Title: Decline of ITN use among children living in the capital of city in Gabon from 2010 to 2020

Abstract

Aim: The aim of this study was to assess the trends of ITN use among children attending for malaria diagnosis in the main sentinel site for malaria surveillance of Gabon

Methodology: Data were collected from October 2023 to November 2023 at the malaria sentinel site for malaria surveillance of the Regional Hospital of Melen in Gabon. Data from 2010 to 2020, including age, gender, years of screening and ITN use the night before the consultation were reported on a dedicated form.

Results: Data from 13687 children were analyzed, the rate of ITN use was 57.7% (n=7902). The trend of ITN use decreased significantly from 76.2% in 2011 to 41.9% in 2017, with a slight increase until 2019 (54.9%). According to age, use of ITN was more frequently reported in infants (64.1%) and children aged between 2 to less than 5 years (57.1%) compared to older children (53.1%) and adolescents (51.2%) (*P<0.01*). The rate of mosquito net use significantly decreased in all the age groups (*P<0.01*).

Conclusion: The ITN use is still insufficient in Libreville. Effort should be done to be able to reduce malaria transmission in Gabon.

Keywords: Malaria, ITN use, Gabon

Introduction

Malaria remains a major public health problem in many developing countries. In 2021, an estimated 247 million cases of malaria occurred in worldwide, with 63000 deaths due to malaria: high mortality rates (76%) among children aged under 5 in the WHO African region was reported [1]. Among preventive measures, insecticide-treated nets (ITNs) are one of the proven cost-effective components of malaria prevention through vector control approach [2]. In Western Kenya, ITNs were associated with a reduction in the incidence of malaria parasitemia [3]. ITNs have been shown to reduce the number of infective mosquito bites by 70 to 90% in various geographical settings [4]. Moreover, the percentage of the population sleeping under an ITN increased considerably between 2000 and 2021, for the whole population (from 2% to 47%), for children aged under 5 years and for pregnant women (from 3% to 53%) [1].

In Gabon, changes in malaria morbidity were observed between 2008 and 2020; data from the Malaria National Control Program (MNCP) highlighted prevalence ranging from 13% in 2008 to 40% in children under five years with a mortality rate of 120 per 1,000 inhabitants in 2020 [5]. ITN use is recommended since 2003 in Gabon and distribution campaigns are performed by the MNCP or private donors in the 56 departments of the country. Although, coverage of 48% and 64% to 75% are noticed in urban in rural areas respectively, the prevalence of malaria does not follow the same trends. Indeed, it is significantly lower in urban regions (20-36%) compared to rural settlements where it can reach 75% [6,7]. Moreover, ITN ownership does not often correspond to ITN use [5; 8].

Data on ITN use are scarce in the country. Through sentinelle sites for malaria surveillance, data on bed net ownership and use can be assessed.

The aim of this study was to assess the trends of ITN use among children attending the main sentinel site for malaria surveillance of Gabon.

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Methods

Data were collected from October 2023 to November 2023 at the malaria sentinel site for malaria surveillance of the Regional Hospital of Melen (RHM) in Gabon. The main activity of the sentinel site consists of the screening febrile patients for malaria performed by the team of the Operational and Clinical Research Unit (ORCU). Thus, age, gender, day of screening and ITN use the night before the attendance at the sentinel site are regularly collected using the register of the sentinel site. Data from 2010 to 2020 were reported on a dedicated form.

Statistical analysis: All data were analyzed using Statview 5.0 software. The qualitative ones such as frequency were used and compared with the bivariate Chi-Square or Fisher Exact tests. *P value* below 0.05 was considered statistically significant.

Results

Data from 13687 children were analyzed. Their median age was 36[14-84] months. The sex ratio was: 1.1. The majority (62.4%; n=8536/13678) of the children were aged below 5 years old. More than 40% (n=5505) consulted after 2017 (Table 1).

