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An audit of malaria mortality using the "Malaria Death Investigation Form" at United Bulawayo Hospitals, Zimbabwe: 1996-2000

*TK MUDIAYI, **M TSHIMANGA

Abstract

Objective: To identify the main causes of confirmed malaria deaths and assess the validity and the relevance of use of the MDIF in determining areas for improvement of care.
Design: A cross sectional study.
Setting: United Bulawayo Hospitals, a tertiary hospital in Zimbabwe.
Subjects: Patients whose cause of death was malaria using MIDF.
Results: Of 470 confirmed cases admitted in UBH during the study period, 53 (11.2%) died and were included in the study. Most deaths occurred in the over 15 years age group (88.6%) with only 3 deaths each in the other groups. All patients were referred or admitted to UBH with complicated and severe malaria; 39(74 %) had more than one complication such as CM and acute renal failure (ARP). Most patients came from or had visited a rural area and did not implement basic prophylactic and therapeutic measures put in place by the NMCP such as early self-medication. Three pregnant women aborted. Guidelines regarding investigations and treatment were not strictly adhered to. Delay in seeking treatment and in referring was generally observed at all levels of the health system. Cases of malaria deaths were found in the city in people who had not travelled to rural area. The MDIF was used in one case only.
Conclusion: Malaria mortality accounted for 11 % of confirmed cases. Main causes of death were CM and *ARP.* Parameters contained in the MDIF were those utilised by most authors who have investigated malaria mortality in Africa and there was a similarity in the observations. In view of the information it could provide if properly used, the MDIF is a valid tool for collecting data that the NMCP needs in order to rationalise its strategies at UBH and in other health facilities. Its use should be generalised and compulsory.

Introduction

More than 90% of worldwide malaria morbidity and mortality occurs in sub-Saharan Africa where about one million direct deaths are recorded annually. The fight against the pandemic is based on a long- term use of highly efficacious treatment and transmission control (1, 2). However, incomplete and imprecise case detection and diagnosis impede an accurate quantification of the disease burden (3, 4).

In Zimbabwe, malaria is a serious public health problem with uneven geographical distribution and impact on local institutions and communities. For instance, no malaria. transmission has been reported in the two cities of Harare and Bulawayo that host the country's four tertiary level hospitals. However, conversely, the rate of parasite resistance to available drugs in some rural areas (Chirundu, Hwange etc ..) has put the country in the "action period" according to the WHO/AFRO classification (5 - 7).

The National Malaria Control Programme (NMCP) is a unit set up by the Ministry of Health for the control of the disease. It has produced and issued case management guidelines and assigned specific

Maun General Hospital
P O Box 21 675
Maun
Botswana
*** Department of Community Medicine*
University of Zimbabwe College of Health Sciences
P O Box 178
Avondale, Harare
Zimbabwe

Correspondence to:

TK Mudiayi
Maun General Hospital
P O Box 21 675
Maun
Botswana
E-mail: tkmudiayi@hotmail.com

objectives to health system facilities. In central hospitals, the intervention to be evaluated is malaria case management. This with other outcome indicators, especially the malaria case fatality rate (CFR), could then be used to assess the program implementation at those referral institutions. The Malaria Death Investigation. Form (MDIF) was introduced by the NMCP in the year 2000 for accurate identification of management problems that impede the disease control nationally (5 - 7).

United Bulawayo Hospitals (UBH) is a group of tertiary level hospitals. It receives referrals from the city and the southern part of Zimbabwe, where many dry areas are infested by epidemic forms of malaria, caused almost exclusively by Plasmodium Falciparum (PF) (5, 6).

We found no publication on malaria deaths exploiting MDIF in Zimbabwe. In this study, the form was used to identify and document factors associated with malaria mortality at UBH and assess the validity and relevance of information obtained in this way.

