



# Mazingira and the malady of malaria: Perceptions of malaria as an environmental disease in contemporary Zanzibar

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## ABSTRACT

This paper addresses how contemporary Zanzibaris perceive the relationship between the *mazingira* (roughly translated as “environment”) and the malady of malaria. More broadly, this article presents data exploring Zanzibari conceptions of the *mazingira*, the relationship between the *mazingira* and malaria, and who Zanzibaris believe are responsible for acting on, or for, the *mazingira* in regards to malaria. We use the biomedical disease malaria—and the local syncretic understanding of it, which we recognize by referring to it as the “malady of malaria”—as a lens to investigate Zanzibari conceptions of the *mazingira*. We highlight the need to integrate local forms of knowledge, which we refer to as vernacular knowledge. 50 interviews show that Zanzibaris believe the *mazingira* can be modified in positive ways to cleaner, safer spaces that will also reduce malaria levels. People expressed widespread agreement that there is a clear relationship between the *mazingira* and the malady of malaria, though they differed in what exactly the relationship was.

## 1. Part 1: Introduction

In comments made in 2011 at the Gates Malaria Forum, Melinda French Gates rightly noted that “Zanzibar had an up-and-down history with malaria ... the malaria burden in Zanzibar oscillated like a sine wave.” This observation suggests an interesting and challenging set of questions about this up-and-down history, the possibility of progress on malaria elimination, and how malaria has been normalized in Zanzibar as part of the disease landscape. This paper addresses the long history of malaria interventions in Zanzibar over the past 120 years, and how contemporary Zanzibaris perceive the relationship between the *mazingira* (roughly translated as “environment”) and malaria. More broadly, this article presents data exploring Zanzibari conceptions of the *mazingira*, the relationship between the *mazingira* and malaria, and who Zanzibaris believe are responsible for acting on, or for, the *mazingira* in regards to malaria.

This paper uses the biomedical disease malaria—and the local syncretic understandings of it, which we recognize by referring to it as the malady of malaria—as a lens to investigate Zanzibari conceptions of the *mazingira*. The focus is not on malaria per se, but to use it as a starting point to consider larger, more intertwined questions such as how people view themselves in relation to the *mazingira*.

We make two arguments related to contemporary Zanzibari understandings of the *mazingira* and why epistemic diversity and the inclusion of vernacular forms of knowledge is important. First, we highlight

the need to integrate local forms of knowledge—which we refer to as vernacular knowledge—into STS and the historiography of disease. We make the straightforward argument that there is a great value in incorporating local conceptions of disease and the environment and present it not as erroneous understandings of biomedicine or Western European concepts. The vernacular knowledge we report on is drawn from oral sources contextualized through a consideration of the history of biomedical malaria, and local understandings of the malady of malaria past and present. We offer these interdisciplinary sources and methods in an effort to diversify the geographic spaces written about in the history of science and science and technology studies (STS), and the types of knowledge that are regularly integrated. In this case, oral sources allow us to center the voices and experiences of people on the receiving end of a century of various malaria interventions rather than continue to rely on colonial modes of thinking about the African continent.

Second, we offer that vernacular knowledge by reporting on oral interviews conducted in Zanzibar. We highlight the meaning and value of Swahili language terms such as *mazingira*, and use the phrase “malady of malaria” to indicate the inconsistencies between biomedical malaria and the experienced illness. We argue that Zanzibari framings of *mazingira* indicate peoples’ deep awareness of global power inequities, and the island’s precarious position as an international aid recipient. Zanzibaris believe the *mazingira* can be modified in positive ways to cleaner, safer spaces that will also reduce malaria levels. People expressed widespread agreement that there is a clear relationship between the *mazin-*

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*gira* and malaria, though they differed in what exactly the relationship was. The most salient issues raised in interviews about the *mazin-gira*/malady of malaria relationship were not the same as the environment/malaria connections that are emphasized in most biomedical framings of the disease.

1.1. Study location

Data comes from the Indian Ocean island of Unguja, commonly referred to as Zanzibar, which is one of the two islands making up the Zanzibar Archipelago, sitting roughly 50 km off the east coast of Tanzania. We focus on this small place because Zanzibar's history and current malaria campaigns have an outsized impact on contemporary global decisions about malaria eradication. Since the early 1900s, it has been idealized as the perfect site for elimination attempts due its island ecology, small size, endemic levels of disease, small population, and relatively stable political climate. Initial efforts by the British protectorate government through the 1950s focused on environmental control and centered on mapping mosquito breeding sites, destroying mosquito habitats, and sporadic mass drug administration (Issa, 2011; Nisula, 1999). The campaign by the World Health Organization (WHO) in the 1950s–1960s focused on indoor residual spraying (IRS), and many WHO experts erroneously predicted Zanzibar would be the first example of successful malaria elimination in tropical Africa (Graboyes & Meta, in press). For five years in the 1980s, USAID unsuccessfully tried to reduce malaria prevalence rates with continued spraying, but ran into problems of insecticide resistance (Evaluation of the USAID Zanzibar Malaria Control Project, 1983).

Since 2002, malaria projects have been funded by the Gates Foundation and the US President's Malaria Initiative (PMI), which emphasized “hot spot” spraying, the distribution of insecticide treated bed nets, widespread access to malaria tests and artemisinin-based treatment (that currently has no resistance), and the creation of digital systems for tracking malaria cases. These recent efforts have proven highly effective, though there are questions about how secure those gains are. In the past 20 years, malaria rates have dipped lower than they have been in decades, and the Zanzibar Malaria Elimination Programme (ZAMEP) describes the disease as “nearly eliminated” with current prevalence of less than 1% on parts of the island (Björkman et al., 2019). In international discussions of malaria control, Zanzibar is frequently invoked as a success—an example of malaria conquered in tropical Africa.

Yet, as with many appealing narratives, this one is not quite true. Not a single program in Zanzibar over the past century has eliminated malaria. Malaria has been *nearly* eliminated multiple times; which is the same as saying it has *never* been eliminated. Despite new chemicals, new treatments, new tests, new bed nets, and new tracking systems, the mosquito vector and malaria parasite remain entrenched in the local environment and local bodies. As Melinda French Gates alluded to with her “sine wave” reference, over the past hundred years, malaria rates have plummeted and then rocketed back up at least three times, with prevalence rates in children ranging from 75% to under 5% (Conner, 2021; Graboyes & Meta, in press). Countless campaigns have been launched in Zanzibar and promises are continuously made about malaria's imminent demise. Yet the disease remains.

1.2. Methods and sources

This article reports on the results from 50 oral interviews conducted in Zanzibar between 2017 and 2019. Interviews were conducted in the population center of Zanzibar Town/Ng'ambo and surrounding peri-urban communities. The broad focus was to collect peoples' recollections, impressions, and understandings of the history of malaria interventions on the island. The interviews focused on lived experiences with the disease, how malaria is perceived as an environmental disease, memories of specific interventions (such as spraying, mass drug admin-

istration, distribution of bed nets), and impressions of the current malaria elimination activities.

Interviews were held with 41 Zanzibari members of the lay public, 9 Zanzibari malaria experts and medical professionals, and dozens of informal conversations. Participants were recruited through personal and professional contacts, snowball recruitment, and introductions from local government officials (*shehas*). Participants included those who self-selected in by approaching us and asking to participate. Interviewed participants are not random or representative, though we did arrive at saturation for many interview questions.

Interviews lasted between 45 and 90 min, were conducted in Swahili or English by JM or MG, and typically occurred inside the individual's home or place of work. Participants received an information sheet in English and Swahili; the interviewer explained the project verbally; finally, the participant was verbally consented. With permission, interviews were audio recorded and participants were asked again at the end of the interview if they were comfortable having their proper names associated with their statements (In this article, we opted to use honorifics and first names). At the conclusion of the interview, each participant was provided a gift worth approximately 12,000 Tanzanian Shillings (approximately \$5 USD) delivered in the form of soap, sugar, tea, cloth or cash.

