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# Using community health workers for malaria control: experience in Zaire

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*The potential for using community health workers (CHW) for administering timely and effective treatment for presumptive malaria attacks was evaluated in the Katana health zone in Zaire. In each of the 12 villages of an intervention area (area A) with 13000 inhabitants, a CHW was trained in the use of a simple fever management algorithm. The CHWs performed their services under the supervision of the nurse in charge of the area's health centre (HC). Malaria morbidity and mortality trends were monitored during 2 years in area A and in an ecologically comparable control area (area B), where malaria treatment continued to be available at the HC only. Health care behaviour changed dramatically in the intervention area, and by the end of the observation period 65% of malaria episodes were treated at the community level. Malaria morbidity declined 50% in area A but remained stable in the control area. Parasitological indices showed similar trends. Malaria-specific mortality rates remained, however, at essentially the same levels in both areas. The non-comprehensiveness of the CHWs' care and their ambiguous position in the health care system created problems that compromise the sustainability of the intervention.*

## Introduction

Early diagnosis and prompt treatment of malaria are essential to avert severe morbidity and mortality in non-immune individuals (1). Together with the implementation of sustainable preventive measures and the strengthening of local research capacities, the early detection and containment of epidemics constitute the basic technical elements of the Global Strategy for Malaria Control (2). Timely professional treatment of malaria episodes is, however, hard to organize in regions with scattered populations who have to travel long distances to the nearest health care facility. It has been suggested that community health workers (CHWs) could provide correct case management at the community level and thereby increase the access to good quality care (3, 4). This study in the Katana health zone, Zaire, aimed to evaluate further the potential of CHWs to reduce malaria morbidity and mortality.

## Subjects and methods

### Study area and population

The Katana health zone is situated in the eastern

part of Zaire, on the western shore of Lake Kivu (Fig. 1). This mountainous region (altitude  $\geq 1500$  m) has a temperate climate with two rainy seasons separated by a short (January) and a prolonged (May–September) dry season. The health zone has an area of approximately 1200 km<sup>2</sup>. It is exclusively rural, with a homogeneous population of about 210000 persons who belong to the Shi tribe. Less than 1% of households have an income from salaried jobs or trading, and subsistence farming is virtually the only economic activity (5). The level of educational attainment is very low, particularly in girls, of whom almost 90% do not complete a single year of formal schooling (6). Primary health care (PHC) is delivered through a network of 17 health centres (HC) and a well-equipped 660-bed hospital. The priority health problems are related to infectious and parasitic diseases (7), and the infant mortality rate and child mortality quotient attain respectively 13% and 18%.

### Malaria epidemiology and control efforts

Malaria ranks third among causes of mortality, and fever attributed to malaria is the most frequent diagnosis at the HCs. The predominant malarial parasite is *Plasmodium falciparum*: found alone (86%), sometimes associated with *P. malariae* (10%), but rarely with *P. ovale* (<2%). In 1986, less than 5% of the isolated *P. falciparum* strains showed an RII resistance to chloroquine (8). Malaria is meso-endemic, and transmission is continuous with seasonal fluctuations (9). The spleen and parasite rates (the proportion, respectively, of healthy individuals with enlarged spleens, and with thick blood films

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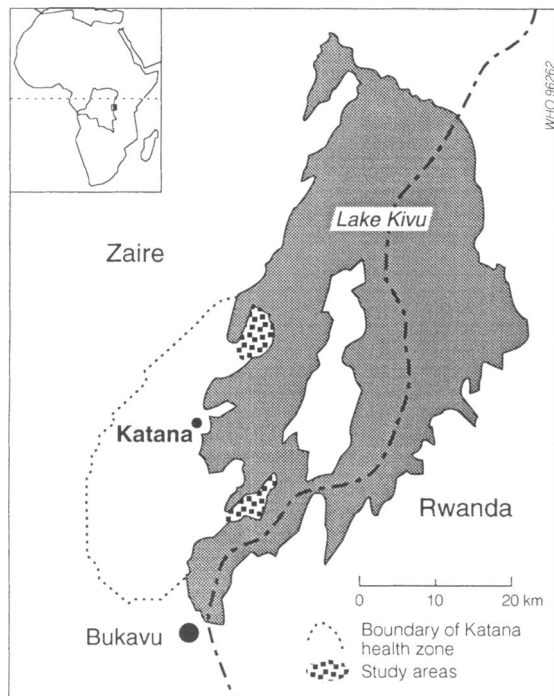
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Fig. 1. Location of the Katana health zone and study areas.



