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Malaria Prevention:
Use of Bed Nets and Environmental Factors in Guinea-Bissau

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ÚTDRÁTTUR

Inngangur: Skordýraeitruð moskítónet (ITNs) eru ein ódýrasta og besta leiðin til að forðast malaríusmit og lækka dánartíðni barna undir 5 ára aldri. Netin eru þó kostnaðarsöm og eru því í vaxandi mæli niðurgreidd eða þeim dreift ókeypis. Heilbrigðisyfirvöld í Gíneu-Bissá og Unicef dreifðu um 240 þúsund rúmnetum til barna undir 5 ára aldri árin 2006 og 2007.

Markmið: Skoða malaríuvarnir í Gíneu-Bissá, og þá sérstaklega notkun moskítóneta en einnig uppruna þeirra, dreifingu og álit notenda á þeim. Einnig eru skoðaðir helstu umhverfisþættir.

Aðferðafræði: Rannsóknin náði til fjögurra strandhéraða og stóð frá hápunkti regntímabils í ágúst fram í miðjan nóvember 2007. Gögnum var safnað með opnum einstaklingsviðtölum, hópviðtölum, þátttökuathugunum og stöðluðum spurningalista. Rannsóknin hlaut tilskilin leyfi stjórnvalda.

Niðurstöður: Moskítónet eru talin ómissandi yfir regntímann og þau eru einungis notuð til að verjast skordýrabitum. Aðrar skordýrarvarnir byggja á notkun reyks. Flest net í notkun eru keypt óskordýraeitruð og óniðurgreidd á frjálsum markaði. Í mörgum héruðum er netanotkun yfir 90% og margir einstaklingar sofa undir hverju neti. Afskekkt svæði, svo sem litlar eyjar, hafa takmarkaðan aðgang að mörkuðum, kostnaður við kaup á netum er hár og netanotkun þar er tiltölulega lítil. Slík svæði þurfa sérstaka athygli við dreifingu og markaðsfærslu moskítóneta.

Ályktun: Dreifing heilbrigðisráðuneytisins á moskítónetum fór vel fram og netin komust í réttar hendur. Tryggja þarf heilbrigðisráðuneytinu fjármagn til lengri tíma fyrir reglubundna dreifingu neta til ófrískra kvenna og ungabarna auk endureitrunar neta. Hundrað ára saga baráttu gegn malaríu sýnir þó að sjúkdómnum verður ekki eytt með einni nálgun. Samræma þarf mismunandi aðferðir til að ná árangri og kljást þarf við malaríu sem hluta af stærra vandamáli fátæktar.

Leitarorð: Malaría, ITNs, LLINs, moskítónet, rúmnet, dreifing, Gínea-Bissá.

ABSTRACT

Introduction: Insecticide Treated Bed Nets (ITNs) are one of the most efficient evidence-based interventions to combat malaria infection and the high under-five mortality rates in sub-Saharan Africa. The nets are costly and are thus increasingly subsidised or distributed free of charge. The Ministry of Health and Unicef distributed a total of 240 thousand LLINs to children less that five years of age in 2006 and 2007.

Objective: Gather information on mosquito prevention in Guinea-Bissau, especially the use of bed-nets, their origin and attitudes toward the nets. The research also explored environmental factors.

Methodology: The research was carried out in four coastal regions for three and a half months from August to mid-November 2007. Qualitative methods included open interviews, focus group discussions and participant observation. Quantitative methods included standardised questionnaires as well as use of documents from health care officials. Official permission for the research was obtained from the government.

Results: Bed-nets are considered indispensable during the rainy season and they are exclusively used for insect protection. Other methods of insect protection include the use of different varieties of smoke. Majority of the bed-nets in circulation are bought untreated and unsubsidised from local markets. Use of bed-nets in many areas is above 90% with several individuals sleeping under each net. Very remote rural areas, i.e. small islands, have limited access to markets and prices are high. These areas show much lower rates of bed-net use and need special attention in net distributions and measures to increase marketing.

Implications: The distribution structure of the Ministry of Public Health is an important resource. My research underlines the importance of assuring stable funding for the continuous ITNs distribution and re-treatment programs with long-term funding commitments. The roughly hundred year history of the fight against the disease has shown that malaria cannot be eradicated with simple “magic solutions”. Different methods must be integrated to achieve results and the connection between malaria and poverty need to be addressed.

Key words: Malaria, ITNs, LLINs, bed-nets, distributions, Guinea-Bissau.

FOREWORD

The writing up of my MA thesis (60 ECT units) represents half of my master's program. My research has been supervised by two instructors; Jónína Einarsdóttir, professor in the Anthropology Department of the University of Iceland; and Geir Gunnlaugsson (MD, MPH), professor of Public Health in the school of Health and Education, Reykjavík University. I am proud if their respect and motivation for Guinea-Bissau has influenced my work.

Preparations before heading off to the field were spent reading background information on the diverse subjects connected to the research such as: Malaria, Kriol language, the history of Guinea-Bissau, ITNs, malaria control policy, etc. I left for Bissau in the beginning of August 2007 and came back in late November 2007. In the middle of the research period my wife was able to join me for two weeks that made the separation more bearable. I first and foremost want to give gratitude, love and respect to my wife and partner Margrét and my five years old stepdaughter Freyja Sól for lifting up my spirit throughout the separation period that seemed much longer than it actually was as well as giving me support me during the writing up of the research.

I would like to express my sincere gratitude to the following list of partners that contributed to my research: The Ministry of Public Health in Guinea-Bissau (especially Dr. Augusto Paolo and Dr. Evangelino Quadé), The Bandim Health Project (special thanks to Peter Aaby, Amabelia Rodrigues, Adulai G. Rodrigues, the two mobile teams as well as Mr. Joaquim Gomes), Katinka Pålsson, Asumané Sambá for his invaluable contributions, Augusto A. Lopez, the Unicef Offices in Bissau and in Iceland (special thanks to Dr. Mehundo Faton and Stefán I. Stefánsson), the Icelandic International Development Agency (ICEIDA), ALCAN in Iceland, the Icelandic Centre for Research (RANNÍS).

I and Margrét were fortunate enough to pay a visit to a small boy named Nelson during our visit in the Biombo region, our coming sparked a huge smile on his face by the time he realised that we had come only to meet "him". Nelson was born slightly handicapped; he looked different from other children. Soon after our visit he became ill (most probably from an easily curable condition) he passed away in October 2007, roughly 5 years old. I dedicate this paper to little Nelson and to other children that never get a real chance in life.

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ABBREVIATIONS

ACT	Artemisinin Based Combination Therapies
ACSD	Accelerated Child Survival and Development Project
AGMS	Guinean Association of Social Marketing
A-P	Poliomyelitis vaccine
ANC+	Antenatal Care Plus
BCG	Bacillus Calmette-Guérin (tuberculosis vaccine)
BHP	Bandim Health Project
CFA	Central African Franc (currency code XOF)
DDT	Dichloro-Diphenyl-Trichloroethane
DPC	Difficult Partnership Country
DSP	Department for Public Health
DSS	Demographic Surveillance System
DTP	Diphtheria, Tetanus and Pertussis (vaccine)
EPI+	Expanded Programme on Immunisation Plus
GFATM	Global Fund against Aids, Tuberculosis and Malaria
GNP	Gross National Product
HMM	Home-based Management of Malaria
IMCI+	Integrated Management of Childhood Illness Plus
INEC	National Institute of Statistics
IPT	Intermittent Preventive Treatment
IRS	Insecticide Residual Spraying
ITN	Insecticide Treated Net
Kr.	Guinea-Bissau Portuguese-Kriol language
Lat.	Latin names
LLIN	Long Lasting Insecticide treated Net
LIC	Low Income Country
LICUS	Low Income Country under Stress
MARA	Mapping Malaria Risk in Africa
MDA	Mass Drug Administration

MDGs	Millennium Development Goals
MIC	Middle Income Country
MICS	Multiple Indicator Cluster Surveys
MT	Mobile Team
NGO	Non-Governmental Organisation
NPRSP	National Poverty Reduction Strategy Paper
Pa.	Papel language
PNLP	National Program against Malaria
PNLS	National Program against HIV/Aids
PNLT	National Program against Tuberculosis
Pt.	Portuguese language
RBM	Roll Back Malaria Partnership
S/P	Sulfadoxine-Pyrimethamine (i.e. Fansidar)
UNEP	United Nations Environment Programme
UNDP	United Nations Development Programme
Unicef	United Nations Children's Fund
USAID	United States Agency for International Development
WFP	World Food Programme
WHO	World Health Organisation

1 INTRODUCTION

Malaria control methods are numerous and are aimed at different parts of the disease cycle: its parasite, vector, host or their environment. Through the history, although there have been success stories, some programs have been shown to have done more harm than good in the long run (Tren & Bate, 2001). Most countries in the African continent have been facing an aggravated situation due to emerging resistance to malaria drugs and decreasing aid-levels in the 1980s and 90s. The countries in sub-Saharan Africa today shoulder around 90% of the world malaria-burden, counting around three thousand deaths per day, mostly children under the age of 5 years (Kofoed, 2006).

Almost 10 million children under the age of 5 years die annually in the 42 poorest countries of the world. According to Jones, et al. (2003), it is possible to prevent 60% of these deaths by employing simple and cheap interventions such as provision of ITNs. Malaria is a direct cause for 8% of the children and proportionally higher proportion in sub-Saharan Africa. In addition, it has been shown that malaria infections are also dangerous for pregnant women and the growing foetus and affect birth weight and life expectancy of newborns (WHO, 2004). Insecticide Treated Bed Nets (ITNs) are one of the most efficient evidence-based interventions to combat malaria infection and the high under-five mortality rates in sub-Saharan Africa. The nets are costly at the individual level and are thus increasingly subsidised or distributed free of charge.

An integrated national distribution of roughly 240 thousand long lasting insecticide treated bed-nets LLINs (as well as vitamin A supplementation and de-worming) for children under the age of 5 years took place in Guinea-Bissau in November and December 2006 and a year later in the Bissau capital area. The campaign was carried out by the Ministry of Public Health of Guinea-Bissau along with its main partners, including Unicef. The research looks at the main sources of bed-net, both programs and markets. The study revolves around the side of the beneficiary within distribution campaigns and what takes place after the most vulnerable groups (pregnant women and children under 5 years of age) take home their bed-nets. I try to shed light on the patterns of net-use and the

physical environment in four coastal regions in Guinea-Bissau, and also elaborate on people's perception of different types of bed-nets, why people use bed-nets and what types of bed-nets they prefer?

The first time I almost came across bed-nets was in a cultural exchange program I took part in Nigeria in 1999. Entering my room I found four poles sticking out of my bed and asked what they were for. I was told that these poles could be used to attach bed-nets that could protect me against mosquito bites, I was told by some that bed-nets were quite annoying gadgets that blocked air circulation and in any case there were no mosquitoes in this house. In short I never actually used a mosquito net during my 21 months in Nigeria and I quickly learned not to worry about not having one. Of course my condition was different from most people since I had the choice providing myself with whatever protection that I wanted to buy, insecticides or other, but this experience still gave me a glimpse into how easy it is to develop a fatalistic attitude in everyday life. In my own context in Iceland, I can remember some years back when safety belts were only for decoration in the back seats of vehicles.

The idea for my research originally came from my instructor Jónína Einarsdóttir who had herself taken part in a part in a country-wide distribution of long lasting insecticide treated nets in Guinea-Bissau in the end of 2006 that was largely funded by UNCEF in Iceland. When I decided to take on this assignment I was already intrigued by the country after hearing Jónína's lectures on her fieldwork with Papel-mothers in the Biombo region. I had also encountered a bed-net user survey while working with the International Federation of the Red Cross and Red Crescent in Niger in 2005/6. That survey was of quantitative nature and was performed after a very large ITNs distribution program in the country. I was optimistic that a qualitative research angle could produce complementary insights into use-patterns of ITNs.

This MA thesis in Development Studies revolves around the side of the beneficiary within these distribution campaigns and what takes place after the most vulnerable groups (pregnant women and children under 5 years of age) take home their bed-nets. However, the research looks at the use of all bed-nets, whatever their sources. I aim to shed light on the patterns of bed-net use and elaborate on people's perception of different types of nets. Why do people use

bed-nets and what types of bed-nets do they prefer? In addition, attention is also paid to some environmental factors that contribute to malaria transmission. Data was gathered in four coastal regions in Guinea-Bissau for three and a half months from August to mid-November 2007. Qualitative methods included open interviews, focus group discussions and participant observation. Quantitative methods included standardised questionnaires as well as documents from health care officials.

In the second chapter of the thesis I review the history of malaria as well as policies and campaigns carried out to contain or to eradicate the disease. I revisit some of the strategies that have been used to fight the disease as well as evidence for current control methods such as ITNs. In the third chapter I outline the setting of the research in Guinea-Bissau, a small West-African state that got independence in 1974 from the Portuguese and currently ranks with the third lowest Human Development Index (HDI) in the world. In the fourth chapter, I describe the methodology of the research that relied on a combination of qualitative and quantitative methods. Chapter five outlines the results of my study and chapters six and seven discuss the findings in connection with the theoretical background and present conclusions of my research.

2 POLICIES OF MALARIA CONTROL IN RETROSPECT

In this chapter I discuss the history of the different strategies of malaria control. I describe the WHO malaria eradication campaign in the 1950s and 1960s where DDT was to serve as the "miracle" solution for all malarial regions. While this program virtually put an end to malaria in Europe and North America, it left it a disease of poorer nations.

2.1 Humans and malaria

The history of malaria goes back millions of years. Mosquitoes have transmitted the malaria parasites to animals such as birds, reptiles, rodents, apes, monkeys and also to humans throughout their evolution (Carter & Mendis, 2002, p. 575). The animals that are affected by malaria are hosts to the malaria parasite and the mosquito acts as the parasite vector. The parasite has a very complex life cycle that takes place both in the mosquito vector and its hosts.

Human malaria seems to have been known in China almost 5000 years ago (Spielman & D´Antonio, 2001, p. 91). Ideas about the origins of this disease have varied throughout time and its connection to the mosquito vector was not confirmed until 1897 by Ronald Ross. Soon after it was shown that not all mosquitoes acted as malaria vectors, and the culprits were narrowed down to a few species of the genus *Anopheles.* Out of the approximately 450 Anopheles species known today, only around 30-40 act as vector of human malaria (Kiszewski, Mellinger, Spielman, Sachs, Malaney, & Sachs, 2004).

The total number of malaria parasites species (or *Plasmodium*) affecting vertebrates (including humans) is about two hundred (CDC, 2006). Only four of these species naturally[1] cause malaria in humans. These four human malaria parasite species all produce different clinical symptoms in humans which are not all equally dangerous:

1 According to White (2008) humans can also be manually infected (through blood transfusion) with some simian *Plasmodium* species. Wagner-Jauregg was awarded the Nobel price in the 1930s for treating the neuro-syphilis patients with simian malaria parasites (inducing high body temperature). Later experiments have shown that some simian *Plasmodium* species can also infect humans naturally (through the mosquito vector) and *P. knowelsi* is often referred to as the "fifth human malaria parasite".

- *Plasmodium falciparum* is responsible for the majority of all malaria deaths today, of which about 90% occur in Africa south of the Sahara. The infection of red blood cells can develop very rapidly and can thus cause severe blood loss (anaemia) (NIAD, 2007; Wiser, 2008). In addition, *falciparum* parasites can cause the clogging of non-infected red blood cells (so-called *rosette* formation), that block small blood vessels in the brain and produce the fatal cerebral malaria in children (Newton, Hien, & White, 2000). With prompt and effective treatment it is almost always curable. *Falciparum* is the least competitive of the four species where transmission rates are low; this is due to the fact that it does not enter into a dormant stage and produce relapses like the other *Plasmodium* species (Bockarie & Dagoro, 2006).
- *Plasmodium vivax* is the most geographically widespread of the four species. It can produce relapses for up to a decade and the chronic disease is debilitating (Mendis, Sina, Marchesini, & Carter, 2001, p. 100; NIAD, 2007). It generally produces less severe symptoms than *P. falciparum* but can in rare cases result in death (most often due to the rupture of an enlarged spleen).
- *Plasmodium ovale* is rare and generally occurs in West Africa. It can cause relapses like *P. vivax* (NIAD, 2007).
- *Plasmodium malariae* is rare and has the ability to endure in red blood cells for decades without ever producing clinical symptoms (NIAD, 2007). A person with no symptoms can however still infect mosquitoes, or humans through blood donation. Since *P. malariae* can thrive in both sparse and moving populations, it has been called the “gypsy” malaria. It is the only malaria that produces *quartan* fever (with fever episodes occurring every third day) (Carter & Mendis, 2002).

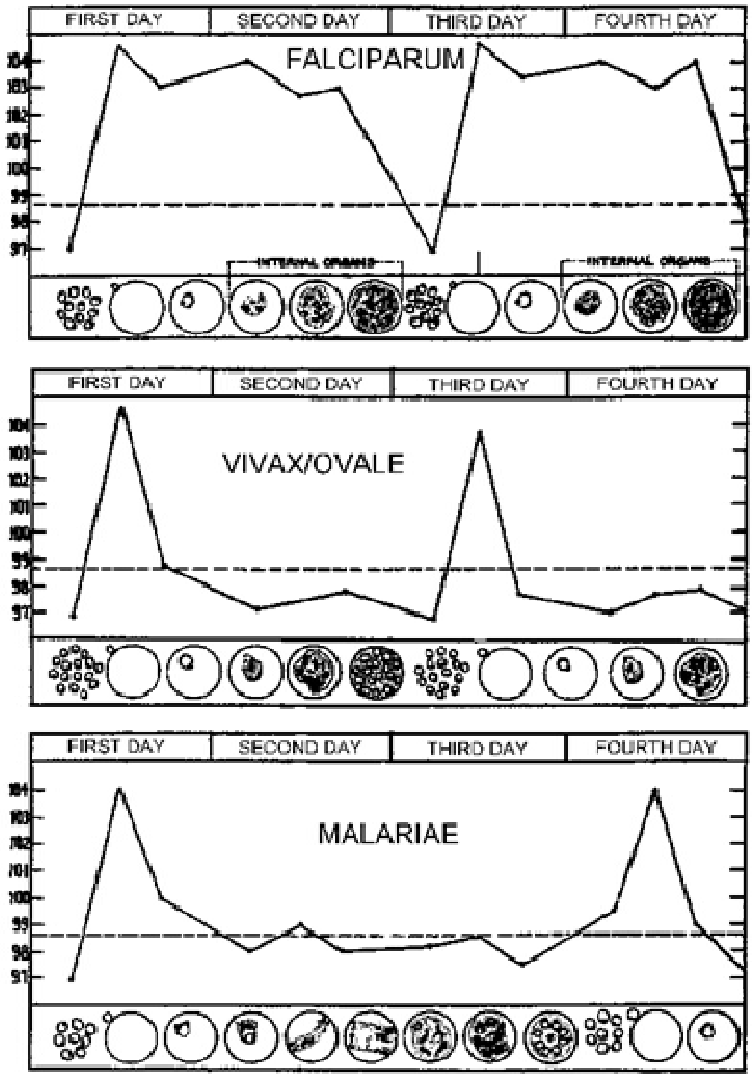

Figure 1 Different fever episodes of the four different species of malaria. Figure adapted by: (Wiser, 2008). Original figure from: (Neva & Brown, 1994).

According to Carter (Carter & Mendis, 2002) different malaria fevers have been diagnosed and documented in the Mediterranean since ancient times. *P. vivax and P. ovale* were thus labelled "benign tertian" fever since paroxysms (fever attacks) typically occurred every second day and attacks were rarely fatal. *P. falciparum* malaria that produced paroxysms with the same interval was however identified as "malignant tertian" fever (p. 565). Figure 1 illustrates the connection between paroxysms and the phases of different *Plasmodium* parasite infections. High fever corresponds to the period of *merozoite* invasion from red blood cells.

2.1.1 The transmission cycle

The life cycle of the human malaria parasite involves two hosts: Firstly, the female *Anopheles* mosquito and secondly, humans (CDC, 2006). Transmission of parasites between the two hosts occurs only during blood-feeding of the mosquito vector (Figure 2).

When an infected female mosquito infects a human it injects so-called *sporozoites* (parasites) through its salivary glands into the human-host during blood feeding (CDC, 2006). The *sporozoites* make their way into the liver-cells and mature in about one week into so-called *schizonts* which in turn ruptures and releases *merozoites*[2]. After this initial replication in the liver, the parasites continue undergoing asexual multiplications in the red blood cells in the bloodstream.

Merozoite infected red blood cells are transformed into ring stage *trophozoites* and then mature into *schizonts* in 48-72 hours (CDC, 2006). These *schizonts* then rupture and release more *merozoites* that in turn infect new red blood cells. *P. falciparum merozoites* differ from the other parasite species for the fact that they are able to infect all red blood cells, but the other three parasite species predominantly infect very young blood cells. This substantially increases the rapidity of infection and high parasite load due to *P. falciparum* (Kakkilaya, 2006).

The clinical manifestations of the disease appear in humans at the point where red blood cells (*schizonts*) rupture releasing new *meorzoites* into the blood (CDC, 2006). A part of the *merozoites* formed in red blood cells turn into so-called *gametocytes*, which is the sexual form of the parasites.

[2] *P. vivax* and *P. ovale* parasites, *hypnozoites* (or dormant parasites) can formed in the liver cells and can persist and cause relapses by invading the bloodstream years later (CDC, 2006).

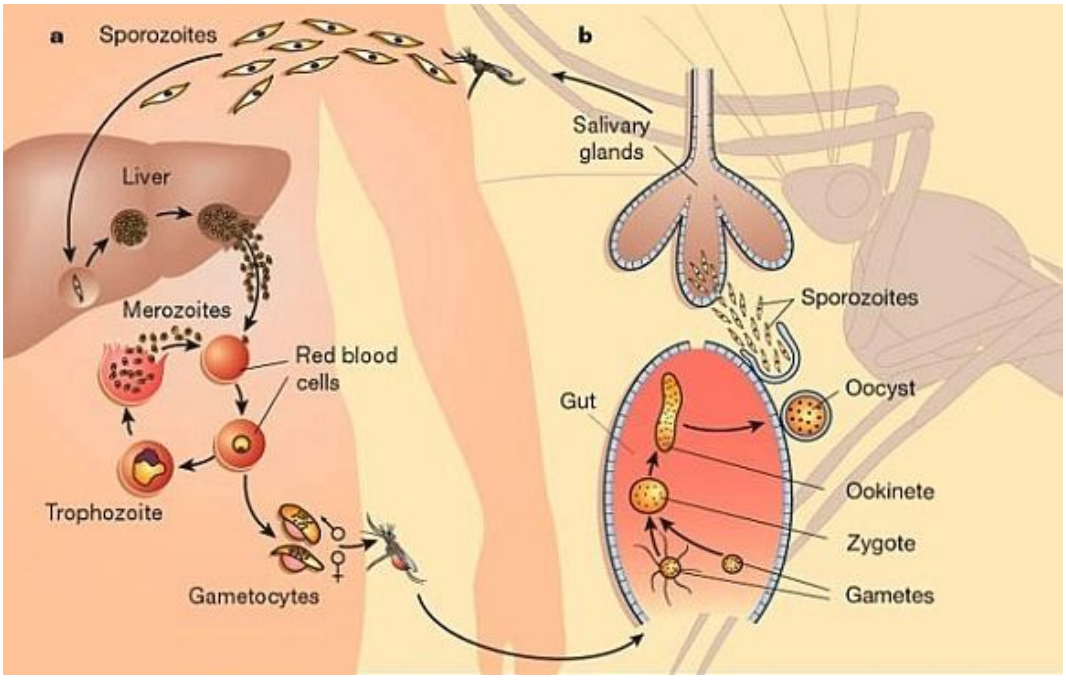

Figure 2 Transmission cycle of malaria in humans. Figure from: (Ménard, 2005, p. 113)

In turn, when an uninfected female mosquito bites an infected human, it sucks up *gametocytes* along with blood (NIAD, 2007, pp. 8-11; CDC, 2006; Despommier, Gwadz, Hotew, & Krisch, 2005). Once in the mosquito's stomach, the *gametocytes* develop into sperm-like male *gametes* or large, egg-like female *gametes*. Fertilization produces an *oocyst* filled with new infectious *sporozoites*. The *oocyst* finally ruptures and thousands of thread-like *sporozoites* migrate into the mosquito's salivary glands. Here, the cycle starts over again when the mosquito bites its next victim.

The life-cycle of the malaria parasites presents quite a complex picture. The next section presents the human immune responses to the parasites. The immune responses are of an equally complex nature, very hard to build up and easily lost. These two aspects (life-cycle and immune responses) however present the possibilities and difficulties in development efforts of a protective malaria vaccine.

2.1.2 Human immunity to malaria

There are numerous categories and levels of immunity that humans can build up against the malaria (Figure 3) (Carter & Mendis, 2002). Immunity is strongest in countries where malaria transmission is high and stable throughout the year (or endemic). It is important to note that this protection does not develop sufficiently

in children under the age of five years that can only achieve weak levels of immunity. In areas where malaria is present only a short period of the year (or epidemic), the immune protection of grown-ups fluctuates much and protection in children less than five years of age is considered absent. Strong and effective anti-parasitic immunity is achieved only after many and frequent infections in endemic regions. However, having been achieved at such cost, effective immunity is readily lost again. An interval of half a year to a year without re-infection appears to be sufficient to leave an individual vulnerable to the full impact of a malarial infection (Carter & Mendis, 2002, p. 576).

