Published in final edited form as:

Sex Transm Infect. 2011 December ; 87(7): 553–559. doi:10.1136/sextrans-2011-050186.

Prevalence and factors associated with HSV-2 and hepatitis B infections among truck drivers crossing the southern Brazilian border

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Abstract

Objectives—The authors estimate the prevalence of HIV, syphilis, hepatitis B virus (HBV) and herpes simplex virus type-2 (HSV-2) infection and correlates of HBV and HSV-2 infection among truck drivers crossing the southern Brazilian border at Foz do Iguaçu.

Methods—Between October 2003 and March 2005, 1945 truck drivers were sampled while accessing voluntary counselling and testing services; 1833 (94.2%) were tested for HIV (ELISA and confirmatory immunofluorescence assay) and syphilis (non-treponemal (VDRL) and treponemal tests (FTA-ABS)). From these, 799 stored sera were tested for HSV-2 (type-specific ELISA test for detection of IgG) and HBV (core antibodies (anti-HBc) with positives tested for surface antigen (HBsAg)). The authors estimate HIV, syphilis, HSV-2 and HBV prevalence and determine socio-demographic and behavioural correlates of HSV-2 infection and HBV exposure.

Results—HIV prevalence was 0.3% (95% CI 0.1 to 0.6) and syphilis 4.5% (95% CI 3.6 to 5.4). Among those tested for HBV and HSV-2, 32.3% (95% CI 28.9 to 35.6) had serological evidence of exposure to HBV and 26.6% (95% CI 23.5 to 29.7) tested positive for HSV-2. Factors

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Competing interests: None.

Patient consent: Obtained.

Ethics approval: Approval for the study was obtained from the Population Council's Institutional Review Board and from the Committee for the Protection of Human Subjects at the Universidade Estadual do Oeste do Paraná (UNIOESTE), in Cascavel, Brazil.

Contributors: AAP conducted the statistical analysis and wrote the first draft of the manuscript. JD, MC and SAL designed and wrote the research protocol from which this paper originated. AR was the technical consultant for this project. KP, SAL and MC supervised the data analysis and writing of the paper. RSD and MCS were responsible for the laboratory analysis and actively contributed regarding all sexually transmitted infections detection described in the paper. All authors provided substantive contributions to the final version of the manuscript.

Provenance and peer review: Not commissioned; externally peer reviewed.

independently associated with HBV exposure included increasing age, Brazilian nationality and unprotected anal sex. Increasing age and reporting an unknown number of lifetime partners were associated with HSV-2 infection.

Conclusions—In this sample of truck drivers in southern Brazil, HIV prevalence was lower than national population estimates; exposure to HBV was higher than population estimates, while per cent positive for HSV-2 was similar to population estimates. The low prevalence of HIV in truck drivers indicates prevention successes; however, future HIV prevention programming should incorporate HBV vaccination and sexually transmitted infection prevention.

INTRODUCTION

Mobile populations, including truck drivers, have been identified as a highly vulnerable group for acquiring and transmitting HIV and other sexually transmitted infections (STIs).¹² Studies conducted to date have demonstrated elevated HIV prevalence in truck drivers as compared with non-mobile male populations in Asia³⁴ and Africa.⁵⁶ In Brazil, one study of truck drivers estimated HIV prevalence at 1.3%,⁷ well above 0.8% estimate for the adult male population.⁸

STIs may play a role in HIV transmission and are markers for HIV vulnerability, yet few data exist regarding the prevalence of STI among truck drivers or comparable male workforce populations in Brazil. STI symptoms are commonly reported among truck drivers: 29% of truckers interviewed in a study in Northeastern Brazil reported a history of urethral discharge⁹ and 36% in a sample of long-distance truckers in Brazil reported either symptoms or STI diagnoses.¹⁰ Among the least studied STIs in Brazil is the herpes simplex virus type-2 (HSV-2), which has been identified as a risk factor for HIV acquisition.¹¹ We found no published estimates of HSV-2 prevalence among truck drivers in Brazil. HSV-2 prevalence among the low-risk population of male blood donors in Brazil is estimated between 26% and 29%.¹²¹³

A few studies have documented hepatitis B virus (HBV) prevalence in Brazilian men, including one study among truck drivers estimating any exposure to HBV at 18.9%,¹⁴ substantially higher than that of male blood donors (4%–8%)¹⁵¹⁶ and higher than the only population-based study estimating exposure prevalence at 12% in non-vaccinated urban men.¹⁷ The only study of syphilis conducted among truckers in Brazil⁷ reported an estimated prevalence of 13%, including 8% who tested positive for active infection as compared with estimates in blood donors of around 1%.¹⁸

We report prevalence of HIV, syphilis, HBV and HSV-2 infection in a sample of truck drivers who participated in an HIV voluntary counselling and testing (VCT) service located at the Foz do Iguaçu border crossing in southern Brazil. We also assess the socio-demographic and behavioural correlates of HBV and HSV-2 infection.

