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Involvement of Private Pharmacies in the Biological Diagnosis of Malaria Cases: The Case of Côte d'Ivoire

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Abstract: Introduction. In Côte d'Ivoire, current policy recommends the introduction of rapid diagnostic tests (RDTs) for malaria, including in the private sector, to facilitate effective case management. The main objective of the study was to examine the impact of introducing RDTs in private pharmacies with regard to national recommendations. **Patients and methods.** In order to assess knowledge, attitudes and practices after a few years of practice, a cross-sectional study was carried out from August to December 2015 among 300 professionals from private pharmacies (PPs) in the northern zone of the city of Abidjan. **Results.** Overall, PPs performing RDTs accounted for 25.1%. Fever (63.3%), headache (17.7%) and body aches (16.1%) were the main signs that led pharmacists to perform the test. The main criteria determining the choice of RDT are good sensitivity and specificity (45.6%), easy handling (42.6%) and lowest cost (11.8%). In 57.4% of cases, pharmacists performing RDTs said that the cost of the test (CFA 2000 or EUR 3 on average) is the main reason for non-acceptance by customers. In 97.1% of cases, the measures taken in the event of negative results were symptomatic treatment counselling followed by a medical consultation. In 2.9% of cases, some pharmacists recommended an antimalarial. On the other hand, in 92.6% of cases, the measures taken in the event of a positive result were antimalarial treatment with artemisinin-based combination therapies (ACTs). For pharmacies that did not carry out RDTs (74.9%), low customer demand was cited in 56.1% of cases. **Conclusion.** It would be appropriate for private pharmacy outlets to comply with the legislation by not carrying out RDTs within their pharmacies. Pending the implementation of these texts, it is imperative to improve on the shortcomings revealed.

Keywords: malaria; rapid diagnostic tests; private pharmacies; Côte d'Ivoire

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1. Introduction

In 2015, malaria was still endemic in 94 countries, with 429,000 deaths recorded [1]. Africa accounted for nearly 92% of malaria-related deaths, far ahead of the Southeast Asian region (6%) and the Eastern Mediterranean region (2%) [1]. Globally, according to the World Health Organization (WHO), 84 countries are still endemic, and the number of malaria deaths decreased from 625,000 to 619,000 from 2020 to 2021, but remained higher than the estimated 568,000 deaths in 2019, before the COVID-19 pandemic began [2]. Faced with this situation, the WHO recommends several control strategies, including the early diagnosis and rapid treatment of malaria cases [3]. Microscopy, despite being the gold standard, requires a source of electricity, equipment, reagents and qualified microscopists for its implementation [4]. Thus, in some areas of sub-Saharan Africa where this examination is inaccessible, rapid diagnostic tests (RDTs) have become the main diagnostic or confirmation tool for malaria since 2012 [5,6]. The proportion of suspected malaria cases tested with a diagnostic test (microscopy or RDT) in sub-Saharan Africa increased from 36% in 2005 to 41% in 2010 and 65% in 2014. In 2022, RDTs accounted for 84% of screening means among suspected malaria cases [2,5]. Since the advent of artemisinin-based combination therapies (ACTs), the WHO, in order to reduce the risk of resistance due to drug pressure, recommends that the treatment of malaria be preceded by biological confirmation (thick drop or RDT) [4]. RDTs are immunochromatographic tests that detect specific antigens (proteins) produced by plasmodia in the blood of infected people [7]. Most RDTs currently used to diagnose *Plasmodium falciparum* infections detect *histidine-rich protein* II or HRP II [7]. HRPII-based RDTs are specific to P. falciparum [7]. In contrast, RDTs targeting pan-lactate dehydrogenase (pLDH) or aldolase can detect all *Plasmodium* species that infect humans, although they are less sensitive than HRP2-based tests, especially with low parasite densities [8].

In Côte d'Ivoire, progress has been made in recent years in the fight against malaria. Indeed, a significant reduction in malaria-related mortality in 3 years with a number of deaths ranging from 3931 in 2017 to 1641 in 2019 has been observed [9]. Thus, Côte d'Ivoire, ranked 9th in 2015 on the list of the 15 countries with a high malaria-related mortality rate in the world, is no longer on this list according to the WHO 2022 report [9,10]. Like many countries, Côte d'Ivoire, since 2011, has recommended prescribing antimalarials on the basis of a confirmed, not presumptive, diagnosis. To facilitate its application, malaria RDTs have been made available free of charge to health centers [11]. PPs are an essential part of the country's health system as they play an important role in outpatient case management. As in many countries in sub-Saharan Africa where malaria is endemic, self-medication by purchasing antimalarials in private pharmacies is common [7,12]. Thus, many PPs perform these malaria RDTs to distinguish between fevers of malarial origin and those caused by other diseases. However, according to pharmaceutical ethics in Côte d'Ivoire, private pharmacies should not carry out biological examinations at homes. Under these conditions, it seems appropriate

to evaluate the conditions for implementing these RDTs within these pharmacies. The aim of this study was to assess the knowledge, attitudes and practices regarding the use of malaria RDTs by PPs staff in the northern zone of Abidjan in Côte d'Ivoire.

