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VIRAL HEPATITIS B AND C SEROPREVALENCE AMONG AT RISK POPULATION IN TARABA STATE: A SEROPREVALENCE STUDY

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Abstract

Viral hepatitis is the inflammation of the liver caused by some hepatrophic viruses that indiscriminately infect all populations with certain sub-populations being more at risk/vulnerable to the infection. The highest burden of the infection is seen in sub-saharan Africa with Nigeria belonging to the highly endemic countries with Taraba state having the highest burden in the country. It is undisputable that data regarding the prevalence of this infection is key in the prevention, management and control of epidemic by responsible bodies and authorities globally. However, data regarding viral hepatitis among at risk population remain scanty and continuous to prevail despite the endemicity of the disease in the region. It is against this background that this study determined the prevalence of the disease among some selected at risk populations in Jalingo who were seeking viral hepatitis treatment in center for initiative and development Taraba, Taraba state of Nigeria. A total of 397 individuals comprising of 160 health care workers and 237 people living with HIV were considered for the study. Total male participants were 138 and 259 females within age range of 8-80 years. Out of the total participants, 46/397(11.6%) were reported to be positive for HBV out of which 9(2.27%) were HCW and 37(9.32%) were PLHIV. However, no statistically significant association between at-risk-population and HBV was observed. A total of 54/397(13.6%) were positive to HCV out of which 17(4.28%) were HCW and 37(9.32%) were PLHIV but no significant association between at-risk population and HCV was observed. Infection by the viruses were observed in all the age groups of the population. A total of 5/397 participants (1.26%) were coinfected with viral hepatitis B and C out of which (0(0%), 1(0.25%)) were Males and females HCWs respectively while (0(0%), 4(1.01%)) were males and females PLHIV respectively. The age group between 22-33 and 34-45 recorded 20(5%) each for HBV while the

age group of 70+ recorded 0(0%) prevalence for HBV. The age group of 34-45 recoded the highest prevalence of 23(5.8%) for HCV infection while the age group of 58-69 recorded 0(0%) followed by 70+ who recorded 2(0.5%). The findings of this study reported a high prevalence of viral hepatitis infection amongst the at risk population.

Key words: Viral hepatitis; health care workers; people living with HIV and co-infection

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Introduction

Hepatitis is a health condition characterized by inflammation of the liver cells commonly caused by viral infection which can either be acute or chronic, symptomatic or asymptomatic and can lead to liver damage. Further complications can arise from various causes such as heavy intake of alcohol, toxin ingestion and certain suppressive medical conditions [1]. Hepatitis B virus HBV and Hepatitis C virus HCV are public health problems worldwide and are among the main causes of liver cirrhosis and hepatocellular carcinoma [2]. In 2015, [3] estimated that there were 257 million people with chronic HBV infection and 71 million people with chronic HCV infection worldwide. [4] reported that these infections have reached endemic proportions in sub-Saharan Africa. According to 63rd World Health Assembly (WHA63.18), inadequate preventive and control measures, as well as lack of access to appropriate and affordable treatment, are responsible for the increased morbidity of viral hepatitis in developing countries such as sub-Saharan Africa [5]. [3] also estimated that in 2015, viral hepatitis led to 1.34 million deaths worldwide and chronic infections with hepatitis B virus (HBV) and hepatitis C virus (HCV) accounting for more than 90% of viral hepatitis mortality. Nigeria is one of the countries with the highest burden of viral hepatitis with a prevalence of 8.1% of Hepatitis B and 1.2% of Hepatitis C [6]. Hepatitis B and C viruses can be transmitted by exposure to contaminated blood or infected body secretions but can be transmitted through other situations such as percutaneous exposure (needle-sticks/ injection drug use; IDU) or body fluid contaminated with blood containing the virus, or invasive procedures such as phlebotomy, haemodialysis and surgery involving infected blood or instrument contaminated with these viruse [4]. Some people termed at risk population have higher chances of contracting this disease. Such population include people living with HIV (PLWH), health care workers (HCW), people who inject drugs (PWID), people with multiple sex partners, iatrogenic infection and children born to infected mothers [7]. However this ailment can be prevented among the at risk population through standard protocol of vaccination and other prophylactic measures [8]. The disease can also be treated or managed in infected individuals through comprehensive health education on blood borne pathogens and immunization for at risk population, antiviral drugs (Lamivudine, adefovir and dipivoxil) and immunostimulatory therapy with alpha-interferon[5].