Table 1: General characteristics of included children

Variables	N	%
Age (N=13678)		
< 2 years	4690	34.3
[2-5[years	3846	28.1
[5-10] years	3447	25.2
[11-18] years	1690	12.4
Gender (N=12438)		
Female	5998	48.2
Male	6440	51.8
Years (N=13687)		
2010	447	3.3
2011	1052	7.7
2012	769	5.5
2013	1076	7.9
2014	1245	9.1
2015	2058	15.0
2016	862	6.3
2017	683	5.0
2018	1841	13.4
2019	1724	12.6
2020	1940	14.2

Globally, the ITN use prevalence was 57.7% (n=7902/13687), it significantly decreased from 2011 (76.2%) to 2017 (41.9%); then it slightly increased until 2020 (51.5%) (Figure 1).

According to age, children who slept under an ITN were significantly younger (36[12-72] months) than those who did not (42[18-96] months (*P<0.01).*

The frequency of ITN use was 64.1% in infants (ranging from 84.7% in 2010 to 61.8% in 2020 (*p<0.01*)), 57.1% in patients aged between 2 and 4 years (from 68.5% in 2010 to 42.5% in 2020 (*P<0,01*)), 53.1% in the 5-10 years old ones (from 71.7% in 2010 to 50.7% in 2020 (*P<0.01*)), and 51.2% among the adolescents (from 65.8% in 2010 to 41.2% to 2020 (*P<0.01*)) (*P<0.01*) (figure 1).

INT use was equally performed for girls (57.2%; n=3431) and boys (57.7%; n=3714) (*P=0.61*)

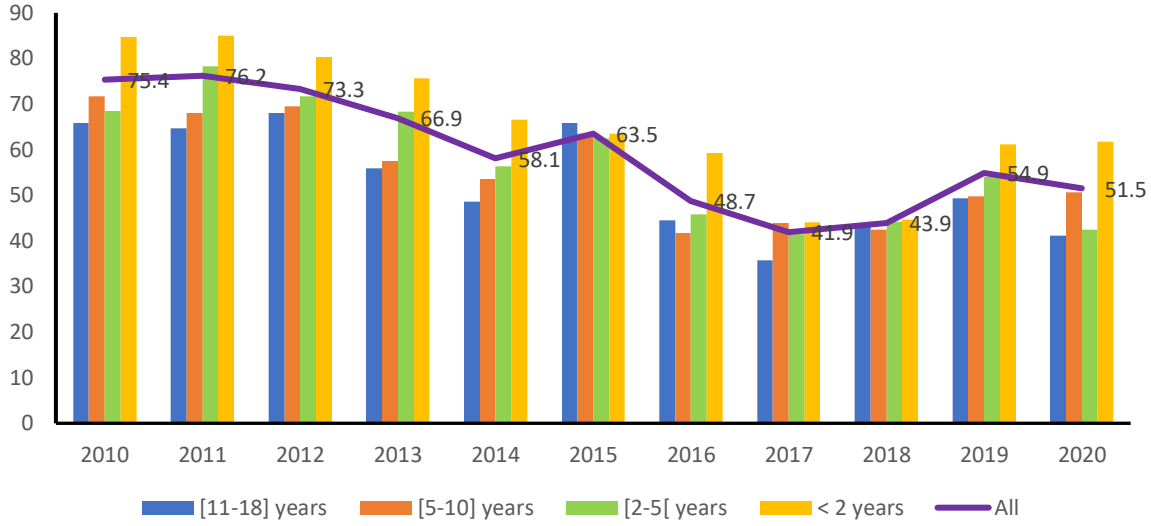

Figure 1: Trend of bed net use among children according to age

Discussion

This study assessed the trends in ITN use over a period of 11 years in patients attending in a sentinel site for a malaria surveillance in Gabon. This is the first largest report of the country which included data from more than 13.000 children, the most vulnerable populations affected by malaria. Our results show that the rate of ITN use was 57.7%, this is far from the MNCP goal which is a coverage of 80% [9]. The rates found are lower than those reported in Democratic Republic of Congo (78,4%), Eastern Ethiopia (62,4%) [10,11]. Data from rural areas highlight a higher utilization of ITN (73.3%) in 2018**,** while it was 43.9% in the main sentinel site of the capital city [6]. The slight decrease observed in 2020 was probably due to the lock down during the acute phase of the COVID-19 pandemic which has strongly reduced ITNs distribution.

