



Evaluation of two emergency interventions: outbreak of malaria and epidemic of measles

Orientale Province, DRC, June 2012-September 2013

EVALUATION REPORT

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MANAGED BY THE VIENNA EVALUATION UNIT

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Executive summary

Introduction

This report sets out the results of the evaluation of two emergency interventions: outbreak of malaria and measles epidemic, carried out by OCG in Orientale Province of the Democratic Republic of the Congo between June 2012 and July 2013. It is a retrospective evaluation that was done between March and May 2014, with the methodology based mainly on a review of documents and interviews with resource persons. Its objective was to capitalise on the lessons learned so as to improve preparation and response capacity for future epidemics in similar situations.

During the malaria outbreak, MSF led a four-month emergency intervention (28 June - 25 October 2012) targeting some 380 000 persons in the four health zones. In all, 58 761 cases of simple malaria were treated by the ambulatory units, and 3 537 cases of severe malaria were treated in four hospitalization units. In addition, 6 886 persons benefited from the “Test & Treat” strategy, 3 236 of whom (47%) tested positive and received ACT treatment.

To respond to the measles epidemic, MSF intervened for nine months (November 2012 - July 2013) and covered some 741 000 persons in the seven health zones. In all, 26 804 cases of simple measles and 4 114 cases of complications were treated by MSF. In addition, 189 067 children between the ages of 6 months and 15 years were vaccinated against measles, with coverage ranging, according to surveys, from 87% to 97%.

Results

Given the severity of the two situations, with mortality rates that significantly exceeded emergency thresholds, particularly during the malaria outbreak, and exceptionally high attack rates in both epidemics, we find that the two interventions met the acute needs of the population and are considered **highly pertinent**.

In this remote zone, with a dysfunctional health system, the **intervention strategy** targeting the therapeutic and preventive component and taking into account the two levels of the health system (hospitals and peripheral facilities), as well as the community, seems **appropriate** for attaining the set objective of reducing excess mortality related to the two outbreaks. However, we find that, for the two interventions, **the needs greatly exceeded the operational capacities of OCG**.

With respect to the **therapeutic aspect**, the evaluation shows that the treatment of severe cases in hospitals monopolised most of the resources and thereby reduced the capacity of the teams to consolidate their activities on the periphery. However, to reduce mortality in this context where the peripheral facilities cruelly lack resources and the care is not free of charge, it seems wise to **balance support between peripheral activities and work in the hospitals as best as possible**.

Concerning the **timeliness of intervention**, we note that the two outbreaks were **detected very late**. This is attributable mainly to inadequate epidemiological surveillance, but also to **inadequate emergency preparation**. This absence of work beforehand also contributed to the late opening of certain intervention sites, to the shortage of experienced human resources and to the tardy launch of vaccination campaigns.

With regard to the **effectiveness of the therapeutic aspect**, the evaluation shows that, despite challenges related to geographical access and the availability of resources, MSF succeeded in providing free treatment of simple cases in many peripheral facilities, as well as in introducing intensive paediatric care in a number of hospitals. However, we find that the availability of experienced human resources (national and expat) at the opening of projects and expertise in certain areas such as the organisation of care, the treatment of complicated paediatric patients, the provision of nursing care and the set up of a blood reserve are essential to guarantee quality care and keep mortality low.

The vaccination campaigns against measles got off to a **very late** start, for the most part at the end of the epidemic. The factors contributing to this delay were related to the authorisation to vaccinate, but also to the lack of preparation of MSF teams once authorisation was obtained. However, we find that, despite the logistical constraints, the vaccination coverages were **very satisfactory**.

The **advocacy** activities had a **significant impact** in the two interventions, such as success (even if late in obtaining authorisation to vaccinate against measles or the introduction of IV Artesunate in the treatment of severe malaria. However, the mobilisation of other actors was minimal during the two emergencies.

With regard to operations, medical supply and pharmacy management were considered the weak points of the two interventions.

Conclusions

Despite the late detection of the two emergencies and many problems in implementation, the two interventions are considered successes. It is probable that, in the absence of MSF, most of the 58 000 malaria cases and 30 918 measles cases would not have received medical treatment, and this would probably have resulted in considerably more deaths in the affected zone.

However, we find that often the same errors were repeated from one project to another and that there were few links between the projects. It seems pertinent to envisage, for this type of emergencies, evaluations carried out in real time in order to capitalise on good practices, but also to quickly correct errors in implementation.

Summary of recommendations

- ⇒ Improve preparation for emergencies (strengthening of BEP, standard kits, proactive monitoring, recruitment plan, advance work with the authorities...)
- ⇒ Enhance the role of relocated staff in emergencies in the DRC (clarification of deployment, improvement of skills, appropriate tools....)
- ⇒ Facilitate the delivery of intensive care in emergencies (expertise on opening, guidelines on oxygen therapy specific position for nursing care support...)

- ⇒ Guarantee the availability of a blood reserve during malaria emergencies (standard kit, practical guidelines, expertise on opening)
- ⇒ Achieve a better balance of resources between activities in hospitals and on the periphery (change of mentality, better co-operation with MPH ...)
- ⇒ Make supply autonomous during emergencies, clarify its role and relationships with other units
- ⇒ Strengthen pharmacy management during emergencies (appropriate tools, standard kits, support to those in charge)
- ⇒ Plan real time evaluations during emergencies

Abbreviations

ACT	Artemisinin-based combination therapy
ATB	Antibiotherapy
BEP	Bunia emergency pool
CFR	Crude fatality rate (taux de létalité brute)
CHW	Community health worker
HR	Human resources
CI	Confidence interval
CMR	Crude mortality rate
CPA	Complementary package of activities
DRC	Democratic Republic of the Congo
EPI	Expanded Program of Immunization
EPREP	Emergency preparedness plan (Plan de préparation aux urgences)
GAVI	Global Alliance for Vaccines and Immunization
GRH	General Referral Hospital
HA	Health area
HAT	Human African Trypanosomiasis
HC	Health centre
HUBU	Haut and Bas Uelé
HZ	Health zone
IEC	Information, education, communication
LogCo	Logistic coordinator
LRA	Lord's Resistance Army (Armée de résistance du Seigneur)
MICS	Multiple Indicator Cluster Survey (Enquête par grappes à indicateurs multiples)
MII	Mosquito net impregnated with insecticide
MPH	Ministry of Public Health
MSF	Médecins Sans Frontières
OCB	Operational Centre Brussels (Centre opérationnel de Bruxelles)
OCG	Operational Centre Geneva (Centre opérationnel de Genève)
OP	Orientale Province
RDT	Rapid Diagnostic Test
SAM	Severe acute malnutrition
SIA	Supplemental immunisation activities
SNIS	Système National d'Information Sanitaire
TT	Therapeutic treatment
U5MR	Under 5 Mortality rate
VC	Vaccination coverage
WHO	World Health Organisation

1 Introduction

1.1 Objectives of the evaluation

The **general objective** of this evaluation is to capitalise on the lessons learned in order to improve the capacity to prepare for and respond to future epidemics of measles and outbreaks of malaria in similar contexts.

Specific objectives:

- ⇒ To evaluate the appropriateness and effectiveness of these two emergency interventions (strategic choices, timeliness of interventions, functioning , etc.)
- ⇒ To highlight the positive and negative aspects of these two interventions
- ⇒ To make recommendations for future interventions in similar contexts

1.2 Methodology

The evaluation methodology consisted mainly in

- a) a review of documents – activity reports, end-of-mission reports, final reports, survey reports, reference works, articles, etc.
- b) rapid synthesis and analysis of data available in the reports and from Qlik view
- c) interviews with resource persons (Geneva, coordination, field)

The documents for review were provided mainly by the responsible program officer in Geneva, who also identified the main sources likely to provide answers to the questions in this evaluation. The additional documents were gathered following interviews with resource persons in accordance with the topics that needed to be further investigated. In addition, searches for complementary documents were done to further explore certain topics or to verify contradictory information that emerged during the interviews.

Data analysis was not part of this evaluation. Only a quick search and analysis of data was carried out for the descriptive part of this report.

The interviews with resource persons constituted the basis of this evaluation. In all, 67 people were interviewed during this exercise, including 16 who were seen during our visit to Geneva. Of the 107 persons contacted for a distance interview, 57 responded positively and 51 were able to be interviewed via Skype or by telephone.

Fifty of the 67 people interviewed (75%) had a medical profile¹ and 17 (25%) were non-medical².

¹ Doctors, nurses, laboratory assistants, pharmacists, IEC, epidemiologists

² Administrators, logisticians

Eleven people interviewed (16%) were based in Geneva or were flying referents at the time of the two emergency interventions. Twelve people (18%) were members of coordination and 44 (66%) worked in the field.

1.3 Limitations

The principal limitations of this evaluation relate to the time elapsed between the two interventions, which took place between June 2012 and July 2013, and their evaluation, which began in March 2014.

Because of this delay, the field visit and interviews with the target population were not taken into account. Nor were the opinions of the beneficiaries included in this evaluation.

In addition, mainly for practical reasons (difficulty of organising distance interviews) no national and/or relocated staff were interviewed during this exercise. Considering their central role in the two interventions, their exclusion from the interviews is a weakness of the methodology chosen.

Moreover, some resource persons in the two interventions were not available for the interviews, mainly because of their participation in another MSF mission.

The absence of certain key documents (e.g. final report on the measles intervention) did not assist in understanding this intervention.

2 Context and description of interventions

2.1 Context of the intervention

The two emergency interventions (malaria outbreak and measles epidemic) that are the subject of this evaluation took place in the districts of Haut and Bas Uélé (HUBU) in Orientale Province. OCG has been present in this province since 2001 and two projects were underway there at the same time as these two emergency interventions: a regular program to fight Human African Trypanosomiasis (HAT) based in Dingila, and an emergency programme based in Dungu, targeting the population affected by the repeated attacks of the LRA. The latter was ended in December 2012. Despite its reduced presence, the LRA remains active in the zone, imposing security constraints on the MSF teams in accessing certain areas of Haut Uélé.

MSF was the only actor intervening in the two emergency situations. Despite the mobilisation of other actors by MSF, the attention of other humanitarian actors present in the zone was mainly directed towards the conflict in Kivu.

It should be noted that, concurrently with these two emergency interventions, MSF teams also responded to an Ebola epidemic that was declared in the district of Haut-Uélé (Isiro) and to a small outbreak of meningitis in Buta. These two interventions are not the subject of this evaluation.

2.2 Operation of the health system in the RDC

The health system of the DRC was inspired by the 1978 Declaration of Alma Ata, based on the Primary Health Care Strategy, and by the 1987 Bamako Initiative, focussed on community participation and the cost recovery system. The costs are often prohibitive for most of the population, and it is estimated that only 20% of the population makes use of health services (1). This is mainly related to financial and geographic inaccessibility.

