

# Prevalence and Risk Factors of Hepatitis C Viral Infection Among Pregnant Women at a Tertiary Institution in Lagos, Nigeria

Ngozi Nwabuogo Anayochukwu-Ugwu<sup>1</sup>, Innocent Anayochukwu Ugwu<sup>2, \*</sup>,  
Joseph Tochukwu Enebe<sup>2</sup>

<sup>1</sup>Department of Medical Laboratory Science, Federal Neuropsychiatric Hospital, Enugu, Nigeria

<sup>2</sup>Department of Obstetrics and Gynaecology, College of Medicine, Enugu State University of Science & Technology (ESUT) and ESUT Teaching Hospital, Parklane, Enugu, Nigeria

## Email address:

ngoziyanayo2004@yahoo.com (Ngozi Nwabuogo Anayochukwu-Ugwu), innocent.ugwu@esut.edu.ng (Innocent Anayochukwu Ugwu),  
Joseph.enebe@esut.edu.ng (Joseph Tochukwu Enebe)

\*Corresponding author

## To cite this article:

Ngozi Nwabuogo Anayochukwu-Ugwu, Innocent Anayochukwu Ugwu, Joseph Tochukwu Enebe. Prevalence and Risk Factors of Hepatitis C Viral Infection Among Pregnant Women at a Tertiary Institution in Lagos, Nigeria. *International Journal of Infectious Diseases and Therapy*. Vol. 8, No. 1, 2023, pp. 23-30. doi: 10.11648/j.ijidt.20230801.13

**Received:** January 26, 2023; **Accepted:** February 17, 2023; **Published:** February 28, 2023

---

**Abstract:** Hepatitis C viral infection is a blood borne disease caused by Hepatitis C virus (HCV). It is significantly associated with morbidities and mortalities in men and women. Infection mostly occurs via contact with blood from transfusion of unscreened blood as well as blood products, illicit parenteral drug use (sharing of injection needles), unsafe health care and injection practices. Women who are pregnant and their unborn babies and infants are among the group of people less commonly talked about when the disease burden of HCV is being discussed in Nigeria. This study therefore aimed to ascertain the prevalence of hepatitis C virus infection among the pregnant women as well as the risk factors associated with the acquisition of the infection. Four hundred consenting antenatal attendees at the Lagos Island Maternity hospital, Nigeria were recruited and their blood samples were taken for analysis. A pretested and validated semi structured questionnaire was used to obtain information on risk factors for Hepatitis C Virus infection and socio demographic characteristic of participants. Univariate analysis was performed to obtain proportions and frequencies. In order to uncover additional risk variables for HCV infection, bivariate data analysis was carried out. Chi-square test was performed to assess statistical significance which was assumed at 0.05%. The mean age of the study subjects were 30.6 years with a standard deviation of  $\pm 5.0$  years. Majority of the study subjects 133 (33.2%) were in the age group of 30-34, most of them 238 (59.5%) had tertiary education, 396 (99.0%) were married, 110 (27.5%) were traders and 329 (82.3%) were of monogamous family setting. There was an overall sero-prevalence of 1.5% among the pregnant women with a higher prevalence of 1.25% among pregnant women who had more than one delivery (multiparous women) and 0.25% among pregnant women who had no previous delivery (nulliparous women). The risk factors that were significantly associated with the transmission of HCV infection included "Tattoo/Scarification ( $P=0.002$ )" and "sharing of sharps and needles" ( $P=0.015$ ). There is the need for effective public education on the ways of spread of HCV virus, practice of universal precautionary measures, adequate sterilization of instruments, appropriate use of injections, safe disposal of waste and sharps and avoidance of other high risk behavior that may lead to HCV infection. A more lager studies on the epidemiology of HCV infection is needed to inform health policy makers on strategies for prevention, screening, control and treatment of HCV infection.

**Keywords:** Hepatitis C Virus, Prevalence, Risk Factors, Pregnant Women

---

# 1. Introduction

Hepatitis C viral infection is caused by hepatitis C virus (HCV) which is an enveloped single stranded RNA virus that belong to the flaviviridae family and is significantly associated with morbidities and mortalities in men and women [1]. It can cause both acute and chronic hepatitis which may eventually result in liver cirrhosis, cancer or even death of the infected person [2, 3]. It is estimated that globally, about 58 million individuals do have chronic hepatitis C infection with nearly 1.5 million additional infections occurring yearly [4]. There are also about 3.2 million children and adolescent who are chronically affected with hepatitis C infection. In 2019, it was noted that hepatitis C viral infection killed 290,000 people most due to hepatocellular cancer and liver cirrhosis [4]. This disease poses a global public health challenge and it has been postulated that mortalities from liver disease will continue increasing over the next 20 years [5].

