IAE Journal of Research and Development (IJORED)
Vol. 1, Issue 1 August 2025, pp. 133-155,
eISSN: 3088-5515, pISSN: 3088-5523,
Published by IAE.
DOI: https://doi.org/10.61408/ijored2025v01i01.07

Departures from the Design: Unethical Practices in Experimentation of *Chloroquine* and Unscientific Treatment-Seeking Behaviour for Malaria in Muheza District, 1980-2000

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Abstract

Unethical practices in the experimentation of the chloroquine drug for its safety and efficacy in the treatment of malaria were prevalent in sub-Saharan Africa. In Tanzania, unethical testing of chloroquine, which was the first-line treatment for malaria was widespread between 1980 and 2000. Despite these unethical experimentations leading to deaths, physical and psychological problems on patients, historians have overlooked their role in promoting unscientific treatment-seeking behaviour for malaria. This paper utilized a qualitative research approach drawing from both primary and secondary sources. An analysis of these sources justifies that some researchers from the National Institute for Medical Research (NIMR) at the Amani Centre did not adhere to ethical standards in the experimentation of chloroquine on human subjects in Muheza District. The findings also demonstrate that unethical experimentation of chloroquine resulted in health problems for patients, contributing to the local people's unscientific treatment-seeking behaviour for malaria. The paper concludes that unethical practices in chloroquine experiments created distrust among the local population, which could hinder new research projects in drug testing or disease outbreaks in Tanzania.

Key words: *unethical practices, chloroquine, unscientific treatment-seeking behaviour*

Introduction

Malaria is a significant contributor to disease burden in Tanzania. One-third of all outpatient visits and inpatient admissions and a quarter of inpatient deaths are due to malaria (Kolodziej et al., 2024). It is a major cause of chronic anaemia in children and pregnant women, neurological impairments, and low birth weight; and can exacerbate the severity of other diseases (Trape, 2001; White, 1999). For many years, *chloroquine* has been used as the first-line treatment for uncomplicated malaria. After its introduction in the mid-1940s, it became the only antimalarial drug available in most dispensaries and health centres in Tanzania (Alilio et al., 2001).

Throughout the world, human beings acquire diseases during their lifetime, which often requires them to use drugs to restore their health. The availability of new drugs depends on the use of various ingredients (Blackmen & Haddad, 2005). Experimenting the efficacy and safety of existing drugs helps medical researchers adjust doses for a consistent cure of patients (Bloland, et al., 1998). During experimentation, researchers are obligated to adhere to the established international ethical principles to protect human subjects (Mashalla et al., 2009). However, violations of ethical principles in drug trials have occurred worldwide, attracting the attention of historians because of their major impact on human beings (Ogungbure, 2011: Agulanna, 2010).

It was observed that from the 1980s to the 2000s, incidents of high experimentation of *chloroquine* for its efficacy and safety were reported in all sub-Saharan countries across the entire width of the continent (Flegg et al., 2013). However, there are no clear reports of unethical practices in the experimentation of *chloroquine* on patients and its contribution to unscientific treatment-seeking behaviour for malaria among these African nations, particularly Tanzania.

The drive to pursue this subject stem from scholarly reports that, between 1980 and 2000, *chloroquine* showed a terrible failure in the treatment of malaria in Tanzania. Studies have revealed that *chloroquine* resistance spread slowly from the 1960s to the 1970s. However, between 1980 and 2000, the rate of resistance accelerated rapidly (Mubyazi et al., 2005). In 1960, the parasite resistance to *chloroquine* was five percent (Clyde, 1961), and in 1970, the resistance rose to ten percent, but in 1985, it was suddenly recorded at 50 percent, and in 1990, the resistance reached 52 percent (Alilio et al., 2001).

