

Social determinants of malaria among gold miners in Shwekyin Township, Myanmar

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ABSTRACT

Background: Myanmar is one of the countries with evidence of artemisinin resistance and the greatest burden of malaria in the Greater Mekong Subregion. At present, migrant/mobile populations are considered to play a major role in the potential spread of artemisinin-resistant malaria within countries and across borders. In this regard, we conducted a cross-sectional community-based survey in Shwekyin Township, Bago Division, of Myanmar from March to April of 2013 to investigate social determinants of malaria among gold miners.

Methodology: We conducted a total of nine Key Informant Interviews and five Focus Group Discussions in two gold mines and two villages with different accessibilities to health facilities. We asked key informants about local health services, people's perception of malaria, and treatment-seeking behaviors. We performed Focus Group Discussions on knowledge, attitudes, and treatment-seeking behaviors of migrants regarding malaria.

Results: Most villagers and gold miners had a fair understanding of causes, transmission, and symptoms of malaria though somewhat mixed and confused. The villagers had better knowledge and practices of prevention than the gold miners. Though villagers close to rural health centre used to undergo treatment within 48 hours of fever, those living with malaria social workers and gold miners were still experiencing self-treatment. Drug retailers played a major role in their first and initial response to malaria. Artesunate and artemether were the most familiar anti-malarials among all respondents. All the respondents accepted the use of rapid diagnostic tests well but they understood negative test results poorly and sometimes this led to self-treatment using artemisinin-based monotherapies.

Conclusion: Limited knowledge and practice of malaria prevention might be social determinants of malaria among gold miners. Self-treatment using artemisinin-based monotherapies was still common, even after negative rapid diagnostic test results in the vicinity of a health facility.

Keywords: Malaria, Myanmar, Migrants, Qualitative, Knowledge, Attitude and Practices

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1. INTRODUCTION

Malaria is one of the life-threatening infectious diseases which are widespread in tropical and subtropical regions. In 2012, about 207 million cases of malaria infection and 627,000 deaths were reported globally [1]. Although the number of malaria cases has fallen by more than 50% in 43 countries over the past decade, one of the major growing threats to control efforts against malaria is the emergence of parasites that are resistant to artemisinins [1]. Artemisinins produce early remission of clinical symptoms of malaria and therefore adherence to the full 7-day treatment regimen is generally poor. Since such incomplete treatment courses induce emergence and spread of artemisinin resistance, WHO called for a ban on artemisinin-based monotherapies (AMTs) and replacement with artemisinin-based combination therapies (ACTs) in 2007 [2].

Along with the emergence of artemisinin-resistant malaria in western Cambodia in 2006-2007, there is growing evidence of artemisinin-resistant parasites in other parts of the Greater Mekong Sub-region (GMS), including eastern Myanmar [3, 4]. According to World Malaria Report (2013), about 60% of the population in Myanmar is living under malaria risk and 37% are in high transmission areas. *Plasmodium falciparum* (65%) and *Plasmodium vivax* (35%) are the major malaria parasites in Myanmar. Regarding vector species, *Anopheles minimus* and *Anophele dirus* are the most prevalent. As prevention and control interventions, ITNs/LLINs have been distributed free of charge to all age groups since 2003 [1]. In Myanmar, ACTs have been the first line treatment for *Plasmodium falciparum* malaria since 2002 [1].

According to WHO guidelines, public health care providers are treating the patients of all ages by using RDTs and ACTs free of charge. But more than 70% of malaria treatments are directly accessed from the private sector and more than 80% of all malaria cases are still treated with AMTs in Myanmar [3, 4]. And at present, migrant/mobile populations are considered to play a major role in the potential spread of artemisinin-resistant malaria within countries and across borders. These populations live and work in areas with high malaria transmission, high human–vector contact and limited access to health services including RDTs and ACTs [4, 5]. Understanding treatment seeking behaviors of malaria among the migrants is necessary for developing an appropriate strategy to prevent the emergence of artemisinin resistance. For this reason, this qualitative study aimed to investigate social determinants of malaria among migrants in Myanmar.