Table 1 describes the characteristics of the 50 participants. Among the 50 people we spoke with, ages ranged from 18 to 89 and 44% of our sample was between the ages of 59 and 89 years. Since the larger project is concerned with the history of malaria on the island, we did have a slight preference to interview older Zanzibaris. The majority of interviewees were born and raised in Zanzibar, with only 7 participants noting that they had moved from mainland Tanzania or Pemba. Education level was not collected from all participants, yet our sample is heavily skewed towards the educated. Of the 37 respondents to this question, 27% held college level degrees and/or certificates and 32% received secondary education.

The interviewer wrote ethnographic notes the same day, and JM and MG discussed the main themes of the interview within a few days of it taking place. Audio files were transcribed into Swahili by Deborah Mushi, a native speaker. After transcription, data was coded and organized by identifying key words, themes, concepts, and phrases. This process of cleaning, Organization and analysis was conducted over an 18-month period, and the co-authors reviewed transcripts repeatedly. All co-authors have high levels of Swahili language competency (JM is a native speaker, MG and RC are advanced speakers.) Relevant passages were translated into English by JM.

One limitation of this data is in accurately reporting female perspectives. Although women made up nearly 50% of the sample, a majority

Table 1  
Summary statistics for interviews, 2017–2019.

<b>Total number of formal interviews</b>	<b>50</b>
# of men (% of total)	29 (58%)
# of women (% of total)	21 (42%)
<b>Respondents reporting age</b>	<b>39</b>
# of people 18–28 (% of total reporting)	4 (10.25%)
# of people 29–38 (% of total reporting)	2 (5.12%)
# of people 39–58 (% of total reporting)	11 (28.20%)
# of people 59–89 (% of total reporting)	22 (56.41%)
<b>Respondents reporting education</b>	<b>37</b>
# of people with no formal education (% of total reporting)	5 (13.51%)
# of people with only elementary level education (% of total reporting)	10 (27.02%)
# of people with secondary level school education (% of total reporting)	12 (32.43%)
# of people with college level education (% of total reporting)	10 (27.02%)
# of people with expert medical, malaria knowledge (through training or occupation) (% of total reporting)	3 (8.11%)
# of people with government position/personnel (% of total reporting)	6 (16.22%)

of those we spoke with minimized their knowledge and experience, often using phrases expressing the general sentiment of “you shouldn’t talk to me, talk to a male relative or a community leader” and even going so far as to invite a male relative into the interview space to join the conversation. In many of these cases, the declaration of non-knowledge seemed perfunctory, as the women then went on to give clear and compelling answers. This tendency could be partially explained as a rhetorical norm among women in Zanzibar or as a way to signal to the interviewer that the topics being covered were outside the realm of what is typically considered female expertise.

Another limitation is in the genealogical section where we rely on pre-colonial and colonial texts produced by male European government officials, travelers, or church members passing through the region. These texts are overwhelmingly racist and nearly all function as justifications for colonialism or Christian missionary work. We work with these materials because they are what is available, yet we work with them critically.

### 1.3. Vernacular knowledge

One contribution of this paper is to integrate African voices and African vernacular knowledge more fully into the history of science, STS, and current global health discussions. We use the term “vernacular knowledge” to capture different forms of thinking, knowing, and meaning-making on the continent using categories that are locally present, especially ones presented in African languages. It captures a body of local knowledge that is part of a larger epistemic framework, what Oreskes calls an “established knowledge tradition” (Oreskes, 2019, p. 63). Vernacular knowledge is not “traditional” in the sense that it is unresponsive to foreign contact, and it certainly is not static (Agrawal, 1995). Vernacular knowledge includes oral knowledge about the present in addition to historical, pre-colonial knowledge that has shifted over time. Many of the best works documenting forms of local knowledge around malaria and disease show distinct patterns of change—the broadening of meanings, adopting new terms, and melding formerly distinct patterns of explanation (articles such as Giles-Vernick et al., 2011 discussing *sumaya* in Burkina Faso and Livingston, 2007 parsing *thibamo* and tuberculosis in Botswana). Explanations of why a particular disease occurs, how it disables, who is affected, and effective preventatives or cures all fall within the realm of vernacular knowledge. It encompasses the observational and experiential learning coming from centuries of living with a particular condition.

The concept is closely linked to related terms such as endogenous knowledge, indigenous knowledge, traditional knowledge, local knowledge, and traditional ecological knowledge used in fields such as anthropology, ecology, environmental history, ethnoscience, sub-altern studies, and African Studies (Agrawal, 1995; Bohensky & Maru, 2011; Cetina, 1999; Fairhead & Leach, 1996; Hountondji, 1997; Huntington, 2000; Nadasdy, 1999; Nash, 2007). More broadly, scholars focused on African philosophy have raised challenging questions about the presence and defining of African epistemes and African epistemology and how this might affect our thinking about forms of knowledge on the continent (Kresse & Marchand, 2009).

Our framing of African vernacular knowledge draws most directly on work by Mavhunga (2018) and Tilley (2011). Mavhunga re-integrates African vernacular knowledge in the realm of sleeping sickness and the *mhesvi* (tsetse fly) in Zimbabwe, showing the value in privileging African epistemic categories rather than European or biomedical ones. We follow Mavhunga’s lead of centering Zanzibari knowledge (contemporary knowledge that draws on local histories and past experiences) by using the Swahili term *mazingira*, as a reminder that this thinking is happening in another language, in another epistemic frame. Tilley (2011) approaches African forms of knowledge from a different angle, pointing out that it was rarely acknowledged or integrated into

official colonial accounts across the continent, even when broadly interdisciplinary “ecological” approaches were being used.

There has been a vibrant literature on how postcolonial technoscience can be informed by an area studies approach. Anderson has written extensively on the role of South East Asian Studies within STS, even “trying to re-imagine science studies as a form of area studies” (2009). This postcolonial approach to technoscience entails critically viewing the globalization of science, while still paying attention to local histories and situated knowledge, and integrating heterogeneous sources (Anderson, 2014; Monnais & Tousignant, 2006). It recognizes that science, technology, and biomedicine travel, but focuses more on local appropriations, adaptations and transformations, highlighting the agency of local communities. These topics have been carefully considered by Hecht, Breckenridge and Serlin and this article is meant to contribute to what they call the “political work that the history of technology, perhaps especially in African history, performs through absences and voids” (Serlin, 2017).

### 1.4. Biomedical malaria: the briefest introduction

In order to fully appreciate how rooted in the environment biomedical malaria is, it’s necessary to have a basic understanding of its biology and life cycle. Biomedical malaria is a vector borne disease, transmitted by the bite of an infected female *Anopheles* mosquito, from one person to the next. *Anopheles* mosquitoes must ingest a malaria parasite (*Plasmodium*) from a person who is currently infected, live long enough for the parasite to develop in the mosquito’s gut, and then bite another human where the parasite exits the mosquito and enters the human bloodstream, causing a new infection (Packard, 2007). Once a person is infected, the parasite undergoes distinct developmental phases inside the human liver and the blood stream. The symptoms are cyclical fevers, malaise, and often stomach upset or vomiting in addition to anemia. Technically, all malaria cases are treatable and death is preventable if treatment is sought quickly enough, and the right treatment is given. However, if a case of malaria *isn’t* treated promptly, occurs in a young child or person without acquired immunity, who has another illness, or is immunocompromised, the disease can lead to death. As with all vector borne diseases, the right environmental conditions have to be met to allow the vector to live, breed, and thrive (Webb, 2014). Without the vector’s habitat, there is no vector; without the vector, there is no disease.

