

# Prevalence of Hepatitis C Virus and Associated Risk Factors among Inmates at New Bell Prison, Douala, Cameroon

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## Abstract

Although a high prevalence of HCV infection in correctional facilities has been well reported in several countries around the world, there has been no such data from Cameroon. The aim of this study was to determine the prevalence and factors associated with viral hepatitis C seropositivity among prisoners incarcerated at the New Bell Central Prison in Douala. From the 2<sup>nd</sup> to the 27<sup>th</sup> of July 2018, 940 inmates selected using a systematic random sampling method were interviewed to collect data on sociodemographic status, duration of incarceration, number of incarcerations and risk factors for HCV transmission. Blood samples were collected for screening of anti-HCV antibodies via HEPA-SCAN HCV CARD Test. Positive samples had a confirmatory ELISA test. Data were analysed using EPI DATA 4.4.0.0 software. Statistical significance was set at a  $p < 0.05$ . Of the 940 prisoners selected, 94.1% (884) were males. The mean age of the study population was  $33.81 \pm 10.35$  years (extremes: 14 and 74 years). HCV prevalence was 4.4% (40). The use of non-injectable illicit drugs (OR 2.87 95% CI 1.44 - 5.73) ( $p = 0.002$ ) but not injectable illicit drugs (OR 1.91 95% CI 0.43 - 8.41) ( $p = 0.42$ ), male homosexuality (OR 17.45 95% CI 7.58 - 40.13) ( $p < 0.001$ ), sharing of needles (OR 3.45 95% CI 1.59 - 7.83) ( $p = 0.001$ ), past history of tattooing or piercing (OR 5.94 95% CI 2.80 - 12.16) ( $p < 0.001$ ) and age  $\geq 50$  (OR 4.069; 95% CI 1.9 - 8.68) ( $p = 0.003$ ) were significantly associated with HCV antibodies positivity. Inmates in New Bell Central Prison accumulate risk factors for viral hepatitis

C, thus contributing to the high prevalence in this setting. Control strategies and programs that reach this particular population should urgently be implemented.

## Keywords

Prevalence, Risks factors, Hepatitis C, Prisoners

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## 1. Introduction

Hepatitis C virus (HCV) infection is a major public health problem in the world with significant mortality and morbidity especially in Sub Saharan African and East Asian countries [1]. In 2015, WHO estimated at 71 million the number of people chronically infected by HCV worldwide [1]. About 1.75 million people newly acquire hepatitis C virus infection each year. Hepatitis C and B viruses related death is about 1.3 million every year mainly due to liver cirrhosis and/or hepatocellular carcinoma (HCC) [1].

With a general population HCV prevalence estimated at 6.5%, Cameroon is considered as one of the most affected countries in the world [2].

Prisoners are a high risk population for infectious diseases with a high prevalence for viral hepatitis and HIV. Overall prevalence of HCV infection ranging from 0.2% to 13% has been reported by several studies in Europe [3] [4] [5], North America [6], Latino America [7] and Africa [8] among adult inmates. This high risk is linked to the prison setting with poor hygiene, promiscuity, malnutrition, tattooing and other forms of skin piercing, physical and moral violence, intravenous drug use, homosexuality and lack of knowledge about HCV transmission modes as reported by several authors [9] [10]. Being incarcerated for longer period or having more than one incarceration has also been associated to HCV infection [9] [11].

In addition prisoners suffered from limited access to appropriate health care services, lack of early detection and treatment of some chronic disease could serve as reservoirs for HCV infections.

Despite the high prevalence HCV infection in Cameroon, published data on the prison setting are scarce. The aim of this study was to determine the prevalence of HCV antibodies and their associated risk factors among inmates of the New Bell central prison Douala in Cameroon.

## 2. Materials and Methods

### 2.1. Study Design

This was a cross sectional study from the 2<sup>nd</sup> to the 27<sup>th</sup> of July 2018 at the New Bell central prison including 940 inmates obtained by systematic random sampling from a total of 3356 inmates present during the study period. The participants were arranged alphabetically and selected using a sampling interval of 4.

Data collected included age, gender, profession before detention, level of education, marital status, religion, number, quarter and duration of incarceration. Data on risk factors for HCV transmission was equally collected on a pretested questionnaire. Detection of anti HCV antibodies was done using HEPA-SCAN HCVCARD (RECKON DIAGNOSTICS P.LTD (3/7, BIDC, Gorwa Vadogara 390,016 (INDIA)) which is a rapid diagnostic test for detection of anti HCV antibodies in plasma and serum. Inmates who tested positive had a confirmatory ELISA test.