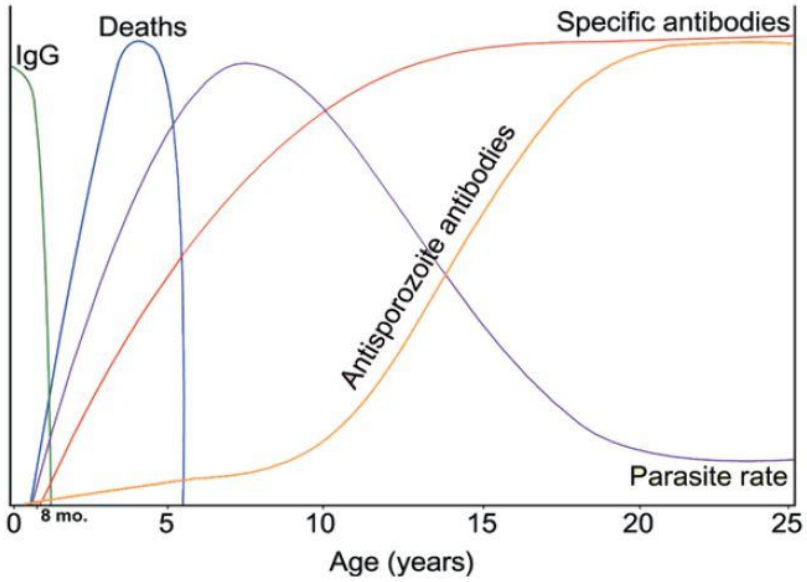

Figure 3 The graph shows the relationship between age, mortality and the development of different human immunological responses to malaria in an African endemic malaria context[3]. Figure taken from: (Despommier, Gwadz, Hotew, & Krisch, 2005, p. 64).

In some tropical regions where humans have been in contact with malaria for thousands up to tens of thousands of years, genetic traits (or polymorphisms) have been naturally selected and are connected with increased protection against malaria infection. One of these traits is the *sickle cell trait* that is the most common in West-Africa (Carter & Mendis, 2002). Children who are heterozygous to the trait (carry one sickle cell allele) are at 10% of the normal risk to develop lethal cerebral malaria due to *P. falciparum* infection, however children who are homozygous to the trait (carry both sickle cell alleles) develop sickle cell anaemia.

[3] **IgG** refers to a natural specific immune response against *P. falciparum* merozoites, that develops in grown-ups in endemic regions. This immunity is transferred by mothers to infants but is lost in a few months after the infant starts producing its own blood (Kinyanjui, Conway, Lanar, & Marsh, 2007)

Another protective genetic trait is the *Duffy negativity* which has made local populations from Central and West Africa almost universally refractory to developing *vivax* malaria (pp. 571-2).

Looking at the history of malaria in lizards or birds can provide indications on the evolution of the disease in humans since these animals have known malaria for much longer than humans. Escalante, Feeland, Collins, & Lal, (1998, p. 8128) have pointed out that the virulence of malaria parasites in lizards does not seem to have diminished with regards to the duration of the host-parasite relationship. Carter & Mendis (2002, p. 573) furthermore point out that more than 5000 years of exposure to *vivax* malaria in S-Asia has not led to selection for high levels of the above mentioned *Duffy negativity* protective trait. Though human populations in some regions of the world are genetically protected against certain strains of malaria, we should therefore not count on natural human "adaptation" to the disease.

2.2 Malaria control in retrospect

The word "malaria" comes from Old Italian and literally means "bad air". The word is a reminder of the ideas Europeans had until just over a century ago about the origin of illnesses. The belief was that malaria was transmitted by foul air or *miasmas*[4] from marches and wetlands (Spielman & D´Antonio, 2001). This idea sparked off campaigns many hundreds of years back – pushing populations to make ditches and drying up wetlands around densely populated and malaria infested areas such as the wetlands around Rome in Italy. Even though the premises for this belief were false, by situating the origins of the disease in "dirty" water, communities did limit the actual breeding grounds of the mosquito and succeeded in reducing the burden of malaria long before confirming where malaria came from (Tren & Bate, 2001, p. 21).

Bed-nets have also been used for a long time. The Romans and Greeks in ancient times used thin materials (i.e. gauze or muslin) to protect themselves against the inconvenience of mosquitoes and unknowingly created a physical barrier against the disease at the same time (Frey, Traoré, De Allergri, Kouyaté, &

4 Miasmas are defined as infectious or noxious exhalations from putrescent organic matter (Shorter Oxford English Dictionary).

Müller, 2006, p. 1). Similarly, in W-Africa the Hausa, the Fulani and the Mandinga (in the Gambia and Guinea-Bissau) have traditionally fabricated and slept under bed-nets for hundreds of years (Lindsay & Gibson, 1988).

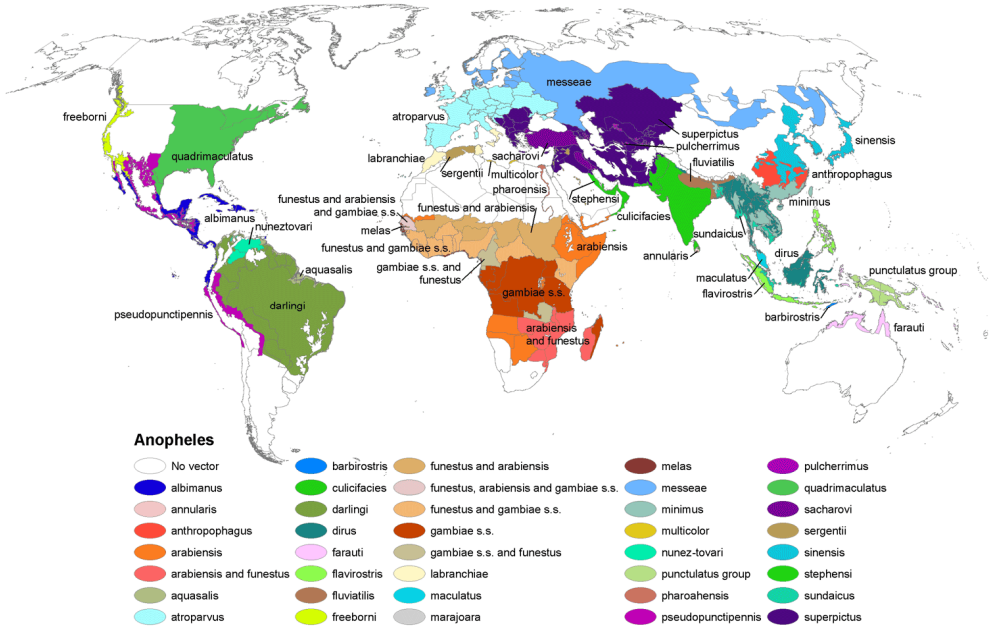

Figure 4 Distribution of different malaria vector species in the world. Figure from (Kiszewski, Mellinger, Spielman, Sachs, Malaney, & Sachs, 2004, p. 488)

The geographical boundaries of malaria today are mostly bound to the tropics. Malaria however has a long endemic history in both Europe and North-America, with summer epidemics periodically popping up in eastern Scandinavia, Canada and Siberia. The eradication of the disease from US and W-Europe was not finally achieved until in the 1950s (Spielman & D´Antonio, 2001). Even though malaria has been pushed out of the most wealthy regions of the world, travel and the presence of vector species for malaria pose a threat of reintroduction. The distribution of malaria vector species can be seen in Figure 4. The map shows the areas occupied by potential malaria vector species.

Other non-vector species, i.e. from the *Aedes* comlex, equally occupy many of the coldest regions of the globe, including Greenland and northern Canada. Iceland presents quite a unique case, since no mosquito species has been able to adapt in the country. Mosquitoes in cold climates rely on hibernation under winter ice in ponds and lakes. The non-presence of mosquitoes in Iceland, has been explained by the frequent temperature fluctuations during the winter that tricks mosquitoes out of winter hibernation (Gíslason, 2002).

2.3 Drugs and policies

Jesuit missionaries in South-America learnt to use the bark of the *cinchona* tree against malaria in the beginning of the 17th century (Spielman & D´Antonio, 2001). The active ingredients' extract from the bark was later named quinine and was to become the first potent malaria medicine known to Europeans against malaria. Surprisingly, it would take more than two hundred years for quinine to become widely used in Europe against the disease. The Cinchona powder was generally not of good quality and protestant Christians were furthermore reluctant in using it because of its seemingly catholic origin. Other curative methods such as blood-extraction prevailed in Europe up until the mid 19th century (Tren & Bate, 2001, pp. 29-30).

Today, one of the central aspects of malaria control is prompt access (both physical and financial) to effective malaria treatment. A study performed by Trape, et al. (1998) in Senegal indicated that mortality due to malaria had been rising fast between 1984 and 1995 due to the emergence of parasite resistance to malaria drugs. During this period mortality increased five-and-a-half-fold in areas of epidemic transmission. Responding to the global emergence of chloroquine and sulfadoxine-pyrimethamine (S/P) resistant strains of malaria parasites, the WHO (and other international organisations) are today advocating strongly for the change of national drug policies to combination drug therapies (or ACTs) that are based on Artemisinin[5] in combination with other drugs (WHO, 2006).

Poor health care and coverage in sub-Saharan Africa has according to the WHO often led to "the by-passing of health care facilities [...] in favour of health care from the private or informal sector with inappropriate or poor-quality drugs" (WHO (ii), 2004, p. 7). In 2005, African leaders promised once more to greatly increase access to prompt and effective treatment[6]. Home based management of malaria (HMM) is currently being promoted by WHO and others as a method to increase the quality of malaria diagnosis and treatment. Since the diagnosis and treatment in HMM is mostly performed by non-professionals (i.e. trained shop-keepers, mothers, etc.) unit-dose-packaging with clear regimen-information is an

[5] Artemisinin is produced from a newly re-discovered 2000 year old Chinese medicinal plant *Artemisia annua* (Kumar & Srivastava, 2005). The ACT acronym stands for: Artemisinin based Combination Therapies.

[6] By the year 2010, that 80% of episodes should be treated within 24 hours (RBM, 2005)

important aspect of the strategy to avoid under-dosing (Figure 5) (WHO, 2006). Effective case-detection also relies on the use of so-called rapid diagnostic tests or RDTs (Hopkins, Talisuna, Whitty, & Staedke, 2007).

Figure 5 a) large chloroquine bulk-container b) Coartem (Artemether–Lumefantrine). Unit-does packing offer visual explanation on how to keep a correct regimen. Figures from: (WHO/TDR, 2006).

Hopkins, Talisuna, Whitty, & Staedke (2007) point out that though HMM programs show positive results in some regions, different strategies will need to be developed to suit diverse cultural environments. They also point out that these new technologies of ACT therapy as well as RDTs come at a cost which could divert funds from other public health programs if funding is not further scaled-up.

According to Kofoed (2006, p. 67) and Ursing, et al. (2007, p. 555) the new ACT therapies are between 10-20 times more expensive than treatment with chloroquine or S/P. They claim that the shift of drugs policy could create a financial barrier to effective treatment for the poorest if there is no long-term commitment from donors or governments to subsidise them.

Since ACTs rely on cultivation of the plant *Artemisia annua*, Kumar & Srivastava (2005, p. 1097) claim that the most important price barrier of Artemisin could be overcome by boosting up cultivation of the plant in India. Kindermans, et al. (2007, p. 5) however underline the huge price fluctuations of ACTs in recent years, that present a serious threat to the whole ACTs implementation program. They claim that if procurement of the drugs is not better coordinated and the number of quality producers is not increased, market-price

fluctuations will become a serious problem. Furthermore, they claim that the relatively short shelf-life of ACTs increases even more the need for stable market prices.

2.3.1 Mass Drug Administration

Mass Drug Administration Campaigns (MDAs) were first inspired by an optimist belief in new medicines such as quinine and chloroquine. In MDAs, whole populations are treated with malaria drugs irrespective of symptoms of malaria. The first documented campaign was in 1931 in a rubber plantation in Liberia (Von Seidlein & Greenwood, 2003). Following the campaign (as with other MDAs), the parasite prevalence in the population did decrease but unfortunately it was unsucessful in interupting the transmission of malaria. This was due to the fact that the both quinine and chloroquine do not intervene at the gametocyte level (i.e. kill the parasite in its sexual stage) (p. 452). In later years this has been aggravated by the emergence of drug resistance in malaria parasites (Greenwood, 2004, pp. 2-3). Today, MDAs are very rarely employed due to the increased risk of triggering drug-resistance in malaria parasites (WHO, 2006). MDAs are only considered to be viable during malaria epidemics in areas where the season of malaria transmission is short (such as in dry or high altitude areas). Primaquine and Aretemisin based drug combinations (ACTs) are now promoted for MDAs as they intervene at different levels of the gametocytal stage (p. 135).

2.3.2 Preventive treatment

Intermittent Preventive Treatment (IPTs) is a method of malaria prevention where drugs are provided at specific time points to certain vulnerable groups within a population irrespective of their infection status (Carter & Mendis, 2002). IPTs have generally been provided to pregnant women in endemic areas. The objective is both to clear the body of parasites and to leave a drug residual effect (prophylaxis) for a certain period. IPTs have also been shown to benefit children less than one year old without hampering the early development of their immune systems (p. 588).

Travellers have for centuries also used quinine, chloroquine and later other malaria medication as a protection against malaria (Tren & Bate, Malaria and the DDT Story, 2001, p. 28). Still today, most expatriates and travellers in endemic malarial countries are advised to take chemoprophylaxis for malaria protection.

Prophylaxis is however not a guarantee against infection and travellers from non-malarial countries are advised to use other precautionary methods such as using insect repellent pomades, wearing long trousers, sleeves and socks in the evening and sleeping under insecticide treated nets (WHO (i), 2005, pp. 54-6).

2.4 Vaccine development efforts

Forty years ago researchers demonstrated that injecting people with irradiated (sterile) sporozoites could build up protection against malaria infection. At that time-point it looked like a vaccine against malaria was close, however a highly effective malaria vaccine has still not been developed. Key obstacles to the development of a vaccine include the cost of research, the diversity of malaria parasite and the variability of natural antigens (WHO (ii), 2005, pp. 45-6; Phillips, 2001).

Figure 6 Malaria vaccine research and development is a very costly venture. The figure on the left shows the production of SE36 malaria vaccine for testing. Figure from: (Ti Benderana, 2007).

Similar to anti-malarial medication, there is little commercial incentive for private firms to invest in development of vaccines against malaria. The cost of vaccine development is very high while the most hard-hit countries and regions are generally the poorest (Figure 6) (Phillips, 2001). The solution that is actually needed is a cheap, safe and effective transmission-blocking vaccine with a long lasting effect. This situation makes funding for the malaria vaccine efforts difficult.

Malaria vaccine development efforts have up to now depended on funding from rich governments and large charitable foundations such as the Bill and Melinda Gates fund. Fortunately for the research and development sponsors they are backed up by opinion-givers like the WHO. A report from the WHO (ii) (2005, pp. 45-6) suggests that the development of a highly effective prophylactic

malaria vaccine for humans is still a very feasible project. Figure 7 shows the evolving vaccine pipeline and possibilities that lie behind the development of new vaccines. The size of circles is proportional to the number of deaths caused by each disease. The shaded area around the circles is proportional to number of deaths that are currently prevented by traditional Expanded Programme on Immunisation (EPI) vaccination programs.

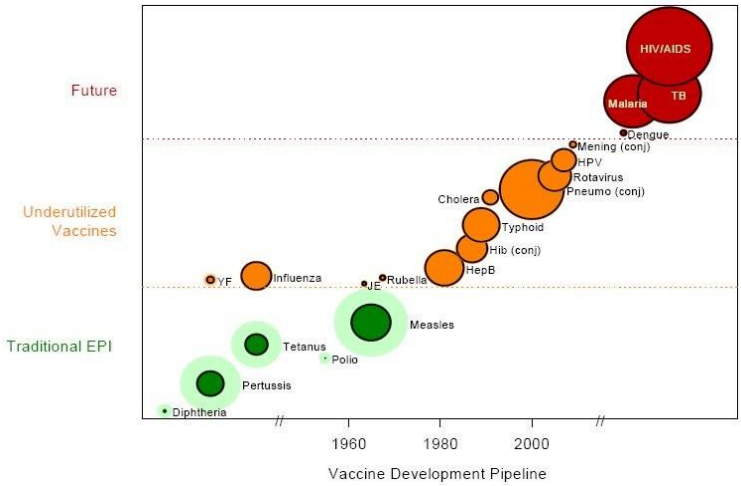

Figure 7 The evolving vaccine pipeline. Figure from: (WHO (i), 2007).

2.5 Vector control programs - Reducing the risk of malaria

2.5.1 Larval control

Historically, the most effective campaign against African vectors are the Rockefeller foundation[7] funded mosquito eradication campaigns in the 1930s. The accidentally introduced *Anopheles gambiae*[8] was eradicated from a 54 thousand km^2 area in northeast Brazil and from the Nile valley in Egypt (Killeen, Fillinger, Kiche, Gouagna, & Knols, 2002). The success of these programs relied overwhelmingly on the destruction of larval habitats, notably through the use of *Paris Green* (a heavily toxic arsenic based larvicide). These programs have been criticised for over-reliance on larvicides, but in fact relied on a combination of other methods such as insecticide spraying (with *pyrethrum*), putting up door and window screens, distribution of bed nets, improved access to drugs, etc (p. 623).

[7] Rockefeller Foundation was founded by the oil tycoon John D. Rockefeller in 1901, with the aim of promoting the well-being of mankind (Tren & Bate, Malaria and the DDT Story, 2001, p. 35).

[8] It is not yet known which sub-species of *Anopheles gambiae s.l.* was erased from Brazil in 1930. The most likely culprits are *A. arabiensis* Patton and *A. gambiae ss* Giles (Killeen, Fillinger, Kiche, Gouagna, & Knols, 2002, p. 620).

The legacy of putting vector control in the foreground is all the same labelled the "American way" by Spielman & D´Antonio (2001) as opposed to an "Italian way" which aimed mainly at improving social conditions, such as improving housing and better access to medication to fight malaria.

Integrating multiple methods in malaria control programs is today seen by policy making institutions as instrumental for their success. According to the WHO (2004) integrated approaches include the use of a range of evidence based interventions often used in combinations. They furthermore emphasise the need to implement in close collaboration with the health sector as well as other stakeholders in order to ensure sustainability.

Larval control is labelled by many as being too complex and hard to implement in tropical Africa. This is due to the need for vast amounts of geographical and biological information on breeding grounds and habits of the mosquito vectors that often present a moving target. Killeen, et al. (2006, p. 517) see this as an overly negative view and point out that instead of over-anticipating problems before implementing larval programs in tropical Africa, evidence should be raised while pilot programs are running. Larval programs could thus be streamlined gradually through a *"shoot first, ask questions later"* method, which was used in the highly successful campaigns in Brazil and Egypt in the 1930s.

There are however mixed voices from the academic community regarding the prospect of larval control in Africa. A study that Over, et al. (2004) performed between 1993-1999 in the Solomon Islands undermines the effectiveness of larval control, using current larvicides. Their study underlines the efficacy of DDT (Dichloro-Diphenyl-Trichloroethane) spraying, ITNs use and malaria education that all decrease malaria independantly, but that larval control with *Temephos* larvicide does not.

Walker and Lynch (2007) on the other hand see opportunities for larval control in today´s malaria prevention. They have gathered information from various field studies performed in Africa during the past 15 years. Their results indicate that focussing larval control efforts in urban areas, where larval habitats are more predictable, would have an optimal impact on lowering malaria transmission. They however stress the importance of employing other control and

protection methods, such as IRS and ITNs, in conjunction with the larval programs.

Dhiman (2000) points out opportunities that *Remote Sensing* (or satellite imagery) offer. Through this technology it is now possible to detect, map and forecast mosquito breeding grounds and the information can easily be used to build buffer zones around towns and villages.

2.5.2 IRS Programs and the Global Eradication

Insecticide Residual Spraying (or IRS) can have a marked impact on malaria transmission rates by moderately reducing mosquito longevity (or life-span) and significantly reduces the chance for mosquitoes to develop *sporozoites* (that are needed to infect humans) (WHO (i), 2006, p. 5).

Before the Second World War, IRS-programs were hard to sustain in endemic countries due to the need for frequent reapplication of chemicals, high-cost of implementation and the emergence of insecticide-resistance in insects. DDT was "re-discovered" by the US military in 1943[9] and this innovation quickly changed attitudes toward IRS-programs. Experiments showed that DDT, unlike other incecticides, continued killing insects for up to a year without the need of reapplication. Furthermore, initially it seemed to have no negative effects on the environment (Spielman & D´Antonio, 2001, p. 145).

During and after the Second World War mosquito breeding grounds flourished in Europe due to sabotage of waste disposal facilities and tidal gates. With earlier successes in Brazil and Egypt in mind, the Rockefeller Foundation was now confident to launch a Global Malaria Eradication Campaign where DDT was to function as the "silver bullet". WHO took over the campaign in the 1950s, though major part of its funding still came from USAID (Spielman & D´Antonio, 2001, p. 147). The US funding at the height of the Cold War put WHO into a difficult position and the eradication program was labelled by many as representing US propaganda material (Tren & Bate, 2000).

In a pilot program on the island of Sardinia 256 tons of DDT were dusted over the small island and an army of 25 thousand field-workers dried wetlands, applied larvicides and sprayed homes with DDT. After five years of eradication

[9] It had first been invented as a moth killer by a Swiss scientist 50 years earlier (Spielman & D´Antonio, 2001).

efforts and millions of dollars spent, scouts were sent out to look for survivers. To their surprise, they found both larvae and adults alive and thriving. In other countries similar results appeared. Despite the fact that the malaria vector mosquitoes seemed to survive, the disease was completely driven out of the US, southern Europe and finally became a disease of the poor countries (Spielman & D´Antonio, 2001, p. 151).

In retrospect, the Global Malaria Eradication Campaingn had a monumental impact in the world, apart from the continent of Africa. The program managed to save millions of lives around the globe. Early on it became clear that the program was unable to wipe out the mosquito vector species, so theoretically malaria could always pop up again. Widespread development of mosquito resistance to DDT and other insecticides, as well as the malaria parasite resistance to chloroquine (the second pillar of WHO´s eradication program), did not inspire further funding of the campaign.

At the height of the program in 1962, environmentalist Rachel Carson published her book *Silent Spring*. Her book presented the devastating impact that DDT had on birdlife and its accumulation in the food chain. DDT was banned in the US ten years later and most of the other rich (now non-malarial) countries followed suit. USAID subsequently stopped funding WHO malaria eradication efforts in 1963 and oriented funding efforts to family-planning programs (Tren & Bate, 2001, p. 91).

Decreasing funds and the move to ban DDT in the US in 1972 was according to Tren & Bate (2001, pp. 91, 41) influenced by three main factors: pessimism due to the failure of eradication of mosquitoes (indications that control programs would need to be sustained indefinitely even in the rich countries), environmental concerns (an opinion lobbied by environmental groups in rich-countries) and thirdly neo-Malthusian ideas of imminent over-crowding in the world that insinuate that saving lives in ecologically “unsustainable” areas is pointless (Rapley, 2002, pp. 172-3). This last factor was somewhat echoed by USAID´s subsequent concern for family planning programs in development countries.

The scaling down of DDT-use in the world would soon turn to catastrophe in many of the poor malarial countries. The worsening situation was of course

also caused by the lack of funds and structural means of the developing countries to manage these programs. This was especially true for the newly independent African countries. Even if malaria rates in Asia never returned back to their orginal heights, Sri Lanka for example saw the number of malaria cases rise from only 17 cases in 1964 to over a half a million in 1969 (Tren & Bate, 2000, p. 23).

According to Carter & Mendis (2002; WHO (i), 2006, p. 3) the DDT eradication program of WHO and USAID was never quite implemented in the countries of Africa south of the Sahara, and the idea of malaria eradication in Africa was never properly belived in. Up until the 1980s the region witnessed a a moderate decrease in cases but, after the 1980s the disease burden grew steadily to original heights.

The development of insecticide resistance of mosquitoes to DDT has often been attributed to the use of DDT in malaria control. Tren & Bate (2001, p. 67) however point out that the resistance is probably more linked to its heavy use in industrial agriculture than ever in IRS programs. Furthermore, to put environmental concerns into proper context, the amount of DDT needed in IRS programs, the entire high-risk population in Guyana (about 17 thousand houses covering 215 thousand km^2) could be protected with the same amount of DDT that might be sprayed on 0.4 km^2 of cotton in one season (Roberts, Laughlin, Hsheih, & Legters, 1997, p. 300).

2.5.3 The use of DDT for malaria control today

Still today DDT remains banned in most countries. In 1995, the Governing Council of the United Nations Environment Programme (UNEP) called for legally binding convention on 12 organic pollutants (called “the dirty dozen”) that accumulate in the environment (including DDT) – this is called the *Stockholm convention*. At the Stockholm meeting developming nation were severely underrepresented and alone environmental pressure groups alone sent in twice the number of African delegates (Tren & Bate, 2001).

Following the ban of DDT, South-Africa and Madagascar among others, experienced huge rises in malaria prevalence after only a few years of using other insecticides, due to the emergence of resistance to these alternative insecticides (Tren & Bate, 2001, p. 72). In 2001 the UNEP met to discuss a revision of the Stockholm convention. It came into force in 2004 and included clauses that would

permit a very controlled use of DDT for IRS programs in some countries. Several African countries have since reintroduced the use of DDT in their IRS programs (Figure 8) (WHO, 2007).

