



Impact of Home-Based Management of malaria combined with other community-based interventions: what do we learn from Rwanda?

Manasse Nzayirambaho, Jean de Dieu Bizimana, Robert Jean Freund, Pascal Millet, François-Xavier Merrien, Gilles Potel, Pierre Lombrail

► To cite this version:

Manasse Nzayirambaho, Jean de Dieu Bizimana, Robert Jean Freund, Pascal Millet, François-Xavier Merrien, et al.. Impact of Home-Based Management of malaria combined with other community-based interventions: what do we learn from Rwanda?. The Pan African Medical Journal, 2013, 14, pp.50. 10.11604/pamj.2013.14.50.2096 . hal-03703056

HAL Id: hal-03703056

<https://ehesp.hal.science/hal-03703056>

Submitted on 23 Jun 2022

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Research

Impact of Home-Based Management of malaria combined with other community-based interventions: what do we learn from Rwanda?

Manasse Nzayirambaho^{1,*}, Jean De Dieu Bizimana¹, Robert Jean Freund², Pascal Millet³, François-Xavier Merrien⁴, Gilles Potel⁵, Pierre Lombrail⁶

¹National University of Rwanda School of Public Health, Kigali, Rwanda, ²École des Hautes Etudes en Santé Publique, Rennes, France, ³Centre René-Labusquière, Université Victor-Segalen Bordeaux-2, Bordeaux, France, ⁴Faculté des Sciences Sociales et Politiques, Université de Lausanne, Lausanne, Switzerland, ⁵Laboratoire EA 3826 (Thérapeutiques Cliniques et Expérimentales des Infections), UFR Médecine et Techniques Médicales, Université de Nantes, Nantes, France, ⁶Laboratoire de Santé Publique et d'Epidémiologie, UFR Médecine et Techniques Médicales, Université de Nantes, Nantes, France

*Corresponding author: Manassé Nzayirambaho, National University of Rwanda School of Public Health, P.O. Box 5229, Kigali, Rwanda

Key words: Children, fever, malaria, Rwanda

Received: 28/09/2012 - Accepted: 03/01/2013 - Published: 05/02/2013

Abstract

Introduction: This study aimed to evaluate the impact of home-based management of malaria (HBM) strategy on time to treatment and reported presumed malaria morbidity in children aged less than 5 years in Rwanda. **Methods:** The study was carried out in two malaria-endemic rural districts, one where HBM was applied and the other serving as control. In each district, a sample of mothers was surveyed by questionnaire before (2004) and after (2007) implementation of HBM. **Results:** After implementation, we observed: i) an increase ($P<0.001$) in the number of febrile children treated within 24 hours of symptom onset in the experimental district (53.7% in 2007 vs 5% in 2004) compared with the control district (28% vs 7.7%); ii) a decrease in the reported number of febrile children in the experimental district (28.7% vs 44.9%, $P<0.01$) compared with the control district (45.7% vs 56.5%, $P<0.05$). **Conclusion:** HBM contributed to decrease time to treatment and reported presumed malaria morbidity.

Pan African Medical Journal. 2013; 14:50. doi:10.11604/pamj.2013.14.50.2096

This article is available online at: <http://www.panafrican-med-journal.com/content/article/14/50/full/>

© Manasse Nzayirambaho et al. The Pan African Medical Journal - ISSN 1937-8688. This is an Open Access article distributed under the terms of the Creative Commons Attribution License (<http://creativecommons.org/licenses/by/2.0>), which permits unrestricted use, distribution, and reproduction in any medium, provided the original work is properly cited.

