The Risk of Artemisinin In Early Pregnancy
A Case-Study from Babati District

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ABSTRACT

The intention of the study is to evaluate the risk of artemisinin in early pregnancy through the use of a qualitative research approach, with a focus on rural women in Babati District, Manyara Region, Tanzania.

Artemisinin-Based Combination Therapy (ACT) is the most effective and recommended antimalarial treatment at the present. Artemisinin compounds are extracted from Artemisia annua, a plant which has been used as an herbal medical treatment in China for 2000 years. Except few side-effects, there have not been any reports on medical problems due to artemisinin intake during pregnancy. On the other hand, artemisinin tested on animals have revealed that complications such as death of embryos are possible during pregnancy, why more research is needed concerning artemisinin safety in first trimester of pregnancy.

However, evaluating the risk of artemisinin in pregnancy is referred as complex, when numerous factors could contribute to e.g. fetal loss, abnormalities, or wrong medication. Cultural and economical aspects have to be considered when designing a monitoring system, to enable effective registration of drug quality and drug intake, and follow-up study of mother and child. Accessibility, affordability, possibility and knowledge, are other significant related aspects that have to be managed to eliminate the risk of artemisinin in early pregnancy.

Keywords: malaria; combination therapy; traditional medicine; fetus.
# Abbreviations

<table>
<thead>
<tr>
<th>Abbreviation</th>
<th>Description</th>
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<tbody>
<tr>
<td>ACT</td>
<td>Artemisinin-Based Combination Therapy</td>
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<tr>
<td>ALU</td>
<td>Artemether Lumefantrine</td>
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<td>ART</td>
<td>The Artemisinin-Resistant Strain</td>
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<tr>
<td>CAM</td>
<td>Complimentary or Alternative Medicine</td>
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<tr>
<td>EMEA</td>
<td>The European Medicine Agency</td>
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<tr>
<td>FDA</td>
<td>The US Food and Drug Administration</td>
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<tr>
<td>IPT</td>
<td>Intermittent Preventive Treatment</td>
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<tr>
<td>MC</td>
<td>Mobile Clinic</td>
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<tr>
<td>MCH</td>
<td>Maternal-Child Health Services</td>
</tr>
<tr>
<td>MOHSW</td>
<td>The Ministry of Health and Social Welfare</td>
</tr>
<tr>
<td>NGO</td>
<td>Non Governmental Organization</td>
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<tr>
<td>NMCP</td>
<td>National Malaria Control Programme</td>
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<tr>
<td>PER</td>
<td>Pregnancy Exposure Register</td>
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<tr>
<td>PMTC</td>
<td>Prevention Mother to Child Transmission</td>
</tr>
<tr>
<td>PV</td>
<td>Pharmacovigilance</td>
</tr>
<tr>
<td>RCH</td>
<td>Reproductive and Child Health</td>
</tr>
<tr>
<td>SP</td>
<td>Sulfadoxine Pyrimethamine</td>
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<tr>
<td>TM</td>
<td>Traditional Medicine</td>
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<tr>
<td>TZS</td>
<td>Tanzanian Shilling</td>
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<td>WHO</td>
<td>World Health Organization</td>
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1. BACKGROUND

Malaria is a blood-borne disease, caused by one of four different types of parasites. The parasite is transmitted to humans via the bite of an infected mosquito, through blood transfusions from an infected person, or from a mother to her unborn child (Badash 2009). According to the World Malaria Report, 109 countries were endemic for malaria in 2008. Malaria infects between 350 and 500 million people each year, and kills one million (WHO 2006b, 2008). Pregnant women are more at risk to malaria as pregnancy decreases a woman’s immunity to malaria, making her more vulnerable to malaria infection and increasing the possibility of illness, severe anemia and death. Regarding the unborn child, maternal malaria increases the risk of unplanned abortion, stillbirth, premature delivery and low birth weight, which is a leading cause of child mortality (WHO 2009a, 2003).

As a response to increasing levels of resistance to antimalarial medicines, the World Health Organization (WHO) recommends that all countries experiencing resistance to conventional mono-therapies, such as chloroquine, amodiaquine or sulfadoxine-pyrimethamine, should use combination therapies (WHO 2006a).

Intermittent Preventive Treatment (IPT) is when pregnant women are given at least two preventive treatment doses of an effective antimalarial drug, in the second (weeks 13-27) and third trimesters (weeks 28-42). IPT has proven to be a secure, low-cost and efficient way to save lives, reducing infections, maternal anemia and low birth weight (RBM 2009). The most effective antimalarial treatment currently available is artemisinin-based combination therapy (ACT). ACT’s contains artemisinin, a substance extract from the plant Artemisia annua, combined with another effective antimalarial medicine. Artemisinin is nearly 95 percent efficient in curing malaria, when it is properly used in ACT’s. Thirty-two countries have adopted ACT’s, since January 2004, as their first-line treatment (medical therapy) for malaria (WHO 2006a, b). It is unavoidable that some women receive artemisinin treatment in early stages of pregnancy because e.g. wrong medication. There is insufficient scientific evidence to prove the risks of artemisinin treatment in early pregnancy, and a monitoring system is requested. In December 2007 and April 2008, the Global Malaria Program and Making Pregnancy Safer, departments within the WHO, gathered to discuss the foundation of a new Global Antimalarial Pregnancy Register. The intention was to develop a system to enable monitoring of birth outcomes in relation to the experience to artemisinin in the first trimester of pregnancy (TDR News 2008).
1.1. Introduction

*Plasmodium falciparum*, the most common type of malaria in Africa, and the main cause of malaria infection during pregnancy. Every year at least 30 million pregnancies occur among women in malaria-endemic areas of Africa. Malaria during pregnancy causes up to 10 000 maternal deaths and 200 000 newborn deaths each year (WHO 2003; WHO 2009a).

The United Republic of Tanzania is located in eastern Africa, between Kenya and Mozambique, bordering the Indian Ocean, with a population size of 39.4 million (PMI 2009). Malaria accounts for approximately 30 percent of the Tanzanian national disease burden, 35 percent of hospitalizations and 37 percent of deaths for children under the age of five. An estimated 16-18 million cases of malaria occur each year, and among pregnant women, malaria and anemia are responsible for 25 percent of maternal deaths (United Republic of Tanzania 2007). Even though Tanzania has reduced child mortality considerably in the past five years, most of the decline concerns babies after their first month of life. The figures for neonatal mortality have still not been reduced. Each year at least 51 000 newborn die, and 43 000 babies are stillborn (Ministry of Health 2009).

The Ministry of Health and Social Welfare (MOHSW) of Tanzania, and the National Malaria Control Programme (NMCP), initiated a new malaria case management strategy, on Africa Malaria Day, 25th April, 2007. To combat resistance to previous kind of first-line treatment, Sulfadoxine Pyrimethamine (SP), a new ACT treatment policy, *Dawa Mseto Ya Malaria* (in Kiswahili), was established. Tanzania’s MOHSW and NMCP provide ACT’s free of charge for all children under the age of five, while the rest of the population is offered the treatment to subsidized prices. Furthermore, a special system provided by the Tanzanian government helps economically vulnerable inhabitants to receive treatments for free (United Republic of Tanzania 2007). However, many health facilities in Tanzania lack regional and national data collection systems, up-to-date reports and reviews of death. The annual health statistical summary provided from of Tanzania’s official statistics, captures only pre-discharge facility births, while the majority of babies delivered at home and late neonatal deaths that occur from infection, are missed (Ministry of Health 2009).