Scholarly works have shown that it is well known among Tanzanian government officials that the World Health organisation (WHO) recommends a change in drug when resistance reaches 25 percent (Machangu, 2021). However, the government did not immediately replace *chloroquine* as stipulated in the international protocol. In 2001, when the government officially announced a change in its malaria treatment guidelines, *chloroquine* was replaced with *sulfadoxine pyrimethamine* (Mubyazi et al., 2005). The strong factor for the delay in replacement was the recognition for many years that *chloroquine* was the official first-line drug for the treatment of uncomplicated malaria because it was cheap, low in toxicity, effective against all forms of malaria, relatively easy to manufacture, and readily stored and transported even under extreme climatic conditions (Nuwaha, 2001; Ronn, 1997). Thus, some scholars have noted that although the government provided enough room for experimentation of *chloroquine*, solutions for its efficacy and safety did not appear (Roux et al., 2021). Nevertheless, researchers capitalized on the opportunity to abuse ethics in *chloroquine* experiments on malaria patients, which contributed to unscientific treatment-seeking behaviour for malaria in Muheza District.

Health-seeking behaviour has deep historical roots among Africans. Studies have shown that, for a long period, the presence of various medical systems, known as medical pluralism, influenced how people sought

treatment for diseases (Vaughan, 1994). During the pre-colonial period, the traditional healing practices of the Sambaa, Bondei, Ngindo, and Zigua ethnic groups dominated Muheza District. Later, outsiders introduced new traditions and systems of Islamic clerics, Ayurvedic medicine, Western biomedicine, and intercessory services (Sindiga et al., 1995). Similar to traditional healing, new systems have also proved to be effective and safe in addressing the health needs of local communities (Ribera, 2006). However, traditional healing and biomedicine had a much larger impact on local people than Islamic clerics, Ayurvedic medicine, or intercessory services. Thus, throughout the study period, the presence of traditional healers and biomedical experts induced many individuals to seek care from both types of institutions concurrently or consecutively (Oberlander & Elverdan, 2000).

This study provides an understanding of unethical practices in the experimentation of c*hloroquine* drug and their impact on unscientific treatment-seeking behaviour for malaria in Tanzania. This study aimed to raise awareness of unethical practices in drug trials and their impact on health-seeking behaviour by bringing such practices to the attention of governing authorities and the general public, with the goal of preventing similar practices in contemporary biomedical research and human social life. The paper is divided into two main sections. The first section critically examines the ethical principles violated during drug experimentation for malaria treatment and their impact on local people in Muheza District. The second section assesses the consequences of violating ethical principles in drug trials on local people's unscientific treatment-seeking behaviour for malaria in Muheza District.

Methodology

The data for this study were collected from both secondary and primary sources that were carefully examined, interpreted, and presented in a historical context. The secondary literature review involved reading

electronic and printed books, journal articles, workshop proceedings, dissertations, and thesis to gather data on unethical practices in *chloroquine* experimentation and unscientific treatment-seeking behaviour for malaria. These sources were accessed from the Institute of Adult Education Library in Dar es Salaam, the National Institute for Medical Research (NIMR) Library at the Amani Centre, and the Tanganyika Library in Dar es Salaam. To avoid repeating the work of other scholars, the literature search specifically focused on unethical practices in *chloroquine* experiments and unscientific treatment-seeking behaviour for malaria in Muheza District. This approach was indispensable in identifying gaps in the literature and conceptualizing and contextualizing the study.

Primary sources were collected from the NIMR Library at Amani Centre and the Tanganyika Library in Dar es Salaam. The NIMR Library provided documentary materials for this study on unethical practices in the experimentation of *chloroquine* from their uncatalogued medical research confidential and open files. In these research files, the study inspected and read letters written by field workers to their supervisors, and vice versa, on ethics in drug trials involving human subjects. The study also searched for and read private papers written by medical researchers on ethics in drug trials. These documents revealed agreements, disagreements, contradicting ideas, and debates on ethical dimensions and practices in drug trials, involving directors and medical researchers. These archival documents provided meticulous data on different themes related to unethical practices in the experimentation of *chloroquine* and unscientific treatment-seeking behaviour for malaria in Muheza District. The Tanganyika Library provided information on international ethical principles for research involving human subjects, statistics on population, and the socio-economic profile in Muheza. Before collecting data from documentary materials, the researcher obtained a permit from the office of the Director of NIMR at the Amani Centre and that of the Director of Tanganyika Library in Dar es Salaam.