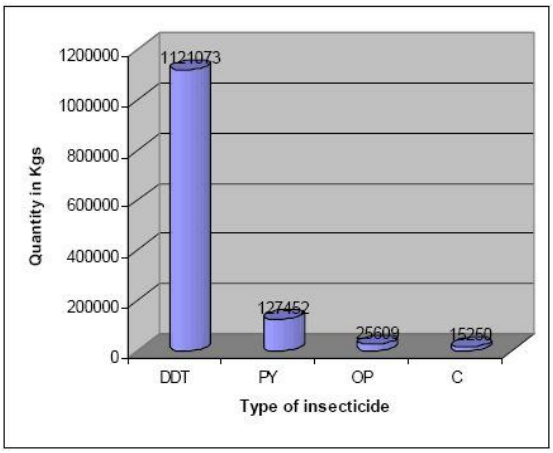

Figure 8 DDT is still the preferred choice of insecticides used by African countries that employ IRS spraying. These countries are mostly concentrated in southern and eastern Africa. Pilot spraying programs are under-way in Cameroon, Nigeria, Ghana and Senegal in West Africa. Figure from (WHO, 2007, p. 5).

2.5.4 Personal Protection

Funding of malaria control efforts has since the 1930s much revolved around "new" technologies such as new drugs, insecticides, vaccine development etc. When looking at the decline of malaria in Europe, the greatest drops in malaria rates however occurred parallel to an improved socio-economic status and adjustments of housing conditions, well before potent malaria drugs or insecticides became wide-spread. Lindsay, et al. (2002) point out the potency of these "low-tech" methods, including the screening of houses (blocking mosquito entrance) and promotion of environmental hygiene, etc.

2.5.5 Insecticide Treated Bed nets - ITNs

Traditional bed-nets have been used in many parts of the world for insect protection for thousands of years. Users have most of the time not connected their net use with protection against malaria, but rather with protection against night-biting insects and improved sleep (Frey, Traoré, De Allergri, Kouyaté, & Müller, 2006).

Insecticide-treated-nets (ITNs) are a malaria control tool that dates back to the Second World War[10]. ITNs integrate two distinct protective instruments into a

[10] Applying synthetic-pyrethroids (insecticides) on clothing and mosquito bed-nets was a method used during the second world war by the Russian, German and U.S. armies (Lengeler, de Savigny, & Cattani, 1996; Lindsay & Gibson, 1988).

single product, representing both a physical and a chemical barrier between man and mosquito (Lindsay & Gibson, 1988). The first function of the insecticides (synthetic-pyrethroids[11]) on the net mesh is to repel insects from sleeping quarters, houses and houses. Secondly the insecticide kills or knocks-out insects that persist and perch on the net looking for a way of entrance.

Country	Transmission pressure a	Morbidity reduction (%) b	Source
The Gambia	1-10 (S)	45	Snow et al. (1987)
The Gambia	1-10 (S)	63	Snow et al. (1988)
Kenya	300 (P)	30	Sexton et al. (1990)
Kenya	300 (P)	40	Beach et al. (1993)
The Gambia	1-10 (S)	45	Alonso et al. (1993)
Guinea-Bissau	20-50 (S)	29	Jaenson et al. (1994)
Sierra Leone	20-40 (S)	49	Marbiah (1995)
Tanzania	300 (P)	55	Premji et al. (1995)
Kenya	10-30 (S)	44 c	Nevill et al. (1996)
a Entomologic inoculation rate: Infective bites/Person/Year & Seasonality (P: Perennial; S: Seasonal)			
b Comparaison of Malaria Fever & Parasitemia of children sleeping with and without ITNS			
c Reduction in Severe life-threatening Malaria			

Table 1 Studies in the 80s and 90s showing evidence for a significant morbidity reduction in connection with the use of ITNs under program conditions. Table adapted from: (Lengeler, de Savigny, & Cattani, 1996).

In the late 1980s, studies performed in sub-Saharan Africa indicated the beneficial effect of ITNs by lowering morbidity and mortality in children (Table 1). These studies were performed amidst a degrading health situation in the continent as a whole. This was largely caused by diminishing development-aid-volumes (including fiscal cuts for the health sectors), rising levels of drug- and insecticide resistance, degradation of health structures, armed conflicts etc. Several large ITNs programmes and studies were subsequently organised by WHO/TDR in collaboration with many other donor agencies to assess the overall effect of ITNs use on child mortality in different ecological and cultural areas of Africa, (i.e. in The Gambia, Ghana, Burkina Faso and Kenya). These trials supported former findings and indicated that for every thousand children "in the age group 1-59 months, under ideal trial condition with regular use of ITNs, about 6 lives can be saved per year" (Minja, 2001, pp. 8-9).

[11] Common synthetic *pyrethroids* used for on ITNs are *permethrin*, *deltamethrin* and *lambdacyhalothrin*. The pyrethroids have a short half life, and do not accumulate in the environment like DDT. Studies have also indicated that they are non-toxic to humans and other mammals (Lines J. , 1996).

Despite the early positive results, ITNs were not deemed to be a "sustainable" option in fighting the malaria burden (Lengeler, de Savigny, & Cattani, 1996). Unicef did pilot free-distribution and re-impregnation (insecticide) campaigns in various regions in Tanzania in the early to mid 1990s but these efforts were however discouraged because of funding constraints and concerns over low-retreatment of nets. In the distribution evaluations, the programs were labelled as being: "donor-driven projects with little prospects of sustainability in the long term" (Minja, 2001, p. 37).

2.5.5.1 *Market supply of bed-nets*

Although information about the use of bed-nets in sub-Saharan Africa is relatively sparse, it is clear that there are great regional variations in ownership rates. This is not only on a country or a regional level, but differences also occur between different ethno-linguistic or socio-economic groups within the same area (Minja, 2001). On a large scale, bednet use seems to be higher in West Africa than in East Africa (Zimicki, 1996, p. 130), and higher in urban centres rather than in rural areas (Lengeler, de Savigny, & Cattani, 1996).

The high cost of bed-nets has long been mentioned as an important barrier for scaling up ownership of bed-nets through targeted free-distributions. Most bed-nets in Africa however, are not gifts from humanitarian aid organisations, but are acquired by poor people with their hard earned money at unsubsidised rates (and often bearing import taxes[12]) from local African markets (Guyat & Snow, 2002). This situation might alter with ever increasing role of net distributions, but African markets will however continue to be an important supply of bed-nets. The bed-nets supplied by African markets are very rarely treated with insecticides but come in a wide variety of materials, sizes, colours and shapes. In some African countries their use is very wide-spread (such as in Guinea-Bissau and the Gambia) which should inspire the whole ITNs agenda with the hope that ITNs programs could be sustained by economic participation of the beneficiaries. This would however make it even more important for aid organisations and donors to listen carefully to the different needs of the buyers regarding material, colours, shapes, sizes and prices of nets.

[12] In 2007, seven years after the Abuja summit, 24 of the 39 signatories continue to impose taxes and tariffs on bed-nets and ITNs (Alilio, et al., 2007).

When looking at the connection between social status and net ownership, the results look contradicting. Often there seems to be an inverse connection between socio-economic status and net-ownership rates. Chitsulo, et al. (1992) in (Zimicki, 1996) point out that in areas of low overall net ownership, there seems to be an correlation between higher socio-economic status and higher bed-net ownership. On the other hand where net ownership is generally high, socioeconomic status seems to have relatively little influence on ownership rates (Chitsulo, et al. 1992 in Zimicki 1996).

Several studies have indicated that factors such as gender and age influence the use of ITNs. Aikins, et al. (1994, p. 84) points out that in the Gambia young children usually sleep under the same net as their mother. Another study from Bagamoyo in Tanzania indicated that older children had the least access to nets. Older men were the most frequent users followed by mothers and children under two years of age (Makemba, et al., 1995).

2.5.5.2 *Sustainability concerns over ITNs*

ITNs gradually lose their insecticidal action through normal use and especially through frequent washing with detergents. The WHO formerly recommended that for ITNs to maintain a minimum insecticidal action, nets needed to be re-treated at least every 6 months. In 2007 this minimum period between re-treatments was extended to 12 months (or after three washes) (WHO (ii), 2007). This need for periodic re-treatment of ITNs has also sparked reluctance among donors, and fears of "un-sustainability" of ITNs distribution programs since it forces donors into long-term commitments (Phillips, 2001).

Studies on the willingness of bed-net users to pay a nominal (subsidised) fee for the re-treatment of their nets various African countries (The Gambia, Tanzania and Kenya) showed very discouraging results for donors. Projects with a cost recovery element for the re-impregnation showed that only 5-30% of nets were ever re-treated if a nominal fee was required. Despite large subsidies of insecticides and intense promotional activities for the re-treatment of nets, the outcome was disappointing and people did not seem to share WHO's and Unicef's ambition for insecticide re-treatments of their bed-nets (Guyat & Snow, 2002, p. 12; Curtis, et al., 2003, p. 306).

These results seemed to underline the assumption that people do not only use their nets for malaria-protection. People have slept under nets for centuries without knowing the link between the mosquito and malaria. Several studies have furthermore indicated that increased knowledge of what causes malaria does not correlate with increased net use (Minja, 2001, p. 24). Qualitative studies have further revealed that reasons for sleeping under bed-nets are actually quite diverse including protection against nuisance insects (including mosquitoes) that disturb peoples sleep, privacy, protection from falling debris, extra warmth in the rainy season, etc. (Minja, 2001, p. 17 & 25; Aikins, Pickering, & Greenwood, 1994). These complex and sometimes paradoxical findings suggest that ecological, climatic and social factors need to be taken into account when trying to understand and scale up the use of ITNs.

One of the problems with bed-nets is connected with non-use during the dry season. Local populations often acknowledge the problem of mosquito nuisance but frequently see it as a seasonal problem. A research led by Winch, et al. (1994) in Bagamoyo, Tanzania found that the population was not only less likely to use bed-nets during the dry-season, but also that the local-diagnosis of malaria was less likely when mosquitoes became less abundant in the dry-season. The local diagnosis and treatment of illnesses was found to correlate with what disease was common in the season when the person had fallen ill.

An untreated bed-net without holes and that is properly used, should theoretically provide a perfect physical barrier against mosquitoes (Lines, Myamba, & Curtis, 1987). But mosquitoes can however always bite a person lying against the mesh and bed-nets are furthermore relatively fragile and can normally develop holes that mosquitoes are able to enter (Smith, Uday, Grabowsky, Selanikio, Nobiya, & Aapore, 2007). Studies on mosquito biting behaviour have indicated that untreated bed-nets can divert biting mosquitoes to people sleeping without nets close to the bed-net-users (Lines, Myamba, & Curtis, 1987). ITNs on the other hand have been shown to provide additional protection to non-users by driving mosquitoes away from sleeping quarters and houses where the ITNs are being used.

Evidence on the beneficial effect of sleeping under untreated nets is quite mixed. Some studies have indicated that the insecticide-treatment of nets is the

major protective element, but others indicate that untreated nets can offer up to half the protection that an ITN gives (Choi, Breman, Teutsch, Liu, Hightower, & Sexton, 1995). A study performed by Lines (1996) similarly indicated that an intact untreated net provides similar protection against bites as an ITN with large holes, reducing night-biting by up to 95% (Lines J. , 1996).

Another initial uncertainty factor for donors regarding ITNs programs was the question of the long-term effectiveness of distribution programs; a central question here is whether distributed nets that are not re-treated continue to protect users. Lengeler, et al. (1996) distinguish between the efficiency and effectiveness of ITNs interventions. The efficacy being "determined in research field trials under excellent conditions of targeting, coverage, and compliance". On the other hand effectiveness is "the efficacy level achieved by the same intervention under real-life, program-delivery conditions".

Studies after free distributions of ITNs indicated decreasing morbidity and mortality due to malaria, but the long-term effects of ITNs under daily life conditions were not yet known (Minja, 2001, p. 14). Some researchers have even expressed fears that ITNs use might hamper the early development of immunity in the long run, and simply postpone morbidity and mortality due to severe malaria (Phillips, 2001).

Several issues give reason for optimism regarding the sustainability of ITNs programs. The evidence indicating the ineffectiveness of untreated nets is extremely narrow, relying on only one randomized controlled trial (RCT) performed by Snow, et al. (1988). A review of surveys and studies on the protective efficiency of untreated nets and ITNs done by Choi, et al. (1995) indicated that untreated bed nets provide half the protection that an ITN would provide.

2.5.5.3 *Long Lasting Insecticide Treated Nets*

A recent technology promises to provide answers to the long term sustainability concerns over ITN programs. Newly developed long lasting insecticide treated nets (so-called LLINs) have insecticides incorporated within the net fibres and are supposed to retain insecticidal efficacy for up to 5 years.

ITNs and LLINs - From (WHO (ii), 2007)**.**

An insecticide-treated net is a mosquito net that repels, disables and/or kills mosquitoes coming into contact with insecticide on the netting material.

There are two categories of ITNs: conventionally treated nets **(ITNs)** and long-lasting insecticidal nets **(LLINs)**:

- A conventionally treated net is a mosquito net that has been treated by dipping in a WHO-recommended insecticide. To ensure its continued insecticidal effect, the net should be re-treated after three washes, or at least once a year.
- A long-lasting insecticidal net is a factory-treated mosquito net made with netting material that has insecticide incorporated within or bound around the fibres. The net must retain its effective biological activity without re-treatment for at least 20 WHO standard washes under laboratory conditions and three years of recommended use under field conditions.

The distribution of LLINs has in the last several years been scaled up by leading international organisations including the WHO. It has been demonstrated that in the long-term, the yearly cost of maintaining LLIN coverage is significantly lower than maintaining a conventional ITNs program with yearly re-impregnation campaigns (WHO (ii), 2005, p. 3).

The role of LLINs has been limited because production has been out-paced by exponential demand[13]. Surprisingly, despite the enormous demand for LLINs their prices have remained quite stable over the years. Between 2004 and 2006 production of ITNs doubled from 30 million nets to 63 million nets. There are indications that the production side has finally caught up with the rising demand. Delivery time of LLINs shipments in 2008 is now half of what they were in 2006 (Unicef supply division, 2008).

Studies have demonstrated the cost effectiveness of LLIN programs in reducing child and maternal mortality and thus achieving the MDGs. Despite the evidence the question if the commitment to scale up ITNs use will be sustained

[13] Today there is however only one brand of LLINs, *Olyset Net*©, that has full WHO recommendation. Four other brands have interim recommendation: *Permanet2.0*©, *Duranet*©, *Interceptor*© and *Netprotect*©. (WHO (iii), 2007)

and if LLINs will be re-supplied with at least a five year interval to all vulnerable groups in malarial regions in the world?

2.5.6 Funding for malaria control

After almost two decades of neglect, the international community has shown a renewed interest in fighting child death in poor countries (including the malaria burden). This motivation materialised in the late 1990s with the timed United Nations Millennium Development Goals (MDGs), the disease specific Roll Back Malaria partnership (RBM) and the Abuja declaration of African Heads of State in the year 2000. These goals are seen as guiding-principles by most international development organisations. The RBM has set out to halve malaria burden of malaria by 2010, and the MDGs set out to halt and reverse the insurgence of malaria and other major diseases by the year 2015 (Breman & Holloway, 2007, p. 36). New funding has resulted in promises of more rapid success. The RBM has now extended the targets of correct treatment of malaria within 24 hours and ITNs coverage (for children less than five years old and pregnant women) from 60% up to 80% before the year 2010 (Breman & Holloway, 2007, p. 37).

Tren and Bate (2001, pp. 34, 48) have criticised the lack of vector control in these efforts and overemphasis on few methods, mainly on access to drugs and on ITNs distributions. Breman and Holloway´s (2007, p. 36) have criticised the methodology of measurement of the MDGs for the fact that in most cases there is no solid baseline data to evaluate the disease burden that is meant to be halved. They furthermore claim that the only valid indicators to evaluate the burden of malaria would be by measuring its morbidity and mortality. The current methods are mostly based on a set of indicators that focus on the coverage of program tools. This means that success can for example be measured in household ownership of ITNs.

Bate (2007) points out that despite a huge increase in funds for the fight against malaria in recent years there is still a gross lack of accountability and transparency of aid agencies and their programs. When looking at the US support for RBM partnership “Only approximately 8% of USAID’s US$80 million financial year (FY) 2004 budget was used to purchase actual lifesaving interventions” the rest being used mostly to pay for consultancies and advice giving programs, whose impact or success are difficult to measure (Bate, 2007).

Fiscal year	Total contributions (in thousands of USD)
1999	19,129,701 (1%)
2000	42,287,888 (2%)
2001	386,285,841 (21%)
2002	418,551,580 (22%)
2003	409,595,904 (22%)
2004 (Projected)	599,416,847 (32%)
Total	1,875,267,761 (100%)

Table 2 International funding for Malaria Control efforts between 1999 and 2004. Table from (Bate, 2007).

In January 2002, the Global Fund against Aids, Tuberculosis and Malaria (GFATM)[14] was formally founded after G-8 summit in 2001. The fund concentrates exclusively on the fight against three above mentioned pandemics. Since its founding, the amount of funding allocated to the fight against the three diseases has risen dramatically (Table 2) (Bates & Herrington, 2007, p. 14).

In 2007, Global Fund funding accounted for half of all donor-resources for malaria. The main donors of Global Fund are the European Union and the U.S. contributing approximately 80% of its funds (Salaam-Blyther, 2006, p. 11). The Global Fund does not take any part in implementation of programs, working through partners (i.e. UN organisations, Governments and NGOs). In the case of Difficult Partnership Countries (DPCs), U.N. organisations (UNDP in the case of Guinea-Bissau) act as the Principal Recipient of funds (PR) and the Ministry of Public Health as the Secondary Recipients (SR). Continuation of Global Fund funding is then solely based on evaluation of certain performance indicators. Radelet & Siddiqi (2007) and Levin and Dollar (2005) have criticised this methodology, stating that it has disqualified countries that suffer from weak governance, such as Guinea-Bissau, which are in fact often the very ones worst affected by the three pandemics.

2.6 Summary

I have briefly outlined the history of human malaria and the main methods of fighting the disease both before and after the identification of its mosquito vector roughly 110 years ago. During the last 50 years the main burden of the disease has

[14] In this paper, I use the term Global Fund when referring to the GFATM.

been concentrated in the countries of Africa south of the Sahara. It has furthermore been pointed out that the burden of malaria is the heaviest in so-called Difficult Partnership Countries (DPCs). Despite higher than average burden, the DPC countries receive less development aid than many would expect (Levin & Dollar, 2005).

From an historical perspective, the fight against malaria has mostly focused on the use of "miracle" tools or inventions such as mass drug administrations, larvicides, DDT and recently ITNs. However, the most vital factor in driving malaria out of the US and Western Europe has been increased general prosperity (in a wide-sense), interlinked with vector control activities.

Following a national distribution of LLINs to children less than 59 months old in Guinea-Bissau in November 2006; I conducted a three and a half month study in four coastal communities in the country. The main objective of my study was to gather practical information on people's views on bed-nets and their actual use within the households. I also analysed different situations that people in these four coastal areas face with regards to the physical environment, access to resources, health care and bed-nets.

Surveys after ITNs distributions have generally focussed on coverage rates while largely ignoring how the nets are used in the local context. In my research I have used a combination of both quantitative and qualitative methods to deepen my understanding of people's situation regarding malaria.

3 SETTING

3.1 Guinea-Bissau

Guinea-Bissau is a tiny African state situated on the western tip of continent. It is one of the poorest countries in the world and ranked in the third last position in the Human Development Index of the UNDP (2007/8).

Figure 9 Geographical location of Guinea-Bissau in W-Africa.

The country covers 36.125 km2 (roughly a third of the land-area of Iceland). The terrain is generally flat and low apart from hills in the south-eastern region. The coastline is characterised by tidal estuaries and sand deposits from the rivers extend far into the sea. Mangrove forests and swamps[15] stretch along the tidal rivers and creeks into the interior of the country as far as 100 km (Hughes & Hughes, 1992).

Guinea Bissau - Population Indicators		
Area (land)	36,125 km2	INEC 2007
Population	1,39 million	INEC 2007
Urban population (est. 2006)	30%	INEC 2007
Main ethno-lingustic groups	Balanta 28%, Fula 23%, Mandinga 13% Manjako 11%, Papel 7%	W-Bank, 2006
Main religions	Muslim 40%, Animist 37%, Catholic 17%	W-Bank, 2006
Adult literacy rate	28,60%	MICS 2006
Human development rank	174/177	UNDP 07/08
% living on < 1$/day (2002)	21,60%	W-Bank, 2006
% living on < 2$/day (2002)	65,70%	W-Bank, 2006

Table 3 Main population indicators for Guinea-Bissau

The official language of Guinea-Bissau is Portuguese, but it is spoken by only a small fraction of the population. Portuguese Kriol (referred to as Kriol in this paper) is the vernacular language (or lingua franca) in Guinea-Bissau. Most Guineans have a different mother tongue, but in some urban areas such as Bissau there are some people who speak Kriol or Portuguese as their first language.

[15] "Mangroves are a group of highly evolved facultative halophytes [plants that can tolerate high concentrations of salt] that occupy the intertidal zones in estuaries, lagoons and coastal mudflats in tropical and subtropical areas" (Cornejo, Koedam, Luna, Troell, & Dahdouh-Guebas, 2005).

According to a household poverty survey performed by INEC in 2002, 21.6 percent of Guineans live extreme-poverty and 65.7 percent in poverty (World Bank, 2006, p. 25). The level of poverty is lowest in the capital Bissau as well as coastal Biombo, Bolama, and Cacheu regions while the landlocked regions of Bafata and Oio show higher levels of poverty. However, in comparison to other sub-Saharan African countries, the geographical distribution of poverty is quite uniform. The report states that: "poverty seems to be widespread everywhere in the country".

3.1.1 Recent history and civil war

Guinea-Bissau is a former Portuguese colony and declared its independence along with Cape Verde Islands after 11 years of armed struggle in 1973. It was formally recognised in 1974 after the fall of the fascist regime in Portugal. In 1980 Joao Bernardo "Nino" Viera led a successful coup against President Luis Cabral that ended the political coalition with Capo Verde. Guinea-Bissau is furthermore surrounded by former French colonies, sharing borders to the north and east with Senegal and to the south with Guinea-Conakry. However, the Casamance region in Senegal bordering north-western Guinea-Bissau has in many ways stronger linguistic, religious and historical similarities with Guinea-Bissau than with the rest of Senegal. According to Dykman (2000) the Portuguese had a colonial presence in the Casamance region until it was sold to France in 1866.

In June 1998, an 11 month military uprising broke out in Guinea-Bissau. According to Lehtinen (2002), president "Nino" Viera accused the chief of the army Brig. Gen. Ansoumané Mané, of selling arms to rebel groups in the Casamance region and dismissed him from his duties. Mané, backed by 90% of the army, responded by demanding the immediate resignation of President Viera and free elections. According to Einarsdóttir (2007, p. 101), 48 hours later 1,800 troupes from neighbouring Senegal and Guinea-Conakry arrived in the Bissau capital to defend the government of Guinea-Bissau against the so-called "junta" forces led by Mané.

According to the World Bank (2006) more than 300 thousand people were forced away from their homes in the capital Bissau. Much of the already weak socio-economic infrastructure, including health care and education structures, were destroyed during the war (Ministry of Social Solidarity, 2000). Mortality

patterns also changed during the war; mortality due to infectious diseases doubled in the rural areas surrounding the capital, mostly due to the lack of basic health care, food shortage and overcrowding (Aaby, 2003(b)).

In May 1999, “Nino” Viera signed an unconditional surrender to the “junta” forces of Mané. Since the end of the civil war, the country has seen two presidential elections that have been judged free and fair. Kumba Yala gained power in 2000 but ended his turbulent tenure in a bloodless army coup in 2003. A transitional government was subsequently put in place and new elections were announced in 2005 in which “Nino” Viera was re-elected president (World Bank, 2006).

Before the civil war, Guinea-Bissau had been hailed for showing good macro-economic progress under the enhanced IMF structural adjustment package (ESAF) (IMF, 2005). Guinea-Bissau had been gradually paying off debts, reforming its business environment and the government was collecting higher tax revenues. After the civil war in 1998, the country went through an economic collapse and later stagnation.

Three of the largest bilateral donors, US, Sweden and Netherlands were all in the process of pulling out shortly before the war due to a shift in the aid paradigm that had made Guinea-Bissau an unattractive development “partner”. Einarsdóttir (2007, pp. 102-3) has thus pointed out the role official development aid programs played in the advent of the war. Severe economic policies were furthermore imposed by the World Bank and IMF structural adjustment programs creating extreme tensions at the government level. Rudebeck (2001) points out in this vein that the starving of the army prior to the war had resulted in a mafia like behaviour at top levels.

Levin and Dollar (2005, pp. 2-3) claim that the so called DPCs receive “around 40% less aid than predicted by their policy and institutional strength in pooled-sectional regressions, primarily due to disproportionately low flows from bilateral donors”. Aid flows to so-called DPCs are furthermore highly volatile and countries can easily jump between the categories of being aid “darlings” that receive more than would be expected or aid “orphans” that receive less than expected, as experienced by Guinea-Bissau (Levin & Dollar, 2005).

Today, roughly ten years after the civil war, the country is categorised as a post-conflict nation. Guinea-Bissau is furthermore still stuck with bad "partnership" labels such as: Difficult Partnership Country (DPC), Poor Performer and Low Income Country under Stress (LICUS). According to Levin and Dollar (2005) these labels will continue to discourage bilateral and multilateral donors from venturing into long-term development programs with the Guinean government and ministries. Guinea-Bissau has furthermore been described by international media as being a safe haven for drug smugglers and recently labelled as the "world's first narco-state". This view has for example been echoed in articles in the Economist (2007) and in the Observer (2008).