METHODS

Study design

Between October 2003 and March 2005, a quasi-experimental intervention study was implemented at customs stations in two border towns in southern Brazil: Foz do Iguaçu (the intervention site: borders Paraguay and Argentina) and Uruguaiana (the comparison site: borders Argentina and sits 60 km from the Uruguayan border) in order to evaluate an HIV prevention project targeting truck drivers crossing the southern Brazilian borders. Both border areas are sites of substantial trade and movement due to the Mercosur Trade Agreement. Details of the sampling, data collection and main findings of this intervention study are described elsewhere.¹⁹ As part of the intervention, a health unit was set up at the customs station on the Brazilian side of the border crossing, offering VCT, syndromic management of STIs and other general health services.

From October 2004 to March 2005, 2050 truckers accessed services at the health unit and were asked to respond to a face-to-face interview and provide a blood sample for HIV and syphilis testing. Overall, 1945 truck drivers (95%) consented to the interview, of which 1833 truckers (89%) also provided a blood sample for HIV and syphilis testing, and 1469 (76%) provided a second sample for storage and subsequent STI testing. The interview solicited socio-demographic and occupational information as well as sexual and drug-use behaviour and reported history of STIs in the last 6 months. In 2005, additional testing was performed to estimate HSV-2 and HBV prevalence on a subset of the stored serum samples (n=799), including all HIV- or syphilis-positive participants and those treated for a symptomatic STI (n=115) and 684 randomly selected samples from truckers who tested negative for HIV and syphilis and were not treated for symptoms. This sampling selection method was chosen to ensure adequate power to look at co-infections.

All eligible participants provided informed consent prior to interview and sample collection. Approval for the study was obtained from the Population Council's Institutional Review Board in New York and from the Committee for the Protection of Human Subjects at the Universidade Estadual do Oeste do Paraná (UNIOESTE), in Cascavel, Brazil.

Laboratory methods

The Municipal Laboratory in Foz do Iguaçu, Brazil, performed HIV and syphilis testing. HIV testing procedures followed Brazilian guideline number 488/98.²⁰ Antibodies against HIV types 1 and/or 2 were tested for using an ELISA (Murex HIV®; Abbott Laboratories, Abbott Park, IL, USA) followed by confirmatory immunofluorescence assay (IFI-HIV) (Bio-Maguinhos; FIOCRUZ, Rio de Janeiro, Brazil). Syphilis status was determined by a commercial antibody to cardiolipin test (VDRL Bras; Laborclin, Paraná, Brazil) and by a fluorescent treponemal antibody absorption test (FTA-ABS; Biolab, BioMérieux, Rio de Janeiro, Brazil). All samples positive for VDRL and FTA-ABS were classified as positive for syphilis (including recent or past infection).

HSV-2 and HBV testing were performed at the Retrovirology Laboratory at the Federal University of São Paulo, Brazil. HBV testing consisted of two phases. The first test performed was the core antibody test (anti-HBc) (Ortho® HBc ELISA test system; Ortho-

Clinical Diagnostics, Inc., Rochester, NY, USA), which indicates exposure. If negative, the participant was classified as hepatitis B negative. If the anti-HBc test was positive, a test for surface antigen (HBsAg) (Ortho® antibody to HBsAg; Ortho-Clinical Diagnostics, Inc.) was performed. HSV-2 testing was carried out using a type-specific ELISA test for detection of IgG antibodies to HSV-2 to detect both latent and active infections (Biokit, S.A., Barcelona, Spain). The sensitivity of this platform ranges from 86.7% to 97.5% and specificity from 92.6% to 96.2%, presenting high level of agreement with other commercially available kits.

Statistical analysis

All data were double entered in Microsoft Access, and analysis was performed using STATA V.9.0. HIV and syphilis prevalences were estimated among 1821 and 1829 truckers, respectively, who underwent HIV and syphilis testing and had interpretable results. HBV and HSV-2 prevalences were estimated from a subsample (799 truckers) of those who provided blood for storage and future STI testing. Prevalence estimates and association measures for both HSV-2 and HBV were weighted to account for over-sampling of truckers positive for syndromic or laboratory HIV/STI diagnosis.