2. MATERIAL AND METHODS

2.1 Study setting

Myanmar Artemisinin Resistance Containment (MARC) defined areas of Tier 1, 2 and 3 according to Global Plan for Artemisinin Resistance Containment (GPARC) guidelines

and recognized migrant/ mobile populations as an important target group [4, 5]. Our designated area was Shwekyin Township, Bago Division, of Myanmar which is one of the Tier 1 areas of Myanmar [4]. The township covers plains and hilly forested areas. This township is about 945.44 square miles in area and with a total population of 87, 954 (male 42, 730 and female 45, 224). There are 82 villages and a number of gold mines in Shwekyin Township. Township hospital, regional hospital, 5 rural health centers, 18 subrural health centers and malaria campaign workers are providing public health care. The malaria control strategy includes provision of long-lasting insecticide-treated nets (LLINs) and early diagnosis/adequate treatment (EDAT) through health staffs and village volunteers. In Shwekyin, thousands of people are migrants, working in gold mines. A study conducted in 16 townships of Bago Division under the Malaria control project supported by Japan International Cooperation Agency (JICA) in 2009 found that 97% of 28,332 positive (confirmed) cases were migrants [4].

2.2 Study design and sampling

We carried out a cross-sectional community-based survey from March to April of 2013. From the study area, we selected two gold mines and two villages of different population sizes, distances from the city, and availabilities of health care services for this qualitative study. We recruited a big village V1 with a Rural Health Centre and a small village V2 with a Malaria Social Worker to explore their knowledge, attitudes, and treatment-seeking behaviors relative to malaria. Accordingly, we included a small gold mine, G1, which was located near V1, and a big gold mine, G2, which was far from the city, to reveal the social determinants and treatment-seeking behaviors of malaria among gold miners with different accessibilities to health care services. At first, we requested permission to conduct our study from gold mine and village authorities.

We conducted a total of nine Key Informant Interviews (KIIs) in two gold mines and two villages. According to the recommendation of household heads and workers, we recruited people like authorized persons, religious leaders, village heads, village health workers, midwives, local healers or teachers, drug retailers, and worker heads from gold mines as key informants for interview. We asked key informants about local health services, people's knowledge and perception of malaria, anti-malarial drugs, rapid diagnostic tests (RDTs), and their treatment -seeking behaviors. We performed a total of five Focus Group Discussions (FGDs): one each in two gold mines, two in V1 and one in V2. Each FGD included about 7 people. The local authorities mobilized FGDs` participants. We recruited the adult males and females ages 18-60 years with a history of fever within the past one month. We included participants from different parts of villages and gold mines to maximize diversity. We conducted FGDs with the aim to explore barriers to access in more detail,

gathering in-depth information on the interaction between different factors and how they influence access to prompt and effective treatment. We focused questions on knowledge, attitudes, and treatment-seeking behaviors regarding malaria. We conducted all KIIs and FGDs in schools and monasteries to provide privacy and we digitally recorded and took notes as necessary.

