

## Prevalence of hepatitis C virus infection among recyclable waste collectors in Central-West Brazil

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*The prevalence of hepatitis C virus (HCV) in a population of recyclable waste collectors (n = 431) was assessed using a cross-sectional survey in all 15 cooperatives in the city of Goiânia, Central-West Brazil. The HCV prevalence was 1.6% (95% confidence interval: 0.6-3.6) and a history of sexually transmitted infections was independently associated with this infection. HCV RNA (corresponding to genotype 1; subtypes 1a and 1b) was detected in five/seven anti-HCV-positive samples. Although the study population reported a high rate (47.3%) of sharps and needle accidents, HCV infection was not more frequent in recyclable waste collectors than in the general Brazilian population.*

Key words: epidemiology - hepatitis C virus - recyclable waste collectors

Hepatitis C virus (HCV) is a major causative agent of liver disease, including chronic hepatitis, cirrhosis and hepatocellular carcinoma. Approximately 130-170 million individuals are thought to be infected worldwide (Lavanchy 2011). HCV has a positive-sense single-stranded RNA genome that presents a high degree of genetic heterogeneity. The phylogenetic analysis of full-length or partial sequences of HCV isolates has led to the identification of six major genotypes (1-6), each comprising multiple subtypes (designated 1a, 1b etc.) (Simmonds et al. 2005).

Recyclable waste collectors collect, separate, classify and sell recyclable waste materials, such as paper, cardboard, glass, ferrous and non-ferrous metals and other recyclable materials. They are autonomous workers who may or may not belong to cooperatives or associations. In 2002, this job became regulated by the Brazilian Occupational Classification and the number of recyclable waste collectors has increased significantly in urban areas. There are approximately one million recyclable waste collectors in Brazil (CEMPRE 2012). Despite its economic and environmental importance, studies have shown that waste collection is associated with poor health and high levels of morbidity (Gutberlet & Baeder 2008, Almeida et al. 2009, Kuijter et al. 2010, Rachiotis et al. 2012). In addition, recyclable waste collectors have a lifestyle that is associated with unfavourable social, cultural and environmental factors (Porto et al. 2004, Silva et al. 2005, Medeiros & Macêdo 2006).

To our knowledge, there are currently few data regarding the prevalence of HCV infection in this population. A high HCV infection prevalence (12.4%) was found

among recyclable waste collectors in the city of Santos, Brazil (Rozman et al. 2007, 2008), but no other data regarding HCV infection in this population are available. Therefore, the aim of the present study was to assess the prevalence of HCV infection in recyclable waste collectors in Central-West Brazil. The HCV genotype distribution and predictors of infection were also identified.

A cross-sectional study was performed in a population of recyclable waste collectors in the city of Goiânia (population of 1,300,000), the capital of the state of Goiás, Central-West Brazil. From April 2010-May 2011, recyclable waste collectors were recruited in all 15 cooperatives. Of the 432 individuals who were invited to participate in the study, all but one agreed to participate. Written informed consent was obtained from all participants prior to the start of the study. The participants were interviewed to obtain demographic data and identify risk factors associated with HCV transmission. The protocol used in the present study was approved by the Ethical Committee of the Federal University of Goiás.

Blood was collected (10 mL) from all participants and serum samples were tested by ELISA for antibodies against HCV (anti-HCV; Hepanostika Ultra, Biomedical, Shanghai, China). Anti-HCV-positive samples were re-tested by immunoblotting (Chiron RIBA HCV 3.0 SIA, Ortho Clinical Diagnostic, Rochester, NY, USA) and subjected to RNA detection using nested polymerase chain reaction with primers complementary to the conserved area of the 5' non-coding region of HCV (Ginabreda et al. 1997). A line probe assay was used to determine the genotype of the isolates according to the procedure described by the manufacturer (Inno-LiPA HCV II, Innogenetics, Ghent, Belgium).

The prevalence of HCV and 95% confidence interval (CI) were calculated. Fisher's exact test was used to compare variables and evaluate the association between HCV infection (defined as positive for anti-HCV) and risk factors, which were further analysed with a multivariate logistic regression model. A p value of < 0.05 was defined as statistically significant. Statistical evalu-

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ations were performed using Statistical Package for the Social Sciences version 11.0.

The study population was primarily composed of females (62.4%). The mean age was  $36.9 \pm 13.6$  years. The majority of the participants were non-Caucasian (79.4%), married (48.7%), had received nine years or less of formal education (fundamental education in Brazil) (78.7%) and reported a monthly income of US\$ 300 or

less (52.7%). Seven recyclable waste collectors were found to be anti-HCV positive by ELISA and immunoblotting, resulting in an anti-HCV prevalence of 1.6% (95% CI: 0.6-3.6).