Introduction

In sub-Saharan Africa, children less than 5 years of age continue to pay the heaviest tribute to malaria [1,2]. In response to this situation, many countries have adopted the strategy of home-based management of malaria (HBM) [3] supported by the World Health Organization and have complemented it with other community-based interventions. This is the case in Rwanda, where the introduction of HBM was done in parallel with the community-based health insurance schemes locally known as *mutuelle de santé* [4], the distribution of insecticide-treated bed nets, and the introduction in the health facilities of artemisinin-based combination therapy (ACT) [5,6]. Studies based on health facility statistics after implementation of these latter two interventions notably showed fewer hospital admissions for severe malaria [5], and reduced malaria morbidity and mortality [6] in children less than 5 years old in the health facilities. These decreases occurred while the development of community-based health insurance schemes was improving access to care in the facilities [4]. The part played by HBM in this decrease has still to be evaluated, taking into account the fact that at the time, treatment was given without rapid diagnostic test (RDT) or laboratory confirmation of malaria.

In Rwanda, the HBM strategy was adopted in May 2004. It aims to facilitate access to care and to reduce the time to effective treatment. In December 2004, the district of Nyanza was one of the first pilot districts where HBM was tested. In this country, HBM is based on voluntary community health workers known as drug distributors (DDs) who are elected by the population and trained for this activity. Currently, DDs use RDT to detect malaria prior to any treatment. However, by the time this study was conducted, DDs were trained to recognize malaria using a simple algorithm and to administer ACT according to an age-appropriate treatment protocol. Any child aged less than 5 years with febrile illness was considered to have malaria. The DDs examining the febrile children brought by their mothers had to decide to address them to the health center or to treat them at home if there was no contra-indication. In the latter case, the DDs sold to the mothers, at a subsidized price, pre-packaged artemether-lumefantrine (AL) tablets, and gave the first dose. A child was considered febrile if the DD personally noted, by touch, the presence of fever, or if the mother reported that the child has had fever.

In addition to distribution of drugs, DDs were also in charge of sensitizing and providing information to the community and in particular to mothers on early consultation for fever and the correct administration of anti-malaria drugs to children aged less than 5 years.

In Africa, studies on the health impact of HBM, including its effects on morbidity, are still sparse, particularly as many countries are changing their malaria treatment policy in favor of ACT [7]. In Rwanda, there has been no study of the health impact of HBM at a community level. Such evaluation is increasingly important as HBM continues to be extended in other African countries.

The aim of this study was to evaluate, at a community level, the impact of HBM on time to treatment and on malaria morbidity (febrile episodes without RDT or laboratory confirmation), and on reported all-cause morbidity in children aged less than 5 years in the pilot district of Nyanza two and a half years after its introduction, independently of the possible impact of other community-based interventions.

Methods

Study design

A comparative study was carried out in 2 districts, the HBM pilot district and a control district. The variables studied were measured in both districts 5 months before and 2 and a half years after implementation of HBM. Between these two measurements, HBM was implemented by the national malaria control program. During and after implementation of HBM, all other activities relating to malaria control continued as usual in both districts.

Setting of the study

The two districts in which the study was carried out are rural and malaria was endemic. The district of Nyanza was chosen by the Ministry of Health as a pilot district for HBM because of its malaria endemicity and the presence of a financial partner. The district of Bugesera was randomly chosen among the malaria-endemic districts where HBM had not yet been introduced. The district of Nyanza is located in the South Province of Rwanda, whereas the district of Bugesera is located in the East Province. In Rwanda, the major malaria vectors are *Anopheles gambiae* and *Anopheles funestus*. *Plasmodium falciparum* is the predominant species, responsible for over 90% of cases [8,9]. Like all the country, Nyanza and Bugesera have two principal rainy seasons: between February and April, and between September and November. According to the National Institute of Statistics of Rwanda, in 2007 the district of Nyanza had a population of 239 707 inhabitants and the district of Bugesera 274 113 inhabitants. Children aged less than 5 years represented about 15% of the total population in the two districts. Both districts have a subsistence economy based essentially on agropastoral activities.