It is now widely recognized that local malaria epidemiology is affected by a vast number of environmental characteristics. These include conditions such as topography of the land (altitude, aspect, slope); climate conditions (rainfall, temperature, relative humidity, windspeed); land cover/land use patterns (rainforest, deciduous, forest-savanna mosaic, savanna, cropland); and anthropogenic changes (distance to villages, roads, housing type) (Ayala et al., 2017; Hirzel et al., 2002). Small changes in any of these characteristics can lead to increases or decreases in the malaria burden. Specific to Zanzibar, articles have been published describing the relationship between malaria hotspots and environmental conditions such as hydrology, geology, and geomorphology formations on the island (Hardy et al., 2015). Understanding the deeply rooted relationship between biomedical malaria and environmental conditions calls for an investigation of more local interpretations as it relates to the environment/*mazingira*.

## 2. Part 2: A brief genealogy of the malady of malaria in Zanzibar

Societies have worked to understand the condition of malaria for as long as they have been plagued by it—framing it in terms of larger cosmologies of individual and communal health, sickness, and misfortune (Feierman & Janzen, 1992; Feierman, 2000). In Africa during the pre-colonial era, the malady of malaria existed with a multitude of different names and explanations, as evidenced by the diversity of names and eti-

ologies recorded in travelers' accounts and the plethora of names that continue to exist across the continent today (Winch et al., 1996). This section presents a brief genealogy of the malady of malaria in Zanzibar, drawing on pre-colonial and colonial era texts, presenting information about vernacular knowledge by focusing on the category of illness known as *homa* (fever) and the plurality of explanatory systems in the region.

The Swahili Coast, of which Zanzibar is a part, is an area long characterized by medical pluralism and syncretism. Swahili conception of disease, medicine, and healing can be characterized as being broad, inclusive, and adaptive to foreign ideas and systems (Beckerleg, 1989; Graboyes, 2015; Malowany, 1997). That syncretism is a result of the region's long engagement with foreign healing systems. Dating back to at least the 10th century, the Swahili Coast had regular and sustained contact with the larger Indian Ocean world including significant and regular movement of Persians, Arabs, Omanis and Indians with the annual monsoon winds that occurred as part of the dhow shipping trade (Gilbert, 2005; Sheriff, 1987). People turned to a variety of healers including diviners, herbalists, European and Indian apothecaries, and those specializing in Islamic medicine while explaining disease by drawing on humoral theories, Islamic medicine, Ayurvedic practices, homeopathy and ideas from the African interior (Issa, 2009). Anthropologists consider Zanzibar a place with a “plural medical culture,” but that is not new (Nisula, 1999, p. 289).

### 2.1. Naming the malady of malaria, historically: *Homa*

A good starting point is to consider how people on the Swahili Coast have referred to the malady of malaria over time. Multiple sources show *homa* (fever) was the broad category of illness under which this condition fit, though it could be defined more narrowly by cause, severity, or demographic of the sufferer. *Homa* derives from the Arabic root *huma*, and is close to the contemporary Arabic word for fever, *hamaa*. As one Swahili speaker described its centrality: “*homa* is the mother of all illnesses” (Winch et al., 1996). As a descriptive category based on symptoms, *homa* likely captured many conditions that would be considered biomedically distinct diseases, including malaria, cold, flu, dengue, or yellow fever.

There are four key Swahili language dictionaries and texts dating back to the 1850s–1930s that provide insights into how this malady was understood, categorized, and named during this 80 year period. The earliest text is Krapf's 1882 Swahili dictionary, compiled along the Swahili coast between 1850 and 1880. There, *homa* (*hamma*) is defined as fever, and there are variations on fever listed, including those characterized by severity and cause. The Madan dictionaries were compiled in the 1880s–1890s in Zanzibar, led by the UMCA missionaries Madan and Steere. They include entries for *homa*, defined as fever, and include “malarial fever” and “ague fever” as sub-categories. *Dege* appears and is linked with infantile convulsions—the first early reference to the now-common childhood ailment referred to as *degedege*. As both Krapf and Madan's dictionaries were published before Grassi and Ross's discoveries, it's no surprise there is no entry for “malaria” and no linking of fevers with mosquitoes. That connection is made for the first time in the Johnson dictionaries, which were compiled between 1900 and 1939. *Homa* is listed as “fever” and it includes a listing for *homa ya malaria* (fever of malaria). In the Swahili dictionary, for the first time, there is an entry for *malaria* and it is listed as *homa ya malaria* followed by the English, “malarial fever.” Since the 1930s, the words “malarial,” *homa* (fever) and *mbu* (mosquito) have been associated in dictionaries, though it's likely that early references reflected the European authors' growing familiarity with tropical diseases rather than the understanding of local residents.

Table 2 presents information from four early texts, 2 contemporary accounts of malaria on the Swahili Coast, and findings from our interview data.

**Table 2**  
Fever and malaria terminology 1850s–2020, Swahili coast.

Krapf, 1882. <i>A Dictionary of the Suahili Language</i> . Gathered Swahili Coast, 1850–1880	
<i>Homma</i> ( <i>hamma</i> )	Fever
<i>Homma ya kidapo</i> <i>Homma cha beredi</i>	The shivering fit in fever
<i>Malaria</i>	No entry
<i>Dege/Degegede</i>	No entry
Velten, 1903 [Bakari, 1981]. <i>The Customs of the Swahili People</i> . Gathered Bagomoyo, 1890s	
Fever	There are two sorts of fever, cold and hot. Cold fever comes in the rains, when a man goes out and is caught in the rain. When he comes home, he feels cold and shivers. The cure for this is to have hot tea made to drink and the smoke of green benzoin passed through the limbs. Then he should wrap himself up until he sweats. Hot fever is when the sun is fierce and a man has gone out in it and caught the sun and has fever. He shivers all over, sometimes sweating and sometimes cold, and his head throbs. The cure is to be rubbed all over with dalia water and to apply some to the forehead. When the dalia dries, his limbs grow cool and he feels better. When a child has a fever, seven sorts of smoke are prepared for him by the teacher in a paper on which are written the <i>aham fashadh</i> , and this is put in sesame oil. Fire is brought, and the herbs are put in it, and the child is put in the smoke until he sweats. When an adult has fever, he is treated in the same way. When a person has a high fever and shows sign of delirium, people say, “We will test his head.” His head is shaved, and butter is applied with coconut paste spread on cotton and applied to the crown of the head. The butter is rubbed in until the skin oozes. Then it is fastened with a piece of black cloth. This treatment is continued for three days, and it is then known whether or not his mind is going.
Madan, 1894/1903. <i>English Swahili Dictionary</i> . <i>Swahili English Dictionary</i> . Gathered Zanzibar, 1880s–1890s	
<i>Homa</i>	Fever, esp. of malarial or ague-fever, described as <i>marathi ya baridi</i> , or <i>ya baridi</i> , or <i>ya kitapo cha baridi</i> , i.e. the chilly or shivering sickness ... <i>Homa ya vipindi</i> , intermittent fever. <i>Kidinga popo</i> , dengue fever, <i>mkunguru</i> .
<i>Dege</i>	Infantile convulsions, fits ( <i>kifafa</i> ); a kind of moth
<i>Malaria</i>	No entry
Johnson, 1939. <i>A Standard Swahili-English Dictionary</i> . Gathered East Africa, 1930s.	
<i>Homa*</i>	Fever, any sickness with a high temperature <i>Homa ya vipindi</i> , intermittent fever. <i>Homa ya papasi</i> , Spirillum tick fever. <i>Homa ya malaria</i> , Malaria fever. (Arabic) * = not of Bantu origin
<i>Malaria*</i>	<i>Homa ya malaria</i> , malaria fever. (English) * = not of Bantu origin
<i>Dege</i>	1) Infantile convulsions, fits ... 3) a large bird
<i>Malaria</i>	<i>Homa ilelwayo na namna ya mbu</i> [fever caused by mosquitoes]
Langwick, 2011. <i>Bodies, Politics, and African Healing</i> . Gathered SE Tanzania, late 1990s.	
<i>Degegede</i>	Old problem and common malady. Involves jerking, a hot body, foaming of the mouth, and eyes rolling to the back of the head. Children are most vulnerable, but anyone may be affected. A child with <i>degedege</i> is being played with by a <i>shetani</i> [devil]. Likely will not respond to hospital treatment.
Kamat, 2013. <i>Silent Violence</i> . Gathered Dar es Salaam, early 2000s.	
<i>Homa ya kawaida</i>	Ordinary fever
<i>Homa kali</i>	Strong fever
<i>Homa ya malaria</i>	Malaria
<i>Degegede</i>	Severe form of illness that affects mostly young children. Caused by “bad luck” or “God's will,” having something to do with a “spirit bird.” Can be treated in a variety of ways, including injections and biomedicine.
Graboyes, Meta, Clarke, 2021. Interview data gathered in Zanzibar, 2017–2021	
<i>Homa tu</i>	Literally: “only fever.” Indicating the common nature of the fever
<i>Homa za kawaida</i>	Everyday fever. Corresponds with Kamat's “ordinary fever”

