Burden of HIV, Tuberculosis Infection and Risk Factors amongst Inmates of Correctional Institutions in Port Harcourt Nigeria

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Authors' contributions

This work was carried out in collaboration among all authors. All authors read and approved the final manuscript.

Article Information

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ABSTRACT

Aims: Burden of infectious diseases in correctional institutions constitutes a public health concern due to the confined nature and congestion of the prisons. This study aimed at surveying Burden of HIV, Tuberculosis Infection and Risk factors amongst inmates of Correctional Institutions in Port Harcourt Nigeria

Study Design: The study was descriptive, comprising both males and females. A total of 178 inmates constituted the study population

Place and Duration of Study: Port Harcourt Maximum Prisons, Creek Road and the Juvenile Remand Home, Borokiri, Port Harcourt, Nigeria, between the months of May to December 2019.

Methodology: Two millilitres of blood was collected from each participant after receiving their informed consent. The blood was dispensed into EDTA anti-coagulant bottles and used for serological investigations of HIV 1&2, and TB. Samples positive for TB was confirmed using the

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GeneXpert Molecular technique while HIV 1&2 were confirmed using Real-Time PCR and their Viral Loads determined.

Results: The overall prevalence of HIV and MTB in the study population were: HIV 1 & 2 (3.9%) and Tuberculosis (0.6%) The Mean Viral Loads of positive samples were HIV 1&2 (479.3 copies/ml); and High MTB was detected. The most significant risk factors identified are as follows:, inmates with tattoos on their bodies (χ^2=83.6, p<0.0001), took part in blood initiation ceremonies (χ^2=110.1, p<0.0001), have exchanged needles/sharp objects (χ^2=2.2, p>0.0001), have tribal marks (χ^2=58.4, p<0.0001), received blood (χ^2=151.1, p<0.0001). Majority of the inmates have had sex before, 159(89.3%) [89(56.0%) had multiple sex partners up to 3 and above, 32(20.1%) had 2 partners while 38(23.9%) said they were single sex partners (χ^2=37.1, p<0.0001)]. On condom use, 90(50.6%) of the inmates do not use condom while 88(49.4%) admitted they use condoms. 7(3.9%) of the inmates have indulged in anal sex (χ^2=151.1, p<0.0001). 6(3.4%) had history of family drug use while 23(12.9%) have used drugs prior to imprisonment

Conclusion: The prevalence of HIV among inmates in this study is quite high and remains a public health problem while that of Mycobacterium tuberculosis (MTB) though appearing relatively low still remains a public health risk. The risk factors amongst inmates of Correctional Institutions in Port Harcourt Nigeria have been identified in this study. The high HIV 1 & 2 prevalence with MTB prevalence with high viral load results indicates poor health conditions which if not contained can spread to other inmates. This requires prompt interventions and treatment among the correctional inmates.

1. INTRODUCTION

Correctional inmates often possess a history of high-risk behaviours such as injection drug use, trade sex and unprotected sex with high risk partners, which place them at a risk of infection, blood borne and sexually transmitted diseases prior to incarceration [1]. Other factors that may fuel the highly infectious environment in prisons include poor/non-availability of health facilities/services, overcrowding and congestion, unhygienic environment, malnutrition [2,3]. Overcrowding remains a concern in both developed and developing countries and is a key causative factor for a myriad of other problems which ultimately turns these custodial settings into breeding grounds of infectious diseases; hence, prisons are known for frequent out-breaks of illness [2,4].

The Nigerian Port Harcourt Prison was built in 1918 by the colonial British rulers and has several blocks of old structures which serve as cells, infirmary, workshops and offices for the officials [5]. Nigeria has 148 prisons and about 83 satellite prisons, 10 prison farms and 9 cottage industries for the training of inmates. 14 to 15 people are crammed in cells with dimension of 4 feet by 6 feet originally planned to take one person [6,7]. More than 50,000 individuals are currently incarcerated in Nigerian prisons constituting more than 300% the actual capacity of the prisons [8]. Investigation reveal that there are over 100 mixed prisons in the country and only one exclusively female prison which is located in Lagos [9,6,8]. Similarly, the Port Harcourt prison originally designed with a capacity of 804 inmates currently holds up to 5,000 persons including women and minors with 3,700 awaiting trial [10]. The Nigerian prison population is made up of adult males and females, young persons, children, pregnant women, nursing mothers, criminal and civil lunatics, debtors, detainees, first offenders, long and short term prisoners, condemned prisoners and inmates awaiting trial or being held for safe custody [9]. The vulnerable group (the juveniles, women and the mentally ill) constitute about 4.5% of the total prison population [6,11].