In-depth, semi-structured, and open-ended interviews were conducted with two groups of anonymous interlocutors in Muheza District. The first group consisted of 21 local people who were either friends, neighbours, relatives, or victims of unethical practices in *chloroquine* drug trials. The second group included ten medical researchers with extensive knowledge of drug trials involving human subjects. Interlocutors were asked about their experiences with unethical practices in *chloroquine* drug trials and unscientific treatment-seeking behaviour for malaria in Muheza. Their insights helped to fill gaps in documentary information and rectified distortions, inaccuracies, and exaggerations. Before the interview sessions, the researcher ensured that all participants provided informed consent, ensuring the confidentiality of the information gathered and the anonymity of the participants.

The Prevalence of Malaria in Muheza District

Muheza is one of the 11 districts in the Tanga Region of northeastern Tanzania. It was established in 1974 after a split with Tanga District. The district of Muheza has a population of about 238,260, with a growth rate of 2.1 percent, slightly lower than the national average of 2.7 percent (NBS, 2022). The district has a tropical climate, with agriculture being the primary source of income. Local people grow maize, cassava, rice, yams, and bananas as food crops, whereas coconuts, oranges, mangoes, black peppers, cinnamon, tea, and cloves are grown as commercial crops (URT, 2024).

Malaria is endemic in Muheza District, with transmission peaking after the rainy season in May and June (Alilio et al., 2001). This situation prompted researchers from NIMR at the Amani Centre, located in the district of Muheza, to conduct *chloroquine* drug trials on a number of local people between 1980 and 2000. According to interlocutors, the geographical location of the centre influenced some researchers to involve more people in its experimentation in Muheza than in other parts of the country. In

some cases, the drug was tested on human subjects without adhering to international ethical principles, leading to deaths or physical and psychological consequences on patients.

Unethical Practices in *Chloroquine* Experiments

Throughout the study period, the estimated number of local people subjected to unethical practices in *chloroquine* experimentation reached 57,000. This number is a low estimate based only on the references to pre-*chloroquine* trial tests the study observed in the materials at the Amani Research Centre. The study counted the figure from the positive pre-drug trial tests that clearly stated the number of human subjects included in researchers' reports between 1980 and 2000 (NIMR Amani, 1980-2000). During the study period, Muheza District experienced a higher number of human subjects than ever before because of an increased rate of malaria resistance to *chloroquine* (Alilio et al., 2001).

It is important to recall that, after the Second World War, the persistent mistreatment of human subjects in Western nations played a significant role in shaping universal protection norms and standards in drug trials (Ashcroft, 2003). Between the 1940s and the 1990s, the Nuremberg Code, United Nations Human Rights Charter, Declaration of Helsinki, and Belmont Report were established to generate medical knowledge to protect the health of human subjects (Kruger et al., 2014; Roth, 2005). One interlocutor commented: "There is no doubt that from 1980 to 2000 researchers were well trained with strong ethical values." However, according to another interlocutor: "It was the burden of malaria that led researchers to bleach ethical standards regarding the experimentation of *chloroquine* on human subjects in Muheza District."

