Malaria misdiagnosis: effects on the poor and vulnerable

Lancet 2004; 364: 1896–98

Mark Amexo, Rachel Tolhurst, Guy Barnish, Imelda Bates

Liverpool School of Tropical Medicine, Liverpool L3 5QA, UK (M Amexo MSc, R Tolhurst PhD, G Barnish PhD, I Bates FRCP)

Correspondence to: Dr Imelda Bates
ibates@liv.ac.uk

Context **Effective and affordable treatment is recommended for all cases of malaria within 24 h of the onset of illness. Most cases of "malaria" (ie, fever) are self-diagnosed and most treatments, and deaths, occur at home. The most ethical and cost-effective policy is to ensure that newer drug combinations are only used for true cases of malaria. Although it is cost effective to improve the accuracy of malaria diagnosis, simple, accurate, and inexpensive methods are not widely available, particularly in poor communities where they are most needed.**

Starting point **In a recent study in Uganda, Karin Källander and colleagues emphasise the difficulty in making a presumptive diagnosis of malaria, and highlight the urgent need for improved diagnostic tools that can be used at community and primary-care level, especially in poorer populations (*Acta Trop* 2004; 90: 211–14).**

Where next? **Health systems need strengthening at referral and community level, so that rapid accurate diagnosis and effective treatment is available for those who are least able to withstand the consequences of illness. Indirect evidence strongly suggests that misdiagnosis of malaria contributes to a vicious cycle of increasing ill-health and deepening poverty. Much better direct evidence is needed about why and how misdiagnosis affects the poor and vulnerable.**

Malaria deaths, currently at 3000–6000 a day, are increasing; 90% of the deaths are in young African children, most of whom die at home. About 40% of the world's population living in the poorest countries is at risk of malaria infection. International organisations advocate effective and affordable treatment for all cases of malaria within 24 h of onset of illness. In high-risk settings, this advice has been translated into policies that recommend home treatment of all childhood fevers as malaria. In a recent study of children reporting to health centres in Uganda, Karin Källander and colleagues[1] found that 30% had symptoms compatible with both pneumonia and malaria and required dual treatment. This report, and previous studies,[2] have concluded that community treatment of all childhood fevers as malaria is likely to result in malaria over-diagnosis with consequent under-diagnosis of other fever-causing disorders such as pneumonia.

Implementation of these recommendations, particularly for those most vulnerable to malaria, is increasingly difficult: the effectiveness of cheap monotherapies is deteriorating, combination therapies are dearer, and illness is not confirmed as malaria in most cases. WHO has endorsed combination therapy for malaria and international efforts have focused on optimising and evaluating various polytherapies.[3–5] The challenge is how to ensure that the more expensive combination therapies reach most of those who truly have malarial illness and not just an elite minority.

We developed a framework to guide the systematic collection of information on the clinical, social, and economic effects of inaccurate malaria diagnosis and how this disproportionately affects the poor and vulnerable (figure). We reviewed over 600 documents but none specifically covered malaria misdiagnosis and such groups. Thus we combined information about malaria misdiagnoses with data about the effect on poor and vulnerable individuals, households, and communities.

Misdiagnosis of malaria

In Africa over 70% of malaria cases do not present initially to health facilities but diagnose and manage their "malaria" (ie, fever) at home with traditional remedies or drugs bought from local shops. They only attend health centres after self-treatment fails, and even then they do not receive a good-quality diagnosis.[6] At peripheral health facilities a diagnosis of malaria is based solely on clinical features such as fever. Although this approach can reduce morbidity,[7] many infectious diseases mimic malaria and this strategy leads to high rates of over-diagnosis (table) and over-treatment of malaria.[8] Microscopy, considered to be the gold standard for malaria diagnosis, is generally available at district hospitals. However, it is often not used[1] and has an accuracy of only 70–75%.[9] Microscopy depends on well-maintained equipment, uninterrupted supply of good-quality reagents, trained staff, and good-quality monitoring and supervisory systems. Maintaining a quality-assured microscopy service is a major challenge even for district hospitals, so it is not suitable for routine use at community level. Rapid diagnostic tests based on detection of *Plasmodium*-specific proteins can be used if microscopy is unavailable, but they have significant limitations, such as cost and inability to provide information about the density of infection.[10]