Among the biggest killer diseases worldwide, Tuberculosis (TB), and HIV/AIDS continue to surge, with HIV/AIDS and TB accounting for the overwhelming majority of death [12]. Developing countries face challenges of both communicable diseases (especially Tuberculosis, HIV, Malaria, Hepatitis and Sexually transmitted diseases) as well as non-communicable diseases [13]. During the early days of AIDS epidemic, prisons and jails were commonly referred to as breeding grounds for AIDS, such statements are still made today [14]. This means that unprotected sex and the sharing of drug injection equipment are rampant in prisons and that these activities commonly result in the transmission of HIV, hepatitis and sexually transmitted diseases [14].

HIV prevalence was greater than 10% in prisons in 20 countries while TB infection rates in prisons are equally high and may be up to 100 times those outside prison [15].

1.1 Study Design and Sample Collection

A Cross Sectional Design was used in this study. Each of the inmates from both study areas were administered self -structured questionnaires to access information bothering on their health status, demographics and risk factors for the infectious diseases that relates to this study. Selection of the inmates was done randomly. Thereafter, two milliliters of blood was dispensed into an EDTA anticoagulant bottle and used for malaria parasite test and the determination of HIV. Blood samples which were positive for HIV and TB, were confirmed using molecular methods. HIV were confirmed using the Real - Time PCR while TB was confirmed using the GeneXpert machine.

1.2 Statement of the Problem

Documented information, data, sentinel surveys and epidemiological testing of samples of the general population and selected groups like patients and blood donors for infectious diseases are available [16,17,18] with little or no emphasis on inmates of correctional institutions. This group of people which constitute a significant proportion of our population are often neglected. The resultant effect is that the burdens of infectious diseases which may be prevalent in that population group are left undiagnosed. There are no provisions in correctional institutions for regular medical checks. The inmates are usually taken to the hospitals whenever they fall ill. This, together with poor environmental conditions, may promote the spread of these diseases among inmates. There is paucity of information on the burden of diseases like HIV and TB as well as risk factors among inmates of Correctional Institutions (prisons, remand homes). These infections have the potential to cause great morbidity and mortality in prison populations, yet the actual prevalence of these diseases is not known.

1.3 Justification

There is need for the epidemiological studies of infectious diseases to be carried out in correctional institutions because these group of confined individuals are often neglected in research and interventions, as such, there is paucity or dearth of information on infectious diseases in correctional institutions. Also, the prison environment is a restricted environment to non-inmates and so pose great risk for researchers who would venture to conduct research in such a criminally infested environment. This study is therefore a bold attempt and first of its kind in this part of the world to provide information on some selected infectious burden in correctional institutions.

2. METHODOLOGY

2.1 HIV -1 and 2 Test Procedure

Alere Determine™ HIV -1/2, an invitro immuno chromatographic rapid test kit, visually read for the qualitative detection of antibodies to HIV-1 and HIV-2 was used. 50µl of patient plasma was applied to the sample pad, one drop of chase buffer was added and allowed to wait a minimum of 15minuites to allow the mixture to migrate through the conjugate pad through the solid phase to the immobilized recombinant antigen and synthetic peptides at the patient window sit.

