



# Vaccination against yellow fever in French Guiana: The impact of educational level, negative beliefs and attitude towards vaccination



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## ABSTRACT

**Objective:** Analyze the impact of educational level, negative beliefs and negative attitudes on the yellow fever vaccination coverage (YFVC).

**Methodology:** This analytical study involved a sample of 2763 people from 866 households. Educational status was described in six levels: No level (Respondent had never attended school), level-1 (respondent left before intermediate school), level-2 (Respondent attended intermediate school), level-3 (respondent attended high school), level-4 (Respondent attended university), Other level (When the level could not be determined). The Attitude towards vaccination was described in terms of person's availability to recommend vaccination to third. The relationships were analyzed by multivariate mixed logistic regression.

**Results:** Among the 2763 peoples, 2039 (73.8%) were vaccinated against yellow fever. People who left high school with or without the French baccalaureate were more likely to be vaccinated against YF than people without any diploma (OR = 1.4;  $p < 0.05$ ). The probability of being vaccinated among people with negative attitudes was reduced by 40% (OR = 0.6;  $p < 0.05$ ).

**Conclusion:** Low level of education, negative beliefs and negative attitudes have significant impacts on YFVC. Negative beliefs and attitudes result often from a major lack of information about the benefits of vaccination. This deficit is exacerbated in persons with low educational level.

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## 1. Introduction

Yellow fever is an acute viral hemorrhagic disease transmitted by infected mosquitoes. It's re-emerging because vector control and routine immunization decreased in most endemic areas over the recent decades. This recent resurgence was associated with increased risks of infection among non-immune travelers. The disease occurs at various ages according to the country, the sex, and the occupation of the exposed person [1–6]. A recent outbreak affected several countries in Central Africa [6].

The disease has no specific cure yet. Immunization is the only efficient preventive measure against the disease [5,7]. This vaccination may be administered as early as 9 months of age and is

highly recommended in children under 5 living in or traveling to highly endemic areas [4,7]. Until 2014 in Guyana before the adoption of the amendment in Annex 7 of the International Health Regulations, a person should have his last yellow fever vaccine within the last ten years to be protected [8]. To prevent outbreaks in the affected regions, the yellow fever vaccination coverage (YFVC) must be 60%–80% of the at-risk population [5].

To estimate this YFVC, the Expanded Programme on Immunization (EPI) of the WHO conducts series of surveys in samples from the target population in both developing and developed countries [9,10]. Whatever the methods and resources used to estimate the YFVC, the determinants of a good YFVC vary according to the context. In endemic tropical countries, regular vaccination campaigns seem necessary to keep the YFVC in the 60%–80% range as recommended by the WHO [11,12].

To explain the low vaccination rates in some areas, some authors referred to the lack of time in unvaccinated persons and the lack of vaccinators during vaccination campaigns [12–15]. However, opposition to vaccination already known in Western countries is

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increasingly seen in tropical regions now exposed to Western culture [16–27].

In French Guiana, yellow fever reappeared in 1998 [28]. Vaccination against yellow fever is mandatory since 1967 and the French High Council for Public Health (“Haut Conseil de la Santé Publique”, HCSP) recommends that vaccination be given as soon as the age of nine months [29,30]. Systematic controls of immunization of travelers at the frontiers are made to ensure compliance with this regulation. Despite this regulation, the issue of immunization coverage remains a concern [31]. In 2000, the French Institute for Public Health Surveillance (“Institut de Veille Sanitaire”, InVS) reported an insufficiency in the immunization coverage, especially regarding yellow fever [32].

The health authorities expressed thus the need to plan and implement immunization activities. In 2007, a regional initiative involving the French Guiana Health Agency (“Agence Régionale de Santé”, ARS), the social security institution (“Caisse Générale de Sécurité Sociale”, CGSS), and the French Red Cross (FRC) resulted in the implementation of a vaccination program that enables General Practitioners (GPs) to administer vaccine against yellow fever. The present study is a secondary data exploitation of the first evaluation of this vaccination program. It aims to analyze the relationship between educational status, negative beliefs, negative attitudes and YFVC in French Guiana.

## 2. Methodology

### 2.1. Study design

This analytical study involved a sample of 2763 people from 866 households of French Guiana. The data were collected for a cross-sectional survey conducted between 17 February and 18 March 2014 to evaluate an experimental vaccination program against yellow fever, implemented in 2007 and conducted by GPs in French Guiana [33]. The sample consisted of representative households from all origins and people aged at least 9 months living temporarily or permanently in French Guiana during the investigation period.