One of the international ethical standards emphasizes that, in any research on human beings, each potential subject must be adequately informed of the aims, methods, anticipated benefits, and potential hazards of the study and the discomfort it may entail (WMA, 1964). Throughout the study

period, some researchers did not care about parental consent in studies involving primary school children. This was contrary to the international protocol that stipulates that, in the case of legal incompetence, informed consent should be obtained from the legal guardian. When the subject is minor, permission from the responsible relative must be obtained in accordance with national legislation (WMO, 1996). Some researchers from Amani did not comply with these guidelines. Between March and August 1980, *chloroquine* was tested on 174 children at Kwabada, Mbambara and Misongeni primary schools in Muheza. This study was conducted on children without informed consent from their parents or guardians. In this study, although death did not occur, 25 children fainted, as 16 others complained of prolonged headache, dizziness, and swelling of their body parts (NIMR Amani, 1980). A similar study of *chloroquine* trial conducted from October 1980 to February 1981 on Kicheba Primary School children in Kicheba Village and Yamba Primary School in Mwakijembe Village in Muheza without informed consent from their parents failed to cure 679 of 973 children. This terrible result represents almost 70 percent of the project failures. (NIMR Amani, 1981). Similarly, between March and September 1984, two students from Kwemsala Primary School, four from Msowelo Primary School and three from Makole Primary School in Muheza died of malaria during the study to check the efficacy and safety of *chloroquine*. However, 714 other students were still subjected to the study up to December without any information to their parents, despite high risks due to lack of treatment during drug experimentation (NIMR Amani, 1984).

Another unethical practice was performed by researchers who did not care about the treatment of human subjects involved in the drug trials. This was contrary to the international guideline that insists that in the treatment of a sick person, the physician is free to use new diagnostic and therapeutic measures, if in his or her judgement, it offers hope of saving life, re-establishing health or alleviating suffering (WMO, 1996). Between January

and September 1985, elderly individuals subjected to *chloroquine* experimentation at Muheza District Hospital contrary to international standards, were not treated. In this study, 21 of the 57 elderly people died of malaria due to ineffectiveness of the tested drug (NIMR Amani, 1985). Similarly, in 1987, researchers tested *chloroquine* on 16 pregnant women at the Amani Clinic. These women were subjected to *chloroquine* drug trials without receiving proper treatment and care for the swelling of their bodies and dizziness effects they developed (NIMR Amani, 1987). According to an interlocutor: "Researchers from Amani ignored the treatment of human subjects after *chloroquine* experimentation because they lacked funds to purchase drugs for such purposes."

Nevertheless, in the 1990s, researchers administered several ineffective *chloroquine* tests in Muheza with many side effects, without terminating the study or treating the affected human subjects. From October 1993 to August 1994, malaria prophylaxis using *chloroquine* tablets was tried on 81 children in the villages of Mpapayu, Kwemkabala, and Potwe in Muheza District. In this study, 60 children who frequently showed positive results on blood slides were not treated. These results indicate a high default rate due to drug inefficiency (NIMR Amani, 1994). In 1995, although tested *chloroquine* tablets on children in Kwafungo, Lusanga, Mbaramo, and Mbomole villages in Muheza showed a failure rate of 78 percent, medical researchers did not stop their investigation or treat the affected children (NIMR Amani, 1995). From January to July 1997, a total number of 179 children from Misongeni, Msowelo, and Tongwe primary schools in Muheza were subjected to *chloroquine* drug trial after they were found to have malarial parasites. In the first two months of January and February, approximately 126 children, which was almost 70 percent, were not cured. However, several researchers from the Amani Research Centre continued to test the drug for the whole year without any treatment and care for the children, despite the high failure rate that was shown in the early months (NIMR Amani, 1997).

