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Human immunodeficiency virus, hepatitis B, C and D in Bangladesh's trucking industry: prevalence and risk factors

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Background Human immunodeficiency virus (HIV) and hepatitis B and C, viral infections with shared percutaneous, mucosal and perinatal routes of transmission, are responsible for serious morbidity and mortality globally. In Bangladesh there is a dearth of research on prevalence and risk factors for these diseases. This study examines the prevalence of HIV and hepatitis (B, C, D) and risk factors associated with infection in men in Bangladesh's trucking industry (drivers and helpers on trucks), a population at risk for sexually transmitted infections.

Methods The study population comprised 388 men (245 drivers, 143 helpers) working out of Tejgaon truck stand in Dhaka, Bangladesh. Subjects were selected through a two-tiered sampling strategy. Of 185 trucking agencies 38 were randomly selected and a $\bar{x}$ of 10 subjects was recruited from each agency. Subjects were interviewed, underwent a comprehensive physical examination and had blood samples taken. Gold standard laboratory tests were conducted to detect HIV, hepatitis B, C, and D infections. To assess risk factors associated with current hepatitis B infections or being a carrier (HBsAg) and lifetime exposure to hepatitis B infection (anti-HBc), simple and multiple logistic regression analyses were performed.

Results The prevalence of diseases were: HIV 0%, hepatitis C <1%, hepatitis B surface antigen 5.9%, antibody to hepatitis B core antigen 48.1% (with 5 of the 23 HBsAg positive cases testing positive for HBeAg and 18 for anti-HBe), and hepatitis D 0%. Having ever received a therapeutic injection and having had relations with a commercial sex worker (CSW) in the past year were both significantly associated with lifetime exposure to hepatitis B (anti-HBc); having received a therapeutic injection in the past year was associated with being either currently infected with hepatitis B or a carrier (HBsAg).

Conclusions The results of the study illustrate the importance of educating health care practitioners about the dangers of unsterile injections, and of educating men in the trucking industry as well as their partners (CSW in particular) about the importance of condom use, especially in high-risk sexual contacts.

Keywords HIV, hepatitis, Bangladesh, truck drivers, injections, blood transfusions

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Human immunodeficiency virus (HIV) and hepatitis B and C, viral infections with shared routes of transmission, cause serious morbidity and mortality globally. Major routes of transmission for HIV are sexual and percutaneous exposures, vertical transmission from mother to child, and blood transfusions.[1] Hepatitis B is more often associated with vertical transmission, sexual contact and both household and occupational contacts.[2] Hepatitis C is primarily transmitted through percutaneous exposures (particularly in the context of injection drug use) though it appears that it can be transmitted sexually as well as vertically.[2] Human immunodeficiency virus is incurable and given the impossibility of most infected people in developing countries having access to the expensive anti-retroviral drugs used in industrialized nations, cannot generally be effectively treated. Hepatitis B and C, if untreated, can lead to liver cirrhosis and hepatocellular carcinoma. Globally, it is estimated that by the beginning of 1998 over 30 million people were infected

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with HIV, the virus that causes AIDS, and that 11.7 million people around the world had already lost their lives to the disease.[3] Groups with lifestyles that have placed them at high risk for the disease have included injection drug users, commercial sex workers (CSW), and long distance truck drivers. An estimated 2 billion people have been infected with hepatitis B at some time in their life and 350 million of these cases remain chronic carriers.[4] Although the incidence of hepatitis C is much lower than hepatitis B, the number of chronic carriers is estimated to be around 170 million worldwide.[5]