Materials and Methods

We reviewed the ward registers, infection control and prevention unit (ICP) weekly surveillance and monthly reports and medical records including MDIFs of patients admitted at UBH and whose cause of death was malaria for the period 01 October 1996 to 30 September 2000. We completed a MD IF for each patient without one. The MIDF is made of 4 parts. The first part records patient's demographics and relevant past medical history (pregnancy and age, area visited, onset of symptoms, self-treatment with chloroquine (CQ), malaria prophylaxis, concurrent illness). Each of the other 3 parts is to be filled at any health facility level for notification of malaria death cases. They contain information on case management and follow up (means of confirming the diagnosis, type and complications of malaria, treatment details, date(s) and reasons of referral to higher level health centre, duration of illness, date and time of death and health provider's comments).

At UBH, specialists supervise in-patients care and ICP unit, experienced clerks man the information centre and wards are managed by Senior State Registered Nurses (SRNs). Malaria statistics are collected daily by the ICP sister-in-charge and dispatched weekly and monthly to relevant urban, provincial and national offices. As per WHO/PAHO and ICP national recommendations, malaria patients are reported by age group: 0-5 years, >5-15 years and >15 years and classified in 3 types: clinical (CLI), confirmed (CON) and cerebral malaria (CM) (8). CLI is a syndrome of a pyrexial illness of acute onset, occurring after visiting malaria infested area or not, accompanied by headache, joints pain and, especially in children, by other systemic manifestations. These may involve the respiratory (RS), cardiovascular

(CVS), central nervous (CNS) systems and the gastrointestinal tract (GIT). This syndrome, for which no other cause was found, responded well to antimalarial treatment though malaria parasite blood smear (MPS) was either negative or not done. CM was defined in clinical terms as presence of impaired level of consciousness (LaC) due to malaria (3,8, 9). The level of consciousness was assessed with the Glasgow Coma Scale (GCS). Complication such as respiratory distress (RD) was characterised by acidotic breathing and tachypnoea (rate> 24 per minute). Hypoglycaemia and anaemia were considered when blood glucose (RBS) was less than 2.2 mmol/L and haemoglobin $\leq 6g\%$

Hyperpyrexia was a temperature ≥ 39.5 DC. Only in-patients with a confirmed diagnosis of malaria at time of death were included in the study. Confirmation was defined as demonstration of PF or its antigens in blood or other tissues. These investigations could have been carried out in any health facility during the disease course that resulted in patient's death at UBH. Clinical or negative blood smear malaria cases were excluded.

Case management was evaluated using the guidelines for malaria diagnosis and treatment published by the Ministry of Health and Child Welfare (10). Collection and analysis of data was performed in and with Microsoft Excel. A sample of MDIF is attached to this study.

Results

Malaria admissions, types and deaths From 01 October 1996 to 30 September 2000, 2019 cases of suspected malaria were admitted at UBH of which 83(4.1 %) died. Those accounted for 2.2% of overall admissions and 0.8% of deaths. All patients were managed in paediatric and medical wards. Of 470 confirmed cases, 122 (26 %) occurred in the 0-5 years age group, 40 (8.5 %) in the 5-15and 308 (65.5 %) in the over 15. There were 53 (11.2%) deaths that were included in the study.

MDIF use
Only one (1.9%) MDIF was found filled in one patient record.

Demographics
Of 53 deaths, 16 (30.2%) were female including 3(18.7%) pregnant women, giving a sex ratio M/F of2.1:1. Forty-seven (88.6%) deaths occurred in the over 15 year age group. The under 5 and >5 - 15 year age groups had 3 (5.7%) deaths each. The average age was 33.6 years (5 months - 74 years) and the median 35 (Q1 = 23 and Q3 = 43) years.

Forty (75.4%) deaths occurred during the rainy season (November - April), with a peak of 15(28.3%) cases in April. The highest mortality rate was recorded in 1999 at 3.8 % while the lowest was in 1996 at 0.6 %. Fifty-two (98.1%) patients came from UBH urban and

rural designated referring areas, namely 24 (46.0%) patients, including one each in the 0-5 and 5-15 age groups, from the city of Bulawayo and 28(54.0%) from the provinces (Matabeleland South: 24; Masvingo Province: 3 and Midlands: 1). One (1.9-%) patient came from Matabeleland North. Four patients, 2 in each of the 0-5 and 5-15 years age group, came from rural area.