The importance of data in health management cannot be overemphasized. However, the paucity of data continues to prevail in developing countries Nigeria inclusive despite the challenge paused by this ailment in this countries. Nigeria is a viral hepatitis endemic country with a prevalence rate of 10% - 40% for HBV and 4.7% - 20% for HCV [4] and Taraba state recording the highest prevalence in the country [9]. Despite this, there is still a high percentage of the at risk population that still have their status unknown and data of such population continues to remain un-niform and scanty. It is against this background that this research aimed at investigating the sero-prevalence of viral hepatitis B and or C amongst at risk population so as to manage and reduce the endemicity of this ailment through re-strategizing and modification of management mechanisms.

Materials and Methods

Study region and population

This was a cross-sectional descriptive study carried out at Center for Initiative and development (CFID) in Taraba State. The Hepatitis Counselling and Testing (HCT) unit of CFID is responsible for carrying out free testing and counselling of viral hepatitis in Taraba State with it's headquarters in Jalingo being the capital city of Taraba state. Its coordinates are 8^0 54'N and 11^0 22'E and have an estimated population of 118,000 people. The targeted population for this study included individual who are at risk with specific reference to People Living with Human Immuno-Deficiency Virus (PLHIV) and Health care workers (HCWs). These categories of population of at least 8 years of age and seeking medical care at CFID were eligible for the study. Three hundred and ninety seven subjects were enlisted for the study which took place at CFID in 2019.

Determination of Sample Size

Sample size determination was calculated using Cohcran's formular for determining sample size as given below:

$$n = \frac{z^2 pq}{e^2}$$

Where n = is the sample size
p = is the estimated population proportion (0.16)
q = 1-p (0.84)
e = is the desired level of precision (0.05)

herefore, $n = \frac{(1.96)^2 \times 0.16 \times 0.84}{(0.05)^2} = 207$

The estimated sample size (207) was increased to 397 to ensure adequate power for the study.

Sample collection and analysis

Prior to data collection, the investigators set out plans on how to go about data collection by engaging well trained and qualified Lab Technicians of HCT department CFID to facilitate blood sample collection and to ensure that common understanding on the tools is been observed. The data were facially validated by the researchers.

Hepatitis B and C register book was used to record variables under consideration such as HCWs, PLHIV, hepatitis B and or C virus statuses, Sex and age categories of the participants were also captured accordingly.

Laboratory analysis and Screening

The blood samples were collected while serum was used to screen for HBsAg and anti-HCV. A drop of the serum (10µ) was dropped on the test strip following manufacturer's guidelines and instructions. Result was read and recorded 5 to 10 minutes in accordance with the stated instruction. In determining and recording the results, when two lines appears, this implies seropositive while only one line at the control region is an indication of sero-negative.

Statistical analysis

Statistical analyses were performed using SPSS verson 25, Microsoft excel 2016 and Minitab version 17. Data collected were extracted from Microsoft spread sheet and moved to statistical package for social science (SPSS) for cleaning and validation. Simple percentages were used to

describe demographic variables while crosstabulations contingency tables, pie charts graphs and Chi-square test was used for further analysis. A p-value < 0.05 was considered statistically significance.

Limitation

At risk population are quite enormous. However, this study was limited to two at-risk-populations (HCWs and PLHIV) out of numerous others.

