

Malaria-associated morbidity during the rainy season in Saharan and Sahelian zones in Mauritania



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ABSTRACT

Reliable epidemiological data based on laboratory-confirmed cases are scarce in Mauritania. A large majority of reported malaria cases are based on presumptive clinical diagnosis. The present study was conducted to establish a reliable database on malaria morbidity among febrile paediatric and adult patients consulting spontaneously at public health facilities in Nouakchott, situated in the Saharan zone, and in Hodh Elgharbi region in the Sahelian zone in south-east Mauritania during the peak transmission periods. Giemsa-stained thin and thick films were examined under the microscope, and the parasite density was determined according to the procedures recommended by the World Health Organization. Microscopy results were confirmed by rapid diagnostic test for malaria. A total of 1161 febrile patients (498 in Nouakchott and 663 in Hodh Elgharbi region) were enrolled during two successive peak transmission periods in 2009 and 2010. In Nouakchott, 253 (50.8%) febrile patients had positive smears (83% *Plasmodium vivax* mono-infections and 17% *Plasmodium falciparum* mono-infections). In Hodh Elgharbi, 378 of 663 patients (57.0%) were smear-positive, mostly due to *P. falciparum* mono-infections (96.6%). Unlike in Nouakchott, mixed *P. falciparum*–*P. vivax* infections, as well as *P. vivax*, *P. ovale*, and *P. malariae* mono-infections, were also observed at a very low prevalence in southern Mauritania. In Nouakchott, malaria occurred more frequently ($P < 0.05$) with higher slide positivity rates (42–53%) among children aged >5 years old and adults than in young children aged <5 years old in both 2009 and 2010. In Hodh Elgharbi, high slide positivity rates (60.9–86.2%) were observed in all age groups in 2010, and there was no significant trend ($P > 0.05$) in relation with age groups. The present study confirmed the predominance of *P. falciparum* in southern Mauritania reported in previous studies. The presence of *P. vivax* in Nouakchott is a new epidemiological reality that requires an urgent adoption of novel strategies for parasitological and vector control to combat urban malaria. Moreover, the present study provides evidence-based data on malaria burden in two regions in Mauritania that may serve as a springboard to establish and develop a national surveillance system of malaria epidemiology.

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1. Introduction

Malaria is still one of the major causes of morbidity and mortality in many tropical countries. In Mauritania, despite the lack of reliable health data, malaria is often considered as the third cause of medical consultation and hospitalization, after infectious diar-

rhoea and acute respiratory diseases, in 8 of 13 regions (Programme National de Lutte contre le Paludisme, 2006). Although it has been hypothesized that in southwestern Mauritania, malaria epidemiology along the belts flanking the banks of the Senegal River extending from east to west is similar in Senegalese and Mauritanian sides of the border, where *Anopheles gambiae* s.l. is the main vector during the short transmission period (Dia et al., 2009; Ndiath et al., 2012), epidemiological features of malaria transmission, including the main mosquito vectors, are poorly characterized in other parts of the country. The limited numbers of public and

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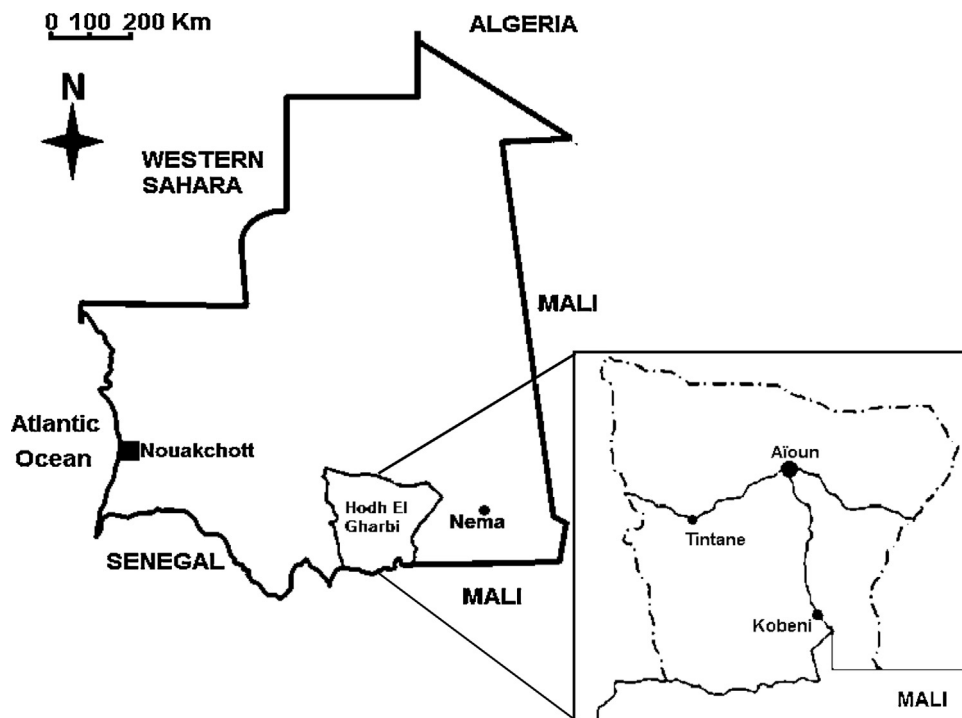