The appearance of two red bars in both the control window (labeled 'control') and the patient window (labeled 'patient') on the strip, was interpreted as positive. The result was negative where only one red bar appeared in the control window of the strip (labeled 'control') and no red bar appeared on the patient window labeled 'patient'. Invalid results were not seen. Positive results were confirmed by molecular methods using Real-Time PCR

2.2 Tuberculosis Test Procedure

One step chromatograhic Tuberculosis Antibody Test (Rapid TB) was used for the quantitative detection of antibodies to *M. tuberculosis* in human serum. 100µl of serum was pippetted into the sample well and allowed to stand for 15 minutes. Results were positive if purple color appeared in two color bands (T' band and 'C' band) within the result window while Negative results showed only one purple color band within the result window at the 'C' band.

Positive results were confirmed by Molecular GeneXpert MTB/RIF Assay method.

2.3 Gene Xpert MTB/RIF Assay

The GeneXpert MTB/RIF system is a fully automated nested Real-Time PCR system, which detects MTB complex DNA in smear positive and negative sputum samples. 2ml of the sample

Reagent was added to 1ml of the sputum, the lid was closed and shaken vigorously 10 – 20 times and incubated for 5 minutes at room temperature. The specimen was then shaken again vigorously 10 – 20 times and re-incubated again for another 10 minutes.

The sample was slowly transferred into the open port of the GeneXpert MTB/RIF cartridge to minimize the risk of aerosol formation and cartridge lid closed firmly. The system was allowed to release the door lock at the end of the run, then the module door was opened and the cartridge removed. Results were reported as: "MTB not detected" or "MTB detected."

2.4 Statistical Analysis

All statistical tests conducted were 2-tailed, and probability value of $\leq$ 0.05 was used as the threshold for declaring statistical significance. Data management and statistical analyses were conducted using SPSS software version 25.0 (SPSS Inc., Chicago, USA). Graphical representations were carried out using the JMP statistical discovery™ software version 14.3 (SAS Institute, Cary, NC, USA).

3. RESULTS

Table 1 Shows the Sociodemographic characteristics of the study participants. Majority of the inmates were males (81.46%), while the females comprised of only 33 inmates (18.4%). Inmates within the age range of 25-34 years dominated the study population which was 60(33.71%). This was closely followed by those within the age range of 15-24 years which accounted for 49(27.53%). The Mean age of the study participants was 31.25 years at 29.07-33.44 (95% CI). 93(52.25%) of the inmates had secondary education while 18(10.11%) had no formal education. A very large proportion of the inmates, 111(62.36%) were singles while only 67(37.64%) were married. Their family background indicated that 89(50.00%) came from monogamous family background. Analysis of the Occupational Status of the inmates revealed that the majority of the inmates, 50(28.74%) were students. Of all the tribes encountered, inmates from the Igbo tribe 44(24.72%) dominated the study population, inmates from Rivers state constituted 62(34.83%).

Table 2 shows the frequency distribution of disease conditions diagnosed among the prison inmates. HIV 1 & 2 showed a prevalence of 7(3.9%), Tuberculosis was found to be 1(0.6%) respectively.

Table 3 shows the prevalence of diagnosed diseases and viral loads of positive inmates. The Mean Viral load for HIV1 & 2 was 479.3 at -138.2 -1,096.8 (95%C1), the viral Mean value for Tuberculosis was MTB DETECTABLE (High).

Table 4 shows the risk factors with health implications among prison inmates. Significant numbers of inmates have tattoos on their bodies, take part in blood initiation ceremonies, have exchanged needles/sharp objects, have tribal marks, received blood(p<0.0001). Majority of the inmates have had sex before, 159(89.3%). Of 159 inmates, 89(56.0%) had multiple sex partners up to 3 and above, 32(20.1%) had 2 partners while 38(23.9%) said they were single sex partners (χ^2=37.1, p<0.0001). On condom use, 90(50.6%) of the inmates do not use condom while 88(49.4%) admitted they use condoms. 7(3.9%) of the inmates have indulged in anal sex. 6(3.4%) had history of family drug use while 23(12.9%) have used drugs prior to imprisonment. The associations were significant with chi-square test.