Bangladesh currently has very low rates of HIV infection, though exact national rates are unknown due to the lack of ongoing surveillance and rigorous research. At the end of June 1997, UNAIDS estimated that there were 21 000 infected adults in Bangladesh (0.03% of the adult population);[6] however, only 102 cumulative AIDS cases had been reported to the National AIDS Committee by December 1998. Two of those cases were in truck drivers (Dr Nazrul Islam, personal communication 1999). Little data are available on hepatitis prevalence in Bangladesh. The few studies that have been published focused on high-risk groups such as female CSW and professional blood donors. For hepatitis B surface antigen (HBsAg), studies have reported 8% prevalence in intravenous drug users[7] and 9.7% in CSW.[8] In the general population there are no reliable estimates of hepatitis B and C infection. Studies of the sero-prevalence of HBsAg have found rates of 3.5% in pregnant women,[9] 8.6% in patients who had undergone a major operative procedure[10] and 2.3% in schoolgirls.[11] There is even less research on hepatitis C. In one study, anti-HCV was detected in 2.4% of professional blood donors and 0% of voluntary donors,[12] and in another study 56% of patients with hepatocellular carcinoma tested positive for the hepatitis C virus antibody.[13] No research has been published focusing on these diseases in men in Bangladesh's trucking industry, a group considered to have a lifestyle that places them at high risk for sexually transmitted infections.

In this study, the prevalence of HIV and hepatitis (B, C, D) is examined in truck drivers and helpers (young men who travel on the trucks to assist drivers) working out of Tejgaon truck stand in Dhaka, Bangladesh. The study also assesses associations between infections and aspects of lifestyle and medical history that have been identified as risk factors in adults (i.e. sexual, percutaneous and transfusion exposures).

Methodology

The study population comprised 388 truck drivers and helpers 15–60 years old, employed by transport agencies at Tejgaon truck stand in Dhaka in the winter of 1999. The study was approved by the Institutional Review Board of the University of Alabama at Birmingham and the Ethical Committee of the Bangladesh Medical Research Council.

Due to the impossibility of obtaining a complete list of the approximately 10 000 drivers/helpers operating at the truck stand and the difficulty in locating those individuals, a two-tiered sampling strategy was devised. A census of the 185 transport agencies with an office at Tejgaon truck stand was conducted; from that census list 38 of the agencies were randomly selected for participation using a random numbers table on Epi-Info. This randomization ensured that there would not be an over-representation of workers from certain agencies, which was important given that the kinds of personnel employed by agencies might differ. The recruitment objective was 10 subjects per agency. The mean number that showed up at the clinic was 10 and the mode was 11. Overall 245 drivers and 143 helpers participated. Three male research assistants went to each agency over a period of several days and requested drivers or helpers who were in the office at the time to participate in the study (the refusal rate was approximately 15–20%). They then either accompanied the subjects back to Paricharja clinic (a non-profit clinic located in the centre of the truck stand) or gave them an identification card (with the name of the subjects' trucking agency) and requested that they come to the clinic within the week.

In the clinic, after subjects provided informed consent for participation in the study, they were interviewed about their lifestyle for 30–45 minutes by research assistants using a structured questionnaire. This was followed by a comprehensive physical examination conducted by a male physician (primarily for the identification of sexually transmitted diseases for a companion study to this one). Blood specimens were collected using standard venipuncture techniques.

Laboratory tests were performed in the Department of Immunology of the Bangladesh Institute of Research and Rehabilitation in Diabetes, Endocrine and Metabolic Disorder (BIRDEM), a reference laboratory for hepatitis in Bangladesh. Serum was screened by enzyme immunoassay for hepatitis B surface antigen (HBsAg) (Bio-Kit, Barcelona, Spain), antibody to hepatitis B core antigen (anti-HBc), hepatitis B e antigen (HBeAg), antibody to hepatitis B e antigen (anti-HBeAg), hepatitis D antigen (HDV), antibody to hepatitis D antigen (anti-HDV), and antibody to hepatitis C antigen (anti-HCV) (Diasorin s.r.l., Vercelli, Italy). On the tests that were positive for anti-HCV (ELISA), a confirmatory Line Immuno Assay was done (LIA, Diasorin, Italy). Antibody to HIV1 and HIV2 was detected by synthetic peptide enzyme-linked immunosorbent assay (ELISA, Behring Diagnostics, Germany).