## 2.2. Study Setting

Created in 1930, the New Bell prison in Douala is one of the two largest prisons in Cameroon. It is a mixed prison with separate male, female and children quarters. It has a capacity of 960 places for over 3500 prisoners with 27 cells containing between 30 - 200 prisoners per cell giving an average space of 0.2 m<sup>2</sup> per inmate for a standard of 0.4 m<sup>2</sup>. The New Bell central prison is divided into 10 quarters which harbours 4 different groups of persons; Minors (males less than 18 years of age), aged persons (males above 55 years of age), females of all age groups and males between 18 and 54 years of age. Males between 18 and 54 years constitute 86.7% of all inmates.

The prison offers health services for inmates and has 1 medical doctor, 2 state registered nurses, 5 assistant nurses and 2 laboratory technicians. All new prisoners have complete physical examination by the site physician with systematic HIV screening but no screening for viral hepatitis is done despite the precarious conditions in this setting.

## 2.3. Data Analysis

The Statistical Package for Social Sciences (SPSS) version 21.0 (Institute, Cary, NC, USA) was used for data analysis. The odds ratio (OR) and the 95% confidence interval (95% CI) were calculated to assess associations between HCV antibodies positivity and sociodemographic variables, some accepted risk factors for HCV infection in univariate analysis. Independent associations were evaluated by calculating the adjusted OR by multivariate analysis for the sociodemographic variables and the risk factors found to be significant in the univariate analysis. A P value of <0.05 was considered significant.

## 2.4. Ethical Considerations

Ethical clearance was obtained from institutional ethical review board of the University of Montagne Banganté Cameroon while administrative authorization was procured from the regional delegate for penitentiary administration Littoral region and the superintendent in charge of the New Bell central prison. Prison inmates tested positive for HCV antibodies were then referred to the medical doctor in charge of the prison health service for proper management. All included inmates signed a written consent form.

### 3. Results

Of the 940 prisoners included, 94.1% (884) were males and 5.9% (56) were females (**Table 1**). The mean age was 33.81 years ( $\pm 10.35$  years) with extremes of 14 and 74 years. The most represented age group was 30 - 39 years with 41.1% of cases (**Table 1**). Prevalence of HCV antibodies was 4.4% (40) (**Table 2**). Among the 940 prisoners, 60% (566) were unaware of HCV infection and risk factors for HCV transmission (**Table 3**).

**Table 4** and **Table 5** showed the Odd ratios for HCV antibodies positivity according to socio-demographic characteristics and some risk factors of HCV among new bell prison inmates in Douala. Inmates aged 50 years and above

**Table 1.** Baseline socio-demographic characteristics of the study population.

Characteristics	Number	Percentage (%)
<b>Gender</b>		
Male	884	94
Female	56	6
<b>Age (years)</b>		
[10 - 19]	58	6.2
[20 - 29]	270	28.9
[30 - 39]	385	41.1
[40 - 49]	148	15.8
$\geq 50$	78	8.3
<b>Level of education</b>		
Never to primary	629	66.9
Secondary and above	311	33.1
<b>Marital status</b>		
Single	560	59.5
Married	368	39.2
Widow	12	1.3
<b>Religion</b>		
Christian	704	74.7
Muslim	200	21.2
Others	36	3.8
<b>Profession</b>		
Private sector	400	42.7
Civil servant	114	12.2
Trader	193	20.6
Student	99	10.6
Farmer	25	2.7
Unemployed	103	11

**Table 2.** Prevalence of HCV antibodies.

Serology	Number	Percentage (%)
Positive HCV Ab	40	4.4
Negative HCV Ab	900	85.6

**Table 3.** Knowledge on HCV infection and risk factors for transmission.

	Number	Percentage (%)
Yes	374	39.8
No	566	60.2
Total	940	100

**Table 4.** Odd ratio for HCV antibodies positivity according to socio-demographic and carceral characteristics among New bell prison inmates in Douala.

Characteristics	Number tested	HCV Ab positive N (%) £	HCV Ab negative N (%) ¥	OR (95% IC)	P value	Adjusted OR	Adjusted P-value
<b>Gender</b>							
Male	883	38 (95)	845 (93.8)	1.21 (0.28 - 5.16)	0.787	1.12 (0.22 - 5.59)	0.892
Female	56	2 (5)	56 (6.2)				
<b>Age (years)</b>							
[10 - 19]	58	0 (0)	58 (0)	0.39 (0.11 - 2.97)	0.319		
[20 - 29]	271	2 (5)	269 (28.8)	0.56 (0.11 - 2.17)	0.551		
[30 - 39]	385	13 (32.5)	372 (41.3)	0.79 (0.32 - 2.21)	0.261		
[40 - 49]	148	8 (20)	140 (15.5)	2.27 (0.3 - 22.21)	0.465		
≥50	78	17 (42.5)	61 (6.7)	4.069 (1.90 - 8.68)	0.001	3.89 (1.56 - 9.68)	0.003
<b>Level of education</b>							
Never to primary	628	29 (72.5)	599 (66.5)	1.32 (0.65 - 2.68)	0.433		
Secondary and above	311	11 (27.5)	30 (3.3)				
<b>Duration of incarceration (months)</b>							
>12	465	33 (82.5)	432 (48)	5.05 (2.12 - 11.54)	<0.001	5.17 (2.16 - 12.35)	0.002
≤12	471	7 (17.5)	463 (51.4)				
<b>Number of incarcerations</b>							
≥2	250	9 (22.5)	241 (26.7)	0.79 (0.37 - 1.69)	0.54	0.443 (0.19 - 1.011)	0.57
1	690	31 (77.5)	660 (73.1)				