The consequences of misdiagnosis of malaria are felt at individual, household, and national levels. Individually, treating all fevers presumptively as malaria masks underlying potentially fatal conditions.[2] Individuals wrongly diagnosed with malaria will be exposed to unnecessary side-effects of drugs, and the true cause will not be recognised or treated. This scenario is likely to lead to prolonged and worsening illness with loss of income or productivity, and repeated visits to health providers.

Disproportionate effect on poor and vulnerable

The poor are less likely to seek western medical care for treatment of fevers than the more wealthy, leading to

Method of malaria diagnosis	Reasons for misdiagnosis	Consequences of misdiagnosis			Potential for disproportionate effects on the poor and vulnerable
		Medical	Social	Economic	
Presumptive diagnosis (fever +/−algorithm, at home or health facility)	Clinical features (eg, fever) sensitive but non-specific for malaria	**Individual level** Prolonged illness More severe illness Wrong treatment Drug toxicity	Loss of faith in health service Shift towards traditional healers Loss of self-esteem	Loss of earnings Increased expenses for transport, drugs, consultations	Loss of job Inability to buy food or educate children
Malaria microscopy	Over-diagnosis of malaria (artifacts mistaken for parasites) Lack of equipment maintenance No supervisory or quality-assurance mechanisms	**Household level** Increased stress	More children Loss of social standing Fragile livelihood Household rupture (eg, divorce, separation, neglect of children)	Loss of household income	Women particularly disempowered and vulnerable Lack of money necessitates sale of assets or borrowing at high interest rates Migration of household head for work leads to family disruption
Rapid diagnostic tests	Not quantitative May not be species-specific	**National level** Increased real or perceived antimalarial drug resistance Health facilities overburdened by extra unnecessary work	Disruption of family units and social relationships	Reduced productivity Reduced economic growth Inaccurate public-health data Unreliable information for planning and budgeting	Reduced opportunity for education Weakening of national economy

Figure: **Framework for synthesising evidence about effect of malaria misdiagnosis on the poor and vulnerable**

delays in diagnosis and treatment and more advanced disease (Worrall E, Basu S, Hanson K, London School of Hygiene and Tropical Medicine, personal communication). If this situation is compounded by inaccurate diagnoses, confidence in allopathic health services will be lost in favour of traditional healers. The belief that these providers can treat complicated malaria will be reinforced, thereby exacerbating the severity of illness. Reasons for poor people adopting a wait-and-see approach include unaffordable fees, long waiting times, unavailability of drugs, and poor attitudes among staff.[11] The result is prolonged and more severe illness.

The poor and vulnerable will have greater hardship than the more wealthy and advantaged if they lose productive time through illness. Most households in poor malaria-endemic countries depend on subsistence livelihoods with no insurance or savings as a financial buffer when ill. For those on an economic knife-edge, additional health-care costs and protracted illness due to malaria misdiagnosis could push them into a downward spiral of increasing poverty and vulnerability. Precarious livelihoods will be threatened by even short non-productive periods because of their own illness or time spent looking after ill relatives. The effect is particularly devastating in women, who generally are the carers. Children may also leave school to earn money or to take care of ill relatives, leading to exam failure and repeated school years and perpetuating the cycle of poverty and vulnerability due to reduced employment prospects.[12,13]

Poor patients spend a higher proportion of their income on the direct and indirect costs of seeking health care than the more wealthy. Combined with lost productivity, this cost significantly reduces their disposable income.[13] Sick people and their families will often persist in paying for care to restore health even if they need to sacrifice basic needs, such as food and education.[14] Eventually the poorest people will borrow money or pawn goods, leading to delays in seeking treatment and lowering of self-esteem and social standing. Indirect costs associated with seeking health care for "malaria" and taking care of the sick can add almost 80% to the cost of seeking treatment.[15] This cost will increase if misdiagnosis and subsequent treatment failure mean repeated visits to clinics.