Hepatitis C viral infection is a blood borne disease and infection mostly occur via contact with blood from transfusion of unscreened blood as well blood products, illicit parenteral drug use (sharing of injection needles), unsafe health care and injection practices [4]. The disease can also be transmitted from an infected pregnant woman to her baby and also through sexual practices that may result in blood exposure (having multiple sexual partners and men having sex with men) though these means of transmission are really less common [4]. Women who are pregnant as well as their unborn babies and infants are among the group of people less commonly talked about when the disease burden of HCV is being discussed [6]. The prevalence of HCV among the pregnant women ranges from 0.15% to 2.4% in low income countries but with a higher estimate of about 8.6 % in the sub Saharan African population [7, 8]. Factors responsible for increase in perinatal transmission risk include transfusion of poorly screened or unscreened blood and blood products, high HCV viral load in mother, illicit parenteral use of drugs and co infection with other sexually transmitted diseases like HIV [9, 10] unsafe surgical practices and concomitant alcoholism [11].

In Nigeria, there are studies on prevalence and risk of HCV in pregnancy [6, 12]. Routine diagnosis of HCV infection is often limited to screening of blood donors [13]. There are very few number of women presenting as blood donors in most of the states of the country when compared with the men, therefore, data on the distribution of this disease among women is lacking [13]. In the country routine screening of pregnant women is not practiced and often considered not justified since there is absence of HCV vaccine, absence of intervention to mitigate vertical transmission of HCV infection [8]. Nevertheless, testing pregnant women for HCV will assist in identifying women who are asymptomatic but chronic carriers at risk of transmitting the disease to their household and children, as well as discover those that may gain from monitoring or treatment. Though there is no recognizable vaccine for prevention of HCV infection, WHO recommends treatment

with ‘pan-genotypic direct-acting antivirals (DAAs)’ for children up to 3 years, adolescents and adults who have chronic hepatitis C infection [4].

Pregnant women who are at a higher risk of having HCV infection should be screened for the disease and if they are positive, must be confirmed by having HCV RNA test done. This however is not done in Lagos state, Nigeria. There is thus scarcity of published data and limited knowledge on chronic HCV infection as well as on the actual risk associated with mother to child transmission. Given the fact that majority of HCV infection in the perinatal period are asymptomatic but later present with long term complications during adulthood with associated increased financial burden, ill-health and death, there is need for early and accurate diagnosis among pregnant women in order to encourage healthy and safe control and preventive practices that will decrease mother to child transmission of HCV infection. This study therefore aimed to ascertain the prevalence of hepatitis C virus infection among the pregnant women as well as the risk factors associated with the acquisition of the infection. The findings of this study are expected to inform obstetrics policy and programme development for a more efficient response to this disease through further advancement of HCV virus infection prevention, treatment and care in mothers and their infants.

# 2. Methodology

## 2.1. Description of Study Area/Setting/Population

Lagos state Nigeria is located in South Western part of the country with an estimated population of 17,552942 people and has a population density of 5000 persons/Kilometer, making the state one of the most densely populated cities in African continent [14]. Lagos Island Maternity Hospital remains one of the foremost maternity hospitals in Nigeria. It is owned by the Lagos state government. The hospital has 215 beds and a complementary neonatal (Special Care baby) unit. It is a specialist hospital that takes care of all obstetrics and gynecological problems in Lagos Island. It also receives referrals from other private hospitals, other Lagos State government hospitals, and also from tertiary institutions from Lagos environs and other states as well as from the surrounding hospital located in the suburbs of the city [15]. It is now a center for post graduate training in Obstetrics and Gynecology, and in Family Medicine. The hospital has an average of over 7000 antenatal attendees annually.

## 2.2. Study Population

The participants of this study were women attending antenatal care in the Lagos Island Maternity Hospital. These women were from different areas of the country but predominantly indigenes from the southern part. Risk factors for HCV infections such as female circumcision, polygamy, early marriage and sexual intercourse, tattooing, pedicure, manicure and sharing of sharp instruments are common practices in the surrounding area of the hospital making it a suitable setting for this study.