In this system, the operational unit is the Health Zone (HZ), which covers between 100 000 and 200 000 inhabitants (2). Orientale Province has a total of 83 HZs. The health facilities of the HZ are divided into two levels linked by a referral system. On the first level, health centres (HCs) offer a Minimum Package of Activities to a population of some 10 000 inhabitants spread over a geographical area of 5 to 8 km² and corresponding in the health plan to a Health Area (HA). On the second level, General Referral Hospitals (GRHs) offer a Complementary Package of Activities (CPA), including surgical care and blood transfusion. In the remote zones, a network of community health workers (CHW) provides, theoretically, a bridge between the population and health services. However, as the CHWs work on a volunteer basis, their activities are often difficult to seize.

2.3 Malaria situation in the DRC and development of the malaria outbreak in Orientale Province

Malaria remains one of the major public health problems in the DRC, being the primary cause of morbidity and mortality among children under 5. Most of the Congolese population (97%) lives in areas with high transmission and *Plasmodium falciparum* is responsible for over 95% of infections.

Katanga Province, Orientale Province and Kinshasa were the regions that recorded the most cases of malaria between 2007 and 2011 (3).

In 2012, over 9 million cases and more than 21 000 deaths were reported by health authorities³. However, these figures represent only the tip of the iceberg because most of those stricken by malaria do not go to health facilities.

The availability of malaria diagnostic tests and treatments (RDT + ACT) at health facilities is uncertain, given the lack of a partnership to support them.

Moreover, the availability and use of preventive measures such as mosquito nets is low in the DRC. The last MICS showed that only 38% of children under 5 had slept under a mosquito net impregnated with insecticide (MII) prior to the survey (4).

Between June 2011 and June 2012, a number of MSF sections were induced to intervene in outbreaks of cases of malaria, localized phenomena in various provinces.

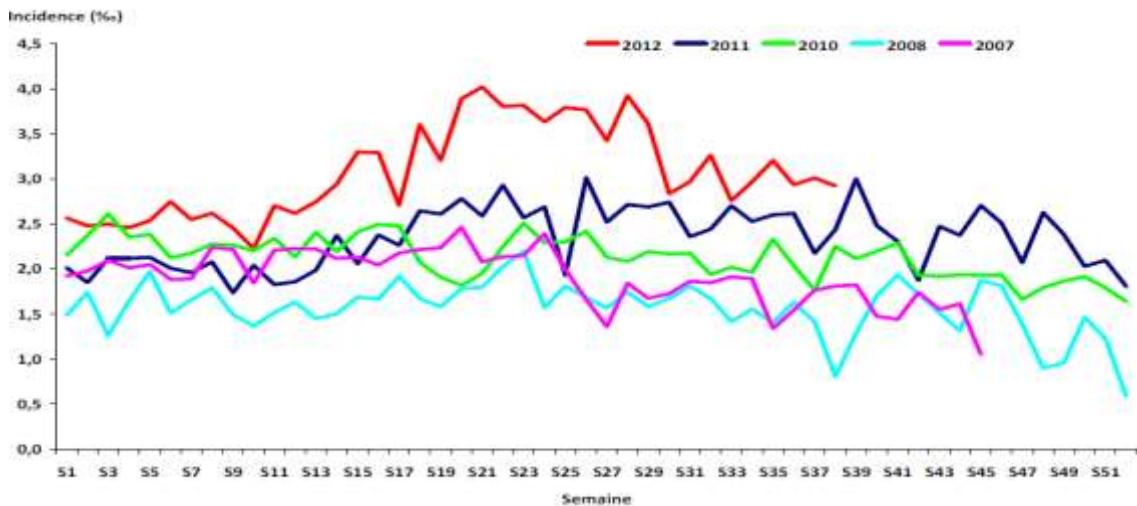
During this period, approximately the following numbers of cases were treated:

- some 70 000 cases in Maniema, in Equateur and in OP for OCB
- some 15 000 in Katanga for OCP
- some 30 000 in Katanga for OCA

In Orientale Province, transmission of malaria remains intense and permanent with an upsurge of cases of malaria over a five- to eight-month period coinciding with the rainy season. While annual variations of the malaria incidence are usually observed in this context, the exceptional nature of the malaria outbreak observed in OP in 2012 should be emphasized (Figure 1-2).

³ Source: PNLP

Figure 1: Weekly Incidence of malaria in Orientale Province, DRC, 2007- 2012 (S38)

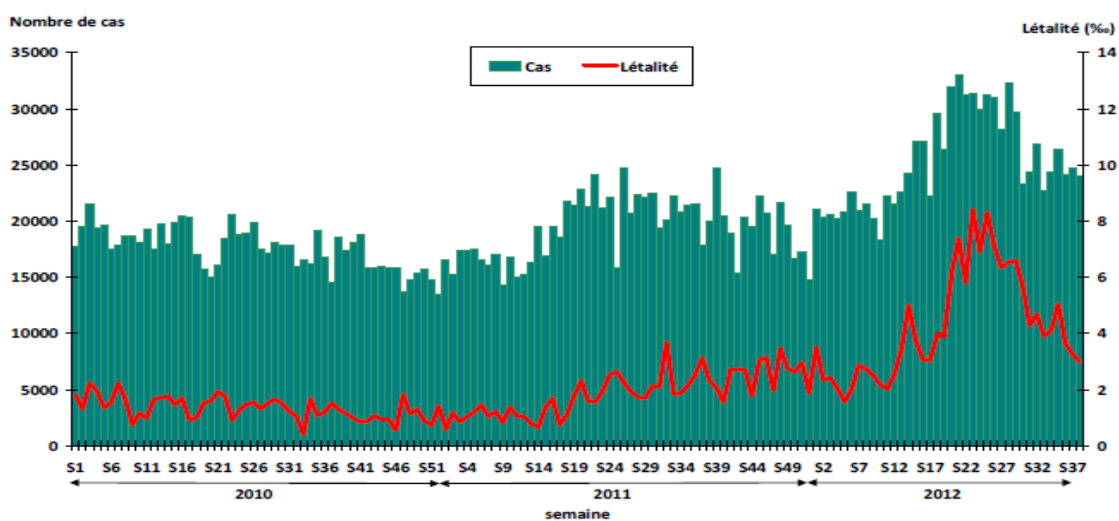


Source: EPICENTRE (based on cases and deaths reported in health facilities)

In a context of ongoing transmission of malaria, we do not speak of a true epidemic. However, this malaria outbreak with significant excess mortality related both to high incidence and to an unusual seriousness of malaria cases, was considered an emergency situation.

Figure 1 shows that the malaria incidence in OP gradually rose between 2010 and 2012. In 2012, the number of malaria cases began to increase from week 10 and reached its peak in week 21, followed by a plateau until week 28 and a gradual decrease from week 29. Lethality was considerably greater in 2012 compared to the previous years. It began to increase from week 11 (2.25%) and reached its peak in week (4.32%)

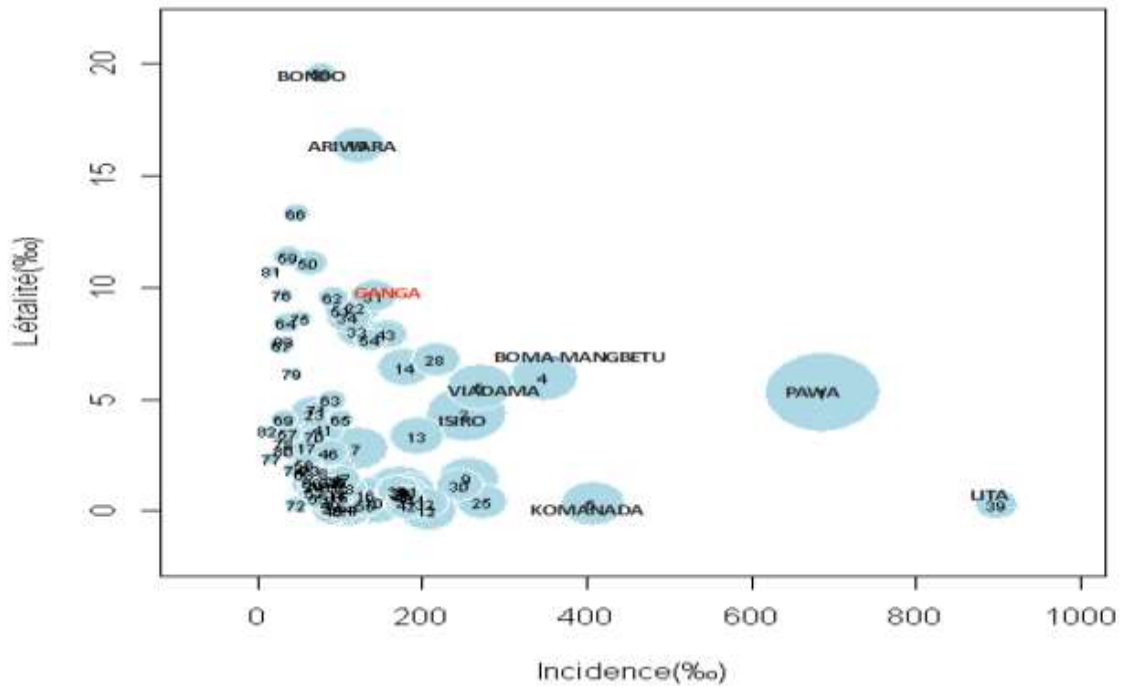
Figure 2: Change in lethality of malaria in Orientale Province, DRC, 2007-2012 (S-S38)



Source: EPICENTRE (based on cases and deaths reported in health facilities)

The descriptive report of the malaria outbreak prepared by EPICENTRE (3) shows its **focalised character**, with the presence of several pockets particularly affected by this outbreak, the largest number of cases being recorded in the Pawa HZ and very high case fatality rates in the Bondo (19.5‰), Poko (16.4‰) and Aketi (13. ‰) HZs, Figure 3.

Figure 3: Distribution of health zones by incidence of malaria and lethality



The severity of this emergency was shown by the retrospective survey of mortality conducted by MSF in the Pawa HZ in November 2012 (5). This survey showed disturbing mortality rates, significantly exceeding the internationally recognized emergency thresholds⁴. For the entire reference period⁵ the crude mortality rate (CMR) was estimated at 1.5/10 000 persons/day (CI 95% 1.2-1.7) and the mortality rate of children under age 5 (U5MR) was estimated at 4.56/10 000 persons/day (CI 95% 3.1-5.7). The U5MR for the period between April and July 2012 rose to 6.83/10 000/day (CI 95% 4.3-9.3). Causes of death possibly compatible with malaria corresponded to 63.9% of reported deaths.

The comparative table of CMRs and U5MRs from mortality surveys conducted by the various actors in the same region shows mortality rates higher in 2012 compared to 2010 (Table 1).