Sampling

The pre-implementation study comprised 362 mothers (178 in the district of Nyanza and 184 in the district of Bugesera) with a participation rate of 98%. Its aim was to collect basic data to be used to evaluate the impact of HBM after implementation. For the post-implementation study, sample size was calculated to include at least 40% of febrile children aged less than 5 years treated within 24 hours of symptom onset in the experimental district (or two times more than in the control district). With a power of 90% and a 95% confidence interval, taking into account a cluster effect of 2 and a non-response rate of 2%, the minimum number of mothers required in the two districts was 376, or 188 in each district. All mothers took part in the study, a participation rate of 100%. During the two studies, before and after implementation, the mothers investigated were recruited in cells (the smallest administrative unit at the time), which were selected by the cluster sampling method. In each cell selected, the number of mothers to be investigated was estimated in proportion to the size of the cell. The investigators visited the households following a circular centrifugal route (starting from the center towards the periphery of the cell) until the required number of persons had been included. In each household, the carers of the children aged less than 5 years were questioned.

Variables and data collection

The questionnaires were designed to determine, before and after HBM implementation: i) time to treatment for febrile children aged less than 5 years reported by the mothers during the 2 weeks before our survey; ii) the occurrence of fever (presumptive malaria); iii) the development of illness (all disease causes). The questions put were identical before and after implementation. After implementation, specific questions on HBM were added and were

put only in the experimental district. The DDs and health facilities (dispensaries, health centers, hospitals) were considered as formal sources of care.

The first study was carried out in July 2004 and the second in July 2007. The questionnaires were administered in the households to the carer of the children aged less than 5 years (the biological mother, or in her absence, another person aged at least 18 years). In this study, « mother » refers to the carer of the sick child in the household. The aims of the study were first explained to the mothers, who were then included in the study after giving their voluntary informed consent. Mothers who were not resident in the district were excluded from the study. The mothers were interviewed face to face and the questionnaires were directly filled in by the investigators.

Experienced investigators were carefully selected and trained in administration of the questionnaire. The questionnaires were translated into kinyarwanda (the native language of Rwanda) and pre-tested before being applied. The completed questionnaires were checked the same day to ensure they were correctly and fully completed. Double data entry was performed using Epi Info 3.3.2 (CDC, Atlanta, GA, USA). Data were converted into SPSS 13.0 (SPSS Inc., Chicago, IL, USA) for statistical analysis. In each district, the variables studied were compared before and after implementation of HBM and the data of the experimental district were compared with those of the control district. Comparisons were made using the chi-squared test and Fisher's exact test for small series, and the conventional level of 5% was considered significant.

Results

Characteristics of the sample

The majority of mothers were aged less than 40 years, were married and had an agropastoral activity (94%). One in 5 was illiterate (**Table 1**). In both districts, at least 90% of mothers recognized fever as a sign of a malaria episode.

Time to treatment

After implementation of HBM, the percentage of febrile children aged less than 5 years who were treated within 24 hours improved significantly in both districts (**Table 2**). In this experimental district, the majority of febrile children were treated in a formal health care source (35/54), by a DD (26/35), and within 24 hours (23/26). Lastly, among the febrile children who had not received treatment within 24 hours (other treatment modalities), 19/25 had not been treated in a formal health care source. Also, if the anti-malaria treatment given was ineffective, the DDs referred the sick children to the nearest health facility.

Malaria morbidity and overall reported morbidity in the community

After implementation of HBM, the reported proportion of febrile children among the children aged less than 5 years (presumed malaria morbidity) decreased in both districts, experimental (28.7% in 2007 vs 44.9% in 2004, (**Table 3**).

Discussion

Time to treatment

Rapid treatment of malaria is critical as it can progress to severe disease in a few hours, especially in children [10]. In the study carried out before HBM implementation, we observed that in both districts (experimental and control), less than 1 in 10 children aged less than 5 years was taken to a formal health care source within 24 hours. Similar results have been reported in other malaria-endemic countries [11].