As observed earlier, in the late 1970s, information from the Amani Centre showed that more than 60 percent of malaria patients used as human subjects during *chloroquine* resistance testing were not cured (NIMR Amani, 1980). This proportion was far above the requirement set in the international code, which emphasizes that illness resistance to any drug should not fall below ten percent. This means that the curative ability of dependable and reliable drugs for the treatment of patients should range from 90 to 100 percent (NIMR Amani, 1990). However, according to an interlocutor: "During the late 1980s and the early 1990s, researchers from the Amani Centre continued to experiment *chloroquine* in different parts of Muheza without terminating the study to treat affected patients." For instance, one hospital-based study on children under five years of age was conducted at district designated hospitals in Muheza from 1987 to 1989. This study showed that *chloroquine* failed to treat malaria at a rate of 76 percent. Although this study does not disclose the consequences for children, the failure rate of *chloroquine* suggests that there may have been many side effects and a high incidence of death because many sick children lacked appropriate treatment for a long period (NIMR Amani, 1989).

Another similar unethical drug trial on children was administered by researchers from Amani. This study was conducted on children between February 1990 and September 1991 in Muheza. Parasitological follow-up of the children during the study showed a 76.7 percent of *chloroquine* failure in malaria treatment. As a result, through their findings researchers acknowledged that malaria resistance to *chloroquine* led to the loss of many children in the area (NIMR Amani, 1991). According to international standards, the situation in Tanzania during the 1980s indicated that *chloroquine* had already shown a very high failure rate in malaria treatment. This shows that there was no need to test its efficiency and safety from 1980 to 2000 in Muheza, especially given the fact that efficacious drugs, such as *sulphadiazine* and *pyrimethamine* have been available since the 1960s and have been effective even for the treatment of malaria cases resistant

to *chloroquine* (NIMR Amani, 2000). An interlocutor commented: "These studies were unethically conducted according to international standards because the affected children were not treated. As a result, many children were unnecessarily injured, whereas others died due to a lack of reliable medical treatment."

Another unethical drug experiment was conducted by researchers who neglected the appropriate scientific procedures. This disregard was contrary to the Helsinki protocol, which stipulates that biomedical research involving human subjects should conform to generally accepted scientific principles and thorough knowledge of the scientific literature. According to this code, it is the duty of researchers to protect the lives and health of the human subjects involved in medical research (WMA, 1964). However, researchers were overzealous to such an extent that they hurriedly tried drugs on children without observing whether data on potential risks were completed. For instance, between November 1992 and April 1993, the efficacy and safety of *chloroquine* were tested on infants in Mkuzi, Mlingano, Mbomole, and Ngomeni villages in Muheza for the treatment of malaria. In this study, 27 of 165 infants experienced swelling of their body parts, and three of them died. Researchers involved in this drug trial admitted that not enough was known about its toxicology with respect to infants (NIMR Amani, 1993). Similarly, in 1995, researchers from Amani tested the efficacy and safety of *chloroquine* for the treatment of malaria on infants at the Muheza District Hospital. The records in this study shows that 64 of 89 infants experienced body swelling, and seven of them died. In this study, it was documented that the *chloroquine* dosage tested on infants at the Muheza District Hospital was potentially dangerous because data on its toxicity was not yet well established (NIMR Amani, 1995).

Some unethical practices in drug experiments results from the use of unqualified personnel. This is contrary to the Helsinki protocol, which stipulates that research involving human subjects should be conducted

only by scientifically qualified persons under the supervision of a clinically competent medical person. According to this code, the ultimate responsibility for the human subject must always rest with a medically qualified person and never on the subject of the research, even though the subject has provided consent (WMA, 1964). From September 1998 to February 1999, researchers from Amani used research assistants to help in experimentation on the reliability of *propoquine dihydrochloride* on children for the treatment of malaria in the villages of Mhamba, Mkuzi, Potwe, and Songa in Muheza. Many of these assistants were not experienced in maintaining the research records. This situation shows that there was no information on the identity of the patient or the frequency of the drug received by a particular child. Thus, a lack of proper records produced unreliable data for researchers (NIMR Amani, 1999). Even in 2000, contrary to the international code, researchers from Amani did not supervise incompetent research assistants to test the reliability of the *suphanonethoxine* on children in the villages of Misozwe and Tongwe in Muheza. These assistant researchers did not record the consequences of the drug on each child as required, which led to the death of two children in Misozwe and one in Tongwe (NIMR Amani, 2000).