2. Materials and Methods

2.1. Study Site

This study took place in the city of Abidjan, the economic capital of Côte d'Ivoire. This city has 10 municipalities and is part of the administrative region of the lagoons. The study took place in PPs spread over six municipalities of the northern zone of the city of Abidjan, Côte d'Ivoire. These 6 communes (Abobo, Adjamé, Attécoubé, Cocody, Plateau and Yopougon) had 300 PPOs at the time of the study. The city has a population of 5,616,633 (51.6% males and 48.4% females) [13].

2.2. Type and Period of Study

This was a cross-sectional study that took place from August to December 2015.

2.3. Study Procedures

Prior authorization was obtained from the National Union of Private Pharmacists of Côte d'Ivoire. The list of pharmacies in the study area was provided by the syndicate of these pharmacies. In addition, the pharmacists' oral consent was obtained prior to the start of the investigation. Each dispensing pharmacist was questioned with a very specific questionnaire depending on whether the pharmacy performed RDTs for malaria or not. This interview enabled us to gather information from the pharmacists on the use of RDTs and the reasons why malaria RDTs are not used in PPs that do not use them.

2.4. Statistical Analysis

These data collected were entered and analyzed using Statistical Package for Social Science (SPSS) version 16 software. The relationship between two variables was tested using Fisher's exact test with a 5% risk of error.

3. Results

3.1. Results of Private Pharmacies Performing RDTs

Out of a total of 300 pharmacies located in the northern zone of Abidjan, 271 (90.3%) had agreed to participate in the survey. Of these, only 68 (25.1%) performed RDTs. Almost half of the private pharmacies that refused to take part in the study (48.3%; 14/29) were from the municipality of Yopougon (Table 1).

Table 1: Distribution of pharmacies in the study with or without RDTs according to the municipalities surveyed.

	Pharmacies Performing Malaria RDTs		Pharmacies Not Performing Malaria RDTs	
Municipalities	**Number of Employees (n)**	**%**	**Number of Employees (n)**	**%**
Plateau	3	4.4	18	8.9
Cocody	31	45.6	48	23.6
Abobo	10	14.7	34	16.7
Attécoubé	1	1.5	6	3.0
Adjamé	5	7.4	27	13.3
Yopougon	18	26.5	70	34.5
Total	68	100	203	100.0

3.2. Results of the KAP Study of Professionals in Private Pharmacies Performing RDTs

Table 2 summarizes the knowledge, attitudes and practices of PPs performing malaria RDTs. RDTs were performed by the licensed pharmacist, assistant pharmacist or pharmacy auxiliaries. They all claimed to have received hands-on training in the use and interpretation of the RDTs. They claimed to be using single-use material supplies provided by the manufacturer, checking the expiry date and carefully following the manufacturer's instructions when carrying out the test. The conditions for performing the test are summarized in Table 2.

Table 2: Knowledge, attitudes and practices of PPOs performing malaria RDTs.

	Number (n = 68)	**Percentage (%)**
Reasons for the presence of RDTs in pharmacies		
High frequency of clinical signs of malaria in patients	39	57.4
To deliver antimalarial drugs only to malaria patients	28	41.2
Strong customer demand	1	1.4
Criteria for choosing RDTs		
Good sensitivity and specificity	31	45.6
Easy handling	29	42.6
Lower cost	8	11.8
Test proposal moments		
At a council meeting	34	50.0
At the patient's request	32	47.1
Based on clinical signs of malaria	2	2.9
Clinical signs motivating the test		
Fever	43	63.3
Headache	12	17.7
Aches	11	16.1
Shiver	2	2.9

Main manipulators of the test		
Pharmacist	36	53.0
Assistant Pharmacist	25	36.7
Pharmacy Assistants	7	10.3
Years of RDT practice		
<1 year	26	38.3
1 to 3 years	33	48.5
>3 years	9	13.2
Retention of RDTs		
Room temperature	61	89.7
In a refrigerator	7	10.3
Performed test place		
In the customer's seat	25	36.8
In the galenic preparation room	18	26.5
Reserved room	15	22.0
At the back of the counter	10	14.7
Equipment used to carry out the test management method		
Gloves, alcohol swabs and packaging discarded in the trash Intended for biological waste + lancet in needle box	37	54.4
Glove, alcohol swab, wrapper and lancet discarded in the main waste bin of the pharmacy	31	45.6
Use of expired RDTs in the pharmacy		
Valid RDT	64	94.1
Expired RDTs	4	5.9

3.3. Acceptability of RDTs by Patients

Patients did not immediately agree to the test in 69.1% of cases. The high cost (CFA 2000 or EUR 3 on average) of the test was the main reason for refusal (57.4%).