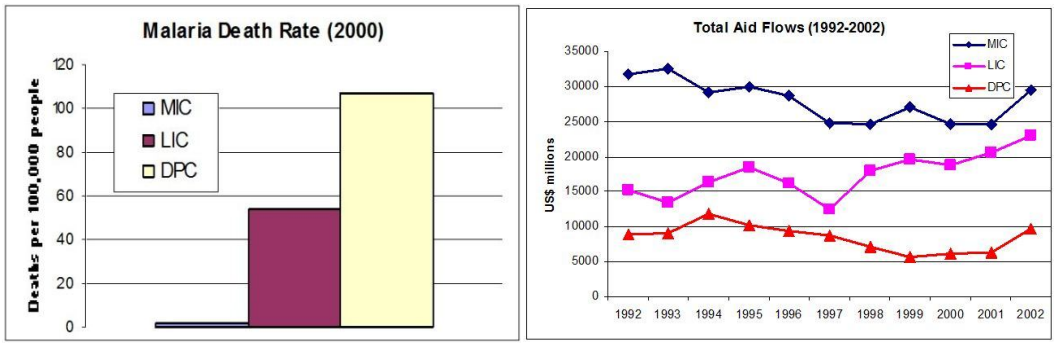

Figure 10 a) Malaria-mortality in DPCs. b) Official development aid to DPC countries (Levin & Dollar, 2005)

Figures 10a) demonstrates the concentration of the malaria burden in so-called Difficult Partnership Countries (DPCs) and Figure10b) shows that at the same time aid flows are higher to both Low and Middle Income Countries (LICs & MICs) than to the DPCs (Levin & Dollar, 2005).

3.2 Health care structure

In 2004, the total expenditure on health per person per year in Guinea Bissau was 9$ (representing 6,3% of GNP). Roughly half of the expenditure came from the government budget and the other half from patient's user-fees (Kofoed, 2006, p. 30).

Guinea Bissau had six functioning hospitals before the military uprising broke out in 1998. The doctor to patient ratio was approximately 1 physician per 8100 people (20 times less than in the US), and approximately 1 nurse/midwife per 1050 persons. During and after the war there was heavy emigration of health workers from Guinea Bissau whereby at least 20 of the 168 physicians left the country (Lis, 2003). In 2000, 251 physicians and 262 nurses from Guinea-Bissau

were working abroad, most in Portugal and France. The low proportion of nurses working abroad could result from the lack of financial means to leave (Clemens & Pettersson, 2007).

Guinea Bissau - Basic Health Indicators		
Life expectancy at birth	45,8 years	UNDP 07/08
Infant mortality rate	138 per 1000 live births	MICS 2006
U5 mortality rate	223 per 1000 live births	MICS 2006
Maternal mortality	1.100 per 100.000 live births	UNEC 2007
Adult HIV prevalence Rate	3,80%	UNDP 07/08
At least 1 **bed-net** in household	79,20%	MICS 2006
At least 1 **ITN** in household	43,60%	MICS 2006

Table 4 Main health indicators for Guinea-Bissau

Simão Mendez national teaching hospital is the only tertiary services hospital in the country. The 500 bed hospital is located in the Bissau capital and was built by the Portuguese during colonial times. According to Lis (2003) there were some damages to the hospital structure during the war but the most serious constraints are due to chronic under-funding, especially after the civil-war. A recent controlled intervention trial by Biai, et al. (2007) in the Simão Mendez national hospital, indicated that case management can be significantly improved and the high hospital mortality due to malaria decreased by giving small financial incentives to health staff in the hospital.

In the vicinity of the national hospital there are four specialised clinics that work with: tuberculosis, psychiatry, rehabilitation and maternal and child health. One clinic situated in Cumura in Biombo Region specialises in the care of leprosy patients (Cá, 1999). Today, the clinic in Cumura also specialises in the care of HIV/Aids patients.

On the regional level the Guinea-Bissau health system is split into eleven sanitary regions. The structure runs parallel with the nine administrative regions with the exceptions of Bolama/Bijagos and Casheu/SãoDomingos regions that are both split into two sanitary regions. There are four regional hospitals situated in different parts of the country in: Bafatá town in the centre, Gabu town in the east, Cacheu town in the north and in Catio town in the south (Dias, 2006).

On the local level, the eleven sanitary regions split into 114 so-called sanitary areas, the population of the sanitary areas are then served through sectoral hospitals and health centres (pt. *centros de saúde*) or village health units (pt. *unidades de saúde*) that are responsible for providing basic health care including

childhood vaccinations, dissemination of information and performing distribution campaigns (Cá, 1999, p. 20). On the local (area) level the health centres are often run by chief nurses that are at times assisted by midwifes and laboratory technicians.

3.2.1 Main partners of the Ministry of Public Health

According to my informants the key partner organisations of the Guinean Ministry of Public Health include Unicef, World Health Organisations (WHO), Global Fund to Fight HIV/AIDS, Tuberculosis and Malaria (GFATM), World Food Programme (WFP), World Bank and Plan International (NGO).

The Ministry of Public Health in Guinea-Bissau has implemented Unicef's ACSD (Accelerated Child Survival and Development Project) strategy in the country since 2003. According to Bryce, Black, Gilroy, Jones, & Victoria (2007) three high impact schemes are carried out under the ACSD strategy that integrate a number of cost-effective tools to reduce child mortality and morbidity. First, the EPI+ package is aimed at improving child health through: standard "keep-up" vaccinations, periodic "catch-up" vaccination campaigns, biannual vitamin A supplementation, de-worming, distribution of ITNs to children under 5 years and pregnant women and yearly re-impregnation of bed-nets. Secondly, the ANC+ (Antenatal package is aimed at improving the health of women during pregnancy through: intermittent preventive malaria treatment, tetanus immunisation, supplementation with iron/folic acid. Thirdly the IMCI+ (Integrated Management of Childhood Illness Plus) is aimed at promoting improved management of pneumonia, malaria and diarrhoea through effective treatment in health facilities and at home, promotion of the consumption of iodised salt, sensitisation on breastfeeding and complementary feeding of infants (p. 1).

In 2003, Unicef expanded its parts of its ACSD project to Guinea-Bissau and six other countries in the sub-region: Burkina Faso, The Gambia, Cameroon, Guinea Conakry, Niger and Chad. This expansion did not include all elements of the ACSD strategy and did not reach all the regions of the countries (Webster, 2006, p. 17). In Guinea Bissau the EPI+ and ANC+ (Antenatal Care Plus) components were in 2003 implemented in three regions in Guinea-Bissau and then later scaled up to 5 of the 11 regions (UNEC, 2007). According to the Ministry of Public Health in Guinea-Bissau the EPI+ and ANC+ components are

carried out on a national level, including LLINs “catch up” distributions, and distributions of ITNs to infants during routine vaccination and to pregnant women that attend pre-natal consultation.

In 2007 the Ministry of Public Health submitted a proposal as a main recipient for malaria control and prevention funds (under the 6th round of fundin). Formerly, Guinea-Bissau did not receive malaria funds directly from the Global Fund and was represented by the UNDP during the 4th round of funding (Global Fund, 2008).

The Ministry of Public Health in Guinea-Bissau now manages two free-distribution mechanisms of ITNs. Both are mainly implemented at the local level by the local health services, as a part of the EPI+ component of the ACSD initiative.

The first involves giving ITNs free-of-charge to pregnant women at their first pre-natal consultation and to infants that complete a correct vaccination schedule before the age of 9 months. The Ministry of Public Health furthermore conducts re-impregnation campaign of bed-nets. The campaigns should, according to WHO standards, take place at least yearly for the nets to maintain a sufficient insecticidal action (WHO (ii), 2007).

The second mechanism involves punctual “catch up” national distribution campaigns of LLINs to children under the age of 5 years of age and pregnant women. A nation-wide “catch up” distribution of approximately 240 thousand LLINs for children under the age of 5 year was performed between November/December 2006 (apart from Bissau autonomous sector) and in Bissau autonomous sector November 2007.

According to the Ministry of Public Health, the WHO and Global Fund operate a coordination cell within the Ministry’s Department for Public Health (DSP). Under the DSP there are three programs that each deal with one of the three pandemics: malaria (PNLP), HIV/AIDS (PNLS) and tuberculosis (PNLT). The WHO supports a technical-assistance post within for the National Program against Malaria (PNLP).

The Ministry of Public Health (including the PNLP) furthermore work with a private/public enterprise, the Guinean Association of Social Marketing (AGMS), for the production of posters and organising ad-campaigns. According

to the Ministry of Public Health, a network of community-radio-stations has also been set up around the country through funding from WHO and Unicef. The community radio stations both broadcast regular emissions, as well as disseminating messages for the Ministry of Public Health especially passing information about health service campaigns.

3.3 Malaria

According to Kofoed (2006) there has been little research on the level of endemicity of malaria in Guinea-Bissau. According to the Guinea-Bissau's National Poverty Reduction Strategy Paper (NPRSP) malaria represents the single greatest public health concern in the country and is the leading cause of mortality and morbidity for children under 5 years of age (Ministry of Finance, 2006). According the INEC (2007) the disease is by far the most frequent diagnosis in the health care structures nation-wide with approximately 110 thousand reported cases in 2006. In the paediatric ward in Simão Mendes National hospital 64% of hospital deaths in are caused by the disease.

A recent study by Rodrigues, Schellenberg, Kofoed, Aaby, & Greenwood (2008, p. 7) indicates that the malaria prevalence has been decreasing fast in the Bissau capital and that it has now reached a low level (2,8%) among children under 5 years of age compared to 59% of children in Bissau between 3-6 years in 1990 and 26% of children between 1-2 years in the end of the rainy season in 1994 (Kofoed, 2006, p. 33).

In Bissau, the *P. falciparum* malaria parasite is the most frequently seen (85-95%) of cases. A small proportion has mixed infections and *P. ovale* and *malariae* are rarely found. The transmission of malaria occurs in all seasons in the country, but a study has indicated the burden of the disease is highest in the beginning of the rainy season and shortly after the end of the rainy season (Kofoed, 2006, p. 33) A study performed in 1991 by Gonçalves, Ferrinho and Dias (1996) indicated a great variation between villages in malaria parasite rates of children between two and nine years of age in the Prábis sector in the Biombo region. During the rainy season 2% of villages were *hypoendemic* (parasite rates btw. 0-10%), 49% of villages were *mesoendemic* (parasite rates btw. 11-50%), 37% of villages were *hyperendemic* (parasite rates btw. 51-75%) and 14% of villages were *holoendimc* (parasite rates above 75%) (p. 13). Another study from

the Prábis sector performed by Smedman, et al. (1986; 1988) in 1983 showed that 47% of children between 9-18 months were infected with *falciparum* malaria. During the dry season malaria prevalence dropped, but remained *mesoendemic*. The research also showed that malaria parasitemia did not inhibit antibody production after a measles vaccination (p. 152).

Since November 2005 Coartem (Artemether–Lumefantrine) has been recommended as a first-line treatment for uncomplicated malaria (Ursing, Kofoed, Rodrigues, Rombo, & Gil, 2007(b)). However, this change of drug policy has not yet been implemented, so the less expensive Chloroquine and S/P are still frequently being prescribed by health facilities. According to Kofoed (2006, p. 67) and Ursing, et al. (2007, p. 555), the new ACT therapies are between 10-20 times more expensive than treatment with Chloroquin or S/P. The hesitation of health services to prescribe Coartem is partly because of the unwillingness of patients to pay for more expensive malaria drugs. The lack of laboratory facilities also aggravates the clinical over-diagnosis and unnecessary treatment of suspected malaria cases (Rodrigues, Schellenberg, Kofoed, Aaby, & Greenwood, 2008, pp. 6-7).

A recent study from Ursing, et al. (2007) has given evidence that chloroquine is still a potent malaria drug in Guinea-Bissau. The emergence of chloroquine resistance has remained relatively constant in the country between 1990 and 2005. The hypothesis is that effective dosing is the reason for in the slow development of resistance against chloroquine in Guinea-Bissau. The drug has commonly been prescribed at more than double the normal dose in the country (63mg/kg instead of 25mg/kg), and thus it is speculated that the high doses halt the development of resistance.

3.3.1 Mosquito breeding grounds

In endemic malaria regions there are three key variables that influence malaria transmission rates: precipitation, temperature and humidity. Rainfall is imperative for creating breeding-grounds for most *Anopheles* larvae. Temperature influences how fast the mosquitoes and larvae develop. Finally, humidity impacts the longetivity of mosquitoes - the transmission cycle generally breaks when relative humidity is consistently below 60% (Grover-Kopec, Blumenthal, Ceccato, Dinku, Omumbo, & Connor, 2006).

Figure 11 shows the approximate duration of the malaria transmission season in Guinea-Bissau. The entire area of Guinea-Bissau is classified as being endemic. The dark-green area indicates that malaria transmission occurs throughout the year, or between 7-12 months; and the light-green areas indicate malaria transmission is seasonal, occurring between 3-6 months per year (MARA, 2004). This illustration does not mean that malaria is not transmitted during the dry season, but rather indicates the duration of the peak months of transmission.

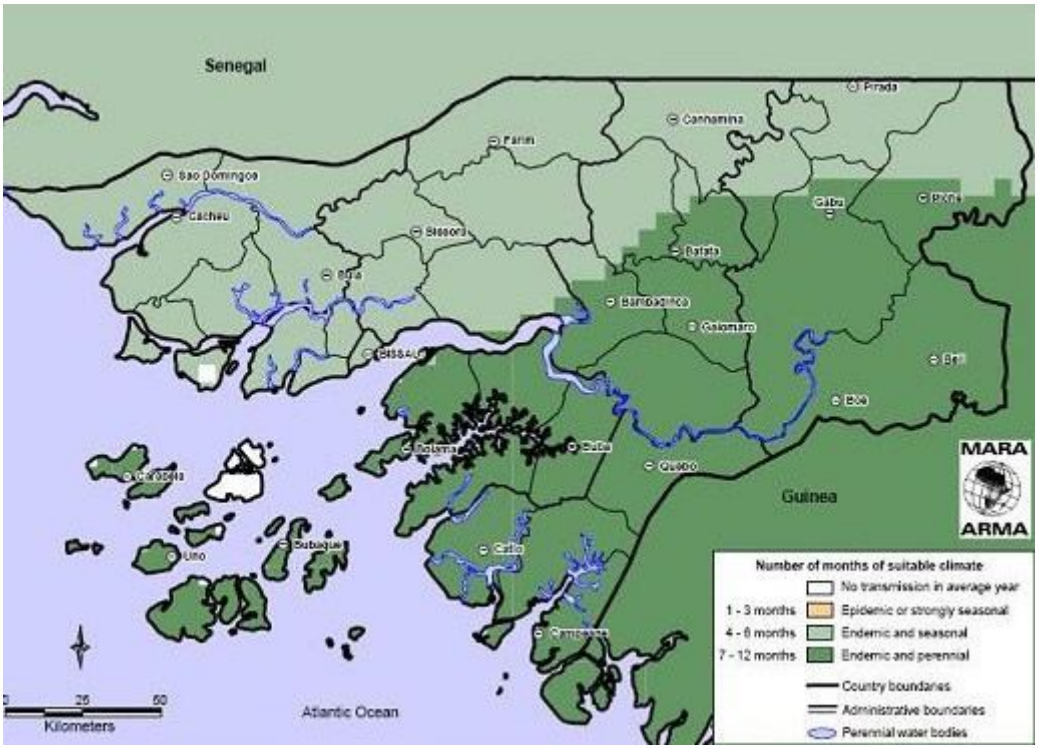

Figure 11 Map from the MARA project showing the duration of malaria transmission in Guinea-Bissau (MARA, 2004 (b)).

Eleven different species of *Anopheles* mosquitoes have been identified in the country. Four of these species belong to two species clusters and are classified as the most efficient malaria vectors in the whole of the Afro tropical region (Hamon, Adam, & Grjebine, 1956; White, 1974). These species have adapted to diverse breeding conditions and have different feeding preferences. *A gambiae s.s.*, *A. arabiensis* and *A. funestus*, have relatively long life-spans, mostly prefer feeding indoors (*endophagic*) on humans (*anthropophilic*). These three species are generally recognized as the most efficient vectors of human malaria as well as *Bancroft filariasis* (Hervy, Le Goff, Geoffroy, Hervé, Manga, & Brunhes, 1998). Kofoed (2006) has furthermore pointed out that the main *Anopheles* species found in sub-Saharan Africa are also the species that are by far the most efficient

falciparum malaria vectors. According to Pålsson, et al. (2004, p. 751) the feeding period of *A. gambiae s.l.* (a complex of the main malaria vectors) in a suburban area outside of Bissau was between 07:15 PM and 07:10 AM.

The role of *A. melas* in malaria transmission in Africa is contested. *A. melas* has adapted to extreme breeding conditions in salty sea water, especially in mangrove swamps and the vector is found all along the W-African coastline. Hervy et. al. (1998) claim that *A. melas* is an inefficient malaria vector due to its relatively short life span that does not allow the *Plasmodium* parasite to complete its necessary cycle (*sporogonic* cycle) in the vector´s abdomen and salivary glands. However, a study from Equatorial Guinea indicated that *A. melas* was in fact the most important malaria vector species in the coastal villages where it is abundant (Moreno, et al., 2004). A study from the Saloum delta in Senegal indicated that *A. melas* is an efficient malaria vector when it is abundant and that it extends the transmission season of malaria into mid-dry season in areas situated close to the sea and mangrove swamps (Diop, et al., 2002)[16].

A study on the main species breeding along the river Gambia indicated that *A. melas* is the dominant Anopheles species (80%) in flooded alluvial zones (containing up to 72% sea water) and that *A. arabiensis* dominates in the rain-fed rice-fields (Bøgh, Clarke, Jawara, Thomas, & Lindsay, 2003). A study Gonçalves, Ferrinho and Dias (1996, p. 15) performed in Prábis sector in Biombo region in Guinea-Bissau further suggested that one of the main determinants of malaria transmission in the rural villages was closeness to the bolanha rice fields.

Pålsson, et al. (2004) assessed factors affecting mosquito abundance within houses in a suburban area in Bissau. The amount of biomass per m^2 in the house was shown to significantly increase mosquito abundance as well as the presence of pigs in the household and the presence of a well in the compound. Closeness of houses to rice fields and presence of goats did not seem to influence mosquito abundance (p. 750). A study performed in rural Biombo region in 1991 however indicated a strong correlation between parasite rates among children between two and nine years old and closeness to rice fields (Gonçalves, Ferrinho,

[16] A study on malaria transmission in non-coastal areas (where A. melas is absent) have actually indicated that malaria is inversely connected with the presence of rice fields. One hypothesis is that this stems from relatively greater wealth in areas engaging in irrigated farming (Ijumba & Lindsay, 2001).

& Dias, 1996). Another study by Smedman, Gunnlaugsson, Norrby, Silva, & Zetterström (1988) performed in 1983 found that malaria rates in children between 8-19 months were significantly higher in low-lying villages situated close to the bolanha rice paddies in Prábis sector, Biombo region (p. 886).

3.3.2 ITNs use

The use of bed-nets has a long tradition in both Guinea-Bissau and The Gambia. A study performed by Aikins, et al. (1993) revealed 85% overall bed-net-use in Gambia. The Mandinka ethnic group had the highest percentage of users (92%) while the use among the Fulani ethnic group was less frequent (74%). The study also revealed that 98% of the bed-net users in the survey witnessed their parents using bed-nets during their childhood. Mandinkas also have an age-long tradition of using locally made bed-nets (Md. *Wusungo*) a tradition that dates back as far as 1894 (1993, p. 27). A study performed in 1986 in the Bandim suburb in Guinea-Bissau likewise revealed 69% net use among the respondents (Aikins, Pickering, & Greenwood, 1994, p. 82). Another survey indicated that 84% of the population in four regions representing the country were using bed-nets and that 36% were using insecticide treated nets (Rodrigues, Schellenberg, Kofoed, Aaby, & Greenwood, 2008).

Multiple Indicator Cluster Surveys (MICS) were performed simultaneously in various countries of sub-Saharan Africa in 2000. These studies confirmed the high prevalence of bed-net use in The Gambia and Guinea-Bissau. On a national scale, the use of bed-nets was relatively highest in the two countries; 67% in Guinea-Bissau and 42,1% the Gambia. These numbers are quite different from other neighbouring countries that showed much lower figures, such as Senegal (15,2%), Guinea-Conakry (27,2%) and Sierra Leone (15,2%) (IBRD/WB, 2005, pp. 105-111).

3.4 Study Areas

Initially I had planned to perform my study in three ecologically different regions in Guinea-Bissau from the peak of the rainy season in August 2007 until the beginning of the dry season in November 2007. During the course of my stay the focus on ecological difference between regions changed. I finally performed my study in four regions that were all close to the coastline and the main criteria of choice was difficulty or ease of access.

Figure 12 My study areas in four coastal regions in Guinea-Bissau. Map from: (Académie de Créteil, 2007).

The duration of my study was 3,5 months from the beginning of August 2007 to mid-November and. My study covered most of the rainy season since the first rains arrived late in 2007. Figure 12 shows a map of Guinea-Bissau indicating the four study areas: Quinhamel sector in Bimobo Region, Empada sector in Quinara region, Bubaque sector in Bolama region (Soga Island); and the autonomous sector of Bissau.

3.4.1 Quinhamel sector in Biombo region

Biombo (AS Dorce) - General Info		
Main languages	Papel & Kriol	BSH
Mobility	Bus (from Bissau), by foot (in Biombo)	BSH
Distance from Bissau	45 km	BSH
Study period (in the field)	35 days (frequent visits)	BSH
Population in Dorce (2007)	6.571	INEC 2007

Biombo region was a convenient area to start my research. The research area was situated only an hour's bus-ride from Bissau, mostly on paved roads. It is the most densely populated region (apart from the capital area) with 71 habitants /km^2 and the population has relatively good access to the health care facilities (Einarsdóttir, Passa, & Gunnlaugsson, 2001).

Even before my arrival I had very good contacts in the region due to the fact that my research instructors had lived and worked in the region for five years. I quickly had access to housing close to the study areas, and built a good net of resource persons. I was able to start working with a French/Papel speaking

translator. I was offered lodging in a local health centre in a family setting. No member of the family was English or French speaking. Despite being immensely tiring at times, this actually forced me to remain immerged in a Kriol setting right from the start of my study period.

3.4.2 Empada Sector in Quinara Region

Quinara (AS Daresalam, Empada) - General Info		
Main languages	Beafada, Balanta, Manjako & Kriol	BSH
Mobility	Motorcycle, 4x4 (with mobile team)	BSH
Distance from Bissau	340km (to Daresalam)	BSH
Study period	5 days (28.Oct.07 - 01.Nov.07)	BSH
Population two AS (2007)	21.773	INEC 2007

While Biombo represented a region with relative ease of access and good coverage of health care facilities, road conditions in the south are generally difficult and road distances become great due to the lack of bridges and ferries. I decided to perform a part of my study in Empada sector in Quinara region, the second least densely populated area in the country with only 13,69 persons/km^2 in 1991 (INEC, 2007(b)).

Empada sector in Quinara region is very complex ethno-linguistically and divides into two sanitary areas; Daressalam and Empada. Empada town has a multi-ethnic population but in the smaller villages (Kr. *tabankas*) ethnic boundaries become more pronounced. Most of the small villages bear the name of the founding ethnic group as a suffix. This separation of ethnic groups has many exceptions and does not hint that communities are intolerant to each other. People from many other regions and neighbouring countries had settled in many of the villages and I often came across family-compounds (Kr. *moranças*) speaking more than one local language.

The fieldwork in Empada was done together with a mobile research team from the Bandim health program[17]. The mobile team planned working in Empada at the same time. I and my research assistant were able to lodge with the mobile team in Empada town. Working side by side with the mobile team also provided us with transport between villages and removed the difficulty of randomly sampling the villages and compounds in villages where we worked – we could

[17] The Bandim Demographic Surveillance System (DSS) is presently monitoring nearly 12% of all births in the country. In the capital the study covers a population of 75 thousand in five suburbs of Bissau. In the rural areas two mobile teams furthermore gather data in five regions, covering a population of 28 thousand, and a survey of women of fertile age furthermore comprises of 25 thousand women (Aaby, 2003; Sodeman, 2003).

simply follow in the footsteps of the Bandim mobile team that works with randomized sample of villages.

We took off to Empada two days before the mobile team which allowed us to work for one day in a particularly isolated coastal village some 25 km away from Empada town. The village is situated on the edge of a narrow peninsula in the Empada sector. The road leading to the village includes a 20 km long walking track that we travelled by a motorbike. The population of the village was small - 13 mothers of children under six years - so sampling was not necessary since we included all compounds in the study. We were however not able to visit secondary dwellings (semi permanent work-camps) that are dispersed in the forest and along the mangrove coastline.

3.4.3 Soga Island in Bolama/Bijagos region

Bijagos (Soga Island) - General Info		
Main languages	Bijago & Kriol	BSH
Mobility	Access by boat, by foot	BSH
Distance from Bissau	60 km by boat	BSH
Study period	7 days (02.Nov.07 - 08.Nov.07)	BSH
Population in Soga (2006)	1.203	INEC 2007

Soga Island in the Boloma-Bijagos region was my third research area. The region is the least densely populated area in Guinea-Bissau with just over 10 persons /km^2. Soga Island lies close to Bubaque island (the economic capital of the region) but does not have steady transport to other islands or to Bissau city. Small hand peddled canoes are commonly used to access the market in Bubaque town. The short journey on small canoes between islands can however be very dangerous due to the strong tide and swift weather changes.