4. DISCUSSION

The overall prevalence rate of HIV infection among inmates in Port Harcourt maximum prison and the Juvenile Remand Home in this study was 3.9%. This value appears slightly higher when compared to estimated global prevalence of HIV among prisoners. WHO [4] and Goirokhi *et al.,* [19] recorded a prevalence of 3% among prisoners, although in some settings, HIV prevalence in prison could be fifteen (15) times higher than that found in the general adult population. HIV prevalence among prison inmates in the sub-Saharan African Region was found to vary between 2.3% to 3.4% with South Africa as the most attended [20] and in West Africa, the HIV prevalence was seen to range between 2.3% and 10.8% [19]. But in Nigeria, NACA [21] reported HIV prevalence within states to range between 0.2% to 15.2%, although the national prevalence was reported as 3.4%. A more recent report has it that HIV in the general population in Nigeria is estimated to be 1.4% [22]. The prevalence obtained from this study however agrees with general findings on the burden of infectious diseases (HIV) among incarcerated individuals which is higher than that obtained among non-incarcerated individuals [19].

Table 1. Sociodemographic characteristics of study participants

Characteristic	N	Percent (%)	95% CI
Gender			
Female	33	18.54	13.52-24.89
Male	145	81.46	75.11-86.48
Age Group (Years)			
< 15	13	07.30	04.32-12.09
15-24	49	27.53	21.49-34.51
25-34	60	33.71	27.17-40.93
35-44	28	15.73	11.11-21.80
45-54	12	06.74	03.90-11.41
55+	16	08.99	05.61-14.10
Mean ± SD	178	31.25	29.07-33.44
Educational Status			
No Formal Education	18	10.11	06.49-15.42
Primary School	45	25.28	19.46-32.14
Secondary School	93	52.25	44.94-59.46
Tertiary Education	22	12.36	08.31-18.00
Marital Status			
Single	111	62.36	55.05-69.15
Married	67	37.64	30.86-44.95
Family Background			
Monogamous	89	50.00	42.73-57.27
Polygamous	87	46.07	38.91-53.40
Unknown	7	03.93	01.92-07.89
Occupation			
Artisan	16	09.20	05.74-14.41
Business	7	04.02	01.96-08.07
Civil Servant	9	05.17	02.74-09.53
Farmer	9	05.17	02.74-09.53
Security Service	8	04.60	02.35-08.81
Student	50	28.74	22.53-35.86
Technician	21	12.07	08.03-17.75
Trader	30	17.24	12.35-23.55
Transporter	18	10.35	06.64-15.76
Other	6	03.45	01.59-07.32

95% CI: 95% Confidence Interval Within a given characteristic, the percentages may not add up to exactly 100 due to rounding.

Table 2. Frequency Distribution of Diseases/Conditions Diagnosed among Prison Inmates (N - 178)

Diseases/Conditions	n	%
HIV 1&2	7	3.9
TB	1	0.6

Table 3. Prevalence of Selected Diagnosed and Viral Load of Positive Inmates

Disease	Positive		Viral Load		
	n	(%)	Measure	Mean	95% CI
HIV 1&2	7	23.6	Copies/ml	479.3	-138.2-1,096.8
Tuberculosis	1	0.6	MTB DETECTED	High	----

Abbreviations: 95% CI: 95% Confidence Interval; MTB: Mycobacterium Tuberculosis Within a given characteristic, the percentages may not add up to exactly 100 due to rounding

