Observing and comparing the water points frequented in the village environment: towards a better understanding of the mechanisms of transmission of Buruli ulcer disease in south-eastern Benin

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- 1 Buruli ulcer is one of the 17 neglected tropical infectious diseases in the world. It is caused by the bacteria *Mycobacterium ulcerans* and its symptoms are necrotizing cutaneous lesions that can reach bones. Buruli ulcer affects populations (mainly women and children) living in rural areas of west and central Africa. Nowadays, early diagnosis combined with antibiotic treatment and appropriate wound care can keep the infection under control and prevent permanent lesions such as amputations or disabling retractions of one or several limbs. However, this care strategy is often ineffective in the endemic areas because the formulation of an appropriate and effective preventive strategy also requires the precise identification of what makes an aquatic environment favourable to *M. ulcerans*. To date, only open surface stagnant waters or slow running waters have been identified at risk. Therefore, we propose to observe and characterize water points that are used by villagers for domestic uses. The main goal of this study is to investigate if the variations in the use of unprotected water sources can be related with variations of the incidence of Buruli ulcer in two districts located in the southeast of Benin.
- 2 The south-eastern part of the Benin was selected as the study area for its significant endemicity of Buruli ulcer which has led to the construction of a Buruli ulcer treatment center in 2004 -the “Pobé CDTUB” – covering three districts (Plateau, Northern Ouémé,

Southern Ouémé). In partnership with this facility, we had access to geolocalized epidemiological data over 10 years for all the patients treated in Pobé's CDTUB.

- 3 As the main risk factor of Buruli ulcer is directly linked to proximity of aquatic environment, and activities related to water (Pouillot et al., 2007 ; Nackers et al., 2007), it was essential to firstly identify and name correctly all water sources present in the study area. Therefore, a typology has been designed (Figure 1), based on an environmental study of the hydro geographical characteristics of 198 water sources. From this work, 8 different configurations have been characterized: 6 types of natural and unprotected water sources (water courses and water bodies) and 2 types of artificial and protected water sources (hydrological installations without contact with aquatic environment).
- 4 The localization of the Pobé CDTUB patients (data issued of the research program "GeANT") shows that people working or living close to humid and gentle slope areas (from 0 to 20 meters high) seem to be more exposed to the disease. These areas are commonly referred as « lowland sites » by local population. On the basis of this preliminary observation, we sought to identify whether or not each water source used by the population belonged to these specific environments. Two « lowland sites » have been differentiated in our study area: Ouémé River floodplain (type 1) and rivers or streams in the steep-sides valleys (type 2). A diversity of water uses in these specific aquatic environment has been observed. Exposure risk factors have been estimated on the basis of hydrological dynamics of each lowland sites, its shape and also anthropogenic features achieved in the past (ie. Drains and irrigation channels) which have modified the environment.
- 5 Whether an unprotected water source is located in a « lowland site » or not, there is a need to better describe its attributes. As an example for the category "River", the additional attributes « Grass banks with aquatic plants » and « Sandy banks » are useful to point out natural and anthropogenic features reducing or increasing the potential exposure to the vector (i.e., a water bug). The results reveal the diversity of water sources used by local inhabitants and finally distinguish the potential transmission sites from the low risk sites.
- 6 The potential transmission sites are mainly located inside or close to the « lowland sites » (type 1 and 2). The aquatic environment in these areas is a breeding ground for the contamination vectors. The water sources in uplands (Northern Ouémé and Southern Ouémé) are mainly springs and streams that flows through the flanks of valleys and hillsides. These water sources are characterized by a circulating water, a regular maintenance of the surrounding areas and occasionally protective layouts. In these areas, the disease vector can also be found in some improperly maintained stagnant water sources.
- 7 Activities or behaviors related to water have also been observed, assuming that it could increase or decrease the exposure risk. A total of 37 endemic and non-endemic villages have been included in this global study based on direct observations, and on several detailed tools detailed in Table 1. Activities involving an extended contact with water are suggested to be at higher risk than others with regard to the transmission of the Buruli ulcer. Some of these activities are not necessarily linked to domestic uses ex. (farming or leisure activities like children swimming). Lastly, a seasonality effect had been pointed out.

Typology of water sources in the study area

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