

Seroprevalence Survey of HIV and Hepatitis B Virus and Behavioral Characteristics among Heavy Truck Drivers along Port Sudan-Khartoum Highways

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Abstract

The prevalence of human immunodeficiency virus (AIDS) and hepatitis B virus among heavy truck drivers and their assistants has been well documented globally in correlation with their behavioral characteristics. The present study aimed to screen for human immunodeficiency virus (HIV), hepatitis B virus (HBV), and behavioral characteristics among heavy truck drivers in Port Sudan. A cross-sectional study was conducted on 274 heavy truck drivers and their assistants who used the highway Port Sudan-Khartoum in Port Sudan city during 2019-2021. Data on behavioral characteristics and substance use habits were collected using a structured questionnaire, and an ELISA test was used to screen for HIV and HBV infections in the study participants. The chi-square test, odds ratio, and confidence intervals were used to find the association between behavioral characteristics and seropositive HIV/HBV. Of the 274 enrolled participants, the seroprevalence rates of HIV were 2.7% and HBV was 23.7%. Ninety-four (34.3%) of them had a history of high-risk sexual behavior outside of marriage; only two (0.7%) used condoms; 14.2% of participants reported alcohol use; and 1.1% reported drug use. Univariate analysis revealed that having a sex history outside of marriage with ≥ 1 sex partner and never using a condom with a spouse or casual partner were significant risk factors for HIV and HBV among drivers. Fortunately, we found that most of the drivers reported low alcohol and drug use. Concerning this study, the seroprevalence of HIV and HBV is highly associated with a history of having sex outside of marriage and sexual behavior among truck drivers and assistances. Additional studies are needed to further investigate other STIs and behavioral characteristics associated with factors in truck

drivers/assistance in different truck stop regions in Sudan.

Keywords

Sexual Transmitted Infection, Port Sudan, Truck Drivers/Assistance

1. Introduction

In low- and middle-income countries that lack or have inadequate rail services, transport relies heavily on road transport [1] [2]. The Port Sudan-Khartoum highway, the most important road transport, contributes daily to local economies in the trade and logistics industries. Port Sudan is recognized as Sudan's main seaport and the source of 90% of the country's international trade. It is located in eastern Sudan [3]. Truck drivers are the main agents of this transportation system, transporting goods and services within the country [4]. Globally, sexually transmitted infections (STIs), with an increasing magnitude in the spread of human immunodeficiency virus (HIV), hepatitis B virus (HBV), hepatitis C virus (HCV), and other STIs, are among the most serious public health problems facing truck drivers (drivers and assistants) [5] [6]. On the other hand, truck drivers tend to have multiple sexual partners due to their traveling nature and the fact that they are away from family for a long period of time [5]. There are eight most common STIs (chlamydia, gonorrhoea, syphilis, trichomoniasis, hepatitis B virus [HBV], herpes, HIV, and human papillomavirus [HPV]), of which four are curable (chlamydia, gonorrhoea, syphilis, and trichomoniasis) [7]. Public awareness and research efforts are more focused on women because the burden of the disease sequelae due to pregnancy complications, etc. is considered a female issue despite the sexual transmissibility [7] [8]. In spite of this, men are equally at risk for STIs and should be treated equally with women [7]. The long-term effects of STIs on men are a major global cause of infectivity, long-term disability, and death, with severe medical and psychological consequences [8].

Evidence from studies in Africa, Southeast Asia, Eastern Europe, and the South indicates that heavy truck drivers are at increased risk of STIs and engage in high levels of risky behaviors such as unprotected sexual intercourse, commercial sex, multiple sexual partners, and high levels of drug use [4] [6] [8] [9] [10]. There are various behaviors and practices that put heavy truck drivers at risk of STIs for several reasons: being poorly educated with limited knowledge and awareness about STIs, having a poor perception of the risk of potentially acquiring an infection from their sexual quest, and having little or no access to sexual health services [7] [11]. There are currently no published studies on the prevalence of STIs in association with the behavioral characteristics of heavy truck drivers in Sudan. Accordingly, this paper aims to investigate the prevalence of STIs (HIV and HBV) as well as behavioral characteristics in heavy truck drivers and their assistants in Port Sudan, Khartoum Highway.