### 2.3. Study Design

This was a cross-sectional study. Consenting antenatal attendees at the Lagos Island Maternity hospital, Nigeria were recruited between March and October 2015 and their blood samples were taken for analysis. A pretested and validated semi structured questionnaire was used to obtain information on risk factors for Hepatitis C Virus infection and socio demographic characteristic of participants.

### 2.4. Inclusion/Exclusion Criteria

Pregnant women greater than or up to 15 years of age, attending antenatal care and who gave informed consent were included in the study. Those who were too ill to participate and those who did not give consent were excluded.

### 2.5. Sample Size Determination

This was calculated to provide a 95% confidence level, an error margin of plus or minus 5% making use of previous study of prevalence of HCV among pregnant women attending antenatal care in Southwest Nigeria which was 3.9% [16]. A total of four hundred (400) pregnant women (after correcting for 10% non-response) were recruited.

### 2.6. Ethical Considerations

Ethical approval was sought and obtained from Lagos State Government/ Lagos State University Teaching Hospital, Ikeja ethical committee with ethical certificate Number LREC/10/06/531. A written informed consent was got from each participant after a thorough explanation in a clear and simple language of the study concept before recruitment into the study. Participation was voluntary. Privacy, anonymity and confidentiality were also maintained.

### 2.7. Data Collection

Data was gathered using a quantitative approach. This was achieved through the use of a semi-structured interviewer-administered questionnaire and laboratory testing. The questionnaire and serologic data were connected using individual identity and serial numbers. All other items for an individual, such consent forms, followed the same code. During the data analysis, this code was also used for an individual's data.

#### 2.7.1. Collection and Handling of Specimens

Approximately 4 ml of venous blood was drawn and properly labeled in plain sample bottles using the participant's unique serial number and code from their completed questionnaires. This was done in accordance with the general safety precautions. After allowing the samples to coagulate, clot-containing samples were centrifuged at 2,500 rpm for five minutes. Serum was extracted from cells using a micropipette and put into tiny vials that were properly labeled with the accompanying serial numbers and codes and then stored at -8°C in the freezer. This process was done on every antenatal clinic visit days.

#### 2.7.2. Laboratory Investigations

The serum samples were subjected to an anti-HCV screening test utilizing a fast chromatographic immunoassay kit (DiaSpot HCV One Step and ACON Hepatitis C Test Strip). Assays were conducted at room temperature. As the test strips needed to acclimatize to room temperature before testing, the vials were allowed to attain room temperature before being opened. The test strip was placed vertically into the serum for 10–15 seconds with the arrows pointing downward. The maximum line (MAX) on the strip was followed to prevent crossing it. The strip was set down on a non-absorbent surface, and a ten-minute countdown was started to see if the red line would form. The concentration of HCV present in the specimen affects how intensely the red color is on the test line. Any shade of red in the test (T) region was therefore regarded as positive. Negative results included one red line on the control (C) region and no red color at all on the test (T) region. According to the manufacturer's instructions, all specimens that tested positive were confirmed using an ELISA of the third generation ((MONOLISA anti-HCV plus version 2, Biorad, Marnes-La-Coquette, France). To prevent confusion and record errors, test results were promptly recorded on the matching serial numbers and codes.

### 2.8. Data Analysis

Analysis was done using the Statistical Package for Social Sciences (SPSS). Univariate analysis was performed to obtain proportions and frequencies. In order to uncover additional risk variables for HCV infection, bivariate data analysis was carried out. Chi-square test was performed to assess statistical significance which was assumed at 0.05%.

## 3. Result

### 3.1. Socio-Demographic Characteristics of Respondents

Table 1 showed the socio demographic variables of study participants. A total of 400 pregnant women were included in this study. The mean age of the study subjects were 30.6 years with a standard deviation of  $\pm 5.0$  years. Majority of the study subjects 133 (33.2%) were in the age group of 30-34, most of them 238 (59.5%) had tertiary education, 396 (99.0%) were married, 110 (27.5%) were traders and 329 (82.3%) were of monogamous family setting.