Manyara Region, one of Tanzania’s 26 regions, has about 140 medical facilities serving totally five districts with over a million inhabitants. According to the “Arusha Times”, 2007, Babati District, northern Tanzania, was found to report 151 maternal deaths for every 1000 expectant women whom went to seek medical attention. Numbers do not necessarily cover
cases such as home delivery or those attended by midwives and traditional healers (Nkwame 2007; National Website of the United Republic of Tanzania 2009). Besides “modern” antimalarial medication, traditional medicines have been and are still used by several communities in Tanzania. In cases where accessibility or affordability of “modern” medicine is inadequate, indigenous medication might be the only form of treatment (UNEP 2009a, b). Artemisia annua was previously grown only in China and Viet Nam, but in 2004, WHO, with partners, started a project intended at helping farmers in Tanzania cultivate Artemisia annua. According to WHO, the plant has turned out to be a good cash crop for local farmers (WHO 2009b). The plant, Artemisia annua, has been known by the Chinese for over 2000 years. Besides being used in ACT’s, the plant can also be prepared as a tea, used for therapeutic purposes, such as antimalarial treatment, although it is not recommended during early pregnancy (Doctors for Life International 2004).

1.2. Problem Formulation

The reasons for high child mortality rates in Babati District, is related to child pregnancies, traditional practices, few medical facilities, long distance to health centres, and because of diseases such as malaria among other (Nkwame 2007).

Pregnant women’s possibility and accessibility to malaria treatment and health counseling could be considered as limited in the rural areas of Babati District, compared to the variety of services a city has to offer. This is why it might influence a pregnant woman’s choice of medical treatment and whom she decides to contact for medical advice.

Artemisinin-based combination therapies are recommended as the best antimalarial drugs available at the market. Still it doesn’t necessarily mean that all women, in rural Babati have access to ACT’s, nor does an Artemisinin compound signify that it is appropriate to use during early pregnancy. Artemisinins derivatives are not recommended during early pregnancy, unless the patient has a problematical disease and a safer option is not available. Safety during the first trimester (week 1-12) has not yet been proven (WHO 2006c).

Rural women’s experiences of the use of artemisinin (ACT or herbal-treatment) in pregnancy, might reveal possible risks, and could provide essential information necessary to improve future malaria prevention interventions.
1.3. Purpose
The aim of the study is to evaluate the risk of artemisinin in early pregnancy.

1.4. Research Questions
- Are there any medical problems related to artemisinin in pregnancy?
- What kind of factors might influence women’s exposure to artemisinin during early pregnancy?
- How can the risk of artemisinin toxicity during pregnancy be reduced?

1.5. Delimitation
The study is restricted within Babati District, Tanzania, with a focus on rural women. The result does not represent all women from rural Babati District.
2. METHOD

The thesis is based on both a literature-study as well as a case-study, while using a qualitative research approach. During February to March, 2009, a three weeks field-study was completed in Babati District, Manyara Region, Tanzania. Empirical information was collected through direct observation and semi-structured interviews with relevant actor’s such as pregnant women and medical professionals in both urban and rural areas in Babati District.

Fieldwork is considered to be the essential action of qualitative evaluation methods. Field-studies allow the evaluator to study individuals and situations through personal contact (Patton 1987, p.70). During a field work, the evaluator often has to be flexible, taking advantage of new opportunities through the actual data collection, due to on-the-spot decision about sampling. There are strengths and weaknesses to any single data collection strategy. By using more than one data collection as a strategy, the evaluator can mix strengths and correct some of the shortages by just using a single source of data or method. Multiple data collection strategies are also known as “triangulation”. Instead of relying too much on one single method or one informant, triangulation is considered as a more effective option, increasing the validity and reliability of findings. The types of triangulations that have been used in this study are; “data triangulation”, meaning that a variety of data sources have been included in the study, for example interviewing people in different type of positions or with different point of opinions regarding the use of artemisinin during pregnancy. Another type of data is the “methodological triangulation”, which involves the use of a variety of techniques to study a particular problem, or agenda. Observation, interviews and documentation are example of methods used in this study (Patton 1987, p.16, 60).

To get a deeper understanding regarding a specific problem or situation, information-rich cases become useful. A “case” can for example be a person, a program, a time period, an important incidence, or a society. Even if there are only a few cases available, valuable information can be provided. Case-studies are for the most part essential in evaluations where the aims are to, among other, capture variations from one (program) experience to another. To enable new information-rich cases, a so called “snowball sampling” is used. It is a process when a number of people in the program, are asked about whom else to talk with, while the “snowball” keeps on getting bigger, metaphorically speaking (Patton 1987, p.19, 56; Repstad 1999, p.45).
The sampling process and organizing of meetings with informants was arranged, with the help of field assistants familiar with the local area. They also offered the support to interpret from local mother tongue e.g. Kiswahili to English, during interviews. From the early stage of the field study, the assistant-interpreter was informed about the aim of the study area and the plan of activity. The field assistant(s) were clarified about her/his professional role in relation to the process of research, to avoid setbacks to occur, although their expertise and their personal advice were encouraged. During a few occasions the interpreter, or another actor, interfered negatively, and had an unconstructive impact on the informant, by answering the question being asked, or summing-up a long answer; not interpreting the whole sentence, which may have contributed to a loss of important information. On the other hand, some informants talked fluently English, why deep interviews, without interpreters, were made possible.

Qualitative interviewing, involves diverse types of research methods and implementation. During an “informal conversational interview”, questions are spontaneously developed during communication, while the people with whom the researcher is talking to might not even realize that they are being interviewed. An “interview guide” is a list of questions or topics that are to be investigated during an interview and functions as a checklist to make sure that relevant issues are discussed, a benefit when time is limited. A “standardized open-ended format” is when the interview questions are prepared, written precisely the way they are supposed to be asked, a technique which is suggested when the same category of information is preferred from each informant, or because of finite time (Patton 1987, p.108-114). A combination of these interview styles were used in this study.

Sixteen interviews were accomplished, in rural and urban areas of Babati District, including Bonga village, Dareda village, and Babati town. The field-study involved visits to private and public health facilities, Duka la Dawa (local drug store), Beda House (“Soup-kitchen”), Babati District Council, and the Regional Governmental Office in Babati. Interviews were conducted with the target group, health care professionals (Midwives and Doctors), and other relevant actor’s such as, a traditional medicine man, a local Medical Vendor, Principle Social Welfare Officer, and a Doctor in Agro-forestry.
Table 1: The Target Group

<table>
<thead>
<tr>
<th>“Rural women” from Babati District Includes:</th>
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<tbody>
<tr>
<td>Pregnant women</td>
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<tr>
<td>Mother</td>
</tr>
<tr>
<td>Malaria infected women</td>
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Each case, representing the target group, was interviewed in the health facilities, of rural Babati (Tab.1). While the women were waiting for their medical appointment, they were briefly informed about the study area and was then invited to, voluntarily, take part of an interview, knowing individually that their names would be confidential. The interviews were held in a separate room, with one informant at a time, to assure privacy. The only people present during the interviews, apart from the informant, were the evaluator and interpreter, except case y3 where a doctor attended occasionally during parts of the meeting.

Group discussions were not organized during the field study, to avoid situations such as respondents influencing each other’s answers. Another reason was to protect the informants from the spread of unwanted rumors, having in mind that the topic being discussed could be considered as sensitive or even taboo, in the local community. Tape recorder was not used during the interviews; to minimize the risk of distracting the informants, which might have adventured the quality of the result. The interviewer avoided to affect the outcome; by acquiring an objective approach during the discussions. The interviews took approximately thirty minutes, more or less, depending on the situation and case. Significant factors such as the health condition of the informants, e.g. pregnancy or malaria was taken into account, by e.g. having the interview time reduced depending on signs of ill health or fatigue. After the completed observations/interviews, pictures were taken on motives that were considered as relevant to the topic being studied. The physical environment of a social setting can be applicable since it clarifies the context.

The indoor environment of a health facility could explain:

- Resources (quantity or type of medical resources being available)
- Hygiene
- Space
- Work environment (a stressful environment could involve poor service)
- Images on the walls (relevant information)
The outdoor environment could help to illustrate:

- Location
- Nearby transportation such as buss connections
- Infrastructure such as roads

All these factors are significant when analyzing for example women’s accessibility to correct antimalarial treatment during pregnancy.