2. Methodology

2.1. Study Design, Population and Data Collection

A descriptive-analytical cross-sectional study was carried out three times per month from July 2019 to April 2021. We used a mobile clinic tent to conduct this study at a large trucking terminal in southern Port Sudan, local government area, Red Sea State. Al-Shahenat trucking terminal was chosen as the largest of the three trucking terminals, with numerous short- and long-distance shipping companies, transport companies, clearance depots for imports and exports, warehouses, and related service centers. Additionally, Al-Shahenat is an ideal gateway to most of Sudan's regions. Because of its well-connected location to the hinterland, long- and short-distance truck drivers use the port regularly as a common destination. The study population included long-distance truckers and their assistants who were present at the time of data collection. The study was proposed to the entire population in a tent clinic that was established by the researcher at a highway near a traffic police station. The purpose of the study was explained to each subject separately before they enrolled in the study, and they were chosen based on accessibility and agreement that the purpose of this study was confidential and that the information provided by them would not affect their working status. The truck drivers and assistants who were over 18 years old, worked on the Port Sudan-Khartoum highway for at least 1 year, and did not return home overnight were eligible for the study. Based on the Cochrane formula for calculating sample size in a cross-sectional study, the study managed to receive 274 out of 410 (66.8%) truck drivers and assistants who were randomly interviewed successfully and who were accepted to give blood specimens for screening HIV and HBV. This positive response rate could be attributed to the level of understanding of the individuals who participated in the study.

Data collection for this study was done by the principal investigator with the cooperation of public health providers. The face-to-face interview and structured questionnaire with closed-ended questions were used to collect demographic, behavioral characteristics (e.g., number of partners, condom use, STI history), and substance use history (e.g., drug, alcohol, smoking, sniffing). All interviews were conducted anonymously, with no identifying or locating information collected, and all interview forms were coded with unique numbers. A standard questionnaire was designed regarding the sexual risk behaviors of heavy truck drivers in a southern Nigerian town [2]. After the questionnaire was designed and pre-tested with the respondent being interviewed to guarantee the validity and reliability of the data, the questionnaire was developed in English and translated from English to Arabic. Upon completion, it underwent many revisions by the research supervisor, gaining their approval.

Blood serum samples were screened for HIV antibodies using RecombiLISA HIV 1 + 2 Ag/Ab ELISA (CTK Biotech Inc., USA). Hepatitis B surface antigen (HBsAg) was tested using RecombiLISA HBsAb ELISA (CTK Biotech Inc., USA). The procedure to run the ELISA test was followed as mentioned by the

manufacturer, Kits (CTK Biotech Inc., E0714S1C01 and E0714S2F00). All laboratory testing was performed in the department of medical laboratory sciences at the National University of Sudan.

2.2. Statistical Analysis

All data were analyzed using the Statistical Package for the Social sciences for Windows software package version 29.0 (SPSS-IBM, Armonk, NY). Descriptive statistics, including frequencies, Chi-square, the odds ratio (OR) and the 95% confidence interval (95% CI) for seropositive HIV/HBV were used to assess associations with behavioral variables and substance use habits in univariate analysis with P-value < 0.05 were considered statistically significant.

2.3. Ethics Considerations and Statement

The design and protocol of this study were approved by the Ministry of Health, sexual transmitted disease control programs, and the Research Ethics Committee of Alzaiem Alazhari University, Khartoum State, Sudan. After explaining the objectives of the project, written consent was obtained from all drivers participating in the study. To comply with ethical standards, the questionnaires were distributed anonymously (pre-coded) to participants, and they were guaranteed that all this information would be confidential. None of the foreign citizens' heavy truck drivers took part in the study.

3. Results

In this study, 274 heavy truck drivers and assistants along the Port Sudan-Khartoum highway were enrolled based on a random sample, whose mean and standard deviation of age were 42.4 ± 13.4 years. All of the study participants were male and of Sudanese nationality. The mean and standard deviation of their driving experience were 14.40 ± 9.01 years. The maximum and minimum years of activity as a driver were 33 years and 2 years, respectively. Over two-thirds of the respondents were married, 20.4% were single, and 2.2% were divorced or widowed (**Table 1**). The positive seroprevalence of HIV and HBV in the study participants was ($n = 7$; 2.6%) and ($n = 65$; 23.7%), respectively.