Another unethical practice was the result of researchers testing drugs on adults without appropriate laboratory examinations and trials on animals. This was contrary to the international guideline, which stipulates that research involving human subjects should be based on adequately performed laboratory and animal experimentation (WMO, 1996). In 1986, researchers tested the efficacy of *chloroquine* on 124 adults in the villages of Lusanga, Mbaramo, Ngomeni, and Songa in Muheza. Researchers decided on their own initiative to test the increased dose of 35 instead of the common standard of 25 milligrams per kilogram (mg/kg) of body weight because of prolonged inefficiency of the drug. Researchers did not test the increased amount of *chloroquine* on laboratory animals as the international guideline required before its administration to human

subjects. During the administration of this drug, the increased dosage was so toxic that 41 patients fainted and six of them died (NIMR Amani, 1986). Similarly, in 1988, c*hloroquine* was tested on 95 children in Emau, Kwamkoro, Mlingano, and Shebo in Muheza. An increase in the dose from 25 to 35 mg/kg of body weight caused blindness in two children and dizziness in seven children, of whom two died (NIMR Amani, 1988).

Available evidence shows that during the 1980s, the efficiency and safety of *chloroquine* were compared to those of *quinine*, *propoquine dihydrochloride,* and *sulphanonethoxine* on children in Muheza District. These studies did not follow international ethical principles in drug trials involving human subjects. It is evident that researchers tested the increased dosage of malarial drugs on children before drawing any conclusions from laboratory animal studies (NIMR Amani, 1983; 1988). Local people were not informed in detail about the aims and impact of these studies on children. Instead, their children were given free drugs to treat their malarial problems. In these studies, which were conducted in Lusanga, Magoroto, Mtindiro, and Tongwe villages in Muheza, Amani researchers increased ten milligrams in the standard *chloroquine* dosage by their own curiosity because of the inefficiency of the drug. However, there is no indication that this increase was tested on animals before being administered to human subjects, as stipulated by the Helsinki Standard (NIMR Amani, 1986). Evidence shows that a number of children fainted and were quickly transported to Muheza District Hospital for help. Researchers ignored the increase in dosage, dismissing it as a minor alteration that does not harm the patients (NIMR Amani, 1988). In such situation, one interlocutor commented: "Although researchers took some precautions regarding the increased doses, there were extreme risk cases where the increased dosage led to severe side effects and numerous deaths among underprivileged human subjects in many parts of Tanzania." Another interlocutor remarked: "It was observed that, in order for researchers to maintain confidentiality in their drug trials on vulnerable human subjects, these

studies did not disclose the exact number of affected individuals and deaths that occurred."

Other incidents of unethical practices were reported by researchers who conducted drug trials without weighing the risks and benefits to elderly people, as required by regulations. According to international standards, physicians should abstain from engaging in research projects involving elderly people, unless they are satisfied that the hazards involved are predictable. Physicians should cease investigation if the hazards outweigh the potential benefits (WMO, 1996). Available evidence shows that in 1983, researchers from Amani went to Kwemkabala, Mpapayu, and Potwe villages in Muheza to test the effectiveness of *chloroquine* on elderly people without considering its potential benefits to participants (NIMR Amani, 1983). A similar record shows that, in 1997, primary school children in Bomu-Bomu, Delema, and Mbomole villages did not benefit from improvements in their health conditions because they did not receive treatment with ineffective *chloroquine* (NIMR Amani, 1997). In 2000, although researchers continued with *chloroquine* experimentation on children in Emau and Delema villages, available evidence showed that the drug was ineffective and risky for children. This circumstance was the result of the fact that five of 27 children died from the ineffective drug (NIMR Amani, 2000). However, researchers' prolonged unethical practices in *chloroquine* drug trials on patients contributed to unscientific treatment-seeking behaviour for malaria in Muheza.