The majority of pharmacists (97.1%) offered symptomatic treatment (antipyretics, antiemetics, etc.) followed by referral to a medical consultation in the event of a negative RDT result, while some (2.9%) still advised CTAs. In case of a positive RDT result, antimalarial treatment using ACTs was offered to the patient in 92.6% of cases.

Finally, 73.5% of pharmacists said they would be willing to perform RDTs free of charge, if they were supplied with all the necessary inputs.

3.4. Type of RDTs Performed in Private Pharmacies

The utilization rates of the 12 tests listed in the PPOs are detailed in Table 3. This table shows which of the tests evaluated in Côte d'Ivoire have obtained marketing authorization.

Table 3: List of RDTs used by private pharmacies.

	Utilization Rate (%)	Marketing Authorization	Tests Evaluated in Côte d'Ivoire
SD Malaria antigen *P. f*/pan	18.7	Yes	Yes
Plasmotest	18.7	No	No
Clearview malaria *P. f*	16.0	Yes	Yes
SD malaria antigen *P. f*	13.3	Yes	Yes
Accurate	10.7	No	Yes
Excel quick test device	6.7	No	No
Immunoquick Malaria +4	4.0	Yes	Yes
Optimal-it	4.0	Yes	Yes
Malaria pf test device	2.7	No	No
Onsite malaria pf/pan antigen	2.7	No	Yes
One step malaria *P. f*	1.3	No	Yes
Pan malaria antigen rapid test	1.3	No	No

P. f: Plasmodium falciparum.

3.5. Private pharmacies that do not perform malaria RDTs

Low customer demand (n = 38; 55.8%) was the most cited reason for the 203 pharmacists who did not perform RDTs in their pharmacies. Of them, 4/38 or 10.5% said they had previously performed the RDTs. However, they stated that they would be willing to carry out the RDTs if all inputs were provided to them free of charge.

3.6. Marketing Authorization and RDTs in Private Pharmacies

In total, twelve different tests were identified in the field during the study. Of these twelve tests, only eight have been evaluated in Côte d'Ivoire and marketing authorization has been issued to five suppliers by the Directorate of Pharmacy, Medicines and Laboratories (DPML). The utilization rate of non-regulatory tests is 44.1%. The characteristics of these RDTs are presented in Table 3.

4. Discussion

The fight against malaria requires the involvement of all health professionals in both the public and private sectors, including private pharmacies. In 2023, Côte d'Ivoire had more than 1000 pharmacies open for 12 hours a day with at least one pharmacist per pharmacy according to the Ivorian Pharmaceutical Regulatory Authority. Faced with the evolution of their pharmacy missions, the dispensing pharmacist must have a good command of new therapeutic strategies and finally better meet the needs of his clientele. As malaria is the number one fatal disease in vulnerable groups [10], and as the pharmacy is often the first resort of the Ivorian population before consulting a doctor, pharmacists must comply with the National Malaria Control Program NMCP (PNLP in French) guidelines in Côte d'Ivoire in their daily practices.

The WHO and NMCP recommend the management of malaria cases after confirmation via a parasitological diagnosis [4,8]. The use of antigen-testing RDTs is a key component of this strategy and the mainstay of expanding access to malaria diagnostics in areas where good microscopy services cannot be maintained. In Côte d'Ivoire, since 2007, the NMCP has promoted the use of malaria RDTs in its revised national intake policy on febrile illnesses [11]. However, our study reported a low diffusion of RDTs at the PP level (25.1%). On the one hand, the code of ethics does not allow RDTs to be carried out in PPs in Côte d'Ivoire; on the other hand, affordability could be a limiting factor in their extension to PPs. This is consistent with a study conducted in Mali in 2017 where

only 29% of patients had a confirmatory biological diagnosis of malaria before starting treatment [12]. Indeed, the lack of free delivery of RDTs in pharmacies is an obstacle to its expansion, as is the case in public primary contact health facilities. This trend could be reversed, as the majority of pharmacists would like to perform RDTs free of charge if all inputs were provided to them, as is the case in public health structures.

The use of RDTs in PPs to distinguish fevers caused by malaria from those caused by other diseases is important for at least three reasons. First, RDTs allow for an improvement in the quality of care through the rapid management of malaria cases, thus preventing many deaths (100,000 deaths/year) [14], but also the appropriate management of non-malarial febrile diseases in endemic areas [15]. Secondly, it will be cost-effective in economic terms compared with presumptive treatment with a significant individual and national economic impact [16]. This economic impact has been estimated at more than USD 68 million for the entire public sector in countries in the WHO African Region [8]. Finally, it will allow for the rational and efficient management of antimalarials with 400 million unnecessary treatments avoided/year [14] and a 75% reduction in antimalarial consumption [17,18].