Demographics, behavioral characteristics and substance use habits are shown in **Table 1**; 34.3% of the drivers had a history of sex outside of marriage, and 42.6% had two or more sexual partners. Two drivers (0.7%) reported using condoms in the past six months (with regular partners as contraceptive), while 99.3% had never used condoms, of which 12.0% did not know what a condom is. Approximately 58.4% of drivers engage in sexual behaviour at the age of 18 and above. The majority of drivers 97.1% didn't screen for STDs (HIV/HBV) in the previous 6 months. Drivers were asked; if you are positive for (HIV/HBV), 54.7% of them reported they would have shared the results with their spouses or causal partners, while most drivers (96.7%) did not stop having sex. Among 274 drivers; 89.4% had smoked a cigarette, 88.7% snuffed tobacco, 14.2% drank alcohol and only 1.1% had used recreational drug.

Table 1. Demographic data, sexual characteristics, substance use habits and sexually transmitted infection among heavy truck drivers/assistants (n = 274), Port Sudan-Khartoum highway, 2019-2021.

Characteristics	Frequency (%)
Demographic data	
Age	
<20 years	2 (0.7%)
20 - 39 years	115 (42.0%)
40 - 59 years	127 (46.4%)
≥ 60 years	30 (10.9%)
Truck driving years	
1 - 5 years	47 (17.2%)
≤10 years	74 (27.0%)
>10 years	153 (55.8%)
Marital status	
Married	212 (77.4%)
Living together	3 (1.1%)
Single	53 (19.3%)
Divorced or widow	6 (2.2%)
Behavioral characteristics	
History of sex outside of marriage	
Yes	94 (34.3%)
No	180 (65.7%)
Current number of sexual partner (casual or sex worker), n = 94	
One sexual partner*	35 (37.2%)
Two or more sexual partners*	40 (42.6%)
Casual partner	19 (20.2%)
Using condom during the past six months	
Yes	2 (0.7%)
No, I and my partner are free from STDs	120 (43.8%)
No, without reason	119 (43.4%)
No, I don't know	33 (12.0%)
Early sexual debut	
≤18 years at first sex	3 (1.1%)
>18 years at first sex	160 (58.4%)
I didn't remember	105 (38.3%)
No	6 (2.2%)

Continued

Screening of STDs (HIV/HBV) in previous 6 months	
Yes	8 (2.9%)
No	266 (97.1%)
If you are positive to (HIV/HBV), do you stop having sex	
Yes	8 (2.9%)
No	265 (96.7%)
If you are positive to (HIV/HBV), do you tell your spouses or causal partners?	
Yes	150 (54.7%)
No	124 (45.3%)
Substance use habits	
Alcoholic drink use	
Yes	39 (14.2%)
No	235 (85.8%)
Recreational drug use	
Yes	3 (1.1%)
No	271 (98.9%)
Cigarette smoke use	
Yes	245 (89.4%)
No	29 (10.6%)
Tobacco snuff use	
Yes	243 (88.7%)
No	31 (11.3%)

In univariate analyses listed in (Table 2) comparing drivers with seropositive HIV or HBV test results to those with seronegative results. For seropositive HIV in heavy truck drivers/assistants were significantly associated with having history of sex out marriage (OR = 1.08; 95% CI = 1.02 - 1.14), and not using a condom (OR = 1.96; 95% CI = 0.49 - 7.82). for seropositive HBV in heavy truck drivers/assistants were significantly associated with having history of sex out marriage (OR = 2.02; 95% CI = 1.46 - 2.81), not using a condom (OR = 2.32; 95% CI = 1.45 - 3.73), early sexual debut (OR = 0.98; 95% CI = 0.63 - 1.51), sharing the STIs results with their spouses or causal partners (OR = 1.89; 95% CI = 1.06 - 3.39), and did not stop having sex (OR = 2.07; 95% CI = 0.85 - 5.08). Additionally; the association between substance use listed in table; the seropositive HIV was not statistically significant, while seropositive HBV showed significant association between the cigarette smoke use (OR = 1.02; 95% CI = 0.52 - 2.02) and the tobacco snuff use (OR = 1.21; 95% CI = 1.06 - 1.39).

Table 2. Association between seropositive HIV and HBV test result and behavioral characteristics and substance use habits: heavy truck drivers (n = 652), Port Sudan-Khartoum highway, 2019-2021.