Photographing was done discreetly, with the approval of those concerned. However, pictures were not taken of the women in the target group, to protect their anonymity.

The period after the interview is vital to ensure the validity and reliability of qualitative methods. The interviewer must go through the interview notes (hand written list of key points), to assure that what was written makes sense, to identify parts of uncertainty, and to assess the quality of information received from respondent. Directly following the interview is when the observations are written down about the description of what has been, or not been observed.

Example of observation questions:

- What did the participants do during the interview?
- Did their behavior change during the activity?

The evaluator-observer should distinguish between what was observed and the participants own perspective about their personal actions or experiences, thereby avoiding hypothetical guessing (Patton 1987, p.79-139; Repstad 1999, p.116).

Statistical research methods often include randomly selected samples, allowing some generalization to a larger population. Due to the low amount of cases in this evaluation, the result cannot be representative to the female population of Dareda village, Bonga village, or Babati District. Still, it is significant to keep in mind that even a small number of carefully selected qualitative cases can contribute to a more in depth understanding of a certain issue, compared to a large, statistically significant sample.
The evaluation approach contains a combination between inductive and deductive design (Fig.1). Observations and textual data have both been employed in order to formulate a theory and verify the risks of artemisinin in early pregnancy.

Figure 1: Inductive and Deductive Approaches

![Diagram of Inductive and Deductive Approaches](image)

(Eriksson & Wiedersheim 1997, p. 229)

The final data is eventually used in a process where it is organized and categorized to enable analysis by explaining patterns and linkages in the findings.

Table 2: Qualitative Data Collection

<table>
<thead>
<tr>
<th>The Qualitative Data Collection Includes:</th>
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<tr>
<td><strong>Information from open-ended interviews</strong></td>
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<tr>
<td>Direct quotations from informants about their experiences, attitudes and knowledge</td>
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<tr>
<td><strong>Data from observations</strong></td>
</tr>
<tr>
<td>Detailed descriptions of activities and participant’s behaviors</td>
</tr>
<tr>
<td><strong>Document analysis</strong></td>
</tr>
<tr>
<td>Quotations, parts from official or public reports, legislation, literature, facts, research</td>
</tr>
<tr>
<td><strong>Statistics</strong></td>
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<tr>
<td>Provided by e.g. a government or an organization</td>
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Documents and statistics were collected via library and the Internet; Google Scholar, Pub Med, Medline, NGO and governmental websites, etc. (Tab.2).
The reliability and representatively of available information have been taken into consideration. The quality of data collected from (non-governmental) organizations might be of a lower standard. Whereas (medical) scientific publications published in scientific journals, involve a higher quality and validity.

2.1. Previous Studies

Official documents, published by governments, public-authorities, nongovernmental organizations (NGO), and researchers, are available. These are for example international, regional, and national reports concerning, policies, guidelines, and legislation on Malaria management, as well as demographical health surveys, and medical reviews. Statistical finding on malaria in pregnancy in Babati District is limited. There are no follow-up studies accessible on birth outcomes, in Babati District, linked to the experience to artemisinin compounds, including herbal-treatment, in the first trimester of pregnancy.
3. ARTEMISIA ANNUA

Artemisia annua belongs to the class of flowering plants Magnoliopsida. It is a large, various types of plants with up to 400 species, many of which have a scented and bitter taste. Artemisia annua is an annual shrub of 50-150 cm in height. It has fern-like leaves, yellow flowers, and a camphor-like scent. Artemisia annua is also known as Sweet Wormwood, Sweet Annie, Sweet Sagewort, Annual Wormwood, or “Qing Hao” (ancient Chinese name meaning “green herb”) (De Ridder et al. 2008, p. 302-314). The Artemisia annua grows in mild climates in tropical areas at higher altitudes and is mainly widespread in China and Vietnam. But most A. annua is nowadays commercially grown on small properties and larger plantations, due to high demand and a quite short dry-leaf and artemisinin yield. Artemisia annua is also cultivated in among other East Africa, the United States, India and Brazil (De Ridder et al. 2008; MMV2009).

3.1. Artemisinin

For over 1,500 years Chinese herbalists have used leaves from the Artemisia annua plant to treat fever. The plant was rediscovered in 1970. In 1971, scientists demonstrated that the plant extracts had antimalarial activity. And in 1972 the active ingredient, artemisinin was revealed (MMV2009). The main artemisinin-related compounds found in Artemisia annua are the artemisinin-resistant strain (ART), arteanniun B, and artemisinic acid. The total amount of ART varies depending on e.g. removal methods, collection periods, sample preparation, environmental influences, and type of analytical equipment and techniques used in order to measure ART. The ART concentration of leaves from one plant may vary, with the upper leaves containing more ART than the middle or lower leaves (De Ridder et al. 2008). Artemisinin is inadequately soluble in oil or water, and is usually administered orally, although it can be given rectally and when suspended in oil, intramuscularly. Synthetic derivatives that are water soluble (artesunate) and oil soluble (artemether) have been developed to enable intravenous and intramuscular treatment of malaria. They are also used in combination with other appropriate antimalarials such as e.g. amodiaquine, to produce ACT’s (Willcox & Bodeker 2004, p.43-51).
4. THEORY

The theory consists of facts about e.g. research and structural approaches that are related in controlling artemisinins during pregnancy. The theory begins with a short introduction on maternal malaria treatment, whereas continuous information is divided into three field-topics; (1) “Artemisia Efficiency in Pregnancy” with a focus on artemisinin safety, (2) “Artemisinin Control in Pregnancy” concerning monitoring of artemisinin, and finally (3) “Drug Registration” regards the necessity of effective medical control mechanisms.

4.1. Maternal Malaria Treatment

Malaria treatment during pregnancy differs depending on the severity of maternal disease, taking into account if it is “uncomplicated malaria” or “severe malaria”. The life of the mother has to be considered as well as the life of the newborn. So called “safe” (non-toxic) drugs are suggested to be used in case of maternal malaria treatment except no alternatives of confirmed efficacy are accessible.

The present WHO recommendation for treatment of uncomplicated malaria in pregnancy relies on ACT’s in the second and third trimester. Oral quinine is advised as a first-line treatment (for seven days) during first trimester of gestation (WHO 2006c, d).

4.1.1. Artemisia Efficiency in Pregnancy

Artemisinin and its derivatives are considered as safe compared to other antimalarial drugs. According to a research on artemisinin safety during pregnancy, published in 2007, fourteen significant studies (nine descriptive/case reports and five controlled trials) could be identified regarding artemisinin during pregnancy. The studies included 945 pregnant women (123 in the first trimester and 822 in second or third trimesters) whom were exposed to artemisinin compounds. Yet no evidence was found and the studies could not prove any kind of connection between the use of artemisinins and increased risk of negative pregnancy outcomes (Dellicour et al. 2007). But studies on animals have managed to confirm that there are in fact some risks related to artemisinin intake during pregnancy. Artemisinin compounds have shown to have a negative influence on rats and monkeys, resulting in e.g. death of embryos or abnormalities in early pregnancy. On the other hand, physiological factors such as e.g. the balance between reproductive hormones, differs in rats and women, an example why
findings in animals might not be applicable to humans. However, the significance of the findings in animals to humans should not be discounted (WHO 2003; De Ridder 2008).

4.1.2. Artemisinin Control in Pregnancy
To evaluate teratogenicity risks (referring to birth defects or malformations) documentation of antimalarial exposures during early pregnancy is considered as necessary. Drug registration should be completed in health centres where antenatal care is provided to women during first trimester. The US Food and Drug Administration (FDA) and the European Medicine Agency (EMEA) advocates active assessment of antimalarial pregnancy exposure registries (PER’s). The PER’s should include products used in pregnancy or during childbearing age. It is of special interest to record medication in which there have been findings such as case-studies or animal-data, regarding adverse pregnancy outcomes. Documentation of pregnancy outcomes exposed to ACT’s are encouraged and is required to be done by Pharmacovigilance (PV) programmes, to enable evaluation of medical intake and the development of the infant (Kuile 2008; WHO 2006c).