Table 4. Risk factors with health implications among prison inmates

Characteristic	N (%)	χ^2 (df)	P-value
Do you have any tattoo?			
No	150 (84.3)	83.6	
Yes	28 (15.7)	(1)	<0.0001****
Have you taken part in any blood initiation ceremony?			
No	159 (89.3)	110.1	
Yes	19 (10.7)	(1)	<0.0001****
Do you share/exchange needles/razor/sharp objects?			
No	99 (55.6)		
Yes	79 (44.4)	2.2 (1)	0.134 ns
Do you inject drugs?			
No	176 (98.9)	170.1	
Yes	2 (1.1)	(1)	<0.0001****
Do you have any tribal marks?			
No	140 (78.7)	58.4	
Yes	38 (21.3)	(1)	<0.0001****
Do you consume alcohol?			
No	92 (51.7)		
Yes	86 (48.3)	0.2 (1)	0.653 ns
Do you smoke Indian herm?			
No	96 (53.9)		
Yes	82 (46.1)	1.1 (1)	0.294 ns
Have you donated blood before?			
No	161 (90.4)	116.5	
Yes	17 (9.6)	(1)	<0.0001****
Have you received blood/transfused before?			
No	171 (96.1)	151.1	
Yes	7 (3.9)	(1)	<0.0001****
Have you had sex before?			
No	19 (10.7)	110.1	
Yes	159 (89.3)	(1)	<0.0001****
If yes, with how many partners (n=159)?			
1 Partner	38 (23.9)		
2 Partners	32 (20.1)		
3 Partners	89 (56.0)	37.1	<0.0001****
Mean ± SD	2.3 ± 0.84	(2)	
Do you use condom?			
No	90 (50.6)	0.02	
Yes	88 (49.4)	(1)	0.881 ns
Do you indulge in anal sex?			
No	171 (96.1)	151.1	
Yes	7 (3.9)	(1)	<0.0001****
Any history of family drug use?			
No	172 (96.6)	154.8	
Yes	6 (3.4)	(1)	<0.0001****
Did you use drug prior to imprisonment?			
No	155 (87.1)	97.9	
Yes	23 (12.9)	(1)	<0.0001****

*χ^2 (df) = Chi-Square Value (degree of freedom); Within a given characteristic, the percentages may not add up to exactly 100 due to rounding. Significance Levels: ****=p<0.0001; ns=Not Significant (p>0.05)*

In this study, the viral load of inmates who tested positive were examined and the mean viral load obtained was 479.3 copies / ml at 95%CI. According to Asmuth et al. [23] high levels of viral load in HIV correlates with disease severity and indicates a high likelihood of disease progression.

Tuberculosis (TB) is a highly contagious airborne infectious disease which can spread through the lymph node and bloodstream to any organ in the body. Its spread is exasperated by coughing, sneezing, breathing infected air during close contact with an infected person, droplets from shouts or spits of an infected person, inhalation of infected particles in the air and can also be spread by drinking unpasteurized milk [12, 24]. WHO reports that TB is one of the top 10 causes of death in the world and the second most frequent occurring infectious disease in the world with global health challenges. The current global estimate of TB in the general population is said to be at 2.0% per year. In correctional facilities where the burden of the disease is said to be far higher than that in the general population, varying prevalence rates were observe although according to WHO, the survey carried out to collate data on TB showed that TB was 83.6 times higher than the general population in the European region alone.

In this study, the overall sero-prevalence of TB among connectional inmates in Port Harcourt Maximum Prison and the Juvenile Remand Home was 0.6%. This prevalence is highly reduced when compared to data obtained from other prisons around the world. Data such as up to 25% have been observed among the US inmates [2] while studies in Zambian prison, estimated TB to be up to 22.7%. Similar studies carried out among prisoners of central jail Hindalga, Belguim, India, and Karnataka recorded a more reduced prevalence of 2.0% while Karachi Central Prison in Pakistan reported 3.75 times more pulmonary TB than the general population [25]. The reason for this nose diving figure may however not be unconnected with the fact that the assertions by these researchers were recorded well over ten (10) years ago. Between those years and now a lot of researches have been carried out which has led to the production and supply of vaccines, free treatment and in some cases, free screening and sensitization notwithstanding. While progress has been made in policy development and strategic planning, provision of care, to prevent emergence of resistance and development of

proper laboratories for detection of resistant cares is still ongoing.

While the prevalence of TB in prisons in Nigeria has always been assessed as co-infection with HIV, there is no data of the prevalence of TB alone among correctional inmates in Nigeria, except a retrospective study carried out by [26] at Kuje prison between 2004 and 2008, where they observed a prevalence rate of 2.4% TB. The prevalence of TB in the general population in Nigeria in 2012 was estimated to be 311 per 100,000 Nigerians which was said to be the highest in the world and also the highest in Africa NBTS [27]. For instance, Erhabor *et al.,* [28] examined the prevalence of human immunodeficiency virus infection among TB patients in Port Harcourt, Nigeria and the prevalence of HIV among these patients was 25%. In a similar investigation in Sagamu, Nigeria, Daniel and his colleagues obtained a HIV prevalence of 14.9% among TB patients [29]. These investigations were carried out because they believed that only through combined and coordinate efforts for both TB and HIV can this dual epidemic be halted. Recently, it has been noised that the prevalence of HIV in Nigeria has dropped drastically to about 1.4% in the general populace which may be possible reason why the prevalence of TB must have also reduced [22].