**Table 1.** Socio-demographic variables of respondents.

Variables	Frequency (n=400)	Percentage (%)
Age-group		
15-19	2	0.5
20-24	43	10.8
25-29	129	32.0
30-34	133	33.2
35-39	79	19.8
40-44	11	3.0
$\geq 45$	3	0.7
Mean age	30.6 $\pm$ 5.0 SD	
Education		
No education	23	5.7
Primary	14	3.5

Variables	Frequency (n=400)	Percentage (%)
Secondary	125	31.3
Tertiary	238	59.5
Marital status		
Single	4	1.0
Married	396	99.0
Occupation		
Unemployed	93	23.2
Semi-Skilled	101	25.3
Traders	110	27.5
Civil servants	66	16.5
Health workers	30	7.5
Family Settings		
Monogamous	329	82.3
Polygamous	71	17.7

Table 2 showed the obstetrics history of respondents. Parity status showed that about 233 (58.3%) had more than one previous deliveries (multiparous), 198 (50.4%) had 1-2 living children, and 201 (50.3%) were in their second trimester.

**Table 2.** Obstetrics history of respondents.

Variables	Frequency (n=400)	Percentage (%)
Parity		
Nulliparous	167	41.7
Multiparous	233	58.3
No of Living Children		
0	170	43.3
1-2	198	50.4
≥3	25	6.3
Trimester		
1 <sup>st</sup>	33	8.2
2 <sup>nd</sup>	201	50.3
3 <sup>rd</sup>	166	41.5

### 3.2. Sero-Prevalence of HCV Antibodies Among Respondents

Table 3 showed sero-prevalence of HCV antibodies among respondents. Six (6) of the respondents were positive for HCV antibodies, showing a sero-prevalence of 1.5%

**Table 3.** Sero-prevalence of HCV antibodies among respondents.

Result of anti HCV	Frequency (n=400)	Prevalence (%)
Positive	6	1.5
Negative	394	

Table 4 showed sero-prevalence of HCV infection and Age of respondents. The sero-prevalence of HCV Infection was 1.25% among respondent aged 30-39 years and 0.25% among respondents aged 40-49 years.

**Table 4.** Sero-prevalence of HCV infection and Age of respondents.

Age (Years)	Frequency n=400	HCV Sero-positivity	Prevalence (%)
19-29	174	0	0.00
30-39	212	5	1.25
40-49	14	1	0.25
Total	400	6	1.5

Table 5 showed that sero-prevalence of HCV infection was 1.25% among pregnant women who had more than one delivery (multiparous women) and 0.25% among pregnant

women who had no previous delivery (nulliparous women).

**Table 5.** Sero-prevalence of HCV infection and parity of respondents.

Parity	Frequency (n=400)	HCV Sero-positivity	Prevalence (%)
Nulliparous	167	1	0.25
Multiparous	233	5	1.25
Total	400	6	1.5

### 3.3. Risk Factors for Transmission on HCV Infections

Table 6 showed frequency of risk factors for transmission of HCV infection among the study population. Thirty seven (9.3%) of respondents had been transfused in the past, 1 (0.3%) had used intravenous drug without doctor's prescription, 290 (72.5%) had undergone surgeries, 85 (21.3%) were circumcised, there was a history of multiple sexual partners in 118 (29.5%), 8 (2.0%) had sex with HCV Infected persons, 44 (11.0%) had tattoo/scarification marks, 130 (32.5%) had shared sharp objects and needles, 118 (29.5%), 23 (5.7%), and 1 (0.3%) have had history of D&C, jaundice and hemodialysis respectively and 11 (2.8%) had being in close contact with hepatitis C case.

**Table 6.** Frequencies of risk factors for transmission of HCV among respondents.

Variable	Frequency (n=400)	Percentage (%)
History of blood transfusion		
Yes	37	9.3
No	363	90.7
History of IV Drug Use		
Yes	1	0.3
No	399	99.7
History of Surgery		
Yes	290	72.5
No	110	27.5
Circumcision		
Yes	85	21.3
No	315	78.7
Multiple sexual partners		
Yes	118	29.5
No	282	70.5
Sex with infected person		
Yes	8	2.0
No	392	98.0
Tattoo/Scarification		
Yes	44	11
No	356	89
Sharing of sharps and needles		
Yes	130	32.5
No	270	67.5
History of Dilatation & Curettage		
Yes	118	29.5
No	282	70.5
History of Jaundice		
Yes	23	5.7
No	377	94.3
History of Haemodialysis		
Yes	1	0.3
No	399	99.7
Close contact with hepatitis C person		
Yes	11	2.8
No	389	97.2

### 3.4. Bivariate Analysis

As shown in table 7 below, the risk factors that are

significantly associated with the transmission of HCV infection included “Tattoo/Scarification” (P=0.002) and “sharing of sharps and needles” (P=0.015).