positive for *Plasmodium* parasites) among the population <5 years of age range from 5% to 18% and from 25% to 44%, respectively, and both attain their maximum during the long dry season. The age pattern for acquisition of antibodies against *P. falciparum* is characteristic for unstable malaria transmission (9). The health services' routine malaria control activities concentrate on the treatment of clinical cases presenting at the HC or hospital. Chemoprophylaxis is not promoted, either for pregnant women or children. Impregnated bednets are used, on the initiative of the individual, by an insignificant minority of better-off inhabitants. The use of mosquito repellents is somewhat more widespread.

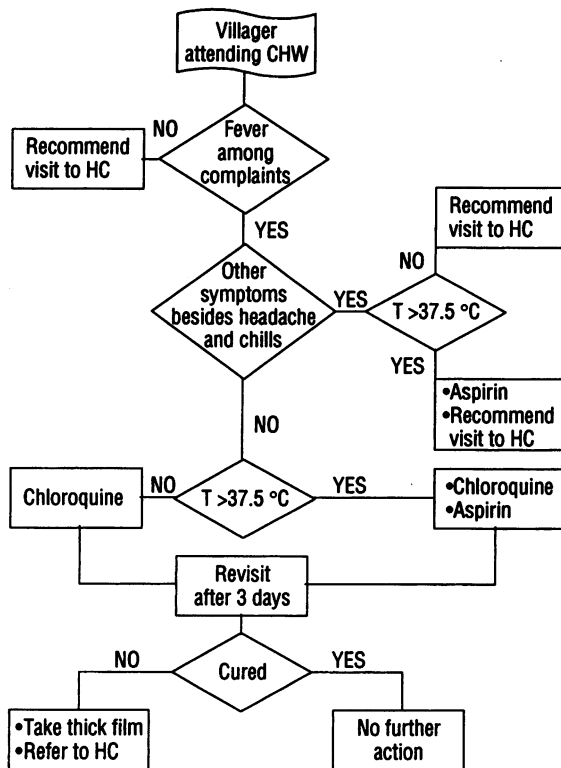
**The intervention**

The zone's PHC development plan set up a pilot community trial for providing malaria treatment at the "grass-roots" level. In all villages of the intervention area (area A) villagers were identified who would quickly provide chloroquine phosphate treatment for isolated episodes of fever (i.e. presumed malaria attacks). In order to measure the impact of this intervention, a control area (area B) was se-

lected for monitoring malaria morbidity and mortality under routine health care protocols (i.e. treatment at the nearest HC only). The two areas, both peninsulas, are situated 22-km south and 10-km north of the hospital. They were closely comparable socioeconomically, and their populations were each covered by HCs that supplied curative and preventive services representative for the Katana health zone. The areas had the same malarial ecology, and malariometric indices were similar in each (9).

The 12 villages composing area A had an average population of 1200 (range, 500-1500). These communities received, before the intervention, educational messages on malaria. They approved the plans for the malaria control project, and in each village the inhabitants chose a literate volunteer as malaria CHW. The selected CHW received 2 weeks of in-service training in the area's HC in the use of a simple treatment algorithm for fever and the early recognition and local management of malaria patients (Fig. 2). They were also instructed in the use of

Fig. 2. Flow chart for management of fever (i.e. possible malaria) patients by community health workers (CHW) in Katana, Zaire, 1986. HC = health centre.