Past medical history.

Text box 1 gives information on the past medical history (PMH) of the 53 malaria deaths. Of the dead, 8 (15%) Bulawayo residents reported no outside trip, 85% visited rural areas, 87% sought treatment more than 24 hours after experiencing symptoms, and 53% did not take CQ before presenting to the health facility and 85% were referred more than 24 hours after complications had appeared.

Table I: Past medical history in UBH malaria deaths, 1996-2000 (n=53).

Drug Propylaxis	:	data not available
Rural residence or visit in past 2-6 weeks	:	45 (85%)
Duration of symptoms (before seeking treatment:		
- <24 hours	:	25%
- >1-7 days	:	64%
- >7 days	:	11%
- Mean	:	4.1 (0-14 days)
Chloroquine therapy before going to primary health facility:		
Yes	:	21 cases, 20 (38%) completed course
No	:	28 (53%) cases
Other	:	4 (8%) took oral quinine
Time before referral to UBH:		
- <24 hours	:	8 (15%)
- 1 day	:	25 (47%)
- 2 days	:	4 (8%)
- >2 days	:	16 (30%)
- Mean	:	2.2 days (0 -14) days

Text box 2 provides information on malaria diagnosis and treatment in the study group at both referring and UBH levels.

Table II: Case management in malaria deaths at UBH, 1996-2000 (n=53).

Procedures	Referring level results	UBH Results
1. Investigations:		
MPS taken	Positive: 49 (92%)	Positive: 33 (63%)
	Missing: 4 (8%)	Negative: 9 (17%)
		Missing: 10 (19%)
		Not done: 1 (2%) died before
Mean blood glucose level (n=4)	NA*	1.15 mmol/l (0.5-1.8)
	NA	4.9 g% (2.0 - 6.0)
Mean platelets counts (n=15)	NA	48.9* 10^3 cells/mm^3 (18-121)
Mean urea (n=23)	NA	36.21 mmol/l (10-74)
Mean creatinine (n=19)	NA	739 mmol/l (135-2231)
LP (n=7)	Not performed	Positive: 1 (bacterial meningitis)
		Normal: 5
		Missing: 1
Electrolytes (Na, K) (n=6)	NA	Normal
Chest X-ray (n=5)	NA	Abnormal: 5 (pneumonia)
HIV test (n=3)	Not performed	Positive: 3
Gastroscopy	Not performed	1 (haematemesis)
Bone marrow aspiration	Not performed	1 (severe anaemia)
2. Type of malaria diagnosed:		
Severe/complicated	53 (100%)	53 (100%)
Cerebral malaria	23 (43%)	34 (64)
3. Treatment:		
3.1 Antimalaria drugs given:		
First line:		
CQ	20 (completed oral CQ)	0
	1 (incomplete course)	0
Oral Q	4	0
Oral SP	2	0
Second line:		
IV Q	26 (no loading dose)	52 (loading dose in 13)
IM Artemether	3	4 (from second day)
3.2 Atibiotics given according to EDLIZ (Penicillin, chloramphenicol, Gentamycin):		
	Yes	Yes
3.3 Other drugs given according to EDLIZ:		
	Yes	Yes
IV fluids (5% dextrose; 0.9%Nacl)	28	53
50% Dextrose	NA	4
3.4 Other treatments given according to EDLIZ:		
Peritoneal dialysis	0	4
Blood transfusion	0	2

*NA: data not available

Diagnosis.

In all patients, malaria parasite slide (MPS) was taken and diagnosis of complicated or severe malaria made at their primary health centres or by general practitioners. At UBH, MPS examination was performed in 52 (98.1 %) patients. One patient died before this procedure.

Reason for Referral and Admission.