Unscientific Treatment-Seeking Behaviour for Malaria

This section illuminates the nature of local people's unscientific treatment-seeking behaviour for malaria in Muheza District. Evidence shows that from the 1940s to the 1970s, almost 80 percent of people believed that *chloroquine* was the best drug for the treatment of uncomplicated malaria compared to other remedies (NIMR Amani, 1980). During this period,

95 percent of Muheza residents regularly rushed to formal health facilities to access *chloroquine,* which was trusted to be effective and safe for malaria treatment (NIMR Amani, 1984). However, according to an interlocutor: "Since the early 1980s, people's confidence in the drug changed because of the realization that ineffective and unsafe *chloroquine* was unethically tested on their bodies."

The familiarity of local people in Muheza was a result of the leakage of information from researchers who told sick relatives and friends to take precautions during their visits to formal health facilities (NIMR Amani, 1999). An interlocutor observed: "The awareness of these residents also stemmed from their own observation of the high rates of death, as well as the psychological and physical disabilities that occurred among patients who received the drug at health facilities, schools, and prisons." Researchers from the Amani Centre noted that information circulated among local people through discussions during their gatherings at burial ceremonies, weddings, markets, and village meetings (NIMR Amani, 2000). Another interlocutor remarked: "Thus, prevailing circumstances and discussions were strong factors for local people to practice unscientific behaviour regarding the search for a cure for malaria."

It remains to be emphasized that the awareness that ineffective and unsafe *chloroquine* was unethically tested on patients upset a number of residents to attend formal health facilities in search of a cure for malaria. This situation influenced local people to design their own procedures, which focused on unscientific treatment-seeking behaviours for malaria (NIMR Amani, 2001). An interlocutor concluded: "It is obvious that the designed unscientific procedures were initially carried out by a few individuals and later spread to a large number of members in local communities in Muheza District."

In these African societies, the unscientific procedures designed for the treatment of malaria focused on four endeavours. The first unscientific

attempt by residents of Muheza to seek treatment for malaria began at home when they experienced symptoms such as headache, muscle aches, high temperatures, shaking chills, and loss of appetite (Oberlander and Elverdan, 2000). The determination of a cure for malaria involved the use of modern antipyretic drugs such as *paracetamol* and *asprin*, which were accessed at nearby shops. Available evidence shows that about 60 percent of people start the process of healing malaria with antipyretic drugs at home (NIMR Amani, 1998). However, some studies have concluded that these drugs only relieve fever on patients with uncomplicated malaria. Since patients did not receive appropriate treatment, approximately 46 percent of them experienced difficulties such as loss of appetite, vomiting, and convulsions (NIMR Amani, 2001). Thus, the local people were forced to attempt a second possibility to cure malaria.

Unlike the first option, it was observed that in their second choice, patients decided to purchase malarial drugs at shops available in their locations. This initiative appeared because of the long persistence of untreated malaria, which developed into complicated cases (NIMR Amani, 1988). Nevertheless, it is clear that the Tanzanian government allowed the establishment of drug shops in the 1970s to address the shortage of medications for its citizens (NIMR Amani, 1980). Before the 2001 policy change, these drug shops were permitted to stock oral formulations of *chloroquine* and *amodiaquine*, as the first and second-line drugs respectively (Mubyazi, 2005). Following permission to establish drug shops, the government released an ethical principle to guide the provision of drugs. This principle prohibited drug shops from sell prescription medicines. However, according to an interlocutor: "Retail drug sellers in Muheza did not obey the law that forbade them from selling prescription medicines." In this case, drugs such as *sulfadoxine pyrimethamine*, *quinine,* and *artesunate*, which were not allowed to be in shops, but to the pharmacies were sold to approximately 70 percent of local people without prescriptions from physicians. It is evident that about 55 percent of the patients were not

cured because they did not receive the correct dose regimes for specific parasites. It was also noted that 43 percent developed complications such as swelling of body organs, dizziness, abortion, premature deliveries, and even death (NIMR Amani, 2001. Thus, unfortunate patients attempted to cure malaria through traditional methods.

