou. *Tropical Medicine and International HealthVolume 16, No1 pp. 1392-1396.*

[28] Nicole Ngo-Giang-Huong, Gozangue Jourdain, Wasna Sirirungsi, Luc Decker, Woottichai Khamduang, Sophie Le Coeur, Surat Sirinotankan, Rosalin Somsamai, Karin Pagdi, Jittapol Hemvuttiphan, Kenneth Mclntosh, Francis Barin, Marc Lalleman (2010). Human Immunodeficiency Virus-Hepatitis C Virus coinfection in pregnant women and perinatal transmission to infants in Thailand. *International Journal of Infectious Disease. Volume 14, Issue 7, pp. 602-607.*

[29] Opaleye O. O., Igboama M. C., Ojo J. A. and Odewale G. (2016). Seroprevalence of, HBV, HCV and HTLV among Pregnant in Southwestern Nigeria. *Journal of Immunoassay and Immunochemistry. 37 (1). 29-42.*

[30] Agwale S. M., Tanimoto L., Womack C., Odama L., Leung K., Duey D., Negedu-Momoh R., Audu I., Mohammed S. B., Inyang U., Graham B., Ziermann R. (2004). Prevalence of HCV coinfection in HIV infected individuals in Nigeria and characterization of HCV genotypes. *Journal of Clinical Virology. Volume 31. Supplement 1, pp. 3-6.*

[31] Isa, I. M., Abdullahi, S. A., Sani, M. A., Esona, M. D. (2015). Seroprevalence of hepatitis B virus in a tertiary institution in North Western Nigeria. *African Journal of Microbiology Research.* Volume. 9 (3), pp 171-179, 21.

[32] Arya, R., Autonisamy, B., Kumar, S. (2012). Sample Size Estimation in Prevalence Studies, *Indian Journal of Pediatric*s Volume 79, Issue 11, pp 1482-1488.

[33] Waje Timothy, Muhammad Yusha'u, Dadah Anthony, Maikaje Dominic Bawa (2016). A comparative study on Hepatitis B Surface Antigen (HBsAg) Seroprevalence between Outpatients in Public and Private Hospitals within Kaduna Metropolis, Nigeria. *American Journal of Epidemiology and Infectious Disease. Volume 4, Issue 3. pp. 47-63.*

[34] Jason J. Pirozzolo, Donald C. Lemay (2007). Blood Borne Infections. *Clinics in Sports Medicine. Volume 26, Issue 3, pp. 425-431.*

[35] http://www. cdc. gov/niosh/topics/bbp/genres. html. 2016.

[36] Favour Osazuwa, Onah Victor Obinna and Anikwe Victor Chika (2012). Sero-epidemiology of Human Immunodeficiency Virus (HIV), Hepatitis B and C among pregnant women in Rural Communities of Abaji Area Council, Nigeria. TAF Preventive Medicine Bulletin: 11 (4), pp. 431-438.

[37] Mohammed Hanafiah K., Groeger J., Flaxman S. T., Wiersma S. T. (2013). Global Epidemiology of Hepatitis C infections: new estimates of age specific antibody to HCV. CDC: 2015 *Hepatology*: Volume 57, Issue 4. pp. 1333-1342.

[38] Buseri, F. I., Seiyaboh, E. and Jeremiah, Z. A. (2010). Surveying Infections among pregnant women in the Niger Delta, Nigeria. *Journal of Global Infectious Disease. 2 (3). pp. 203-211.*

[39] Chinenye Gloria Anaedobe, Victor Ugochukwu Nwadikeand Adeola Fowotade (2016). Hepatitis C Virus among pregnant women in, Nigeria: Prevalence, Correlates and Coinfection with HIV. I*nternational journal of Tropical Disease and Health. 14 (1). pp. 1-11.*

[40] Zaccheaus Awortu Jeremiah, Baribefe Kaote, Fiekumo Buseri and Felix Emelike (2008). Prevalence of antibody to HCV in apparently healthy portharcourt blood donors and association with blood groups and other risk indicators. US national Liberary of Medicine: Blood Transfusion 6 (3): 150-155.

[41] Kenneth G. Castro, M. D. John W. Ward, M. D. Laurence Slutsker, M. D., M. P. H. James W. Buehler, M. D. Harold W. Jaffe, M. D. Ruth L. Berkelman, M. D. (1993). Revised Classification System for HIV Infection and Expanded Surveillance case definition among adolscents and Adults. CDC Staff Report mmwrq@cdc.gov.

[42] Bala, J. A., Kawo, A. H., Mukhtar, M. D., Sarki, A., Magai, N., Aliyu, I. A. and Sani, M. N. (2012). Prevalence of Hepatitis C Virus infections among blood donors in some selected hospitals in Kano, Nigeria. *International Research Journal of MicrobiSerology (IRJM).* ISSN: 2141. pp. 217-222.