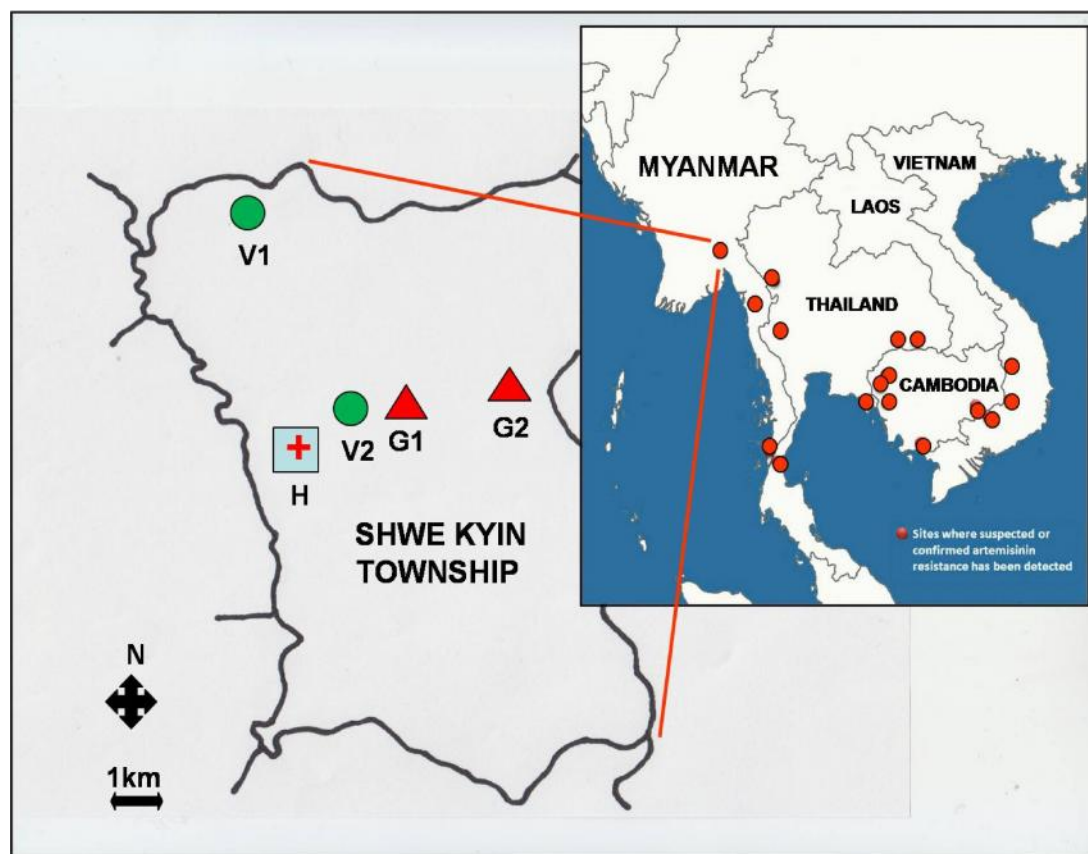


Fig 1: The map of Shwekyin Township showing study sites. [V1 and V2 represent two villages. G1 and G2 stand for two gold mines. H indicates the location of township hospital. Red spots in the upper right corner of the map represent sites where suspected or confirmed artemisinin resistance has been detected. (WHO, World Malaria Report, 2013)]

2.3 Data analysis

Field supervisors checked all data collecting forms for completeness and reliability. We transcribed digital recordings of KIIs and FGDs verbatim in the original Myanmar language and then had them translated into English by a bilingual research member. On completion, another member read and reviewed each translated English transcript, comparing it against the audio recordings and original Myanmar version. We identified

118 quotations that best mentioned knowledge, attitudes and practices of the respondents
119 regarding malaria.

120 **3. RESULTS**

121 **3.1 Socio-demographic characteristics of participants**

122 The participants of three FGDs in two villages included 11 males and 10 females.
123 Most of them were 20-40 years old, native-born and married. Regarding ethnicity, the
124 villagers were mostly Myanmar and the remaining ones were Karen. Most of the males are
125 gold mine related workers and females were mostly dependents. Most of the participants
126 have had middle school education. Average daily incomes of males were 1000 – 2000 Kyats
127 of Myanmar currency (about 1-2 US dollars). Two FGDs in two gold mines included seven
128 males in G1 and four males and three females in G2. Most of them were 30-50 years old,
129 from other townships, and married. The gold miners in G1 were mostly Myanmar but in G2
130 mainly belonged to Karen ethnicity. Their education levels were mostly primary school. Most
131 of them earned on average 3000-4000 Kyats of Myanmar currency (about 3-4 US dollars)
132 per day.

133 **3.2 Major research themes**

134 **3.2.1 Understanding of malaria**

135 Most villagers and gold miners reported at least two major causes of malaria:
136 mosquito bite and drinking contaminated water. People who are going into the forest and
137 working in gold mines are perceived to get malaria through mosquito bite and by drinking
138 contaminated water. Most frequently, they linked the cause and transmission of malaria
139 infection with drinking contaminated water and an unclean environment. A few gold miners
140 mentioned malaria was due to contaminated food touched by a mosquito or fly.

