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Short Report: HTLV-1 and -2 Infections among 10 Indigenous Groups in the Peruvian Amazon

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Abstract. Infections with HTLV-1 and -2 were detected in 12 (1.9%) and 6 (0.9%) indigenous individuals living in 27 Amazonian villages in Peru. All infections occurred in Shipibo-Konibo people. HTLV was more common among participants living in villages distant from larger port cities and women with non-monogamous sexual partners.

HTLV infection is concentrated in specific areas of Japan, Central and South Africa, the Caribbean, and Latin America. Among indigenous populations in Latin America, HTLV-1 infection has been reported in groups living in the Andean highlands, whereas HTLV-2 has been reported in groups living in the lowlands.^{1–3} Although several Latin American countries have reported the presence of HTLV among indigenous groups (Argentina, Bolivia, Brazil, Chile, Colombia, Panama, Paraguay, Peru, and Venezuela), it is difficult to estimate the HTLV prevalence among Amazonian indigenous groups, because there are few population-based studies.^{1–9}

There are 71 different indigenous groups in Peru, and most HTLV-1 and -2 infections in indigenous groups have been reported in the Andean region among Quechua and Aymara populations, the two most populous indigenous groups in this area.⁸ In contrast, there is limited data about HTLV in the Amazon region. In the only published study of HTLV among Amazonian indigenous groups in Peru, two cases of HTLV-1 were detected; one case was in a Shipibo-Konibo village, and the other case was in a Kechwa-Lamas village. Additionally, two cases of HTLV-2 infection were detected; one case was in a Wampis village, and the other case was in a Harakmbut village.⁹

HTLV prevalence was higher in high-risk populations, such as female sex workers (FSWs) and men who have sex with men. The work by Wignall¹⁰ reported a 10.3% HTLV-1 prevalence among Peruvian FSWs who were born in the Amazon region.

HTLV is associated with adult T-cell leukemia/lymphoma and myelopathy/tropical spastic paraparesis (HAM/TSP)—diseases with a low incidence but high morbidity and mortality. HTLV-1 is also associated with increased rates of tuberculosis, uveitis, infective dermatitis, and strongyloidiasis.¹¹ In this study, we sought to determine the prevalence and factors associated with HTLV infection in 27 indigenous communities living along the Peruvian Amazon basin.

Data presented herein were collected as part of a larger study of sexually transmitted infections (STIs) among Amazonian indigenous peoples conducted in 2007–2008 (Orellana ER, unpublished data). The study was an extension of the Peru PREVEN community-randomized trial.¹² Study sites were remote indigenous villages, accessible mainly by boat, with some villages located up to a 12-hour boat ride from one of four major port cities in the Peruvian Amazon: Iquitos, Pucallpa, Yurimaguas, and Puerto Maldonado (Figure 1).

We recruited all eligible adults from villages with 30 or fewer eligible adults, and we took a random sample of 30 participants from each village with more than 30 eligible adults. Individuals were eligible if they were between 18 and 29 years old and had lived in the community for at least 6 months before recruitment. We excluded individuals who had resided outside the village for more than 3 of the 6 months before enrollment. Participants completed questionnaires that included an interviewer-administered component to collect demographic data and a self-administered component to capture more sensitive sexual behavior data based on a standardized population-based survey used in nationwide surveys of sexual behavior and STI/human immunodeficiency virus (HIV) of urban young adults.¹² Participants also provided genital and blood samples for diagnosis of STI.

All HTLV testing was performed at the US Naval Medical Research Unit Six in Peru (NAMRU-6). HTLV-1 and -2 antibody testing was conducted using enzyme-linked immunosorbent assays (ELISAs; Vironostika, NC) with confirmatory Western blot assay (HTLV-1/2 Blot 2.4; Genelabs Diagnostics, Singapore). An individual was considered HTLV-1–seropositive if the ELISA was positive and confirmatory Western blot assay revealed bands representing gag (p24, p19), gp46, and two env proteins (GD21 and rgp 46-I). An individual was considered HTLV-2–seropositive if the ELISA was positive and confirmatory Western blot assay revealed bands representing p24, GD21, and rgp46-II. If gag and env proteins were absent but other HTLV-specific bands, such as p53 or p19, were present, the individual was considered indeterminate. Subjects with indeterminate results were excluded from the analysis.