The local people opted for traditional healing systems as their third choice for malaria treatment in Muheza. Most of these were people who thought that the causes of their malaria did not emanate from natural forces, since their determination to use biomedicine did not cure the problem (Oberlander & Elverdan, 2000). Available data show that about 67 percent of patients consulted traditional healers following the belief that the cause of malaria originated from unnatural forces, such as angered ancestral spirits, evil spirits, or the effect of witchcraft (NIMR Amani, 1988). One interlocutor mentioned: "In such situations, patients who believed that the disease was caused by human-induced forces consulted the traditional healers." However, studies have shown that numerous residents consulted traditional healers for advice and treatment of malaria compared to those who attended formal health services. Throughout the study period, evidence shows that about 60 percent of deaths occurred in traditional healing systems compared to 40 percent, which were recorded at formal health facilities (NIMR Amani, 1999).

The fourth choice of indigenous people in Muheza focused on the search for a cure for malaria at formal health facilities. For a long period, two main concerns were important for their attendance at health facilities. As mentioned earlier, first, it is clear that local people used to attend health facilities when they conceived that their malarial illness was a result of naturalistic outcomes. Second, it was because of the assurance that *chloroquine* was effective and safe for the treatment of the disease (Alilio et al., 2001). However, throughout the period of this study, it seems that local people in Muheza decided to move to health facilities as their last resort because they had no other alternative for seeking a possible cure for

malaria (Mubyazi, 2005). This is shown by the large number of patients who were in critical conditions of the disease during their arrival at health facilities. Studies indicate that about 45 percent of patients arrived at health facilities very late, when malaria was at its critical stage (NIMR Amani, 1999).

Conclusion

This study illustrates how medical researchers from the Amani Centre intervened in *chloroquine* resistance by testing its efficacy and safety on patients in Muheza District. However, despite the presence of international guidelines for appropriate practices in drug experimentation on patients, some researchers violated ethical principles. The unethical practices in *chloroquine* experimentation that led to health consequences for patients influenced local people to engage in unscientific treatment-seeking behaviour for malaria. This practice was influenced by the availability of medical pluralism, which has a long history and is a common behaviour among the local people, even before colonial rule was established in Tanzania.

The experimentation of *chloroquine* for its efficacy and safety left local people with unpleasant memories of how medical specialists neglected international ethical regulations. The deep consequence of these unethical experiments is the legacy of distrust they instilled among the local people in Muheza District. According to interlocutors, the magnitude of this type of anxiety towards medical practice was immense, serving as an impediment to new research projects that could address drug testing or disease outbreak in different parts of Tanzania.

Recommendations

Although the extent of unethical practices in *chloroquine* experimentation and unscientific treatment-seeking behaviour for malaria in Tanzania remains unknown, they have serious health implications for many local

people. Despite the presence of international guidelines for drug experimentation, strict adherence to these guidelines is lacking. It is recommended that penalties for violating these guidelines be included within the guidelines themselves, so that any medical practitioner who disregards them faces disciplinary actions. The Tanzanian Ministry of Health should prevent unethical practices in drug experimentation by enforcing the prescribed penalties outlined in the guidelines.

The Ministry of Health should also address unscientific treatment-seeking behaviour by directly raising awareness among the local people. These individuals should be educated about the consequences of using drugs without a prescription, as this practice can lead to issues such as overdose, increased illnesses, allergic reactions, organ damage, and stroke. Unscientific practice can also contribute to the failure of drugs, as highlighted by Roux et al. (2021), who note that owing to its accessibility and affordability, *chloroquine* was excessively used without a prescription, resulting in its ineffectiveness for treating malaria.

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