The Table describes the univariate and multivariate analyses of factors associated with HCV infection in recyclable waste collectors in Central-West Brazil. A univariate analysis demonstrated that this infection was

TABLE  
Factors associated with hepatitis C virus (HCV) among recyclable waste collectors in Central-West Brazil

Risk factor	HCV positive/total	%	OR (95% CI)	p	Ajusted OR <sup>a</sup> (95% CI)	p
Age (years)						
≤ 40	2/276	0.7	1.0	-	1.0	-
> 40	5/155	3.2	4.6 (0.9-23.8)	0.05	2.8 (0.5-16.0)	0.25
Gender						
Female	3/269	1.1	1.0	-	1.0	-
Male	4/162	2.5	2.2 (0.5-10.2)	0.28	0.8 (0.1-5.2)	0.85
Duration of profession (years)						
≤ 1	2/227	0.9	1.0	-	-	-
2-10	3/157	1.9	20.2 (0.3-19.1)	0.40	-	-
> 10	2/47	4.2	5.0 (0.5-51.3)	0.13	-	-
Sharps/needle accidents <sup>b</sup>						
No	2/222	0.9	1.0	-	-	-
Yes	5/204	2.5	2.8 (0.5-14.4)	0.21	-	-
History of familial hepatitis <sup>b</sup>						
No	4/341	1.2	1.0	-	-	-
Yes	3/82	3.7	3.2 (0.7-14.6)	0.11	-	-
Blood transfusion <sup>b</sup>						
No	4/376	1.1	1.0	-	1.0	-
Yes	3/54	5.6	5.5 (1.2-25.1)	0.01	5.0 (1.0-25.0)	0.05
Surgery <sup>b</sup>						
No	2/200	1	1.0	-	-	-
Yes	5/231	2.2	2.2 (0.4-11.4)	0.34	-	-
Tattoo						
No	4/347	1.2	1.0	-	-	-
Yes	3/84	3.6	3.2 (0.7-14.5)	0.12	-	-
Dental treatment <sup>b</sup>						
No	0/17	0	-	-	-	-
Yes	5/335	1.5	-	0.61	-	-
Illicit drug use						
No	4/345	1.2	1.0	-	-	-
Yes	3/86	3.5	3.1 (0.7-14.0)	0.13	-	-
Incarceration <sup>b</sup>						
No	3/353	0.8	1.0	-	1.0	-
Yes	4/75	5.3	6.6 (1.4-30.0)	< 0.01	1.9 (0.3-10.9)	0.45
Unprotected sex with multiple partners						
No	1/255	0.4	1.0	-	1.0	-
Yes	6/176	3.4	9.0 (1.1-75.1)	0.01	7.6 (0.9-66.0)	0.07
Sexually transmitted infections <sup>b</sup>						
No	2/324	0.6	1.0	-	1.0	-
Yes	5/90	5.6	9.5 (1.8-49.7)	< 0.01	6.7 (1.2-36.5)	0.03

a: adjusted for gender, age, blood transfusion, incarceration, unprotected sex with multiple partners and sexually transmitted infections; b: the denominator represents the number of patients who answered the question; CI: confidence interval; OR: odds ratio.

associated with having received a blood transfusion, incarceration, unprotected sex with multiple partners and sexually transmitted infections (STIs). A history of STIs ( $p = 0.03$ ) was independently associated with HCV infection according to multivariate analysis and receiving a blood transfusion ( $p = 0.05$ ) and having unprotected sex with multiple partners ( $p = 0.07$ ) also showed an association, but had a borderline  $p$  value.

Among the anti-HCV-positive samples, HCV RNA was detected in five samples determined to be genotype 1: subtypes 1a ( $n = 2$ ) and 1b ( $n = 3$ ).

The present study represents the first investigation to provide not only HCV prevalence data, but also information regarding risk factors associated with acquiring the infection and the HCV genotypes infecting recyclable waste collectors in Central-West Brazil. The 1.6% prevalence rate of HCV infection found in these individuals in Goiânia was similar to that observed in a multicentric population-based study in the capital cities of Brazil (1.38%; 95% CI: 1.12-1.64) (MS/SVS 2011). Nevertheless, relative to other Brazilian recyclable waste collector populations, this prevalence was lower than the prevalence reported in Santos (12.4%) (Rozman et al. 2007, 2008). This difference may reflect differences in the rates of parenteral and sexually risky behaviours between these populations in Goiânia and Santos.

A history of STIs (adjusted odds ratio = 6.7; 95% CI: 1.2-36.5) was the main predictor of HCV infection among recyclable waste collectors. These data were consistent with findings obtained previously (Marx et al. 2003, Tohme & Holmberg 2010). In addition, unprotected sex with multiple partners was associated with HCV infection according to the univariate analysis of data obtained from the study population. These sexually risky behaviours have been reported by other authors (Terrault 2002, Wang et al. 2007, Alter 2011) and appear to be common in this population (Rozman et al. 2007, 2008). It should be stressed that most preventative policies related to STIs are aimed at groups with higher exposure risks and do not include recyclable waste collectors.

Although we did not find that occupational exposure to waste was a risk factor for HCV infection, recyclable waste collectors who reported longer employment times and occupational injuries with sharp instruments/needles had an increased HCV infection prevalence. In addition, the studied population reported a high rate (47.9%; 204/426) of sharps and needle accidents (Table) and a low adherence to using gloves (63.6%) and other personal protective equipment (data not shown). These data were consistent with findings from other studies (Porto et al. 2004, Silva et al. 2005, Medeiros & Macêdo 2006, Gutberlet & Baeder 2008, Rozman et al. 2008) and reinforce the importance of educating individuals on proper waste handling and informing individuals of health and safety issues, including providing access to personal protective equipment. Additionally, educational campaigns concerning proper waste disposal practices at the household level are also necessary.

Among the seven anti-HCV-positive recyclable waste collectors, five were also HCV RNA positive and infected with HCV genotype 1. This genotype predominates

in Brazil, as do subtypes 1a and 1b, which were identified in this population (Campiotto et al. 2005, Martins et al. 2006, Lampe et al. 2010).

In conclusion, HCV infection was not more frequent in recyclable waste collectors than in the general Brazilian population. A history of STIs was a predictor of HCV infection and the HCV genotype/subtypes identified in the study population were consistent with those currently circulating in Brazil.

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