£: percentage according to total number of patients positive for HCV antibodies; ¥: percentage according to total number of patients negative for HCV antibodies.

**Table 5.** Odd ratio and adjusted odd ratio for HCV antibodies according to risk factors among new bell prison inmates in Douala.

Characteristics	Number tested	HCV Ab positive N (%) £	HCV Ab Negative N (%) ¥	OR (95% CI)	P value	Adjusted OR	Adjusted P-value
<b>Poor knowledge on risk factors of HCV transmission</b>							

## Continued

NO	625	29 (72.5)	596 (66.1)	1.35 (0.66 - 2.73)	0.495		
YES	315	11	304				
<b>Injected illicit drugs used</b>							
YES	26	2 (5)	24 (2.6)	1.91 (0.43 - 8.41)	0.42	2.21 (0.37 - 10.94)	0.49
NO	913	38	875				
<b>Non injected illicit drugs used ¥¥</b>							
YES	430	28 (70)	402 (44.7)	2.87 (1.44 - 5.73)	0.002	1.87 (0.85 - 4.093)	0.119
NO	508	12	496				
<b>Men having sex with men</b>							
YES	31	11 (27.5)	20 (2.2)	17.45 (7.58 - 40.13)	<0.001	3.831 (1.65 - 8.84)	0.002
NO	908	29	879				
<b>Sharing of needles, razors or teeth brushes</b>							
YES	271	35 (87.5)	236 (26.1)	3.45 (1.59 - 7.83)	0.001	2.74 (1.14 - 6.54)	0.025
NO	664	5	659				
<b>History of tattooing or piercing</b>							
YES	360	31 (77.5)	329 (36.4)	5.94 (2.80 - 12.66)	<0.001	3.831 (1.65 - 8.84)	0.002
NO	576	9	567				
<b>History of scarifications</b>							
YES	391	36 (90)	355 (39.4)	13.76 (4.85 - 29.01)	<0.001	10.28 (3.51 - 22.08)	<0.001
NO	549	4	545				
<b>History of blood transfusion</b>							
YES	115	7 (17.5)	108	1.55 (0.67 - 3.59)	0.320	1.10 (0.43 - 2.82)	0.832
NO	825	33	792				

£: percentage according to total number of patients positive for HCV antibodies; ¥: percentage according to total number of patients negative for HCV antibodies; ¥¥: non-injectable illicit drugs were marijuana, cocaine.

were at increased risk of HCV infection (OR 4.069; 95% CI 1.9 - 8.68) ( $p = 0.003$ ) as compared to younger patients. Being incarcerated for more than one time was not associated with high risk of HCV seropositivity (OR 0.79; 95% CI 0.37 - 1.69) ( $p = 0.54$ ). However the duration of incarceration greater than 12 months had 5.05 fold (95% CI 2.12 - 11.54) higher risk of HCV transmission. In univariate analysis, use of non-injectable illicit drugs (OR 2.87 95% CI 1.44 - 5.73) ( $p = 0.002$ ) but not injectable illicit drugs (OR 1.91 95% CI 0.43 - 8.41) ( $p = 0.42$ ), male homosexuality (OR 17.45 95% CI 7.58 - 40.13) ( $p < 0.001$ ), sharing of needles (OR 3.45 95% CI 1.59 - 7.83) ( $p = 0.001$ ) and past history of tattooing or piercing (OR 5.94 95% CI 2.80 - 12.16) ( $p < 0.001$ ) were all significantly associated with HCV antibodies positivity. Nevertheless, in multivariate analysis, the use of non-injectable illicit drugs was no longer associated to HCV transmission (adjusted OR 1.87 95% CI 0.85 - 4.09) ( $p = 0.119$ ).

Inmates with past history of blood transfusion had 1.55 fold (OR 1.55 95% CI 0.67 - 3.59 higher risk factor for HCV transmission but this was not significant ( $p = 0.32$ ).