Among the risk factors and major routes to the spread and acquisition of HIV are varying forms of use and sharing of sharp objects, exchange of needles, razors, the use of contaminated injecting equipment when using drugs, piercing the skin for tribal marks, tattooing and blood initiation ceremonies. These factors where however observed in this study. In prisons, it is very difficult to obtain clean sharp or drug injecting equipment. Besides, possessing a needle is often a punishable offence, therefore, many inmates share equipment that has not been unsterilized between uses. In this study, the risky behaviours with serious health implications, ranged from tattooing 28(15.7%), taking part in blood initiation ceremonies 19(10.7%), sharing/exchange of needles, razors, sharp objects 79(44.4%) to injecting drugs 2(1.1%) and making tribal marks 38(21.3%). A number of studies have found that injecting drug users (IDUs) are more likely to share injecting equipment within the prison than before their incarceration and this has been estimate to range between 0 and 30% while 75% males and 69% females shared needles and syringes inside

the prison. Although some IDUs may be aware of the risk of contracting HIV through this medium, many however even wash the needles with water but this does not guarantee cleanliness and sterility especially where clean needles are not available [30].

Blood donation and blood transfusion are another high risk route of acquiring and spreading HIV infection. Respondents in this study, although they were neither transfused nor did they donate blood, as prison inmates, but rather prior to their incarceration, 17(9.6%) of the inmates had donated blood while 7(3.9%) had been transfused. Although one cannot categorically say that the percentage of sero-positives observed in this study acquired the infection through blood donation or transfusion, however, prior to 1985 when the screening of the nation's blood supply for HIV began, some people were infected with contaminated blood through the transfusion of blood or blood products. The nationwide screening revealed that 0.04% of the donated blood and blood products were found to be HIV sero-positive [31].

The prison conditions and its high risk environment are often regarded as breeding grounds for the acquisition and spread of HIV infection because they are frequently overcrowded. For instance, due to overcrowding inmates take turns to sleep and lack of sleep or inadequate sleep could lead to a chain of other high risk behaviours such as bullying, intimidation, urge to harm, depression, having suicidal tendencies and violence which may eventually result in physical assault, gang fighting and inflicting of injury. These risky behaviours were identified and also observed in the course of this study, this may be attributed to quest for power and supremacy among correctional inmates. Where physical injuries, broken skin or loss of blood is involved, contact with infected blood however increases transmitting and acquiring HIV. These high risk behaviours among the inmates were highly significant at p-values 0.007 to < 0.0001. Researchers such as WHO [32] and Robenstein *et al.,* [33] reported that about 25% of prisoners suffer violence each year.

Risk factors to the transmission and spread of TB are however numerous considering the various forms of the infection, however, the type and stage of the infection notwithstanding. The health status of any individual is primarily determined when one subjects oneself for voluntary counseling and testing (VCT), which exposes the actual health status of such individual. VCT is however, one of the health status indicators. In this studies moreover, a good percentage of the inmates did not seem to be knowledgeable about VCT and so about 90.4% declined the knowledge such. Interestingly, 93.4% of these inmates never assessed this facility outlet and so were completely ignorant of their health status and these are statistically significant at P < 0.0001. Hence, in this study, only 29.2% respondents subjected themselves to being screened at one time or the other, and it can be said that these inmates knew and valued their health status and any underlying ailment or infection would have been promptly identified and early management initiated. The 70.8% that could not have themselves screened can however be referred to as being vulnerable.