An analysis of socio-demographic, occupational and behavioural predictors was carried out for HSV-2 and HBV exposure but not for HIV and syphilis, given the few individuals with HIV or syphilis. Bivariate analyses were conducted using the χ^2 statistic or Fisher exact test to examine the association of positive diagnostics and socio-demographic and occupational characteristics, sexual behaviours with principal, commercial and occasional partners, and past blood transfusion. Commercial partners were defined as those with whom the participant had sex in exchange for money or gifts and occasional partners as those whom the participant saw sporadically or saw only once and who was not paid for sex. All independent variables moderately associated ($p < 0.20$) with infection in the bivariate analyses were considered in the logistic regression modelling process. The final model was selected using stepwise elimination of variables with p values > 0.05 , with the exception of important known confounders.

Number of lifetime sexual partners and ever having had a male sexual partner were added to the questionnaire 3 months into the study, which generated approximately 20% of missing values for these variables. As a result, we conducted multiple imputation for these variables using STATA's *ice* and *micombine* options.²¹

RESULTS

There were no significant differences between socio-demographic and behavioural characteristics between the 1945 participants who responded to the survey and the subset of participants ($n=799$) who were screened for HBV and HSV-2 (table 1). Among both populations, the median age and years of schooling completed were 39 and 7 years, respectively, and 95% had a steady partner. Approximately 73% of the participants were Brazilian, and there were slightly more Paraguayans and fewer Chilean and Argentine truckers in the subsample screened for HSV-2 and HBV, although the difference was not significant.

Participants reported a median of 20 lifetime sexual partners, with 50% of truckers reporting between 10 and 50. Ninety-four per cent of the participants in both samples reported having had vaginal sex with a regular partner in the last 6 months, and 32% and 45%, respectively, reported having had sex with a sex worker or occasional partner in the same period (table 1). Over 70% of truckers reported unprotected vaginal sex with regular partners; 38% and 12% of respondents reported unprotected vaginal sex with their last occasional and sex worker partner. While anal sex was reported by <30% of truckers, 64% of the participants who had anal sex reported unprotected anal sex. Approximately 7% of respondents reported ever having had a male sexual partner and 8% reported having received a blood transfusion.

Prevalence of HIV and STI

Five truck drivers tested positive for HIV (0.3%; 95% CI 0.1 to 0.6) (table 2), including two who were also positive for exposure to HBV (anti-HBc) and HSV-2 and one who was positive for HBV, HSV-2 and syphilis. Eighty-two of the 1829 truck drivers tested positive for syphilis (4.5%; 95% CI 3.6 to 5.4). Among the 799 truck drivers tested for HBV, 32.3% (95% CI 28.9 to 35.6) had serological evidence of exposure to HBV. Overall, 2.4% (95% CI 1.1 to 3.5) were positive for HBsAg and 29.8% (95% CI 26.6 to 33.1) were anti-HBc positive and HBsAg negative. Estimated prevalence of HSV-2 was 26.6% (95% CI 23.5 to 29.7), being significantly higher in those who also tested positive for HIV or syphilis or were treated for an STI based on syndromic diagnosis (43.8%) compared with the randomly selected truck drivers (25.1%) (data not shown).

Factors associated with HBV exposure

The odds of testing positive for HBV exposure increased linearly with age (trend $p=0.01$) and were highest among those with incomplete high school education (table 3). Paraguayans, Argentineans and Chileans were less likely to be anti-HBc positive (OR 0.3; 95% CI 0.2 to 0.5) as compared with Brazilians ($p<0.01$). Drivers who reported >50 lifetime sexual partners had 2.2 times the odds of being anti-HBc positive compared with those with 10 or fewer lifetime partners (95% CI 1.2 to 3.8). After adjusting for covariates in the multivariate model, increasing age and Brazilian nationality remained significant predictors of HBV exposure. Report of >50 lifetime sexual partners remained marginally associated with HBV exposure ($p=0.06$). Truckers who reported unprotected anal sex with any type of partner in the past 6 months had 1.7 times the odds (95% CI 1.2 to 2.7) of being positive for HBV compared with those who did not report unprotected anal sex. However, men who reported unprotected vaginal sex with regular partners had a decreased odds of being positive for HBV (OR 0.6, 95% CI 0.4 to 0.8). No significant interaction was found in this analysis.