**Table 7.** Association between HCV infection and risk factors for HCV transmission among respondents.

Variables	HCV sero-positivity		X <sup>2</sup>	DF	P value
	Yes	No			
History of blood transfusion			4.2	1	0.099
Yes	2 (33.3)	35 (8.9)			
No	4 (66.7)	359 (91.1)			
History of IV Drug use			0.5	1	0.415
Yes	1 (2.9)	5 (1.4)			
No	33 (97.1)	361 (98.6)			
History of Surgery			4.7	1	0.051
Yes	4 (66.7)	106 (26.9)			
No	2 (33.3)	288 (73.1)			
Circumcision			3.0	1	0.113
Yes	3 (50.0)	82 (20.8)			
No	3 (50.0)	312 (79.2)			
Multiple sex partner			4.1	0.065	0.065
Yes	4 (66.7)	114 (28.9)			
No	2 (33.3)	280 (71.1)			
Sex with infected person			6.7	1	0.115
Yes	1 (16.7)	7 (1.8)			
No	5 (83.3)	387 (98.2)			
Tattoo/Scarification			19.8	1	0.002*
Yes	4 (66.7)	40 (10.2)			
No	2 (33.3)	354 (89.8)			
Sharing of sharps and needles			7.2	1	0.015*
Yes	5 (83.3)	125 (31.7)			
No	1 (16.7)	269 (68.3)			
History of D&C			4.1	1	0.065
Yes	4 (66.7)	114 (28.9)			
No	2 (33.3)	280 (71.1)			
History of Jaundice			0.1	1	1.000
Yes	0 (0.0)	23 (5.8)			
No	6 (100.0)	371 (94.2)			
History of Haemodialysis			0.1	1	1.000
Yes	0 (0)	1 (0.3)			
No	6 (100)	393 (99.7)			
Close contact with Hepatitis C person			0.1	1	1.000
Yes	0 (0)	11 (2.8)			
No	6 (100)	383 (97.2)			

\*Statistically significant

## 4. Discussion

This current study was aimed to ascertain the prevalence of hepatitis C virus infection among the pregnant women as well as the risk factors associated with the acquisition of the infection. The evidence from this study may be used to detect gaps in HCV screening during ANC by healthcare professionals; create more awareness on the associated risk factors for HCV infection. This study showed an overall sero-prevalence of 1.5% among the pregnant women with a higher prevalence of 1.25% among pregnant women who had more than one delivery (multiparous women) and 0.25% among pregnant women who had no previous delivery (nulliparous women). The risk factors that are significantly associated with the transmission of HCV infection included “Tattoo/Scarification” (P=0.002) and “sharing of sharps and needles” (P=0.015).

The sero-prevalence of hepatitis C antibodies of 1.5% found in this study is similar to that of moderate grading of HCV infection according to the World Health Organization. Hepatitis C virus infection can be graded as high, moderate or low when the prevalence is > 3.5%, 1.5% - 3.5% and < 1.5% respectively [17]. This finding is comparable with prevalence of 1.86% found in 269 booked pregnant women attending the University of Benin Teaching Hospital, Benin City, Edo-State [18], 1.39% found among 649 pregnant women at Federal Medical Centre (FMC), Ekiti, Ekiti State [19], and 1.1% found among 267 pregnant women attending Igbinedion University Teaching Hospital Okada, Edo-State [20]. This prevalence is also similar to prevalence of 1.8% reported for the obstetric population in a western African neighbor, Cameroon [21], and 1.03% observed in India [22]. However, the prevalence of HCV infection in this study was higher than the 0.5% recorded among pregnant women in Yenagoa [23], 0.4% found among pregnant women in

Calabar [13], 0.1% in Turkey [24], 0.3% in Sudan [25]. Again, this prevalence is lower than 9.2% reported in Osun State [16], 3.6% recorded in Edo State [26] 2.1% in Gabon [27] and 8.5% in Sana'a Yemen [28]. These studies' differential prevalence rates could be attributed to a variety of factors, including test kit sensitivity and specificity, varying sample sizes, demographic features of the study population, and variations in sociocultural practices. Regional variations in the risk factors for HCV infection may possibly be the cause of these discrepancies.