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Table 2 (continued)

Krapf, 1882. *A Dictionary of the Swahili Language*. Gathered Swahili Coast, 1850–1880

Homa ya mbu	Mosquito fever
Malaria ya kichwani	Literally: “malaria in the head.” A bad case of malaria described as causing headaches or even delirium
Malaria ipo tumboni	Literally: “malaria is in the stomach.” Having fever, stomach-ache and severe vomiting which also lead to general body malaise
Malaria Kali	Fierce/severe malaria
Malaria Sugu	Chronic malaria

Additional insight about pre-colonial disease systems comes from a 1901 German text, drawing on research conducted by Carl Velten in Bagomoyo in the 1890s (Velten, 1901). The book was later translated into English as *The Customs of the Swahili People* (Bakari, 1981). Velten worked closely with a group of men to collect local norms, customs, and practices; the text includes 36 chapters on a variety of topics, with a nine page chapter “Of Diseases and Their Cure,” describing 23 unique disorders ranging from jiggers to syphilis. The first entry, and the lengthiest, is for “fever” and the entry is fully reproduced in Table 2. Fevers are linked to environmental changes and natural conditions and were also distinguished by the age of the sufferer and the severity of the fever. There are some notable absences in this chapter on disease: no specific reference to “malaria” or *mbu* (mosquito), and no reference of *homa* (fever) being linked to malaria or mosquitoes. The book lends credence to the idea that on the pre-colonial Swahili coast, the malady of malaria was likely named and understood as *homa* (fever), and that its cause was broadly environmental.

This 1890s text also illustrates the multiple explanatory systems for ill health existing on the Swahili coast during this time. There are references to environmental explanations including exposure to rain and sun. But there are also many other explanations for illness given, including congenital (hydrocele being passed from father to child); recognition of sexually transmitted conditions (women spreading syphilis and gonorrhea to men); person to person transmission (asthma, consumption, fits); external causes of disease (“an insect entering the ear and dying leading to deafness”); and situational causes (“madness being brought on by the loss of property or the death of a dear wife”) [Bakari, 1981, p. 140]. Only in the discussion of one condition, *tende* (elephantiasis), does the author say that its origin is a spell (*tenzo*).

Despite this early text showing a variety of explanatory models, much prior scholarship, especially in anthropology, has focused on the differences between African and biomedical models, fixating on explanations involving witchcraft. A handful of works have eloquently pointed out this tendency and offered thoughtful critiques (Langwick, 2011). Some trace this tendency back to EE Evans-Pritchard’s influential research among the Azande, and his statement that the “Azande attribute sickness, whatever its nature, to witchcraft and sorcery” (Evans-Pritchard, 1937, p. 65). Evans-Pritchard’s conclusions likely had outsized impact given it was one of the first Western studies into African understandings of disease. Whatever the cause, the fact is that on the Swahili Coast, there are multiple systems people can and have drawn upon to explain the cause of the malady of malaria, or other illnesses.

Those multiple systems are nicely laid out by Pool, which he organizes into 3 broad categories: personalistic explanations tend to be “social and moral;” naturalistic explanations tend to be “empirical and practical;” and a final category for the “unexplainable” (Pool, 1994, pp. 1–2). A personalistic explanation attributes the ill health to the “active and purposeful intervention of an agent” such as a human (witch/sorcerer), non-human (ghost, ancestor, spirit), or the supernatural (deity). In contrast, a naturalistic explanation traces the roots of disease to conditions such as cold, heat, winds, or imbalances within the body. The explanations are not mutually exclusive and illnesses are frequently attributed to interrelated causes. An example from the Kenyan coast in the 1980s illustrates how these different explanatory modes work in

practice. As Beckerleg describes, when a boy died diagnosed with biomedical malaria, the family explained his death as a result of having “no blood in his body.” Old ideas about humoral theory merged with new information about vitamins and malnutrition as they stated the boy should have eaten “hot” foods such as beans, liver and raisins, which would “strengthen the blood” in the same way that vitamins did (Beckerleg, 1989, p. 165).

This type of syncretic explanation is common, and in the context of multiple healing systems, biomedicine must “coexist with apparently contradictory” information (Beckerleg, 1989, p. 166). In Ifakara, Tanzania, people’s explanations for the malady of malaria often wove together notions of witchcraft with “knowledge of the biomedical cause.” In addition to noting mosquito bites as a cause of malaria, other modes of transmission included drinking or wading through dirty water, and or being exposed to hot sun, working hard, or changes in the wind (Muela et al., 1997, pp. 45–47; Muela et al., 2002, p. 407). A 1983 study from coastal Tanzania found that community members could list eight different causes of *homa ya mbu* (Fivawo, 1986). A 1993 study in Dar es Salaam found that 21% of the interviewed patients reported consulting a traditional healer prior to arriving at the biomedical facility (Gessler et al., 1995, p. 146).

In Zanzibar, there is a high level of awareness of biomedical malaria: the causes, the available tests, the drug treatments as pills or injections available in biomedical clinics, hospitals, or pharmacies. Many people can identify the basic symptoms and recognize that more severe cases or death can often be prevented by seeking testing and care early from a biomedical facility (Ministry of Health, Zanzibar, 2017). Yet it remains common that alongside these high levels of biomedical knowledge, there remains a plurality of explanations and treatments for malaria-like symptoms. Research carried out in 1996–1997 found that only 34% of the hundreds of people they interviewed related malaria with the bite of an infective mosquito. Other causes included “dirty water, change of weather, wind, eating unwashed mangoes, playing in the sun, excessive work (for adults), and/or lack of adequate food” (Alilio et al., 1998).

These medically plural and syncretic understandings have been aided by biomedically informed malaria interventions throughout the 20th century, and Zanzibar has been the site of many malaria activities since the early 1900s. The past 120 years can be broken into four broad time periods. The first was the British protectorate years from 1907 to 1953, when activities centered on environmental control meant to reduce the number of mosquitoes by mapping and destroying breeding sites in and around the main urban center of Zanzibar Town (Issa, 2009, 2011). During these years, there was reclamation of a tidal river (Darajani Creek) separating Stone Town from Ng’ambo and significant malaria research completed (Mansfield-Aders, 1927). The second period was from 1954 to 1968, when the WHO attempted to eliminate malaria with indoor residual spraying (IRS) using the insecticides DDT and dieldrin (Graboyes & Meta, in press). This program reduced malaria across the island, but the failure to eliminate and cancellation of the program led to an epidemic of rebound malaria in the 1970s–1980s (Conner, 2021). The third period was from 1969 to 2002, and was notable for extremely high malaria rates and sparse interventions, the only formal international program being USAID’s 1984–1989 program that failed to improve the malaria situation (Schwartz et al., 1997). The fourth, and most recent period, is from 2003-present. Promisingly, malaria rates have remained low by a combined focus on prompt testing and treatment with artemisinin combination therapy, digital case tracking, long-lasting insecticide treated bed nets, and insecticide spraying in “hot spot” areas (Bjorkman et al., 2019). The recent effects of the Covid-19 pandemic on malaria rates are unclear, though the pandemic does not seem to have caused a significant uptick in cases in Zanzibar.