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Table 1: Population in the study areas, Katana, Zaire (1 September 1986)

Age (years)	Area A			Area B		
	Males	Females	Total	Males	Females	Total
<1	259	237	496 (3.8) <sup>a</sup>	311	318	629 (4.2)
1-4	1 038	1 071	2 109 (16.1)	1 166	1 204	2 370 (15.8)
5-9	994	1 005	1 999 (15.3)	1 137	1 147	2 284 (15.2)
10-14	795	806	1 601 (12.2)	906	897	1 803 (12.0)
15-24	1 080	1 188	2 268 (17.3)	1 307	1 395	2 702 (18.0)
25-34	837	865	1 702 (13.0)	947	936	1 883 (12.6)
35-44	578	581	1 159 (8.9)	728	635	1 363 (9.1)
45-54	312	366	678 (5.2)	406	364	770 (5.1)
55-64	298	268	566 (4.3)	303	362	665 (4.4)
≥65	307	199	506 (3.9)	305	225	530 (3.6)
Total	6 498	6 586	13 084 (100)	7 516	7 483	14 999 (100)

<sup>a</sup> Figures in parentheses are percentages.

a contact register that had sex, age, major signs and symptoms, and referral as entries. The treatment of presumptive cases of malaria consisted of oral administration of chloroquine phosphate (25 mg/kg for 3 days), which was, at the time, the recommended "first line" drug in the region (10). It was provided at cost (US\$ 0.008 per tablet containing 100 mg chloroquine base), and no consultation fees were charged by the CHW, making treatment three times cheaper than at the HC.

After training, the CHWs started their activities in area A communities. Since CHWs were also local farmers, they were, in principle, always accessible to the villagers, who had been motivated through health education to consult the CHW for any fever episodes. They worked under the close supervision of the nurses in charge of the HCs and also attended monthly meetings chaired by the medical coordinator of the project (CD). They received only a symbolic monetary reward, as well as the standing gained in the community. Nevertheless, no CHW dropped out of the project. In area B, no specific malaria control effort was undertaken. Ill persons identified during the passage of the morbidity and mortality survey team were, however, referred to the area's HC. Such patients were exempted from paying the normal consultation fees.

### Data collection, management, and analysis

The survey methodology (6) and details of the questionnaires and diagnostic criteria have been described previously (7).<sup>a</sup> In short, information on the mortality and morbidity in the population of both

areas was collected in a multi-round survey. The first round started on 1 August 1985 and was followed by three consecutive rounds at roughly 6-month intervals. Enumeration was on a *de jure* basis (including all declared residents, present or not), and recruitment of neonates and migrants continued until the end of the survey. In each round, all households were visited twice, with a 1-week interval between visits. At each visit, 7-day morbidity recall was elicited. The person-time morbidity sampled thus varied each 7-day interval. Because of their gradual recruitment and release, not all households were followed over the same calendar period, but between 1 March 1986 and 28 February 1987 the complete population of the two areas was under mortality surveillance. Mortality recall for the previous 6 months was only elicited during the last three survey rounds. The last survey round ended 31 July 1987 (see Table 1). Surveys were carried out by two field-teams consisting each of one supervisor and six interviewers, the latter of whom were permanent residents in the area and had completed at least 6 years of primary schooling. They each visited 40-50 households per week. Supervisors were graduate nurses, who inspected all completed survey forms, reviewed doubtful or abnormal results with the surveyors, and made, when necessary, control visits. They revisited a random sample of 10% of households each week.

The basic household questionnaire, written in the Shi language, consisted of four parts: administrative information, information on relatively fixed household characteristics, specific information on each household member, and information to be recorded at each subsequent visit, among other things the household's total number of deaths, births, and migrations, the total number of ill persons on the day of the visit (prevalence), and the number of new illness episodes starting during the previous 7 days

<sup>a</sup> Van der Stuyft P. [An epidemiology unit in a modern academic environment: redundant anachronism or vital quintessence?] (in Dutch). Antwerp, Universitaire Instelling Antwerpen, 1991 (Ph.D. thesis).