The age of acquiring infection is the major determinant of the incidence and prevalence rates [19]. Hepatitis C infection is known to increase with age; seropositivity has been shown to rise till the age of 40 and then drop over time [27]. In this study, pregnant women in the age range of 30-39 years were observed to have more prevalence of HCV infection. This is comparable to the study conducted in which pregnant women in the age range of 26-35 years were found to have high prevalent rate of HCV [19]. This is also comparable with age group 32-36 years found to have high prevalent rate of HCV infection [26]. However this is in contrast to higher proportion of persons aged 40 years and above found to be hepatitis C positive compared to persons aged 40 years and below found in a study conducted in the general population [29]. This variation in age may be as a result of difference in sociocultural practices among the different population in which the studies were conducted.

The increased HCV prevalent rate observed in the age group (30-39years) may be as a result of increase chance of exposure in each pregnancy. Most of the HCV sero-positive women were found to be multiparous. This is similar to the findings by Esan *et al* [19] and Ugbebor *et al.* [26]. This could be due to increase chances of exposure to some risk factors (like blood transfusion, surgical procedures etc.) as chances of exposure to HCV infection becomes greater with each pregnancy and child birth. When determining the likelihood that a person has HCV infection, it is important to take into account any aesthetic alterations such as body piercings or tattoos, cultural traditions that permit female circumcision and scarification marks, as well as dangerous injection habits [6]. In this study, "tattoos/scarification" and "sharing of sharp objects" were significantly associated with HCV infection. This may be due to poor Infection Prevention Control (IPC) practices in many referral centers where tattoo and scarification are practiced. Also, these acts may involve the use of sharp objects like needles. Tattoos, scarification, body piercing, acupuncture and tribal marks are widespread practices in Africa, and have been linked to HCV and other similar diseases transmission by researchers [30]. This signifies the need for more effort to be channeled to continue educational campaign and national public enlightenment on infection prevention control practices as well as proper sterilization procedures. Nevertheless, considering the strength of the sample size of this study, caution should be applied as these findings may not be generalized. Further population and multi-center studies are needed.

Though there were increasing number of HCV sero-

positivity among those who had blood transfusion in this study, it was not statistically significant. This was also observed in Calabar [13] but differs from the findings reported in Congo [31] and in Ibadan [6] where blood transfusion is a risk factor significantly associated with HCV transmission. Before the advent of HCV testing, transfusion related infection was a major risk factor for HCV globally [32] and in populations that are implementing routine blood screening of donors, this has been mostly eliminated. Nevertheless in other communities, use of unsafe blood and its products remains the predominant risk of infection [32]. Continued use of commercial blood donors by some countries remains a major contributory factor [33].

## 5. Conclusion

The overall sero-prevalence of anti- HCV is 1.5% among the pregnant women studied in Lagos, Nigeria. The risk factors that are significantly associated with the transmission of HCV infection included "Tattoo/Scarification" and "sharing of sharps and needles". There was a higher prevalence in multiparous compared to nulliparous and primiparous women. There is the need for effective public education on the ways of spread of HCV virus, practice of universal precautionary measures, adequate sterilization of instruments, appropriate use of injections, safe disposal of waste and sharps and avoidance of other high risk behavior that may lead to HCV infection. There is also the need for additional larger studies using nucleic acid testing (HCV RNA) for a more robust estimate of prevalence of HCV in pregnancy. The outcome of these studies will further inform health policy makers on strategies for prevention, screening, control and treatment of HCV infection. However, pregnant women who are at risk of having HCV infection should be offered anti-HCV testing and if found positive HCV RNA test should be done for further management.

## Acknowledgements

Many thanks to the management and staff of Lagos Island Maternity Hospital for their assistance and support throughout the period of the research.

## References

- [1] Madhava, V., Burgess, C., Drucker, E. (2002). Epidemiology of chronic hepatitis C virus infection in sub-Saharan Africa. *Lancet Infect Dis.* 2 (5): 293–302. Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3270354/> (Accessed: 28 August 2022).
- [2] Blach, S., Zeuzem, S., Manns, M, *et al.*, (2015) Global prevalence and genotype distribution of hepatitis C virus infection in 2015: a modelling study. *Lancet Gastroenterology & Hepatology*, 2 (3), 161–176.
- [3] World Health Organization, (2012) Prevention and Control of Viral Hepatitis Infection: Framework for Global Action, World Health Organization, Geneva, Switzerland.

