Five-Year Eradication of Hepatitis B Infection after an Outreach Immunization Program in the Waorani Population in the Ecuadorian Amazon

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Abstract. In Waorani communities of the Amazon basin of Ecuador, hepatitis B (HB) surface antigen was found in 14% of asymptomatic persons. The aim of this study was to identify the Waorani population in Ecuador and obtain an epidemiologically adequate coverage of vaccination against hepatitis B virus (HBV) among them. Between February and September 2010, three vaccination campaigns were completed as part of a collaborative activity between the Ecuadorian Ministry of Public Health and the community leaders in the intervention areas. In addition, in 10 of the 22 Waorani communities, during first contact, a questionnaire about risk factors for HBV infection was administered. A total of 16 Waorani communities were registered before the beginning of this intervention, but during the actual process, six additional communities were identified. In total, 1,251 community members were registered, 92.7% of which received all three doses of the vaccine. Among them, 83% of survey respondents reported having been vaccinated, but only 22% were able to show proof. Only 1% of respondents were intravenous drug users, whereas 22% had at least one tattoo. All self-identified as heterosexual, but only 32% reported using condoms during sexual intercourse. By March 2015, no new cases of HB were been reported in any of the Waorani communities. Herein, we report the importance of intersectoral collaboration to strengthen health interventions in an isolated population like the Waorani area.

INTRODUCTION

An estimated one-third of the global population has been exposed to the parenterally transmitted hepatitis B virus (HBV). Approximately 350 million are chronically infected and are at risk of cirrhosis and liver cancer.¹ Delta or hepatitis D virus (HDV) has a similar transmission pattern,² and depends on HBV replication products for its own replication within the human host.³

HBV and HDV are endemic in Amerindian populations^{4,5}; however, among countries, large differences in prevalence that range from 25% to 83% are associated with ethnicity, geography, and socioeconomic factors.^{5,6} In particular, outbreaks have been reported in Brazil,⁷ Colombia,^{8–10} Peru,¹¹ and Venezuela.^{4,5,12}

The Huaorani or Waorani (also called Sabela, Auishiri, Auca, and Huao) is a native American population inhabiting the northwest of the Amazon, in the east of Ecuador. Their ancestral territory is located in an area of approximately 30,000 km² between the Curaray and the Napo rivers in the Amazon rainforest. The Waorani sustains a link with some uncontacted indigenous populations that live in voluntary isolation. Currently, their territories are threatened by oil exploration and logging.

In a study conducted in the Waorani communities at the Amazon basin of Ecuador,¹³ hepatitis B (HB) surface antigen was found in the serum of 54% of jaundiced individuals and in 14% of asymptomatic persons. Interestingly, from 58 individuals identified with jaundice, four of the 22 Waorani communities were home to 79% of cases. In fact, it is well known that the Waorani population has the highest HB prevalence in the Amazonian region, and several cases of fatality due to liver disease progression and related complications have been reported.^{14,15}

The aim of this study was to evaluate the impact of an adequate rate of vaccination against HBV among the Waorani population.

SUBJECTS AND METHODS

The Waorani population in Ecuador is found in the Amazon rainforest, in the province of Orellana (286 km from Quito), and is distributed into three main geographical areas: Tiwino, Pompeya, and Nuevo Rocafuerte (Figure 1). An important mobilization occurs within these areas on a regular basis, either for hunting or for community activities.

Between February and September 2010, three vaccination campaigns were completed in a collaborative activity between the Ecuadorian Ministry of Public Health and the community leaders of Tiwino, Pompeya, and Nuevo Rocafuerte.

A comprehensive outreach health team consisting of a medical doctor, a nurse, and a Waorani health worker visited the communities at a specific date and time, after a previous agreement with the community leader. Once in the community, the population was informed about the benefits of vaccination and answers were provided to questions that arose.

Ecuador has implemented the World Health Organization vaccination schedule guidelines.^{16–18} The vaccine used for HB in adults is recombinant (Heberbiovac HB, La Habana, Cuba) and for children is conjugated absorbed (pentavalent). For children, the first dose is provided at the initial contact (newborn), the second dose after 1 month, and the third dose after 6 months. This schedule has demonstrated 95% efficacy in the prevention of HBV infection and its chronic consequences.^{19,20} To ensure the proper completion of the full vaccination scheme, a record of each individual's name, age, community of residency, doses received, and dates administered were maintained.