Results

Figure 1. Gender distribution of Participants

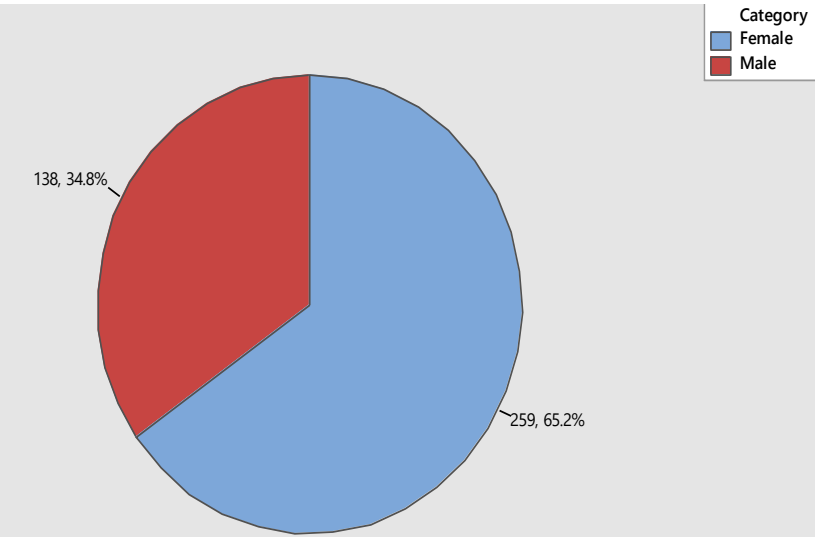

Figure 2. Pie Chart Showing Age Distribution of Participants in the study Area

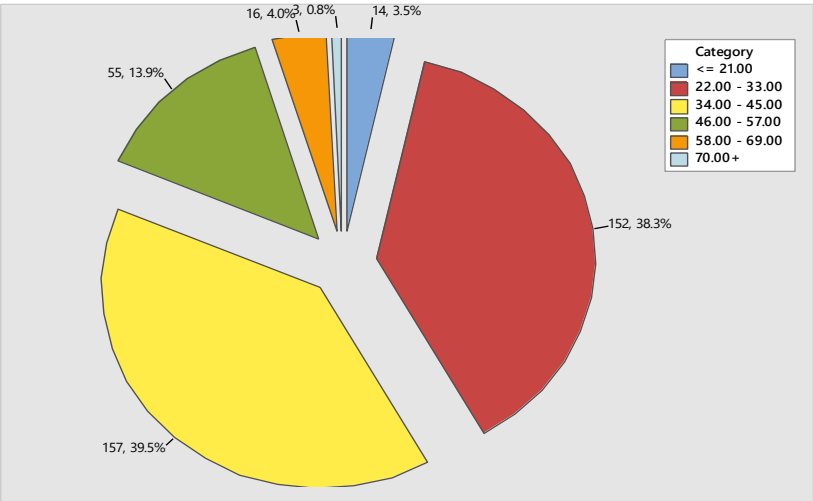

Figure 3. HBsAg Status of Participants

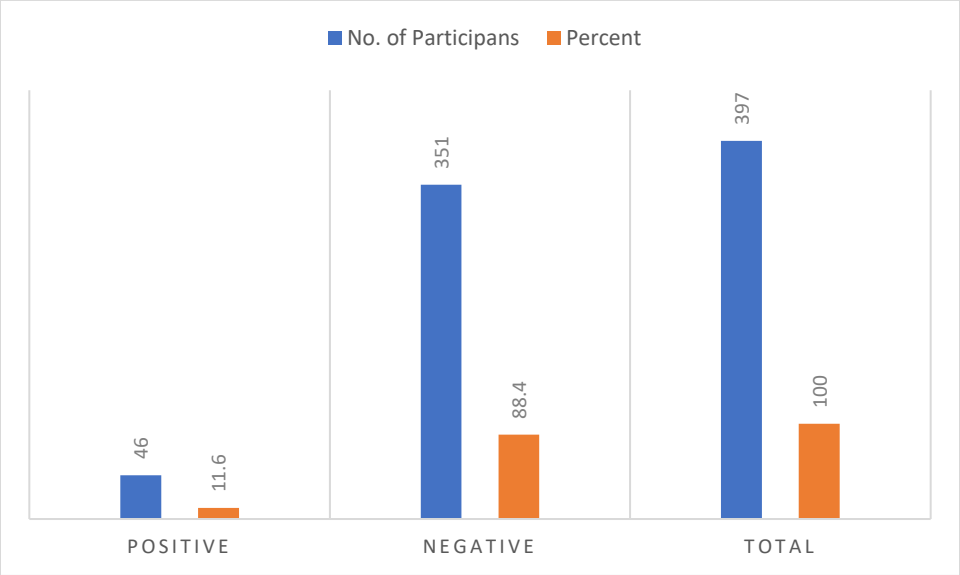

Figure 4. HCV Status of Participants

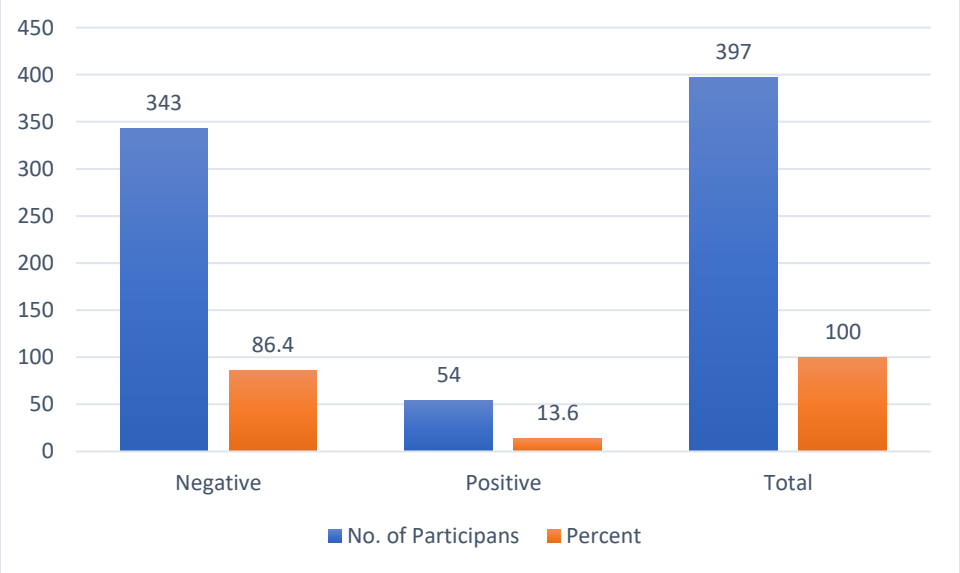

Table 1. Tabulated Statistics of at-risk Participants against HBsAg

Rows: Sample Columns: HBsAg

	Negative	Positive	All
HCWs	151	9	160
	38.04	2.27	40.30
PLHIV	200	37	237
	50.38	9.32	59.70
All	351	46	397
	88.41	11.59	100.00

Pearson Chi-Square = 9.299, P-Value = 0.002

Table 2. Tabulated Statistics of at-risk Participants against HCV

	Negative	Positive	All
HCWs	143	17	160
	36.02	4.28	40.30
PLHIV	200	37	237
	50.38	9.32	59.70
All	343	54	397
	86.40	13.60	100.00

Pearson Chi-Square = 2.021, P-Value = 0.155

Table 3. Tabulated Statistics of at-risk Participants against HBsAg and HCV

	Negative		Positive		All
	Negative	Positive	Negative	Positive	All
HCWs	135	16	8	1	160
	34.01	4.03	2.02	0.25	40.30
PLHIV	167	33	33	4	237
	42.07	8.31	8.31	1.01	59.70
All	302	49	41	5	397
	76.07	12.34	10.33	1.26	100.00

Table 4. Tabulated Statistics of Participants sex against HBsAg

	Negative	Positive	All
Female	224	35	259
	56.42	8.82	65.24
Male	127	11	138
	31.99	2.77	34.76
All	351	46	397
	88.41	11.59	100.00