Two and a half years after HBM implementation, we observed that time to treatment had decreased in both districts. This is probably related in particular to improved financial accessibility of care thanks to the community-based health insurance schemes. At a national level, the membership rate of this health insurance system in fact rose from 27% in 2004 to 75% in 2007[12]. A study assessing the impact of community-based health insurance schemes on access to care in Rwanda [4] showed that members made greater use of health services than non-members (4 to 8 times more for curative consultation).

However, our results have shown that after implementation of HBM, time to treatment was shorter in the experimental district. In this district, half the children aged less than 5 years (compared with less than 1 in 3 children in the control district) were taken to a formal health care source within 24 hours of fever onset, and in 8 of 10 cases they were taken to a DD. This suggests that HBM had a specific impact on the number of children treated within 24 hours. The results of our study confirmed those of the health facility reports [13] showing that, in HBM areas, 80% of febrile children aged less than 5 years at the time seen by DDs and in health centers were treated within 24 hours of symptom onset. An evaluation of HBM in Uganda [14] had also shown that in 2003, 56% of child carers sought treatment within 24 hours of symptom onset after the introduction of HBM.

Reported malaria morbidity in the community

Our results suggested that implementation of HBM was followed by a significant decrease in the number of febrile children aged less than 5 years in the two districts. This decrease may be due to the combined effect of several interventions. In addition to introduction of the community-based health insurance scheme, insecticide-treated bed nets had been distributed on a nation-wide scale to children aged less than 5 years and pregnant women during the observation period. During the same period, in all health facilities in the country the Ministry of Health introduced AL as first-line anti-malaria treatment instead of amodiaquine and sulfadoxine-pyrimethamine.

Studies have shown that cases of pediatric malaria seen in the health facilities decreased following the distribution of insecticide-treated bed nets [15] or introduction of ACT in health facilities [16]. Our results suggested, however, that malaria morbidity (in fact, febrile episodes) decreased more in the experimental district. This could be explained by the preventive effect of early anti-malaria treatment leading to a reduced level of transmission.

Few studies have found that programs for treatment of presumptive malaria in children aged less than 5 years by community health workers can reduce malaria morbidity [17, 18]. A systematic review of publications on the health impact of HBM in Africa [7] concluded that the efficacy of the HBM strategy, in particular in reducing malaria morbidity, remains to be proven. This is especially important as the fear that parasite resistance may be induced by widespread use of antimalarials has not been lifted [19].

Not all febrile children treated presumptively by DDs necessarily had malaria, for fever is a symptom of many other diseases, including

respiratory tract infections. By the time this study was conducted, DDs did not have the possibility of confirming the presence or absence of the parasite in children reported to be « febrile » by their mothers. However, we assume that the situation in Rwanda probably did not differ from that of the other malaria-endemic African countries, where the majority of cases of fever were malarial [20].

Conclusion

Our findings suggested that implementation of HBM led to a significantly higher proportion of febrile children receiving treatment within 24 hours of symptom onset and to a decrease in reported malaria morbidity. These effects were accompanied by a general trend towards improvement, probably attributable in particular to the development of community-based health insurance schemes, the distribution of insecticide-treated bed nets and the introduction of ACT in the health facilities.

Competing interests

Authors declared they have no conflicts of interest.

Authors contributions

MN, PL and JDB conceived and developed the study. MN supervised data collection and entry. MN and PL analyzed and interpreted the data, and wrote the first draft of the manuscript. RJF, PM, JDB, FXM and GP commented on the draft manuscript and took part in writing the report. All authors read and approved the final version.

Acknowledgments

We are grateful to the health and administrative authorities of the districts of Nyanza and Bugesera for their excellent collaboration. We are particularly grateful to all the investigators and all the mothers who participated in this study. This study received financial support from the University of Nantes, France, through Laboratoire EA 3826 (Thérapeutiques Cliniques et Expérimentales des Infections) and the Laboratoire de Santé Publique et d'Epidémiologie of the Faculty of Medicine, University of Nantes.