Fig. 1. Map of Mauritania showing the study sites in Saharan (Nouakchott) and Sahelian (Hodh Elgharbi) zones.

private health care centres, as well as the lack of well-trained laboratory technicians and limited health resources in general, have been obstacles to improve patient management and develop reliable health statistics over the past decades (Cortes et al., 2003).

According to the Mauritanian Ministry of Health (Programme National de Lutte contre le Paludisme, 2011a), malaria prevalence in Mauritania had increased from 26,903 cases in 1990 to 188,025 cases in 2006, 210,970 cases in 2007, and 201,044 cases in 2008. Although there is no concrete evidence based on laboratory-confirmed diagnosis, agrarian projects in southern Mauritania, economic development of northern oases, and spread of drug-resistant malaria have been implicated as possible explanations of increasing malaria prevalence (Cortes et al., 2003). Other natural climatic changes, including increased rainfall in Saharan regions and annual flood in Hodh Elgharbi region in southern Mauritania, in particular a major flood in the city of Tintane in 2007, may also have contributed to develop an ecosystem that favors mosquito breeding.

The present study was undertaken to collect and compare parasitological data among febrile patients spontaneously consulting at health facilities in Nouakchott and Hodh Elgharbi region during the rainy season in 2009 and 2010 and to estimate malaria burden in these human populations residing in these regions.

2. Patients, materials, and methods

2.1. Study areas

The study was simultaneously conducted at three health facilities (Aïoun Hospital and Kobeni and Tintane Health Centres) in three cities (Aïoun, 16°39'N, 9°37'W; Kobeni, 15°49'N, 9°24'W; and Tintane, 16°21'N, 10°13'W) in Hodh Elgharbi region, southeastern Mauritania during the rainy season in September–October 2009 and September–October 2010 (Fig. 1). Aïoun and Kobeni cities have been known to be urban sites of malaria transmission (Jordan et al., 2001). Tintane is situated in an arid zone that had been classified as a malaria-free zone. This city lies along the main road that links

the capital city to Nema in eastern Mauritania. In 2007, malaria epidemics occurred after heavy rainfall and flood. The amount of rainfall in June, July, August, September, October, and November 2009 was 8 mm, 46 mm, 78 mm, 85 mm, 0 mm and 0 mm in Aïoun (total of 217 mm during the entire rainy season), 3 mm, 98 mm, 122 mm, 75 mm, 0 mm and 0 mm in Kobeni (total, 298 mm during the entire rainy season), and 11 mm, 98 mm, 108 mm, 144 mm, 1 mm and 0 mm in Tintane (total, 362 mm), respectively. In 2010, the amount of rainfall in June, July, August, September, October, and November was 52 mm, 31 mm, 222 mm, 14 mm, 0 mm and 0 mm in Aïoun (total, 319 mm), 62 mm, 109 mm, 226 mm, 176 mm, 0 mm and 0 mm in Kobeni (573 mm), and 22 mm, 39 mm, 159 mm, 127 mm, 0 mm and 0 mm in Tintane (total, 347 mm), respectively.

Further studies were conducted at three health facilities (National hospital centre, Cheikh Zaid hospital, and Teyarett health centre) in Nouakchott (18°11'N; 16°16'W), the capital city of Mauritania, immediately after the rainy season in October–November 2009 (rainfall in June, July, August, September, October, and November 2009: 11 mm, 8 mm, 58 mm, 76 mm, 0 mm, and 0 mm, respectively) and October–November 2010 (rainfall in June, July, August, September, October, and November 2010: 2 mm, 0 mm, 71.6 mm, 72.4 mm, 0 mm, and 0 mm, respectively; official monthly data recorded by the Office National de la Météorologie in Nouakchott). Nouakchott is situated in the Saharan zone along the Atlantic coast. Until recent years, it has been believed that Nouakchott lies in a malaria-free zone. However, the presence of numerous *Plasmodium vivax*-infected symptomatic patients without any recent or past travel history to malaria endemic zones, together with the identification of *P. vivax*-infected *Anopheles* spp. captured within the capital city, has demonstrated that *P. vivax* malaria in Nouakchott is a consequence of autochthonous transmission, rather than imported cases (Cortes et al., 2003; Mint Lekweiry et al., 2009; Mint Lekweiry et al., 2011; Ould Ahmedou Salem et al., 2013).

2.2. Patients

All patients who were febrile at the time of consultation or patients with a history of fever within the past 48 h, regardless of

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