All 53 (100%) cases were referred to or directly admitted at UBH for severe/complicated malaria. Among the reasons for referral, we found 25 (47.2%) cases of CM, 23 (43.4%) cases of deterioration of general condition, 11 (20.7%) cases of convulsions, 3 (5.7%) cases of acute renal failure (ARF) and 1(1.9%) case each of hyperpyrexia, acute gastro- enteritis, severe anaemia and bleeding tendency. All 3 children under 5 and 2 between 5 and 15 years had impaired LOC. In most cases, several complications were found in one single patient.

Referrals to UBH were decided by Medical Officers in 32 (62.0%) cases, by Clinical Officers in 3 (5.6%) cases, by SRNs in 12 (22,6%) cases and in 5 (9.4%) cases by State Certified Nurses (SCNs). Referral document was found in all referred cases.

Management at referring level.

Twenty-six (49%) patients including the 20 (37.7%) who had completed CQ course received parenteral Quinine (Q) as antimalarial second line drug in accordance with official guidelines, but without the loading dose. Time, route, doses and indications of other drugs that were administered corresponded to official current recommendations. There were no data available for other investigations. Basic nursing care data were available and appropriate.

Management at UBH.

Of the 33 patients whose repeated slides were still positive at UBH, 20 (40%) had completed self-antimalarial treatment with CQ. As shown in Table 2, only few patients had basic laboratory investigations performed. Parasitaemia count was not done.

Monitored IV Q was commenced or continued in 52 (98.1 %) patients of whom 13 (25.0%) had a loading dose. Intramuscular (IM) Artemether was injected from the second day of admission in 4 (7.6%) adult patients, including a woman who delivered a preterm baby. One patient died before any treatment could be instituted.

Antibiotics which were administered to patients following official recommendations were: oral (or per nasogastric tube) anti-tuberculous drugs in 2 patients already on that treatment, IV Crystalline Penicillin plus IV Chloramphenicol in all cases of suspected meningitis and pneumonia. IV Gentamycin was added in infant respiratory infections. Oral Cotrimoxazole was given against gastro-enteritis.

All patients were commenced or continued (for in-patients referred from district hospitals) on TV fluids (5 % Dextrose, Ringer's Lactate, Normal Saline) especially for dehydration. Two (3.8%) patients were transfused. IV Frusemide and IV Diazepam were administered in acute renal failure (ARF) and fits respectively. IV 50% Dextrose (in bolus) was given in hypoglycaemia as were oxygen per mask and anti-pyretics in respiratory distress (RD) and fever respectively. Peritoneal dialysis (PD) was initiated in 4 (7.6%) cases of ARF, gastroscopy and bone marrow aspiration (BMA) performed on one patient each. One of seven lumbar punctures (LP) done for meningism showed acute bacterial meningitis in one child and 4 were normal.

In all cases, etiologic and symptomatic treatments were administered following official Recommendations.

Complications and associated conditions.

Apart from complicated/severe malaria that was diagnosed in all patients, the following conditions were also found present in 39 (73.5%) cases: 34 (64%) cases of CM, 20 (37.7%) cases of ARF, 14 (26.4%) cases of bleeding tendency, 13 (24.5%) cases of anaemia, 10 (18.8%) cases of jaundice, 7 (13.2%) cases of RD, 5 (9.4%) cases of pneumonia, 5(9.4%) cases of gastro-enteritis and dehydration, 4 (7.6%) cases each of hyperpyrexia and shock, 2 (3.7%) cases of hypoglycaemia and 1 (1.9%) of haemoglobinuria, 2 abortions and 1 preterm delivery.

Concurrent diseases often presented in combination in one patient. HIV / AIDS was confirmed in 3(5.6%) patients. Meningitis was confirmed in one child. Five (9.4%) had pneumonia while 2(3.7%) were on antituberculous therapy. There were also 2(3.7%) cases of septicaemia and one (1.8%) case each of haemorrhagic colitis, diabetes mellitus and intestinal obstruction.

Hospital stays, post-mortem examination.

The mean stay was 2.7(0 - 10) days. Deaths were properly certified. Post-mortems (PM) was carried out in 3 (5.7%) patients. MPS were found in the brain, - confirming CM- in 2(3.7%) patients and haemorrhagic colitis found in one (1.9-%) case.