In addition, a self-directed questionnaire, regarding risk factors for HBV infection, was given to 10 randomly selected Waorani communities.

RESULTS

A total of 22 Waorani communities were administered vaccinations, yielding 1,251 participants (Table 1). From this sample, 2.9% ($N = 36$) were neonates aged less than 28 days,

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From those surveys, reported risk factors were the following: previous use of intravenous drugs (1%); 22% had at least one tattoo; 3% had received a blood transfusion; 7% had visited the dentist during the previous week; and 15% acknowledged receiving an intramuscular injection during the last 2 weeks. All respondents defined themselves as heterosexuals, and 32% reported using condoms during sexual intercourse. Nine percent reported sexual intercourse with sexual workers or with potentially HB-infected individuals without protection.

DISCUSSION

The first field evaluation of the mass introduction of HB vaccine in endemic areas of Latin America was in the Colombian Amazon.²⁴ In such highly endemic areas like the Waorani territories, transmission factors comprise environmental conditions and cultural practices such as exposure to bat bites, extraction of jigger fleas with knives, use of teeth to extract stings, scarification, bloodletting, piercing or tattooing, and sexual activity at an early age. Also, oral

Waorani communities identified in the province of Orellana, Ecuador

A bar chart comparing the number of subjects in two groups: 'Total population' (black bars) and 'People with three doses completed' (gray bars). The y-axis represents the number of subjects, ranging from 0 to 1400 in increments of 200. The x-axis lists four categories: Kawimeno, Pompeya, Tiwino, and Total. The data is as follows:

Category	Total population	People with three doses completed
Kawimeno	113	85
Pompeya	287	250
Tiwino	851	825
Total	1251	1160

FIGURE 2. Number of third doses administered.

exposure via sharing of breastfeeding, premastication of food, sharing chewing tobacco, and consumption of drinks fermented with saliva have been highlighted as potential mechanisms of transmission.^{4,25}

It is estimated that over time, substantial reductions in HBV and HDV prevalence is expected from HBV vaccination. Ecuador started a vaccination program against HB in the Amazon Basin in 1992. Children under 5 years of age and newborns were subject to receive three doses of inactivate viral HB vaccine, using a short schedule: first dose at the time of birth, second and third doses 2 months afterward. However, difficulties in reaching more remote areas were reported as a result of cold-chain issues, historic fragmentation of records that resulted from vaccination administration being undertaken by different health agencies and religious missions. These factors have impeded efforts to achieve the target coverage specified in the National Extended Program of Immunization.

Geographically isolated areas like Kewerino require approximately an 8-hour journey by river in a powered cooler followed by 4 hours on foot. Barriers to HBV also include a shortage of qualified teams. Moreover, achieving the frequency of visits needed for effective outreach to the community is also an area of concern. Less remote villages may have an indigenous nurse trained to use vaccines in refrigerated storage; however, maintaining an adequate supply of vaccines is problematic and HBV immunoglobulin vaccine is currently unavailable. Remote villages face enormous challenges in sustaining the cold chain including distribution, transportation, handling, preservation, and storage in optimal conditions of light and temperature to ensure the immunogenicity and protective efficacy of the vaccine. Clearly, timely neonatal vaccination would require substantial input of both human and financial resources combined with extensive logistical backup, in what continues to be a very challenging operating environment. Even if vaccination should result in interruption of HBV transmission, for a generation, there will be a pool of individuals at risk for HDV outbreaks as a result of persistent HBV infections.

Furthermore, a complete three-dose vaccination scheme was very difficult to achieve in the Waorani population due to the continuous mobilization within communities. Default to follow-up for subsequent doses occurred easily.

Overcoming HBV barriers in the Waorani population is one of the most important factors. Intersectoral collaboration intended to strengthen health interventions might contribute to positive outcomes. However, it has to be noted that no single strategy is perfect. For example, when the community would call together the community members for health issues, other activities such as social meetings, negotiations with oil companies, and hunting, appeared to be prioritized by some.

Following this experience, we believe that a similar vaccination approach for other vaccines (yellow fever, poliomyelitis, etc.) might improve coverage and obtain better epidemiological positive results in the Waorani population.

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