(incidence). For 96% of the reported events the mother was the interviewee.

For each death or episode of illness information on the subject concerned was collected on an individual mortality or morbidity questionnaire. The date and circumstances of the event, the occurrence and duration of standardized symptoms, the health care behaviour and, possibly, the treatment given were recorded. These questionnaires were adapted to the local situation from those proposed in earlier studies (11).<sup>b</sup> The morbidity questionnaire attempted to distinguish between seven syndromes: malaria, diarrhoea, acute upper respiratory infection, acute lower respiratory infection, skin rash in children, trauma, and "others". A diagnosis of malaria was made if the presence of fever, possibly with chills or vomiting, but without further complaints indicative of other diseases, was reported. On the mortality questionnaire, in addition to the absence or presence of standardized signs and symptoms and their duration, any relevant observation or comment of the caregiver was recorded. These forms were interpreted by two doctors who independently extracted the probable cause of death. A death was attributed to malaria when the verbal autopsy revealed isolated fever of acute onset, with or without convulsions, possibly accompanied by vomiting and headache, but without any further signs or symptoms (thereby excluding patients with, among other things, concomitant acute respiratory infection, measles, or diarrhoea), leading to death within 7 days. Agreement between the doctors was high ( $\kappa = 95\%$ ) and any disagreement was discussed in order to find a consensus.

A cross-sectional malarial survey was conducted before (in February 1985) and during the intervention period (in February 1987). Thick blood films were collected from a sample of healthy subjects living in both areas. The blood films were Giemsa stained and 200 microscopic fields were examined under oil immersion (objective  $\times 100$ , eyepiece  $\times 10$ ). The crude parasitological index and the high parasitaemia index, i.e. the percentage of slides with more than 2000 asexual forms of *P. falciparum* per  $\text{mm}^3$  of blood were determined (12).

All data were entered in dBase III and a print-out of the critical items was systematically compared with the survey forms; data consistency was checked with a custom-made verification programme. Data analysis was performed with SPSS/PC software. The

difference between proportions or rates was tested with a two-tailed  $\chi^2$  test, and the reported 95% confidence intervals are test based.

## Results

Table 2 summarizes by area the evolution of the crude malaria morbidity and mortality rates before and during the CHW intervention. The prevalences and incidences showed a significant 50% decline in the intervention area but remained stable in the control area. The specific mortality rates fluctuated in both areas, but pre- and post-intervention levels remained essentially the same. The parasitological indices reflected the malaria morbidity trend (Table 3): the crude parasitological index and high parasitaemia index respectively showed a five- and six-fold reduction in the intervention area, whereas the decline was far more modest (a two-fold reduction) in the control area.

During the intervention important changes took place in the health care behaviour of the population in area A (Table 4). The number of malaria episodes that remained untreated decreased significantly, more cases were treated at home (+16%) and by the CHW (+16%), and the utilization of the health sector (-9%) and of the informal private sector (-23%) sharply decreased. This resulted in more than 65% of the episodes being treated at the community level by the end of the observation period. The health care utilization profile in the control area showed little change, but the proportion of cases receiving treatment decreased by 8%. At the same time there was, in the intervention area but not in the control area, an increase in the use of chloroquine as the first-line treatment and a concurrent drop in the use of quinine (from 15% to 7%).

The study permitted the observation of the institutional, social and financial problems related to the use of CHWs for malaria control activities. The main findings are summarized qualitatively below.

- Problems concerning the relation between the CHWs and the health care system, as follows:
  - CHWs desired more than a token financial reward for their activities;
  - CHWs were eager to receive further training and to broaden the scope of their therapeutic activities;
  - CHWs wished to be established formally in the hierarchy of the health care system and to have prospects for career development; and
  - project management and supervision of CHWs unacceptably increased the workload of HC staff.