4.1.3. Drug Registration
An “Observatory for Drug Quality” has been established by the WHO in cooperation with organizations such as The European Union (EU), UNICEF, World Bank, and NGO’s. The aim is to manage the accomplishment of sufficient and valuable control actions to enable improvements in essential drug quality (Pécoul et al. 1999, p.366)
Another significant approach is to regulate herbal products, often referred as “traditional medicine”. By developing regulations and a national policy on herbal medicines, the quality, safety, and efficiency of herbal medical products would be guaranteed. An approach initiated by the WHO is therefore to integrate Traditional Medicine (TM) and Complimentary or Alternative Medicine (CAM) within national health care systems (WHO 2005).
5. EMPIRICAL STUDY

Information from interviews and observations in Babati District revealed various aspects regarding artemisinin use among pregnant women. Several obstacles were found to be hindering rural women from receiving appropriate health/medical-care, risking both their own lives and their fetus.

5.1. Accessibility

According to Mr. Edward Mollel, principal Social Welfare Officer at the governmental office in Babati, poverty itself is a major obstacle: “…a sign of poverty is, not being able to visit the hospital, not having transportation, not affording transport or living too far away from hospital.”

Both midwives from Dareda and Bonga village, sees transportation as a big obstacle. Many pregnant women in rural areas of Babati District are forced to travel or walk far distances to the nearest health facility. The midwives further explains that women risks giving birth on their way to the hospital, not having any other options than delivering babies at home. Another problematic aspect is that many pregnant women do not seek health care during their first trimester, which explains why there are many women whom end up getting medication later during their pregnancy. Mrs. Ruth Kabelelo that works at the Bonga health centre clarifies that due to a limited staff they are not capable of making home visits, even though she would want to. The opposite situation prevails at the Dareda Reproductive and Child Health (RCH) clinic, formerly known as a Maternal-Child Health (MCH) service. They have Mobile Clinics (MC’s), vehicles or “health-care on wheels” delivering health services in remote communities, providing local people with medical care and information, making approximately 1-5 visits per month in rural areas.

There are also women that prefer other health facilities than the ones located in the vicinity. The reason for that could be related to service. “Dareda clinic”, Dareda hospital, and the Dispensary, all claims that they have many patients visiting them from remote areas, just because of their good service. According to Doctor E. Ami, medical staff, equipment, medication and money are example of facts that improve the quality of the service offered at a health facility. Where human, economical, and medical resources are missing, patients are not offered sufficient service. An example is that health centers in rural Babati, often lack
laboratory staff, therefore doctors recommend their patients to other health facilities. Even though the Dispensary is located in “Babati town” many of their patients comes from rural areas of Babati District. The dispensary is a medical reception not providing free medical service, yet there are patients that prefer the dispensary over other optional nearby hospital.

5.2. Antimalarial Treatment

Free health-care and medical-treatment is offered to children between the ages of 0-5 (including the fetus). The policies involve all public health facilities in Babati District. Some private clinics, such as the “Dareda clinic”, provided health-care for free. According to the doctors and midwives who took part in the interviews, health personnel from Babati District have been notified about the risk of artemisinin compounds in early pregnancy, and that it could damage the fetus. Medical-staff, and other relevant actors, have been invited to participate at information-meetings and seminars organized by the Tanzanian government, concerning among other ACT’s and policies regarding antimalarial drugs. While combination therapies (Dawa mseto, in Kiswahili), is recommended, mono-therapies are no longer said to be practiced, in Babati District.

Four health facilities were observed during the field-study in Babati District, two were located in the rural settings and the remaining two in town.

Table 3: Antimalarial Treatment in Pregnancy

<table>
<thead>
<tr>
<th>Health Facility</th>
<th>First Trimester</th>
<th>Second Trimester</th>
<th>Third Trimester</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bonga Health Centre</td>
<td>Quinine</td>
<td>ACT</td>
<td>ACT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SP-Prophylaxes</td>
<td>SP-Prophylaxes</td>
</tr>
<tr>
<td>Dareda (RHC) Clinic</td>
<td>Quinine</td>
<td>SP-Prophylaxis</td>
<td>SP-Prophylaxis</td>
</tr>
<tr>
<td>Mrara Hospital</td>
<td>Quinine</td>
<td>ACT</td>
<td>ACT</td>
</tr>
<tr>
<td></td>
<td></td>
<td>SP-Prophylaxes</td>
<td>SP-Prophylaxes</td>
</tr>
<tr>
<td>Z.A.C.I. Dispensary</td>
<td>Quinine</td>
<td>ACT</td>
<td>Other medication</td>
</tr>
</tbody>
</table>

All four health facilities, recommended Quinine as a malarial treatment during first trimester in pregnancy (Tab.3). SP-prophylaxes were prescribed in later stages in pregnancy. ACT’s were avoided during first trimester, and were only recommended after twenty weeks in pregnancy, except “Dareda clinic”, that did not offer artemisinin at all, to any of their patients. Artemether Lumefantrine (ALU) is an example of a combination therapy that was told to be given during pregnancy.
5.3. The Risk

According to Doctor Kaaya, from Mrara hospital, all malaria drugs involve a risk. Preferred vaccines are the ones that have been scientifically evaluated and the risks are well known. There is a bigger skepticism when it comes to the use of “new” medicines available on the market, e.g. artemisinin.

Side-effects from artemisinin is considered to be rare, however vomiting and eczema, are example of typical symptoms. When side-effects are shown, the medication is changed to another alternative drug, apart from Bonga health centre, were a higher dose of the same medication was given to the patient. In cases of chronic malaria and non effective medication, “Dareda clinic” recommends their patients to visit other health facilities.

Doctor E. Ami, from the Dispensary, claims that malaria itself can cause miscarriage-abortion, since there are several factors that can affect the mother and/or her fetus. It is therefore difficult to investigate the direct reason for complications. Doctor E. Ami further argues that there might be a chance that artemisinin is given during early pregnancy, despite the medical staff’s awareness of the risks. These obstacles could occur when medical personal are not aware of the patient’s pregnancy, and therefore wrongly prescribing her artemisinin. Mistakes can be made by medical staff, by not asking the patient about her health condition i.e. if she is pregnant or not. However the patient herself also has a responsibility to inform about her pregnancy, which is not always the case. Lack of knowledge; e.g. non awareness of being pregnant, or the risks related to medical intake during pregnancy, are reasons why some patient’s do not inform about their own pregnancy.

According to Doctor Kaaya, the first question that medical personal should ask female patients are concerning the menstruation cycle, to find out if the patient is pregnant, and thereby make sure that suitable medication is given. At the Dispensary, female patients are offered pregnancy tests, considered as a good method of preventing mistakes. In “Dareda clinic”, all female patients have to go through a so called “Prevention Mother to Child Transmission” (PMTCT) test. This health evaluation includes urine, and blood test, body-weight, blood-pressure, and HIV-test. Furthermore, female malaria patients are also invited to information meetings, where different health related topics are discussed, e.g. vaccination, side-effects, etc. Malaria patients are not recommended to contact local drug-stores for medical consultation. Doctor David and Midwife y1 considered “Duka la Dawa” as risk-full, meaning that even though a drug vendor might sell “good” medicine, they do not have enough
knowledge for accurate medical consulting. To avoid wrong medication or dosage, malaria treatment is taken in the clinic.

5.4. Drugstore (Duka la Dawa)
A local medical vendor, in “Babati town”, claimed that customers must have a medical prescription from a doctor when buying antimalarial medicine at the Duka la Dawa. Female customers come from both urban and rural areas of Babati District.