Pearson Chi-Square = 2.700, P-Value = 0.100

Table 5. Tabulated Statistics of Participants sex against HCV

	Negative	Positive	All
Female	220	39	259
	55.42	9.82	65.24
Male	123	15	138
	30.98	3.78	34.76

All	343	54	397
	86.40	13.60	100.00

Pearson Chi-Square = 1.344, P-Value = 0.246

Table 6. Tabulated Statistics of At-risk population sex vs HBsAg and HCV Coinfection

		Negative		Positive		All
		Negative	Positive	Negative	Positive	All
HCWs						
	Female	65	6	4	1	76
		16.37	1.51	1.01	0.25	19.14
	Male	70	10	4	0	84
		17.63	2.52	1.01	0.00	21.16
PLHIV						
	Female	125	28	26	4	183
		31.49	7.05	6.55	1.01	46.10
	Male	42	5	7	0	54
		10.58	1.26	1.76	0.00	13.60
All						
	All	302	49	41	5	397
		76.07	12.34	10.33	1.26	100.00

Table 7. Tabulated Statistics of At-risk population, Age Range, HBsAg and HCV

		Negative		Positive		All
		Negative	Positive	Negative	Positive	All
HCWs						
	<= 21.00	5	1	0	0	6
		1.259	0.252	0.000	0.000	1.511
	22.00 - 33.00	46	6	6	0	58
		11.587	1.511	1.511	0.000	14.610
	34.00 - 45.00	52	4	1	1	58
		13.098	1.008	0.252	0.252	14.610
	46.00 - 57.00	25	3	0	0	28
		6.297	0.756	0.000	0.000	7.053
	58.00 - 69.00	6	0	1	0	7
		1.511	0.000	0.252	0.000	1.763
	70.00+	1	2	0	0	3
		0.252	0.504	0.000	0.000	0.756
PLHIV						
	<= 21.00	5	0	2	1	8
		1.259	0.000	0.504	0.252	2.015
	22.00 - 33.00	68	12	13	1	94
		17.128	3.023	3.275	0.252	23.678
	34.00 - 45.00	65	16	16	2	99
		16.373	4.030	4.030	0.504	24.937

	46.00 - 57.00	20	5	2	0	27
		5.038	1.259	0.504	0.000	6.801
	58.00 - 69.00	9	0	0	0	9
		2.267	0.000	0.000	0.000	2.267
	70.00+	0	0	0	0	0
		0.000	0.000	0.000	0.000	0.000
All						
	All	302	49	41	5	397
		76.071	12.343	10.327	1.259	100.000

Table 8. Crosstabulation of AGE and HBV

			HBsAg		
			Negative	Positive	Total
AGE (Binned)	<= 21.00	Count	11	3	14
		% of Total	2.8%	0.8%	3.5%
	22.00 - 33.00	Count	132	20	152
		% of Total	33.2%	5.0%	38.3%
	34.00 - 45.00	Count	137	20	157
		% of Total	34.5%	5.0%	39.5%
	46.00 - 57.00	Count	53	2	55
		% of Total	13.4%	0.5%	13.9%
	58.00 - 69.00	Count	15	1	16
		% of Total	3.8%	0.3%	4.0%
	70.00+	Count	3	0	3
		% of Total	0.8%	0.0%	0.8%
Total		Count	351	46	397
		% of Total	88.4%	11.6%	100.0%

Table 9. Crosstabulation of AGE and HCV

			Anti_HCV		
			Negative	Positive	Total
AGE (Binned)	<= 21.00	Count	12	2	14
		% of Total	3.0%	0.5%	3.5%
	22.00 - 33.00	Count	133	19	152
		% of Total	33.5%	4.8%	38.3%
	34.00 - 45.00	Count	134	23	157
		% of Total	33.8%	5.8%	39.5%
	46.00 - 57.00	Count	47	8	55
		% of Total	11.8%	2.0%	13.9%
	58.00 - 69.00	Count	16	0	16
		% of Total	4.0%	0.0%	4.0%
	70.00+	Count	1	2	3
		% of Total	0.3%	0.5%	0.8%
Total		Count	343	54	397
		% of Total	86.4%	13.6%	100.0%