141 *“When we go to forest and mountain, we are bitten by the mosquitoes and also we*
142 *have to drink unclean water for example like water fermented with fallen leaves, you see?*
143 *We got malaria in this way, I think.” [54 year old, male FGDs participant, V1]*

144 Most of the villagers and gold miners perceived feeling of body heat with shivering
145 and headache as the major symptoms of malaria from their experiences. But they could not
146 mention the danger symptoms of severe malaria.

147 *“When I got malaria, I started to feel hot outside of my body and then shivering*
148 *inside. My head and body began to ache and I didn’t want to work anymore. I was thirsty so*
149 *much. You know, I felt sleepy and could not touch water.” [25 year old, female FGD*
150 *participant, G2]*

151 Regarding knowledge about anti-malarial drugs, although most of the villagers and
152 gold miners knew and could cite the name Artesunate and Artemether correctly, only a few

153 villagers living in V1 knew and could describe the appearance and color of Coartem
154 (government recommended drug).

155 *"This brand (showing the registered brand of Artesunate tablets) is the best selling*
156 *antimalarial drug. Every malaria season, the owners of the gold mines used to come to my*
157 *shop and buy a large number of boxes of Artesunate tablet for their workers. Most of them*
158 *are really familiar with Artesunate and always ready to take it like their snack."* [Key
159 Informant Interview with 45 year old, male, owner of a big drug shop]

160 **3.2.2 Preventive measures based on their perception of malaria**

161 When we asked about prevention methods, most of the villagers named using bed
162 nets as the most common one. Using mosquito coils was the second choice of prevention.
163 But in case of gold miners, as their knowledge and perception about the cause and
164 transmission of malaria were somewhat mixed and confused, they mentioned drinking boiled
165 water, eating safe food and cleaning the environment as preventive measures.

166 *"We don't know so much. It depends on sanitation of house and environment. We*
167 *try to keep our environment clean. We need to eat safe food and water, I think. And also we*
168 *need to sleep under bed net, I think."* [43 year old, male FGDs participant, G2]

169 **3.2.3 Old friend in their treatment seeking behaviors**

170 Regarding their first action after getting a fever, most of the villagers in V1 used to
171 get malaria diagnosis and treatment at the public health facility within 48 hours. Though
172 Malaria Social Worker had been serving in V2, most of the villagers in V2 did not know of his
173 presence and service. They used to buy a drug cocktail containing Artesunate from nearby
174 retailers and took it by themselves within 48 hours. Only when their fever was not relieved
175 and still high, they went to township hospital directly. In case of gold miners in both G1 and
176 G2, their first response was self-treatment or treatment provided by their manager or owner.
177 Most of the gold miners with long working experience used to buy and keep Artesunate
178 tablet by themselves.

179 *"Last year, I myself experienced being the owner of a gold mine in the forest on the*
180 *mountains. When I went to my gold mine, I brought a package of boxes of Artesunate tablets*
181 *together with me. So, when my workers got malaria, I treated them by using these drugs.*
182 [Key Informant Interview with 43 year old male, the owner of the biggest drug shop in
183 Shwekyin]

184 *"When I got fever in this gold mine, I really wished I could go to the health facility*
185 *but the motorcycle transportation fee was about 20 000 Myanmar Kyats (20 US dollars) for*
186 *one way, you see? Sometimes we could not rent any motorcycle especially at night and*
187 *during raining season. Then we had to take drugs provided by our head of workers.* [32 year
188 old, male FGDs participant, G2]

3.2.4 Beyond the complete adherence to RDTs

Almost all the respondents accepted the use of RDTs well. Most of the villagers thought they got malaria whenever they were febrile. They were willing to go and take RDTs at the public health facility. But when the RDT was negative and they did not get any anti-malarials, they were dissatisfied with the service. It led them to self-treatment by taking cocktails of drugs available at the nearby shop. The most commonly used drugs in cocktails were Artesunate or Artemether tablet, a kind of analgesic and antibiotic.