Data were analyzed using STATA Version 8 (College Station, TX). Fisher exact and χ^2 tests were used to assess the association between categorical variables. Unconditional logistic regression was used for bivariate analysis. This study was approved by the ethics committee at Universidad Peruana Cayetano Heredia and the NAMRU-6 in Peru.

A total of 644 eligible individuals agreed to participate. Of these participants, 638 agreed to provide a serum sample and were included in the analysis; 356 (55.8%) participants were females. The mean age of participants was 23 years (range = 18–29 years). The majority (53%) had a high school education or less, 95% were literate, and 60% were cohabitating. In general, indigenous villagers' livelihoods depend on small-scale agriculture, fishing, other natural resource extraction, and commerce. The participants were from 27 villages that included 10 indigenous ethnic groups. The communities included were (1) Puerto Maldonado: three Ese eja, one Shipibo-Konibo,

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FIGURE 1. Map with the four major port cities in the Peruvian Amazon.

one Amarakaire (Harakmbut), and one Kichwaruna villages; (2) Yurimaguas: one Cocama-Cocamilla and five Shawi villages; (3) Iquitos: two Maijuna, one Murui, three Yagua, and one Bora villages; and (4) Pucallpa: eight Shipibo-Konibo villages.

The overall prevalence of HTLV-1 infection was 1.9% (12/638), and the overall prevalence of HTLV-2 infection was 0.9% (6/638). All infections were detected in eight of nine Shipibo-Konibo villages. The prevalence of HTLV-1 and -2 in this ethnic group was 4.1% (12/290) and 2.1% (6/290), respectively. HTLV-1 and -2 infections were significantly associated with the Shipibo-Konibo people (Table 1). All but one HTLV-2 infection occurred in villages where HTLV-1 infection was also detected; we did not detect anyone coinfecting with both HTLV-1 and -2. Four test results were indeterminate. Two indeterminate results were detected in Shipibo-Konibo participants, and two indeterminate results were detected in Maijuna participants.

Of the nine Shipibo-Konibo villages included in the study, eight villages had participants who tested positive for HTLV-1 or -2. Of the eight villages, five villages were located less than 1 hour from the port city, and three villages were more than 1 hour from the port city. HTLV-1 and -2 prevalence in villages closer to the port city was 2% (4/205) and 0.5% (1/205), respectively. In villages farther from the port city, the prevalence was 9.4% (8/85) and 5.9% (5/85), respectively.

Presence of HTLV-1 or -2 infection was not significantly associated with age, sex, educational level, marital status, or income level. Prevalence of infection did not vary between participants who reported ever having sex and participants who did not. Also, prevalence did not vary by age of sexual debut or lifetime number of sex partners. Among participants who reported not ever having sex, two (4.9%) participants

TABLE 1
Demographic characteristics and sexual behaviors among young adults living in indigenous villages along the Peruvian Amazon basin