Results

A total of 397 participants were recruited for this study of which 138(34.8%) were Male and 259 (65.2%) were female (Figure 1). Participants were within the age range of 8 to 80 years with age mean of 36.9. Total participants within the age bracket less than or equal to 21 years were 14(3.5), 22-33 years were 152(38.3%), 34-45 years were 157(39.5%), 46-57 years were 55(13.9%), 58-69 years were 16(4%) and those who had 70 years and above were 3 (0.8%) (Figure 2). Figure 3 shows the overall HBsAg status of participants 46(11.6%) of the participants were positive for viral hepatitis B, while in Figure 4., 54 (13.6%) of the entire population under consideration were positive for HCV. Table 1. Is the cross tabulation and chi-square test of association of the two at-risk population (HCWs and PLHIV) and HBV. The number of at-risk population who were positive for HBV were 46(11.59%) out of which 9(2.27%) were HCW and 37(9.32%) were PLHIV (Table 1.). There was said to be a statistically significant association between at-risk-population and HBV. Table 2. Is the cross tabulation and chi-square test of association of the two at-risk population (HCWs and PLHIV) with HCV. The number of at-risk population who were positive for HCV were 54(13.6%) out of which 17(4.28%) were HCW and 37(9.32%) were PLHIV (Table 2.). There was no significant association between at-risk population and HCV observed. Table 3 shows the distribution of co-infection (HBV+HCV) among at risk population results shows that out of 5(1.26%) at-risk population who were coinfected with the two viruses, 1(0.25%) occurs among HCWs and 4(1.01) were PLHIV respectively. Table 4 shows the cross tabulation and chi-square test of association of the two at-risk population based on participants' gender and HBV. The result shows that 46(11.59%) of that participants were positive for HBV out of which 11(2.77%) were Male and 35(8.82%) were females. No statistically significant association was observed between gender and HBV infection. Similarly, Table 5 shows the cross tabulation and

chi-square test of association of the two at-risk population based on their gender and HCV. The result shows that 54(13.6%) of that participants were positive for HCV out of which 15(3.78%) were Male and 39(9.82%) were females. There was no statistical association between gender and HCV. There was no test of association conducted between age categories and hepatitis B and C viruses because some of the cells had zero entries which violates Chi-square test rules. Table 6. Shows the overall statistics of at-risk population based on gender and Coinfection (HBV+HCV). A total of 5 participants representing 1.26% were coinfected with viral hepatitis B and C out of which (0(0%), 1(0.25%)) were Males and females HCWs while (0(0%), 4(1.01%)) were males and females PLHIV respectively.

In addition, Table 7 shows the marginal distribution of at-risk-population based on age categories and coinfection (HBV+HCV). Among all the participants across age categories, 5(1.26%) were coinfected with the viruses (HBV+HCV) out of which none were coinfected within the age brackets of (less than or equal to 21 years, 22-33 years, 46-57 years, 58-69 years and 70+ years), only one 1(0.25%) within 34-45 years was coinfected among HCWs. Also, (1(0.25%), 1(0.25%) and 2(0.5%)) of PLHIV within (les than or equal to 21 years, 22-33 years and 46-57 years) were coinfected with both viruses (HBV and HCV). None of the PLHIV within the age range of 46 years to 70 + years were coinfected with hepatitis B and C (Table 7).

As reported in table 8. The age group between 22-33 and 34-45 recorded 20(5%) each for HBV while the age group of 70+ recorded 0(0%) prevalence for HBV. The age group of 34-45 recoded the highest prevalence of 23(5.8%) for HCV infection while the age group of 58-69 recorded 0(0%) followed by 70+ who recorded 2(0.5%).

Discussion

Viral hepatitis has been associated with high mortality and morbidity [10] most especially in resource constrained countries where inadequate health facilities continues to emphasize more on treatment of disease conditions rather than preventive medicine despite the role prevalence survey plays in reducing the burden of this disease and its complication from our society [4].