The three most popular antimalarial brands, sold at the “WAIDA” (name of the drug store) according to the drug vendor are:

1. Ekeltin – Single dose treatment
2. Coartem – Drug combination; artemether & lumefantrine
3. Sulphadar – Single dose treatment

Pregnant women prefer:
- Duo-Cotexcin - Drug combination (Dihydroartemisinin & Piperaquin phosphate)

In case a customer is illiterate, and not capable of reading the medical use directions, written on the package, the drug vendor herself, claims to explain verbally or by drawings.

There are no experience of complains of side-effects or complications due to medication in pregnancy.

A combination therapy at the “WAIDA” costs 12000 Tanzanian Shilling (TZS)

5.5. Monitoring System
Mrs. Ruth Kabelelo, midwife at the Bonga health centre, personally did not have any access to statistics or any other detailed information, via the health centre, concerning prevalence of malaria in pregnancy, or the number of pregnant women on (artemisinin) antimalarial medication. At the “Dareda clinic”, and Mrara hospital, handwritten information was available from previous month of medical appointments (Table 5). “Dareda clinic” also provided their patients with personal cards on which some medical/health information was written. According to Doctor Kaaya there are as many as 31 RCH clinics in Babati District.

Still there was no common registration system for all the RCH clinics in the region.

One explanation, according to Doctor Kaaya, why data on malaria prevalence and artemisinin intake during pregnancy are insufficient, is because the absence of a missing monitoring system in Babati District. Even though there are national statistics available on malaria
incidence, indicators such as, “malaria under five” (age 0-5) or “malaria above five” (including adults) does not contain detailed information on e.g. incident of malaria cases among pregnant women, in Tanzania.

All medical professionals that took part in the study stated that there is a need of a monitoring system, except Doctor David, from Dareda hospital. Even though Doctor David did agree that artemisinin should be avoided during early pregnancy due to possible risks, he did not believe that artemisinin itself, could affect the fetus in such way that babies might be born with disabilities. Furthermore Doctor David did not consider that there is a need for any evaluations, or monitoring systems, to investigate the risks of medical intake, artemisinin, and its effect on the fetus. Doctor Kaaya stated that artemisinin is a relatively new medicine, and so far, even if there is a present debate in Babati District on artemisinin in pregnancy, it seems that it is still a national issue, and has not yet reached “grass-root” level. There are for example no NGO or association that is active in this matter in Babati district. Doctor Kaaya also declared that even if there are only minor side effects, there is a need for further research on artemisinin. However research requires money and a big hindrance is the lack of resources.

5.6. Traditional Medicine

Mr. Leonard Mao, an Agricultural Officer at the Babati District Council, claimed that local medicine (traditional medicine), are nowadays no longer used by the local peasants in Babati District. The few ones still practicing herbal treatment are often Maasai people.

All medical professionals during the interviews claimed of not having any experience of traditional medicine. They were not familiar of patients practicing traditional malaria treatment, nor did they have experience of treating female patients for complications due to toxicity from herbal medication. They did not want to comment possible risks related to the use of herbal traditional treatment in pregnancy, claiming they did not have enough knowledge about traditional medicine and were therefore not capable of discussing the risks. In addition, Ruth Kabelelo did think that more research is necessary, about the risks of traditional medical intake during pregnancy.

Isaac Mollel, also known as “Mr. Beda”, moved from Maasai land to “Babati town” in 1986, where he is legally practicing traditional medicine. Isaac Mollel is an active herbalist, and is well known by people all around Tanzania, whom travels from far distance for treatment.
Isaac Mollel also runs a little “Kitchen-soup” called “Beda-House”, where herbs are prepared and sold, mostly mixed in to soups or food. The local treatment and type of herbs used differ depending on diagnosis; e.g. blood pressure, diabetes, rheumatism, etc. According to Mr. Beda symptoms related to malaria could be mistaken for influenza, since the symptoms for malaria rarely comes alone, a reason for why treatment of other diseases is recommended. A combination of herbs is therefore often used when treating malaria, and is also considered as a more effective treatment. Mr. Beda was not familiar with the Artemisia annua plant, but he did have experience of several other kinds of herbs used for, among other, malaria treatment. The dosages vary depending on age, gender, and health condition.

A typical “medicine-soup” contains a mixture of three-four different herbs, and cost around 500 TZS. Mr. Beda clarified that the soup rinses the body from all kinds of “bad” substances (toxic, virus, and disease) making the person whom drinks it to become healthy and strong. A typical side-effect such as heavy sweating, often affects people when not being adjusted to the medication. However, heavy sweating, according to Mr. Beda, is actually a good sign; a way for the body to get rid of toxic, meaning that the medicine is being effective.

According to Mr. Beda, customers/patients visit him from both urban and rural areas in Babati. The ones, who seek help from Mr. Beda, include rich and poor, men and women. The patient’s socio-economical situation is relevant, deciding if and how often customers can afford medication (soup). The majority of the women that consult Mr. Beda for medical advice or treatment are Maasai women.

Traditional medicine is also practiced among other tribal groups and rural women in Babati District. Even though women are welcomed to visit the “Beda-House”, they prefer to book private appointments for herbal treatment. The reason for that is unclear, but Mr. Beda thinks that one explanation is that women feel ashamed. Mr. Beda had not experienced negative outcomes of herbal treatment on pregnant women or their fetus, and he did not believe that
herbs could cause disabilities in children. Mr. Beda also stated that the negative effects during pregnancy are not due to traditional medicine, but it might be a result from modern pills (“western medication”). Mr. Beda argued that there are many unserious medicine men that only have as a goal to earn money. Some of them come from the town, and move to the rural areas, to the villages, were they mislead people giving them wrong medication, which could be seen as a serious health risk factor.

A typical herb used as an antimalarial treatment during pregnancy, is “Mwarubaini”, commonly used by the Maasai women. Mr. Beda himself prefers the “Mwarubaini”, claiming that it is more effective. Pregnant women are given a strong dose, to protect the fetus, from getting infected. Mr. Beda further explained that it is not only the dose that is significant; also how the medicine is prepared is relevant.

According to Mr. Leonard Mao, Artemisia annua and “Mwarubaini” are two very different plants, still they do have the same activity to treat malaria, “…the same functioning, but different plant!” Mr. Leonard Mao further explains that the Neem Tree (“Mwarubaini” in Kiswahili) was imported to Babati District from Skinyanga Region, Tanzania, in 1994. The demand came from farmers, who use the plant as pesticide to protect their fields/crops. The plant is not usually used as a traditional medicine. The biggest reason for that is that it is time consuming to prepare the plant to a medicine. A wrong dosage can end up killing e.g. a woman or/and her fetus (leading to a miscarriage). Many people therefore use modern medication instead of the traditional plant, in case malaria treatment is necessary. But there are places in which locals can visit, where medical plants are already prepared and served.

According to Mr. Leonard Mao, the Artemisia annua was initiated by some Americans, whom introduced the plant to local farmers, in Babati District, in 2005. The plant was not sold after harvest and the farmers stopped their interest in the product. The Artemisia annua plant can be found in Dareda and in Bashnet (two administrative wards in Babati Districts) although it is not used, according to Mr. Leonard Mao.

“..It’s a strange plant…” “…nobody has advised the farmers about the plant…”
“Nobody use it!”

Quote: Mr. Leonard Mao
According to Doctor Kaaya, the Mwarubaini tree grows “everywhere” and is therefore very easily accessed, while the Artemisia annua plant is still very new, and only cultivated in two areas in Babati District.

5.7. Women’s Experience of Malaria Treatment

The target group consists of seven pregnant rural women, between the ages of 20-35 years. All informants (apart from x1 and x4) had experience of malaria (during second trimester) in pregnancy, and they were all medicated with SP-prophylaxis. However, they were not familiar with other antimalarial treatments beside the SP. They described the treatment as effective, and had not experienced or heard of any side-effects.