Factors associated with testing positive for HSV-2

The odds of testing positive for HSV-2 infection increased linearly with age (trend $p<0.01$) and with more years working as a truck driver (trend $p<0.01$) (table 4). These variables were highly collinear. The odds for HSV-2 positive test also increased with the number of lifetime sexual partners, but the trend was not significant. Regardless of the type of partnership, the odds of being positive for HSV-2 were significantly higher among those who did not know how many sexual partners they had had in their lifetime (OR 2.2, 95% CI 1.2 to 4.2), which

might indicate a large number of sexual partners. Also, those who had ever had a male partner had approximately three times the odds of being positive for HSV-2 infection than those who had never had a male partner (OR 2.7, 95% CI 1.4 to 5.2). Those who had ever received a blood transfusion had increased odds of being positive for HSV-2 (OR 1.7, 95% CI 0.9 to 2.9) as well. In multivariate analysis, increasing age, unknown number of lifetime partners, reported male sexual partners and being non-Brazilian remained associated with HSV-2 seropositivity. No significant interaction was found in this analysis.

DISCUSSION

In this study, HIV prevalence among truck drivers was slightly lower than Brazilian population estimates. In the subsample, HBV prevalence was higher and HSV-2 prevalence was similar to that of estimates in the Brazilian male population. Only five truckers tested positive for HIV (0.3%; 95% CI 0.1 to 0.6), which is much lower than a previous HIV prevalence estimate of 1.3% among 300 Brazilian truck drivers⁷ and than the estimated 0.8% HIV prevalence for the adult male population in Brazil.⁸ These findings indicate that unlike truck drivers in Asia and Africa, truck drivers in the Southern Cone of Latin America may not have an elevated prevalence of HIV.

It is noteworthy that almost half of the truckers who participated in the baseline survey of the intervention (systematically sampled) reported having an HIV test previously, which is higher than the proportion of Brazilian men in a national survey in the same age group reporting previous HIV testing (28.4%).²² This may suggest more health seeking behaviour among our sample of truckers or better access to health services. Additionally, because the majority of the truckers (70%) were employed through trucking companies, it is likely that these truckers have company sponsored health plans and improved access to health exams, including HIV testing. Also, Brazilian truckers have access to medical services offered by national transport workers NGO (SEST and SENAT), which offers medical assistance, condom distribution and health educational activities including HIV/AIDS. As a result, this favourable context for HIV testing and education may have contributed to lowering HIV risk among truckers and potentially the low estimated HIV prevalence.

The 4.5% prevalence of syphilis in this study population was also substantially lower than that in a previous study of Brazilian truck drivers in Santos, which was estimated at 8.3%,⁷ but higher than that found among Brazilian blood donors (1.1%)¹⁸ and military recruits (0.9%).²³ No estimate of syphilis prevalence in the general male population exists for comparison. The lower estimate of HIV and syphilis in this truck driver population compared with the Santos study may be due to differences in background prevalence: Brazil's epidemic is concentrated in the Southeast region, particularly in the state of São Paulo, with >50% of Brazil's AIDS cases.²⁴ Of note, reported condom use in this sample of truckers is quite similar to that among 15–64-year-old men participating in the recent 2008 national knowledge, attitudes and practices survey.²⁵ However, truckers in this study and others^{7,26,27} reported multiple partners at a rate higher than the general male population.

Prevalence of HBV exposure found in the subsample was considerably higher in this study (32.3%) than estimates reported previously in Brazilian truck drivers (18.9%),¹⁴ estimates

among blood donors (4%–8.3%)¹⁵¹⁶ or among the general male population in a representative sample from three different regions in Brazil (northeast, central-west and the Federal District) in 2004 and 2005 (11.7%–12.5%).²⁸ HBV exposure in our study population is similar to that found among HIV-negative men who have sex with men in Rio de Janeiro (33.3%).²⁹ Also in this study, we found increased exposure to HBV among Brazilians compared with the truck drivers from other South American countries. Similarly, Silveira *et al*³⁰ described higher HBV exposure among Brazilians (7.9%) compared with other populations from South America, such as Argentina (2.1%) and Chile (0.6%), principally among populations from the southern region of Brazil, where HBV is endemic.¹⁶ Seventy-seven per cent of the truck drivers in our sample lived in the southern region of Brazil. Age, increasing numbers of lifetime partners and unprotected anal sex in the past 6 months were also associated with HBV exposure, and unprotected vaginal sex with a regular partner was associated with lower odds of HBV exposure in our sample. This last finding is likely due to the fact that truckers having unprotected sex with regular partners, who represent the majority of the sample, were less likely to have two or more commercial or occasional partners compared with truckers having protected sex (data not shown).