Linguistically the island is quite homogenous. Nearly all the population in Soga Island speak Bijago language as their mother tongue and Kriol is less spoken than on the mainland. The research assistant that worked with me in Quinara region was born in Soga but was unable to work with me on the island due to other work commitments. He was however able to accompany me to the island and help organise transport to and fro Soga, recruit a research assistant who could translate between the Bijago and Kriol as well as finding me a place to stay and organising food (in a family setting).

Figure 13 Rented boat heading back to Bubaque from Soga Island. Rubane Island is seen in the background. Distance from Soga port to Bubaque is 7 km. Image by BSH.

Bornodaro (2006) claims that the Bijagos Islands have always been a marginal region throughout the history of Guinea Bissau. According to him the Bijago were "Marginal in the preparation of the [independence] war, excluded from the fight and from mobilisation, late in getting in touch with the structures of the PAIGC and, consequently, underrepresented at the political level" (p. 116)

Access to Bubaque town from Bissau today is relatively frequent. Every day large canoes travel approximately 60 km from Bissau to Bubaque town. The canoes carry up to a 100 passengers as well as transporting goods. Safety is not a central theme and the canoes are always overloaded, rarely have more than one outboard motor and do not have safety vests. A modern ferry boat also sails between Bubaque and Bissau once a week. I was never comfortable with travelling with the canoes, but was still forced to use it on two occasions.

3.4.4 Bissau Tchapa port

Bissau (SAB)- General Info		
Main languages	Kriol & other languages	BSH
Mobility	Taxi, by foot	BSH
Distance from Bissau	0	BSH
Study period	Throughout the period	BSH
Population (2007)	407.424	INEC 2007

In Bissau I had my permanent dwelling and performed interviews with informants within the Ministry of Public Health, Unicef and regional health officials. I participated in the preparation and distribution of LLINs in Bissau in November 2007 (one year after the distribution in other regions).

In Bissau I performed a small market survey in order to gather information on the supply of bed-nets, prices and their design. I spent one day in Bandim market in Bissau in the month of September and discussed with the majority of large scale bed-net suppliers. When visiting the bed-net suppliers, I did short interviews and took photos of their collection or production upon their acceptance. The population living in the so-called “Tchapa” are mostly Balanta speaking women and small children from the Tite peninsula in Quinara. Tite is situated on the other side of the estuary of the Geba River (only about 11 km by boat but 350 km by road). According to the women, their husbands transport coals from Tite to Bissau on motorised canoes, while the women are responsible for selling them in different markets in the capital. The men come to Bissau approximately every two weeks or so and stay for a couple of days, but the women generally stay for longer periods up to a few months and are often accompanied by their youngest children.

4 METHODOLOGY

Anthropological fieldwork has long been linked with the idea of the "western" anthropologist performing ethnographic studies in "non-western" societies (Augé, 2006). With the postmodern turn in anthropology important questions were raised regarding the objectivity of the anthropologist and the concept of culture (Moore & Sanders, 2006, p. 17). The custom of writing about culture as a static object governed by imagined ethnic- or country- borders was for instance challenged by Gupta & Ferguson (1992) who drew attention to the difficulty of defining culture by space; rather they proposed a much more dynamic view of culture as something constructed, reproduced, transformed and shared across borders. This critique of culture equally expands the idea of the so-called "field" where anthropologists work. The field can now be located in many sites at the same time (both at home and far away). This has been called multi-sited fieldwork (Eriksen & Nielsen, 2001, p. 162).

When studying a health related subject such as the use of ITNs and attitudes towards malaria, Minja (2001, pp. 52-3) has pointed out that "western" bio-medical knowledge has commonly been equated with scientific truth or "a correct representation of some aspect of the world" (Good, 1994, p. 9). Minja further points out that traditional beliefs and practices are often regarded by health specialists as lack of knowledge. Over the past decades, an alternative view has emerged that "views biomedicine as one form of knowledge among many, rather than as a depiction of the biological world that can serve as the norm for judging all other accounts" (Good, 1994) in (Minja, 2001, p. 53).

Whether in the field, interpreting data or writing it all down it was important to realise my position of power as a researcher in the field. I however agree with Scheper-Hughes (2006, pp. 508-9) who points out that the power imbalance and subjectivity of observation do not need to be paralysing for researchers, the compromise being to conduct "good enough ethnography" whereby the anthropologist is aware of his limitations and his place and does his best at giving honest information and representing his informants point of view.

4.1 Research Methods

Qualitative ethnographic methods such as participant observation still seek the same broad idea as in the beginning of the 20th century when Malinowski developed the methodology; trying to "see the world through the eyes of the native" (Malinowski, 1922, p. 25) or "by observing and participating to try to understand participants themselves view social life" (Esterberg, 2002, p. 59). The researcher furthermore tries to translate experiences of informants and make it understandable in other contexts (Esterberg, 2002, pp. 2-3; Bibeau, 1997).

I took off to Guinea-Bissau in the beginning of August 2007 to perform a 3,5 month study on the use of bed-nets. I planned to collect both quantitative and qualitative data that could produce complementary results (Table 5). Gathering information started long before actually taking off to Guinea-Bissau. Study preparations at home were important but the most crucial part of my preparation was of course adapting to a new environment, learning very basic social skills, and acquiring communication skills during the short duration of my study.

Methods used	Biombo	Quinara	Soga	Bissau
QUALITATIVE				
Focus Group Sessions	X		X	
Informal interviews	X	X	X	X
Participant Observation	X	X	X	X
QUANTITATIVE				
ITNs user Survey	X	X	X	X
Household Survey	X			
Market analysis of bed-nets	X			X
Geographic info on breeding sites	X			

Table 5 List of methods used in each of the four study regions.

Semi- and non structured interviews were used in all four study areas. The objective was to expand my understanding of individual opinions concerning ITNs use, i.e. access to the nets within the family, distribution, interactions with donors. Most interviews in the villages were performed on house-verandas. Third parties (translators, husbands, co-wives (Kr. *kombosas*), visitors, children and others) would frequently jump in and out of the discussion. In some instances my hosts would start a whole discussion where I was no longer a participant. This loose structure was important since it often produced new leads for the direction of my research. Furthermore, preparation of my qualitative questionnaire took a long time. While gradually testing the questionnaire I was also able to pick up

new discussion points as they came along and thus allow the research lead me. Interviews with health professionals, people working with international organisations, missionaries and others were more structured and most often took place in relatively silent office-spaces.

A large part of my research was spent just being with the people both observing life and trying to participate in some aspects. This exercise often aroused much curiosity in the villages about what I was actually doing there. It was also a source of amusement for many. I once followed a mother of eight children from Biombo region for shrimp fishing in the tidal creeks; this was both to get a glimpse of this aspect of life and also to check out if there was any bed-net material being used for fishing. After this experience, my presence in this particular compound (Kr. *morança*) changed and became much more comfortable. Minja (2001, p. 54) has pointed out the complex relationship between knowledge and practice. In some situations people are able to verbalise their opinions and in some they cannot. Participant observation was used to deepen and ground my understanding of how informants see and use the ITNs in their everyday lives.

Informal communication and interviews with informants were mostly performed in Kriol. The most important aspect when choosing a working language during interviews was to find the language that best suited my informants. Interviews with people, who were not fluent in Kriol, were done with the help of translators that translated local languages into either French or Kriol. In the first weeks, I would try posing questions directly to my informants and the translator would jump in anytime he felt it was necessary and re-pose the question in a different manner. I would furthermore ask the translator for his opinion if I did not understand responses fully. Some of my Kriol speaking informants also had a difficult time understanding my pronunciation, due to my poor language or pronunciation skills. A translator was always present in the beginning to correct misunderstandings and to re-phrase communication that had gone wrong. This loose interview/translation structure might all seem chaotic but it was very fruitful for me to advance in Kriol and learn practical social rules of communication through trial and error.

Focus-group studies are small group-meetings (of approximately 10 people) where the topics of discussions are directed by a moderator (Esterberg,

2002, pp. 108-11). Focus-groups can yield numerous insights in a short period of time. Individuals within the focus-group are able to react to each other's opinions, and thus create a certain common-knowledge through debate. The disadvantage of this method of research is especially that socially embarrassing opinions can disappear during the discussions. I conducted three short focus-group sessions with mothers in Biombo region that focussed on the attitudes to bed-nets and preferences when buying a bed-net. I conducted two similar focus-group sessions with mothers in Soga Island. I was also able to conduct one formal focus group session with all the chief nurses in the Biombo region (health workers originate from all parts of the country). I employed a French/Kriol speaking moderator during the session and was able to gather insights on what the health workers hear and see every day from the population in Biombo. Other focus group sessions were performed with the help of a local translator

It is of course important to look at figures of ITNs use with some reservation. Especially those derived from quantitative surveys that have been conducted by non-local researchers in unfamiliar social and cultural environments. Zimicki (1996) gathered several studies that show how people's responses do not always represent real use patterns. In a study in western Kenya, night visits were performed in the dry season to compare people's responses with real ITN use. Most non-users said that they had either "forgotten" or that it was too hot to use the nets (Sexton, et al., 1990). I did not perform such unexpected night visits, but since most bed-nets remain firmly attached during the day. I need to assume that the nets are being used during the night.

Analysis of data was done both in the field and at home. In the field I was able to work out the main themes in my field-notes and interviews. Voice-recordings, photos as well as documents that I received from informants were reviewed and grouped into relevant folders in my computer. Much of the data was also discussed at length with key informants and research assistants.

Since it was impossible to foretell the situation in the field, I based my research on inductive reasoning. I therefore allowed the objectives and research questions to develop and evolve during the research period (Esterberg, 2002, p. 7).

Social adaptation, language-learning and adjusting to climatic factors demanded efforts from me and sometimes resulted in stress. I believe that it was

very important for me as a researcher (as well as a research tool) to be aware of my psychological limitations and not to drown myself completely in my research, for too long at least. Every night I was able to talk on the phone with my girlfriend home in Iceland. In the middle of the research period my girlfriend came to visit me for two weeks. This period also allowed me to detach myself from my research and to concentrate on my own life and I got to experience Guinea-Bissau as a tourist. Coming back into the research I found it helpful to be able to reassess the direction I was going with a little perspective.

4.2 Participants and resource persons

The research was carried out in four different regions of Guinea-Bissau that are all situated close to the coastline. In all my four study areas the main informants were mothers of children under six years of age[18]. The mean age of my respondents was 28 years with an average of 3,1 children alive. Despite their young age, my average respondent had experienced more than one child either during or after labour (Table 6).

Ethnic/Ling Group	N.	%	Births Aver	Age Aver
Balanta	17	16,8	4,3	30
Beafada	33	32,7	4,3	26,4
Bijago	34	33,7	3,9	28
Fulani	1	1	5	26
Mandinga	2	2	3	30,5
Mandjako	4	4	3,8	24,5
Papel	10	9,9	5,3	31,3
Total	**101**	**100**	**4**	**27,6**

Table 6 Ethnic composition, age and number of children of the 101 mothers that took part in my bed-net survey performed in four regions of the country.

Other important informants in my study included health staff working in the local health care facilities in the study areas, research assistants and translators, staff of the Ministry of Public Health, PNLP and staff of the Unicef in Guinea-Bissau. During the course of my study many other informants were also drawn into my research both in the context of casual conversations and more formal interviews.

Access to the field was facilitated by a number of people and institutions. Most of my initial contacts were organised by my research-instructors before I

[18] Children under six years of age were consequently under five years of age during the distribution of LLINs in November 2006)

took off to Guinea-Bissau. Most importantly, I was able to situate my research under the umbrella of a large Danish/Bissau-Guinean research body called Bandim Health Project (BHP) that has been operating in the country for thirty years. Within the project I had access to office facilities, a safe for my funds and documents, housing in Bissau and I was able to build up a very good social network of both Guinean and Scandinavian health-researchers.

Unicef in Iceland had also sent an introduction letter to the Unicef country office in Guinea-Bissau. The introduction granted me good access to this contact. Through my instructors I was also able to set up a good contact within the Ministry of Public Health in Bissau. Through this contact I was able to locate other valuable resource persons within the Ministry.

4.3 Quantitative methods

I performed two quantitative studies during my study period. Firstly, I performed quantitative survey on bed-net use and on the bed-net distributions in four regions of Guinea-Bissau between 28.October 2007 and 15.November 2007. Data entry was done in Excel and statistical analysis of the data was performed in SPSS and Excel.

Secondly, I gathered data from all compounds in two villages in the Biombo region. The number of family-compounds (Kr. *moranças*) in the two villages was 178. In these compounds a population of 5.088 inhabitants lived in a total of 672 houses (see questionnaire in Appendix, section 9.2). Data collection was done alongside other aspects of the research and was therefore quite time consuming. In total data collection lasted two months from mid-September to mid-November 2007. In the first village, I gathered data along with an assistant/health worker and a third Papel speaking assistant. In the second village, data was mostly gathered by the assistant/health worker. Data entry and statistical analysis were done in Excel.

When describing the use of bed-nets through quantitative data one of the first thing to decide is whether to look at the bed-net as a unit of measurement, regardless of how many people sleep under it; or if one looks at the individual-user of the bed-net as a unit of measurement. In this analysis I mainly look at the net-user as a unit of measurement, acknowledging that many people can be

protected by one net[19]. Both viewpoints are however complementary and I will try to expand the information by for example citing the mean number people under each bed-net.

Taken in the strictest sense as quantitative surveys, my two surveys have some limitations. The sample-surveys were however not meant to generate exact bed-net user statistics that could be used to generalise the behaviour of a predetermined population. The main purpose of my study is rather to provide insights into bed-net use patterns in various coastal areas of the country that are facing different situations of accessibility and health service coverage, as well as to provide insights into distribution methodology in different settings (where accessibility can obviously play a role).

4.3.1 Bed net survey in four regions

N° of	Quinara	Soga Isl	Bissau Port	Biombo	Total	Valid
Repondents (Women)	55	33	5	8	**101**	**101**
Houses	32	29	5	7	**73**	**73**
Beds	190	114	22	29	**355**	**353**
Persons in Beds	372	227	78	81	**758**	**756**

Table 7 Number of respondents, houses, beds and bed-occupants in the four study regions.

The research questionnaire in my bed-net survey included 13 questions regarding family-compound composition, information on the distribution, general use and maintenance of bed-nets and other ways of preventing biting insects (see questionnaire in Appendix in section 9.1).

Age groups in bed-net user survey	Nbr. Valid	% of total
Children < 6months	20	2,65
Children 6 - 59 months	197	26,06
Pregnant women	28	3,70
Children 5 - 14 years	169	22,35
Adults > 15 years	342	45,24
Total	756	100,00

Table 8 Age groups represented in the bed-net user survey conducted in 355 sleeping places in 79 houses and four regions in Guinea-Bissau.

The participants in the survey were mothers with children under six years of age. Close relatives of the woman (i.e. husband or mother) were also accepted to respond for the woman when she was absent. The total number of my respondents in my four study regions was 101 women living in 73 houses. I

[19] It has however been pointed out by Rozendaal (1997, p. 81) bed-nets cannot protect an indefinite number of people as when the number of people under each net increases, there is more direct contact with the mesh, and a higher probability that the mosquito can feed through the net .

furthermore visited all sleeping-places in the houses and gathered additional information. The total number of sleeping places visited was 355 in a total of 73 houses/houses. A total of 758 individuals were sleeping in a total of 355 sleeping places, with an average of 2,14 persons sleeping in each bed (Tables 7 & 8).[20]

Bed-nets available in Bissau:

1. Market bought bed-nets (Kr. *tendas di feira*). These nets are not pre-treated with insecticides. They can be bought in many varieties (colours, sizes, fabrics, designs, suspension points, etc.). The market-nets are not always made out of netting materials, often made with light synthetic clothing materials.

2. ITNs from the Health Centre (Kr. *tenda di hospital*). ITNs are distributed by health centres for pregnant women (Kr. *tenda di prenhada*) that perform prenatal consultations and for newborns (Kr. *tenda di vaksina*) that follow the normal vaccination regime under the ANC+ and EPI+ schemes of Unicef[21].

3. LLINs from the National distribution (Kr. *tenda di distribucão*) *Olyset Net* and *Permanet2.0* LLINs that were distributed during the national campaign in the end of 2006 in all regions except in Bissau Autonomous Sector which received the LLINs a year later in November 2007.

Bed-nets encountered generally originated from three sources: ITNs came from hospital distribution programs (mostly two types), two types of LLINs were distributed in the national distribution campaign 2006-7 and finally other types of bed-nets (most tailor-made and untreated) came from the market. The nets were easily recognisable. When inspection was not possible (locked room, etc.), it was possible to discern the origin of the nets by asking questions regarding the colour of the plastic bags the nets came in, etc. As an example both *Olyset Net* and *Permanet2.0* LLINs were delivered in distinct durable plastic bags[22].

[20] Two of the 355 sleeping places were not accessible, bringing the valid number of sleeping places to 353. One place was vacant (removed from cohort). The second place was in use by two youths (between 5-14 years old), information on bed-type and impregnation status are represented as missing values.

[21] The ANC+ (mother health) and EPI+ (child health) schemes are elements of the larger Accelerated Child Survival and Develpment project (ACSD) of Unicef

[22] *Olyset Nets* were delivered in white bags and *Permanet2.0* in dark blue bags. The *Olyset Net* type could furthermore be recognised by asking if the net was made of a strong material and had large holes (Kr. *tenda kin ki risu e ki tene kobas largu*).

I was often faced with conflicting information from house to house when asking my respondents questions on specific time-periods of distributions or re-impregnation campaigns. By trying to ask questions by referring to seasons[23] inconsistent information could sometimes be fixed.

Two of my four study areas (in Quinara region and Soga Island) are relatively difficulty to access, due to bad road conditions, long distance and lack of public transport. Biombo region on the other hand is a densely populated region situated close to Bissau city and with relatively easy access. In Bissau, I also gathered quantitative data for only one day in a community of approximately 200 people living close to the central Port in Bissau.

At the local level the health care structures generally act in close collaboration with the traditional authorities. At my first arrival to the Biombo region I was for example led by chief-nurse to the king's house to explain my presence in the area. In all of my rural study regions, social-mobilisation was organised in collaboration with the local kings (Kr. *regulo*) and village-chiefs (Kr. *chefe di tabanka*). I found traditional authorities especially active in linguistically homogenous areas such as Biombo region and Soga Island. Health care structures worked hand in hand with the traditional structures disseminating information and mobilising populations. In Soga Island there are furthermore state-links (Kr. *comitê*) in each of the five villages, in the central village there is the chief-link that acts as link between the population of Soga Island and the regional authorities in Bubaque Island. There is furthermore one central king in Soga Island and vassal-kings in each of the five villages on the island that have a certain power to mobilise the population.

4.3.2 Working methods with the mobile team in Empada region

When the Bandim mobile team (MT) entered a village the MT-researchers generally split up in four teams that all had different routes. I and my research assistant also split up and each followed one mobile team researcher, visiting the same compounds. When choosing an MT researcher to follow we would randomly draw numbered pieces of paper each time we entered a new village.

[23] Referring to seasons, one could ask questions such as: "had the rains started when the health-officials (Kr. djintis di saúde) came to treat your bed-net last year?"

Since we made visits inside all houses to see all bed-nets and sleeping quarters the MT researchers were much quicker than we were. We therefore had to randomly select houses in the compound to visit, and most often our visit was limited to just one house (Kr. *kasa*) in each compound (Kr. *morança*). The random sampling of houses in the compound was done by first asking how many houses belonged to the compound (only in houses where a woman with a child under the age of six years was living). We would then assign numbers to the houses and each time we visited a new house we would draw a new crumpled note randomly to select the houses. This exercise was often seen as something quite strange and amusing by our hosts.

4.4 Other issues

4.4.1 Informed consent

People in all four of the study-areas were generally positive toward taking part in the study. An interview session would start by approaching the head of the family (Kr. *chefe di morança*) or the first wife of the head of the family (Kr. *dona di kasa*) and explaining our purpose. Quite often, the men were not at home during the day and therefore we would usually explain our visit to the first-wife of the compound (although a few compounds were female-headed). Then all other grown-ups and sometimes children were greeted verbally and with a handshake. Old people were generally specially greeted, i.e. "old woman/man, how is the health?" *(*Kr. *"mindjer/omi garandi, kuma di kurpu?")* etc. As a sign of respect for an elderly person it was also considered respectful to touch your breast after a handshake and/or to support your right arm with the left hand during the handshake.

For a couple of weeks I persisted in religiously reading an informed consent formula to my respondents about how their personal identity would be concealed in my final report. This text can be seen here below:

> Hello Mr/Ms/Mrs
>
> My name is Baldur Helgason and I am doing a survey on the use of bed nets in Guinea-Bissau with the help of Bandim Health Program. This survey can help the Ministry of Health to find ways to improve the health of people in the country.
>
> I would like to talk to you and other members of your household; it will take about 15 minutes. **You do not have to participate, and if you do chose to participate, you don't**

need to answer any question that you don't want to answer. I will be asking hundreds of people these same questions and your name will not be linked to your answers; in other words, no one will know your name.
Do you agree to take part?

I soon decided to abandon the discussion about anonymity altogether, because it almost without exception created a situation of distrust and a confusion that usually had to be repaired by the translator/assistant. My own feeling was that when I went too deep into explanations of the rules and regulations, people got a feeling that I was not there to talk to them person to person but rather that I wanted to position me as a scientist. As a result I started focussing more on explaining to my respondents how I wanted to use my report (Kr. *relatório*), and that I wanted to try and communicate the opinions of the people to the organisations and the Ministry of Public Health connected with the ITNs programs.

After having finished my introduction, the head of the family-compound would then mobilise the family members we wanted to discuss with. This was also a communication-pattern was initially quite disturbing for me, because I sometimes felt as my respondents did not have any choice of taking part or not taking part in the interview. I dealt with this by putting an end to all interviews where my respondents showed any signs of discomfort. I later saw that respondents did not seem to have any problems themselves putting an end to tiresome conversations by saying "we have talked enough, I am tired" (Kr. "*no papia tok, na kansa"*).

4.4.2 Access to homes

Most of the interviews took place underneath verandas of. Entering houses did not present a problem for any of my respondents. The head of the family or his wife would generally assign a person to take a tour into every corner I wished to visit inside the house. The only limitations that I experienced were in a couple of Muslim compounds in Empada region, when no men were at the house. The women would explain to me that as soon as their husband would come home, I could enter and they would show me around.

4.4.3 Photography and Voice Recording

In all the compounds that I visited, I asked to see all the sleeping quarters of the house and if I could take photos (Kr. *postales*) of the beds or nets. I explained that I wanted to see the types of nets they were using and ask which family members were sleeping under which net.

I also explained the reason for my interest in their sleeping quarters by the fact that I did not know how people live and that I was just curious. I would most often make a small demonstration with my digital camera under the veranda of the house before entering. Sometimes the demonstration turned into a photo-shoot of the people of the house. When entering the houses, a family member would most often be assigned to guide me around the house and answer questions about who slept where. Usually more people were called in to help answering the multitude of other questions that sprung up, i.e. regarding the whereabouts of inhabitants, how much the bed-nets cost, how old they were and where they were bought, etc.?

I recorded most of my interviews with a digital recording device Olympus VN-3100PC. Before starting interviews I would ask for a verbal consent my interviewees. Most respondent's first impression of my voice recorder was that it looked like a mobile phone, so I also frequently did a small demonstration of how the voice recorder worked and explained that this was an important tool for me to remember my discussions. After I had started voice recording I either put the voice recorder on my lap or in my breast pocket. I never got the feeling people got suspicious about all my digital apparatuses.

5 RESULTS

5.1 Bed-net use

The statistical survey on the use of bed-nets builds on information from a total of 756 people sleeping in 353 sleeping places in four different study areas. Table 9 outlines the number of participants in each region as well as in each age group.

Age groups in bed-net survey	Quinara	Soga	Bissau port	Biombo	Nbr. Valid	% of total
Children < 6months	6	9	1	4	20	**2,65**
Children 6 - 59 months	104	58	23	12	197	**26,06**
Pregnant women	11	6	10	1	28	**3,70**
Children 5 - 14 years	92	47	2	28	169	**22,35**
Adults > 15 years	157	107	42	36	342	**45,24**
Total	**370**	**227**	**78**	**81**	**756**	**100**
% of total	**48,9**	**30,0**	**10,3**	**10,7**	**100**	

Table 9 Age groups represented in the four regions of my bed-net survey (n=756).

In all of the 353 sleeping places in the four study regions, an average of 2,14 people were sleeping in each place. There were however a very large differences in the mean number of people per sleeping place between different study regions: 1,97 people slept in each sleeping place in Quinara, 1,99 in Soga, 3,55 in Bissau port and 2,79 in Biombo region. This difference correlates quite well with the population density patterns in each of the study regions, whereas Biombo and Bissau city are the two most densely populated areas, and Quinara and Bijagos Islands are the least densely populated areas, showing the fewest number of occupants in each sleeping place.

There was a large difference between the different regions regarding the type of nets used. Soga Island is unlike other study regions, where 41% of the population sleep without bed-nets and only 22% of bed-nets originate from the market. In comparison with Quinara and Biombo regions, over 79% and 71% of bed-nets in originate from the market respectively. The proportion of LLINs from the national distribution in Nov/Dec 2006 is however quite evenly dispersed among the four regions (Table 10). Another factor influencing the high proportion of market bought nets in Quinara and Biombo might be people's preference for taller nets with a "mouth" in these regions (that are only provided by the market).

%	Quinara	Soga Island	Bissau Port	Biombo
LLINs %	16,8	20,7	16,7	17,3
ITNs HC %	2,4	15,9	19,2	8,6
Market %	79,5	22,0	39,7	71,6
Total % net users	**98,7**	**58,6**	**75,6**	**97,5**
Non users %	1,3	41,4	24,4	2,5

Table 10 Proportion of three bed-net types used and non-use of bed-nets in my four study areas (n=756).