#### 4. Discussion

Hepatitis C virus (HCV) is a major public health problem in different part of the world especially in developing countries. With an estimated overall pooled HCV seroprevalence of 6.5%, Cameroon is considered as one of the most infected countries in the world and the burden of disease varies from one group to the other [2]. Prison inmates represent one of the high risk population groups. Overcrowding in prisons and some high risk behaviours such as injecting drug use, tattooing high risk sexual behaviour are factors that could favour the transmission of infectious diseases such as viral hepatitis, HIV and other sexually transmissible diseases. Published data on prison inmates in Cameroon are rare. Therefore the aim of this study was to determine the prevalence and factors associated with HCV antibodies positivity among prison inmates at the New Bell Central Prison Douala.

Our study population was predominantly male (94.1%) with a mean age of  $33.81 \pm 10.35$  years. The most represented age group was that between 30 and 39 years.

The prevalence of HCV antibodies in our study population was estimated at 4.4%. The seroprevalence of HCV infection in the general population in Cameroon is still a matter of concern. Up to now no nationwide representative study has provided better estimates of the seroprevalence of HCV in the country. A recent meta-analysis on 31 studies including 36 407 individuals from different groups has reported an overall pooled HCV seroprevalence of 6.5% [2] that was higher compared to the 2.5% reported by Njouom *et al.* in 2018 [12] in patients aged between 15 - 59 years. In most published studies in Cameroon HCV seroprevalence is higher in older population and the low prevalence reported by Njouom *et al.* could be explained by the fact that they do not included patients of more than 60 years. Nevertheless, HCV seroprevalence of 4.4% reported in this study is high and could be explained by the presence of several risk factors for HCV transmission in our prison setting including homosexuality, scarifications, sharing of toiletries, both intravenous and non-intravenous drug use, history of tattooing and piercing.

About half (48.6%) of our study population admitted drug use with the non-injectable form being the most frequently used despite strict security rules instituted by the penitentiary authorities. This finding is consistent with that reported by Adjei *et al.* [13] in Ghana in 2006 with non-injectable drug use being the most common form of drug abuse. Only 2.7% of our study population admitted intravenous drug use before incarceration which could be explained by the scarcity and expensive nature of these drugs in our setting and similar to reports from other African prisons [8] [13] [14]. The HCV prevalence obtained in

our study is however lower than that reported in European series where epidemic patterns of HCV infection related to injection drug use persists among prisoners. Dolan K *et al.* [15] in 2016 reported HCV prevalence's of 20.2% in eastern Europe and central Asia region, 15.5% in west Europe and 15.3% in North America. This high prevalence's could be attributed to high intravenous drug use with sharing of needles among prisoners in the developed world. Several authors [16] [17] [18] have reported a direct link between high HCV prevalence and intravenous drug use. Hence the absence of IVDU in our study population suggests other routes of contamination especially the sexual route.

HCV infection was significantly associated with homosexuality ( $p < 0.001$ ), sharing of toiletries ( $p = 0.001$ ), scarifications ( $p < 0.001$ ) and duration of incarceration ( $p < 0.001$ ).

These findings are similar to those reported by Adoga *et al.* in 2006 in Nigeria [8] who found duration in prison to be associated with HCV transmission. In our study population, prisoners between 12 - 36 months of incarceration were more at risk for HCV transmission. Homosexuality especially among men increases by 17 folds the risk of having HCV infection. This finding is consistent with the reports from other authors [9] [19]. In the prison milieu, overcrowding and precarious conditions with increased promiscuity favours this practice which is well known as risk factor of HCV infection. Sharing of toiletries ( $p = 0.001$ ), history of tattoos/piercing ( $p < 0.001$ ), scarifications ( $p < 0.001$ ) were also significantly associated with HCV infection. However about 60% of the study population was unaware of this means of HCV transmission.

## 5. Conclusion

Inmates in New Bell Central Prison accumulate risk factors for viral hepatitis C, thus contributing to the relatively high prevalence in this setting. In the aim to eradicate HCV infection, there is an urgent need to implement a viable health policy to manage high risk populations like these prisoners.

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## Authors' Contributions

This work was carried out in collaboration between all authors. Author MK contributed in collection of data, analysis and editing the article; Author FA contributed in study conception, analysis of data and editing the article. Author DT wrote the protocol, collected data. Authors LT, AN, BE, SE, RD contributed in collection of data and revised the first draft of the manuscript. Authors ECN and ON supervised all the activities and approved the final version to be sub-



mitted for publication. All authors read and approved the final manuscript.

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## Ethical Considerations

Ethical clearance was obtained from institutional ethical review board of the University of Montagne Banganté Cameroon while administrative authorization was procured from the regional delegate for penitentiary administration Littoral region and the superintendent in charge of the New Bell central prison. Prison inmates tested positive for HCV antibodies were then referred to the medical doctor in charge of the prison health service for proper management. All included inmates signed a written consent form.

## Conflicts of Interest

Authors have declared that no competing interests exist.

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