All the women in the target group claimed that they were satisfied with the service and expertise, in the respective health facilities that they visit. They all claimed that they had been well informed about e.g. malaria and possible side-effects related to the disease and pregnancy.

Table 4: Target Group

<table>
<thead>
<tr>
<th>Informants</th>
<th>Age</th>
<th>Pregnancy</th>
<th>Children</th>
<th>Malaria</th>
<th>Medication</th>
<th>Side-effects</th>
<th>Traditional medicine</th>
</tr>
</thead>
<tbody>
<tr>
<td>X1</td>
<td>23</td>
<td>8 month</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>X2</td>
<td>30</td>
<td>9 month</td>
<td>4</td>
<td>Previous pregnancy (4 month)</td>
<td>SP-prophylaxis</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>X3</td>
<td>33</td>
<td>8 month</td>
<td>4</td>
<td>Malaria infected</td>
<td>Quinine</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>X4</td>
<td>30</td>
<td>8 month</td>
<td>3</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>X5</td>
<td>24</td>
<td>8 month</td>
<td>1</td>
<td>Previous pregnancy (? month)</td>
<td>SP-prophylaxis</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Y2</td>
<td>25</td>
<td>6 month</td>
<td>1</td>
<td>Previous pregnancy (4 month)</td>
<td>SP-prophylaxis</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Y3</td>
<td>33</td>
<td>5 month</td>
<td>5</td>
<td>Previous pregnancy (5 month)</td>
<td>SP-prophylaxis</td>
<td>-</td>
<td>-</td>
</tr>
</tbody>
</table>

X: Bonga Village  
Y: Dareda Village

Even though the target group could read and write, self-medication was not recommended by the Bonga health centre, and “Dareda clinic” (Tab.4). The medication was taken at the facility, during specific appointments, which the target group felt was comfortable and safe,
not having to worry about wrong dosage. None of the informants had any kind of experience or awareness about traditional medicine, or had been in contact with traditional medicine men. Still several of the women had negative opinions concerning herbal antimalarial treatment (except for x1, y2 and y3). X2 argued that traditional medicine men do not examine pregnant women’s health condition, by e.g. taking tests such as blood value, body weight, etc. and they are therefore not capable of making any diagnosis or providing correct treatment. X2 claimed that there are risks with traditional medical treatments, in this case malaria treatment in pregnancy, and that it might lead to dangerous consequences. Like many of the other informants, X2 mentions the “Mwarubaini” plant as an example of a “bad” drug, used as a traditional medicine during pregnancy. X4 claimed that the “Mwarubaini” has a bitter taste and believed that the taste of bitterness is a sign for danger (toxicity). Informant X3 believed that traditional antimalarial treatment is effective, but not during pregnancy. Both X3 and X4 claimed that “Mwarubaini” intake during pregnancy could lead to miscarriage.
6. RESULT

There are no documented medical problems related to artemisinin in pregnancy, beyond minor side-effect such as e.g. eczema. Malaria itself is a major risk factor including several symptoms which could cause complications or even miscarriage. It is therefore much more complex to enable investigation of direct cause of complications due to antimalarial intake such as artemisinin, during early pregnancy. There is a need of an effective monitoring system, to enable sufficient registration and control of artemisinin intake during pregnancy and outcomes. Furthermore due to the fact that artemisinin is considered as a relatively “new” antimalarial medication with unknown risks, more research is required.

Rural women are often forced to travel far distance to nearest health facility. Transportation is not always available, which might be a reason why some women search for alternative accessible and affordable medication. Alternative antimalarial treatment could e.g. involve traditional medicine, although it is no longer practiced to such a great extent as before, among peasants in Babati District. Since the Artemisia annua plant is not used as a medical treatment among traditional medicine men, or local women in rural areas of Babati District, the plant is not considered as a risk factor during early pregnancy.

Patients are provided with necessary health service and medical treatment depending on whether resources are sufficient and accessible. Knowledge is a crucial factor with a major impact for significant treatment and correct dosage is given. Lack of knowledge of the risk regarding artemisinin intake in early pregnancy is a major issue that could result in wrong medication and jeopardize a person’s health. Unawareness among health personnel or drug vendor, concerning e.g. a patient’s pregnancy, could increase the risk of exposing women to artemisinin during early pregnancy. The risk of artemisinin toxicity during early pregnancy can be reduced by e.g. providing pregnancy tests, asking patients about their menstruation cycle, providing ACT’s at health facilities, arranging information meetings, and home visits.
7. ANALYSIS

According to the Tanzania HIV Malaria Indicator Survey (THMIS) 2007-08, generally 60 percent of pregnant women, in Tanzania, used antimalarial drugs during pregnancy (59% in Mainland and 78% in Zanzibar) and over half (55%) of the rural women received antenatal care at dispensaries (THMIS 2008, p.18). Whereas, findings from Babati District showed that for example five out of seven women, from the target group, had experience of malaria during pregnancy. They had all been in contact with local health facilities, where antimalarial treatments had been prescribed. In each case, medication such as ACT, SP or Quinine had been used (on the basis of gestation). The WHO recommendation for maternal malaria treatment seems to have been approved among health workers in rural settings of Babati District. ACT’s were recommended during second and third trimester in pregnancy, and Quinine as a first-line treatment during first trimester.

All health professional agreed on possible risks related to artemisinin intake during first-trimester in pregnancy, but what type of risk it involved was unclear. The target group, on the other hand, were poorly informed concerning artemisinin as an antimalarial drug; and that it should be avoided during early pregnancy. Even though they claimed to have attended information meetings, in relation to malaria infection, the topics discussed did not involve drug safety in particular. The target group relied on the expertise of health workers and their recommendations concerning (antimalarial) medical treatment. Regardless to health recommendation, or skill of health personnel, wrong prescription should not be excluded. Pregnancy tests during early gestation could therefore be considered as an effective method to detect patients at risk. An obstacle discussed among health professionals in Babati District was the fact that many health facilities in rural areas of Babati District lack sufficient resources, why e.g. pregnancy tests cannot be provided. Whereas the target group meant that lack of medical/health service was a primer reason why they preferred other optional health facilities even though it involved further travel distance or higher expenses.

But one group of women whom could be considered as left behind are the ones that do not have the possibility to visit other facilities, or cannot afford so called “better service”. Alternative health service could therefore involve e.g. visiting a local drug vendor, or perhaps a local traditional medicine man. Options such as these might involve a risk depending on several factors, such as knowledge of the health provider, type of treatment, quality of medicine, medicines used in combination with artemisinin, dosage recommendations, etc.
A monitoring system of antimalarial intake during pregnancy did not exist in Babati District. Data on antimalarial exposures was not available in none of the observed health facilities. Evaluating the risk of artemisinin in pregnancy is referred to as a complicated task requiring resources and an effective system, considering the numerous of factors that have to be taken into account. Home deliveries, for instance, might be an aspect when not being reported. Unreported cases of e.g. child deliveries or miscarriages are an obstacle for monitoring of pregnancy outcomes in relation to intake of antimalarial medication.

Another example is that malaria infection during pregnancy has already been associated with e.g. fetal growth restriction and fertility loss, why malaria itself is considered as a risk factor, and should be taken as a consideration when developing a monitoring system.

The table below demonstrates registered cases on malaria during pregnancy, provided by health facilities in Babati District during the field study.