Bissau port and Soga Island shared a very high proportion of people sleeping without nets. More than 41,4% of the population in Soga slept without bed-nets and 24,4% of the population in Bissau port. In these two regions there is however a relatively high proportion of ITNs from the health centres than in the other regions.

Despite high overall net use in the Quinara study area (98,7%), the proportion of ITNs use was very low (2,4%) compared to 19,2% in Bissau port. The high proportion of ITNs use in Bissau port could be explained by demographic factors since majority of the inhabitants are women with young children who are the target group of ITNs distributed by the state-run health clinics. The low proportion of ITNs use in my study area in Quinara could on the other hand either be explained by a lack of access to health care services, stock ruptures of ITNs in the health care centres in Empada and Daressalam sanitary areas and by the fact that women prefer to guard distributed nets in their stock, while preferred market supplied nets are in use.

Excluding Bissau port[24], children between 6-59 months and pregnant women show the highest proportion of both ITNs and LLINs users, 11,1% of pregnant women use ITNs from the health centres, while only 5,3 % of children under 6 months of age in the three study regions sleep under ITNs from the health centres.

Comparing the mean number of people sleeping under different types of nets can provide possible insights into which nets people are most willing to sleep under. Looking across all study regions, an average of 2,31 person slept under both ITNs and LLINs while an average of 2,15 person slept under bed-nets from the market and an average of 1,88 persons slept in sleeping places without a net.

[24] Due to the very different demographics to other study regions, for example the unusually high proportion of pregnant women and children

In different regions, Biombo and Quinara that have the highest proportion of bed-net use, 97,5% and 98,7% respectively, have approximately 1,2 persons sleeping in each places without bed-net, strikingly lower than in other regions. In Soga 1,81 persons sleep in each bed without a net and in Bissau port there are 3,17 people sleeping together in places without nets. An average of 4,33 people sleep however slept under LLINs from the national campaign in Bissau port.

There was a great difference in the state of nets in the different regions. In Quinara, Biombo and Soga Island the proportion of intact nets was between 50-60%; while only 15% of nets in Bissau port were intact. In Biombo and Bissau port there was the highest proportion of repaired nets 30%. In Bissau port 54 % of nets were with unrepaired holes compared with 36% in Soga Island, 21% in Quinara and only 9% of nets in the Biombo region.

When looking at different age groups in all study regions (excluding Bissau port), children under 6 months of ages have the highest percentage of non-users (21%) while children between 6-59 months have the lowest proportion of non-users (7,5%) other age groups including pregnant women have proportions between 16-18% of non-users.

A very important feature of net use is their use during the dry season, in my survey approximately 90% of my respondents claimed to use nets all year long. The only region showing different results is Biombo where only a third of my respondents claimed to use their bed-nets during the dry season. The high proportion of people claiming to use their nets all year long also coincides with the qualitative information that seems to indicate a much sharper change in the use of bed-nets during the dry season in all my study regions.

When engaging in longer discussions many people I discussed with in all study regions claimed to put nets away during the dry season. This was in contrast to the findings of my statistical survey where 90% of women claimed to use the nets all year long. The Biombo region was the only region in the statistical survey where two thirds of my respondents claimed to put away their nets during the dry season. The main reasons for putting away the net was the absence of mosquitoes and prolonging the lifetime of the net, some women also mentioned that they were happy to put away the nets so they did not have to wash them so often. A woman in Biombo said that around December she washed her nets and kept them in her

box (Kr. *mala*) until the start of the rainy season in order to protect them from tearing. I told an older woman in the Biombo region, that there were no mosquitoes in my country because of the cold weather. She replied "It is true, here when the windy [cold] season comes after the rains, mosquitoes also run away".

5.2 Supply of bed-nets in Guinea-Bissau

Bed-nets generally originate from three sources: (1) ITNs from distribution programs carried out by local health care centres (mostly two types of nets); (2) LLINs; *Olyset Net* and *Permanet2.0* that were distributed during the national distribution campaign 2006-2007; and (3) the largest source that includes all other types of bed-nets, most tailor-made and untreated with insecticides and supplied by the local market forces.

5.2.1 National distribution of LLINs in Nov/Dec 2006

In November and December 2006, the first phase of a national distribution of LLINs took place, whereby a total of 172 thousand children under 59 months (less than 5 years old) in all regions of Guinea-Bissau, apart from the Bissau capital area, received an LLIN. This first phase of the national distribution was largely funded by Unicef in Iceland, that provided 105 thousand LLINs (UNICEF, Guinea-Bissau Country Office, 2007) as well as covering much of the operational costs of the distribution (Ministry of Public Health in Guinea-Bissau, 2007). Other components of this integrated distribution campaign included a "catch-up" of measles vaccination, vitamin-A supplementation and de-worming with Mebendazole. These extra components were performed in all parts of the country, including the Bissau capital area (UNICEF, Guinea-Bissau Country Office, 2007).

According to informants, the first distribution phase in November/December 2006 was performed successively in three geographical areas. It started in the eastern regions of the country, then in the northern regions and finally in the southern regions[25]. All the study areas, apart from the Bissau capital area, are located in the southern regions.

[25] Including the Biombo region that is generally grouped with the Northern region.

Figure 14 Two types of LLINs that were distributed during the national distribution in Nov/Dec 2006 a) *Permanet2.0* & b) *Olyset Net*. Photos by BSH

Social mobilisation before the campaign in the Biombo region was performed by volunteer teams that are called social-mobilisers. In each sanitary area in the region, one volunteer is responsible for the team. The high density of the population in Biombo and homogeneity could be responsible for the large role that social mobilisers have assumed in the Biombo region. Another factor might be the absence of a local radio station in the region that is the most important media in most other regions. Before passing the information about the distribution, all mobilisers in Biombo received training in the regional capital, Quinhamel. They then passed information by megaphones for 7 days in their respective sanitary areas before the campaign started. Each social-mobiliser received a per-diem of 1.500 CFA/day (approx.3$/day). Mobilisation of the population in Biombo was also done through close collaboration with the traditional kings, and in one of the study villages the actual LLINs distribution was performed within the family-compound of the king[26].

According to informants in the Ministry of Public Health and in the local health centres, people in all regions of Guinea-Bissau were given the information to show up with the vaccination cards of their children to the distribution posts. Those who did not show up with vaccination cards would not receive LLINs or other components of the distribution. In Bissau city special vouchers were given to mothers of children under 5 years of age that showed up for the campaign (seen on Figure 15). The mothers were given the information that a distribution would be advertised soon as the nets arrived and they would then receive an LLIN when

[26] See Einarsdóttir (2004, pp. 12-13) on the history and structure of traditional kingdom in the Biombo region.

showing up with the voucher. According to an informant in Unicef in Guinea-Bissau, giving out vouchers was against the recommendations of Unicef. The informant furthermore claimed that nets had been distributed to children under 5 years of age, irrespective of the fact if children showed up with their vaccination cards.

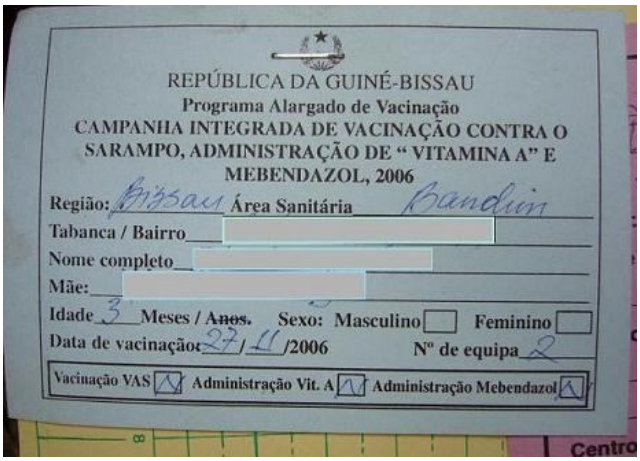

Figure 15 A voucher from a mother from Biombo region that she received in the Bandim health care centre in Bissau. The voucher is stapled to the vaccination card of her child. Photo by BSH.

According to the official strategy of the national distribution, LLINs were aimed at one single target group: children less than 59 months old (UNICEF, Guinea-Bissau Country Office, 2007). Discussing with different actors however often revealed contradictory information on the question if pregnant women were included in the distribution or not. A regional health supervisor in Quinara region for example claimed that pregnant women had been included in the distribution of LLINs in all the sanitary areas of Quinara region (contrary to regional reports presented to the Ministry of Public Health). Local supervisors and most women I spoke with in both sanitary areas that I visited in Quinara (Empada and Daressalam) however claimed that LLINs had only been distributed to children under the age of 5 years and not to pregnant women. In the Biombo region on the other hand, most of the women I discussed with as well as social mobilisers and health personnel claimed that pregnant women were included in the distribution of LLINs.

It is clear that pregnant women[27] were provided with LLINs in some regions and in other regions they were not. The reason for this might have been

[27] The other most vulnerable group to malaria infection (WHO, 2006).

regionally planned methods of compensating pregnant women for the frequent rupture of stock in the national "keep up" campaigns.

The population in all areas that I visited was aware of the distribution and whom it was meant for. There were however some confusion if pregnant women had the right to receive a net or not. The distribution reached all villages that I visited. I only heard of one distribution point that was inaccessible during the distribution, a village situated on an island in the Empada sector in Quinara Region that is only accessible by boat. The remaining nets from the distribution in the Quinara region were according to the health officials sent back to Bissau.

5.2.2 LLIN Distribution in Bissau in November 2007

In August 2007 I followed news on the procurement and shipment of the LLINs for the Bissau capital population, both through Unicef and the Ministry of Public Health. Approximately 60 thousand LLINs had been procured by the Unicef supply division in Copenhagen to complete the national distribution of LLINs. The first distribution had started in November 2006, but Bissau had been left out due to the lack of nets. After the arrival of the LLINs container in Bissau in the end of September 2007 there was uncertainty about the exact timing of the distribution in the city. In the beginning of November 2007, shortly before the end of the research period, I learnt that the distribution in Bissau would eventually take place. The LLINs for Bissau were provided by two donor organisations: Unicef provided 60 thousand nets (type: *Permanet2.0*) and Plan International had topped up the number of nets with 9 thousand nets, in total 69 thousand LLINs for distribution in the capital area.

All nets were packed in bundles of 100 pieces and were received in the warehouse of the Ministry of Public Health in the outskirts of Bissau. During a coordination meeting in the Bissau regional health office, it was stated that 26 bundles (2.600 LLINs) had been reported missing at the time of reception in the Ministry of Public Health. Since the loss happened prior to the reception, the responsibility for the first loss lies with the transporting agent. The day before the distribution, the LLINs were transported to various distribution points. Additional 13 bundles (1.300 LLINs) were reported missing/stolen the day before the distribution bringing the total number of nets for distribution down to 65.100 pieces.

For passing out information on the distribution, megaphones were provided to larger distribution points. There were however problems with the supply of batteries for the megaphones. Distribution supervisors were supposed to shuttle between distribution points in four public vehicles that belonged to the Ministry of Public Health. At the distribution day, however there was a lack of vehicles. Coordination of such a large distribution seemed quite chaotic to me at first. I did not see how much money was budgeted for the management of the distribution, but it seemed meagre. Subsequently, small hurdles such as lack of funds to buy batteries as well as solving a lack of vehicles became large problems that had to be solved with emergency solutions, i.e. by dispatching most of the supervisors on top of the loaded truck transporting the LLINs to the distribution sites.

Figure 16 Distribution post in Bissau. Photo by BSH.

I visited four different distribution posts in Bissau during the campaign. From post to post there was a very big difference in the organisation of the distribution. Overall, the distribution was implemented in a very effective manner and became increasingly structured as it went on in all places that I visited. Majority of mothers in Bissau were told to come to their local health centre with their children in a matter of hours and the end result was that the LLINs ended up in the hands of the target group.

Children under the age of 5 years were eligible to receive a net if their mothers or other care takers showed up with their vaccination card. After they had received their LLIN, information was marked into their vaccination card about the reception of the net and their thumb was furthermore dipped into long lasting ink to underline that they had received a net and were not supposed to return. Children often panicked when their finger was dipped into the ink by the health worker, probably linking the health centre with receiving an injection.

5.2.3 Reasons for not receiving nets

The population of Guinea Bissau is very mobile. In all the study areas that I visited, I came across male and female visitors in all ages (Kr. *ospris*) from other regions and villages. The mobility of people can also complicate issues regarding the provision of health care and services such as the distribution of bed-nets to vulnerable groups. The mobility of these vulnerable groups also underlines that they are also dynamic actors that do not sit in their villages waiting for something to fall from the sky. One family that I visited in the Biombo region had two permanent dwellings situated more than 300 km apart; one in the Biombo region and the other in an isolated fishing village in Tombali region where the husband engaged in commercial fishing. Kofoed (2006) has equally pointed out that it is very common for people to travel between villages and Bissau city for shorter or longer periods of time, especially during harvesting seasons. Many women travel to take part in the cashew-harvest from March to June. Women in Biombo thus earn cash by collecting the cashew apples and making cashew-vine. Younger children tend to travel with their mothers, especially while breastfeeding. Similarly, people from the rural areas often stay for extended periods in Bissau with relatives or friends.

Most mothers who claimed that they did not receive an LLIN during the distribution had problems with the vaccination card of their child. Often these women travelled a lot and some had more than one home, this resulted in vaccination cards of their children being left in the other area, or their children being in one place and the mothers with the vaccination cards in another place. Furthermore, one mother in Biombo (who was also pregnant) travelled with her child to a remote fishing camp in Tombali region to visit her husband. She only heard of the campaign after she returned to Biombo because the national

distribution did not reach the village/camp. The woman would however not have received a net in the Quinara region since she had left her child's vaccination card in Biombo so it would not get lost. Another mother of four children (two under five years) in Biombo said she frequently travelled between Biombo and the São Domingos region to visit her sister to sell cashew nuts. Her four children were in Biombo region during the distribution in November 2006. The woman claimed that her two youngest children did not receive nets during the distribution since their vaccination cards had been left behind with her sister in São Domingos.

In the rural areas people do not only move within country borders. In the Quinara region, I learnt that people from neighbouring countries live along the coastline in small temporary fishing-settlements. I was not able to visit such a settlement, but according to their Bissau-Guinean neighbours, the settlers mostly originate from Guinea-Conakry and Sierra Leone and are often accompanied by women and small children. These populations are able to access the local health structures, but are not taken into account during campaigns etc. One of my study population (mostly women and young children) were living in such work-camps in the Bissau port during most of the year.

5.2.4 Free distribution of ITNs through health-care services

As mentioned above, a continuous distribution of ITNs is operated on a national level through hospitals and local health centres in the country. According to Unicef and the Ministry of Public Health this program is supposed to provide ITNs to pregnant women that attend their first pre-natal consultation (normally out of three consultations); and secondly to infants that complete their EPI+ standard vaccination schedule on time, receiving their last vaccine against measles (Kr. *sarampo*) at the age of 9-12 months.

The protective IPT treatment for women is commonly called "malaria vaccination" by the population and therefore nets for both women and infants are frequently called by one name "vaccination-nets" (Kr. *tenda di vaccina*). The most frequent terms are however "vaccination-nets" (Kr. *tenda di vaccina*) for infants and "pregnant-woman-net" (Kr. *tenda di prenhada*). See Figure 17 showing the two types of ITNs distributed by a health centre in Biombo.

According to a health worker in the Biombo region, pregnant women have the right to receive an ITN from the health care centres during their first pre-natal

visit (normally at 3-4 months into their pregnancy). During the first consultations the women should receive a dose malaria prophylaxis (IPT)[28], iron supplementation and an ITN as a gift. During the second and third consultation they should receive malaria prophylaxis and iron supplementation.

In the Biombo region, the regional health board however operates a system whereby pregnant women receive their ITN during the third and last visit and not the first visit. This system was locally set up to motivate the pregnant women to finish all three consultations, instead of showing up only once to receive the net and the first dose of malaria prophylaxis. The cost of performing a pre-natal consultation is 1.500 CFA (approx 3$) for the three consultations, whereby the woman receives a pregnancy card during her first visit.

Figure 17 Two types of ITNs that are distributed under the ACSD program to pregnant women and infants by the Health Centres. The green ITN is for pregnant women and the white ITN for infants. Photos by BSH.

Some health centres in Biombo operate so-called vaccination days on Tuesday mornings, where routine vaccinations of children take place. According to the EPI+ schedule infants should receive vaccine against poliomyelitis and BCG vaccine against tuberculosis at birth. This should be followed by three additional doses of anti-polio vaccine and DTP vaccine against Diphtheria, Tetanus and Pertussis, given at 6, 10 and 14 weeks of age. The last vaccine against measles should be given at 9 months of age. After the infants receive their last vaccination, the mothers are supposed to carry home an ITN as a gift for adhering to the vaccination schedule but frequently the health centres are out of stock. According to the Ministry of Public Health as well as the regional health

[28] Fansidar™ is a brand of malaria medicine based on active ingredients sulfadoxine and pyrimethamine (S/P)

boards that I visited, children should be eligible to receive an ITN if they show up for the last vaccination between the age of 9 and 12 months. If they show up for vaccination at 13 months they would have foregone their right to receive an ITN.

Despite the fact that my study area was situated quite far away from Quinhamel town in Biombo, many women that I discussed with claimed to have travelled to the regional capital to perform pre-natal consultations in the private missionary hospital rather than going to the state-run clinic. Many pregnant women had thus walked more than five times the distance to the next state run health centre. According to the regional health office in Biombo, in 2006 the missionary hospital served more than 4,5 times the number of women that should be living in its vicinity. The high number of women attending the missionary hospital shows the preference that women give to the non-state-run health centres. Women that had done pre-natal consultation or child vaccination in the missionary hospital in Quinhamel claimed that they had not received a bed-net after their consultation. According to the regional health board in Biombo, the private missionary hospitals are not included in the ACSD strategy and therefore are therefore not provided with ITNs from the state.

Einarsdóttir (2004) also found that pregnant women in Biombo preferred doing pre-natal consultations in the missionary hospital even if they live much closer to a state-run health centres. The most important factor for the women's choice was the constant availability of drugs in the missionary hospital, while there were frequent stock ruptures of medicine in the state-run health centres. The women however complained of hardship and retributions from the catholic nuns operating the missionary hospital if they did not follow all given procedures. Retributions for not showing up for consultation included not being attended to or paying fines (pp. 70-72).

Most of the state-run hospitals and health centres that I visited in the four study regions did not claim to have problems with the provision of malaria medication. However, the only health centre that was stocked with both ITNs for both pregnant women and infants was in my study area in Biombo. Other health centres in the Biombo region either had no bed-nets or only a few ITNs for the infants remaining in their stock in October 2006. The frequent stock-ruptures seem to be a cross-cutting and structural problem in the implementation of the

ACSD program. The frequent unavailability of ITNs could serve to further undermine the already negative reputation of the state-run clinics, and might influence the choice of women to continue flocking to do their pre-natal consultations in the missionary hospital.

According to the Ministry of Public Health, the main donor organisations that supply ITNs for pregnant women under the ACSD are WHO and Plan International. The donor organisations for the ITNs program for infants that come for measles vaccination (before 12 months old) is however mostly run with support from Unicef and Plan International. The reasons for the frequent stock problems of ITNs in the country are not evident but according to the Ministry of Public Health the flow of funds and goods for malaria prevention and control has been extremely irregular from their main donors. Recently, responding to an ITNs stock rupture, the Ministry of Public Health was able to shift Global Fund funds for malaria medicine procurement (due to lower ACT drug prices) to procure ITNs.

During the writing up of my results I have also followed up the stock level of ITNs in the Biombo region by telephone. The health centres have now been provided with new ACT malaria medication, but the stock problems of the ITNs programs seem to continue. In August 2008, there were neither nets for infants nor pregnant women in my study area in Biombo.

5.2.5 Impregnation campaigns

Another feature of the EPI+ scheme of the ACSD program are yearly re-impregnation campaigns of bed-nets[29]. The re-impregnation campaigns have according to the Ministry of Public Health, been performed on a national level since December 2003 (with the exception of 2007). When taking into consideration that majority of bed-nets in circulation in the country originate from the local market and are sold untreated, the re-impregnation campaign becomes an effective method to both “catch-up” and “keep-up” the use of insecticide treated nets.

[29] The WHO formerly recommended that bed-nets needed to be re-treated at least every 6 months. In 2007 this minimum period between re-treatments was extended to 12 months (or after three washes) (WHO (ii), 2007)

According to the regional health board in Biombo, there were two re-impregnation campaigns performed in the region in 2006. A re-impregnation campaign was first performed in the month of June 2006, and the second one in November and December 2006. The second campaign was implemented alongside a national integrated distribution of LLINs and other. According to re-impregnation teams in the Biombo region, the insecticides used for re-impregnation have both been in liquid form in 2005 and in pills in 2006. In both Soga Island and Quinara, both the population and the health personnel confirmed that the last re-impregnation campaign had taken place in June 2006.

The WHO provides technical assistance for the impregnation campaigns an informant in the Ministry of Public Health explains. The next re-impregnation campaign was scheduled in June 2008 (in the beginning of the rainy season), but this has now been further postponed due to the lack of funds and unavailability of re-impregnation insecticides in the country.

5.2.6 Market supplied bed-nets

I visited Bandim market, the largest market in the country, close to the peak of the rainy-season (in the end of August). The visit revealed a high supply of bed-nets. All nets in the market were untreated with insecticides. The nets had most been sewed locally, but the netting or clothing materials used was imported either from Senegal or The Gambia. When I asked of the origins of the netting materials most vendors named China, Taiwan and Asia. Most of the larger bed-net vendors in the market are foreign nationals who originate from neighbouring Senegal and Guinea-Conakry.

Majority of the bed-net vendors kept only a small number of nets on display in their shops, specialising in other products such as cosmetics, second hand clothes, curtain materials, etc. In these shops, nets were being offered to broaden the range of products. Despite shops offering few nets, the design was most often quite varied in colours.

Figure 18 Even small vendors offer many different colours, materials and designs of bed-nets. None of the nets offered in the market are pre-treated with insecticides. Photo by BSH.

Vendors that specialise in the supply of bed-nets generally also had other types of items on display in their shops. The number of shops that specialise on bed-nets in the market was around five. Their small number is most likely explained by large fluctuations in the demand for this "luxury-item" in the market. My respondents in Biombo region said that people often buy bed-nets when they have money in their hands. People in all study regions claimed they have most access to money during the cashew-nut harvest period between April and June. One woman said:

> Here in Biombo, we have a bit during the cashew period, but now the price [of cashew-nuts] has fallen [...] if the prices rise again we will be able to relax a bit.

Most respondents, including bed-net vendors themselves claim that bed-net prices reach a peak in August and September when the rains have set in and mosquitoes and midges become more abundant.

Figure 19 Bed net vendor in Bandim market, Bissau. Bed-nets are sewed in the warehouse behind the vendor. Photo by BSH.

Figure 20 A look inside the warehouse. To make circular bed-net that is suspended by one point one requires: netting materials (from Senegal or The Gambia), approx. 1,5m of PVC plastic tubing (used for making the ring) and a manual sewing machine (seen in the background). Photo by BSH.

One of the larger vendors that I visited in Bandim market in Bissau operated a sewing machine in his warehouse. In the warehouse he could produce his own nets, as well as curtains and other products for his customers. The vendor I discussed with was on leave from school and had come from Conakry to visit and help his father in the shop.

People in the rural areas are quite mobile. Men, women and children and elders frequently travel long distances (by car, foot, canoes or bicycles) for seasonal work, family visits, funerals etc, and an integral part of such travelling is visiting the market for yourself and your people at home. Subsequently most of the respondents in the countryside (whether in Biombo, Bolama/Bijagos or

Quinara regions) said their nets had been bought in Bandim market in Bissau by themselves or relatives.

Figure 21 a) Quinhamel Sunday market; b) nets in the market. Photos taken 09.September 2007 by BSH.

I visited Quinhamel Sunday-market (38 kilometres from Bissau) at the height of the rainy season. I located only one vendor of bed-nets in the market that had put four nets on stand (Figures 21 a) & b)). He had bought his nets from Bandim market and managed to sell all four nets during the market day.

Figure 22 The total selection in one of the three boutiques in Soga Island. Photo by BSH.

In Soga Island there is very sporadic transport with other islands or with the Bissau capital. The only markets on the island consist of three tiny boutiques that are dispersed on the island. These boutiques mostly sell soap, detergent, candles, matches and small biscuits (Figure 22). I did not see any local provider selling imported agricultural produce. During my stay on the island the only other commercial activities I noticed were trading with locally made products such as

straw mats, straw skirts, wood-work, etc. The few people that had nets from a market source, claimed that their nets were bought by themselves or relatives in Bandim market in Bissau.

The price that people claimed to have paid for their nets varied. Prices were between 3000 and 7500 CFA (between 6 and 15 USD). The nets from the market are generally taller than nets from the distributions (they are up to 2 meters high opposed to 1,5 meters standard height of distributed ITNs). The market nets also often have overlapping openings (often called "nets with a mouth") that consume more netting material than other types of nets. The price of the LLINs is significantly lower or between 5 and 6 dollars per piece with transport to Guinea-Bissau. There are three main reasons that may result in higher price of market supplied bed-nets. These are the amount of netting materials used for each nets, the lack of bulk procurement and the small scale of vendors and bed-net producers in the country. Furthermore, all market supplies of nets seem to be concentrated in the Bandim market in Bissau.