The findings of this study reported a prevalence of 11.6% (46/397) of the overall participants to be HBV positive and 13.6% (54/397) positive to HCV. The prevalence of both infections are both high base on the endemicity classification by [11] and [12] for HBV and HCV respectively but wasn't in variance with the National prevalence figure of 10% - 40% for HBV and 4.7% - 20% for HCV [4]. The high prevalence of both diseases among the population can be attributed to iatrogenic processes they most have experienced [4] and also the endemicity of the diseases in the study region. Despite the higher infectious nature of HBV to HCV [13], infection with HCV was found to be higher which can be attributed to the modes of transmission common to the population of study. This finding is in agreement with the findings of [4] who carried out similar study on HCWs in Bida Niger state of Nigeria and reported 11.3% for HBV but was not in agreement with their result of HCV (2.4%). The variation may be attributed to the variation in regional endemicity of the viruses [14].

Looking at the prevalence genderwise, the result shows that 46(11.59%) of that participants were positive for HBV out of which 11(2.77%) were Male and 35(8.82%) were females. No statistically significant association was observed between gender and HBV infection. This implies that HBV infection is independent of gender. The result of this study also shows that 54(13.6%) of the participants were positive for HCV out of which 15(3.78%) were Males and 39(9.82%) were females and no statistical association was observed between gender and HCV. However, the observed differences in figures and percentages observed can be attributed to the differences in the

gender proportion that constitute the population of study or the higher proportion of females to males reported to have been infected with HIV [15] due to their differences in vulnerability constituted by their anatomical differences [16].

The number of at-risk population who were positive for HBV were 46(11.59%) out of which 9(2.27%) were HCW and 37(9.32%) were PLHIV. Statistical analysis revealed that there was said to be a statistically significant association between at-risk-population and HBV. The lower percentage of positivity recorded among health care workers can be attributed to the level of their knowledge and practices towards the virus, post exposure prophylaxis and also can be due to the level of vaccination uptake. On the other hand, the higher percentage reported amongst PLHIV can be attributed to the shared modes of transmission of HIV and HBV (sexual intercourse), vulnerability and untimely recognition of HBV status due to lack of proper awareness of the disease and its asymptomatic nature. Out of the 397 at-risk population who participated in the study, 54(13.6%) were positive to HCV out rof which 17(4.28%) were HCW and 37(9.32%) were PLHIV. When the prevalence of HBV and HCV among HCWs were observed, there is a higher percentage of HCV positivity which can be attributed to lack of vaccination for HCV. The high positivity of HCV still observed in PLHIV can still be attributed to their vulnerability, shared mode of transmission as well as iatrogenic experiences. However, statistical findings revealed that there was no significant association between at-risk population and HCV observed despite the differences observed in the percentages.

Out of 5(1.26%) at-risk population who were co-infected with the two viruses, 1(0.25%) occurs among HCWs and 4(1.01) were PLHIV respectively which can be a reflection of the prevalence of Co-infection previously reported in the region of this study by Adda. et al., 2020 other west African countries [15][14]. However, the differences between the two sub-groups can still be attributed to their differences in vulnerability and level exposure as reported by [16]

The age group between 22-33 and 34-45 recorded 20(5%) each for HBV while the age group of 70+ recorded 0(0%) prevalence for HBV. The age group of 34-45 recoded the highest prevalence of 23(5.8%) for HCV infection while the age group of 58-69 recorded 0(0%) followed by 70+ who recorded 2(0.5%). For both infection, the age bracket comprising the youthful and adult age reported the highest prevalence of the infections. This can be attributed to the sexual activieness of those in the age categories and also their proportion in the entire population and work force. The lowest case was found to exist among the older population probably due to their lower figure among the general population and work force, the infections were cleared before this age or most of them most have succumb to death in due to lack of management and treatment. Similar findings were also reported in the work of [17] in their report of seroprevalence of viral hepatitis among the general population in the same region.