- [4] World Health Organization (2022) Hepatitis C' Available at: <https://www.who.int/news-room/fact-sheets/detail/hepatitis-c> (Accessed 28 August 2022).
- [5] Razavi, H., ElKhoury, A. C., Elbasha, E., Estes, C., Pasini, K., Poynard, T., et al. (2013) Chronic hepatitis C virus (HCV) disease burden and cost in the United States. *Hepatology*; 57: 2164–2170.
- [6] Anaedobe, C., Fowotade, A., Nwadike, V., & Ugochukwu, (2016). Hepatitis C Virus Infection among Pregnant Women in Ibadan, Nigeria: Prevalence, Correlates and Co-infection with HIV. Available at: <https://journalijtdh.com/index.php/IJTDH/article/view/20292/37576> (Accessed 28 August 2022).
- [7] Ford, N., Kirby, C., Singh, K., Mills, E. J., Cooke, G., & Kamarulzaman, A., et al. (2012) Chronic hepatitis C treatment outcomes in low- and middle-income countries: A systematic review and meta-analysis. *Bull WHO*; 90: 540–550.
- [8] Arshad, M., El-Kamary, S. S., Jhaveri, R., (2011). Hepatitis C virus infection during pregnancy and the newborn period. *J Viral Hepat*. 18 (4), 229-236.
- [9] Ward, C., Tudor-Williams, G., Cotzias, T., Hargreaves, S., Regan, L., Foster, G. R., (2000) Prevalence of hepatitis C among Pregnant Women attending an inner London Obstetric Department: Uptake and acceptability of named antenatal testing. *Gut*. 47 (2), 277-280.
- [10] Wong, T., Lee, S. S., (2006). Hepatitis C: A review for primary care physicians. *Canadian Medical Association Journal*, 174 (5), 649-659.
- [11] Antonella, V., Stefania, B., Pier-Angelo, T., (2008) Mother-to-child hepatitis C virus transmission. *Hot Topics in Viral Hepat*. 11: 7-11.
- [12] Omunakwe, H. E., Dan-Jumbo, A., Abere, S. T., Kalio, G. B., & Oyan, B., (2019). The prevalence of hepatitis c viral among women undergoing antenatal care in Port Harcourt, Nigeria. *Nigerian Journal of Gastroenterology and Hepatology* 11 (1).
- [13] Mboto, C. I., Ebenge, I. A., Ogban, I. E., Andrew, P. J., (2010) Prevalence, Sociodemographic Characteristics and Risk Factors for Hepatitis C Infection among Pregnant Women in Calabar Municipality, Nigeria *Hepat Mon*. Spring; 10 (2), 116–120. Online Available at: <https://www.ncbi.nlm.nih.gov/pmc/articles/PMC3270354/> (Accessed 28 August 2022).
- [14] Filani, M. O., (2012). The Changing Face of Lagos: From Vision to Reform and Transformation, 8–11.
- [15] Sotunde, O. F., Sanni, S. A., Onabanjo, O. O., Olayiwola, I. O., & Agbonlahor, M. (2014). A retrospective study of the health profile of neonates of mothers with anemia in pregnancy and pregnancy induced hypertension in Lagos, Nigeria. *Journal of Public Health in Africa*, 5, 63–67. doi: 10.4081/jphia.2014.286
- [16] Ogunro, P. S., Adekanle, D. A., Fadero, F. F., Ogungbamigbe, T. O., & Oninla, S. O. (2007). Prevalence of anti-hepatitis C virus antibodies in pregnant women and their offspring in a tertiary hospital in Southwestern Nigeria. *J Infect Developing Countries*, 1 (3), 333–336.
- [17] Hanafiah, K. M., Groeger, J., Flaxman, A. D., & Wiersma, S. T. (2013). Global epidemiology of hepatitis C virus infection: New estimates of age-specific antibody to HCV seroprevalence. *Hepatology*, 57 (4), 1333–1342.
- [18] Onakewhor, J., & Okonofua, F. (2009). Seroprevalence of hepatitis c viral antidodies in pregnancy in a tertiary health facility in Nigeria. *Nigerian Journal of Clinical Practice*, 12 (March), 65–73. Retrieved from <http://www.ajol.info/index.php/njcp/article/download/45364/28847>