<sup>b</sup> MacCormack CP. Estimation of malaria mortality and morbidity in different ecological areas of tropical Africa, such as tropical rainforest, forest, savannah and Sahel. Ad hoc consultation on applied field research in malaria in Africa. Nairobi, 1983 (TDR-FIELDMAL, Proposal No. 26).

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**Table 2: Malaria morbidity and mortality, by period and area, Katana, Zaire, 1985–87**

Period	Mean prevalence (per 10 000)		Mean incidence per 10 000 person-weeks (No. of person- weeks of observation)		Mortality per 10 000 person- months (No. of person-months of observation)	
	Area A	Area B	Area A	Area B	Area A	Area B
Aug. 85–March 86 <sup>a</sup>	143 (21 455) <sup>b</sup>	121 (22 630) <sup>b</sup>	218 (21 455)	205 (22 630)	17 (102 410)	27 (116 541)
April 86–July 86 <sup>c</sup>	133 (17 139)	91 (25 458)	176 (17 139)	115 (25 458)	21 (51 887)	35 (59 490)
Aug. 86–March 87 <sup>d</sup>	74 (33 285)	109 (31 235)	104 (33 285)	145 (31 235)	14 (103 704)	27 (120 879)
April 87–July 87 <sup>d</sup>	75 (18 870)	104 (25 702)	99 (18 870)	134 (25 702)	32 (21 944)	22 (36 530)
Rate ratio <sup>e</sup>	1.9; 1.6–2.1 <sup>f</sup>		1.9; 1.7–2.2		1.1; 0.6–1.9	
	1.0; 0.9–1.1		1.1; 1.0–1.2		1.1; 0.8–1.7	

<sup>a</sup> Baseline period (no intervention).

<sup>b</sup> Figures in parentheses are the number of observations made in the study population during the corresponding period.

<sup>c</sup> Initial period of intervention in area A.

<sup>d</sup> Programme period in area A (fully operational).

<sup>e</sup> (rate Aug. 85–July 86)/(rate Aug. 86–July 87) = (baseline + initial period)/(programme period).

<sup>f</sup> Figures in italics are the 95% confidence interval.

**Table 3: Crude parasitological index (PI) and high parasitaemia index (HPI) for *Plasmodium falciparum* by area and period, Katana, Zaire**

Period	Area A			Area B		
	<i>n</i>	PI	HPI <sup>a</sup>	<i>n</i>	PI	HPI <sup>a</sup>
Feb. 85	255	34.1	13.3	254	37.8	17.3
Feb. 87	229	7.0	2.2	217	19.3	9.2
Rate ratio <sup>b</sup>		4.9 (3.0–8.1) <sup>c</sup>	6.0 (2.4–15.3)		2.0 (1.4–2.7)	1.9 (1.1–3.1)

<sup>a</sup> % of slides with  $\geq 2000$  asexual forms of *P. falciparum* per mm<sup>3</sup> of blood.

<sup>b</sup> (rate during Feb. 85)/(rate during Feb. 87).

<sup>c</sup> Figures in parentheses are the 95% confidence interval.

**Table 4: Health care behaviour during a malaria outbreak, Katana, Zaire, 1985–87**

	Area A			Area B		
	Aug. 85–March 86 <sup>a</sup>	April 86–July 87 <sup>b</sup>	Difference	Aug. 85–March 86 <sup>a</sup>	April 86–July 87 <sup>b</sup>	Difference
No. of malaria episodes	467	835	—	464	1 089	—
Episodes without treatment	31%	24%	–7%	20%	28%	+8%
Mean number of treatment decisions per patient <sup>c</sup>	1.2	1.2	0.0	1.3	1.2	–0.1
Treatment decided on: <sup>d</sup>						
At home by family member	33%	49%	+16%	48%	57%	+9%
By CHW	—	16%	+16%	—	—	—
By health care provider in the private sector <sup>e</sup>	50%	27%	–23%	39%	30%	–9%
By health system personnel	17%	8%	–9%	13%	13%	0%

<sup>a</sup> No community health worker (CHW).