<table>
<thead>
<tr>
<th>Health Facility</th>
<th>Period</th>
<th>Cases</th>
<th>Health Condition</th>
<th>Medication</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>Pregnancy</td>
<td></td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td>1:st 2:nd 3:rd</td>
<td></td>
</tr>
<tr>
<td>“Mrara”</td>
<td>08-09</td>
<td>14</td>
<td>- - -</td>
<td>✔</td>
</tr>
<tr>
<td>“Dareda”</td>
<td>08-09</td>
<td>239*</td>
<td>- - -</td>
<td>✔</td>
</tr>
<tr>
<td>“Bonga”</td>
<td>08-09</td>
<td>-</td>
<td>- - -</td>
<td>- -</td>
</tr>
</tbody>
</table>

*Pregnant women
✔ Malaria infection
– No data
Trimester in gestation

The data lack information concerning e.g. type of treatment, dosage, and during what trimester it was taken, relevant information which could reveal possible risks due to medical intake (Tab.5). Furthermore the data does not cover any specific information regarding patient health/medical history, which could interfere with the antimalarial medication. Although the “Dareda clinic” did offer their patient’s personal (patient) cards, the information it contained was still not considered as sufficient. Another issue is for example the 239 maternal malaria cases registered at the “Dareda clinic” which do not explain whether these women came from the same rural area or not. Due to the lack of a registration system, and the fact that patients do not necessarily seek help in their home area, makes it even more complex to control the malaria prevalence of Babati District.
Several difficulties can be mentioned regarding awareness or management of herbal medicines, among many countries in the African region. Lack of awareness within the national health authorities and drug control agency, non available accurate system for managing herbal medicines, and insufficient education are just a few examples (WHO 2005). Neither the target group nor the health professionals considered to have any knowledge about herbal medical products or treatments. Herbal medicine was not discussed among health workers and patients. Furthermore no kind of registration or control system on herbal medicines could be found in rural Babati District. Lack of knowledge, cooperation and dialogue among “modern” and “traditional” medical providers, could be considered as a warning sign. Even if there were no evidence on whether the Artemisia annua was used as herbal medical product among the local female population in Babati District. The artemisinin containing plant was accessible in two rural areas of Babati District. There might therefore be a risk that artemisinin containing plants are used as “traditional medicine” during early pregnancy. But because of a lacking control system, pregnancy outcomes are not followed up, why complications or miscarriages cannot be related to “modern” or “traditional” artemisinin treatment.
8. DISCUSSION

Due to the increasing demand of ACT’s and the high burden of malaria infection in developing countries, local production of artemisinin or cultivation of Artemisia annua could therefore be seen as an opportunity for medical self-reliance. However this type of investment would require e.g. different type of resources and knowledge, to enable a good quality production. In countries where access to resources often becomes an obstacle, cost-effective solutions are needed. One way of making artemisinin accessible in poor communities could be through the use of a medical tea prepared from the Artemisia annua plant.

Taking Babati District as an example, Artemisia annua was recognized to be grown in two rural areas; yet, the plant was not used or exported. Still it does not indicate that herbal medical plants are not being used in the region. Considering that the “target-group” and the “health professionals” denied having any association to “traditional medicine” one could assume that such kind of treatment was not being practiced in the District. However the opposite was proven. A traditional medicine man could confirm the use of herbal medical plants, and that there was a certain demand for that kind of treatment among some of the local population, including women. Even though the herbalist was unaware of the “artemisinin tea”, several other antimalarial medicines could be provided.

The fact that Artemisia annua is grown in Babati District is a reason why it is only a matter of time (and interest) until the plant becomes a new self medication, as an alternative to other available traditional herbs used among some of the local population. Even if “artemisinin tea” has been used in China for 2000 years, more research is needed concerning its safety, especially during first trimester in pregnancy.

Finally, top-down solutions are not the answer. Instead, better communication among actors such as health providers, investors, policy makers, on local, national and international level is required to enable an effective malaria control system. Through a community based approach the UN’s Malaria Millennium Development Goal might be achieved, however resources are necessary, and have to be allocated equitable.
8.1. Recommendations

- Effective registration system on drug intake during pregnancy
- A common database
- Follow-up studies of mother and child
- More research on drug safety (including herbal medical products)
- Economical, social, and cultural aspects have to be considered when developing malaria control system
- Cost-effective approaches, using local resources to increase access to ACT
- Increased dialogue and collaboration between “traditional” and “modern” health providers
- Promote increased awareness on patient safety among health providers
9. CONCLUSION

Artemisinin derivatives are claimed to be safe. There are for example no documented medical problems related to artemisinin in pregnancy. However, artemisinin compounds have caused death of embryos or abnormalities when tested on animals during pregnancy. Even though ACT’s are not recommended during first trimester in gestation, there are still several factors which might influence women’s exposure to artemisinin compounds during time-window for sensitivity. Accessibility of healthcare, availability of ACT’s, expertise of health providers, etc. are just a few examples of such aspects. Whereas, increased knowledge, sufficient resources, dialogue (between health providers), effective control/registration system (on artemisinin intake during pregnancy), follow-up studies (of mother and child), and accessible health/medical service in remote areas, are some approaches that are needed to reduce the risk of artemisinin toxicity during pregnancy.
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d) Guidelines for the treatment of malaria
Available at:

Available at:

Available at:
## APPENDIX

### Appendix 1: Informants from Babati District

<table>
<thead>
<tr>
<th>Name</th>
<th>Occupation</th>
<th>Facility</th>
<th>Location</th>
<th>Date</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ruth Kabalelo</td>
<td>Midwife</td>
<td>Bonga health centre</td>
<td>Bonga village</td>
<td>2009-02-26</td>
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<td>2009-02-26</td>
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<td>Bonga village</td>
<td>2009-02-26</td>
</tr>
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<td>Bonga village</td>
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<td>Bonga village</td>
<td>2009-02-26</td>
</tr>
<tr>
<td>David</td>
<td>Doctor</td>
<td>Dareda hospital</td>
<td>Dareda village</td>
<td>2009-03-02</td>
</tr>
<tr>
<td>Y1</td>
<td>Midwife</td>
<td>RCH clinic</td>
<td>Dareda village</td>
<td>2009-03-02</td>
</tr>
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<td>Y2</td>
<td>Irrelevant</td>
<td>RCH clinic</td>
<td>Dareda village</td>
<td>2009-03-02</td>
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<tr>
<td>Y3</td>
<td>Irrelevant</td>
<td>RCH clinic</td>
<td>Dareda village</td>
<td>2009-03-02</td>
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<tr>
<td>E. Ami</td>
<td>Doctor</td>
<td>Dispensary (Z.A.C.I.)</td>
<td>Babati town</td>
<td>2009-02-27</td>
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<tr>
<td>Edward Mollel</td>
<td>Principle Social Welfare Officer</td>
<td>Regional Governmental Office of Babati</td>
<td>Babati town</td>
<td>2009-02-25</td>
</tr>
<tr>
<td>Z1</td>
<td>Medical Vendor</td>
<td>Duka la Dawa “WAYDA”</td>
<td>Babati town</td>
<td>2009-02-25</td>
</tr>
<tr>
<td>Kaaya</td>
<td>Doctor</td>
<td>Mrara hospital (Babati District Council)</td>
<td>Babati town</td>
<td>2009-03-04</td>
</tr>
<tr>
<td>Leonard Mao</td>
<td>Doctor &amp; Agricultural Officer</td>
<td>Babati District Council</td>
<td>Babati town</td>
<td>2009-02-24 2009-03-05</td>
</tr>
<tr>
<td>Isaac Mollel (Mr. Beda)</td>
<td>Traditional Medicine Man (Herbalist)</td>
<td>“Beda House”</td>
<td>Babati town</td>
<td>2009-02-24</td>
</tr>
</tbody>
</table>

### Target Group
Health Professionals
Other Key Informants
Appendix 2: Interview Guide – Target Group

1. Personal Facts
   a) Age:
   b) Children:
   c) Where do you live?
   d) Can you read and write?

2. Health status
   a) Pregnancy:
   b) Trimester:
   c) Status of ill-health:

3. Experience of malaria
   a) When and where were you diagnosed?
   b) Where you pregnant at the time? What trimester?

4. Medical Service
   a) Why did you decide to visit the health facility?
   b) Transportation; how do you get to the facility?
   c) Have you ever visited “Babati town” for treatment? Why?
   d) How do you feel that you have been received at the facility by the health personnel?
   e) Have you ever been invited to an information meeting about malaria?
   f) What topics did it concern?
   g) What tests were you recommended during your visit at the facility?