Through these colonial and international efforts, growing numbers of Zanzibaris were exposed to biomedical framings of malaria. How-

ever, there is agreement that despite this long century of contact, these efforts—especially the colonial ones—should not be considered all-encompassing or hegemonic (Issa, 2009; Larsen, 2008; Mkumbukwa, 2006; Nisula, 1999). British colonial efforts prior to 1950 were limited to the urban areas of Stone Town and Ng'ambo. Only in 1958 did the whole island become more involved in malaria efforts, when the WHO began regular spraying of all the island's built structures. The decades of continued exposure to spraying campaigns, new drugs, new tests, and new bed nets meant that Zanzibaris became increasingly familiar with biomedical explanations, and were able to bring this information into dialogue with existing vernacular knowledge. Different types of archival sources make clear that Zanzibaris were never unquestioning receivers of these new interventions: Swahili language newspaper articles from the late 1940s captured preferences for oil rather than DDT as a larvicide; in the late 1950s, residents were publishing Swahili poetry lamenting the effect of DDT on fly populations (Issa, 2009). As Issa describes interviews with Zanzibari nurses working in a biomedical facility, they remembered that “they did not discourage patients from using” local remedies, and in fact, one went on to say it would be incorrect for the nurse to do so: “you cannot expect someone to condemn the use of the Quran texts for treatment. This is our belief. It is part of our religion” (Issa, 2009, p. 278). The increased contact didn't force people to abandon prior ideas, but merely offered a new set of explanations that could be adopted and adapted as desired, which are apparent in contemporary ethnographies and our own interview data.

## 2.2. Contemporary names and explanations

Moving into the present, in Tanzania and Zanzibar there continues to be multiple terms used to describe the malady of malaria. In Muheza on the mainland, Oberlander and Elverdan (2000) report how three different terms (*degedege*, *mchango*, *kibwengo*) are all related to malaria, but aren't considered to be malaria. In the Kilombero area of Tanzania, Muela et al. have documented how *homa ya malaria* is a recurrent disease of the rainy season whereas only children suffer from *degedege* (convulsions) and *bandana* (splenomegaly and severe anemia) (1997). The condition causing high fevers, seizure, and potential death in young children has been referred to as *degedege* (bird bird) in different parts of Tanzania (Langwick, 2007). From just south of Dar es Salaam, Kamat shows how *degedege* is considered a different condition afflicting only children who happen to be crossed by the shadow of a bird. Proper treatment is by local healers outside of biomedical facilities (Kamat, 2008, 2013). In Zanzibar, *degedege* has been roughly translated as “convulsions” (Koenker et al., 2013) and past research shows that conditions such as convulsions, anemia, and splenomegaly are perceived as “separate and specific illnesses” from biomedical malaria (Alilio et al., 1998, p. 412).

Our 50 interviews in Zanzibar show that what is being heard in the present has strong connections with historical categories. People continue to distinguish based on the malady's severity, the part of the body affected, or the age of the sufferer. Severity was indicated with Swahili terms such as *kali* (strong, fierce) or *sugu* (chronic), with respondents describing cases of *malaria kali* or *malaria sugu*. Distinctions were also drawn based on the secondary symptoms and which body parts were affected. These included mentions of *malaria kichwani* (malaria of the head), noting headaches and delirium, and *malaria ipo tumboni* (malaria of the stomach) referencing the stomach upset and vomiting that accompanies some cases.

Historical sources dating back to the 1850s provide important context for contemporary interview data and indicate ongoing connections and divergences between biomedical malaria and the malady of malaria. First, there was, and is, a gap in how biomedical malaria and the malady of malaria were defined, named, and explained. The malady continues to be referenced as *homa* even when people also acknowledge biomedical malaria. The broad category of *homa* can be narrowed by

referencing secondary symptoms such as headache, stomach upset, being tired, shaking, delirium, and seizures—or further categorized into unique conditions like *degedege*. Second, the condition of *homa* was, and is, often linked to environmental conditions such as cold, heat, rain, and wind. Contemporary Zanzibaris made further reference to the environment by noting that a cleaner, better ordered environment meant people were more likely to suffer from *homa tu* (just fever) or *homa za kawaida* (ordinary fevers) rather than severe forms of *homa* or malaria (*malaria kali*, *malaria sugu*).

While we have not emphasized the variety of treatments people may seek for this malady, there appear to be parallels between historical and contemporary practices. The Bakari text, collected in the 1890s from Bagomoyo, noted that one treatment for fever was to prepare a fire with particular herbs, and to place the child in the smoke until he sweats (Table 2). Ethnographic research completed by Alilio et al. in Zanzibar in 1996–97 found that the most common treatment for febrile convulsions in children was *mafunsho*, which was “smoke therapy” and involved having the child “inhale fumes from burning specific, strongly odorous leaves or tree bark” by placing him under a piece of cloth facing the smoke. This therapy was mentioned by every single one of the hundreds of Zanzibaris the authors spoke with. People offered that the smoke was either functioning to “get the demons out” or to make the child sweat since one woman offered matter of fact, “sweating helps relieve fever” (Alilio et al., 1998).

In the case of these historic and contemporary texts, they do not provide specific information about understandings of the *mazingira*. However, the remainder of the paper will present and analyze data collected from the 50 oral interviews, discussing first what is the *mazingira*, what is the perceived relationship between the *mazingira* and the malady of malaria, and finally, who do Zanzibaris believe are responsible for the *mazingira*.

## 3. Part 3: Malaria as a disease of the *mazingira*

*Mazingira* is everything that surrounds a person. The word comes from the Swahili root word *-zinga*, which means to be surrounded by, or the state of being surrounded. Based on interview data and more extensive informal discussions with people living in Zanzibar, *mazingira* includes humans and human created and modified spaces. This includes spaces such as *porini* (bush/wild spaces), *mashamba* (farm lands), *miji* (cities), *vijiji* (villages), *nyuma* (backyards), living things such as *wanyama* (animals), *miti* (trees), and man-made objects such as *takataka* (trash), *madimbwi* (puddles) and *mitaro* (open, shallow, man-made trenches). As a whole, the environment can be described with many different adjectives, but in all discussions, people most often described it as being *safi* (clean, safe, ordered) or *chafu* (dirty, disordered).

The *mazingira* is discussed in a way that indicates it is not static, but is in fact highly changeable, mutable, malleable. Humans are recognized as actors that can make both positive and negative impacts on the *mazingira*, thus creating either cleaner/safer or more dirty/dangerous spaces. Many respondents remarked on how the *mazingira* can be transformed into safer spaces through the act of cleaning (draining of damp areas, picking up trash) or can become more dangerous (increasing number of people, creating more trash/waste).

The most common definition given of *mazingira* was a broad one, meant to indicate that all things, people, and places were being captured. 25-year-old Bwana Masoud responded that “Environment are the things that surround you, including garbage, trees and even these chairs” [*Mazingira ni vitu vinavyokuzunguruka zikiwemo taka, miti na hata hivi vitu*] (Bwana Masoud, personal communication, August 7, 2019). While explaining the concept, he remarked on how much the term could encompass and that it wasn't dependent on a single item being present. “Environment could be an area without people or trees or couldn't be merely grass, we can't say *mazingira* is concrete [built ob-

jects]” [*mazingira yanaweza kuwa bila watu au bila miti, au sio majani tu. Hatuwezi kusema mazingira ni concrete*] (Bwana Masoud, personal communication, August 7, 2019). At first glance, it doesn't appear that Masoud assigns any specific attributes to the environment since he doesn't outwardly state that the environment is dirty or needs to be cleaned. However, he does allude to the presence of disorder or dirtiness by describing *taka* (trash/garbage) as one part of the environment.