⁴ ≥1 deaths/10,000/day and ≥2 deaths/10,000/day among children under age 5

⁵ The mortality survey covered the period between 25 December 2011 and 31 October 2012

Table 1: Comparison between CMRs and MRU5s according to four different surveys (6)

Study	Location	Date	Reference period	Results
COOPI	Wamba & Pawa, DRC	Mar. 2010	15.12.2009 – 15.3.2010	CMR: 0.75/10 000/d (0.45-1.04%)
				U5MR: 1.52/10 000/d (0.75-2.29%)
ACF	ZS Pawa, DRC	Dec. 2010	15.09.2010 – 15.12.2010	CMR: 0.34/10 000/d (0.18-0.65%)
				U5MR: 0.47/10 000/d (0.18-1.21%)
Epicentre MSF-CH	Danga, DRC	Sept. 2012	01.01.2012-25.09.2012	CMR: 1.06/10 000/d
				U5MR: 2.91/10 000/d
MSF-CH	ZS Pawa, DRC	Nov. 2012	25.12.2011 – 31.10.2012	CMR: 1.51/10 000/d (1.2-1.8%)
				U5MR: 4.56/10 000/d (3.1-5.7%)

Various hypotheses concerning the upsurge and gravity of the cases of malaria have been invoked (6, 7), such as a) reduction in the effectiveness of ASAQ ; b) coinfection with another pathogen; c) change in virulence; d) increased vulnerability of the population; e) change in climatic or entomological factors; f) deterioration of certain components of the fight against malaria; g) major demographic changes; h) changes in epidemiological monitoring; i) change in access to care.

It has not been possible to confirm any of these hypotheses. However, the methods needed to adequately explore them were not brought to bear.

Moreover, OCB, which intervened in several malaria outbreaks in the DRC between 2011 and 2012, attributes them mainly to structural problems, particularly as related to a gradual deterioration of all components of malaria control (8).

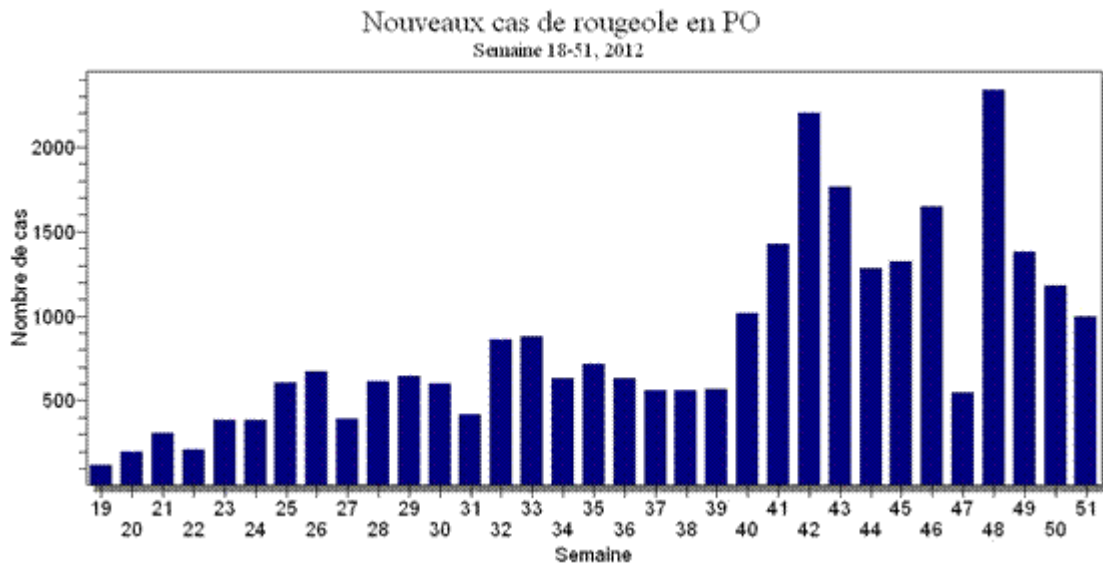
2.4 Measles situation in the DRC and development of the measles epidemic in Orientale Province 2012-2013

Measles is endemo-epidemic in the DRC. The national policy of the Expanded Program of Immunization (EPI) provides for a single dose of anti-measles vaccine (AMV) administered at the age of 9 to 11 months. In addition, supplemental immunization activities (SIA) are regularly organised by the Ministry of Public Health (MPH) in collaboration with the World Health Organization (WHO) and GAVI. However, vaccine coverage (VC), while it has been increasing since 2002, is still below the 95% recommended by the WHO. Coverage was estimated at 74% (CI 95% 73-75) during the national survey carried out in 2012(9).

The low vaccination coverage rate, plus the tardy and poor quality SIA, as well as the slowness of reactive vaccinations, contributed to a large measles epidemic that has been rampant in the DRC since 2010 and successively reached 7 of the 11 provinces of the DRC (2010-2011: Katanga, Maniema, Kasai Oriental and Occidental, Sud Kivu, 2013: Equateur and Orientale Provinces (10).

The first cases of measles in 2012 were reported in Orientale Province in week 18, and the peak of the epidemic was reached in week 48 (11) (Figure 4). By week 51, 28 303 cases and 991 deaths had been reported by the MPH (i.e., an overall lethality rate of 3.5 %).

Figure 4: Development of cases of measles in Orientale Province, DRC, 2012



Source: NHIS of Orientale Province

It should be noted that the attack rates recorded by the MPH during this epidemic were very high in certain zones (e.g., 10.7% in the Aketi HZ between W 1 and W 31 in 2013). However, the case fatality rates reported remained relatively low (0.5% in the Aketi HZ). To confirm these attack rates and to explore the mortality rates specific to measles and the associated factors, a retrospective study was conducted in Aketi by EPICENTRE in November 2013 (12).

That study confirmed the especially high measles attack rates, particularly among children under age of 5 (35.0 %, CI 95%: 31.2-38.7) with a case fatality rate of 7.1% in the same age grouping (CI 95%: 31.2-38.7). Measles was the principal cause of death throughout the reference period⁶. On the other hand, the mortality rates reported in this study (CMR estimated at 55/10 000 persons/day (CI 95%: 0.39 – 0.70), and the U5MR estimated at 1.74/10 000 persons/day (CI 95%: 1.23 – 2.25) were lower than those reported during the malaria outbreak.

⁶ The survey covered a reference period from 25 December 2012 to 9 October 2013.

2.5 Description of emergency interventions

During the **malaria outbreak**, MSF conducted a four-month emergency intervention (28 June - 25 October 2012) targeting some 380 000 persons living in four of the 83 health zones of Orientale Province (Ganga-Dingila, Poko, Pawa, Boma-Mangbetu). During this intervention, MSF set up four hospitalisation units in existing health facilities (GRH in Dingila and Niapu, HC in Zobia, Protestant hospital in Nebobongo) (*Figure 5*). MSF also provided free of charge care for malaria cases in over 100 peripheral health facilities. In all, 58 761 simple malaria cases were treated by the ambulatory units, and 3 537 severe malaria cases were treated in hospital units (7). In addition, 6 886 persons benefited from the “Test & Treat” (T&T)⁷ strategy, 3 236 (47%) of whom who tested positive received ACT treatment. A summary of the malaria intervention is shown in Table 2.

Figure 5: MSF hospitalisation sites during the malaria intervention

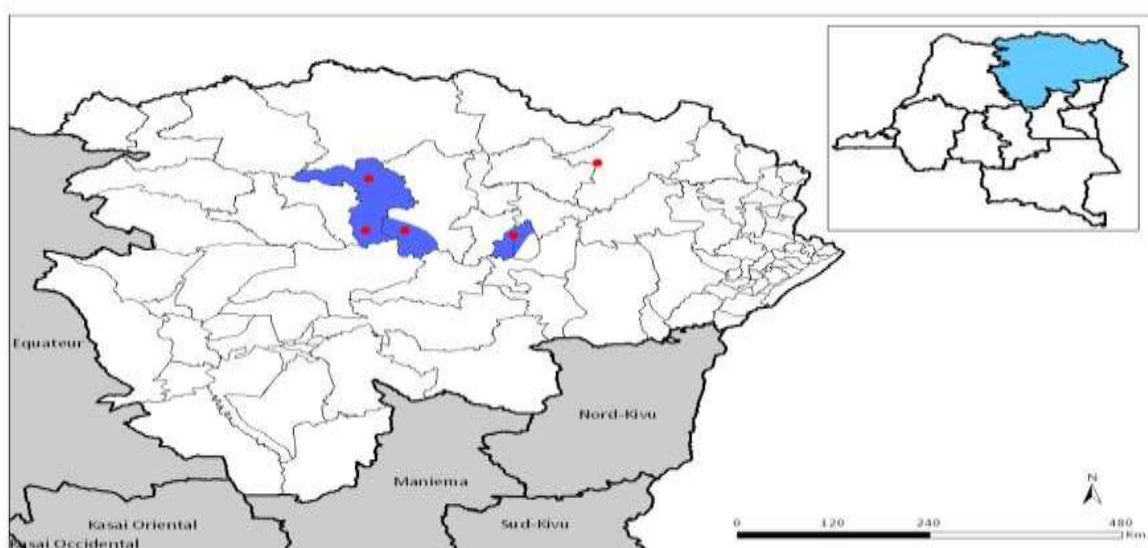


Tableau 2: Summary of malaria intervention

	Dingila	Zobia	Niapu	Pawa/ Nebobongo	TOTAL
Length of intervention	01/07-31/08	15/06-29/09	15/07-29/09	5/08-25/10	15/06-25/10
No. of simple malaria	12 060	18 571	7 244	21 665	59 540
No. of severe malaria	220	1 262	704	1 251	3 437
No. of transfusions	?	?	?	312	?
No. of deaths	8	12	4	60	84
Hospital fatalities	3.6%	1.2%	0.7%	6.1%	2.4%
T&T Stratégie, RDT done (%RDT+)	0	4 448 (48%)	0	2438 (52%)	0

⁷ Detection of systemic malaria with a RDT and treatment of all RDT+ cases (symptomatic or asymptomatic)

To respond to the **measles epidemic**, MSF conducted a nine-month emergency intervention between November 2012 and July 2013 that covered some 741 000 persons in seven HZs of OP (Ganga-Dingila, Buta, Poko, Titule, Aketi, Bondo, Likati), *Figure 6*. The therapeutic component was implemented in all seven HZs via the hospital units and support to peripheral facilities. The preventive component (reactive measles vaccination) was carried out in five HZs⁸. In all, 26 804 simple measles cases of and 4 114 cases with complications were treated by MSF. In addition, 189 067 children between 6 months and 15 years of age were vaccinated against measles, with vaccine coverage ranging, according to surveys, from 87% to 97% (12). A summary of the measles intervention is shown in Table 3.