Statistical methods

All data were analysed using SPSS software. The methods included descriptive statistics (frequencies, means, medians), contingency tables, and multiple logistic regression. To assess risk factors associated with being HBsAg positive, simple logistic regression analyses were performed (due to the small number of HBsAG positive cases, multiple regression analyses could not be conducted). Multiple logistic regression analysis was used to identify background characteristics and risk factors (sexual, percutaneous, and transfusion exposures) associated with lifetime exposure to hepatitis B infection (anti-HBc). Given the small number of hepatitis C infections (three cases), no tests of association could be performed.

Results

Study population demographics

A total of 388 men participated in the study. The population demographics are shown in Table 1.

The average age of participants was 26.8 years (median 26 years). In all, 63% of the men were truck drivers (37.6% mainly drove interdistrict routes and 25.5% local routes within Dhaka) and the other 37% were helpers on trucks (13.7% were

Table 1 Demographic characteristics (N = 388)

Risk factors	Frequency	% of total	Mean	SD
Age (years)			26.8	7.46
15–24	157	40.5		
25–34	159	41.0		
35+	72	18.6		
Marital status				
Single	208	53.6		
Married	180	46.4		
Type of work				
Driver	245	63.1		
Helper	143	36.9		
Local or interdistrict work currently				
Interdistrict driver	146	37.6		
Interdistrict helper	53	13.7		
Local driver	99	25.5		
Local helper	90	23.2		
Income per month (taka)			3587	2113
0–2000 (2000 = $46 US)	130	33.5		
2001–4000	139	35.8		
4001+	119	30.7		
Ever had surgery				
No	350	90.2		
Yes	38	9.8		
Ever had blood transfusion				
No	379	97.7		
Yes	9	2.3		
Ever had a therapeutic injection				
No	60	15.5		
Yes	328	84.5		
Any therapeutic injections in the past year				
No	232	59.8		
Yes	154	39.7		
Missing[a]	2	0.5		
Any intravenous saline solutions in the past year				
No	331	85.3		
Yes	49	12.6		
Missing[a]	8	2.1		
Ever take recreational drugs by injection				
No	387	99.8		
Yes	1	0.3		
Ever use condoms				
No	283	72.9		
Yes	105	27.1		
No. of sexual partners in the past year			4.57	8.68
0	73	18.8		
1	107	27.6		
2	50	12.9		
⩾3	153	39.4		
Missing[a]	5	1.3		
Had sex with a CSW[b] in the past year				
No	177	45.6		
Yes	211	54.4		
Had a male sexual partner in the past year[c]				
No	360	92.8		
Yes	28	7.2		
Ever exposed to HSV2[d]				
No	287	74.2		
Yes	100	25.8		
Missing[e]	1	0.3		

[a] Missing due to respondents' not knowing or to the interviewers failing to ask the question.

[b] Commercial sex worker.

[c] Respondents engaged in anal or oral sex or mutual masturbation.

[d] Herpes simplex virus 2.

[e] Missing due to loss of a blood specimen.

primarily working on interdistrict routes and 23.2% primarily within Dhaka). The average time employed in their occupation was 5.4 years (range 1–40 years). Mean income was 3587 taka ($84 US) per month, with 50% earning at least 3000 taka ($70). The mean number of sex partners in the past year was 4.57, and 54.4% of the subjects had had sexual relations with at least one female CSW in the past year. Most sexual relationships were heterosexual with only 7.2% having one or more male sexual partners in the past year. Condom use was very low with 73% never using one; and only 2.8% using them most of the time or always. While 159 subjects (41%) acknowledged taking recreational drugs (mostly marijuana or cough syrup), only one took a drug (heroin) intravenously. Almost 60% of the subjects had had at least one therapeutic injection in the past year and 2.3% had ever had a blood transfusion.

Hepatitis sero-prevalence

None of the subjects tested positive for HIV. Only 5.9% (23) of the men tested positive for HBsAg, indicating either current hepatitis B infection or being a carrier. Nearly half (186), however, had ever been exposed to hepatitis B as diagnosed by hepatitis B core antibody (anti-HBc). Among those who were HBsAg positive, 21.7% (5) were highly infectious as indicated by the presence of HBeAg. Less than one per cent of the study subjects (3) tested positive for hepatitis C and none tested positive for hepatitis D (Table 2).