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Conflict of Interest

No conflict of interest

References

1. Ndako J. A, Owolabi A. O, Olisa J. A, Akinwumi J. A, Dojumo V. T, Olatinsu O. and Adebayo B. A. Studies on the prevalence of Hepatitis C virus infection in diabetic patients attending a tertiary health-care facility South-west Nigeria. BMC Infectious Diseases (2020) 20:664 https://doi.org/10.1186/s12879-020-05388-7
2. Acikgoz A, Cimrin D, Kizildag S , Esen N , Balci P. and Sayiner A. A. Hepatitis A, B and C seropositivity among first-year healthcare students in western Turkey: a seroprevalence study. BMC Infectious Diseases (2020) 20:529 https://doi.org/10.1186/s12879-020-05247-5
3. World Health Organization. Global Hepatitis Report 2017. Geneva: World Health Organization (WHO); 2017. http://apps.who.int/iris/bitstream/ . Accessed 10 June 2020
4. Amiwero C. E, Nelson E. A, Yusuf M, Olaosebikan O. F, Adeboye M. A. N, Adamu U. G,Oladele C, Busuyi J. S, Erinle S. A, Babalola A. Knowledge, Awareness and Prevalence of Viral hepatitis Among Health Care workers (HCWs) of the Federal Medical Centre Bida, Nigeria. The Journal of MedicalResearch 2017; 3(3): 114-120
5. Emechebe G. O, Emodi U, Ikefuna A. N, Ilechukwu G. C, Igwe W. C et al. Hepatitis B virus infection in Nigeria- A review. Niger Med J. 2009; 50:18- 22
6. John, O. T, Issa, A. A, Nasiru, Y. and Ozulonye, O. S. Awareness Level of Hepatitis B and C among Undergraduate Students of Abubakar Tafawa Balewa University (Atbu), Bauchi**.**International Journal of Research and Innovation in Applied Science (IJRIAS), 2020; 5(8):2454-6194.
7. www.ecdc.europa.eu. Accessed September 2020.
8. David K. H, Louise D, Neil O. F, Christine G, Tammy L, Tara N. P et al. SHEA Guideline for management of Healthcare Workers Who Are Infected with Hepatitis B Virus, Hepatitis C Virus, and / or Human Immunodeficiency Virus. Infection control and Hospital Epidemiology. 2010; 31:3
9. www.cfidtaraba.org
10. Memon A. R, Shafique K, Memon A, Draz A. U, Rauf M. U. A, Afsar S. Hepatitis B and C prevalence among the high risk groups of Pakistani population. A cross sectional study. Public Health 2012, 70-9
11. World Health Organisation (WHO). Prevalence of hepatitis virus in the world by country http://www.who. int/csr/disease/hepatitis/en/. 2010. Date accessed online (June, 2020)
12. Alter, M. J. Epidemiology of viral hepatitis and HIV co-infection. Journal of Hepatology 44 (2006) S6–S9
13. Samuel D, Muller R, Alexande G. Educational research: National hepatitis B virus programme. Infect. Dis. 2004;234: 221-332
14. Enitan S. S, Adebola O. K , Adejumo E. N , Itodo G. E , Ileoma E. , Oluremi A. S. and Omotola D. Prevalence of Hepatitis B and C Virus Infection among Students of a Private Tertiary Institution in South-Western Nigeria.2019; 36(3): 1-15
15. Tremeau-Bravard A, Ogbukagu I. C, Ticao C. J, Abubakar J. J. Seroprevalence of hepatitis B and C infection among the HIV-positive population in Abuja, Nigeria African Health Sciences.2012; 12(3)
16. Audu E. S.Hepatitis B and C Co-Infections among Patients Accessing Antiretroviral Therapy in a Tertiary Health Facility in Lafia, North Central Nigeria IOSR Journal of Dental and Medical Sciences (IOSR-JDMS), vol. 17, no. 7, 2018, pp 65-70

17. Adda K. D, Lamiya A, John O. T. Seroprevalence of hepatitis b and or c viruse (s) among the general population in Jalingo, Taraba State. International Journal of Research in Medical Science. 2020; 2(1) 23-27.