



Plasmodium falciparum malaria cases detected for prompt treatment by rapid diagnostic tests in the Ho Teaching Hospital of the Volta Region of Ghana

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ABSTRACT

Background: Prompt diagnosis and effective treatment of malaria cases with efficacious drugs is an important strategy in the management and control of malaria in endemic populations. As part of a study investigating the factors modulating the development of *Plasmodium falciparum* gametocytes in the human host, we assessed the rate of RDT positivity of patients in different departments of the Ho Teaching Hospital and the relation with age and anaemia.

Materials and methods: Eight-hundred and ten individuals attending clinic at various departments within the Ho Teaching Hospital were screened for malaria antigenaemia using RDT as a point-of-entry investigation. RDT positive individuals were immediately treated for malaria whereas RDT negative individuals were treated for other ailments. Haematological analyses were performed for 69 of these patients and the relationship between RDT results and haemoglobin levels were investigated.

Results: The overall RDT positivity rate was 19.8% (160/810) of all individuals screened. There was no significant difference in the haemoglobin levels of RDT-positive and RDT-negative individuals (p value = 0.272). The highest number of attendees screened was children in the paediatric outpatient department and paediatric ward, 62% (507/810), with RDT positivity rate of 17% (91/507). We found the highest RDT positivity rate of 51% (19/37) in the male medical ward.

Conclusions: This study shows that RDT is a useful tool in promoting prompt diagnosis and management of malaria and though children form a majority of hospital attendees and malaria infections, the frequency of malaria detection may be higher in adults as compared to children.

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1. Introduction

Four hundred and forty-five thousand people were killed by malaria from among 216 million clinical cases in 2016, and most of these were children under 5 years [1]. This burden is borne largely by Africa, where despite some achievements in controlling malaria, a vast majority of the African population still live in areas of moderate to intense malaria transmission [2]. Malaria is caused by *Plasmodium* species and is the most important protozoan parasitic disease of man [3]. Six species of *Plasmodium* infect and cause malaria in human beings, namely, *P. ovale curtisi*, *P. ovale walikeri*, *P. malariae*, *P. vivax*, *P. knowlesi* and *P. falciparum* [1, 4, 5]. The latter, *P. falciparum*, causes the most malaria burden and is responsible for a majority of malaria deaths in sub-Saharan Africa due to its virulence [6, 7]. The Ho Teaching Hospital records for the past 3 years (2014–2017) show that malaria is associated with 2–3% of deaths among children <5 and 1–4% among persons older than 5 years (Supplemental Table 1) [8].

Prompt diagnosis and effective treatment and management of malaria remain key component in the malaria control and elimination agenda [8]. Rapid treatment of malaria cases, vector control through the use of long lasting insecticide treated nets, and indoor residual spraying have contributed to the substantial reduction in the global morbidity and mortality associated with malaria [2]. In addition, the number of individuals who develop severe anaemia due to malaria infections has also been on the decline.¹ In compliance with this essential guideline, the Ho Teaching Hospital in the Volta Region of Ghana subjects all suspected malaria cases to rapid diagnostic testing (RDT) regardless of the patient point of entry into the hospital. The RDT is performed by trained health persons at the various departments of the hospital. RDT, compared to microscopy, is less time consuming and does not require any specialized training in order to perform and thus contributes to efficient management of malaria cases in clinics and hospitals. Since 2014, there has been a tremendous increase in the use of RDTs as first line malaria diagnosis with a positivity rate of 20–35% among suspected malaria cases in the Ho Teaching Hospital (Supplemental Table 2) [8].

When suspected malaria patients are promptly diagnosed and treated, not only is their suffering alleviated but the intervention reduces the chances of continuous transmission in the population [9]. In addition, the development of severe malaria or even death is also reduced when prompt treatment with efficacious drugs is available [10]. The likelihood of anaemia, which is often associated with delayed treatment of malaria, is also limited [10].

As an ancillary analyses of a study investigating the development of the transmission stages of malaria parasites in the human host (Dinko et al., 2018, AJTMH, Accepted), we sought to determine the rate of RDT positivity among patients in different departments of the Ho Teaching Hospital and whether RDT positivity related to the level of patient haemoglobin and age. In this study we analysed RDT positivity rates among patients diagnosed at the various departments where RDT testing was available.

2. Materials and methods

2.1. Study area and site

The study was conducted at the Ho Teaching Hospital, Ho, in the Volta Region of Ghana. This study site and region has been described previously [11]. The Ho Teaching Hospital serves as the main referral point for tertiary healthcare in the Volta Region but provides both primary and secondary healthcare to all kinds of patients. It is located in Ho, which is the regional capital of the Volta Region. Ho is one of the towns located in the central part of the Volta region and the population of the municipality was estimated at around 70,000 inhabitants [8]. Malaria transmission in the municipality is continuous with some seasonal peaks coinciding with the rainy seasons. The major rainy season lasts for 4 months, from April to July, and the minor rainy season is usually from September to November [12]. Minimal cases of malaria are recorded during the dry periods intervening the wet seasons, but the highest malaria cases are seen 1 month after the beginning of the rainy season.

2.2. Sampling and rapid diagnostic testing

During the period of March 2015 to May 2016 patients attending hospital at the Ho Teaching Hospital (formerly Volta Regional Hospital) were tested for malaria by rapid diagnostic tests (RDTs) (Standard Diagnostics Inc., Korea) at the various departments within the hospital. The departments included: 1) casualty ward 2) diabetic and surgical outpatient department 3) female medical ward 4) gynaecology ward 5) male medical ward 6) medical outpatient department 7) general outpatient department 8) paediatric ward 9) paediatric outpatient department and 10) psychiatric ward. It is the arrangement within the Ho Teaching Hospital to test all individuals suspected of malaria with fever, temperature > 37.5 °C and convulsions via RDT in order that prompt antimalarial treatment can be administered. To achieve this, the diagnostic laboratory within the hospital supplies these wards and outpatients' departments with RDTs for prompt screening of patients by well-trained medical staff stationed in the respective departments. In some departments, the tests were performed by the attending physician while trained nurses carried out the tests in other departments. The results obtained were entered into a form which were later entered into the hospital database. Once test results were obtained RDT positive individuals were given prompt treatment and later referred to the laboratory for further tests. All RDT-positive individuals were provided with 3 daily dose of artemether-lumefantrine while RDT negative individuals were treated for other ailments. We collected and analysed the data presented here as part of our studies of *P. falciparum* gametocytes.

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