HSV-2 prevalence in this truck driver population (26.6%) was similar to that observed among Brazilian male blood donors,¹²¹³ among sexually active adults in the general population (30%),³¹ and is approximately double the estimated prevalence in the US male population (but similar to that estimated among US black, non-Hispanic men).³² Findings indicate that the HSV-2 epidemic in Brazil, like much of the world, is likely generalised. Of the 222 individuals positive for HSV-2, only five reported having been diagnosed with herpes in the last 6 months and only 32 reported symptoms consistent with HSV-2 infection during the same period; a minority of symptomatic episodes of genital herpes may be clinically recognised.³³ We found that increasing age, inability to report one's number of lifetime partners and ever having male partners were significantly associated with HSV-2 infection. Despite the low percentage of truckers in our study reporting sex with men (6.7%), such practices are likely not uncommon, as services of male/transvestite sex workers may be highly available along truck routes and cost less than sex with female sex workers.²⁵³⁴ The association of HSV-2 with age and inability to report one's number of lifetime partners likely reflect the truckers' time of risk exposure. No measures of sexual behaviour in the last 6 months were independently associated with HSV-2 infection; because HSV-2 is a chronic infection, lifetime measures of sexual behaviour more accurately represent one's exposure than recent report of sexual behaviour. Wald³³ noted that not all seroprevalence studies have documented a direct association between sexual activity and risk of HSV-2 infection: in populations with high HSV-2 prevalence, individual risk behaviour may not be an important predictor of STI acquisition, given that the probability of having an infected partner is high even among those with few partners.

This study population includes truckers who accessed services at a mobile health unit in the customs station; this is not a random sample of truck drivers entering the customs station. Based on customs records, we estimate that around 20% of all truck drivers who entered the customs station received services at the mobile health unit. However, we found few differences in characteristics and reported behaviours between the truck drivers in this

analysis, who sought VCT services, and a systematically selected group of truck drivers, who took part in surveys prior to and following installation of the mobile health unit.²¹⁹ As a result, prevalence estimates presented here may approximate the STI burden in truckers crossing the southern Brazilian border.

Some limitations need to be noted. Approximately 20% of values were missing for two key behaviour variables: number of lifetime sexual partners and ever having had a male sexual partner. We preferred to use imputation to account for this missing data rather than excluding 20% of respondents from the risk factor analysis. The multiple imputation method chosen has been described as preferable to handle missing data,³⁵³⁶ given there was no reason to suspect that data are missing systematically.

We cannot generalise our findings to all truck drivers working in southern Brazil. Our sample is limited to those choosing to undergo VCT in a single border crossing, though our sub-sample reported similar characteristics and behaviours to a systematically selected group of truck drivers taking part in other study surveys. Also, the HBV and HSV-2 prevalence estimates were based on a subsample of truckers and not on all of those who provided blood sample for storage. We oversampled those with HIV, syphilis and symptomatic STI in order to increase the power to look co-infectious. To deal with this strategy, we weighed the sample to estimate the HBV and HSV-2 prevalences and correlates.

This study is among the first to estimate the prevalence of HIV, syphilis, HBV and HSV-2 infection in mobile South American men. There are few previous STI studies with truck drivers or male mobile workforce populations with which to compare our findings. Although the prevalences of HIV and syphilis in our sample were lower than expected based on previous research with truckers, the prevalence of HBV exposure was higher than found among blood donors or among representative samples with male general population. HSV-2 prevalence was high and similar to other Brazilian groups, indicating a generalised epidemic in Brazil. Given the elevated prevalence of HSV-2 found in this study and across Brazil and given its association with HIV infection, wider counselling and testing for HSV-2 may make an important contribution to STI/HIV prevention. Also, the elevated HBV exposure prevalence found in this study highlights the important need for vaccination against HBV among this mobile population. In Brazil, routine HBV vaccine is generally restricted to sex workers, men who have sex with men, adolescents and health professionals. Additionally, it is vital that interventions targeting this mobile population and other at risk populations incorporate prevention of other STI, including both HBV and HSV-2, as significant sources of morbidity and mortality in addition to their potential impact on risk of acquiring HIV infection. Finally, because mobile populations may play a future role in the movement of HIV infection, continued monitoring of HIV in this population is justified.

Acknowledgments

The authors would like to thank our dedicated and talented project coordinator, Cristina Ogura and the team of counsellors, educators and nurses who staffed the trailer. We thank the customs officials at EADI Sul in Foz do Iguaçu and the municipal laboratory of Foz do Iguaçu for performing HIV and syphilis testing. We also thank Jaime Rojas and Michael C. Burkly, from the US Agency for International Development Mission in Brazil, for their support of the project. We thank Alan Hubbard at University of California Berkeley for statistical advice.