Table 2 Serological test results for hepatitis

Serological marker	N	Positive (%)[a]
HIV[b]	387[c]	0
Hepatitis B (HBV)		
Surface antigen (HBsAg)	387	23 (5.9)
Core antibody (anti-HBc)	387	186 (48.1)
Envelope (e) antigen (HBeAg)	23	5 (21.7)
Envelope (e) antibody (Anti-HBe)	23	18 (78.3)
Hepatitis D (HDV)		
Antigen (HDV)	23	0
Antibody (anti-HDV)	23	0
Hepatitis C (HCV)		
Antibody (Anti-HCV)	387	3 (0.8)
Both HBV (HBsAg) and HCV	387	0

[a] The percentages are over the total sample for a particular test.

[b] Human immunodeficiency virus.

[c] The blood specimen of one subject was lost bringing the N down to 387.

Risk factors for HBsAg

A total of 23 men tested positive for HBsAg. In bivariate analyses (simple logistic regressions) of the associations between risk factors/background characteristics and being HBsAg positive, the only significant association was with having had a therapeutic injection in the past year. Ever exposure to the herpes simplex virus 2 (HSV2), a biological marker of past high-risk sexual activity, came close to significance (P = 0.052) (Table 3).

Though not significant, the odds of infection were over twice as high for those who had had a blood transfusion in their life or who had had a male sexual partner in the past year.

Risk factors for anti-HBc

Multiple logistic regression was used to analyse risk factors associated with lifetime exposure to hepatitis B, as indicated by the presence of the antibody to the hepatitis B core antigen. Forty-eight per cent of the men (186) tested positive for the core antibody (Table 4).

In multiple logistic regression, having ever received a therapeutic injection and having had sexual relations with a CSW in the past year were both significantly associated with lifetime exposure to hepatitis B. While not significant, ever having had a blood transfusion, having a male sexual partner in the past year, and ever being exposed to HSV2 all increased the odds of lifetime exposure to hepatitis B.

Discussion

Numerous studies in other contexts have found truck drivers (particularly long distance drivers) to be at high risk for HIV and other sexually transmitted diseases.[14–19] In our study none of the subjects tested positive for HIV, while 48.1% of the subjects tested positive for lifetime exposure to hepatitis B (anti-HBc) and 5.9% for current infection or being a carrier (HBsAg). Less than one per cent tested positive for the hepatitis C antibody. For hepatitis D, none were found to be positive. The latter finding is consistent with routine tests conducted in the BIRDEM laboratory over the last 5 years, in which no hepatitis D virus, HDAg or anti-HDV, has ever been detected in routine laboratory tests at the hospital (MS Hassan, personal communication).

The finding of zero prevalence of HIV in our study group is comparable to the prevalence reported in sentinel surveillance in 1999.[20] It is lower than in truck drivers in the adjacent country of India. UNAIDS, compiling data from various unpublished sources, noted that testing of truck drivers at different sites in India in the 1990s had revealed rates of HIV infection ranging from 1% to 6%.[21] The 5.9% prevalence of hepatitis B in our subjects is comparable to the 2–8% prevalence estimated for the region by the World Health Organization.[22] A comparable study of hepatitis B amongst truck drivers in India found a rate of 3.53%.[23] The prevalence of hepatitis C (<1%) in our study subjects is slightly lower than the estimated WHO level of 1–2.4% of the subcontinent,[24] 1.85% in India and 2.4% in Pakistan.[25] There are no comparable studies of hepatitis C virus prevalence in truck drivers in the region.