Country	Negative microscopy/ positive clinical diagnosis	Overestimation by clinical diagnosis (%, mean 61%)
Ethiopia	1931/2490	78
The Gambia	248/407	61
The Gambia	122/260	47
Germany	178/231	77 (travellers)
Honduras	106/202	53
India	1806/1945	93 (children)
	2536/2885	88 (adults)
India	227/526	43
Indonesia	266/560	48
Malawi	311/983	32
Malawi	211/248	85
Nigeria	788/1384	57
Papua New Guinea	676/2096	32
Sahel countries	137/297	46 (wet season)
	210/220	96 (dry season)
Senegal	243/353	69
Tanzania	237/380	62
Tanzania	134/272	49
Tanzania	46/164	28
Thailand	953/1254	76
Thailand	666/913	73
Thailand	106/204	52
Uganda	319/742	43
Uganda	102/180	57
Zimbabwe	189/261	72
Zimbabwe	207/287	73

Table: **Clinical malaria diagnosis versus microscopy confirmation**

High mortality rates induce households to have more children, which creates a high dependency ratio and affects household saving behaviour and lowers the gross national product per capita.[13] In some societies the death of a husband results in dispossession of his widow, forcing her and her children into extreme economic hardship. The increased economic and social stress of illness and additional children may rupture household relationships, resulting in divorce, separation, or child neglect. If a household is perceived to suffer an excessive amount of ill health (eg,when an illness is inappropriately treated as malaria), witchcraft is often blamed, which can lead to social isolation and victimisation, especially for women.[16]

Implications for public-health and health systems

Malaria-endemic countries have economic growth rates that are 1·3% lower than countries without malaria.[13] The gap in prosperity between these groups of countries is widening every year and it is predicted that malaria cases will double over the next 20 years.[17,18] In many countries patients pay for health services, including consultations, laboratory tests, and drugs. These cost-recovery measures have driven the poorest away from allopathic health services and increased self-medication.[19] To ameliorate the effect on the poor, policies for user-fee exemptions have been developed but are difficult to implement effectively.[20]

From the public-health perspective, misdiagnosis of malaria results in excessive reporting of malaria cases, under-reporting of diseases that mimic malaria symptoms, increased true or perceived malaria resistance, and misallocation of resources.[21] Malaria misdiagnosis will result in more clinic attendances, putting additional pressure on already constrained and under-resourced health systems. The effects on health-service provision are wide-reaching and increase the likelihood that the service will fail to respond appropriately and effectively.

Conclusion

With the introduction of antimalarial drugs that are more expensive and toxic than traditional, but failing, monotherapies, it will be unethical for health professionals to condone the current level of malaria misdiagnosis. The balance between the risk of wrong diagnosis and use of antimalarial drugs might be acceptable when drugs are safe and cheap, but with more expensive and less safe drug regimens it is more cost effective to improve the accuracy of malaria diagnosis.[22] The effect of malaria misdiagnosis falls most heavily on the poor and vulnerable who are least able to withstand unnecessarily prolonged ill-health with subsequent missed earning opportunities and repeated visits to health facilities.

Direct evidence is lacking about the effect that the high levels of "malaria" mismanagement are having on the poorest and most vulnerable in society. However, indirect evidence is strongly suggestive that such mismanagement contributes to a vicious cycle of increasing ill-health and deepening poverty. As with antiretrovirals, antimalarial drug development has outstripped the ability of the health systems in poorer countries to accurately identify and target those who have disease and would benefit most from therapy.[4] Intensive efforts are needed, exceeding those put into optimising antimalarial therapy, to develop diagnostic tools for malaria that are simple, cheap, accurate, and useable where malaria has its most devastating impact—the most vulnerable communities who are least able to articulate and advocate for their needs.

We declare we have no conflict of interest. Our review was funded through the Malaria Knowledge Programme at the Liverpool School of Tropical Medicine by the UK Department for International Development. We thank all members of the Vulnerability and Health Alliance who assisted with sourcing information.

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