Tables

Table 1: Sociodemographic characteristics of mothers, 2004

Table 2: Time to treatment of febrile children aged less than 5 years, n(%)

Table 3: Reported malaria morbidity and general morbidity in children aged less than 5 years, n (%)

References

1. Breman JG, Alilio MS, Mills A. Conquering the intolerable burden of malaria: what's new, what's needed: a summary. *Am J Trop Med Hyg.* 2004 Aug;71(2 Suppl):1-15. **PubMed | Google Scholar**
2. Nahlen BL, Korenromp EL, Miller JM, Shibuya K. Malaria risk: estimating clinical episodes of malaria. *Nature.* 2005 Sep 8;437(7056):E3; discussion E4-5. **PubMed | Google Scholar**
3. World Health Organization/United Nations Children's Fund. Management of sick children by community health workers, intervention models and programme examples. Geneva and New York: World Health Organization, Department of Child and Adolescent Health and Development, and United Nations Children's Fund, Programme Division. 2006. **PubMed | Google Scholar**
4. Musango L, Martiny P, Porignon D, Dujardin B. The prepayment scheme in Rwanda (II): membership and use of services by beneficiaries. *Sante.* 2004 Apr-Jun;14(2):101-7. **PubMed | Google Scholar**
5. Sievers AC, Lewey J, Musafiri P, Franke MF et al. Reduced paediatric hospitalizations for malaria and febrile illness patterns following implementation of community-based malaria control programme in rural Rwanda. *Malar J.* 2008 Aug 27;7:167. **PubMed | Google Scholar**
6. Otten M, Aregawi M, Were W, Karema K, Medin A, Bekele W et al. Initial evidence of reduction of malaria cases and deaths in Rwanda and Ethiopia due to rapid scale-up of malaria prevention and treatment. *Malar J.* 2009 Jan 14;8:14. **PubMed | Google Scholar**
7. Hopkins H, Talisuna A, Whitty CJ, Staedke SG. Impact of home-based management of malaria on health outcomes in Africa: a systematic review of the evidence. *Malar J.* 2007; 6: 134. **PubMed | Google Scholar**
8. Rwagacondo CE, Niyitegeka F, Sarushi J, Karema C, Mugisha V et al. Efficacy of amodiaquine alone and combined with sulfadoxine-pyrimethamine and of sulfadoxine-pyrimethamine combined with artesunate. *Am J Trop Med Hyg.* 2003 Jun;68(6):743-7. **PubMed | Google Scholar**
9. Fanello CI, Karema C, van Doren W, Van Overmeir C et al. A randomised trial to assess the safety and efficacy of artemether-lumefantrine (Coartem) for the treatment of uncomplicated *Plasmodium falciparum* malaria in Rwanda. *Trans R Soc Trop Med Hyg.* 2007 Apr;101(4):344-50. **PubMed | Google Scholar**
10. World Health Organization. WHO Expert Committee on Malaria. Twentieth Report. Geneva: World Health Organization (Technical report series 892). 2000. **Google Scholar**
11. Nsungwa-Sabiiti J, Tomson G, Pariyo G, Ogwal-Okeng J, Peterson S. Community effectiveness of malaria treatment in Uganda ? a long way to Abuja targets. *Ann Trop Paediatr.* 2005 Jun;25(2):91-100. **PubMed | Google Scholar**
12. Ministère de la Santé du Rwanda: Rapport annuel 2007. Available at: <http://www.moh.gov.rw/publication.html>. Accessed 25/11/2009.
13. Ministère de la Santé du Rwanda : Rapport annuel 2006. Available at: http://www.moh.gov.rw/docs/may2006/RAPPORT%20ANNUEL%202006_MINISANTE.pdf. Accessed 25/11/2009.