The most frequent adjectives respondents used when talking about the *mazingira* derived from two terms, *-safi* and *-chafu*, which are often discussed in contrast/opposition to each other though they are not at all perfect antonyms. The root terms, common derivatives, and some common usage examples are listed in Table 3.

What is important to note about these terms is that they function as an easy gloss to make an initial assessment of an environment. *Safi* is an extremely common term used in Zanzibar in both spoken and written Swahili. Despite being a rather generic term, *safi* can do a great deal of descriptive work. Depending on the object being described as *safi*, the term can indicate that something is clean, safe, well-ordered, organized, or well. As the examples in Table 2 show, a person can indicate that they are *safi sana* (doing well) in response to a greeting from another person, while water that has been treated with a chlorine treatment and is safe, clean and drinkable can be described as *maji safi* (clean water).

In the same way that *safi* conveys generally positive characteristics around safety, cleanliness, hygiene and well-being, *chafu* captures some opposing elements. *Chafu* is used to describe items and spaces that are dirty, disordered, or undesirable. The word *chafu* can also be used to explain how bad a situation is. For example, a bad behavior of a person can be termed *tabia chafu* to describe how promiscuous a person is. In another context, *chafu* is directly associated with certain birds and animals (such as ducks or pigs) because of their surroundings and foods that they eat, which are regarded as dirty in human context. Generally, *chafu* has a negative connotation highly related to another Swahili word, *mbaya* (bad).

One set of respondents described *mazingira* by focusing on the immediate surroundings and cleanliness of the home (10/50 of the interviews). In these responses, mention was made of the *nyumba* (house) or the *kaya* (household). Bi. Kondo is a 62-year-old self-employed female born and raised in Zanzibar. When responding to a question about what *mazingira* meant to her, she referred to keeping one's own home and household clean: “Environment is to ensure your household is in clean environment” [*Mazingira ni ndo nili kushughulikia ile kaya yako iwe kwenye mazingira masafi*] (Bi. Kondo, personal communication, November 26, 2019). She defined *mazingira* as the space that was geographically proximate to her, rather than identifying a set of objects or living things. Kondo's definition included the process of cleaning the *kaya* (household), implying an inherent level of disorder or dirtiness (*uchafu*) in the surrounding environment that has to be constantly managed or mitigated.

**Table 3**  
-Safi and -Chafu definitions and common usage.

Root term	Common derivatives	Basic translation	Common usage
-Safi	<i>Usafi</i> (adj)	Clean	<i>Maji safi</i> (clean water)
	<i>Kusafi</i> (v)	Safe	Greeting: “How are you?”
	<i>Kusafisha</i> (v)	Well-ordered	Response: “ <i>Safi sana.</i> ” (very good)
		Good	<i>Kuweka usafi</i> (to make it clean) <i>Kusafisha mazingira</i> (to clean the environment)
-Chafu	<i>Uchafu</i> (adj)	Dirty	<i>Choo chafu</i> (dirty bathroom)
		Unclean	<i>Kaya chafu</i> (disordered home/compound)
		Disordered	<i>Mazingira machafu</i> (dirty environment)
			<i>Tabia chafu</i> (bad [personal] character)

This framing of the environment as a place that was in need of human modification, that the *mazingira* was a space that started as *chafu*, was a recurring theme that surfaced in multiple interviews. In this framework, the *mazingira* isn't only a place or set of objects, but also the actions needed to keep the space ordered and safe. For respondents who answered in this way, basic assumptions about the *mazingira* implied it was a space that was dirty, disordered, and had elements of danger that humans were responsible for keeping at bay through acts of cleaning, organizing and managing.

In multiple interviews it became apparent that in addition to describing a space and objects within it, *mazingira* as a term incorporates an element of danger. People mentioned that threatening animals or disease-transmitting insects are also part of the *mazingira*, and that these are often found in the “bush” (*porini*), which is widely understood to be a less safe space than a village (*kijiji*) or city (*mji*). One of the dangers interviewees recognized in the *mazingira* is disease. Interview questions focused specifically on malaria, a disease which people described as having strong environmental connections with weather, rain, water, plants and other objects. But many people also mentioned other diseases—diarrheal diseases, worms, lymphatic filariasis—as ailments linked to particular environments, and as part of Zanzibar's *mazingira*.

### 3.1. What is the perceived relationship between *mazingira*/malady of malaria

Many participants understood that malaria is transmitted via infected mosquitos, and that mosquitos are associated with dirty places within the *mazingira* (puddles, bushes, or trash piles), thus identifying a direct correlation between malaria and *mazingira*. When we asked the question “do you see any relationship between malaria and *mazingira*?” nearly all respondents (N = 36/50) stated there was a relationship: *uhusiano upo* (the relationship is there). Many respondents discussed the relationship by describing specific aspects of the *mazingira*, such as *madimbwi* (puddles), *maji* (water), *mvua* (rain), *hali ya hewa* (weather), *mbu* (mosquitoes), *takataka* (trash), *makaro* (septic tanks), and *miti* (trees). Some people—not always those with expert knowledge—made direct connections between specific environments and malaria life cycles. Multiple people remarked that puddles and standing water are breeding places for mosquitos, that mosquitos are more common among trash or in disordered spaces, and that mosquitos bring malaria. Differing from published research about the understandings and perceptions of malaria from the Tanzanian mainland and Africa more broadly, most people mentioned only mosquitos as the cause of malaria (Muela et al., 2002, p. 407). Very few people discussed other causes for malaria, noting it could be brought on by eating bad food or working in rice paddies. No one offered personalistic explanations (such as a witch, spirit, or sorcerer) or unexplainable etiologies (that it was impossible to know what caused malaria) though it's possible people were unwilling to share this sentiment with us.

A common relationship interviewees discussed was that a clean household/home environment could prevent malaria by getting rid of mosquito habitats. Many people identified elements of ideal mosquito breeding sites, such as the presence of stagnant water nearby the home (this was also reported in Bauch et al., 2013). Commonly reported sources of stagnant water include sewage systems, empty bottles and containers, coconut shells etc. This would seem to be a very micro-way of thinking of the environment and its dangers. Stagnant water was sometimes linked with the presence of overgrown grasses, or bushes nearby the home, and that this type of uncut vegetation also presented an ideal mosquito habitat. Overall, respondents noted strong connections between the malady of malaria and the *mazingira*, as seen from Mzee Antony, a 47-year-old male, who explained that “due to the relationship between malaria and the environment, even malaria itself depends on the environment. Because malaria is caused by mosquitos that come from dirty environments” [*Uhusiano wa malaria na mazingira*



*hata malaria yenyewe inategemea na mazingira. Kwa sababu malaria inasababishwa na mbu watokanao katika mazingira machafu* [Mzee Antony, personal communication, September 23, 2019].

Interviewees often connected cleaning (*kusafisha*) the *mazingira* to malaria prevention, and when pressed about what particularly needed to be cleaned, people mentioned *takataka* (trash), or general *machafu* (dirt, dirtiness). During interviews, it was unclear if the need to clean refers only to aspects of the environment that are human-caused, such as the presence of trash near houses, or whether areas with less obvious human impact, particularly those labeled “bush” (*porini*) might also need to be cleaned in some way in order to prevent the malady of malaria. The idea of cleaning the environment as a way to reduce malaria, or that the disease is associated with dirt and rubbish has been reported around the continent (from Cote d'Ivoire: *Essé et al.*, 2008; in Zimbabwe: *Macherera et al.*, 2017; in Ethiopia: *Adera*, 2003; in Mozambique: *Portugaliza et al.*, 2019).