There has been a considerable decline in ITN use over the years. Such data are rarely reported in children. In Ethiopia, bed net use significantly decreased among pregnant woman from 2010 (83.6%) to 2016 (36.5%) [12]. Interestingly, the same trend was noticed in our study site during the same period, where ITN use frequency decreased from 75.4% in 2010 to 41.9% in to 2017. After, the Abuja Meeting in 2000 and due to the Global Fund support, most of the African

endemic countries implemented the ITN through free distribution campaigns. Five to seven years after, awareness campaigns and ITN distribution significantly decreased when this support ended. This was the case in Gabon. The government did not immediately take over from the global fund. Indeed, the country submission to Global Fund performed in 2014 and 2015 were unsuccessful. Some campaigns of ITN distribution were organized by local actors notably, from private sectors. In 2018, the country benefited from the Global Fund support and the number of campaigns increased. In Burkina Faso, the government has set a national goal to increase ownership, access, and use of bed nets, and has carried out two large-scale free mass distribution campaigns [13]. The authors report a significant increase in net ownership per household, from 5.6% in 2003 to 89.9% in 2014 [13]. This strategy of free ITN mass distribution has been shown to rapidly extend the ITN ownership in low-coverage areas and to reduce social inequalities [14,15]**.** However, these campaigns should not be the only mechanism by which ITN are distributed in the community. Free distribution during prenatal consultations for pregnant women and at vaccination centers for children would also help to increase household coverage of bed nets. These strategies have been used in Gabon. ITNs could also be sold in stores at reduced prices, making them available to all. These strategies would make it possible to increase the ITN access in our country. Moreover, the government should better support the MNCP in this effort. Other alternative strategies could be the distribution of ITNs nets in schools and the integration of community health worker into MNCP teams need to be promoted [16].

As expected, young children were more frequent at sleeping under mosquito nets than older children. Sleeping under an ITN is systematic for newborns and infants; indeed, mothers' benefit from a free ITN when they go to antenatal care visi, and if they don't sleep with their baby, they purchase an ITN that is placed on their cribs until they are 2 to 3 years old. Moreover, prior to 2015, only children under the age of five and pregnant women benefited from the free distribution of bed nets in Gabon.

Bed net use was generally more than 45% in older children, who are known more frequently infected by *P.falciparum* compared to the youngest in the country [17]. One explanation is that they continue to use the ones they received when they were younger, given that every pregnant woman receives a bed net every time she becomes pregnant. The second explanation would be the application of the national decision on universal coverage in ITN, regardless of age, from 2014, so that some older children would have benefited from this decision.

Conclusion

The ITN use, which is a key component of strategies for malaria control and prevention, is still insufficient in Libreville. Effort should be done to increase ITN ownership and use to achieve a significant reduction malaria transmission in Gabon.

Limitation of study

This study has one limit. ITN ownership and the number of inhabitants in the children house were not recorded. These information are essential to adjust strategies to achieve effective coverage and protection against mosquitoes and a reduction in malaria transmission. However, obtaining information on the actual use of ITNs is an important performance indicator for the MNCP, which

will be able to adapt its strategies according to the distribution rate of bed net. A prospective household survey assessing these information would complete our data.

Ethical approval

This study was carried out at the sentinel site of malaria survey, which works with the Malaria National Control Program (MNCP) and the Ministry of Health. The study team received the approval of the MNCP director and the Medical Director of the RHM for data use. All participant data were anonymized.

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Competing interest

The authors declare no competing interest.

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