Figure 6: MSF intervention sites during the measles epidemic

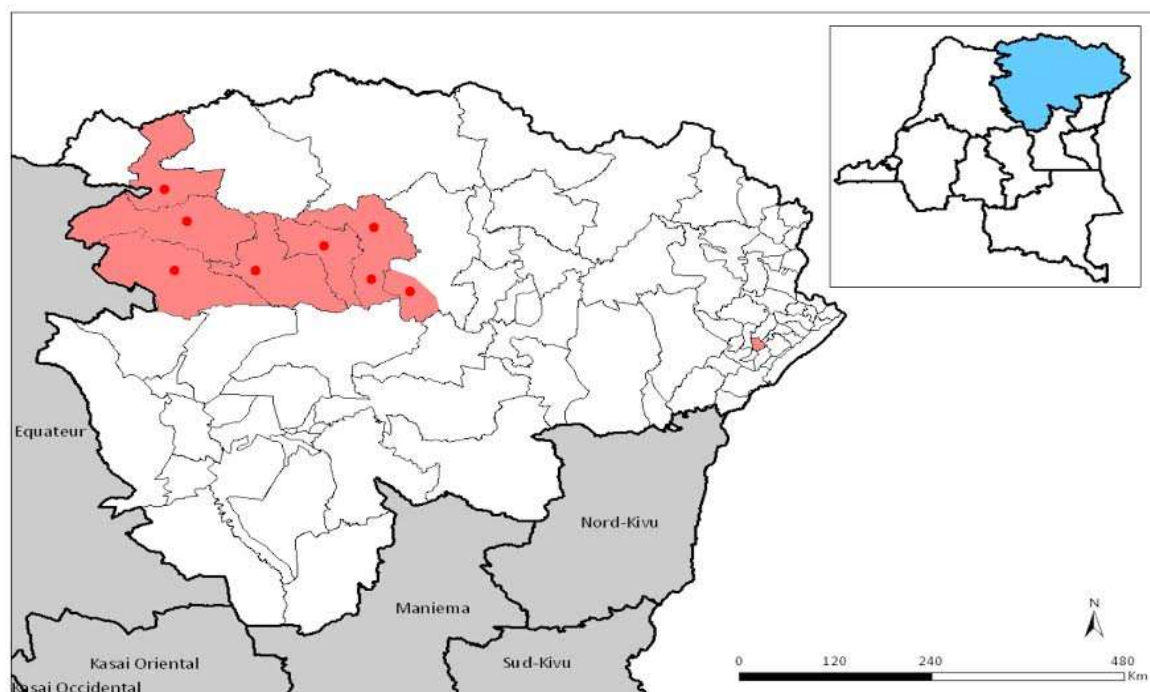


Table 3: Summary of measles intervention

	G.Dingila - Zobia	Buta	G.Dingila Nord	Niapu	Titule	Aketi	Bondo	Likati	Total
Length of intervention	10/11/12 13/01/13	21/11/12 15/03/13	5/12/12 12/03/13	10/12/12 13/01/13	20/12/12 20/02/13	09/02/13 30/06/13	04/04/13 17/07/13	26/04/13 30/06/13	10/11/12 17/07/13
Simple cases	2 345	4 203	2 486	306	3 055	12 359	1 591	459	26 804
Severe cases	310	875	462	68	240	1 633	430	96	4 114
No. of deaths	13	25	9	2	4	23	4	0	80
Hospital fatalities	4.8%	3.1%	2%	2.9%	1.1%	1.4%	0.9%	0%	2%
Children vaccinated	13 317	35 452	28 439	?	30 080 ⁹	52 895	38 068	20 896	189 067

⁸ Vaccination in two HZs (Titulé et Poko) was carried out by the MPH with support from UNICEF

⁹ Vaccination by MPH

It should be noted that the last period of measles intervention coincided with the peak of malaria in 2013. Given the large number of malaria cases among patients suffering from measles, MSF kept the project in Aketi open for five weeks after the closure of measles activities to treat the malaria cases.

In addition, during the measles intervention a number of cases of whooping cough were reported and treated in the Titulé HZ without a specific intervention by MSF.

2.6 Intervention strategy

The two intervention strategies (malaria and measles) were designed to reduce excess mortality in the most affected zone of Orientale Province. Four different approaches were initially proposed to achieve the principal objective:

- “therapeutic” approach
- “preventive” approach
- “advocacy” approach
- “research and innovation” approach

However, we find that, during the two emergency interventions, MSF carried out mainly therapeutic activities.

During the malaria emergency, MSF decided not to become involved in preventive activities, such as the distribution of impregnated mosquito nets (MIs) or home spraying, mainly because of the logistical difficulties of this type of intervention in a context of very limited geographical access. MSF did, however, attempt to mobilise other actors, such as UNICEF, to carry out these preventive activities. However, advocacy efforts proved to be ineffective.

With regard to the measles epidemic, the preventive activities (mass vaccination) were anticipated from the outset of the measles intervention. Nevertheless, for various reasons described elsewhere in this report, vaccination was carried out very late in terms of the development of the epidemic.

The therapeutic component was designed in a similar manner for the two interventions, with the support of MSF on both levels of the health pyramid, as well as at the community level.

MSF’s support on the various levels of the health system is shown in Table 4.

Table 4: MSF Intervention on various levels of the health pyramid

Health level	Strategy/Activity	Specific support	General support
Secondary health facilities (general referral hospitals, private facilities (Nebobongo), health referral centres (Zobia))	<ul style="list-style-type: none"> - Free TT of complicated cases (malaria and measles) - Intensive care - Direct blood transfusion - TT of malnutrition 	<ul style="list-style-type: none"> - Materiel and medicines support - Expat doctors and nurses - Relocated doctors and nurses - Bonuses to MPH personnel 	<ul style="list-style-type: none"> - Compensation envelope for cost recovery - Donation of medicines for 3 months to guarantee care remains free after MSF leaves
Primary health facilities (health centres and health posts)	<ul style="list-style-type: none"> - TT of simple cases - Referral and transfer of complicated cases - Pre-referral treatment of serious cases (Rectal Artesunate) - Detection of SAM - Strengthening of epidemiological monitoring 	<ul style="list-style-type: none"> - Training - Medicines support - Bonuses to MPH personnel - Supervision by an expat nurse - 1 IEC/3 sites 	<ul style="list-style-type: none"> - Compensation envelope for cost recovery - Donation of medicines for 3 months to guarantee care remains free after MSF leaves
Community (Support to existing network of CHWs)	<ul style="list-style-type: none"> - Awareness (symptoms and free care) - Active detection of measles cases - Limited TT of malaria cases by certain CHWs - Attempts to monitor community mortality (CHWs) - T&T strategy 	<ul style="list-style-type: none"> - Training - Supervision by an expat nurse - 1 IEC/3 sites (malaria) - Bonuses to RECOs 	

It should be noted that, in the absence of authorisation by the MPH to provide mass treatment of malaria (without performing an RDT), MSF anticipated putting in place a Test & Treat strategy (systematic detection of malaria + treatment of all cases with a positive RDT), while evaluating its feasibility and its plus value compared to “classic” methods. This approach is described in more detail in the chapter entitled “Effectiveness of the research and innovation component.”

3 Results

3.1 Relevance and appropriateness of intervention

3.1.1 Relevance of intervention

The two emergency interventions (malaria and measles) met the real needs of the population and are considered highly relevant. The intervention criteria, as well as the exit criteria, were clear to the MSF teams, the health authorities and the population.

The two epidemics showed exceptional attack rates, and the mortality rate was very high, especially during the malaria outbreak. The perception of a particularly serious situation was widely expressed by the persons interviewed: *"The situation was beyond dramatic. I had the impression that it was war. There was not a family without a death. The population was traumatised, they had never seen anything like it...."*

According to those interviewed, the population greatly appreciated MSF's strong presence in this remote corner of the DRC: *"When I returned from working for the regular programme in Dingila, the people in the villages recognized me and thanked me for the emergency malaria intervention that saved many of their children. Even if a child died, the mother had the impression that MSF had done everything to save it."*

3.1.2 Strategic choices

In general, the intervention strategy (described in detail in chapter 2.1.6) targeting the therapeutic and preventive components and working with the two levels of the health system (hospitals and peripheral facilities), as well as the community, seems appropriate for achieving the objective of reducing excess mortality in the most affected zones of Orientale Province.

We find, however, that the principal focus of the two interventions was essentially on the treatment of severe cases in hospitals. Although activities on the periphery were initiated quite rapidly (1 to 3 weeks after the IPD), the hospitals continued to drain most of the resources and the outreach teams lacked the means to consolidate their activities (supervisory training, availability of motorbikes, etc.). However, we find that, in the context of the dysfunctional and underutilized health system, the free treatment in peripheral facilities and the availability of motorbikes to transfer patients radically improved access to care. To further reduce mortality, it therefore seems appropriate to launch activities in the hospitals and on the periphery simultaneously and to better balance resources between the two components. This was also the conclusion of the EPICENTRE report that looked into the factors associated with measles fatalities (12). It found that the case fatality rate was lower among persons who had been treated in an HC and/or in a hospital. However, the reduction in fatalities following medical treatment was much lower among persons living far from a hospital. This difference disappeared, however, with the introduction of free treatment of measles cases in peripheral facilities.

The preventive component was absent in the malaria intervention and very tardy in the measles intervention. This certainly contributed to the very high attack rates and to the particularly high number of severe cases.

On the one hand, the decision not to become involved in preventive activities seems justified for the malaria intervention because of administrative difficulties and the small impact expected in the advanced phase of the malaria outbreak. On the other hand, the delay in vaccination against measles is regarded by most of the persons interviewed as a missed opportunity to stop the progress of the epidemic and reduce complications and deaths due to measles.

Moreover, some strategic aspects were questioned during the interviews:

- Little engagement by MSF with the health authorities, particularly in Kisangani.
- Lack of clarity concerning the treatment of patients other than measles cases = lack or inadequate quantity of medication to treat certain pathologies, unavailability of transfusion kits in certain projects, etc.
- Opinions were divided concerning the decision to support the private hospital in Nebobongo instead of the GRH in Pawa. For some, this decision led to antagonistic relationships with the MPH and instability in the health system. For others, the decision was justified because the facility was in better condition (fewer logistical demands), the staff was better trained, the facility was part of the health system and provided better access to the neighbouring zone, which was also affected.
- Treatment of malaria by the CHWs considered unfeasible because of the low standard of CHWs and the lack of resources for training and close supervision. However, this strategy seems highly appropriate for remote zones (e.g., Zobia)

3.1.3 Preparation for emergencies in the DRC

While the intervention strategy seems appropriate to the emergency situations evaluated, the preparation strategy for emergencies appears to be inadequate.