Many years ago, TB was referred to as consumption disease because affected individuals without effective treatment would waste away until the discovery of antibiotics [27]. It is rather not surprising that of the 34.8% who knew their weight at entrant, 27.5% of them confessed that their weight was actually reducing and these were statistically significant at, P < 0.0001. The reason for this wasting away typified by unintentional weight loss may however not be unconnected with the fact that some individuals must have acquired the infection hence the prevalence rate observed. Besides acquiring this infection, coupled with lack of treatment or poor management of such individuals, with inadequate nutrition and weakened immune system, can be well understood why the wasting away and unintentional reduction in weight. Malnutrition worsens TB and TB condition worsens in the face of malnutrition because, for a long time, it has been known that there is a two way link between TB and malnutrition [34]. Many researchers have attested to this.

High blood pressure has also been identified as a health status indicator and is a risk factor to developing a disease or an injury. In this study however, 81.5% of the correctional inmates did not seem to know their blood pressure probably because they did not know its importance and maybe, because they did not have the economic resource to access it. Blood pressure may not be a risk factor to TB in this study, but high blood pressure has been documented to be a veritable tool that can enhance the propagation of infectious disease because of the devastating effect it has on some organs of the body. One study carried out by Seegert in 2014 [35] found a

significantly higher prevalence of hypertension among TB patients compared to controls. Blood pressure is the strength of blood pushing the artery walls and circulating blood round the body from the heart. Normal blood rises and falls throughout the day but where it remains high for a long time will however, damage the liver, the lungs and increase the risk of cardiovascular disease. Tobacco is a leading cause of cardiovascular disease [36] and its consumption is however one of the risk factors to TB.

In this study however, 46.1% inmates of the Port Harcourt prison said they smoked indian herm which is a stronger form of tobacco with higher nicotine content and more active. Although smoking Indian herm may not have been statistically significant here but is a risky behaviour with serious health implications. This is similar to the findings of other researchers. Besides, smoking such strong and addictive substance, it is mostly taken to escape from depression and as a sedative to induce sleep especially in a confined environment such as the correctional institution. Depression and insomnia (sleeplessness) are however incriminated in derailed mental health and are therefore classified among the high risk behaviours. Depression and lack of adequate sleep are also one of the leading causes of blood pressure complications. It can therefore be said that these risky factors and high risk behaviours are associated with the dissemination of TB. Similarly, it can also be said that a depressed individual who has been deprived of adequate sleep, and has other underlying health conditions may also become aggressive and even develop social tendencies. All these risky factors and high risk behaviours were however identified in this study. Depressed individuals were 86.5%, those who required drugs to induce sleep were 78.1% while those with the urge to harm, kill oneself or harm others were 29.2% and 19.1% respectively. These are all statistically significant at P < 0.0001.

Other risk factors to TB include alcohol consumption, and drug abuse. In this study, 43.3% were involve in alcohol consumption while the percentage that inject drugs, had family history of drugs or used drugs prior to imprisonment are 1.1%, 3.4% and 12.9% respectively and were all statistically significant at P < 0.001 except for alcohol consumption. These assertions have been confirmed by various researchers although the prevalence rates may have varied [37].

5. CONCLUSION

The prevalence of HIV among inmates in this study is quite high and remains a public health problem while that of Mycobacterium tuberculosis though appearing relatively low still remains a public health risk. The risk factors amongst inmates of Correctional Institutions in Port Harcourt Nigeria have been identified in this study. The high HIV 1 & 2 prevalence with MTB prevalence with high viral load results indicates poor health conditions which if not contained can spread to other inmates. This requires prompt interventions and treatment among the correctional inmates.

DISCLAIMER

The products used for this research are commonly and predominantly use products in our area of research and country. There is absolutely no conflict of interest between the authors and producers of the products because we do not intend to use these products as an avenue for any litigation but for the advancement of knowledge. Also, the research was not funded by the producing company rather it was funded by personal efforts of the authors.

CONSENT

As per international standard or university standard, patients' written consent has been collected and preserved by the authors.

ETHICAL APPROVAL

It is not applicable.

COMPETING INTERESTS

Authors have declared that no competing interests exist.

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