Funding This research was funded by the US Agency for International Development (USAID) Mission in Brazil under the terms of Award HRN-A-00-99-00010. The opinions expressed herein are those of the authors and do not necessarily reflect the views of the USAID. AAP received support from the University of California, San Francisco, International Traineeships in AIDS Prevention Studies program (R25MH064712). AAP and SAL received support from the Fogarty International AIDS Training Program (D43TW000003) at the School of Public Health, University of California, Berkeley.

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Key messages

- HIV prevalence in this population of truck drivers was low; unlike truck drivers in Asia and Africa, truck drivers in the Southern Cone of Latin America likely do not have an elevated prevalence of HIV.
- Prevalence of hepatitis B virus among truck drivers was considerably higher than estimates in the general population and similar to that observed among other vulnerable populations in Brazil.
- The elevated hepatitis B virus prevalence found in this study highlights the important role of vaccination against hepatitis B virus among truck drivers.
- Herpes simplex virus type-2 prevalence among truck drivers was high and similar to other Brazilian groups, indicating a generalised epidemic in Brazil.

Table 1

Socio-demographic, occupational and behavioural characteristics of truck drivers accessing VCT services (n=1945) and screened for HSV-2 and HBV (n=799) in Foz do Iguaçu, Brazil, 2003–2005

Characteristics	Total sample (n=1945) N* (%)	Subsample (n=799) N* (%)
Age (years)		
18–28	339 (17.5)	147 (18.4)
29–39	654 (33.7)	256 (32.1)
40–49	617 (31.7)	265 (33.2)
50	332 (17.1)	130 (16.3)
Median (IQR)	39 (31–47)	39 (31–47)
Education (years)		
<8	1058 (54.8)	438 (55.2)
8–10	492 (25.5)	194 (24.4)
11	379 (19.6)	162 (20.4)
Median (IQR)	7 (5–10)	7 (5–9)
Country of residence		
Brazil	1438 (73.9)	584 (73.1)
Paraguay	323 (16.6)	152 (19.0)
Argentina	119 (6.1)	45 (5.6)
Chile	65 (3.3)	18 (2.2)
Years working as truck driver		
<5	392 (20.1)	160 (20.0)
5–10	533 (27.4)	215 (26.9)
11–20	536 (27.5)	222 (27.8)
>20	483 (24.9)	202 (25.3)
Median (IQR)	12 (6–20)	12 (6–21)
Duration of trips (in weeks)		
<1 week	453 (23.3)	179 (22.5)
1–2 weeks	787 (40.5)	326 (40.9)
3–4 weeks	528 (27.2)	227 (28.5)
>4 weeks	106 (5.5)	36 (4.5)
Variable	67 (3.4)	29 (3.6)
Having principal, steady partner		
No	1851 (95.2)	762 (95.4)
Yes	94 (4.8)	37 (4.6)
Number of lifetime sexual partners [†]		
Up to 10	392 (26.1)	135 (23.5)
11–20	304 (20.2)	144 (25.0)
21–50	308 (20.5)	126 (21.9)
>50	284 (18.9)	98 (17.0)
Unknown	213 (14.2)	72 (12.5)

Characteristics	Total sample (n=1945) N* (%)	Subsample (n=799) N* (%)
Median (IQR)	20 (10–50)	20 (10–50)
Ever had a male sexual partner [†]	104 (6.9)	42 (7.3)
Reported vaginal sex in past 6 months with		
Principal/steady partner	1823 (94.0)	748 (93.8)
Occasional partners	618 (31.8)	268 (33.6)
Commercial partners	875 (45.1)	374 (46.8)
Unprotected vaginal sex in past 6 months with [‡]		
Principal/steady partner	1340 (73.6)	525 (70.3)
Occasional partners	236 (38.6)	92 (34.6)
Commercial partners	103 (11.8)	46 (12.3)
Reported anal sex in past 6 months with		
Principal/steady partner	391 (21.4)	168 (22.4)
Occasional partners	110 (17.9)	52 (19.5)
Commercial partners	119 (13.4)	58 (15.5)
Unprotected anal sex in past 6 months with any type of partner [§]	329 (64.1)	141 (63.8)
Ever received a blood transfusion	157 (8.1)	58 (7.3)

* Numbers differ slightly for each characteristic due to missing data.

[†] Variables with 23% of missing values due to changes in questionnaire following implementation.

[‡] Reported among participants who had vaginal sex with each partner type and with condom use data.

[§] Reported among participants who had anal sex with any partner type and with condom use data.

HBV, hepatitis B virus; HSV-2, herpes simplex virus type-2; VCT, voluntary counselling and testing.