Discussion

As per NMCP recommendations, all cases were laboratory confirmed. Making this accurate information on malaria mortality available is important since rational and targeted interventions and programme evaluation at UBH could then take place. Several authors . have emphasised the diagnostic aspect of the disease because of its economic, social and therapeutic implications. However, these figures from UBH could just represent the tip of the iceberg since, as shown in Textbox 1, the majority of patients

came from or visited the rural area which harbours most of affected people. Furthermore, the similarities of symptoms between malaria and other infections, multipathology and infraclinical parasitaemia common in immune people in Africa are some of the problems in estimating the malaria disease burden (1, 3, 11 - 14).

Unlike our findings, according to many authors, children are expected to suffer and die mostly from malaria. The implementation at lower levels of the Integrated Management of Child Illnesses (IMCI) and other child centred programmes may have contributed to that. However, adult morbidity and mortality figures were always higher than those of children during presentations at Annual Malaria Meetings in Zimbabwe in 1997, 1998, 1999 and 2000.

The MDIF was not used at UBH whereas tertiary level institutions have the most important role in malaria programme, namely case management. This would result in a lack of feedback and evidence for programme managers and, therefore, ignorance of specific issues in the treatment of malaria. As stated in the methods, we filled in a MDIF for each patient included in the study in order to get uniformity of the data we needed. We must, however, acknowledge the perfect concordance between wards, ICP and records unit documents. It allowed us to collect data from all confirmed cases of malaria.

While the information obtained from the MDIFs on patients' demographics was quite sufficient, that on management at different levels depended on the quality of the referral documents. Important data on the past medical history (PMH) including previous antimalarial treatment details, like dose, time and route, were not available.

Because of the high risk of death due to malaria complications, the NMCP has established a strategy of home-based and community prophylaxis and care such as Chloroquine holders in rural areas and drug availability over the counter at low price. Information on the disease is also given to the public through health education campaigns and materials. Those measures allow prevention and early treatment of malaria in rural areas especially. Annual malaria workshops are held for health care workers to discuss issues on the disease (5- 7, 10).

As shown in Text box 1, no information was available in patients' notes or referral letters concerning prophylaxis. The high proportion of patients with a history of rural visits contrasts with that (low) of those who follow the official recommendations on malaria prevention and care. The delay in seeking treatment could indicate poor understanding of health messages by the community or ignorance of the potential rapid fatality of malaria.

Decision of referring patients to UBH was also taken late in general. A similar attitude has been described in South Africa, Kenya and Tanzania (15 - 18).

The high risk of abortion incurred by pregnant women as well as the increase in prevalence recorded during the rainy season was also documented elsewhere. The city of Bulawayo recorded 8 cases of fatal malaria in patients with no history of rural visit despite the assertion of absence of urban malaria transmission. Similar cases have been reported in other cities in Africa due to the degradation of sanitation standards (2, 3, 13, 18 - 24).

In all patients, no basic investigations except for MPS were carried out at referring level. That inability to accurately diagnose the complications coupled with the possible delay in transferring patients might have contributed in the global fatal outcome. This has also been reported by other authors (15 - 17).

Forty percent of patients were found to be still positive for malaria at UBH despite completing CQ course self-treatment for 20 of them prior to presenting to referring centres. The possibility of CQ resistance should be ruled out in those cases. The eventuality of this serious development has been reported already by several authors (7, 12,23 - 28).

As in our study, Durrheim in South Africa like other authors also reported CM and ARF as the main causes of death (15,18, 29, 30). Though post-mortem examination remains the ultimate tool for accurate diagnosis, it was carried out in 3 cases only. CM was confirmed in 2 patients and in the third, haemorrhagic colitis, thus implying the importance of polypathology in our study.

Conclusion

Proper medical records keeping has made it possible to obtain accurate data on confirmed malaria deaths at UBH from 1996 - 2000. The causes of death and other related parameters could be identified.