Variable	Seropositive HIV			Seropositive HBV		
	No	OR (95% CI)	P-value	No	OR (95% CI)	P-value
<u>Behavioral Characteristics</u>						
History of sex outside of marriage						
Yes	7	1.08 (1.02 - 1.14)	<0.0001	41	2.02 (1.46 - 2.81)	<0.0001
No	0			24		
Condom use						
Yes	1	1.96 (0.49 - 7.82)	<0.0001	0	2.32 (1.45 - 3.73)	<0.0001
No	6			65		
Early sexual debut						
Yes	2	1.63 (0.32 - 8.23)	0.354*	26	0.98 (0.63 - 1.51)	0.012
No	5			39		
Screening of STDs (HIV/HBV) in previous 6 months						
Yes	1	1.12 (0.86 - 1.45)	0.070*	4	1.54 (0.77 - 3.09)	0.076*
No	6			61		
If you are positive to (HIV/HBV), do you tell your spouses or causal partners?						
Yes	5	1.01 (0.98 - 1.06)	0.360*	43	1.89 (1.06 - 3.39)	0.029
No	2			22		
If you are positive to (HIV/HBV), do you stop having sex						
Yes	1	6.17 (0.65 - 58.3)	0.071*	5	2.07 (0.85 - 5.08)	0.008
No	6			59		
<u>Substance Use Habits</u>						
Alcoholic drink use						
Yes	1	1.00 (0.95 - 1.06)	0.997*	10	1.03 (0.85 - 1.26)	0.761*
No	6			55		
Recreational drug use						
Yes	0	0.97 (0.95 - 0.99)	0.818*	1	1.52 (0.38 - 6.12)	0.383*
No	7			64		
Cigarette smoke use						
Yes	7	1.03 (1.01 - 1.05)	0.356*	58	1.02 (0.52 - 2.02)	0.003
No	0			7		
Tobacco snuff use						
Yes	6	0.76 (0.09 - 6.53)	0.050*	62	1.21 (1.06 - 1.39)	0.035
No	1			3		

HIV: Human Immunodeficiency Virus; HBV: Hepatitis B Virus; No: Frequency; CI: Confidence Interval; OR: Odds Ratio; P value < 0.05: Statistical Significance; P value > 0.05*: Statistical Insignificance.

4. Discussion

This study is possibly the first and most comprehensive heavy truck driver/assistance STIs (HIV and HBV) prevalence in association with their behavior characteristics investigation in Port Sudan, the largest truck stop, and the methods used have established a comprehensive reference point for STIs and associated risk factors present in this group. All respondents were Sudanese males; the majority was sexually active with a spouse's partner, while one quarter had a sex worker and 7.0% reported sexual activity with a casual partner. A study among Sudan's subnational regions found that female sex workers (FSW's) clients accounted for the highest rate in the Eastern and Northern regions [12]. Furthermore, Elhadi, M., *et al.* [13] documented the existence of sex work and the vulnerability of FSWs and their clients to HIV and STIs in the eastern region of Sudan.

This study showed that the seroprevalence of HIV and HBV in truck drivers and their assistance were 2.7% and 23.7% in Al-Shahenat truck stop, Port Sudan city. These rates were considerably higher than those reported in the general population of Sudan [14], but were lower compared with high-risk groups such as sex workers [13]. In this study, the seroprevalence rate of HIV is low, which indicates that, as stated previously in UNAIDS 2018 data, Sudan was classified as a low epidemic with an adult (15 - 49 years) HIV prevalence of around 0.2% [12] [15]. Also, HBV seropositivity is higher among the studied group, which shows consistency with [4] [16] as documented. Sudan is one of the countries with the highest seroprevalence of the hepatitis B virus; the exposure rate ranged from 47% to 78%. The results of a study in South India showed that the prevalence of HIV infection was 2.2% and HBV was 2.6% in long-distance truck drivers [17]. The results of another study in Southern Brazil [6] showed that the prevalence of HIV and HBV in truck drivers was 56% and 2%, respectively. There are a number of sexual behavior risk factors that contribute to the acquisition as well as spreading of HIV, HBV, and other STIs among long-distance drivers, such as unprotected sexual intercourse with infrequent condom use, high alcohol consumption and illicit drug use, and psychological need for sex as a result of a long stay away from home [4] [5] [6] [10].