<sup>b</sup> CHW present (fully operational from Aug. 86).

<sup>c</sup> For treated patients.

<sup>d</sup> Denominator = total number of treatments.

<sup>e</sup> Predominantly practitioners using Western drugs (3% traditional healers).

• Problems concerning the relation between the CHWs and the community, as follows:

- the community expected CHWs to deliver comprehensive and continuous care and became progressively disappointed by their limited services;
- the community was not inclined to compensate CHWs for their efforts, financially or otherwise;
- CHWs tended to elude community (and HC) control of their activities; and
- CHWs did not catalyse genuine community participation in malaria control or in health care in general.

## Discussion

The introduction of a dedicated (for malaria only) CHW in an area where access to the health care system is problematic because of a scattered population should result in increased access to timely and appropriate treatment. The presence of such CHWs does not, however, automatically lead to the utilization of their services. The concurrent delivery of health information and education enhances community perception of the malaria problem. In fact, behavioural changes are critical to the effective utilization and success of a control programme based on the deployment of CHWs.

Failure to secure sufficient behavioural changes in the population studied may, to some extent, explain why CHWs treated only 16% of malaria cases in the intervention area. That their services were non-comprehensive could be another partial explanation for this, as could the existence of a financial barrier: although no consultation fees were charged, patients still had to pay for the drugs they received. Nevertheless, health care behaviour regarding malaria has dramatically changed in the intervention area but not in the control area. The number of malaria cases receiving no treatment has been substantially reduced: 65% of all malaria episodes in the intervention area are now managed at the community level, and the frequency of visits to the private health sector has dropped sharply.

There is also a strong indication that home treatment of malaria has become more appropriate. Extensive cinchona plantations in the Katana region make quinine easily available through the informal private sector and drug vendors. Although in the control area quinine is inappropriately relied upon, in the intervention area it is being replaced by chloroquine as the first-choice drug for self-care. While self-medication for malaria is widespread in Africa (13, 14), the correct use of drugs is the excep-

tion (15). The presence, example, and educational efforts of the CHWs undoubtedly played a major role in the favourable evolution of drug use in the intervention area, as well as in the reduction of treatments obtained from the informal private sector. This result is even more striking when the low educational level and 89% female illiteracy rate in the region (6) are taken into account, as these are factors that may strongly constrain the effectiveness of educational efforts and of health interventions in general (16).

A reduction in the proportion of patients who remain untreated, shorter delays between the first symptoms of malaria and the start of treatment, and increased adequacy of therapy all contribute to a decrease in the average duration of a malaria episode. This must be partially responsible for the two-fold decline in malaria morbidity in the intervention area and the six-fold drop in the high parasitaemia index. The malaria mortality rates fluctuated in both areas, but pre- and post-intervention levels remained essentially the same in all age groups. In a hyper-endemic region in Kenya, Spencer et al. (17) also failed to demonstrate an impact on overall and malaria-specific mortality after the introduction of CHWs who delivered malaria treatment. Systematic chemoprophylaxis provided by CHWs succeeded, in contrast, in reducing malaria morbidity and mortality rates in Farafenni, a holo-endemic region in the Gambia with highly seasonal transmission (18).

The small size of the study population (approximately 15000 persons in each area), however, would hardly permit the demonstration of an effect on malaria mortality rates: to have an 80% chance of detecting a significant 20% reduction in mortality among the population <5 years of age would require, as standard formulae (19) indicate, a sample five times as big as this. The validity of verbal autopsies in diagnosing malaria-specific mortality should also be considered. Although the technique is quite specific, it has a relatively low sensitivity (20, 21), which could bias the mortality ratios in this study and lead to an underestimation of the effect of the intervention.

At any rate, it has been suggested that malaria-specific mortality may not provide the best or most meaningful indicator for assessing community-based malaria control programmes (17, 22). Changes in intermediate outcome indicators — such as morbidity rates (12), or parasite and spleen rates (23) — may provide sufficient evidence, and so-called process indicators — such as access to services, the proportion of cases receiving treatment and the quality and adequacy of care — would seem equally important. In this respect the CHWs' interventions made a difference in the Katana health zone and have con-

tributed towards improving well-being by reducing morbidity due to malaria.