5. Drugstore
   a) Have you ever bought antimalarial medication from a Duka la Dawa?
   b) When and where?
   c) Did you buy the antimalarial medicine to yourself?
   d) Where you pregnant?
   e) What trimester?
   f) Did you have a medical prescription?
   g) Who recommended you to visit the drugstore?
   h) What medication did you buy?
   i) What did it cost?
   j) How did the drug-vendor inform you about the medication?

6. Medication
   a) Do you take any medication at the moment?
   b) What medication?
   c) What side-effects can they give?
   d) What antimalarial medication do/did you use?
   e) Why did you decide to take that medication?
   f) Who recommended you this specific medicine?
   g) Where there any other options/alternative medicine?
   h) How many doses were you given?
   i) Where and how did you intake the doses?
   j) What other antimalarial medicine are you aware of?
   k) What do you know about combination therapy (Dawa mseto)?
I) Do you know what artemisinin or Artemisia annua is?

7. Side-effect
a) Have you been informed about possible side-effects due to antimalarial medication?
b) Do you have any experience of side-effects?
c) What symptoms?
d) How have your pregnancy been during antimalarial treatment?
e) Do you think that the malaria treatment might have affected your pregnancy in some way? How?
f) Do you have any experience of miscarriage during intake of antimalarial medicine?
g) When?
h) How far in pregnancy were you?
i) What medication did you take?
j) Who recommended you the drug?

8. Traditional Medicine
a) Do you know anyone whom practices traditional medicine? Female or man?
b) Have you ever been in contact with a traditional medicine man? What for?
c) What were you recommended?
d) For how long did you intake the medicine?
e) What was your experience?
f) What kind of local herbal treatment is used against malaria?
g) What do you think about traditional treatment of malaria (during pregnancy)?
h) Do you find medical herbs easily accessed?
i) Have you ever made your own medicine to treat malaria?
j) How was it prepared?
k) How was it used?
l) Do you think that there are any risks with intake of herbs during pregnancy?
m) What risks?
Appendix 3: Interview Guide – Health Professionals

1. Personal Facts
   a) Name:
   b) Occupation:
   c) How many years have you been working as …?
   d) How many years have you been working at the facility?

2. Medication
   a) What kinds of antimalarial mono- or combination treatments are offered at the health facility?
   b) What type of ACT’s does the facility provide their patients?
   c) What sorts of antimalarial medication does the facility recommend women during the three stages of pregnancy?
   d) What kind of side-effects can artemisinin cause?

3. Risks
   a) Have medical personnel been informed about the risk of artemisinin intake during early pregnancy?
   b) What risks are related to artemisinin intake during early pregnancy?
   c) Can artemisinin intake during pregnancy damage the fetus?
   d) Do you think that artemisinin intake during early pregnancy could lead to child disabilities?
   e) Can artemisinin intake during early pregnancy cause miscarriage?
   f) Is artemisinin avoided during first trimester in pregnancy?
   g) Is there any chance that artemisinin compounds could be provided to patients during early pregnancy, by mistake?
   h) How do health personnel avoid mistakes, such as wrong medication, from occurring?
   i) Do you have any experience of patients with complications due to artemisinin intake during pregnancy?

4. Health Facility
   a) Do you think that there are differences between health facilities in rural and urban Babati, concerning antimalarial recommendations?
   b) Does the facility treat malaria patients from other areas? Where from?
   c) Why do malaria patients visit this particular facility?
   d) In what way can transportation and distance to health facility become an obstacle?

5. Service
   a) Are home deliveries common in this area?
   b) Do you make home visits?
   c) How are patients informed about malaria and antimalarial medication, during pregnancy?
   d) How do you take concern of illiteracy among patients?
   e) What do you discuss during malaria information meetings?
   f) Are malaria patients aware of side-effects due to medical intake?
   g) Are malaria patients informed about the risks concerning artemisinin intake during early pregnancy?
6. Monitoring
a) Does the facility register prevalence of malaria among pregnant patients?
b) Does the facility register type of antimalarial medication during pregnancy among patients?
c) Does the facility provide health check-ups to evaluate malaria patient during pregnancy, incase medication affects the development of the fetus?
d) Is there a need of a monitoring system, on artemisinin intake during pregnancy, in Babati District?
e) Is there a need of further research on artemisinin intake during pregnancy?

7. Traditional Medicine
a) What do you think about traditional (herbal) medicine?
b) How common is herbal antimalarial treatment practiced among pregnant women in this area?
c) What (local) herbs are used to treat malaria?
d) Are antimalarial herbs easily accessed?
e) Is Artemisia annua accessible?
f) Have a patient ever consulted you concerning traditional medicine during pregnancy?
g) Have you ever confronted a patient concerning practice of traditional antimalarial medicine?
h) What kind of risks/consequences might herbal anti-malarial treatment cause during pregnancy?
i) Have you ever had a patient with complications due to traditional antimalarial treatment?
j) Is there a need for further research on traditional antimalarial intake during pregnancy?
Appendix 4: Interview Guide – Other Key Informants

1. Drug Vendor
   a) What brands of antimalarial medications do you sell?
   b) Price information:
   c) What do you think about malaria combination-therapy?
   d) What do you think about mono-therapy?
   e) What antimalarial medication is most popular among your customers?
   f) What antimalarial medication do pregnant women prefer?
   g) What antimalarial treatment do you recommend women during early pregnancy?
   h) What do you think about artemisinin intake during early pregnancy?
   i) What risks are related to artemisinin intake during early pregnancy?
   j) Have you heard any complaints concerning complications due to antimalarial drug (containing artemisinin) during early pregnancy?
   k) Do you inform customers about medical directions and dosage? How?
   l) Do you inform customers about side-effects due to medication? How?
   m) How do you inform illiterate customers, about dosage, caution and side-effects?
   n) Do you have customers from other areas (rural Babati)?
   o) Are customers sent here (the drug store) from a health facility?
   p) Is it necessary to have medical prescription from a doctor in order to buy antimalarial drugs at the shop (Duka la Dawa)?

2. Traditional Medicine Man
   a) Background:
   b) Occupation:
   c) Do you consider yourself as a “medicine man”, “which doctor”, “healer”, or..?
   d) For how long have you practiced traditional medicine?
   e) How long have you practiced traditional medicine in Babati District?
   f) Are there many traditional medicine men active in (rural) Babati district?
   g) What do you think about unserious herbal practitioners?
   h) What kind of customers do you have?
   i) Where do your customers come from?
   j) What type of diseases can you cure?
   k) Do you treat malaria?
   l) How do you treat malaria?
   m) What types of herbs are used as antimalarial medicine?
   n) Do you use the plant Artemisia-annua?
   o) How much does an antimalarial treatment cost?
   p) Which medicine/herb do you recommend when treating malaria in pregnancy?
   q) Are there any risks related to antimalarial herbal treatment during (early) pregnancy?
   r) Could herbal treatment lead to miscarriage?
   s) Could herbal treatment cause complication/disabilities in children?
   t) What do you think about “modern” antimalarial medicine?
3. Welfare Officer
   a) Is child registration obligatory in Babati District (Tanzania)?
   b) How long has child registration been obligatory?
   c) Does child registration give any details concerning the physical health of a child?
   d) What does the national policy concerning free medical service include?

4. Agricultural Officer
   a) Is Artemisia annua cultivated in Babati District?
   b) When, where, why and by whom was the plant (Artemisia annua) introduced, in Babati District?
   c) Is Artemisia annua an export product? Where to?
   d) Is the plant sold at local markets in (rural) Babati District?
   e) Is the plant easily accessed by locals in Babati District?
   f) Is the plant used as an antimalarial medicine? How?
   g) Do women practice Artemisia annua as an herbal antimalarial medicine during pregnancy?
   h) Can intake of Artemisia annua during pregnancy lead to complications? What complications?