It's notable that most public health campaigns over the past century in Zanzibar have adopted this generic language, encouraging people to “clean” the environment, and using the terms *kusafisha* and describing particular settings as *mazingira machafu* (“dirty environments”). This is true of campaigns led by the British colonial government from 1907 onward (which had Anti-Mosquito Brigade draining swampy areas and putting kerosene on breeding areas), the WHO's elimination attempt 1954–1968, USAID's spraying project 1984–1989, and contemporary malaria elimination efforts supported by the Gates Foundation and the US PMI carried out by the Zanzibar Malaria Elimination Programme (*Issa*, 2009, 2011; *Evaluation of the USAID Zanzibar Malaria Control Project*, 1983). Archival documents from these various campaigns indicate that Swahili-language public health communications used throughout the East Africa region often used these key terms that show up in today's interviews (*Malaria Imepungua*, 1973; *Propaganda Sheet*, 1958). In 1935, leaflets and posters were distributed throughout Zanzibar Town describing the environmental and cleaning measures residents were meant to take (Anti-Malarial Measures, 1935; discussed in *Issa*, 2009, p. 224; *Zanzibar Malaria Elimination Programme Calendar*, 2008).

Mzee Abdalah, a 47-year-old male born and raised in Zanzibar exemplified the idea that the *mazingira*/malady of malaria relationship is unquestionable. When asked what ways people in Zanzibar could protect themselves from malaria he responded that “The other best way to prevent yourself from malaria is to keep the environment in a good condition” [*Njia za kuweza kujizua zaidi na malaria njia kubwa zaidi ni kuweka mazingira katika hali nzuri*] (Mzee Abdalah, personal communication, September 26, 2019). Abdalah is not responding to a question directly asking about the relationship between the malady of malaria and the *mazingira*, nor did the question mention the word *mazingira* at all. In this regard, his response not only identifies an inherent relationship between malaria and the *mazingira* by claiming that the best way for a person to prevent malaria is by way of keeping the environment “in a good condition” (*hali nzuri*), but also because his response was not prompted by a previous discussion of *mazingira*. These terms and phrases should not be considered new framings of the environment, but as the product of decades of biomedical health communication coming in contact with vernacular knowledge about the malady of malaria. Interviews indicated a great deal of biomedical information has been assimilated, such as the malaria lifecycle, the causes, symptoms, appropriate treatments, where to access tests, and how to distinguish severe from moderate cases.

### 3.2. Who is responsible for the *mazingira*?

There were three main ways people responded when asked who was responsible for the *mazingira*, and they typically occurred in this order: first, they acknowledged change was possible but did not specify who should do the work. Second, they would discuss what they personally

could do, but often framed their participation as mere recipients of advice meant to carry out specific tasks, rather than as initiators of independent action meant to take care of the environment. Third, they would name various levels of government and mention specific tasks they thought should be done. Though we anticipated hearing narratives of conservation or preservation, those emerged rarely. Only one person mentioned the Swahili-English composite verb *kuprotect* (*ku* the Swahili verb form) and only one other used the term *salama* (to keep something safe). No one used the terms “to conserve” (*kutunza*), “conservation” (*utunzaji*), “to preserve” (*kuhifadhi*) or “preservation” (*uhifadhi*).

On the first point, a majority of respondents felt it was possible for the environment to change, to be cleaned, to be improved, but rarely named who should do that work. The following passage sums up a vast majority of the responses in this area:

Masoud: *Mazingira ya hapa ni uchafu ... kuna takataka nyingi ...* (The environment here is dirty ... there's a lot of trash.)

Interviewer: But is it possible to clean this environment?

Masoud: *Ndiyo inawezekana.* (Yes, it's possible.) (Bwana Masoud, personal communication, August 7, 2019)

The respondent sidesteps *who* should do it by relying on a passive formation. *Inawezekana* translates to “[the task] is possible.” The second tendency was to identify their own actions in passive ways. Most commonly, people mentioned receiving nets, or their homes receiving spraying. In both cases, individuals had to make decisions to actively use the tool (sleeping under the net) or to allow the intervention to occur (for sprayers to enter the home). The area where some participants identified what they personally could, would, or should do was in relation to cleaning the environment. Many respondents identified that they could clean their own surroundings, either their own home or the grounds around it. But for many of these speakers, despite identifying their own cleaning actions, they implied others in their area were not doing their part because the environment remained dirty/disordered as a whole.

### 3.3. Government responsibilities vs. individual agency

The third trend was that many respondents felt the government had responsibility, and named different levels of government as responsible actors. None of these conversations were overtly political, though respondents sometimes used the topic of malaria as a way to comment on what they saw as *serikali* (government) inefficiencies, inequalities, injustices, or overall untrustworthiness. In these responses, people named all levels of government, from the most local of *shehas* (local head person) or the *manispaa* (municipality), all the way to *wizara* (ministries) and the *bunge* (parliament). References to so many different levels and actors of government drew us to more fully consider the role of the state, and citizens' relationship with the government in shaping their thinking about the *mazingira*. The interview data reveals that how Zanzibar's conceive of their role as actors/agents in the *mazingira* are modulated by larger citizen-state relationships and the mis/trust citizens have in government. Prior interventions by colonial governments and international organisations not only changed malaria epidemiology, but also affected human perceptions and responses (*Giles-Vernick & Webb*, 2013).

This tendency was reported in prior ethnographic work in Zanzibar. Alilio's research from 1996 to 97 noted that one of the “problems” interfering with local malaria control was “the communities' expectation that malaria control was, or should be, the sole responsibility of government” (*Alilio et al.*, 1998, p. 412). Among the hundreds of people they spoke with, “96% of community respondents expected the government to solve the malaria problem” (411). The article was clear in stating this perspective was incorrect, and that future efforts would need to convince people they should take responsibility for their own health. In in-



interviews, people frequently collapsed international actors and different agencies into the broad, generic, category of *serikali* (government). They went on to question the motivations, intentions, and goodwill of the government. Their questioning was particularly sharp around a statistic that has been widely publicized by the government: that “malaria is under 1%” on the island. Some simply stated they didn’t trust information from the government, others hinted at global entanglements of knowledge, expertise and funding and how that may challenge government claims to “success.” General statements were made such as: “the government tells us it’s a success, otherwise donors will be angry”—acknowledging Zanzibar’s dependence on foreign aid not just for malaria, but in general. During interviews in 2017, multiple men, commenting on diagnostic spaces, pointed out the tension with the government so publicly proclaiming malaria rates were under 1%. They expressed sentiments along the lines of “when you go into a clinic, you won’t be tested for malaria even if you have symptoms, even if you ask for a test, since no one wants to find malaria cases.”

The table below presents the main malaria interventions named by interviewees, organized by *who* needs to do the action, and indicating the relationship between what’s required by an individual, the national government, and international funders. What becomes very clear is that there are very few effective interventions that are dependent entirely on individual motivation. Even acts that seem highly autonomous—like whether to sleep under a bed net or not—are only effective *if* bed nets are locally available, at a reasonable (likely subsidized) price, and that can only happen *if* international funding was provided for that specific intervention (see Table 4).

Antony’s response best illustrates the different levels of responsibilities between the three main actors we identified in the interviews: the government, the community, and the individual. He names three different sets of people involved: community members (*wanajamii*), municipal councils (*manispaa*) and health officers (*Bwana Afya*). The municipal councils have a duty to educate community members (*manispaa wenyewe nao wanahitajika kutoa elimu kwa wanajamii*), and health officers have an obligation to provide education to the entire community (*afya akishamwambia manispaa, manispaa yeye ni kutoa elimu kwa jamii*), and community members are also meant to help themselves (*kusaidiana na jamii*) (Mzee Antony, personal communication, September 23, 2019).