- [19] Esan, A. J., Omisakin, C. T., Ojo-Bola, T., Owoseni, M. F., Fasakin, K. A., & Ogunleye, A. A. (2014). Sero-Prevalence of Hepatitis B and Hepatitis C Virue Co-Infection among Pregnant Women in Nigeria. *American Journal of Biomedical Research*, 2 (1), 11–15. doi: 10.12691/ajbr-2-1-3
- [20] Oladeinde, B. H., Omoregie, R., Olley, M., Anunibe, J. A., & Oladeinde, O. (2012). Hepatitis B and C Viral Infections among Pregnant Women in a Rural Community of Nigeria. *International Journal of Basic and Applied Virology* 1, (1), (01–05, ISSN 2222–1298.
- [21] Njouom, R., Pasquier, C., Ayoub, A., Tejiokem, M., Vessiere, A. Mfoupouendoun, J., Tene, G., Izopet, J. (2005). Low risk of mother-to-child transmission of hepatitis C virus in Yaounde, Cameroon: the ANRS 1262 study. *Am J Trop Med Hyg*, 73, 460 – 466.
- [22] Kumar, A., Sharma, K. A., Gupta, R. K., Kar, P., & Chakravarti, A. (2007). Prevalence & risk factors for hepatitis C virus among pregnant women. *Indian Journal of Medical Research*, 126, 211–215.
- [23] Buseri, F., Seiyabo, E., & Jeremiah, Z. (2010). Surveying infections among pregnant women in the Niger Delta, Nigeria. *J. Global Infect Dis.*, 2, 203–211.
- [24] Altinbas, S., Erdogan, M., & Danişman, N. (2010). The seroprevalences of HBs Ag and anti-HCV in pregnant women in Ankara. *Arch Gynecol Obstet.*, 281, 371. doi: 10.1007/s00404-009-1145-6
- [25] Elsheikh, R., Daak, A., Elsheikh, M., Karsany, M., & Adam, I. (2007). Hepatitis B virus and hepatitis C virus in pregnant Sudanese women. *Virology*, 4, 104. doi: 10.1186/1743-422X-4-104
- [26] Ugbebor, O., Aigbirior, M., Osazuwa, F., Enabudoso, E., & Zabayo, O. (2011). The prevalence of hepatitis B and C viral infections among pregnant women. *N Am J Med Sci.*, 3 (5), 238–41.
- [27] Ndong-Atome, G., Makuwa, M., Njouom, R., Branger, M., Brun-Vézinet, F., Mahé, A., Kazanji, M. (2008). Hepatitis C virus prevalence and genetic diversity among pregnant women in Gabon, central Africa. *BMC Infectious Diseases*, 8, 82.
- [28] Murad, E., Babiker, S., Gasim, G., Rayis, D., & Adam, I. (2010). Epidemiology of hepatitis B and hepatitis C virus infections in pregnant women in Sana'a, Yemen. *BMC Pregnancy and Childbirth*, 13: 127.
- [29] Achinge, G., Malu, A., Mbaave, P., Bitto, T., Shaahu, V., Mohammed, H., & Misauno, M. (2013). Prevalence of Hepatitis C in Makurdi, North Central Nigeria. *IOSR Journal of Dental and Medical Sciences*, 7 (5), 2279–0861.
- [30] Olokoba, A. B., Salawu, F. K., Danburam, A., Olokoba, L. B., Midala, J. K., Badung, L. H., Olatinwo, A. (2011). Hepatitis B virus infection amongst pregnant women in North-eastern Nigeria- a call for action. *Niger J Clin Pract*. Jan-Mar; 14 (1): 10-3. doi: 10.4103/1119-3077.79232. PMID: 21493984.

- [31] Laurent, C. I., Henzel, D., Mulanga-Kabeya, C., Maertens, G., Larouzé, B., Delaporte, E. (2001) Seroepidemiological survey of Hepatitis C virus among commercial sex workers and pregnant women in Kinshasa, Democratic Republic of Congo. *Int J Epidemiol.* 30 (4): 872-7.
- [32] Obienu, O., Nwokediuko, S., Malu, A., Lesi, O. A. (2011). Risk factors for hepatitis C virus transmission obscure in Nigerian patients. *Gastroenterol Res Pract*; 939673.
- [33] Hladik, W., Kataaha, P., Mermin, J., Purdy, M., Otekati, G., Lackritz, E. et al (2006). Prevalence and screening costs of hepatitis C virus among Ugandan blood donors. *Tropical Medicine and International Health*, 11: 951-4.