### 2.2. Survey data collection

A two-stage cluster sampling was used for the selection of the households. The sampling was carried out on the population of 2010 as described by the “Institut National de la Statistique et des Etudes Economiques” (INSEE). According to the INSEE data, the population of the region consisted of 64,675 households (average of 3.5 persons per household) that lives in 69 French census geographic entities (named “IRIS”). The populations on 1st January 2010 was 229,040 inhabitants of whom nearly 97% were aged 9 months and over [34]. On average, an IRIS consisted of 3320 people or 948 households. To have a representative sample, the 69 IRIS were sampled. According to estimates, a sample of 2600 individuals or 743 households was needed.

According to the current French legislation, a study that does not change routine management of patients does not require the opinion of the Clinical Research Centers Ethics Committee. However, the structures involved in the cross-sectional survey had validated the investigative process by their commission correspondents, that overseeing ethical data collection in France (“Correspondant Informatique et Liberté”). Each person had signed an informed consent.

### 2.3. Operational definition of the variables

The main outcome criterion was “vaccinated against yellow

fever”. At the time of the questionnaire administration, a person was declared “vaccinated against yellow fever” when the time elapsed since vaccination did not exceed ten years. At the time of the survey in 2014, information on vaccination was only one recorded in the vaccination card.

The main factors studied were the educational status, the beliefs and attitudes towards vaccination.

The educational status was considered as ordinal variable: *No level* (When the respondent had never attended school), *Level-1* (respondent left before intermediate school), *Level-2* (Respondent attended intermediate school), *Level-3* (respondent attended high school), *Level-4* (Respondent attended university), *Other level* (When the level could not be determined). The highest educational level among those of the parents (or the reference person of the household) was that of respondents aged less than 16 years.

Inspired by Begué [16] The respondent's beliefs were collected on six statements about immunization: A-(*Diseases, mainly yellow fever, have already begun to decline before vaccination due to advances in hygiene. Vaccines are for nothing*), B-(*Yellow fever is gone, there is no need to continue vaccination*), C-(*Giving several vaccines simultaneously to children overloads their immune system and increases the risk of negative response to vaccines*), D-(*Many vaccinated people are however sick; vaccines are ineffective*), E-(*Vaccines are responsible for too many harmful adverse effects, even lethal, their long-term effects are still unclear*), F-(*the media, the internet, and the social networks help disseminating false information on vaccination*). About this statement (F), the negative belief was deducted from the respondent's answer approving any media information to discredit vaccination. Recent examples were offered. Thus; the beliefs of the household head or reference person were those of respondents aged less than 16 years.

The belief was coded: *No Negative Belief* (when the respondent accepted none of the six statements), *No Opinion* (Respondent confirmed none of the six statements), *Negative Belief level-1* (Respondent accepted three statements), and *Negative Belief level-2* (Respondent accepted at least four statements).

Regarding the attitude towards vaccination, the question was: *Are you willing to recommend vaccination against yellow fever; for example, to your kids or friends*. The answer was coded: *No (Negative Attitude)*, *Yes (No negative attitude)* and *No Opinion*.

The adjustment covariates were: Gender (*Female, Male*); Age (*9 mo-2yr, 3-6yr, 7-15yr, 16-18yr, 19-60yr, and >60 years*); Marital status (*Single, Married/civil partnership, Divorced/widow/widower, Free union, Others status*); Occupation (*employee, independent worker, student, retired, other*). For respondents aged less than 16 years, it was the marital status and profession of the household head that were used.

In French Guiana, at the time of the cross-sectional survey, the authorization to administer vaccination against Yellow Fever was given to 57 GP and 22 vaccination centers: 8 Centers for Prevention and Care (“Centres Délocalisés de Prévention et de Soins”, CDPS), 3 centers owned by the FRC, 9 centers for mother and child health service (“Protection Maternelle et Infantile”, PMI), 1 Pasteur Institute (Institut Pasteur de Guyane”, IPG), and Cayenne Hospital.

Access to vaccination considered four modalities: *Easy access* (when the person had an authorized GP), *Moderate access* (Person had no authorized GP but lived within 5 km from a center or an authorized GP), *Low access* (when the person lived more than 5 km far from a center or an authorized GP but in a municipality having a vaccination center or an authorized GP), *No Access* (in all others cases). Complementary health was treated in binary variable: *No Complementary and Complementary*.

Travel to an endemic area considered three modalities: *No recent trip, Trip before 2005, and Trip after 2005*. The length of stay in French Guiana considered four modalities:  $\leq 1$ yr,  $>1-5$ yr,  $>5-10$ yr

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