Bi. Mfululwa, a 38-year-old female originally from mainland Tanzania, identifies roles for both the government and individual community members when it comes to cleaning the environment. She describes an intertwined relationship and emphasizes many themes raised by other respondents. She suggests that “for us who live around this street, it is a requirement for everyone to be careful, meaning we are required to be clean and our environment should be clean” [*tunaoishi mtaa huu inatakiwa kila mtu awe makini yani jamani tunatakiwa tuwe wasafi mazingira yetu yawe safi*] (Bi. Mfululwa, personal communication, September 24, 2019). She goes on further to explain that although individuals have responsibilities, it is the job of the government to encourage and motivate its citizens to clean the environment. The citizens, in turn, have the obligation to mobilize each other.

There is an interesting gender component to answers in this area, as women were more likely to directly identify themselves as part of the community, hinting at greater levels of community connectedness. Unlike Antony, who referred to the community as *wanajamii* (community members) Mfululwa identifies *herself* as a part of that community. Her use of “us” and “everyone” and “we” and “our” all highlight her own membership as part of the group. Another female respondent, Bi. Awena, a 20-year-old female student also pointed out that it was the duty of “us, ourselves” (*ni sisi wenyewe*). (Bi Awena, personal communication, September 24, 2019). Like Mfululwa, Awena found that those responsible are “everyone, we ourselves” (*sisi wananchi*), making sure to include herself as a part of the citizens and community.

Table 4

Malaria interventions, organized by responsible actor.

Type of intervention	Individual action	Government action	International action	Result/Impact on malaria?
Trash pickup	Collection of household trash	Collection of trash from neighborhoods	Nothing required	Without government action, <b>ineffective</b>
Drainage of water	Drainage of puddles in home compound	Drainage of large puddles, swampy areas, mosquito breeding sites	Nothing required	Without government action, <b>ineffective</b>
Cutting grass	Cutting of grass in home compound	Nothing required	Nothing required	Unclear effect. Could minimize very locally
Indoor residual spraying	Allow permission for sprayers to enter house	Indoor residual spraying organized and carried out	Funding for purchase of chemicals, equipment, staffing	Without international funding, there is no spraying, <b>ineffective</b>
Outdoor spraying		Outdoor spraying in malaria “hot spot” areas	Funding for purchase of chemicals, equipment, staffing	Without international funding, there is no spraying, <b>ineffective</b>
Bednets	Sleeping under a treated bednet	Distribution of treated bednets	Funding to allow subsidization or free distribution of bednets	Without international funding, fewer bednets available, <b>ineffective</b>
Prompt testing	Prompt clinic testing when having malaria symptoms	Widespread availability of inexpensive malaria tests	Funding to purchase large quantities of rapid malaria diagnostic tests	Without international funding, fewer tests available, <b>ineffective</b>
Prompt treatment	Prompt treatment when diagnosed with malaria	Widespread availability of inexpensive malaria treatment	Funding to purchase large quantities of artemisinin combination therapy, to be distributed subsidized or free	Without international funding, fewer effective treatments available, <b>ineffective</b>
Tracking systems		Tracking systems to identify malaria cases and overall prevalence levels	Funding to purchase and maintain electronic systems	Without international funding for tracking systems, <b>ineffective</b>

To conclude this section, we want to reiterate the distinctions between Zanzibar perceptions of the *mazingira* and biomedical framings of the environment. First, many Zanzibaris we interviewed presented the *mazingira* as a place of danger and as a space that must be cleaned, shaped, or managed by humans (rather than preserved, conserved or protected). Second, that Zanzibaris highlighted the limits of individual agency when it came to cleaning; and finally, that the *mazingira* is seen as a space for government action.

#### 4. Conclusion

By reporting on oral data, this paper advocates for more fully integrating local perspectives and African voices into the history of science and global health discussions. It’s fair to ask what can, or should be done with this type of information. Why does it matter that there are gaps between malaria/the malady of malaria? Why is it important if Zanzibari conceptions of the *mazingira* don’t align with American or Western European notions of the environment? Why might it be mean-

ingful to understand how Zanzibaris see the connections between the *mazingira* and the malady of malaria?

There are many valid answers to these questions, and we propose a few. First, by recognizing gaps between malaria/the malady of malaria we chip away at the idea of biomedical malaria as a stable, unchanging, hegemonic category. We force people to recognize that there isn't a single right way to understand malaria, and that reports focusing on African misunderstandings, mistakes, deficits and gaps in knowledge work to replicate colonial era tropes of uneducated Africans. Recognizing local conceptions of disease acknowledges the reality and persistence of medical pluralism and syncretism. Muela et al. argue that it is not surprising that people draw on multiple explanations since there are many cases when the biomedical system fails to fully resolve their condition. Realities such as “chronic malaria, drug resistance or high reinfection rates” mean that “a single consultation at a biomedical health facility does not necessarily result in a complete cure of malaria” (Muela et al., 1997, p. 44). Biomedical shortcomings, or what Okeke calls “diagnostic inadequacy” are widespread across the continent (Okeke, 2011). In sum, there is a deep logic to relying on multiple explanations and seeking out multiple forms of therapy when there is so much uncertainty and so many cases that are not fully explained or resolved by biomedicine alone. We should not assume that local understandings of the malady of malaria will ever disappear, and that should not be a goal for public health education campaigns or global malaria eradication programs.

Second, when we acknowledge that *mazingira* has connotations, values, and meanings that differ from the English “environment,” we force ourselves to be more aware of the assumptions we make about the universality of specific terms, or even the stability of translation. Vernacular knowledge forces us to listen carefully to what's being said—the terms being used and their connotations. Understanding vernacular knowledge often means knowing and factoring in local history, and placing science in a broader social-political-cultural framework to determine how it makes sense locally. However, vernacular knowledge is not just a historic relic that we are unearthing, but includes contemporary understandings, knowing that contemporary meanings are rooted in past experiences. Practically, knowing that Zanzibaris identify some similar and some different connections between *mazingira*/malady of malaria and environment/biomedical malaria can lead to concrete improvements in how program information is messaged, and making sure that programs are set up in a way that accords with local epistemic and moral frameworks.

Finally, the interview responses make clear there's a tension between public health advice touting individual responsibility about making the environment safer and reducing malaria, and limits of what an individual can do. This was clearly expressed in terms of an individual cleaning their compound or draining small puddles, but seeing the limits of that act if the trash sits in a big pile, or a huge swamp goes undrained due to lack of government action. Similarly, a person may allow spraying inside their home, but if her neighbor refuses, the burden of disease for everyone in the neighborhood is unlikely to be changed.

This article is part of a larger multi-year project that has a mixed methods participatory-social justice design. That means we will have years of continued contact and ongoing collaboration with the Zanzibaris we interviewed. This type of design is iterative, recognizes our Zanzibari participants as sources of information and collaborators, and has an open-ended structure to determine how we should act upon what we've found. In the second half of 2021, we returned to Zanzibar to share findings from our first 50 interviews and ask a series of questions, to find out if participants think we properly interpreted the interview data, getting clarification on points where we are still not clear, and asking people about how they think this information might be productively used locally. Participants were supportive in our interpretations of interview data and provided us with new ideas about how to return with results in the future. This reflexive/reflective element to the

research design means we will share our research results back to participants in a variety of formats (individually, verbally and in written form; in invited focus groups; in public meetings). In addition to publishing our results in academic journals, we are also committed to sharing research findings with local malaria experts and the international groups involved in funding, planning and running malaria interventions on the island in an effort to present another way of thinking about the malady of malaria and the *mazingira*.

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## Uncited reference

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## Declaration of competing interest

None to declare.

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