5.3 Insect protection

Soon as I arrived in the Biombo region I started noticing very itchy allergic-bumps on my legs, I soon learned that my bumps were not all due to mosquito-bites, but to bites from a tiny midge. It is commonly called *melga* in Kriol language (Pa. *n'pipa*). From their physical appearance I branded some as being biting midges (genus *ceratopogonidae*), other small culprits could also be co-responsible for the itchy bites such as sand-flies (genus p*hlebotomus*) and black-flies (genus *simulium*). The midges are also sometimes called "no-see-ums" because of their small size of about 1,5 mm in length. They can therefore easily pass through the mesh of normal mosquito nets. People in Guinea-Bissau complain immensely about bite from these midges. In all my study regions they were abundant during the rainy season, with the exception of the urban Bissau portal area.

My informants expressed many different views about which bed-nets were able to keep away the midges and which nets could not. Some claimed that ITNs provided from the health centres were able to keep out both midges and mosquitoes since they had a tight mesh; other people claimed that even the mosquitoes were able to squeeze their way through the mesh of their LLINs. This

was especially the case when referring to *Olyset Nets* but also the *Permanet2.0*. In the Soga Island, *Olyset Nets* were much more common than the *Permanet2.0* LLINs. The mesh-size of *Olyset Nets* is almost double of that of *Permanet2.0* and they are also made from a much stronger material. The *Olyset Net* was generally referred to as "the hard net" (Kr. *es ki risu*). A number of informants in Soga claimed that mosquitoes were able to enter their *Olyset Nets* (seen on the figure 23b).

Some of my informants had bed-nets that were made from light clothing, non-transparent materials. Without any exception, these informants hailed their nets for effectively being able to keep out "even the midges". On the other hand there were many complaints about high temperature and lack of air circulation under this type of nets. Two elderly men with whom I discussed in Biombo were very proud of their nets that they had had for over 20 years; the nets were both made from a satin-like material. Both men added that their net was able to keep the midges away and they preferred heat to the midges.

Figure 23 a) Taylor sewn net from the market from a clothing material. b) LLIN from the distribution in Nov/Dec 2006. As seen on the label the mark is *Olyset Net*.

Most of my respondents acknowledged that insecticide-treatment on their nets (either from re-impregnation campaign or pre-treatment) could kill mosquitoes (Kr. *i ta mata muskitu*). Some of the women I discussed with were willing to concede that midges were killed as well as mosquitoes when coming in contact with insecticide. A few women claimed that no insect was affected and some claimed that even though mosquitoes were affected, midges were able to resist death. A young mother in Biombo explained that she was very glad with the product (insecticide) that was applied on her net during the re-impregnation

campaigns; it was able to prevent her from getting malaria. She explained that the product killed all types of insects, such as bedbugs, mosquitoes and midges.

> if you take your net and put into the liquid in the health centre, the mosquitoes will stop biting you. If the mosquito touches the net it dies […] then after two days, when the liquid has dried, they start entering my bed-net again.

Mosquitoes and midges are an integral part of life in Guinea-Bissau. When chatting on the veranda at night the presence of mosquitoes and midges was generally perceived as normal and people would not make much fuss about it. At most one could lament that mosquitoes were many tonight, but you still sat outside with the family. In the Biombo region it was common that people sitting on the veranda ignite small sticks (Kr. *lainha*) on the veranda to make a little smoke to drive away biting insects. A very common method was also creating wind by slapping your legs with a piece of cloth. If children were on the veranda, they were often protected by the cloth (Kr. *pano*) of their mother that every now and then drove away the mosquitoes from herself and her children without it bothering other activities and conversations. An elderly woman in Biombo claimed that in the old days, when bed-nets were less frequent in the region, it was common to use the so-called mosquito-grass[30] (Kr. *paja di muskitu*) to keep away the mosquitoes during evenings and night. In most areas people explained that it was possible to put the plant on an open fire in the evening to make smoke intended to drive off the mosquitoes and other flies. In Soga Island and Biombo some informants explained that it was also possible to keep the plant fresh in the house to keep away the flies.

Methods of keeping the flies away also seem to be influenced by the availability of side-products from the local agriculture in each area. In Soga Island where bed-nets are relatively scarce, as well as in the Quinara region where bed-net-use is almost universal, the use of different varieties of smoke is a very common method of keeping mosquitoes and midges away after dark. Smoke from different side-products is called "keep away mosquito" (Kr. *afasta muskitu*). The most common types for this purpose were side-products that derive from the

[30] The mosquito-grass (Kr. *paja di muskitu*, Pa. *ubunu n'gwerma* Lat. *Hyptis suaveolens*) is a very common herb in Guinea-Bissau. It has a distinct fragrance, similar to that of the mint.

African oil-palm tree[31] including: palm fruit kernels (Kr. *n'gadji*), palm fruit pulp (Kr. *bagus di cheben*), palm leaves (Kr. *padja di palmeira*) and rice husk that are all used to generate certain types of smoke to irritate flying insects. Furthermore some of my respondents burned the shell from the fruit of the baobab tree (Kr. *kabasera*, Lat. *Adansonia digitata*) to produce smoke to drive away the flying insects.

Figure 24 a) an example of palm fruit kernels in the Soga Island that have been used to make smoke. b) small sticks are ignited to make smoke on the veranda. Photos by BSH.

I asked a group of women in Biombo about the best way to avoid mosquitoes-bites and malaria. They mentioned tidying up around the house, removing stagnant water and sleeping under bed-nets. The women did not however perceive stagnant brackish water as providing breeding grounds for the mosquitoes, but rather as the source of the sickness. The preferred breeding place of the mosquitoes was perceived as being "in the straw ceiling of the house" and the idea of mosquitoes breeding in brackish puddles was perceived as a very peculiar idea.

[31] The African oil palm is called *siti* or *palmeira* in Kriol (lat. *elaeis guineensis*). It is commonly used as building material i.e. for roofing, the fruit provides palm oil.

5.3.1 Practical issues

Most nets were attached by four suspension points. There were many different varieties of suspension points i.e. large nails in the wall or a tall wooden-poles or iron rods that had been grounded into the floor and/or attached to the roofing. Since roofs are not fully rain-proof and inner ceilings are non-existent, an important feature of bed-nets in the rural areas is plastic-bags or sheeting. The sheeting is commonly attached to the same suspension points above the bed-nets to create additional protection against rain and falling debris. Other types of bed-net roofing were for example dry animal skins that had been pegged on the ceiling poles above the bed-net.

Figure 25 a) An example of a plastic-sheeting ceiling over a market bought bed-net in the Quinara region. b) An example of plastic-bags used as ceiling for two LLINs (*Permanet2.0*) in the Biombo region. Photos by BSH.

When asked what type of nets the population in the Biombo region favoured most, a group of health workers in the region claimed that the women generally wanted large and tall nets that "have mouth" (Kr. *ki tene boka*). Having a mouth means that the nets can be opened and closed from the side, the material on the entrance overlaps so when it can be effectively closed when it is tucked under the bed during night (Figure 26). The health workers furthermore claimed that most women said they preferred coloured nets than white ones since they do not look dirty as quickly.

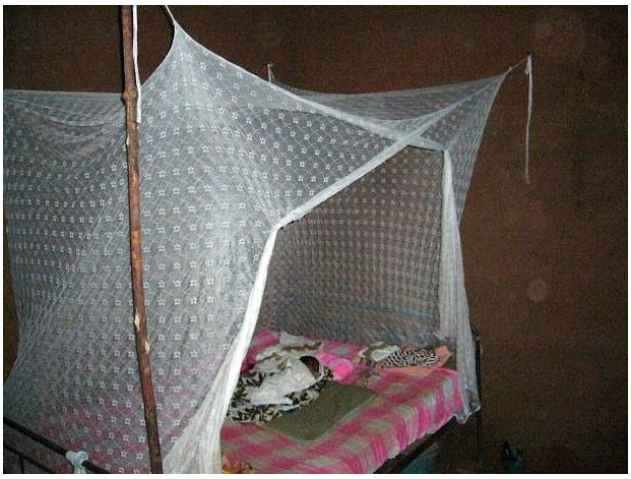

Figure 26 an example of a market supplied net, with a mouth. When this type of net is used in the night the overlapping opening is tucked under the mattress. Photo by BSH.

From my informants in the four study areas individual opinions on the quality of nets varied greatly. One woman from Biombo said she preferred circular nets that are hung from only one point because “they look nicer” and a man from Soga Island claimed the circular nets were much better since they are more durable that nets with four suspension points.

The height of a net was almost always mentioned as an important aspect in focus group discussions in the Quinara and Biombo regions but it was not mentioned in Soga Island. Sleeping places in Soga were often demarcated by straw mats and had walls and ceilings that were quite low. The women from both Biombo and Quinara complained that ITNs from the health centre and from the distributions were too short for their beds and that they did not have a “mouth”. In Soga Island however women found that nets from the distributions were adequately tall. In a couple of cases in the Biombo and Quinara regions, nets that did not have a mouth had been sliced up to make one and a piece of cloth (Kr. *pano*) had been sewed to the upper part of the net so the net could be properly closed during night.

In the study regions there were mixed opinions about whether nets should have large or fine mesh size. Often it boiled down to the question if you prefer midges or “heat” meaning if you want a large or small mesh size. Some women claimed that they did not like lack of air and heat during the night and that they preferred the midge-bites, but most of my respondents however claimed that getting rid of the midge bites was the most important aspect.

Figure 27 Old bed-nets used as fencing reinforcement. Photo by BSH.

Before leaving for Guinea-Bissau, I read news-articles about the use of subsidised and distributed bed-nets being used in poor-countries for different purposes such as fishing nets and wedding gowns. During my research period I never came across a person using new or worn out bed-nets as fishing nets. Worn out nets were however frequently used as reinforcement of fencing material.

Figure 28 Woman from Biombo region shrimp-fishing in a tidal creek. The fishing is done with a traditional shrimp-net (Kr. *ridia di camaron*). The wooden frame is made from roots from a mangrove shrub called *mula* in Papel language (Kr. *tarafi*, Lat. *Avicenia Africana*). Photos by BSH.

To have a better idea of what kinds of nets people were using I followed a woman into the creeks outside her village in Biombo for shrimp fishing. The woman found my idea of using bed-nets for shrimp fishing absurd since it was much too fragile and its mesh was much too fine. The woman was very specific that the mesh-size of her shrimp net needed to be equivalent as the width of her thumb-bone. The more robust *Olyset Nets* are very rare in the Biombo region. They have a much larger mesh than other nets but the mesh size is still much smaller than that of a normal shrimp net.

Figure 29 Sleeping places for some of the people attending the *baloba* festival. Photo by BSH.

When people travel they often bring their bed-nets along with them. During a religious festival in the Biombo region people (mostly older women) arrived from neighbouring villages and camped on the outward-facing veranda of their hosts. Their nets were then attached with two nails to the wall and tied to ceiling poles.

In Soga Island I arrived in November during the harvest period of the highland rice (Kr. *arros di pam-pam*). Many teenagers had come back home from Bubaque island, Bissau or Bolama to help with the harvest. One boy who was attending high-school in Bubaque said that taking part in the harvest of oil palm and palm-vine in December till February helped him earn some money for books and subsistence while schooling in Bubaque. According to Bordonaro (2006, p. 168) who did fieldwork in Bubaque island, the most frequent reason for teenagers dropping out of school is the decision to help the family with the cultivation of rice. Furthermore the cultivation of highland "pam-pam" rice, harvesting oil and wine from palm trees is often done on isolated islands. Families can spend months away from home working in the away from home.

5.4 Environment and malaria in the coastal communities

One of the first things that I noticed, when travelling outside Bissau, were grids of rice cultivation fields along some of the rivers and creeks. Pålsson, et al. (2004) indicated that closeness to these tidal-lowland-rice fields (Kr. *bolanhas*) correlated with increased mosquito abundance in houses. Most villages (Kr. *tabankas*) in

two of my four study areas (in the Biombo and Quinara regions) are situated close to the lowland-rice fields. In Soga Island the inland or highland rice (Kr. *arros di pam-pam*) is the predominant culture. In Soga Island the highland rice fields are generally situated much further away from habitation than in communities that cultivate lowland rice fields. In the fourth study area, in the Bissau Tchapa port, the population did not practice agriculture but mangrove swamps and forests were very close to their dwellings.

There are numerous ways for mosquitoes to enter houses in my study areas. The gross majority of roofs in the area are thatched and no house in the survey had an inner ceiling. Mosquito-entrance into houses is thus possible through the space situated between the wall and the roof in all houses that I visited. Furthermore, no house was equipped with insect netting in door- or window frames and most door- or window shutters did not fit tightly enough to seal it from mosquitoes or even birds in some cases.

Figure 30 Open water well in a study village in Biombo region. Photo by BSH.

Open water wells are not identified as ideal breeding grounds for malaria transmitting mosquitoes; however a study by Pålsson, et al. (2004) indicated that the presence of open-wells in compounds affected mosquito abundance in houses. In one of my study-villages in the Biombo region, there were four sealed-boreholes with hand-pumps dispersed in the village. The boreholes were constructed by a Japanese development project before the military uprising in 1998. Only two of the pumps are functioning today. People generally recognize that water from the boreholes (Kr. *iagu di bumba*) is of much better quality than the water from the open-water wells (Kr. *iagu di fonte*). I found that the farther compounds were located away from the two functioning water pumps; people

increasingly stated that they rely on drinking-water from open wells in their or their neighbour's backyard. However, since all compounds rely on water from open-wells for watering their vegetable gardens, taking showers, etc., the presence of the open-wells was quite equally dispersed in the study village (open well: Figure 30). One large compound that I visited in the study village had a 12 thousand litre open water reservoir, within a room in the house, which was used for making bricks for house-building in the dry season.

Next to newly built or renovated houses there are often large holes that contain puddles during most of the rainy season. The earth used to elevate the floor of the house and the veranda is taken from a hole besides the house. According to my informants a newly built house thus often has a pool of stagnant water in front of the house during the rainy season. The hole gradually fills up in a couple of years with sand and rubbish that is swept into the hole every morning. During the rainy season these holes provide ideal mosquito breeding sites within the family compound.

Situated in the vicinity of the family-compounds there are generally two types of rubbish-holes. Firstly there are compost-holes (Kr. *koba di estruma*) that most often belong to women in the household that gather organic waste that they can use as fertilizer for their vegetable gardens (Kr. *orta kamati*), secondly there are the normal rubbish holes (Kr. *koba di lichu*) that are used for all non-organic rubbish. Most holes are both small in size and are situated under trees or vegetation in porous soil and therefore rarely develop pools.

Another possible mosquito breeding place found within some family-compounds is created by pigs. The pigs dig holes that fill with water in the rainy season; the pigs are then able to cool down during the day by rolling around in the pool. The head of one compound said he was well aware of how mosquitoes bred in stagnant water and could cause malaria, but he claimed that he was still not able to stop his pigs from digging holes around the house. The average number of pigs per compound in the two study villages in Biombo was 5,33 pigs per compound and only 23 compounds (or 12,9%) out of the 178 compounds did not own any pigs. A study by Pålsson, et al. (2004), found a correlation between ownership of pigs and mosquito abundance in houses.

Figure 31 A pig cooling down beside the house. Behind the pig there is a newly constructed pit-latrine with a cement slab. Photo taken 19. September by BSH.

The household study in the Biombo region found a total of 132 pit latrines spread across the two study-villages. An informant that oversees a sanitation cooperation-project with Unicef, Ministry of Public Health, WHO and a local NGO in the region, claimed that only 10 years ago latrines were very rare in the region and that people were used to going to the bush. Most of the latrines are situated within and owned by family-compounds, but a few latrines are public. The latrines are almost without exception non-roofed. The walls are usually made from 4 wooden poles and plastic-sheeting or plastic-bags. The toilet slabs are fabricated within family-compounds and they are provided with a cover for the latrine-hole. Latrines are however regularly left open and the cover is lost. Pit-latrines do not provide ideal breeding places for *Anopheles* mosquitoes but are favourable breeding sites for *Culex* mosquitoes that are vectors of other diseases i.e. *Bancroft filariasis* (Rozendaal, 1997, p. 15). A total of 101 family-compounds (or 56,7%) had a latrine. A few compounds that did not have latrines claimed most family members use the neighbours' latrine. Sixty-seven compounds (or 37,6%) claimed that they did not use pit-latrines.

In the two household study villages there were a total of 178 family-compounds (Kr. *moranças*) that included 672 houses (Kr. *kasa*). Out of the total number of houses there were 50 houses that are constructed in a circle around an inundated patio (Pa. *mehrumehr*). These structues represent 7,4% of all houses in the two villages. The rest (92,7%) are mostly smaller houses/huts (Pa. *kukufoi*).

The *mehrumehr* houses have a dug-down, un-roofed patio in the centre of the house that is inundated during the rainy season. There are generally two roofed verandas in the *mehrumehr* houses (inwards and outwards-facing). The kitchen is generally situated under the inwards-facing veranda and the entrance to sleeping quarters is usually through the inward-facing veranda.

Figure 32 a) An example of a *mehrumehr* in the Biombo region during the rainy season. Photo taken 06. September 2007 by BSH. b) The same *mehrumehr* in the beginning of the dry season. Photo taken 15. November 2007 by BSH.

Figure 33 a) Mosquitoes are breeding in a pool in the patio of the *mehrumehr* house. Photo taken 06.September 2007 by BSH. b) Taken within the same house, under the inward facing veranda where an elderly disabled man sleeps on a bank without a bed-net. Photo taken 12.September 2007 by BSH.

The patio or pit[32] serves both as a working place for the family in the day time during the dry season and creates an open air stable for the larger household

[32] According to Blazejewicz, Lund, Schönning, & Steinck (1981, p. 107) large houses with inundated patios were formerly common in all parts of Manjako-land. This construction type was almost eradicated by a tax

animals in the night (i.e., cows, pork and goats). During the rainy season the patio becomes muddy and animals prefer sleeping under the inward facing veranda (Figures 32 & 33) and people sit under the inward or outward facing verandas of the house when working at home. In most houses some water is also harvested in basins under the verandas during the rainy season. According all informants I spoke to in the Biombo region, it is very unsafe to keep animals roaming around outside the house during night. People generally claim animals can be lost to Balanta[33] thieves or killed by hyenas (Kr. *lubu*). In the smaller houses (Pa. *kukufoi*) animals are kept in rooms inside the house during the night.

During the rainy season the patio/pit in the *mehrumehr* houses provides ideal breeding grounds for the most efficient *falciparum* malaria vectors *A. gambiae* s.s. and *A. Arabiensis* [34], within the compound. Although the patio/pit has a drainage outlet, it still remains muddy and contains puddles of water during most of the rainy season.

So-called *bolanhas* are lowland rice paddies that are cultivated on reclaimed tidal grounds (mostly former mangrove swamps). Dykes (Kr. *orik*) have been erected keep out salty-tidal waters from the freshwater creeks. These dykes are traditionally built and maintained by a large community work effort. According to van Gent and Ukkerman (1993), the *bolanha* rice cultivation is associated with the Balanta ethnic group and has been widely practiced for at least a century. The system has been deteriorating since in the 1960s, since the beginning of the independence struggle (that resulted in a lack of man-power in the villages). The decline of the *bolanhas* is generally linked with large-scale changes in the social-structure that has made it ever harder to socially-mobilize human labour to maintain the dykes. The deterioration of the *bolanha* rice

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system of the Portuguese that imposed a tax-rate based on the number of rooms in each house. Today, this type of traditional architecture only exists in three areas in Guinea-Bissau: in the Papel Biombo-region and in the predominantly Manjako Pecixe and Jeta Islands (situated just outside the Biombo-peninsula).

[33] There are no Balanta villages close to my study villages, but the Balanta however comprises of about 20% of the population in Biombo Region (Einarsdóttir, 2004, p. 10).

[34] These *Anopheles* species are the most efficient vectors of *falciparum* malaria and *Bankroft filariasis*. They prefer breeding in shallow and brackish water that is exposed to the sun and is free of vegetation. Hatching of larvae takes between 8 and 12 days depending on the temperature and these species rarely exceed a perimeter of 2 km (Hervy, Le Goff, Geoffroy, Hervé, Manga, & Brunhes, 1998)

growing-system has also been aggravated by decreasing precipitation and increased sedimentation of rivers (pp. 110-111).

The *bolanha* cultivation was quickly passed on from the Balanta ethnic group to other communities habiting the coastline of the country. In the Biombo region, where I did most of my fieldwork, many dykes are now facing gradual deterioration due to under-maintenance and the rice fields themselves are gradually being damaged by the entrance of salty tidal waters. According to informants in the Biombo region, the unavailability of large community work-efforts has prompted international aid organisations (such as the WFP) to finance the rehabilitation of some of the dykes in Biombo region. The programs have used both heavy machinery and paid labour to perform work that formerly relied on an unpaid collective work mobilised by local chiefs and kings.

Figure 34 shows an aerial view of a dyke during the dry season in the Biombo region. The dyke's function is to block the entry of the salty tidal waters into the fresh water creek. During the rainy season the *bolanha*-fields on the banks of the creeks are inunded. After the soil has been washed and de-salinated by rain-water, fields are manually laboured for cultivation of lowland rice (Kr. *arros di bolanha*). Figure 35 shows two brothers from Dorse village preparing their fields before the rice-grass (Kr. *ipan,* Pa. *omano*) can be transplantated in the *bolanha* (note that the same fields are also seen on Figure 34).

Figure 34 Dyke close to Dorse village in Biombo region (Google Earth, 2003)

Figure 35 Brothers working in the field with long knifes (Kr. *arado*, Pa. *unku*). Photo by BSH.

Figure 36 shows an old *bolanha* rice field has been transformed into a WFP/Unicef sponsored small-scale salt production and iodisation project. Small basins or pits (Kr. *kanteru*) have been dug in the fields and industrial plastic sheeting put inside the holes. During the dry season the field is flooded with tidal water and then the gates are closed again. After the sea water has evaporated, salt is collected and iodised in a warehouse in the village. A total of 315 people (mostly women) take part in this Unicef funded salt production project.

Figure 36 Salt production in an old *bolanha* rice field. Photo by BSH.

The *bolanha* fields are generally situated close to villages along the rivers and creeks in Guinea-Bissau. The most efficient malaria vector species rarely fly more than two kilometres away from their breeding site (Rozendaal, 1997). With the gradual destruction of the dykes in mind, it is therefore very likely that the salt

water breeding *A. melas* (a sub species of *A. gambiae*) has been gaining breeding grounds close to human habitation since in the 1960s.

5.5 Treatment of malaria

I engaged in conversations about malaria and mosquitoes throughout my study period. The discussions were mostly informal and my informants were women, men, youths, adults and elderly people from various professions. Discussions took place in all four study areas but majority were in Biombo due to the long period spent in that area.

Generally, people in all study areas had heard of malaria, some people called it "malaria" (Kr. *paludismo*) and others "fever" or "night-fever" (Kr. *kurpu kinti di noite*)[35]. Ideas on the disease-cycle of malaria and who is susceptible to it are however diverse. Majority of my respondents knew that malaria was transmitted through the bite of the mosquito fly. According to a group of women I discussed with in the Biombo region, the malaria disease originates in dirty stagnant water. The mosquito becomes very thirsty after dark and goes on to drink the dirty water as well as drinking blood from people in their sleep conveying the dirt (malaria) to the human body. My informants however noted that people do not automatically acquire malaria when bitten by mosquitoes. In fact, mosquitoes and bites are perceived as a very normal part of life and the environment.

Small children and sometimes pregnant women were however most often mentioned as vulnerable to falling sick with malaria. The fragility of these two groups was indicated both by the fact that they fall sick more often but also by the helplessness of children when they fall sick: "they cannot walk or eat food when they are sick." One woman claimed that resistance against malaria was a question of the quality of your blood. The woman, for instance, claimed to sleep without a bed-net, and still she could not catch malaria because her blood was strong. People with weak blood could on the other hand easily fall sick to malaria. When I asked the woman what happened when women with "strong" blood get pregnant, she responded quickly that "getting pregnant spoils your blood".

Most of my respondents said that their first response to a child getting sick in the family was to head straight to the next health-centre or hospital. I asked a

[35] See domestic diagnosis of childhood illnesses in Einarsdóttir (2004, pp. 114-115)

first wife of a compound in Biombo region about who in her family had the highest responsibility to pay for the hospital treatment of a sick child. She first mentioned the parents of the child, but later found my question absurd saying that "the person that has money pays, a life is much more valuable than money". The woman however said that grown-ups should be able to take care of themselves, those that drink alcohol should be able to make money for their own hospital-treatment. The woman furthermore said that children could sometimes be treated at home with herbal medicine or given revitalizing herbs or special foods to give them enough strength to reach the hospital. According to the woman, home-treatment of sickness was a kind of first-aid before seeking help in the hospital. Herbal treatment of fever symptoms in her compound both consisted of bathing the child's body with a herbal infusions as well as giving the child small sips from the infusion. That same day, a child was being treated for fever by her grandmother in the compound. The woman had prepared a herbal infusion from a local herb called *ubanji* in Papel (Kr. *padja santa*, Lat. *senna podocarpa*). According to the woman, adults could also be treated with this infusion by adding three other types of leaves with the *ubanji* leaves.

Apart from herbal medicine being commonly used within family-compounds, it is possible to heal some diseases through the use of spirits. According to Einarsdóttir (2004) most diseases are considered to be curable if they are diagnosed correctly and treated swiftly but chronic conditions are often diagnosed as having a spiritual cause. A small shrine normally belongs to each family-compound. This shrine is home to the spirit of the compound (Kr. *kasa di iran di morança*). The spirits can be used for both good and bad deeds. They can be used to prevent or cure child diseases. In case of sickness it is common give extra offerings such as rice and alcohol (p. 115).