Pilot project effectiveness does not, however, imply success in a programme context, and the problems observed after the start of the present intervention should raise questions about its sustainability. The major problems were related to the long-term commitment of the volunteer health workers and to the failure to secure genuine community participation, which were accompanied by a progressive loss of enthusiasm. These are comparable to the drawbacks that have hampered the implementation of CHW schemes of widely differing scope and nature (24–26). In essence, all such problems relate to the ambiguity of the CHWs' position as a makeshift liaison between the health care system and the community (27).

In conclusion, this study indicates that the introduction of dedicated CHWs can lead to improved access to and utilization of health care for malaria and result in a decline of malaria morbidity. Nevertheless, a substantial part of these results can probably be attributed to the increase of geographical and financial accessibility to an essential drug (chloroquine), regardless of provider, that satisfied a perceived need in the community. At the same time, this suggests that deployment of dedicated CHWs may not be sustainable, since it leads to a series of problems that can be overcome only by training them for more comprehensive patient management and integrated care and offering them career prospects. A restricted approach seems meaningful only in specific epidemiological circumstances such as outbreaks or, perhaps, massive population movements of non-immune individuals into endemic areas.

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### Résumé

#### Utilisation des agents de santé communautaires pour la lutte antipaludique: une expérience au Zaïre

La possibilité d'utiliser les agents de santé communautaires pour administrer en temps utile un traitement efficace en cas de présomption d'accès

palustre a été évaluée dans la zone de santé de Katana au Zaïre. Dans chacun des 12 villages d'un secteur d'intervention (secteur A) comptant 13 000 habitants, un agent de santé communautaire a été formé à l'utilisation d'un algorithme simple de prise en charge des cas fébriles. L'agent de santé travaillait dans la communauté, sous la supervision de l'infirmière responsable du centre de santé du secteur. Une enquête comportant plusieurs passages a permis de surveiller pendant deux ans les tendances de la morbidité et de la mortalité palustres dans le secteur A et dans un secteur témoin écologiquement comparable (secteur B), où le traitement antipaludique restait uniquement disponible au centre de santé. Les taux de morbidité ont baissé de 50% dans le secteur d'intervention et sont restés stables dans le secteur témoin. Les taux de mortalité palustre ont varié dans les deux secteurs, mais les valeurs avant et après intervention sont restées sensiblement égales. Les indices parasitologiques suivaient les tendances de la morbidité: l'indice parasitologique et l'indice de forte parasitémie ont été divisés respectivement par 5 et par 6 dans le secteur d'intervention alors que leur baisse était beaucoup plus modeste dans le secteur témoin. Au cours de l'intervention, des modifications importantes du comportement de la population en matière de soins de santé ont été enregistrées dans le secteur A: le nombre d'épisodes palustres non traités a diminué de façon significative, un plus grand nombre de cas ont été traités à domicile (+16%) et par l'agent de santé communautaire (+16%), et le recours au secteur privé informel a fortement diminué (-23%). Le profil d'utilisation des services de santé dans le secteur témoin a peu varié, mais la proportion de cas de paludisme ayant reçu un traitement a diminué de 8%. Dans le secteur d'intervention, on a observé une augmentation de l'utilisation de la chloroquine comme traitement de première intention et une baisse de l'utilisation de la quinine (de 15% à 7%). Cette dernière restait largement utilisée dans le secteur témoin. Cette étude a permis d'identifier certains problèmes institutionnels, sociaux et financiers susceptibles de compromettre la viabilité de l'utilisation des agents de santé communautaires pour les activités de lutte antipaludique. Ces problèmes tiennent au fait que les agents de santé n'assurent pas la totalité des soins et qu'ils occupent une position ambiguë, à mi-chemin entre le système de santé et la communauté.

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