To make the response to emergencies in the DRC more effective, an emergency pool was created in Bunia (BEP) by OCG in 2007 with the objectives of carrying out epidemiological surveillance in Orientale Province, investigating alerts and triggering emergency interventions before the arrival of emergency teams, or ensuring the general management of small emergencies.

We find that, at the time of the two emergency interventions evaluated, the BEP was not able to properly meet these objectives (undersized team, lack of leadership, absence of tools, etc.). In addition, the HR mobilisation strategy of the regular projects for the emergencies was not clear, the EPREP stocks were not up to date, epidemiological surveillance was not functional and links with the health authorities in Kisangani responsible for HUBU were virtually non-existent. Moreover, the emergency teams complained about the lack of administrative tools to facilitate HR management and the agreements with the Health Zones. Many shared the feeling of “*working in a country where MSF had never set foot.*”

3.2 Effectiveness of intervention

3.2.1 Timeliness of intervention

We find that the outbreak of malaria in Orientale Province was detected very late. While MPH statistics show that deaths from malaria gradually increased starting in week 11, with the peak being reached in week 23 (Figure 2), the first exploratory mission was only launched in week 24.

The results of this evaluation show that the delay in detecting this outbreak is related mainly to ineffective epidemiological surveillance by regular program teams from the Bunia emergency pool (BEP) relying principally on alerts from the health authorities. We also find that the BEP was not properly sized and equipped to provide proactive epidemiological monitoring throughout Orientale Province. In addition, it seems that the exchange of epidemiological information between sections of MSF was not very effective.

It should be noted that it was the population itself that alerted the MSF team in Dingila about the unusual mortality of children suffering from fever in Zobia. Following receipt of this information, an exploratory mission was quickly organized by the BEP which forwarded the information on the critical situation in Zobia promptly to the emergency cell. The emergency cell then sent an emergency coordinator, who immediately confirmed the results of the first “exploratory mission” and the need for an emergency intervention.

MSF teams were then quickly deployed in the field, with rapid start-up of the project in Zobia, and a malaria unit was set up at the GRH in Dingila (the HAT project was put on stand-by). On the other hand, the start of the other projects (Niapu, Nebobongo) was slower and, due to the unavailability of HR, materiel and medication, the Nebobongo project was begun only after 3 weeks of the exploratory mission.

We also find very late detection of the measles epidemic. Although measles cases gradually increased in Orientale Province from week 18 (Figure 4), and in MSF’s intervention zone from week 33, the emergency teams left the zone in accordance with the set plan in week 43 (end of the malaria emergency). It should be noted that the OCG was unaware that a measles intervention was being conducted by the OCB in the neighbouring zones.

Despite the presence of a number of measles cases in the hospitals, active surveillance of measles cases was not begun and staff of the health facilities received no training in the detection and treatment of measles cases. It was only in week 43 that MSF teams began to be alerted about high levels of measles cases in a number of localities in Orientale Province and several exploratory missions were launched.

We also find late detection of this epidemic despite the presence of emergency teams in the zone (weeks 26-43). The explanations are similar to those already cited for the malaria outbreak: the defective MPH epidemiological surveillance system and the absence of proactive monitoring by MSF, as well as a lack of communication with the others sections of MSF.

As with the malaria outbreak, once the measles epidemic was confirmed by the MSF teams, the intervention was quickly launched. However, we also find that the implementation of some projects (e.g., Bondo, Likati) was late (5-6 months after start-up of the first project).

3.2.2 Identification and coverage of affected population

The identification of target zones for the epidemiological investigations was based mainly on the alerts coming from health authorities or directly from the population. We note that each investigation except that in Poko led to the opening of a new project.

The two intervention teams complained about the lack of an overview of the development of the epidemiological situation throughout Orientale Province. This prevented better planning of the opening and closing of the projects, as well as complete coverage of the most affected zones. *“It was a discovery process. The scale of intervention was unexpected. We were not prepared, everything was improvised.”*

Retrospectively, we find that, in the two interventions, the needs greatly exceeded the operational capacities of OCG. However, the view was expressed in interviews that resources could have been better rationalised to optimise the interventions. *“We did not learn from the errors made. If we had been better organised and prepared, we could have done more.”*

The LRA zone, located north of the Dungen-Doruma axis, was a special case. It was supposed to benefit from a strategy adapted to the specific security context (access by plane, dropping malaria tests and treatments, staff training, support for free care). Due to the lack of an aircraft to transport the staff following the decertification of the ASF aircraft based in Dungen, only a single shipment of medication was organized for Doruma. This support seems inadequate for the situation reported.

3.2.3 Effectiveness of therapeutic component

3.2.3.1 Treatment of cases of malaria and measles

Treatment protocols

At the time of the malaria emergency, a specific protocol was developed for the treatment of severe malaria cases, with several differences compared to the national protocol applied by the regular program:

- IV Artesunate was introduced in agreement with the MPH¹⁰
- Systematic use of antibiotics (Ceftriaxone) because of the suspicion of a coinfection with non-typhi salmonella was required by the MPH for a time, but was quickly abandoned because its plus value was not demonstrated.

The treatment protocol was harmonised between the regular programme and the emergency programme, although the use of IV Artesunate was late in the regular programme, pending a formal agreement with the MPH before the introduction of this new treatment.

During the measles intervention, an internal OCG paediatric and nutritional treatment protocol for clinical cases during a measles epidemic (13) was used. This protocol was considered very clear and practical by the teams in the field. However, many adjustments were required because of the

¹⁰ A verbal agreement was made by the Minister of Health during his visit to Haut Uélé after receipt of a document on the benefits of IV Artesunate produced by CAME (“Make the switch”)

unavailability of certain medications or the availability in insufficient quantities of others, such as the elimination of certain systematic treatments, a change in antibiotics or of the dosages used. These repeated adaptations created confusion within the care teams with respect to the procedures to follow.

It should be noted that, in the two interventions, the treatment protocol to follow was clear for cases of malaria and measles and their complications. But the treatment of patients suffering from other pathologies, particularly severe acute malnutrition, was less obvious.

Quality of treatment in hospitals

The results of this evaluation show that there were great disparities in the quality of treatment among the various projects.

In the malaria intervention, the quality of care at the hospital in Nebobongo was particularly questioned, especially during the first four weeks of the intervention. Various factors were cited during the interviews:

- Poor quality of local nurses and unavailability of relocated nurses - Nebobongo was the third project to open and the pool of relocated staff was exhausted.
- Lack of national doctors (a single doctor for all the hospital units)
- Inadequate supervision by the expat doctor – first mission without experience in paediatrics and tropical diseases
- Tardy visit by the paediatrician – difficulty in being able to send a paediatrician quickly
- Disorganisation of treatment units (triage, patient rounds, etc.) – team overmatched
- Management team too occupied with management of the pharmacy and orders rather than spending time on staff training and the organisation of care – shortage of basic materiel and essential medications

The problems described in the Nebobongo example were also very common during the measles intervention. In the latter, the quality of treatment also varied from one project to another and at different times. The presence of an experienced team at the start of the project seems to be the key point for the quality of care.

Moreover, the example of Nebobongo shows that the absence of a person experienced in emergency paediatric care at the start of a project can result in high rates of intra-hospital mortality. The mortality rate in Nebobongo of around 15% in the first four weeks of the intervention quickly fell to less than 5% after the team's corrective action following the visit by the paediatric referent.

The results of this evaluation also show the need for a staff person solely in charge of supervisory training in quality of care. This person must be freed from managerial tasks such as management of the pharmacy, of medical human resources, peripheral activities, etc. We find that this type of expertise (persons experienced in organisation and supervision in a hospital environment) was rare in the field and, even if present, such persons were often co-opted by the managerial tasks cited above. This contributed to the gaps noted in triage, patient circuit, treatment of patients upon admission, monitoring of patients, correct taking of medication, etc.

We also find that the presence of experienced laboratory assistants is essential, especially during the setup of blood transfusion, in order to ensure security of the procedure.

Treatment in peripheral facilities

The outreach component was designed to make treatment available as close as possible to the communities in order to provide early care for simple cases and thereby prevent their turning into more lethal, severe cases. Deployment to all the health centres (and some health posts) in selected zones took place. Although resources for this component were undersized considering the large number of malaria and measles cases treated in the peripheral facilities and the number of cases referred, it seems that this component was quite effective. However, we do not have enough data to evaluate the quality of this component.

3.2.3.2 Blood transfusion

Blood transfusion was an Achilles heel of the two emergency interventions. Given the absence of a reserve of blood in the health facilities, the lack of blood was sorely felt, particularly during the malaria intervention.

Although the direct blood transfusion system was set up quite quickly in all the projects, children were often transfused late (2-3 days' wait) because of a shortage of donors among the family members accompanying the patients. To help solve the blood problem, a small network of donors was mobilised (living blood bank) in some projects, but this did not solve the problem of a shortage of blood.

With regard to establishing a blood reserve in the hospitals, although this was envisaged by the emergency cell and coordination and was strongly advised by the referring paediatrician, the field teams were reluctant for fear of not having enough donors, but also of not sending contradictory messages to the community about the use of blood solely for the family. Without clear instructions, after receipt from the cold chain set up for the blood bank, rather informal storage of several blood bags was initiated by the national laboratory assistant at the hospital in Nebobongo.

It should be noted that the experience of the BM hospital in Bunia was not adequately exploited to convince the teams of the benefits and feasibility of setting up a blood reserve in this context. The blood reserve at BM radically changed access to blood without the need to resort to outside donors simply by taking 500ml of blood from a family member (compatible or not)¹¹ using a PENTA bag system, which could have served up to four children suffering from severe anemia.

For Geneva, access to blood was key, and many criticised MSF's inability to set up a blood reserve: *"I find that unacceptable. I believe better access to blood could have reduced mortality at the hospital."*

However, it has been found that the teams responsible for setting up these blood reserves were not ready technically and strategically.

¹¹ Use of a PENTA (500ml +4x125ml) bag system.

In addition, we note that transfusion safety/security was not always assured, particularly in the programs' opening phases. The issue was mainly problems with the use and interpretation of some pre-transfusion tests and the lack of qualified lab assistants. A number of doctors stated in interviews that they were faced with an ethical problem of whether or not to transfuse a child in critical condition without being able to guarantee transfusion safety/security.

3.2.3.3 Oxygen therapy

The use of oxygen was described as problematic during the two interventions and the problems were accentuated during the response to the measles epidemic. This was related to the nature of the complications of measles, which often results in respiratory distress.

The problems related to oxygen therapy can be divided into two main categories: a) availability and use of oxygen concentrators; b) administration of oxygen

With regard to the availability and use of oxygen concentrators, despite the fact that the teams were widely encouraged to use oxygen and order oxygen concentrators, we note that the number of concentrators was inadequate, but also a shortage of generators powerful and stable enough to operate several concentrators at a time, especially at the start of the projects. In addition, most of the oxygen concentrators used in the measles intervention were recycled from the malaria emergency or other projects in the DRC and were used under less than ideal conditions for these machines (dust, high humidity), frequently breaking down. Moreover, the maintenance of these devices was not always taken into account from the start of the programmes, and we note that the visit by the biomedical referant to several projects contributed to better use and maintenance of these devices in the field.