Of all the therapeutic practices examined, having had an injection in the past year was the only practice significantly associated with current hepatitis B infection or carrier status (HBsAg), and ever having had an injection was significantly associated with lifetime exposure to hepatitis B infection (anti-HBc). This result is consistent with another study in Bangladesh of 500 patients who had undergone a major operative procedure, which also found a positive association with a history of injections.[10] Various studies globally have linked hepatitis B infections with therapeutic injections.[26–28]

The fact that having an injection in the past year was significantly associated with HBsAg positivity suggests that while disposable needles have become popular in Bangladesh in recent years, some health care practitioners are still not strictly adhering to sterile procedures. Sterility of injection procedures is a concern given that injections are commonly used for a variety of ailments in Bangladesh. Of the 388 subjects, 40% had had an injection in the past year, with 16% having two or more injections. Most respondents who had had an injection in their lifetime had their last injection in a physician's practice (86.3%), but 13.7% had it elsewhere (mainly administered by a compounder in a local shop selling drugs).

Though not significant, having had a blood transfusion in their life increased the odds of being currently infected with hepatitis B or a carrier (HBsAg) twofold (95% CI : 0.24–16.9) and of ever exposure to hepatitis B (anti-HBc) 1.39 times (95% CI : 0.35–5.54). However, the large width of the confidence intervals suggest that caution is needed in drawing any conclusions from these results. A study with a larger sample size, but a different population, in Bangladesh found that of 500 patients who had undergone a major operative procedure, HBsAg positivity was positively related to a past history of blood transfusions.[10]

Of the factors representing high-risk sexual behaviours, only having had sex with a CSW in the past year was significantly associated with lifetime exposure to hepatitis B (anti-HBc), and none of the factors pertaining to sexual behaviour were significantly associated with current hepatitis B infection or being a carrier (HBsAg). The significant finding pertaining to CSW and lifetime exposure to hepatitis B is understandable given the common practice of men in the trucking industry frequenting CSW and the very low levels of condom use even in high-risk sexual contacts. The majority of the men our study group, 54.4%,

Table 3 Bivariate risk factor analyses for being hepatitis B surface antigen positive (HBsAG)

Risk factors	N	No. positive (%)	Crude odds ratio	95% CI
Age (years)	387[a]			
15–24		14 (8.9)	1.0	
25–34		7 (4.4)	0.47	(0.19–1.20)
35+		2 (2.8)	0.30	(0.07–1.34)
Marital status	387			
Single		13 (6.3)	1.0	
Married		10 (5.6)	0.88	(0.38–2.08)
Type of work	387			
Driver		12 (4.9)	1.0	
Helper		11 (7.7)	1.61	(0.69–3.75)
Income per month (taka)	387			
0–2000		8 (6.2)	1.0	
2001–4000		12 (8.7)	1.45	(0.57–3.67)
4001+		3 (2.5)	0.4	(0.10–1.52)
Ever had surgery	387			
No		22 (6.3)	1.0	
Yes		1 (2.6)	0.4	(0.05–3.07)
Ever had blood transfusion	387			
No		22 (5.8)	1.0	
Yes		1 (11.1)	2.02	(0.24–16.9)
Any therapeutic injections in past year	385[b]			
No		9 (3.9)	1.0	
Yes		14 (9.1)	2.47*	(1.04–5.85)
Any intravenous saline solutions in past year	380[b]			
No		21 (6.4)	1.0	
Yes		2 (4.1)	0.63	(0.14–2.76)
Ever use condoms	387			
No		16 (5.7)	1.0	
Yes		7 (6.7)	1.18	(0.47–2.97)
No. of sexual partners in past year	383[b]			
0		5 (6.8)	1.0	
1		5 (4.7)	0.67	(0.19–2.42)
2		2 (4.0)	0.57	(0.11–3.04)
⩾3		10 (6.5)	0.95	(0.31–2.89)
Had sex with a CSW[c] in past year	387			
No		12 (6.8)	1.0	
Yes		11 (5.2)	0.75	(0.32–1.75)
Had a male sexual partner in past year	387			
No		20 (5.6)	1.0	
Yes		3 (10.7)	2.03	(0.57–7.31)
Ever exposed to HSV2[d]	387			
No		13 (4.5)	1.0	
Yes		10 (10.0)	2.34	(0.99–5.52)

[a] One case missing for all bivariate analyses due to loss of blood sample.

[b] For particular analyses additional cases were missing due to respondent not knowing or interviewer failing to ask a question.