"In my last fever, I was quite sure it was malaria because I got malaria so many times since birth. That is why I went to health care provider who tested my blood by using his test. Then, he said I had no malaria and gave me only paracetamol. But as I was still suffering from fever, I went to drug shop and took the cocktail they mixed. Then my malaria was completely cured." [36 year old, male FGDs participant, V1]

"You see, every time the local people get fever, they said it was malaria. They never use the term Fever, ever say Malaria. If the RDTs result is negative, they are not satisfied. If we don't prescribe any anti-malarials to them, they go to buy Artesunate outside and take it by themselves." [Key Informant Interview with 41 year old male, Health Assistant of V1]

4. DISCUSSION

Most of the gold miners and villagers believed that malaria was caused by both mosquito bite and drinking contaminated water in the forest. Similar to findings in Swaziland and India, their perception of mosquitoes as the cause and vector of malaria was somewhat confused [6, 7]. They mentioned feeling hot with shivering and headache as the major symptoms of malaria, but they did not know the danger symptoms of severe malaria. The study conducted in remote villages of Bago Division, Myanmar, in 2006 after five months initialization of a rapid diagnostic test (RDT) and artemisinin-based combination therapy (ACT) program explored the low knowledge of malaria among the remote villagers [8]. Frequent health education programs through various media like TV, radio and newspapers and via the behavioral change campaign of Vector Borne Diseases Control (VBDC) of Ministry of Health Myanmar, might have contributed to the better awareness of malaria among the respondents in our study. But through their traditional beliefs and living experience and malaria attacks, they still perceived malaria was linked to drinking contaminated water and other causes [9, 10].

Regarding preventive measures for malaria, using Insecticide Treated Nets was the best known and the most commonly used method among the villagers. Coverage of LLINs and health education along with activities of MARC in Shwe Kyin Township might have contributed to this result. But in the case of gold miners, the most common preventive measures among them were drinking boiled water, eating safe food, and cleaning the

environment. These findings highlighted the coexistence of traditional and modern beliefs and practices in these societies, similar to other studies in developing countries [9, 10]. Most of the gold miners working there were from the other townships nearby and around the country and some of them have never experienced malaria before. Their education level was lower compared to that of the villagers. That may be why their knowledge regarding prevention of malaria was poor.

Though Artesunate and Artemether were the most familiar anti-malarials among villagers and gold miners, only a few villagers living close to a rural health centre could describe the appearance and color of Coartem (government recommended drug). The awareness of Coartem as the first-line anti-malarial drug was still low in V2 and both gold mines. The reason which could explain that point is public health staffs in rural health centre were very experienced and could provide not only early diagnosis and prompt treatment but also health education thoroughly to the community [9, 10].

The villagers in V1 close to RHC used to get malaria diagnosis and treatment at the public health facility within 48 hours. But most of the villagers in V2 living with malaria social worker were still experiencing self-treatment using a cocktail of drugs containing AMTs from nearby retailers. It was consistent with the study among the Wa ethnic population in Myanmar where a significantly higher proportion accessing the retail sector (79.6%) was found [11]. Only when their fever was not relieved and still high, did they go to the township hospital directly. In case of gold miners, their first response was self-treatment or treatment provided by their manager or owner. Despite their willingness to adhere to diagnosis and treatment which were provided by the public health facility free of charge, difficulty in transport was a great barrier, especially in the rainy season. It inevitably led them to self-treatment or treatment provided by their manager or owner.

Although the public health care providers were prescribing ACTs after testing with RDTs according to national malaria treatment guidelines free of charge, the residents are still using AMTs by self-treatment. This finding was similar to that of the study conducted in remote areas of Cambodia where the coverage rates of RDTs and ACTs were disappointingly low and the use of AMTs alarmingly high [12]. The government was preparing to ban AMTs (Brand name Artesunate) officially but not yet. The best selling anti-malarial drug in that area was AMTs (Brand name Artesunate). ACTs was largely unknown to the local people at the time of the study. None of them had ever heard about drug-resistant malaria and they could not link the use of AMTs and drug-resistant malaria [13, 14]. As drug retailers play a major role in the first and initial response to malaria, refresher courses or education targeting them about the link between monotherapy usage and drug resistance should be considered [15].