The lack of oxygen resulted in the sharing of a single concentrator among several children, often without tubes adapted for the purpose (supply problem) and an often inadequate flow of oxygen. In addition, the teams often had to make arbitrary choices of children who would receive oxygen. The choice of these children varied from one project to another. Some applied strict criteria; others criteria of the best chance of survival.

Regarding the administration of oxygen, the referents reported that its use was too systematic and too long, without clear criteria for determining the start and end of oxygen support or the flow of oxygen to be administered (no use of pulse oximeter). However, the lack of an MSF guideline on the use of oxygen should be noted.

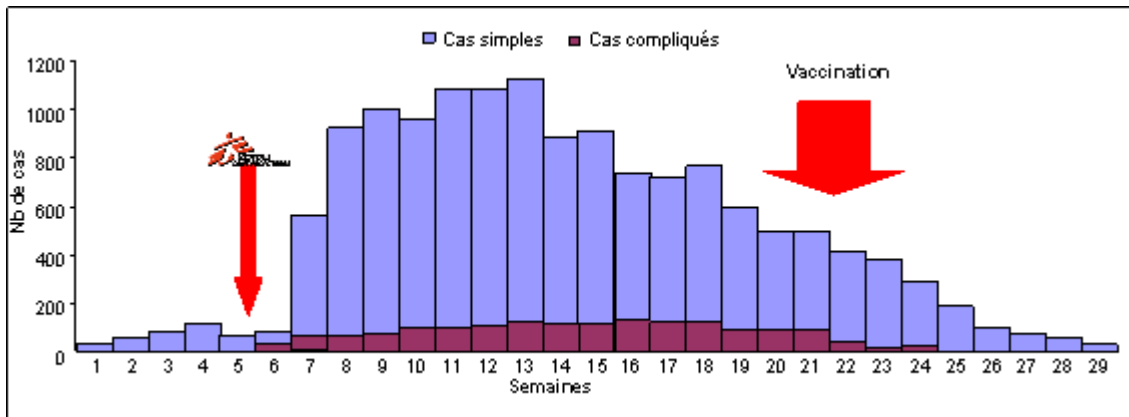
3.2.4 Effectiveness of preventive component

Vaccination against measles

In order to quickly check the spread of the measles epidemic and reduce the number of serious measles cases and deaths, early reactive vaccination targeting children between six months and 15 years of age was planned in all five HZs covered by MSF.

However, this objective was not met and, as shown by the example of Aketi (Figure 7), the vaccination campaigns got off to a very late start, for the most part at the end of the measles epidemic.

Figure 7: Number of weekly cases of measles in the Aketi Health Zone, Orientale Province, RDC, 2013 (Source MSF-OCG and MPH)



The factors that contributed to the delay in the vaccination campaigns are many and can be divided into two separate categories:

- a) Problems related to authorisation to vaccinate
- b) Lack of preparation of MSF teams once authorisation was obtained.

It should be noted that a number of problems led to delayed authorisation to vaccinate:

- Delayed declaration of the measles epidemic related to the need for serological confirmation and to the dysfunction of the system for forwarding samples to the IRNB in Kinshasa – the only laboratory capable of confirming measles cases. We found problems with the collection, forwarding and transmission of results, but also a shortage of reagents in the laboratory. It should be noted that MSF did not play an active role in the handling of these samples (e.g., facilitation of collection and sending to Kinshasa or parallel forwarding to a laboratory in Uganda in case of rupture of the laboratory supplies in the DRC – always by agreement with the MPH to avoid diplomatic contretemps). The late declaration of the epidemic delayed vaccination, for example in Bondo and Aketi. Although the first samples were collected in week 46 of 2012, the epidemic was not declared before week 16 of 2013 in Aketi and week 17 in Bondo – a five-month delay, with over 7 000 cases reported in Aketi at the time of the declaration of the epidemic!!!!).
- Exclusion of the MPH from all MSF vaccination campaigns following the use of vaccines imported into the DRC without any authorisation and the used of expired vaccines by OCA in Katanga. The MPH then produced an official document authorising only the use of EPI vaccines. That is why the vaccines from Cameroon that OCG planned to import for the vaccination campaigns were put on standby. Moreover, MSF (all sections) refused to use the EPI vaccines. This situation could be resolved only a few weeks later after many negotiations in Kinshasa and Kisangani. MSF finally received authorisation to import the vaccines on the condition that the EPI be informed in advance and verify the sources of the vaccines and the storage conditions. However, no official authorisation was ever received for the importation and use of the vaccines held up in Uganda (the transfer by Uganda being a diplomatic faux pas). OCG succeeded finally

in getting a verbal agreement to use these vaccines. Meanwhile, the vaccines from OCB were used for the vaccination campaigns in Dingila and Buta.

With regard to preparation for the vaccination campaigns, we find that the teams were not able to quickly start up these campaigns once authorisation was given. In fact, given the uncertainty of obtaining authorisation, the teams supposed to manage the vaccination were in process of supporting the treatment teams. Moreover, a major turn-over of expats in the midst of the vaccination preparation phase and the presence of inexperienced teams also contributed to the delay in the preparatory phase.

Despite the considerable delays, the vaccination campaigns were finally launched in the HZs of Ganga-Dingila Sud and Nord, Buta, Aketi, Likati, Bondo. In all, between 17 December 2012 and 29 June 2013¹², 189 067 children were vaccinated by MSF. In addition, 30 080 children were vaccinated by the MPH in the Titulé HZ.

Table 5 summarizes the vaccine coverage as shown by post-vaccination surveys (11). The results show that MSF's vaccination strategy was adequate, since the objective of vaccinating at least 90% of the target population was reached in all the HZs.

However, we find much lower vaccination coverage in the zones vaccinated by the MPH (Table 5).

Table 5: Vaccine Coverage in 5 HZs of OP as shown by vaccine coverage surveys

<i>Health zone</i>	Certified by the card		By parent's statement	
	<i>Indicator</i>	<i>CI 95%</i>	<i>Indicator</i>	<i>CI 95%</i>
Buta HZ	88.6 %	82.2 – 92.9	92.6 %	87.8 – 95.6
Ganga-Dingila HZ	90.5 %	86.2 – 93.5	97.3 %	95.5 – 98.4
Aketi HZ	97.7 %	97.0 – 98.4	98.8 %	98.3 – 99.3
Bondo HZ	89.6 %	86.8 – 92.5	94.2 %	91.7 – 96.
Likati HZ	93.4 %	90.8 – 95.9	96.8	95.8 – 97.9
Titulé HZ**	51.4 %	39.6 – 63.0	74.8 %	61.3 – 84.8

** *Vaccination by MPH*

¹² The vaccination campaign in Zobia took place before the exclusion of the MPH (December 2012). The vaccine stock from Dungu and Bunia was used for this vaccination. Subsequently, no vaccination took place before February 2103.

3.2.5 Effectiveness of advocacy component

The advocacy component played a major role in the two interventions, although it was better formalized during the malaria outbreak when health personnel were mobilised to better meet the short- and long-term general objective and the collaboration between MSF sections took precedence so as to speak with one voice.

The results of advocacy activities are summarized as follows:

- The use of IV Artesunate as a first-line treatment for severe malaria and its recognition by the MPH as a better alternative to quinine
- Free of charge medical care was announced in the zones affected by the malaria outbreak, but without the support of the MPH for its application
- Some continuity in the supply of malaria tests and treatments was ensured after MSF's departure
- The health partners, sponsors and agencies concerned were alerted to the malaria situation, but no intervention on their part took place.
- Receipt (although tardy) of authorisation to vaccinate and the use of MSF vaccines.

3.2.6 Effectiveness of research and innovation component

A research and innovation component was developed during the malaria intervention in order to:

- Describe the malaria outbreak and evaluate community mortality
- Develop etiological hypotheses
- Put in place innovative operational approaches (T&T)
- Develop a modern medical information management system

We found that a great deal of effort was invested in this component, with a number of studies done by EPICENTRE and by MSF teams:

- Descriptive analysis of the malaria outbreak (including studies of hemocultures)
- Retrospective survey of mortality in the Pawa HZ
- Exhaustive survey of prevalence and of retrospective mortality in the Danga HA (including evaluation of the feasibility and plus value of the T&T strategy)
- Use of the T&T strategy in the Nebobongo project.

However, we find that the result of these studies arrived late in terms of orienting operational decisions (description of epidemic) or were inconclusive (investigation of etiological hypotheses and of coinfection¹³, evaluation of T&T strategy – late implementation and lack of supervision to evaluate this practice).

¹³ In all, 21 hemocultures were collected and examined between 9 August and 7 September 2012, eight of which were positive. After excluding one patient in whom *Staphylococcus hominis* was isolated, positivity was 33% (7/21), with four different germs isolated. 5/21 (24%) were positive for *Salmonella species* (3). However, these results were insufficient to draw conclusions about coinfection.

While this research and innovation component is considered highly pertinent in terms of changing operational practices, the problems of its implementation during large-scale emergencies were raised in the interviews. It was suggested that follow-on support from outside is necessary to carry out and supervise the studies so as not to overload the teams, which are often overtaxed by the operations.

Regret was also expressed that the unusual malaria outbreak did not attract more attention from malaria experts so that more could be done to explore the etiological hypotheses.

3.2.7 Operational analysis

3.2.7.1 Human resources

Human resources management

Human resources (HR) management was considered especially problematic during the two emergencies. This is related to a number of factors, such as the scope of the interventions and the large number of HR sought, the cumbersome recruitment procedures, the poor qualifications of the national personnel identified on site, the limited availability of relocated staff and the shortage of clinical experience in the treatment of malaria, measles or emergency paediatric care among the expat doctors. Moreover, the difficult working conditions contributed to a large turnover of expat HR.

The key role of relocated staff during the two emergencies was emphasized by many of the persons interviewed. However, their management was considered inappropriate to the difficult working conditions and the prolonged nature of these two emergencies. We were told that some people worked more than six months without taking holidays with a very fast pace of work. In addition, MSF administrators faced many constraints under the labour code of the DRC, such as a limitation on overtime that was difficult to respect during emergencies and then the inability to compensate for overtime worked outside of the law.

Human resources management also constituted a source of frustration and of constant conflicts between the emergency mission and the regular program. On the one hand, the regular program tried to regain experienced staff as quickly as possible so as not to compromise the quality of their programmes; on the other hand, the emergency programs were not able to identify and train their replacements in such short time frames.

The HR problems related to the quality of care are described in the chapter entitled “Treatment of malaria and measles cases.”