[c] Commercial sex worker.

[d] Herpes simplex 2.

* *P*-value ⩽ 0.05.

had had sex with a CSW in the past year (57% of unmarried subjects and 43.1% of married subjects), and 31.4% had done so in the past 3 months. Of the married men who had frequented a CSW in the past year only 24% had ever used a condom with a CSW; of single men who had frequented a CSW in the past year only 28% had ever used a condom in any of those sexual contacts.

Our study had several methodological limitations. One was a sample size that may not have been sufficient to detect risk

Table 4 Multiple regression analysis for ever being exposed to hepatitis B virus infection (anti-HBc) (N = 379[a])

Risk factors	No. positive (%)	Adjusted odds ratio	95% CI
Age (years)			
15–24	73 (46.5)	1.0	
25–34	78 (49.1)	1.14	(0.66–1.96)
35+	35 (49.3)	1.03	(0.48–2.18)
Marital status			
Single	102 (49.0)	1.0	
Married	84 (46.9)	0.88	(0.51–1.52)
Type of work			
Driver	116 (47.5)	1.0	
Helper	70 (49.0)	1.17	(0.73–1.87)
Ever had surgery			
No	167 (47.9)	1.0	
Yes	19 (50.0)	0.97	(0.44–1.99)
Ever had blood transfusion			
No	181 (47.9)	1.0	
Yes	5 (55.6)	1.39	(0.35–5.54)
Ever had a therapeutic injection			
No	99 (42.9)	1.0	
Yes	86 (55.8)	1.98**	(1.08–3.62)
Any intravenous saline solutions in past year			
No	161 (48.8)	1.0	
Yes	21 (42.9)	0.80	(0.42–1.49)
Ever use condoms			
No	132 (46.8)	1.0	
Yes	54 (51.4)	1.00	(0.61–1.65)
Had sex with a CSW[b] past year			
No	72 (40.9)	1.0	
Yes	114 (54.0)	1.69*	(1.08–2.64)
Had a male sex partner in past year			
No	168 (46.8)	1.0	
Yes	18 (64.3)	1.78	(0.78–4.07)
Ever exposed to HSV2[c]			
No	133 (46.3)	1.0	
Yes	53 (53.0)	1.36	(0.84–2.18)

[a] Nine missing cases: 1 due to loss of serum sample, 8 due to respondents not knowing or interviewers failing to ask questions.

[b] Commercial sex worker.

[c] Herpes simplex 2.

* *P*-value ⩽ 0.05, ** *P*-value ⩽ 0.01.

factors for hepatitis infections. The number of positive cases was too small for a multivariate analysis to be done on HBsAg positivity (23 cases) and too small for any analyses of associations with hepatitis C infection (3 cases).

An additional limitation was that a sampling strategy with randomly selected truck drivers and helpers could not be used due to the unavailability of a comprehensive list of truck drivers employed at the 185 trucking agencies located at Tejgaon truck stop. Any such list that could be compiled would only be partially complete. After formative research in which sampling options were assessed, it was determined that the most rigorous and viable sampling strategy was to combine randomization of trucking agencies with a systematic sample of drivers and helpers from the 38 randomly selected agencies. Given that all drivers and helpers need to go to the trucking agencies' offices to obtain their next work assignment, it is unlikely that the recruitment of subjects at those offices biased the sample.

A further limitation was that the data on sexual behaviour was only for the past year, thereby limiting its relevance for analyses of lifetime exposure to hepatitis B or C. Further, the data on sexuality was collected through self-reports for which there is always a question of validity.[29–31] The study did, however, include a biological marker of past high-risk sexual behaviour (HSV2 infection) which is not typically available in studies of hepatitis.

The results of the study point to the importance of educating health care practitioners and patients about the dangers of

unsterile injection procedures. Further, the association between frequenting CSW and hepatitis infections, as well as the reported high levels of sexual relations with CSW and low levels of condom use, indicate the need to educate men in Bangladesh's trucking industry about the health benefits of condom use, particularly in high-risk sexual contacts.

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