In Cambodia, the program of village malaria workers has been established since 2001 and they could play the same role as the health center [16]. In Myanmar, the malaria social workers program was introduced in 2005 and now, 6,100 malaria volunteers were already trained in 2012 [17]. The role of malaria volunteers in improving timely diagnosis and treatment using RDTs and ACTs was found to be beneficial in Myanmar [18]. At this stage, they were trying to cover all villages without health center services and remote areas including gold mines where the migrants were working. But providing early diagnosis and prompt treatment to gold miners were still challenging because they were always migrating and their working sites were always changing [19, 20]. Moreover, the workers serving in the remote gold mine, G2 in this study, were mostly of Karen ethnicity. In this regard, currently provided health education and behavioral change communications all of which were in Myanmar language, were not fully accessible and understandable to them. The comprehensive health care could not be achieved without culturally competent communication between patients and health care providers [21]. For effective health education and behavioral change communication towards Karen people, bilingual interventions and employment of trained bi-lingual health workers should be encouraged.

Treatment-providing behaviors greatly affect the treatment-seeking behaviors of the people with malaria [22, 23]. Ministries of health of WHO member countries are trying to set the policy and guidelines for health care providers to adhere fully to RDTs and ACTs. But at the same time, beyond the full adherence to RDTs and ACTs, thorough understanding of the patients' perceptions and response to the test results are of paramount importance [24, 25]. Though experienced basic health staffs could explain the possibilities and meaning of RDTs results thoroughly to the patients, malaria social workers were not confident and trained enough yet to communicate with patients, especially in the face of negative RDTs results [25, 26]. Providers' knowledge and experience are critical to achieve patients' satisfaction especially in case of negative RDT results otherwise they may resort to self-treatment with AMTs and neglect of other dangerous diseases [25, 26, 27]. Moreover, the issue of greatest concern is the possibility of dissatisfaction and distrust in public health services which will become a major barrier in the utilization of public health facilities.

5. STUDY LIMITATIONS

Owing to the non-random sampling procedure and small sample size in this study, the results are specific to the population sampled and may not be applicable to other areas in Myanmar.

6. CONCLUSION AND RECOMMENDATIONS

Limited knowledge and practice of malaria prevention might be social determinants of malaria among gold miners. Self-treatment using AMTs was still common, even after

negative RDT results in the vicinity of a health facility. To achieve patients' satisfaction with test-based diagnoses and adherence to public health care services, counseling and health education will be critical in dealing with patients, especially RDT negative ones. Health education targeting drug retailers on the link between AMT usage and artemisinin drug resistance should be considered. Regular communication between the owners of gold mines and local administrative and health authorities will lead to a better intervention targeting the gold miners to get good access to LLINs, RDTs, and ACTs.

ABBREVIATIONS

AMTs: Artemisinin-based monotherapies; ACTs: Artemisinin-based combination therapies; FGDs: Focus group discussions; KIs: Key informant interviews; RDTs: Rapid diagnostic tests for malaria; LLINs: Long-lasting insecticide-treated nets; WHO: World Health Organization; VBDC: Vector-Borne Disease Control

ACKNOWLEDGEMENTS

This study was supported by The Fuji Xerox Setsutaro Kobayashi Memorial Fund. We thank all the local health staffs for their support and the people who participated in the study. I am grateful to Professor Kiyoshi Kita, Department of Biomedical Chemistry, School of International Health, The University of Tokyo, Tokyo, Japan and Professor Toshihiro Mita, Department of Molecular and Cellular Parasitology, Juntendo University School of Medicine, Tokyo, Japan for their valuable guidance.

COMPETING INTERESTS

All the authors declare that they have no competing interests.

AUTHORS' CONTRIBUTIONS

Authors WZZY and IK designed the study and drafted the manuscript. Author WZZY collected data and IK managed the analyses of the study. All authors read and approved the final manuscript.

ETHICAL APPROVAL

This study was approved by Ethics committees of the Military Institutes of Nursing and Paramedical Sciences, Myanmar. Before enrollment, written informed consent was obtained from each of the participants. Confidentiality and anonymity were maintained.

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