Expertise required during startup of projects

It is obvious that the startup phase is crucial for the smooth operation of a project. Being aware of this, the emergency cell identified a mobile team consisting of experienced people that was to ensure the startup of the various projects. However, given the problems in replacing certain key positions in the mission, such as the FC, MTL or Medco, this team served instead to fill these gaps.

It seems crucial for program startup to mobilise more experienced expats, including people from headquarters. But also to be able to benefit from the expertise of relocated staff, especially in the area of the organisation of care and training support in nursing care.

Pre-departure briefing

In emergencies with a large number of departures, arrival in the field with no briefing is not exceptional. This can be problematic, especially on first missions. It seems unrealistic to provide a briefing at headquarters for all expats. Alternative briefings have been suggested by those interviewed during this evaluation, such as training briefings online or the presence of a specific team in the field to give quick briefings and training (treatment guidelines, management tools and gathering of data, etc.).

Support to teams

The teams in general felt well supported by their field officers and the general co-ordinators. The support of the emergency cell was also appreciated, with the exception of a few micromanagement problems mentioned in the interviews. The lack of support from medical co-ordination during the first phase of the malaria intervention was raised in many interviews.

With regard to support by the medical department (Dmed), the presence of the referring paediatrician and the mobile paediatricians was very much appreciated in the field, but a longer presence would have been desirable, given the complexity of treatment during the two emergencies.

Regarding other problems (description and understanding of the epidemic, search for coinfection in the malaria outbreak, implementation of blood transfusion, etc.), the emergency cell did not feel adequately supported by Dmed.

The lack of support by Dmed was felt particularly in the malaria intervention, especially given the absence of an MSF guideline on the treatment of a malaria outbreak: *“We expect early and high-quality support from Dmed. This was a unique situation. Everyone expected that a strategy would come from the field. We wasted time drafting this strategy while we could have done something else....”*

Moreover, the epidemiologists in the field regretted not having a technical referant.

3.2.7.2 Logistics

Geographical access to this particularly remote zone and the limited means of transport were major constraints in this intervention, compromising the movement of personnel and project supply. A few landing strips were able to be restored (Zobia, Aketi, Nebbongo, ..) to permit the landing of small planes and thereby ensure air supply for some projects, but space in the planes was limited. Other sites, such as Niapu, were accessible only by motorbike (nine hours by road from Zobia) and continual road maintenance was necessary (particularly bridge repairs) to maintain access.

However, it should be noted that MSF showed the feasibility of a large-scale emergency intervention in this context.

Regarding geographical access in particular, transport presented a real challenge for the teams.

The management of flights was especially challenging, for a number of reasons:

- Landing strips too short, allowing the use only of small planes
- Decertification of MAF planes, which was the main airline used by MSF in the past and was known for its great flexibility, especially in emergency interventions
- Sharing of planes between the regular and emergency missions
- Ban on carrying passengers in the ASF plane based in Dungu
- Lack of agreement to rent an MSF plane

Moreover, the improper use of motorbikes (125 in all) and failure to respect the standards defined by MSF regarding their use was mentioned in the interviews. In addition, some female expats complained of not being informed in advance about the use of motorbikes for transport over long distances because they did not feel comfortable with this mode of transport. It also seems that some moves were made without the use of communications equipment and without helmets, but these reports are anecdotal. The use of rental vehicles of poor quality was also mentioned in the interviews.

The logistical teams also encountered many problems in ensuring sufficient energy for the operation of all the hospital equipment (particularly oxygen concentrators) and for the cold chain. The generators provided were undersized and/or of poor quality and frequently broke down.

It seems that communication between medical and logistics staff was not always optimal in terms of determining needs. We also find that the perception of priorities was sometimes divergent, with a lack of checklists about the minimal logistics package to be delivered to an IPD treatment unit or to outreach teams.

3.2.7.3 Medical supply and pharmacy management

The medical supply chain of the emergency projects, from the needs identification phase to delivery in the field, as well as pharmacy management constituted a weak point in the two interventions. This added dysfunction resulted in many stock ruptures in the field and a great frustrations among teams at all levels (headquarters, co-ordination, field), as well as among medical and non-medical staff.

This is an especially sensitive and complex issue, where the problems are difficult to identify because of divergent interpretations and perceptions among the persons interviewed. There is a serious lack of clarity about the respective responsibilities of the various teams: medical, logistics and supply.

The factors contributing to the dysfunction of the medical supply system and to the pharmacy management problems cited by the various persons interviewed were quite divergent depending

on the type of persons interviewed (medical, supply or logistics) and are therefore presented separately.

From the supply team's point of view:

- The supply setup was too light to serve the regular programmes as well as major emergencies. The reinforcement of the supply manager by an assistant took place after a few weeks, but the latter was still answerable to LogCo of the regular mission. A new supply setup was put in place during the measles epidemic (emergency supply officer with the purchaser, who reported solely to the emergency LogCo, in co-ordination with the supply manager). This setup was deemed more effective and helped to reduce pressure on the supply team, as well as tensions between the two missions.
- The status of supply was not understood. Some considered supply an independent structure, whereas it was fully answerable to the logistical coordinator (LogCo) of the regular mission.
- Supply lacked an interlocutor for emergencies, notably in the initial phase of the malaria outbreak. The LogCo of the regular mission was not much involved in management of the emergency orders, and the emergency LogCo remained in the field.
- Supply was not able to manage the medical stock in Bunia. This stock was intended to be the transit stock, but quickly became a “pharmacy” because, in order to meet orders from the field, it was necessary to open the boxes.
- Dispatching of orders was complicated. The limited means of transport and recurrent changes in the planning of aircraft and space available for freight led the supply team to prioritise the shipment of certain packages. These did not always meet the priorities of the field. In addition, the constant changes in packing lists led to packages being shipped to the wrong locations.
- Lack of anticipation by medical teams and problem of communication with supply. The medical team lacked an appreciation of their needs and did not notify supply of sensitive items (to never be without). The forwarding of information about medical orders was not fluid. The lack of projection of future needs contributed to an excessive number of orders.
- Stock management in some places was deficient. A full box of anti-malaria drugs was found at the end of the project, while many ruptures de stock were noted in the same location.

From the point of view of logistics:

- The supply setup was too light to serve the regular programmes as well as major emergencies. The reinforcement of supply took place after a few weeks, but this was regarded as very tardy.
- The management of orders was too cumbersome (use of Logistics) and was not adapted to emergencies

From the medical team's point of view:

- The time between order and delivery was too long. The regular mission's supply procedures were too complex and were not adapted to emergencies.
- Many stock breakages of essential items because of supply problems and the medical team's failure to anticipate. Consequently, some patients had to return several times for their treatments (e.g., ACT), or the treatment protocols had to be adapted to suit the medications available.
- Lack of a pharmacist in the medical supply chain. The arrival of a pharmacist in central stock was tardy. Moreover, she was not able to provide support to the field for the management of their medical stocks.
- Inappropriate pharmacy management tools. Follow-up on consumption, the definition of needs and the preparation of orders were problematic because of the lack of understanding of the system (in many cases it was the nurses' first mission in charge of the pharmacy), but also because of inappropriate management tools. The Excel spreadsheet for consumption follow-up and Easy-med used for orders were not complementary and the ordering process was therefore not practical. In addition, the field team lacked an appreciation of medical stocks and the alert system for pre-ruptures was not in place.
- Lack of checklists for medication and materiel to be ordered for this type of emergency. At the start of activities, the team often lacked certain items, despite the fact that the materiel required was very similar at each opening. A number of people mentioned that the standard kits ordered were not very useful for these two interventions.

3.2.7.4 Management of medical data

The management of medical data was problematic during the two emergency interventions.

Data from epidemiological surveillance at the MPH facilities was unreliable because of problems of completeness and promptness and also of case definition and under-notification related to the small number of people going to these facilities. This prevented the teams from having a comprehensive overview of the distribution of cases and of deaths in time and space.

To solve this problem and also to obtain more data than usual, MSF designed new software (Qlick view) to allow the individual recording of malaria and measles cases and the subsequent viewing of the development of outbreaks in various geographic localities. One of the advantages of this tool was the possibility of rapid sharing of data between the field, coordination and headquarters.

We find that this tool was much appreciated by the medical officers at headquarters and at emergency coordination and in certain field settings.

On the other hand, it should be noted that this tool was designed quickly to respond to a novel situation for MSF and that it was not completely finalised before its introduction. The operating errors were therefore numerous, but were quickly resolved by the person who designed the tool. The need for an Internet connection for the viewing and sharing of data also constituted a weak point in this regard.

We accordingly find that the introduction of this tool in the field often caused problems, given the reluctance of some to use it on line, frequently out of fear (apparently unwarranted) that it would be too expensive. In addition, some medical staff continued the collection of parallel data, because without the Internet connection they were unable to consult their data.

Apart from the technical problems relating to the tool itself, the problem of supervising the collection of data was raised. The data encoders were often left to themselves and the lack of data managers was sorely felt.

Moreover, the field epidemiologists devoted most of their time to the implementation of Qlikview and had little time to support the teams in analysing data and describing the development of the epidemic.

With regard to the prospective surveillance of mortality in the community, a number of attempts were made to involve CHWs in this follow-up, but this component never really functioned.

4 Conclusion and discussion

Successful interventions under particularly difficult access conditions

Despite the late detection of the two emergencies and many problems in implementation, the two interventions are regarded as successes. It is probable that, in the absence of MSF, most of the 58 000 malaria cases and 30 918 measles cases would not have received medical treatment, and this would probably have resulted in considerably more deaths in the affected zone.

The intervention strategy involving free medical treatment in hospitals and peripheral facilities and a referral system provided by MSF definitely helped reduce the burden of the two outbreaks.

However, we find that, for the two interventions, the needs greatly exceeded the operational capacities of OCG.

Emergency preparation: key to a rapid response

Emergency interventions in a country that has an MSF presence should be built on a solid foundation of preparatory work, especially in the DRC, where emergencies are recurrent. Such preparation includes the development and regular updating of an emergency preparation plan (EPREP), the pre-positioning of stocks, an HR recruitment and management (emergency pool) plan, guidelines on administrative and financial procedures (contract management, examples of MoUs, bonus payment system, etc.), as well as advance work with the health authorities to facilitate the implementation of certain activities during the emergencies (e.g.. importation of vaccines, authorisation for vaccination campaigns, etc.). In addition, an effective epidemiological monitoring system is essential in the preparatory phase.

In the two emergencies, emergency preparation was inadequate and this contributed to the late detection of the two outbreaks, to the HR management problem and also to the delay in the measles vaccination campaign.

Epidemiological surveillance: need for a more active system

Passive waiting for alerts from health authorities proved inadequate for detecting epidemics at an early stage. Moreover, even an MSF presence in the zone did not permit rapid detection of the epidemics.