Variable	Number* (%) of HTLV negative† (N = 620)	Number* (%) of HTLV positive† (N = 18)	OR (CI)	P
Age in years (range)				
18–20	186 (98.4)	3 (1.6)	Reference	0.39
21–25	263 (96.3)	10 (3.7)	2.36 (0.64–8.68)	
26–30	171 (97.2)	5 (2.8)	1.81 (0.43–7.70)	
Sex				
Male	275 (97.5)	7 (2.5)	Reference	0.65
Female	345 (96.9)	11 (3.1)	1.25 (0.48–3.27)	
Ethnic group				
Shipibo-Konibo	272 (93.8)	18 (6.2)	‡	< 0.001
Other	348 (100.0)	0	–	
Educational level				
High school or less	327 (98.2)	6 (1.8)	Reference	0.09
Superior level	280 (95.9)	12 (4.1)	2.34 (0.87–6.30)	
Marital status				
Single	228 (98.3)	4 (1.7)	Reference	0.21
Married	16 (100.0)	0	–	
Cohabiting	368 (96.6)	13 (3.4)	2.01 (0.65–6.25)	
Separated	7 (87.5)	1 (12.5)	8.14 (0.80–82.6)	
Daily income				
≥\$1 US	174 (99.4)	1 (0.6)	Reference	0.06
< \$1 US	432 (96.2)	17 (3.8)	6.85 (0.90–51.8)	
Sexually active				
Yes	572 (97.4)	15 (2.6)	0.51 (0.11–2.32)	0.38
No	39 (95.1)	2 (4.9)	Reference	
Age in years at first intercourse				
Never had sex	38 (95.0)	2 (5.0)	Reference	0.26
< 11	23 (92.0)	2 (8.0)	1.65 (0.22–12.5)	
11–15	294 (98.7)	4 (1.3)	0.26 (0.05–1.46)	
16–20	201 (96.6)	7 (3.4)	0.66 (0.13–3.31)	
21–25	7 (100.0)	0	–	
26–30	0	1 (100.0)	–	
Does not remember	42 (97.7)	1 (2.3)	0.45 (0.04–5.19)	
Lifetime number of sex partners				
0–1	208 (96.7)	7 (3.3)	Reference	0.10
2–5	230 (99.1)	2 (0.9)	0.26 (0.05–1.26)	
> 5	104 (97.2)	3 (2.8)	0.86 (0.22–3.38)	
Does not remember	65 (94.2)	4 (5.8)	1.83 (0.52–6.44)	
Partner had another female partner				
No	209 (99.5)	1 (0.5)	Reference	0.02
Yes	166 (97.1)	5 (2.9)	6.34 (0.73–54.8)	
Do not know	201 (95.7)	9 (4.3)	9.50 (1.19–75.7)	

Bonferroni correction ($P < 0.0045$).

*Numbers may not add up to the total because of missing data.

†Either HTLV-1 or -2.

‡OR cannot be calculated because of empty cells. *P* values were calculated using the Fisher exact test.

were positive for HTLV (one participant with HTLV-1 and one participant with HTLV-2), suggesting the presence of non-sexual transmission. Among females, not knowing whether her partner had other partners (odds ratio [OR] = 9.50, 95% confidence interval [CI] = 1.19–75.7) was positively associated with HTLV infection (Table 1). History of sexual abuse was present in 14.4% (49) of female participants. This abuse history was not associated with HTLV infection (OR = 2.02, 95% CI = 0.30–10.3). Among men, neither sex with a sex worker (OR = 2.0, 95% CI = 0.32–12.25) nor sex with another man (OR = 0.96, 95% CI = 0.11–8.45) was associated with HTLV infection.

This study is the second study to report HTLV infection in indigenous groups from the Peruvian Amazon. In our population-based study of 27 indigenous villages along the Peruvian Amazon basin, HTLV infection was detected exclusively in eight of nine Shipibo-Konibo villages. The overall prevalence rates of HTLV-1 (4.1%) and -2 (2.1%) in the Shipibo-Konibo ethnic group are similar to those rates reported previously among indigenous Peruvians.⁵⁻⁷ The prevalence of HTLV-1 and -2 was higher in individuals living in villages located farther from the port city than individuals living in villages closer to the port city. This finding suggests the long-term presence of HTLV in Amazonian indigenous populations rather than recent introduction into the community. There may be additional cultural practices of the Shipibo-Konibo ethnic group, such as shared breastfeeding, that maintain higher prevalence of HTLV infections over generations. We did not inquire specifically about such risk factors. HTLV infection was more common among women who did not know if their partners had other partners, suggesting that sexual transmission could be responsible for maintaining endemic infection. We did not find an association between HTLV infection and younger age of sexual debut or greater number of lifetime sex partners.

We included only villages located within a 12-hour radius from the port cities by boat and only participants between 18 and 29 years; therefore, we cannot extrapolate the results of this study to other indigenous Amazonian groups. Ethnographic research, phylogenetic analysis, molecular clock analysis, and mitochondrial DNA lineages studies of HTLV-1 and -2 infections could provide a better understanding of why HTLV infection is concentrated only in Shipibo-Konibo populations. Future studies should assess the presence of HTLV infection in neighboring indigenous groups (especially Wampis and Kechwa-Lamas) to determine if risk factors for infection differ by group.

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