The main criteria that guided the choice of RDTs by pharmacists are in line with the WHO recommendations as defined in the guide for NMCP [19]. The choice of a test with good diagnostic performance (sensitivity $\geqslant$ 95% and specificity $\geqslant$ 90%) was mentioned by the professionals of our study. Indeed, for purchase, the WHO recommends that all RDTs be prequalified by the WHO [19]. As a result of periodic evaluations of the performance of the RDTs carried out under the framework, their quality has increased significantly in recent years [4]. In addition, the lack of regulation on the use of these tests in PPs has led to irregularities in their supply. Thus, more than half of the RDTs marketed in PPs are sold illegally. The WHO in its recommendations states that all RDTs must be pre-evaluated in countries that wish to use them as a diagnostic tool [3,8]. It is therefore urgent to make the results of previous RDTs assessments available to PPs to guide their choice.

In addition, there are no regulations for the pricing of RDTs in PPs, as is the case for drugs, hence the refusal of some patients to adhere to the practice of RDTs due to the high cost of the test. As a result, they did not expect to pay additional fees before they had access to the antimalarials they were willing to pay for. As for the presence of RDTs in the pharmacy, the main reason reported by the respondents was the high frequency of clinical signs suggestive of malaria in patients. This result is in line with the result of the NMCP of Côte d'Ivoire (NMCP-CI), which states that in Côte d'Ivoire, malaria is the leading cause of consultation in public health facilities [11].

The way RDTs are stored in the majority of pharmacies is in line with the recommendations of the WHO, which stipulates that tests must be stored between 2 °C and 30 °C [3]. All pharmacists performing malaria RDTs claimed to follow the manufacturer's procedure scrupulously when performing the test. Our results are in line with the recommendations of the NMCP in Côte d'Ivoire on the different steps to follow when performing malaria RDTs [20]. However, we did notice some negligence when it came to managing the materials used to carry out the test. In fact, almost half of the respondents said they had disposed of the gloves, alcohol swab and lancet in the pharmacy's main waste garbage. This practice is contrary to Article 16 of Order No. 131 MSHP/CAB/DGHP/DRHP/ of 3rd June 2009 regulating the management of sanitary waste in Côte d'Ivoire, which states that this medical waste must be deposited in rigid, sealed and leak-proof containers [21]. On the whole, the implementation of the RDTs is correct, but the management of sanitary waste, particularly lancets, is not satisfactory.

Arrangements for a negative test result in this study are consistent with NMCP recommendations that refer the patient to a medical consultation for further testing [11,22]. However, the attitude of treating malaria despite a negative RDT result is observed in some PPs. These data reflect the reluctance of these pharmacists to drop presumptive therapy, even when RDTs results are available. This attitude raises concerns about the risk of wasting antimalarials, exposes patients to the dangers of inappropriate treatment and leads to the emergence of drug-pressure chemoresistance with ACTs. In Côte d'Ivoire, one study found that only 29% of patients who went to a health center because of

fever actually had malaria. In addition, 70% of patients with fever of non-malarial origin still received antimalarial treatment [23].

In the presence of a positive RDT result, the attitude of the majority (92.6%) of pharmacists is consistent with that advocated by the WHO, which recommends the use of ACTs for the treatment of simple malaria [11].

For private pharmacies that do not perform RDTs, the main reason given was low customer demand. As reported in many countries, it is more difficult to integrate the use of RDTs in the private sector compared with the public sector [23–25]. Some pharmacists (18.2%) who no longer perform RDTs claimed to take into account only presumptive treatment, which is contrary to WHO recommendations that require that the management of malaria cases be based on the detection of plasmodia in the blood, with the exception of young children, in areas of high transmission and places where microscopy is non-existent [1]. This attitude of medical personnel has also been reported in other African countries [12,25–27]. Finally, in a similar study carried out in Abidjan, it was reported that the epidemiology and recommendations of the NMCP for the diagnostic and therapeutic management of malaria were poorly known by auxiliaries, which could have implications for their practices. These results also showed the need to raise awareness and train private pharmacy auxiliaries, but also to involve them in NMCP activities [28]. In summary, our results and those of similar studies carried out in Côte d'Ivoire have shown that few activities have been carried out under the NMCP for private pharmacy professionals in recent years. The NMCP should involve private pharmacies more as they are an important link in promoting access to health services.

5. Conclusions

The results of this work revealed that the professionals interviewed have practices that are favorable to the regression of malaria. It would therefore be worthwhile legalizing, encouraging and supervising the performance of malaria RDTs in PPs throughout the Ivorian territory.

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