The establishment of a more proactive surveillance system seems advisable (e.g., regular contact with the medical responsible of the health zones and key people in the population, active surveillance through sentinel sites, etc.) in order to obtain epidemiological information faster. Regular contact with the health authorities in Kisangani, who have a wider vision of the epidemiological situation despite a problem with the completeness of their data, also seems important. In addition, more regular contact with other MSF sections would make it possible to improve the overview of the epidemiological situation in the DRC and in Orientale Province in particular.

Relocated staff: a pillar of response to emergencies in DRC

During malaria and measles emergencies, the support of MPH staff (doctors, nurses, laboratory assistants, etc.) by experienced personnel is essential for ensuring quality care in hospital facilities, and we find that the absence of such support can contribute to high mortality rates in these facilities, particularly in the opening phase of projects.

We also note that the supervision of national staff by expat medical staff without experience in the treatment of tropical diseases and in paediatric emergency care is not appropriate for these types of interventions. In the DRC context, such supervision can be better provided by experienced national staff working in other MSF projects or belonging to the emergency pool (relocated staff). The latter must, however, be supervised by flying experts (paediatricians, laboratory assistants, quality of care experts, etc.) and be trained in advance of the various emergency situations.

A special effort seems to be needed to develop and maintain such expertise within regular projects and to agree to “release” these resources at times of emergencies for periods long enough to set up quality emergency projects. It seems that slightly “overstaffing” the regular programs in order to second some persons more easily during emergencies is not a luxury in a context of repeated emergencies--all the more so in that such persons seem to be the most effective in this type of emergency.

It also seems important to guarantee the presence of experienced staff during the startup of all projects, not only during the first openings, as was the case in these interventions (e.g., shortage of experienced staff during the opening in Nebobongo).

Quality of nursing care: need to be strengthened

The treatment of patients in the DRC is for the most part provided by nurses. For this reason, to reduce intra-hospital mortality in emergencies, nursing care must be strengthened. During the malaria or measles outbreaks, this need was strongly felt in terms of intensive paediatric care, and we find that the local staff is unfamiliar with this type of care. Major gaps were identified in the admission and stabilisation of patients, which are the critical moments for their survival and during which doctors are often absent. In addition, if MSF implements new protocols (e.g., IV Artesunate) or provides sophisticated materiel (e.g., oxygen concentrator) supervisory training of sufficient duration must be provided.

It seems warranted to create specific positions responsible for the quality of nursing care. In the DRC context, this role can also be filled by experienced national staff, who must be properly trained in advance and have access to appropriate tools.

Decentralised treatment: a challenge to be met

In the context of a dysfunctional health system that is not frequently used because care is not free and because of problems of geographical access, the free care provided in peripheral facilities and the availability of motorbikes for patient transfers radically improved access to care. To further reduce mortality, it therefore seems pertinent to begin activities in the hospitals and on the periphery simultaneously and to better balance resources between the two components. This was

also the conclusion of the EPICENTRE report that examined the factors associated with measles fatalities.

Need to integrate the lessons learned quickly

We find that frequently the same mistakes were repeated from one project to another and that there were few links between projects. It seems pertinent to envisage for this type of emergency evaluations carried out in real time so as to capitalise on good practices, but also to quickly correct errors of implementation.

5 Recommendations

Recommendation	Level concerned
Emergency preparation: key to a rapid response	
Create standard kits for the opening phase of malaria and measles emergencies (e.g., therapeutic treatment kit for 50 severe cases)	Emergency platform
Adapt treatment protocols to the context and ensure that orders are in line with the protocols	Medical Department Emergency cell
Finalise the response guideline for a malaria epidemic and include the management of exceptional outbreaks in non-epidemic zones	Malaria working group
Improve emergency preparation in the DRC (strengthening of BEP, emergency stock, proactive monitoring, recruitment plan for emergencies and creation of a pool of qualified HR in the various fields, administrative procedures kit, advance work with the authorities, etc.	Cell 3 Regular DRC mission
Relocated staff: a pillar of response to emergencies in the RDC	
Clarify the deployment and extend the missions of relocated staff in emergencies	Regular DRC mission
Provide ongoing training in the various emergency fields	Regular DRC mission
Reactive vaccination against measles: need to be faster	
Support the sending of blood samples to referral laboratories to speed up the process of confirming the epidemic (required for authorization to conduct a reactive vaccination)	Emergency cell
Clarify the mechanism for importing measles vaccines into the DRC in RDC in the event of an epidemic	Regular DRC mission
Pre-negotiate reactive mass vaccination agreements with the health authorities (with implementation methods involving the health authorities)	Regular DRC mission

Recommendation	Level concerned
Hospital care in emergencies: need for better supervision	
Facilitate the delivery of emergency care in emergencies (expertise at opening, guidelines on oxygen therapy, specific position for nursing support, etc.)	Emergency cell Medical Department
Guarantee the establishment of a blood reserve during malaria emergencies (standard kit, operating protocol, expertise at opening)	Emergency cell Medical Department
Decentralised treatment: a challenge to be met	
Achieve a better balance of resources between activities in the hospitals and on the periphery (change of mentality, better co-operation with MPH, etc.)	Emergency cell
Supply and pharmacy: need for more clarity	
Clarify the role of supply during emergencies and the links with other services	Operations, Supply Department, Medical Department
Make emergency supply autonomous while relying on the existing structure (position as focal point for emergencies with hierarchical link to the emergency LogCo and technical link with the supply manager)	Operations Supply Department
Strengthen pharmacy management in emergencies (presence of pharmacist at opening, appropriate tools, standard kits, support for persons in charge)	Emergency cell Medical Department
Need to integrate the lessons learned quickly	
Make provision for evaluations in real time during emergencies	Emergency cell

6 Annex

6.1 Terms of reference



TERMES DE
REFERENCES v7_ENC

6.2 List of interviewees

1	ABELLO PEIRI, Carme	IEC, Zobia, Niapu, Nebobongo
2	AEBY, Carole	IPD Nurse, Outreach and IEC vaccination, Buta
3	APOLINAR, Alfonso	Doctor, Bondo and Likati, exploratory mission meningitis in Buta
4	ARNOLD, Cassandra	Doctor, Aketi
5	ARNOLD, Martina	IPD Nurse, Zobia
6	AUSTRUP, Kathrin	Pharmacist, Bunia
7	BARUTWANAYO, Divin	Emergency Co-ordinator
8	BEAUPAIN, David	Logistician, Stock Bunia
9	AUDREY, Binet	Outreach Nurse, Bondo
10	BICHET, Mathieu	Deputy Program Manager – Emergency Cell, Geneva
11	BOURQUE, Berthier	Doctor, Buta
12	BROWN, Katy	Field Medical Officer, Nebobongo and Nurse, Aketi
13	BUERKLI, Marco	Field Officer, Buta
14	CACIOPPE, Sita	Field Medical Officer, Zobia and Niapu
15	CAPITAINE, Adrien	Vaccination Logistician, Aketi
16	DAVIES, Lynsey Nicole	Doctor, Nebobongo
17	DE LA TOUR, Rorbeto	Laboratory referent , Genève
18	DE MIGUEL PLIEGO, Emma	Pharmacist, Bunia
19	DELAITRE, Antoine	Emergency Co-ordinator
20	DELMAS, Marie	IPD Nurse, Aketi
21	DELUY, Cécile	HRCO, Bunia
22	DUC, Géraldine	Field Medical Officer and Outreach Nurse, Titule
23	DUPONT, Aurélie	Administrator-Deputy-HOM-Bunia, and Field Officer-Buta
24	FERNAGU, Julie	Logistician-Nebobongo and LogCo-Bunia
25	FRIAS DIAZ, Franking	Doctor, Interim Medco, MTL-Nebobongo, FC-Nyapu
26	GAUGE, Antoine	Emergency Co-ordinator
27	GIGNOUX, Etienne	Réfèrent Epidémiologiste, EPICENTRE, Geneva
28	GONZALES, Alan	Medical Co-ordinator
29	GRANDCLEMENT, Gilles	Logistician, Zobia
30	GRISEL, Elisabeth	IPD Nurse, Buta

31	HO, Leo	Référent Pédiatrie, Genève
32	HUMBERT, Nicole	Admin, Nebobongo
33	JAY, Ana	IPD and vaccination nurse, Likati
34	KOUKPO, Gilles	Doctor, Zobia, Nyapu, Buta
35	LANNEAU, Benjamin	LogCo, E-Coordo
36	LEON, Christine	Epidemiologist
37	LELEVRIER, Yann	Deputy Programme Manager – Emergency Cell, Geneva
38	LESSARD, Isabelle	Nurse – Field Officer, Buta
39	MANICHON, Marie Noelle	Doctor, Zobia and Titule
40	MARTINEZ GARCIA, Daniel	Flying Paediatrician, Zobia and Buta
41	MATHIEU, Julien	Logistician, Buta
42	MOLEKO MBONDE , Jehu	Doctor, Buta
43	MORANDAT, Françoise	Nurse – Field Officer, Nebobongo
44	NEUMAN VOLMER, Amy	Doctor, Aketi
45	OUSMANE, Moussa	Field Medical Officer, Bondo and Aketi. Explo Meningitis Buta
46	PELORCE, Stephanie	Laboratory Assistant, Nebobongo, Nyapu, Zobia
47	PETERSEN, Marianne- Luise	IPD Nurse, Zobia
48	PITTET, Anne	Flying Paediatrician, Zobia
49	QUERE , Michel	Medical referent , Cell 3, Geneva
50	RAVAUD, Annette	Patient Therapeutic Education and Health Personnel Training, Geneva
51	REBHOLZ, Cornelia Eva	Epidemiologist
52	ROCHET, Frédéric	Logistician, Aketi
53	ROMEO, Kristin	IPD Nurse-Zobia and Vaccination Nurse-Dinguila
54	ROSSEL, Ludovic	Medical data manager, Geneva
55	ROWE SERRANO, Daniel	LogCo, E-Coordo
56	RYMSHAW, Ellen	Nurse – Field Officer, Zobia et Nyapu
57	SCARATO, Muriel	Doctor- Field Officer, Buta
58	STERK, Esther	Tropical Diseases Referent, Geneva
59	STERVINO, Florence	Administrator, Buta
60	STORCHENEGGER, Sandra	IPD Nurse, Aketi
61	SVITKOVA, Anna	Paediatric Doctor, Titulé
62	TCHATON, Marie	Doctor, Zobia, Niapu and Nebobongo
63	TENA RUBIO, Javier	Epidemiologist
64	UZZENI, Florent	BEP Officer, Emergency Co-ordinator
65	VARGAS PIECK, Alejandro	Field Medical Officer, Aketi
66	WEGA KWEKAM, Narcisse	Emergency Co-ordinator
67	ZABSONRE, Inoussa	Doctor, Buta

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