Table 2

Prevalence of HIV, syphilis, HSV-2 and HBV among truck drivers crossing the Foz do Iguaçu border, Brazil, 2003–2005

Infection	n (%)	95% CI
HIV-positive (n=1821)	5 (0.3)	0.1 to 0.6
Syphilis (n=1829)	82 (4.5)	3.6 to 5.4
HBV* (n=799)		
Anti-HBc positive (exposed to HBV)	257 (32.3)	28.9 to 35.6
Anti-HBc and HBsAg positive (active HBV infection)	18 (2.4)	1.1 to 3.5
Anti-HBc positive and HBsAg negative (immune to HBV)	239 (29.8)	26.6 to 33.1
HSV-2 positive* (n=799)	222 (26.6)	23.5 to 29.7

* Prevalence and CIs (95% CI) weighted to account for sampling design.

HBV, hepatitis B virus; HSV-2, herpes simplex virus type-2.

Table 3

Variables associated with exposure to HBV infection (anti-HBc positive) in bivariate and multivariate analyses among truck drivers in Foz do Iguaçu, Brazil, 2003–2005

Characteristics*	N (%) [†]	Unadjusted OR (95% CI) ^{‡ §} (n=798)*	Adjusted OR (95% CI) ^{‡ §} (n=786)*
Exposed to HBV	257 (32.3)		
Age (years)			
18–28	35 (24.2)	1.0	1.0
29–39	82 (32.1)	1.5 (0.9 to 2.4)	1.6 (1.0 to 2.7)***
40–49	92 (35.0)	1.7 (1.1 to 2.7)*	1.9 (1.2 to 3.3)**
50	48 (36.4)	1.8 (1.0 to 3.0)*	2.3 (1.2 to 4.1)**
Education (years)			
>10	38 (23.2)	1.0	–
8–10	67 (34.5)	1.7 (1.1 to 2.8)*	–
0–7	150 (34.6)	1.7 (1.1 to 2.7)*	–
Country of residence			
Brazil	221 (37.9)	1.0	1.0
Others	36 (16.5)	0.3 (0.2 to 0.5)**	0.3 (0.2 to 0.4)**
Years working as truck driver			
<5	54 (34.4)	1.0	–
5–10	66 (30.6)	0.8 (0.5 to 1.3)	–
11–20	73 (33.2)	0.9 (0.6 to 1.5)	–
>20	64 (31.4)	0.9 (0.5 to 1.4)	–
Duration of trips (weeks)			
<1	62 (34.9)	1.0	1.0
1–2	118 (36.7)	1.1 (0.7 to 1.6)	1.2 (0.7 to 1.8)
3–4	61 (25.8)	0.6 (0.4 to 1.0)	0.6 (0.4 to 1.1)
>4	7 (20.0)	0.5 (0.2 to 1.1)	0.4 (0.2 to 1.1)
Variable	8 (30.0)	0.8 (0.3 to 1.9)	0.9 (0.3 to 2.3)
Having principal/steady partner			
No	12 (33.3)	1.0	1.0
Yes	245 (32.4)	1.0	0.7 (0.3 to 1.7)
Number of lifetime sexual partners [†]			
Up to 10	35 (26.8)	1.0	1.0
11–20	44 (29.7)	1.1 (0.7 to 1.9)	1.1 (0.7 to 1.9)
21–50	40 (31.3)	1.2 (0.7 to 2.1)	1.2 (0.7 to 2.1)
>50	42 (44.5)	2.2 (1.2 to 3.8)*	1.7 (1.0 to 2.9)***
Unknown	22 (28.7)	1.1 (0.6 to 2.1)	0.9 (0.5 to 1.8)
Ever had a male sexual partner			
No	170 (31.9)	1.0	–
Yes	13 (29.1)	0.8 (0.4 to 1.7)	–

Characteristics [*]	N (%) [†]	Unadjusted OR (95% CI) ^{‡ §} (n=798) [*]	Adjusted OR (95% CI) ^{‡ §} (n=786) [*]
Unprotected vaginal sex with regular partners in past 6 months			
No	98 (36.0)	1.0	1.0
Yes	158 (30.3)	0.8 (0.5 to 1.0) ***	0.6 (0.4 to 0.8) **
Unprotected vaginal sex with commercial and occasional partners in past 6 months			
No	215 (32.0)	1.0	–
Yes	41 (34.2)	1.1 (0.7 to 1.7)	–
Unprotected anal sex with any type of partner in past 6 months			
No	204 (31.2)	1.0	1.0
Yes	51 (37.8)	1.3 (0.9 to 1.9)	1.7 (1.2 to 2.7) **
Ever received a blood transfusion			
No	239 (32.8)	1.0	–
Yes	17 (29.4)	0.8 (0.4 to 1.5)	–

^{*} Numbers differ slightly for some characteristics and analyses due to missing data.