In the current study, 34.3% of heavy truck drivers/assistance had sex outside of marriage, and sexually risky behaviors were significantly increased in all of the HIV seropositive drivers by [OR: 1.08; CI 95%: 1.01 - 2.14] and in two-thirds of the HBV seropositive drivers by [OR: 2.02; CI 95%: 1.46 - 2.8]. Similar to our findings, in studies conducted in Bangladesh [9] and South Africa [16], the chances of unsafe sex with sex workers were higher among truck drivers. The reality is that heavy truck drivers are away from family for almost two weeks, making it difficult for them to have sexual relations with their spouses and increasing the risk of unsafe sex with sex workers. The majority of study participants reported never using condoms. However, barriers to using condoms, including being free of STDs, having no reason, and not knowing about condoms,

were significantly associated with high HIV and HBV prevalence. Previous studies in both developed and developing countries [4] [5] [6] [10] [16] [18] have found that insignificant condom use among truck drivers is associated with an increased risk of STIs caused by unprotected sex with sex workers. In the previous two bio-behavioral HIV surveillance surveys, one carried out in 2008 among four risky populations, the HIV occurrence was 0.1% in female sex workers, 0.9% in men who have sex with men, 2.3% in Khartoum city, and 0.3% in truck drivers in Khartoum-Gezira states [18], and the second in 2011-2012, in 4220 female sex workers in five regions of Sudan, found the highest HIV prevalence was at two sites in the eastern zone (5.0% and 7.7%) [13]. To reduce the risk of STI infection and to minimize and prevent unintended consequences of sexual behavior among truck drivers, assistance workers, and sex workers working along trucking routes by developing an awareness campaign to promote condom use and STI education.

Most of the truck drivers and assistants showed they did not stop having sex with spouses or casual partners if they were HIV/HBV positive. In relation to this risk behavior, it was insignificantly associated with an increase of six times in risk of HIV seropositivity [OR: 6.17; CI 95%: 0.65 - 58.3; P: 0.071] and a two-fold increase in risk of HBV seropositivity [OR: 0.85 - 5.08; P: 0.008]. This suggests that HIV, HBV, and other STIs can be transmitted more easily. It does not matter if an STI is transmitted sexually or non-sexually; if left untreated, it will have the same consequences. Substance use habits, including alcohol consumption and drug use, have been identified as the most common independently associated risk factor for HIV, HBV, and other STIs. In accordance with our data, there is relatively low alcohol and drug usage among truck drivers and assistance. The majority of respondents may not have disclosed the actual information due to issues such as fear of punishment, fear of unemployment, and identification, as our interview tent was behind the police office at the Al-Shahenat truck stop.

It is critical to note that this study has several limitations. A random sample of drivers volunteered to participate along the Port Sudan-Khartoum highway at the Al-Shahenat truck stop. In this regard, the results may not be representative of all Sudanese heavy truck drivers. During the study, participants were interviewed face-to-face, and data were self-reported. Therefore, social desire may have caused false reporting of risky behaviors, and drivers may have been reluctant to report the use of alcohol or illegal drugs. Despite these limitations, this study contributes to the literature on HIV and HBV among Sudanese truck drivers by providing information on the drivers' current STI situation. It also helps guide future public health interventions and preventive strategies. Further research is needed to explore other STIs among truckers, sex workers, and other employees in the trucking industry in different Sudan regions in order to guide effective intervention policies. There are two types: component heads and text heads.

5. Conclusion

This cross-sectional survey of heavy truck drivers, to our knowledge, is the first of its kind in Sudan and provides a precise estimate of HIV and HBV infection and highly prevalent unsafe sex in this population. There is a critical need to launch a health highway program that raises knowledge and awareness, provides accessible and confidential healthcare services for STI testing and treatment, promotes consistent condom use, and establishes peer support networks to encourage behavior change and provide a safe space for addressing sexual health concerns in the country. Further, continuous screening strategies for STIs are crucial for those at higher risk.

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Data Availability

The datasets used and analyzed during the current study are available from the main author (Sara S. Mahmoud) on reasonable request.

Conflicts of Interest

The authors declare no conflicts of interest.

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