14. Batega DW, Greer GJ, Plowman BA. Home-based management of fever strategy in Uganda: assessment of implementation and operation at district and community levels. Arlington, VA: Ministry of Health (Uganda), WHO and BASICS II for the United States Agency for International Development. 2004. **PubMed** | **Google Scholar**
15. Okiro EA, Hay SI, Gikandi PW, Sharif SK, Noor AM, Peshu N, Marsh K, Snow RW. The decline in paediatric malaria admissions on the coast of Kenya. *Malar J.* 2007; 6: 151. **PubMed** | **Google Scholar**
16. Bhattarai A, Ali AS, Kachur SP, Mårtensson A, Abbas AK, Khatib R et al. Impact of artemisinin-based combination therapy and insecticide-treated nets on malaria burden in Zanzibar. *PLoS Med.* 2007 Nov 6;4(11):e309. **PubMed** | **Google Scholar**
17. Delacollette C, Van der Stuyft P, Molima K. Using community health workers for malaria control: experience in Zaire. *Bull World Health Organ.* 1996;74(4):423-30. **PubMed** | **Google Scholar**
18. Tiono AB, Kaboré Y, Traoré A, Convelbo N, Pagnoni F, Sirima SB. Implementation of home based management of malaria in children reduces the work load for peripheral health facilities in a rural district of Burkina Faso. *Malar J.* 2008 Oct 3;7:201. **PubMed** | **Google Scholar**
19. D'Alessandro U, Talisuna A, Boelaert M. Editorial: Should artemisinin-based combination treatment be used in the home-based management of malaria? *Trop Med Int Health.* 2005 Jan;10(1):1-2. **Google Scholar**
20. Dunyo SK, Afari EA, Koram KA, Ahorlu CK, Abubakar I, Nkrumah FK. Health centre versus home presumptive diagnosis of malaria in southern Ghana: implications for home-based care policy. *Trans R Soc Trop Med Hyg.* 2000 May-Jun;94(3):285-8. **PubMed** | **Google Scholar**

Table 1: Sociodemographic characteristics of mothers, 2004

Variable	Experimental district	Control district	P
	n = 178 (%)	n = 184 (%)	
Maternal age, year			
< 21	7 (3.9)	8 (4.3)	0.546
21 – 30	71 (39.9)	78 (42.4)	
31 – 40	76 (42.7)	82 (44.5)	
> 40	24 (13.5)	16 (8.8)	
Civil status			
Married	143 (80.3)	160 (87.0)	0.284
Single	11(6.2)	8 (4.3)	
Widow	17 (9.5)	9 (4.9)	
Separated	7 (4.0)	7 (3.8)	
Educational level			
Illiterate	39 (21.9)	36 (19.6)	0.250
Uncompleted primary education	66 (37.1)	84 (45.6)	
Completed primary education and more	73 (41.0)	64 (34.8)	

Table 2: Time to treatment of febrile children aged less than 5 years, n (%)						
Time to treatment in previous 2 weeks	Experimental district			Control district		
	Before HBM (n=80)	After HBM (n=54)	<i>P</i>	Before HBM (n=104)	After HBM (n=86)	<i>P</i>
Treated within 24 h in a formal healthcare source (health facility or DD)	4 (5.0)	29 (53.7)	< 0.001	8 (7.7)	24 (28.0)	< 0.001
Other modalities	76 (95.0)	25 (46.3)		96 (92.3)	62 (72.0)	
HBM: home-based management of malaria; Health facility: dispensary, health center, hospital; DD: drug distributor						

Table 3: Reported malaria morbidity and general morbidity in children aged less than 5 years, n (%)						
	Experimental district			Control district		
	Before HBM (n= 178)	After HBM (n= 188)	<i>P</i>	Before HBM (n= 184)	After HBM (n= 188)	<i>P</i>
Malaria morbidity (febrile children in previous 2 weeks)						
Febrile children	80 (44.9)	54 (28.7)	< 0.01	104 (56.5)	86 (45.7)	< 0.05
General morbidity (sick children in previous 2 weeks)						
Sick children (all disease causes)	106 (59.5)	101 (53.7)	0.260	123 (66.9)	121 (64.4)	0.613
HBM: home-based management of malaria						