[†] Percentages indicate proportion of HBV exposed per category.

[‡] Exposure data includes reported values; OR estimates incorporate imputed data.

[§] Estimates weighted due to sampling design; ORs reported for variables that remained in the adjusted model, adjusted by other variables shown.

^{*} p<0.05,

^{**} p<0.01,

^{***} p<0.10.

HBV, hepatitis B virus.

Table 4

Variables associated with prevalent HSV-2 infection in bivariate and multivariate analyses among truck drivers in Foz do Iguaçu, Brazil, 2003–2005

Characteristics*	N (%) [†]	Unadjusted OR (95% CI) ^{‡ §} (n=799)*	Adjusted OR (95% CI) ^{‡ §} (n=785)*
Age (years)			
18–28	24 (15.4)	1.0	1.0
29–39	60 (22.3)	1.6 (0.9 to 2.7) ***	1.5 (0.8 to 2.6)
40–49	85 (30.6)	2.4 (1.4 to 4.1) *	2.1 (1.2 to 3.6) **
50	52 (39.4)	3.5 (2.0 to 6.3) **	3.1 (1.7 to 5.7) **
Education (years)			
>10	43 (24.6)	1.0	1.0
8–10	45 (22.2)	0.8 (0.5 to 1.4)	0.9 (0.6 to 1.6)
0–7	133 (29.5)	1.3 (0.8 to 1.9)	1.2 (0.7 to 1.9)
Country of residence			
Brazil	155 (25.5)	1.0	1.0
Others	67 (29.7)	1.2 (0.8 to 1.7)	1.4 (1.0 to 2.1) ***
Years working as truck driver			
<5	27 (15.1)	1.0	–
5–10	47 (21.0)	1.5 (0.9 to 2.6)	–
11–20	67 (29.6)	2.4 (1.4 to 3.9) *	–
>20	81 (38.6)	3.5 (2.1 to 5.9) **	–
Duration of trips (weeks)			
<1	48 (26.1)	1.0	–
1–2	90 (26.3)	1.0 (0.7 to 1.5)	–
3–4	63 (26.1)	1.0 (0.6 to 1.5)	–
>4	10 (28.3)	1.1 (0.5 to 2.5)	–
Variable	10 (34.0)	1.4 (0.6 to 3.4)	–
Having principal/steady partner			
No	7 (18.9)	1.0	1.0
Yes	215 (28.2)	0.6 (0.3 to 1.4)	0.4 (0.2 to 1.2)
Number of lifetime sexual partners			
Up to 10	29 (20.2)	1.0	1.0
11–20	30 (20.5)	1.0 (0.6 to 1.8)	1.1 (0.6 to 1.8)
21–50	35 (25.3)	1.3 (0.7 to 2.4)	1.4 (0.7 to 2.6)
>50	27 (26.2)	1.4 (0.7 to 2.6)	1.3 (0.7 to 2.3)
Unknown	28 (36.2)	2.2 (1.2 to 4.2) *	1.9 (1.1 to 3.3) *
Ever had a male sexual partner [‡]			
No	130 (22.9)	1.0	1.0
Yes	20 (44.9)	2.7 (1.4 to 5.2) *	1.7 (1.0 to 3.2) ***
Unprotected vaginal sex with regular partners in past 6 months			

Characteristics [*]	N (%) [†]	Unadjusted OR (95% CI) ^{‡ §} (n=799) [*]	Adjusted OR (95% CI) ^{‡ §} (n=785) [*]
No	70 (23.7)	1.0	–
Yes	151 (28.1)	1.3 (0.9 to 1.7)	–
Unprotected vaginal sex with commercial and occasional partners in past 6 months			
No	178 (25.5)	1.0	–
Yes	43 (32.9)	1.4 (0.9 to 2.2)	–
Unprotected anal sex with any type of partner in past 6 months			
No	173 (25.5)	1.0	1.0
Yes	47 (32.2)	1.4 (0.9 to 2.1)	1.2 (0.8 to 1.8)
Ever received a blood transfusion			
No	197 (25.8)	1.0	–
Yes	22 (36.7)	1.7 (0.9 to 2.9)	–

* Numbers differ slightly for some characteristics and analyses due to missing data.

[†] Percentages indicate proportion of HBV exposed per category.

[‡] Exposure data include reported values; OR estimates incorporate imputed data.

[§] Estimates weighted due to sampling design; ORs reported for variables that remained in the adjusted model, adjusted by other variables shown.

*
p<0.05,

**
p<0.01,

p<0.10.

HSV-2, herpes simplex virus type-2.