Most patients came late from rural area with complicated malaria and polypathology. Important information on malaria management prior and on admission to UBH was missing. Health education messages and existing guidelines on administration of Q in complicated cases before referral were not adhered to in many cases seen at health centres. General lack of investigations including post-mortem examination might have resulted in delay in diagnosing, properly managing complications and establishing ultimate cause of death.

Parameters presented on MDIF were also those taken into consideration by most authors who investigated malaria death in Africa. Our observations were globally similar to those found elsewhere. If properly used, the MDIF could be a valid and well-designed tool for collecting information on and adequately assessing management and cause of malaria mortality at all health system levels in the country.

Recommendations

The NMCP should regularly communicate with

Central Hospitals to get first hand information on the implementation of their recommendations.

The flaws found in the management of malaria at all levels must be channeled to the NMCP for further analysis and appropriate action to improve adherence to the established guidelines.

At UBH, the medical officer certifying the death of a confirmed or suspected case of malaria must fill in the MDIF.

The heads of the departments of medicine and paediatrics must assign a focal person in their respective units who shall work with the ICP nurse regarding the collection of relevant data on malaria.

The use of the MD IF in its current format must be generalised and made compulsory in all private and public institutions where malaria death can occur.

The malaria focal person of the institution must train heath care workers locally in how to fill in the MDIF. The format and content could always be improved after stakeholders' meeting. The use of computers in keeping MDIF information is safer and encouraged.

Acknowledgements

MALARIA DEATH INVESTIGATION FORM

Name of Facility:.. District:..

Province:.. Date Form Completed:...

Name of deceased:.. Patient No:........................ Age:............................ Sex:........................

Address (where resides):..

Pregnant (Y/N) Estimated gestation (weeks):..

Patient on drug prophylaxis (Y/N):.. Which drugs:..

Which areas did the visit in the past 2-6 weeks:... Date of onset of symptoms...

Was chloroquine taken before presenting to the primary health facility (Y/N):............... Date:..

Details of the patient's visit to the health facility (PHC): 1'' Level

Health facility name (PHC Level):.. Date and time patient presented:..

Malaria slide taken (Y/N):.. Result (-/+) N:............................ Type of malaria diagnosed (uncomplicated/Severe)

Name of antimalaria drugs given:............................ Dose:................................ Route:...................................... Time given:........................

Other drugs given:.. Dose:................................ Route:...................................... Time given:........................

Date and time referred to the next level:..

Reasons for referral:..

Details of the patient's treatment at the second level referral centre: 2ⁿᵈ Level

Health facility name (PHC Level):.. Date and time patient presented:..

Malaria slide taken (Y/N):.. Result (-/+) N:............................ Type of malaria diagnosed (uncomplicated/Severe)

Name of antimalaria drugs given:............................ Dose:................................ Route:...................................... Time given:........................

Other drugs given:.. Dose:................................ Route:...................................... Time given:........................

Ancillary treatment (specify): Blood transfusion, glucose, other?

Date and time referred to the next level:..

Reasons for referral:..

Details of the patient's treatment at the second level referral centre:

Health facility name (PHC Level):.. Date and time patient presented:..

Malaria slide taken (Y/N):.. Result (-/+) N:............................ Type of malaria diagnosed (uncomplicated/Severe)

Name of antimalaria drugs given:............................ Dose:................................ Route:...................................... Time given:........................

Other drugs given:... Dose:................................... Route:.............................. Time given:...........................

Tick all the complications observed at the health facility or listed in the documentation:

■ Cerebral malaria   ■ Respiratory distress

■ Severe anaemia (Hb< or equal to 6g/dl)   ■ Bleeding tendencies

■ Jaundice   ■ Hyperpyrexia

■ Severe haemoglobinuria   ■ Shock

■ Acute renal failure   ■ Hyperparasitaemia (>5% in non-immunes)

■ Hypoglycaemia   ■ Other (specify)

Duration of illness:... Date of death:........................... Time of death..

Was any other concurrent illness present (Y/N):.. If yes, state the illness(es):..

....

Health providers comments:..

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Signed:... DMO/Mo/I/C:........................... Date:..

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Institute of
Development Studies