There are also two types of religious specialists in Papel communities in the Biombo region, these are called *balobeiru* and *djambakus.* These specialists can be either male or female and perform different kinds of ceremonies to divine the future, fight sorcery, epidemics or to cure illnesses through the use of spirits. The *djambakus* often specialise in curing with local herbal medicine (Kr. *mesinju di tera*), but they also command a powerful spirit (Kr. *iran*) that they can use for detecting sorcery and healing certain sicknesses.

An elderly man that was attending a 10 day religious *baloba*-festival in one of my study villages in the Biombo region claimed the local Papel ceremonies were a very important aspect of life and very able to cure and prevent illnesses, but only with the Papel people: "our traditional ways/medicine is for us" (Kr. *terra di nos, es di nos*). He however said that nowadays even the Papel did not dare to take risks with their health "if I start seeing fever, I come running for the white [medicine]"[36].

Many of my younger informants seemed uneasy speaking to me about the traditional Papel ceremonies. A young mother I visited in Biombo echoed the common uttering that only "other people make ceremonies and go to *djambakus* when their child falls sick". The mother said she herself only sought help in the hospital. An older man living in the same compound cut into our conversation and said that he believed that malaria and other illnesses could definitely be cured by people that know medicinal plants as well as by people who know how to cure with the spirits.

A health worker in the area claimed that "all the Papel in Biombo region make ceremonies when a family member gets sick". He however conceded that the population was gradually giving more and more importance to the so-called "white man's medicine" (Kr. *mesinju di branku*) provided by the health centres, the health worker still claimed that people were often too late in responding to sickness by consulting the health centre.

[36] In this sense "white" is a short form for of "medicine from the hospital" (Kr. *mesinju di branku*)

6 DISCUSSION

In this thesis I have presented the history of malaria and some of the strategies that have been used in the fight against the disease. For thousands of years the fight was against an invisible enemy but, finally roughly one hundred years ago the vector of the disease – the *Anopheles* mosquito was identified. Since then the fight has been largely directed against the mosquito fly. During this period there have been many success stories and the total disease burden of malaria has been much lowered in the world since the beginning of the 20th century. However, the success of these campaigns is far from absolute. In the last sixty years the burden of malaria has become somewhat of an African problem, and every year African families grieve the death of almost one million children under the age of five years due to the disease.

Bed-nets are an old protection tool against biting insects that has been used as far back as ancient Greece. Their use has furthermore been documented in Africa for centuries including The Gambia. Compared to other African countries the use of bed-nets has been exceptionally high in Guinea-Bissau and The Gambia. Majority of bed-nets in Africa are untreated with insecticides (IBRD/WB, 2005). My findings from Guinea-Bissau furthermore show that these nets are not gifts from humanitarian organisations but bought by poor individuals with their hard earned money, often at a high price. In my research in Guinea-Bissau, bed-net use in two of the four study regions was close a 100%, and that the majority of the nets derived from the private market. The high level of market bought nets indicates the importance people give to sleeping under bed-nets. In two of the study regions, one small Island community and the other a work camp of women in Bissau port showed much lower rates of bed-nets use. These two areas have much lower rates of market bought nets that most probably results from a lack of access to the markets, due to distance (in the case of Soga Island) and the high cost of bed-nets.

I performed a market survey in the four study areas and found that the market almost uniquely supplies locally (and manually) sewn nets that are not treated with insecticides. The market does not supply any type of ITNs or LLINs.

I did not gather information on eventual import barriers for insecticide treated products (such as ITNs and LLINs) to the country, but insecticide-treated-nets are not supplied by the market. The price of bed-nets on sale is furthermore very elevated costing between 6 and 15 USD, compared to approximately 5 USD for an LLIN. The nets come in a variety of designs, colours and shapes. In my view, the most effective way to increase the use of insecticide treated nets is first of all to make sure that the population has access to good quality nets that fit their needs, at a reasonable price. I believe this could be achieved by encouraging private market-supply of ready-made ITNs and LLINs.

Market supply of bed-nets in Guinea Bissau is concentrated in the Bandim market in Bissau. Market supply is quasi non-existent in the rural areas. The need to carry out effective "keep up" programs in the rural areas is important. Other options of increasing supply to bed-nets in the rural areas would be to offer LLINs for sale in local health centres or in local-shops in the country-side.

When available, the Ministry of Public Health furthermore carries out a continuous distribution of ITNs to infants during their routine vaccination and pregnant women during pre-natal consultations. Despite funding problems, these programs have been maintained by the Ministry of Public Health. The most impressive reality is that in this "fragile state", there is a well functioning local distribution system that can be used on a national scale to access the most vulnerable people. To date, both yearly impregnation programs and continuous ITNs distributions have chronically suffered from the lack of funds. It is crucial for all partners of the Ministry of Public Health to assume long term commitments that would also help to build popular trust toward the state-run health centres.

An integrated national distribution of roughly 240 thousand LLINs (as well as vitamin A supplementation and de-worming) for children under the age of 5 years took place in Guinea-Bissau in November and December 2006 and a year later in the Bissau capital area. The campaign was led by the Ministry of Public Health of Guinea-Bissau in collaboration with its main partners, including Unicef. My research indicates that LLINs reached their target group in all study areas. The use of the LLINs is however not limited to children within the family. Despite some confusions if pregnant women were included in the distribution or not, the dissemination of information and community mobilisation was done effectively

through a collaboration of official and traditional authorities on the local level. Furthermore, despite initial chaos in the LLIN distribution campaign in Bissau, which I took part in went well despite the lack of some important material resources (such as contingency funds, batteries for megaphones and transport).

One of the most important lessons we have learnt during a hundred years of systematic fight against the disease is the need to integrate activities and planning into local administrative structures as well as focussing on multiple methods instead of over-emphasising on "magic solutions" that do not really exist. Though the philosophy of integrated approaches has both influenced the work methods of international organisations (such as WHO) and is generally religiously advocated in reports, the same organisations are still today criticised for overemphasising on vector control and being too vertical in their cooperation – or imposing policies.

In my thesis, I have tried to underline the connection between malaria and the larger issue of human development. It would be naïve to explain the eradication of malaria in the US and Western Europe by something as simple as killing the mosquitoes and larvae. Improved social conditions, including housing, education, health care and other infrastructure, etc. were instrumental in breaking the cycle of transmission. The social reformers in Italy had realised this inter-connection by the beginning of the 20th century. The rising malaria burden in Africa from the eighties and onwards also coincides with the so-called "lost decades" in development. Furthermore, the connection between malaria and declining productivity emphasises the importance of looking at the disease in the larger perspective of "human development" addressing issue of poverty.

The population in my study areas (mostly rural) revealed fragmented knowledge of the malaria disease cycle. Some respondents were able to explain the cycle perfectly but most people had to use their imagination to form a whole from bits of information they had heard. Importantly, none of the explanations that I recorded would be able to encourage habits that increase the risk of getting malaria. As an example, I spoke to women in the Biombo region that explained that mosquitoes bred in the ceiling of their houses. The women still maintained that removing stagnant water and cleaning around the house was important aspect in fighting mosquitoes and malaria. In their view the thirsty mosquito first needed

to get contaminated by drinking the dirty water before being able to convey the disease to their body. The information of removing stagnant water has thus been put into a new context, but removing stagnant water and cleaning around the house has not lost its importance in domestic malaria protection.

Evidence has shown that the most efficient malaria vectors rarely exceed a perimeter of two kilometres. Closeness to breeding sites has furthermore been shown to be an important factor in mosquito abundance in houses. The most important man-made breeding sites in my study areas are: irrigated rice-fields, central patios within circular houses in the Biombo region, holes dug by pigs, open-water wells and holes that have been dug to elevate new constructions. Another question arises when taking into account the increased salination of water in the coastal areas following the destruction of irrigated rice fields. The role of salt breeding *A. melas* in malaria transmission has been widely contested. Where it is the principal vector species, it has been identified by some studies as an effective vector of the disease. More studies should be conducted to assess further the vectoral capacity of *A. melas* in communities living close to the coast or close to mangrove areas.

Kofoed (2006) has indicated the burden of the disease is highest in the beginning of the rainy season and shortly after the rainy season ends. This increase of malaria cases in the end of the rainy season could be explained by factors such as decreasing ITNs use when the rains end. My qualitative data indicates that people put away their bed-nets at the end of the rainy season when the levels of biting insects have decreased. This is done both to protect the nets from wear and tear as well as limiting the time spent for washing laundry. It is important to base interventions on the these findings, and try to focus increasingly on giving information on the transmission cycle and seasons of malaria, that do not necessarily correlate with mosquito abundance. My research showed that bed-nets are not only used to prevent malaria infection but that they are also used to prevent nuisance insects at night. I did not find people using the nets for other reasons, such as fishing.

Today, the objective in the fight against malaria is neither total malaria nor mosquito eradication. Malaria control efforts today focus on how to live with malaria and mosquitoes. These efforts both rely on long term funding

commitments and cooperation as well as methods that malarial countries are capable of sustaining after interventions. Malaria control efforts are also faced with the reoccurring problems of adaptation of the mosquito vector to insecticides and adaptation of the malaria parasite to malaria drugs. With all these factors in mind the crucial question is not whether campaigns or programs like the Roll Back Malaria Program or the UN Millennium Development Goals reach their objectives in time. What is most important is the question if these commitments will be sustained.

7 CONCLUSIONS

Two hundred and forty thousand LLINs were distributed to children less than five years of age in a national distribution led by the Ministry of Public Health in Guinea Bissau and Unicef. The LLINs reached their target group, but their use was however not limited to children under 59 months, the initial target group. Bed-net-use in many areas in Guinea-Bissau is high, above 90%, with many individuals sleeping under each net. Protection against malaria and insect protection for improved sleep are the most important motives for sleeping under bed-nets. No other use of nets was identified. As much as 80% of bed-nets in circulation in some regions are bought untreated and unsubsidised from local markets. A yearly re-impregnation program has been implemented with a two year interval that leaves bed-nets untreated every-other year. Opinions on the most valued design of bed-nets are mixed but most women (apart from women in the Soga Island) prefer a small mesh size to prevent the bites of midges; as well as taller nets (2 metres) that have an overlapping opening, for aesthetic reasons. Very remote rural areas, i.e. small islands, have limited access the markets due to high prices and distances, these areas show much lower rates of bed-net use and need special attention.

The distribution structure of the Ministry of Public Health is an important resource. There is also a clear willingness to pay for and to use bed-nets in most communities in Guinea-Bissau. It is important to ensure stable funding for the continuous ITNs distribution and re-treatment programs with long-term commitments. The roughly hundred year history of the fight against the disease has shown that malaria cannot be eradicated with simple “magic solutions”. Different methods must be integrated to achieve results and the connection between malaria and poverty need to be addressed.

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9 APPENDIXES

9.1 ITN questionnaire (translated from Kriol to English)

QUESTIONNAIRE FOR <u>WOMEN</u>
<u>WITH CHILDREN LESSS THAT 6 YEARS OF AGE</u> OR <u>WOMENTHAT ARE PREGNANT</u>

Date/Tempu	[/ 11 / 2007 / - ____:____]	
GPS Coord.	N _____ W _____	
	NAME / (#)	**# BANDIM**
Region	[ ]	[ ]
Sector	[ ]	[ ]
Village / neighborhood	[ ]	[ ]
Compound	[ ]	[ ]
House	[ ]	[ ]
Name	[ ]	[ ]
Ethnic group	[ ]	[ ]
Age	[years]	

Pregancies : ____(#) Twins : _____(#)
Dead at birth (miscarriages) : _____(#) Children lost : _____(#)
Children living (today) : ____(#) male : _____(#) female : _____(#)

---

1. Did you hear about the distribution campaign of the Ministry of Health and Unicef in Nov. 2006?
   (a) Yes / No
   (b) How did you hear? **(Tick all correct answers)**
   _____
   (For example: hospital visit, At the time of the distribution, Radio, Poster, Chief of the village, Neighbor, Family member, Journal, Social Communicator)

2. Do you know the selection criteria for receiving a net during the distribution in Nov. 2006?
   (a) For women: Yes / No (verify)
   (b) For children: Yes / No (verify)

3. Did you or your child receive a bed-net during the distribution campaign in Nov. 2006?
   (a) _____# Bed-nets

4. Did anyone in your household (pregnant woman or child U5) not receive a bed-net during the distribution in Nov. 2006?
   (a) Yes / No
   (b) Why not? **(Tick all correct answers)**
      i. Travel.
      ii. No card from the hospital (vaccination or pregnancy)
      iii. Did not know where the campaign took place
      iv. The nets finished
      v. No one came to distribute nets
      vi. Distribution was too far away
      vii. The line was too long
      viii. Other_____

5. Last night, how many sleeping places did you have in the house? ____ (#)

6. How many sleeping rooms do you have in this house? ____ (#)

7. How many:
   (a) Children under 5 years of age slept in the house yesterday night? ____ (#)
   (b) Pregnant women slept in the house yesterday night? ____ (#)

8. In one year how many times do you wash your nets?
   (a) _____ #times/year _____ Soap type _____ Drying (sun or shade)

9. Please, could I see all bed-nets you have in your house? **(ITNs questionnaire below in Kriol)**

	Info Tenda					**Djintis domiu na tenda aonti di noite**				
#	Typa (ITN, Long lasting, Utros)	Nunde (Feira /Don / Distrib / Csaude)	Ultimo tretam (#mesos)	Tenda utilis (Todo Ano / T. Di Chuba / NS	Stata di Tenda (+ / 0 / -)	Criancas menos di 6 mesos	Criansas entre 6m - 5 anos	Mindjers gravidas	Mininos entre 5 - 15 anos	Garandis (mas di 15 anos)
1	IT / LI / Ut	F / Do / Di / Cs								
2	IT / LI / Ut	F / Do / Di / Cs								
3	IT / LI / Ut	F / Do / Di / Cs								
4	IT / LI / Ut	F / Do / Di / Cs								
5	IT / LI / Ut	F / Do / Di / Cs								
6	IT / LI / Ut	F / Do / Di / Cs								
7	IT / LI / Ut	F / Do / Di / Cs								
8	IT / LI / Ut	F / Do / Di / Cs								
9	IT / LI / Ut	F / Do / Di / Cs								
10	IT / LI / Ut	F / Do / Di / Cs								

10. How many people slept without a net in this house during the rainy season?
   (a) If someone sleeps without a net, how many # Male: _____ # Female _____
      i. # children under 5 years _____
      ii. # physically handicapped _____
      iii. # mentally handicapped _____
      iv. # elderly people _____
      v. # have alcohol problems _____
      vi. other _____

11. Do you know the selection criteria for receiving bed-nets from the Health centers?
   (a) For women: Yes / No (verify)
   (b) For children: Yes / No (verify)

12. Do you normally use other methods of keeping mosquitoes away?
   (a) Mosquito repellent: Coils, Paja di moskitu, Smoke, Wind
   (b) Insecticides: Liquid, Baygon, Supra-supra (dust) etc.
   (c) Other ways (ceremonies, etc) _____

13. Other relevant issues

_____

_____

9.2 Household questionnaire (two sheets)

#	#	House						Education Adults				Education Children				Sanitation							
Village	Code	Name Chief of the Compound	# Houses	# Houses MeruMehr type	# people living in compound	0-5 years old	Pregnant women	Illiterate women (+15 years)	women that know how to read (+15 years)	Illiterate men (+15 years)	men that know how to read (+15 years)	Children that attend kindergarden	Children that dont attend kindergarden	Children (7-14 years old) that attend school	Children (7-14 years old) that dont attend school	# wells	People drink well water	# Latrine (GPS mark)	People use latrine	# rubbish and compost holes	# stagnant water in compound	kitchen outside	kitchen inside

Bed-nets Info		Who sleeps without nets									Animals								Economic activities						
# Bed-nets from market	# Bed-nets from CS and distribution	# sleeping without nets	Masc	Fem	children 0-5years	elderly people	physically disabled	mentally ill	alchohol problem	Other	**Cows**	Sleeping inside/outside	**Pigs**	Sleeping inside/outside	**Goats**	Sleeping inside/outside	**Chicken**	Sleeping inside/outside	Fishing	Rice fields	Cashew fields	Vegetable gardens	Weaving	money from abroad	Commercial activities

9.3 Frequency tables and calculations on bed-nets use

Frequency tables (SPSS)

		Treatment Status	Use period of bed-net	State of bed-net	Net type	Number of people in the sleeping place
N	Valid	282	290	353	354	354
	Missing	72	64	1	0	0

Treatment Status

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	Impregnated	151	42,7	53,5	53,5
	Not Impregnated	67	18,9	23,8	77,3
	No net	64	18,1	22,7	100,0
	Total	**282**	**79,7**	**100,0**	
Missing	Dont know	72	20,3		
Total		**354**	**100,0**		

Use period of bed-net

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	All year long	262	74,0	90,3	90,3
	Rainy Season	28	7,9	9,7	100,0
	Total	**290**	**81,9**	**100,0**	
Missing	No net	64	18,1		
Total		**354**	**100,0**		

State of bed-net

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	New net without holes	160	45,2	45,3	45,3
	Repaired net	57	16,1	16,1	61,5
	Unrepaired holes	72	20,3	20,4	81,9
	No net	64	18,1	18,1	100,0
	Total	**353**	**99,7**	**100,0**	
Missing	Dont know	1	,3		
Total		**354**	**100,0**		

Net type

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	LLIN kampagna	59	16,7	16,7	16,7
	ITN CS	29	8,2	8,2	24,9
	Feira	201	56,8	56,8	81,6
	Tenda ka ten	64	18,1	18,1	99,7
	ka sibi	1	,3	,3	100,0
	Total	**354**	**100,0**	**100,0**	

Number of people in the sleeping place

		Frequency	Percent	Valid Percent	Cumulative Percent
Valid	1,00	98	27,7	27,7	27,7
	2,00	148	41,8	41,8	69,5
	3,00	76	21,5	21,5	91,0
	4,00	26	7,3	7,3	98,3
	5,00	4	1,1	1,1	99,4
	6,00	2	,6	,6	100,0
	Total	**354**	**100,0**	**100,0**	

Frequency table for bed-net survey (Excel)

N° of	Quinara	Soga Isl	Bissau Port	Biombo	Total	Valid
Repondents (Women)	55	33	5	8	**101**	**101**
Houses	32	29	5	7	**73**	**73**
Beds	190	114	22	29	**355**	**353**
Persons in Beds	372	227	78	81	**758**	**756**

Participants		
Childr_U6months	15	2,6
Childr_6m_5yrs	146	24,9
Pregnant_Women	17	2,9
Childr_5_15yrs	148	25,2
Adults	261	44,5
Total	**587**	**100,0**

Proportion of bed-nets treated with Insecticides in four study regions

Study Regions	Age groups	Treated Net	Non Treated	No Net	Total		Age groups	Treated Net	Non Treated	No Net	Total	% of Reg	% of Total
Quinara	Childr_U6months	60,0	40,0	0,0	**100,0**		Childr_U6months	3	2	0	5	33,3	
	Childr_6m_5yrs	72,4	27,6	0,0	**100,0**		Childr_6m_5yrs	63	24	0	87	59,6	
	Pregnant_Women	75,0	25,0	0,0	**100,0**		Pregnant_Women	6	2	0	8	47,1	**54,2**
	Childr_5_15yrs	71,6	28,4	0,0	**100,0**		Childr_5_15yrs	58	23	0	81	54,7	
	Adults	56,9	39,4	3,6	**100,0**		Adults	78	54	5	137	52,5	
							Total	**208**	**105**	**5**	**318**		
							%	65,4	33,0	1,6	100,0		
Soga	Childr_U6months	20,0	0,0	80,0	**100,0**		Childr_U6months	1	0	4	5	33,3	
	Childr_6m_5yrs	43,2	21,6	35,1	**100,0**		Childr_6m_5yrs	16	8	13	37	25,3	
	Pregnant_Women	0,0	0,0	100,0	**100,0**		Pregnant_Women	0	0	3	3	17,6	**26,9**
	Childr_5_15yrs	26,3	2,6	71,1	**100,0**		Childr_5_15yrs	10	1	27	38	25,7	
	Adults	26,7	10,7	62,7	**100,0**		Adults	20	8	47	75	28,7	
							Total	**47**	**17**	**94**	**158**		
							%	29,7	10,8	59,5	100,0		
Bissau porto	Childr_U6months	100,0	0,0	0,0	**100,0**		Childr_U6months	1	0	0	1	6,7	
	Childr_6m_5yrs	36,4	0,0	63,6	**100,0**		Childr_6m_5yrs	4	0	7	11	7,5	
	Pregnant_Women	40,0	0,0	60,0	**100,0**		Pregnant_Women	2	0	3	5	29,4	**5,5**
	Childr_5_15yrs	0,0	0,0	100,0	**100,0**		Childr_5_15yrs	0	0	1	1	0,7	
	Adults	42,9	0,0	57,1	**100,0**		Adults	6	0	8	14	5,4	
							Total	**13**	**0**	**19**	**32**		
							%	40,6	0,0	59,4	100,0		
Biombo	Childr_U6months	100,0	0,0	0,0	**100,0**		Childr_U6months	4	0	0	4	26,7	
	Childr_6m_5yrs	100,0	0,0	0,0	**100,0**		Childr_6m_5yrs	11	0	0	11	7,5	
	Pregnant_Women	100,0	0,0	0,0	**100,0**		Pregnant_Women	1	0	0	1	5,9	**13,5**
	Childr_5_15yrs	100,0	0,0	0,0	**100,0**		Childr_5_15yrs	28	0	0	28	18,9	
	Adults	82,9	11,4	5,7	**100,0**		Adults	29	4	2	35	13,4	
							Total	**73**	**4**	**2**	**79**		
							%	92,4	5,1	2,5	100,0		
									Grand Total		**587**		**100**

171 persons sleeping in 72 sleeping places were not sure of the treatment status of their bed-net (accounted for as missing values)

Total		
Childr_U6months	20	2,6
Childr_6m_5yrs	197	26,1
Pregnant_Women	28	3,7
Childr_5_15yrs	169	22,4
Adults	342	45,2
Total	**756**	**100,0**

Status of net used by region and by age group (status: New, Repaired, Holes, No net)

Study Regions	Age groups	New without holes	Repaired	Unrepaired holes	No net	Total		Age groups	New without holes	Repaired	Unrepaired holes	No net	Total	% of Age	% of Total
Quinara	Childr_U6months	83,3	0,0	16,7	0,0	**100,0**		Childr_U6months	5	0	1	0	6	30,0	
	Childr_6m_5yrs	62,5	21,2	16,3	0,0	**100,0**		Childr_6m_5yrs	65	22	17	0	104	52,8	
	Pregnant_Women	63,6	9,1	27,3	0,0	**100,0**		Pregnant_Women	7	1	3	0	11	39,3	**48,9**
	Childr_5_15yrs	46,7	21,7	31,5	0,0	**100,0**		Childr_5_15yrs	43	20	29	0	92	54,4	
	Adults	62,4	17,2	17,2	3,2	**100,0**		Adults	98	27	27	5	157	45,9	
								Total	**218**	**70**	**77**	**5**	**370**		
								%	58,9	18,9	20,8	1,4	100,0		
Soga	Childr_U6months	33,3	22,2	0,0	44,4	**100,0**		Childr_U6months	3	2	0	4	9	45,0	
	Childr_6m_5yrs	34,5	8,6	34,5	22,4	**100,0**		Childr_6m_5yrs	20	5	20	13	58	29,4	
	Pregnant_Women	16,7	0,0	33,3	50,0	**100,0**		Pregnant_Women	1	0	2	3	6	21,4	**30,0**
	Childr_5_15yrs	25,5	2,1	14,9	57,4	**100,0**		Childr_5_15yrs	12	1	7	27	47	27,8	
	Adults	29,9	8,4	17,8	43,9	**100,0**		Adults	32	9	19	47	107	31,3	
								Total	**68**	**17**	**48**	**94**	**227**		
								%	30,0	7,5	21,1	41,4	100,0		
Bissau porto	Childr_U6months	100,0	0,0	0,0	0,0	**100,0**		Childr_U6months	1	0	0	0	1	5,0	
	Childr_6m_5yrs	4,3	21,7	43,5	30,4	**100,0**		Childr_6m_5yrs	1	5	10	7	23	11,7	
	Pregnant_Women	20,0	10,0	40,0	30,0	**100,0**		Pregnant_Women	2	1	4	3	10	35,7	**10,3**
	Childr_5_15yrs	0,0	0,0	50,0	50,0	**100,0**		Childr_5_15yrs	0	0	1	1	2	1,2	
	Adults	11,9	28,6	40,5	19,0	**100,0**		Adults	5	12	17	8	42	12,3	
								Total	**9**	**18**	**32**	**19**	**78**		
								%	11,5	23,1	41,0	24,4	100,0		
Biombo	Childr_U6months	100,0	0,0	0,0	0,0	**100,0**		Childr_U6months	4	0	0	0	4	20,0	
	Childr_6m_5yrs	91,7	0,0	8,3	0,0	**100,0**		Childr_6m_5yrs	11	0	1	0	12	6,1	
	Pregnant_Women	0,0	100,0	0,0	0,0	**100,0**		Pregnant_Women	0	1	0	0	1	3,6	**10,7**
	Childr_5_15yrs	46,4	39,3	14,3	0,0	**100,0**		Childr_5_15yrs	13	11	4	0	28	16,6	
	Adults	58,3	30,6	5,6	5,6	**100,0**		Adults	21	11	2	2	36	10,5	
								Total	**49**	**23**	**7**	**2**	**81**		
								%	60,5	28,4	8,6	2,5	100,0		
										Grand Total			**756**		**100**

2 persons sleeping in 1 sleeping place were not sure of the type of their bed-net (accounted for as missing values)